Management and Working Plan #2

Effective January 1, 1997 to December 31, 2001

Pertaining to Special Use Permit #15382

THE
UNIVERSITY OF
BRITISH
COLUMBIA

**Alex
Fraser
Research Forest**

December 31, 1997

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II. MANAGEMENT PHILOSOPHY

Education, research, and demonstration in integrated forest resources management are the primary objectives of the AFRF, and the highest priority must be given to creating and protecting opportunities for these activities. The forest will be managed on a sustained yield basis consistent with these objectives.

Special mention is made of the long term research installation in the Knife Creek mule deer winter range; such installations are of paramount importance to the success of the Research Forest, and their special requirements will be recognized in the yield analysis process. Stands encompassed by major research projects will contribute to the annual allowable cut of the forest only to the extent that harvesting can be integrated into the research program.

A. GOALS OF THE ALEX FRASER RESEARCH FOREST

1. General

The mission of the UBC Faculty of Forestry is to serve the people of British Columbia through excellence in education and scholarship in forestry -- conservation, products, and production processes. The Alex Fraser Research Forest (AFRF) will assist in attaining the mission of the Faculty of Forestry by managing its forest lands to provide an optimal environment for education, research, and demonstration in integrated forest resources management.

2. Education

The AFRF will facilitate education by providing:

- a range of conditions through operations which are conducive to teaching;
- a training ground for students in vocational, technical and academic programs related to forest resources management in British Columbia;
- an outdoor laboratory for advanced students in resource management programs;
- opportunities for continuing education;
- an outdoor classroom for school students and the general public.

3. Research

The AFRF will promote research by:

- providing a secure laboratory for field research in all aspects of forest resources management, but especially for research directed to problems and opportunities specific to the central interior;

- providing a range of conditions through operations which are conducive to the installation of research projects;
- encouraging universities, colleges, federal and provincial institutions, and corporations to conduct field research in subjects specific to integrated forest resources management in the central interior;
- establishing research projects in selected topics of strategic importance to the Research Forest.

Input on research opportunities and direction is received from the Director's Advisory Committee, and the Research Forest Liaison Committee (Faculty of Forestry), and from participation in the Regional Research Advisory Committee (RRAC) process. Continued strong cooperation between the Research Forest and the Cariboo Forest Region Forest Science Section is critical to ensure coordinated efforts and transfer of information.

4. Demonstration

The AFRF will provide an extension service to resource managers and lay-people by:

- demonstrating current and innovative methods of forest resources management;
- demonstrating classical methods of forest resources management;
- demonstrating research results in operational settings to facilitate the transfer of new technology.

B. FOREST MANAGEMENT OBJECTIVES

The objectives of forest management on the Research Forest support the goals outlined above. Management objectives are:

1. to provide opportunities for education, research, and demonstration in integrated forest resources management;
2. to protect the soil of the Forest in all operations;
3. to sustain or enhance the resources available on the Forest for
   - fish and wildlife habitat
   - timber
   - range and
   - recreation;
4. to grow and harvest high quality, large diameter coniferous saw timber and veneer logs for sale within the Williams Lake Timber Supply Area;
5. to regulate the timber harvest to achieve a non-declining yield;
6. to regulate the species and age composition of the forest to ensure
   - vigourous and productive forests
   - a diversity of habitats

- a diversity of product opportunities
- an even or increasing flow of timber harvest through time

C. CONTEXT FOR MANAGEMENT AND WORKING PLANS

1. Forest Practices Code

A Management and Working Plan is a plan approved under certain Forest Act tenures "which specifies proposed management to establish, tend, protect and harvest timber resources and conserve other resource values."[1] The Regional Manager will consider designating this Management and Working Plan as a Higher Level Plan.

A Management and Working Plan is a Higher Level Plan as described by the Forest Practices Code[2] once designated as such. Higher Level Plans are the primary statement of objectives which determine the forest practices prescribed in an operational plan[3] such as a Forest Development Plan or a Silviculture Prescription. By policy, a hierarchy of higher level plans exists, and each type of plan must be responsive to plans which have been written and are of a higher order.[4] Because management plans are the lowest of the higher level plans, this document must respond to all other higher level plans which apply to the area of the Research Forest (refer to Section B3 on page 4).

Higher level plans guide operational plans by: [5]

- stating clear objectives for operations;
- describing forest practices to achieve stated objectives;
- describing known features; and
- describing administrative procedures.

2. Tenure

The Research Forest is Crown Land held under Forest Act tenure by The University of British Columbia. Tenure has two components:

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[1] Province of BC. 1996. Higher level plans: policy and procedures. Forest Practices Code. BC Min. For. and Min. Env. Joint Pub. pp 105.

[2] Forest Practices Code Of British Columbia Act. Bill 40 -- 1994 as amended. Part 1.

[3] Province of BC. 1996. Higher level plans: policy and procedures. Forest Practices Code. BC Min. For. and Min. Env. Joint Pub. pp 4-8.

[4] Ibid

[5] Ibid pp. 11-13

- A Special Use Permit (SUP 15382), which designates the land area of the Research Forest, and requires that the forest resources be managed according to an approved Management and Working Plan -- the SUP is issued by the Regional Manager.

- Two Licences To Cut (one in each Forest District) which authorize the forest management activities of the Research Forest within approved operational plans.

Together these documents provide the legal access for the University to the Research Forest, and the framework within which all activities must occur.

3. Cariboo Chilcotin Land Use Plan

The Cariboo-Chilcotin Land Use Plan "presents the overall framework for land use, conservation and economic development."[6] The Land Use Plan divides the Cariboo-Chilcotin into three Resource Development Zones depending on intensity of use -- Enhanced, Special, and Integrated.

Both blocks of the Research Forest fall into Enhanced Development Zones:

- Gavin Lake Block -- Polygon E5 Beaver Valley

- Knife Creek Block -- Polygon E6 Williams Lake

Each Resource Development Zone is defined in the Land Use Plan, and then that definition is interpreted for each polygon. The Enhanced zone is defined as follows:

> "The Enhanced Resource Development Zone includes areas where economic benefits and jobs will be increased through intensive resource management and development. In this zone, the plan challenges all local resource users and government to set targets for increased sustainable resource development. In particular, forest productivity will be maintained and enhanced through intensive reforestation, spacing, pruning, thinning, and new harvest practices."[7]

Resource targets were set for each polygon; the targets which apply to the Research Forest are shown at Appendix 1. Compliance with the CCLUP will be discussed within the framework of those targets, in each section of Part III.

D. DESCRIPTION OF THE AREA

1. Physical description

The Research Forest comprises two distinct blocks of forest land near Williams Lake in the Cariboo Forest Region. Please refer to the key map at Figure 1. The southern-most block, known as the Knife Creek block, is located on very gentle terrain adjacent to the San Jose Valley and is 3,487 ha in area. The Gavin Lake block, covering 6,315 ha, is located adjacent to Beaver Valley near Quesnel Lake, on gently rolling terrain. Both blocks are serviced by well maintained highways.

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[6] Province of BC. 1995. Cariboo-Chilcotin Land Use Plan: ninety-day implementation process final draft. Prov. BC

[7] Ibid.

Figure 1: Location map for the UBC/Alex Fraser Research Forest.

The dominant landform material on both blocks is a gravelly loamy morainal blanket or veneer over gently rolling terrain. The most commonly occuring soils on the Knife Creek block are Gray Luvisols. Dystric Brunisols and Gray Luvisols are the dominant soils found on the Gavin Lake block.

The Gavin Lake Forest Education Society (GLFES) operates a residential Forestry Centre for up to one hundred people of various ages at Gavin Lake, which is contained by the Research Forest. The area immediately surrounding the Center is used extensively for forest resource education and recreation through GLFES programs. The Forestry Centre and its environment are fundamental to the development of the Research Forest. A formal Memorandum of Understanding between the Gavin Lake Forest Education Society and the University of British Columbia will ensure ongoing co-operation to the benefit of both parties.

2. Biogeoclimatic Description

The Knife Creek block is located in the IDFdk3 biogeoclimatic subzone, with a small component of IDFxm. These subzones are dominated by interior Douglas-fir, but are differentiated by the absence of lodgepole pine and presence of bluebunch wheatgrass in the IDFxm. The eastern portion of the Knife Creek Block is transitional to the SBPSmk subzone, which is dominated by interior spruce and lodgepole pine.

The Gavin Lake block is primarily located in the SBSdw1 subzone, with a significant component of ICHmk3. The SBSdw1 is dominated by mixed stands of Douglas-fir, lodgepole pine, and trembling aspen. The ICHmk3 supports western redcedar, hybrid spruce, and subalpine fir. Please refer to Table 1 for biogeoclimatic data, and to Appendix 2 for a list of Scientific names of plants discussed.

3. Area Summary

Table 2 following describes the Research Forest in terms of its forest cover. Forest cover is shown on the maps in. The contents of Table 2 are displayed graphically in Figure 2.

Table 1: Biogeoclimatic data[8] for the variants occurring on the UBC/Alex Fraser Research Forest.

ZONE & VAR.	CLIMAX TREE SPECIES[9]	ASSOC. TREE SPECIES	DOMINANT UNDERGROWTH	MEAN PRECIP (mm)		MEAN TEMP (°C)	
				Year	Grow	Year	Grow
IDFxm (a4)	Fdi	At,Ac,Sx, (Pli),Jt	snowberry-pinegrass bluebunch wheatgrass-forbs	389	204	4.1	13.3
IDFdk3 (b2)	Fdi	Pli,At,Ac, Sx,(Ep)	pinegrass-forbs	444	214	3.0	11.9
ICHmk3 (e2)	Cw,Sx,	Fd,Pl,At, Ac,Ep	falsebox-forbs-moss	664	308	4.5	12.0
SBPSmk (SBSb2)	Sx	Pli, At, Ac, (Bl), (Fdi)	blueberry - pinegrass - forb	534	227	2.7	10.9
SBSdw1 (k1)	Sx,Fdi	Bl,Pli,At Ac,Ep	shrubs-forbs pinegrass-moss	527	274	3.7	12.8

[8] Anon. 1987. A field guide for the identification and interpretation of ecosystems. BC Min. For.& Lands. Research Section. Williams Lake.

[9] Tree Species Symbols (refer to Appendix 2 for Scientific names):

Ac -- cottonwood	At -- trembling aspen	Bl -- subalpine fir	Cw -- western redcedar
Ep -- white birch	Fdi -- Douglas-fir (interior form)	Jt -- Rocky Mountain juniper	Pli -- lodgepole pine (interior form)
Sx -- hybrid white x Engelmann spruce			

Table 2: Area summary (forested only) for the Alex Fraser Research Forest.

		Area by Species (ha)								
Block	Age Class	Ac	At	Bl	Cw	Ep	Fdi	Pli	Sx	Grand Total
Gavin	1	64.2	1.0	0	295.4	14.2	57.0	174.7	414.8	1021.3
	2	0	82.2	56.8	12.9	0	10.14	0	10.5	172.5
	3	5.3	61.7	15.6	3.0	9.6	380.9	17.09	3.4	496.6
	4	23.0	117.4	8.4	0	0	667.2	214.3	146	1176.3
	5	3.8	49.5	35.8	2.8	31.8	293.6	20.1	10.8	448.2
	6	6.2	3.8	0	0	0	1228.4	114.0	145.7	1498.1
	7	0	0	7.0	25.7	0	418.2	14.92	61.8	527.7
	8	0	0	16.1	164.9	0	266.6	0	110.8	558.5
	9	0	0	0	12.6	0	0	0	4.1	16.7
Gavin Total		102.5	315.6	139.7	517.4	55.6	3322.0	555.1	908.0	5915.9
Knife	1	0	20.6	0	0	0	33.4	68.2	0	122.2
	2	0	1.42	0	0	0	227.5	53.9	0	282.8
	3	0	0	0	0	0	720.8	0	13.2	734.0
	4	0	0	0	0	0	481.3	17	0	498.3
	5	0	1.96	0	0	0	139.3	26.3	0	167.6
	6	0	11.96	0	0	0	339.4	215.3	0	566.7
	7	0	0	0	0	0	91.2	0.1	0	91.3
	8	0	0	0	0	0	955.3	0	0	955.3
	9	0	0	0	0	0	0	0	0	0
Knife Total		0	35.9	0	0	0	2988.2	380.8	13.2	3418.1
Grand Total		102.5	351.5	139.7	517.4	55.6	6310.2	935.9	921.2	9334.1

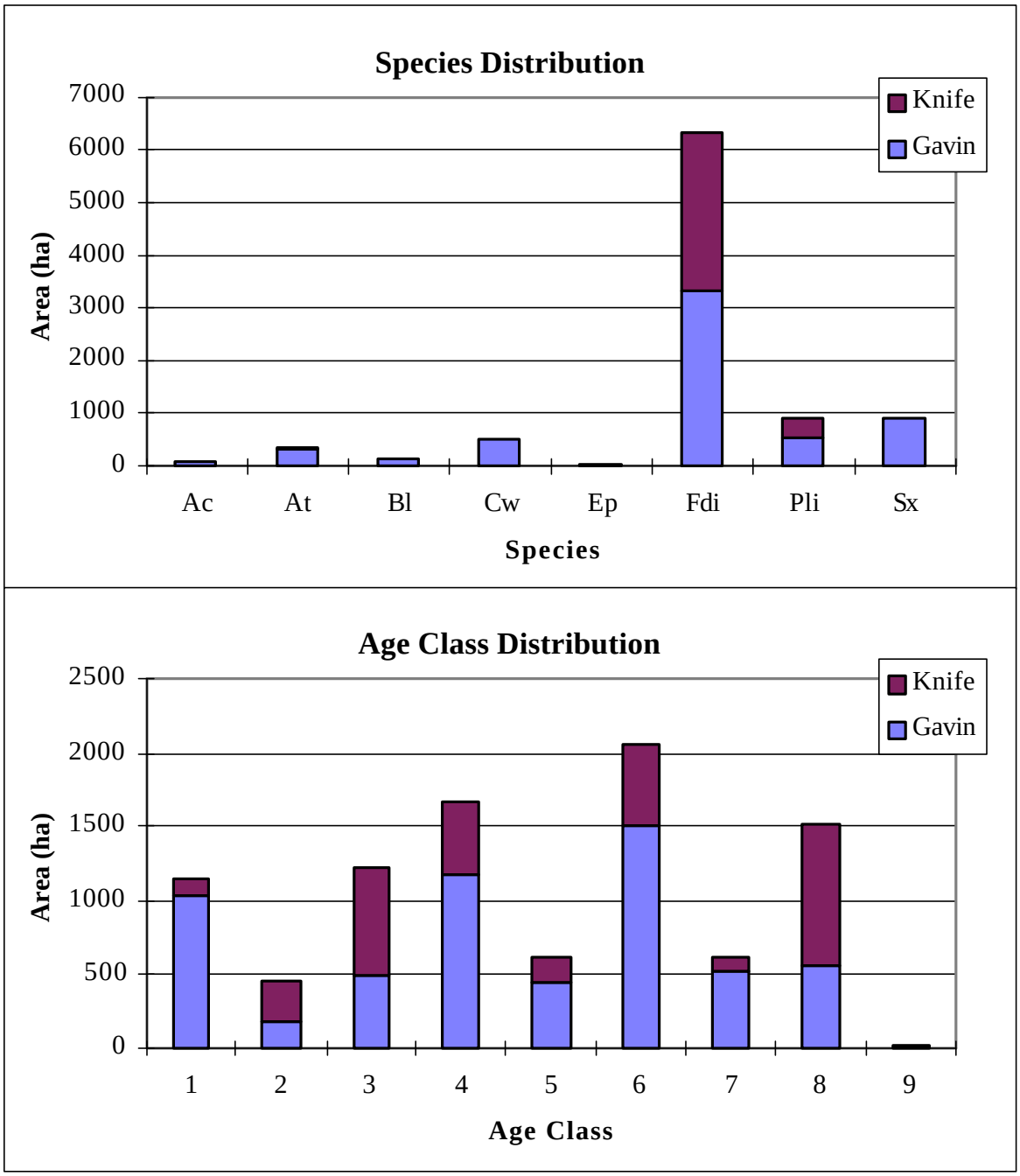

Figure 2: Species and age class distributions for the Research Forest.

4. Use Patterns and Values

Both blocks of the Research Forest have a wide diversity of forest values and uses which must be recognized in the planning process:

- timber production
- domestic range
- recreation values
- fish & wildlife production
- hunting
- cultural values
- utility corridors (pipeline)
- trapping
- guiding
- sport fishing
- water production
- bee keeping
- mining

All of these uses are important, and all prior rights pertaining to these uses and values will be recognized in the operation of the Research Forest. The temporal and spatial integration of all uses will be addressed in the Forest Development Plan.

5. History

The character of the forest on both blocks is to a large measure a product of past history. Frequent wildfires in the Knife Creek block have created an uneven-aged stand condition, and in the Gavin Lake block have resulted in a predominance of early seral stands.

Logging activity dates back to the mid 1940's (and probably before) in the Knife Creek block, and to the early 1960's in the Gavin Lake block[10]. Refer to Appendix 4 for a brief history of forestry development on the Research Forest. These logging practices and the resulting silviculture activities and road networks, combined with successful fire suppression activities, have changed the structure of the forest considerably. In addition, grazing and range management, trapping, hunting, fishing, and fish and wildlife management have helped to shape the forest.

All of these activities have altered the nature of the forest resources as they exist today. It is this modified resource base which will be managed to achieve Research Forest objectives as described in Section A above. Change is a feature of natural ecosystems, and results from both natural processes and management activities.

Although mining activity has been limited on the Research Forest area, much of the Gavin Lake block has been staked with mineral and placer claims. Should these claims become commercial, the impact on this plan would be very significant. Refer to Appendix 9 for locations of active mining claims.

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10 History records and forest cover maps show logging as early as 1942 in the Knife Creek block. The earliest logging in the Gavin Lake block is probably from the 1950's, but maps and records do not show year of disturbance for the areas logged selectively on the Beaver Valley slopes (Compartments G13 and G14).

III. RESOURCE USE STRATEGIES

A. INTEGRATION STRATEGIES

1. Forest Practices Code

The Research Forest will comply with the Forest Practices Code Act, its regulations, and applicable guide books.

2. Use Hierarchy

Because the general objective of the Research Forest is to manage all the forest resources in an integrated manner, it is critical that priorities for land use be identified on an area-specific basis. To this end, each block of the forest (Knife Creek and Gavin Lake) is divided into compartments, and priorities for land use are assessed for each of those compartments.

For example, a particular compartment could have the following description:

Priority
1 - mule deer winter range
2 - timber production
3 - domestic forage production

This system yields a mosaic of Use Priority Zones which will guide the Research Forest Manager in the management of forest resources and in the direction of research and demonstration efforts.

Compartment boundaries are located on geographic features such as ridges, creeks, and roads. Use Priority is assigned by the Research Forest Manager, based upon local knowledge and input from concerned users. Table 3 below shows the area of each compartment and the use priorities assigned. Please refer to Appendix 5 for maps showing Compartments and Use Priority Zones as assigned.

It must be understood that primary use does not imply exclusive use. Even though priorities have been assessed, it is conceivable that one area may have three nearly equal uses. Indeed, more than three uses may apply to any given compartment. It is not intended that the first priority use can proceed without regard for the other uses on the area. Due regard for impacts on secondary or tertiary use must be given in the Silviculture Prescriptions and Forest Development Plan.

3. Planning

The Alex Fraser Research Forest is committed to participation in land-use planning process which include or influence the Research Forest. Staff will participate in such processes as required, and results will be incorporated into Research Forest plans and operations.

Table 3: Compartments and use priority as assigned.

Block	Compartment	Area (ha)	Use 1	Use 2	Use 3
Gavin Lake	G1	285.9	Deer	Timber	Range
	G2	499.8	Timber	Mule Deer	Moose
	G3	627.3	View	Timber	Range
	G4	83.7	Recreation	Timber	Range
	G5	352.2	Timber	View	Range
	G6	477.1	Timber	Range	
	G7	610.0	Timber	Range	
	G8	380.0	Timber	Range	
	G9	208.6	Timber	Range	
	G10	243.7	Deer	Range	Timber
	G11	130.4	Deer	Timber	Range
	G12	187.9	Deer	Recreation	Range
	G13	243.7	Deer	Timber	Range
	G14	253.3	Deer	Timber	Range
	G15	450.6	Deer	Range	Timber
	G16	418.4	Timber	Moose	
	G17	249.5	Timber	Moose	
	G18	481.3	Timber	Moose	
	RESERVES	131.3			
Sub Total		6314.7			
Knife Creek	K1	234.5	Deer	Timber	Range
	K2	302.8	Deer	Timber	Range
	K3	391.4	Deer	Timber	Range
	K4	418.1	Deer	Timber	Range
	K5	488.2	Deer	Timber	Range
	K6	400.6	Deer	Timber	Range
	K7	286.2	Deer	Timber	Range
	K8	486.2	Deer	Timber	Range
	K9	416.3	Deer	Timber	Range
	RESERVE	63.0			
Sub Total		3487.3			
Grand Total		9802.0			

4. Inventory

A full inventory of all forest resources is fundamental to the development of good integrated resource use plans. The Research Forest is being inventoried for values of timber, fish, wildlife,

landscape, recreation, range, and water. The current status of inventories in use on the Research Forest is as follows:

1. A forest inventory has been completed for the Quesnel Lake PSYU by the Ministry of Forests in 1993. This inventory is in use on most of the Gavin Lake Block of the Research Forest, except that Mapsheet 93A041 was not included in the re-inventory. For that reason a narrow gap exists in the inventory, where the seam between the two mapsheets has shifted as a result of the conversion from NAD 27 to NAD 84. It is a high priority to complete the inventory of the Gavin Lake Block to eliminate the mapping problems.

2. A vegetation inventory was completed on the Knife Creek Block as a pilot project under the RIC program. The pilot project was carried out in 1993 by the Ministry of Forests Inventory Branch, and resulted in the installation of approximately 175 plot clusters on a 600 m grid across the Knife Creek Block. Although considerable effort has been spent in bringing the partially completed mapping up to a useable standard, the inventory is still not in use with the exception of the ecosystem mapping. Useful summaries of the plot data have not been forthcoming despite repeated requests.

3. A riparian inventory has been completed in 1996 for all of the Research Forest. This inventory included descriptions of each stream and stream reach in the Research Forest, and classifies each stream according to the Riparian Management Area Guidebook[11]. Physical description includes water chemistry and temperature, and fish species presence. The inventory was completed according to the Lake and Stream Inventory Procedures.[12] Maps are located at Appendix 6.

4. Visual sensitivity has been mapped by the Ministry of Forests for portions of the Gavin Lake Block. This mapping needs to be completed with analysis of the area around Dorsey Lake and Fire Lake. Prouton Lake may also be an area which should be mapped for visual sensitivity.

5. Mapping for the Research Forest is being brought into digital format on an ARC/Info platform, and TRIM data and forest cover data have been acquired to that end. This project has involved Research Forest staff, other staff at the Faculty of Forestry, graduate students, and local contractors. A fully functional GIS database will be available for general use in 1997.

6. A digital orthophoto has been created for each block of the Research Forest, based upon TRIM data and photography. This orthophoto was produced by Industrial Forestry Services Ltd. in Prince George, and can be updated each time new airphotos are acquired.

5. Cultural Heritage Resources

Cultural heritage resources means "...an object, a site or the location of a traditional societal practice that is of historical, cultural, or archaeological significance to the Province, a community,

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[11] Province of BC. 1995. Riparian management area guidebook. Forest Practices Code. BC Min. For. and Min. Env. Joint Pub.

[12] Anon. 1995. Draft lake and stream inventory standards and procedures. BC Min. Env. Fisheries Branch.

Anon. 1989. Stream survey field guide. Dept. Fisheries and Oceans and BC Min. Env. Joint Pub.

or an aboriginal people."[13] The Research Forest will protect cultural heritage resources by complying with the Heritage Conservation Act as interpreted by the Forest Practices Code and Ministry of Forests guidance.

Forest Development Plans and other operational plans will recognize aboriginal rights and archaeological resources through:

1. communication with first nations communities which have expressed interest in the land occupied by the Research Forest;

2. traditional use referrals conducted by the Ministry of Forests to protect aboriginal rights;

3. archaeological overview assessments carried out by the Ministry of Forests or by the Research Forest to determine the need for further study;

4. archaeological impact assessments carried out by the Research Forest to
   - identify and evaluate archaeological resources in proposed development areas
   - identify and assess potential impacts on archaeological resources
   - allow amendment of development proposals in response to identified resources and impacts.

If archaeological resources are not identified until operations are underway despite the direction given above, operations will cease in that area until an impact assessment and mitigation plan can be developed.

B. TIMBER STRATEGIES

1. Timber Management

a) Silvicultural Systems

A silvicultural system is:

> "... a planned program of silvicultural treatments throughout the life of a stand, to achieve stand structural objectives based on integrated resource management goals."[14]

The feasibility of a given silvicultural system is a function of the ecological conditions of the site and the silvics of the target species. Systems must therefore be chosen to marry the site conditions, silvics, and management objectives. Table 4 following describes the silvicultural systems currently considered appropriate for use on the Research Forest. This list is not intended to be exclusive; the range of systems will be expanded as experience with other systems is accumulated.

Table 4: Determination of Sivicultural System as dependent on ecological conditions.

[13] Pronvince of BC. 1995. Forest development plan guidebook. BC Min. For. and BC Min. Env. Jnt Pub.

[14] Province of BC. 1995. Silvicultural systems guidebook. BC Min. For. and BC Min. Env. Jnt Pub.

Biogeoclimatic Zone	Association	Silviculture System	Regen. Method
IDFdk3	All	**Uneven-aged** Single-Tree Selection; Group Selection; Irregular Shelterwood	**Natural** -- reserve advanced regeneration of Douglas-fir
SBSdw1	All	**Even-aged** Clearcutting; Clearcutting With Reserves; Uniform Shelterwood.	**Natural** from Pl cones or sheltered Fd regen; or **Planting**
SBSdw1	Mesic and drier	**Uneven-aged** Single Tree Selection; Irregular Shelterwood, Group Selection	**Natural** -- reserve advanced regeneration of Douglas-fir
ICHmk3	All	**Even-aged** Clearcutting; Clearcutting With Reserves; Group Shelterwood	**Planting**
ICHmk3	All	**Uneven-aged** Group Selection	**Planting**
SBPSmk	All	**Uneven-aged** Single Tree Selection; Group Selection; Irregular Shelterwood	**Natural** -- reserve advanced regeneration of Douglas-fir and spruce **Planting** -- may be necessary in some cases
SBPSmk	Subhygric and wetter	**Even-aged** Clearcutting; Uniform Shelterwood; Group Shelterwood;	**Natural** -- reserve advanced regeneration of Douglas-fir and spruce **Planting** -- may be necessary in some cases

b) IDFdk3, SBPSmk, and SBSdw1 (mesic and drier)

A single tree selection silvicultural system will be employed in all dry Douglas-fir types (IDFxm, IDFdk3, SBPSmk, and SBSdw1 mesic and drier) where stand structures permit. The management objective is to create/maintain an uneven-aged forest. Where current species and stand structures are not appropriate for uneven-aged management, other systems will be employed to push the stand towards the uneven-aged Douglas-fir condition.

The classical approach to uneven-aged management will be employed, with BDq regulation used to set stand structure targets. The gappy nature of the types will be recognized, and voids of up to one tree length in diameter will be allowed.

Target stand structures are a function of Use Priority and site conditions. Because all of this type is within mule deer winter range, the stand structures described herein reflect the conditions described in the Mule Deer Winter Range handbook[15]. In general, residual basal area will be relatively high, maximum diameters will be high, and q-factors will be relatively low. For a first entry, the following range of values will be employed:

- B (residual basal area) = 15 - 25 m^2/ha (65-80% of initial basal area)
- D (maximum diameter) = 60 cm (with reserves for larger diameters)
- q (diminution quotient) = 1.2 - 1.4 (5 cm dbh classes)

Re-entry periods of 20 to 30 years are appropriate given the natural disturbance regime of these types[16]. Re-entry period and residual basal area are intimately linked. Longer re-entry periods require lower residual basal areas, since excessive basal area leads to low vigour and poor stand health. Low vigour is implicated in Douglas-fir bark beetle outbreaks[17]. As indicated by the silviculture system, harvesting will manipulate all diameter classes, and therefore juvenile spacing of immature groups will generally be necessary.

Logging will preferably be carried out in the summer and fall to facilitate adequate scarification for the promotion of regeneration, except where fine textured soils dominate and potential for site degradation is high. Hand falling and line skidders will generally be the harvest method of choice.

Logging will be on a mark to leave basis, except within areas from which only a few trees will be marked to cut. Marking will employ the Almanor Tree Classification (shown at Appendix 7) or some other marking criteria based upon tree vigour. Species of choice for regeneration will generally be Douglas-fir, although lodgepole pine and interior spruce will be deemed acceptable where ecologically appropriate.

Stand health problems of note in the dry belt are:

Douglas-fir bark beetle	Lodgepole pine dwarf-mistletoe
Mountain pine bark beetle	Western gall rust
Root collar weevil	Armillaria root disease
Northern pitch twig moth	Growing season frost

[15] Armleder, H.M., R.J. Dawson, and R.N. Thomson. 1986. Handbook for timber and mule deer management co-ordination on winter ranges in the Cariboo Forest Region. Land Management Handbook No. 13. B.C. Ministry of Forests. Victoria B.C.

[16] A research project (94-10) on the Knife Creek Block found natural fire frequencies of 16 - 18 years IDFdk3.

[17] Day, J.K. 1996. Interior Douglas-fir and selection management. Unpub. Directed Study Report. UBC Faculty of Forestry.

c) SBSdw1 Outside Mule Deer Winter Range

The silvicultural system of choice for the transition zone stands (SBSdw1, outside of mule deer winter range) will be clearcutting or uniform shelterwood, depending upon regeneration objectives. Where Douglas-fir is the regeneration species of choice, shelterwood systems will be employed. Where lodgepole pine is the chosen regeneration species, clearcutting will be used. A mosaic of species within each block will be encouraged during regeneration.

Logging will be carried out in summer, fall, or winter, depending on soil and weather conditions. Hand or machine falling and line or grapple skidders will be employed, except where steep slopes dictate the need for cable systems.

To as large an extent as possible, natural regeneration will be accomplished in shelterwood systems. Clearcuts will be planted, but natural regeneration within plantations will be an important component of the new stand. Regeneration will favor Douglas-fir, with lodgepole pine and interior spruce also considered desirable.

Stand health problems of note in the SBSdw1 are:

Mountain pine bark beetle
Douglas-fir bark beetle
Root collar weevil
Northern pitch twig moth
Spruce terminal weevil
Cattle damage
Small mammal damage
Armillaria root disease
Phellinus root disease
Tomentosus root disease
Growing season frost
Western gall rust
Lodgepole pine dwarf-mistletoe

d) ICH

The silviculture system employed in the wet belt stands (ICHmk3) will be clearcutting and artificial regeneration. Logging will be carried out in summer, fall, or winter, depending on soil and weather conditions.

Site preparation through prescribed fire or mechanical means will generally be required, and species planted will be Douglas-fir, lodgepole pine and interior spruce, depending on specific site characteristics. As much as possible, a mosaic of species within each block will be encouraged through mixed planting, and natural regeneration within plantations will be an important component of the new stand. Brush control will be required on many sites, and may consist of manual or chemical methods. Brushing prescriptions will be made with recognition of the importance of deciduous cover to wildlife.

Stand health problems of note in the ICH are:

Spruce terminal weevil
Black army cutworm
Small mammal damage
Growing season frost
Armillaria root disease
Tomentosus root disease
Indian paint fungus rot
Rhizina root disease

2. Harvesting Rationale

Timber will be harvested in a manner consistent with the objectives of the Research Forest. The rigorous application of annual cut control measures is not always compatible with those

objectives, and significant departures from the levels of cut indicated by the yield analysis may be required from time to time.

The activities of weather and forest health agents regularly affect timber harvest planning through catastrophic events. As stated in Part II B above, the Research Forest will be operated on a sustained yield basis. Two strategies are employed to rationalize timber harvesting:

1. actively address catastrophic losses of timber as they occur, by salvaging damaged and dead timber;

2. direct timber harvesting towards those forest types most susceptible to catastrophic losses.

A conservative Allowable Annual Cut allows the accumulation of a reserve of inventory which provides for harvesting catastrophic losses as they occur.

In general, harvesting efforts will be directed in the following order of priority:

1. timber infested by insects;

2. salvage of dead and dying timber;

3. timber at risk of infestation by insects;

4. timber affected by disease;

5. timber of declining vigour;

6. healthy vigourous timber.

Table 5 following interprets the harvesting priorities outlined above by forest cover type. The contents of Table 5 are depicted on maps at Appendix 10.

Table 5: Harvesting priority and rank as a function of forest cover.

Priority	Rank	Species Composition[18]	Age Class
1		**All coniferous types -- timber infested by insects.**	**All**
2		**Salvage of dead and dying timber.**	**All**
3		**Timber at risk of infestation by insects.**	
	1	Pure Pl.	7+
	2	Pure Pl.	6
	3	Pl leading with any secondary conifer.	6 & 7
	4	Pure Pl, or Pl leading in any mixture.	5
	5	Sx, or Fd outside mule deer winter ranges, with secondary Pl.	6+
	6	Pure Sx, or Fd outside mule deer winter ranges, or mixtures thereof.	7+
4		**Timber affected by disease.**	
	1	Pure or leading Cw.	7+
	2	Pure or leading Bl.	6+
	3	Pure or leading Sx.	6+
5		**Timber of declining vigour.**	
	1	Any leading species except Fd within mule deer winter ranges.	7+
6		**Healthy vigourous timber.**	
	1	Any species except Fd within mule deer winter ranges	6
	2	Uneven-aged Fd -- selection management in mule deer winter range.	N/A

To the extent possible within the limits of the above priorities, harvesting activities will be distributed across the timber profile existing on the Research Forest. Provision of research opportunities may occasionally direct harvesting away from the priorities as listed above.

Where these harvesting priorities are inconsistent with the use priority zone, the harvesting priorities will be modified. For example, harvesting on mule deer winter ranges will conform to a different set of priorities. Refer to Section F3 below and Appendix 4 for a discussion of harvesting on mule deer winter range.

3. Allowable Annual Cut

An Allowable Annual Cut (AAC) of 5,435 m³ has been determined for the Research Forest using the existing forest inventory. This rate of harvest was established as the AAC in Management and Working Plan #1. It allows for considerable reductions in indicated harvest, to provide for mule deer winter range concerns on both blocks of the Research Forest. Please refer to Appendix 11 and Appendix 12 for details on the method of cut determination.

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[18]Species codes used:

Ac -- cottonwood
At -- trembling aspen
Bl -- subalpine fir (balsam)
Cw -- western redcedar
Ep -- paper birch
Fd -- Douglas-fir
Hw -- western hemlock
Pl -- lodgepole pine
Sx -- interior spruce

The FORPLAN analysis results are shown in below in Table 6. These results are depicted graphically in Figure 3 following.

A revised AAC calculation will be carried out in 1997. The calculation will be based upon the ATLAS model, which is a geographically explicit simulation model. The revised AAC will be adopted within this plan upon completion and by agreement of the Regional Manager, Cariboo Forest Region.

4. Cut control

Harvesting will be controlled in five year periods beginning January 1, 1990. The cut control year will include shipments made between December 1 and November 30. Harvesting will be balanced (± 10%) at the end of each five year period, and the over-cut or under-cut will be carried forward into the following period. No annual cutting balance is required, which allows flexibility in harvest scheduling. Each Forest Development Plan will include a cut control statement.

Table 6: FORPLAN Yield Analysis.

	Allowable Annual Cut (m^3/yr)		
Decade	Knife Ck	Gavin Lk	Total
1 (1989-99)	1596	3839	5435
2	1951	4669	6620
3	1951	4669	6620
4	3403	4669	8072
5	3403	4669	8072
6	3403	5817	9220
7	3403	5817	9220
8	3403	6005	9408
9	3403	6005	9408
10	3403	6005	9408
11	3403	6005	9408
12	3403	6005	9408
13	3403	6005	9408
14	3403	6005	9408
15	3403	6005	9408
16	3403	6005	9408
17	3403	6005	9408
18	3403	6034	9437
19	3403	8199	11602
20	3403	8199	11602

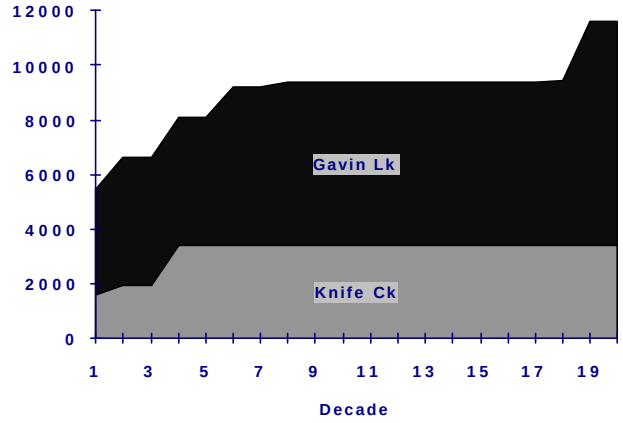

Figure 3: Allowable Annual Cut by decade for the Research Forest.

5. Silviculture

a) Current and future obligations

As required by statute and guidelines, the Research Forest will:

- prepare silviculture prescriptions (SPs) for approval by the District Manager in advance of harvesting activities;
- ensure that appropriate seed or vegetative propagules will be available for regeneration prior to harvesting;
- regenerate all sites within the regeneration delay set out in the approved SP;
- carry out appropriate surveys according to Ministry of Forests specifications to ensure that the new stand is established and growing to the accepted standards;
- achieve free growing status within the time period set out in the approved SP; and
- rehabilitate landings in accordance with the approved SP and the applicable guidelines.

The Research Forest will ensure prompt and adequate reforestation and stand tending operations, on all areas disturbed after October 1, 1987. A silviculture fund will be maintained to ensure adequate funding for those activities from year to year. The objective of silviculture operations will be to maximize the values required by the Use Priority Zone. A full set of records will be kept which will detail the history of activities on each opening on the Research Forest.

b) Outstanding obligations

By agreement with the Williams Lake and Horsefly Forest Districts and the major licensees concerned, the Research Forest will perform all operations required to meet free growing standards on all areas disturbed prior to October 1, 1987. This will be done under contract to the Ministry of Forests, which will retain financial obligations for all of these operations.

6. Compliance With CCLUP Timber Targets

Table 7 below indicates how the Research Forest is performing with respect to the timber targets established in the Cariboo-Chilcotin Land Use Plan. It is important to note that "Modified Harvesting" is defined as

> "..any management practice which is other than the industry norm and has been modified to recognize other resource values."[19]

Although very little cutting on the Research Forest would be considered as the industry norm due to small cut block size, only certain compartments of the Forest have prescriptions modified as recognition of other resource values. The area of those compartments which have a non-timber resource as Use 1 are deemed to be scheduled for modified harvesting.

Areas of "No Harvest" include all categories of forest land in reserve or deferral shown in Table 8.

Table 7: Compliance with CCLUP timber targets.

	Conventional Harv. (% by area)		Modified Harv.[20] (% by area)		No Harv.[21] (% by area)	
	CCLUP	MWP	CCLUP	MWP	CCLUP	MWP
Gavin Lake Block	62	58.6	32	24.2	6	17.2
Knife Creek Block	45	0	50	95.9	5	6.1

C. ROAD STRATEGIES

1. Master Road Plan

A paper plan for complete access development has been created for the Research Forest, and is included at Appendix 13. This plan lays out all of the roads which will be required on each block of the Forest, based upon the following assumptions:

[19] Anon. 1996. Government clarification of key components of the Cariboo-Chilcotin Land Use Plan . Unpub. pp 2.

[20] Silvicultural Systems other than clearcutting, modified in consideration of wildlife or visuals.

[21] Reserves, long-term defferals, sensitive conditions, and non-forest (excluding lakes).

- Maximum favorable grade = 12%
- Maximum adverse grade = 8%
- Maximum skid distance = 400 m
- Status
  - Existing
    - To Standard
    - Substandard
    - Inaccessible
    - Trail
  - Proposed
- Standards
  - Class 4 - Permanent 6 m
  - Class 5 - Permanent 5 m
  - Class 6 - Temporary 4 m

2. Road Construction

An annual road construction program of approximately 3 km of new road is anticipated. New roads will be designed and built according to the specifications of the Forest Road Engineering Guidebook and other provisions of the Forest Practices Code.

3. Road Maintenance

Class 4 and 5 roads are permanent all-weather roads, and are necessary for the education, research and protection functions of the Forest, as well as ongoing harvesting operations. Partial cutting silvicutural systems require extensive permanent road systems to accommodate repeated harvest entries. Section 51(a)) above indicates that much of the harvest activity on the Research Forest will consist of partial cutting. Permanent roads will be inspected annually to ensure that drainage and surface conditions are maintained.

4. Road Deactivation

Class 6 roads will be temporarily deactivated upon completion of harvesting and silviculture operations. Permanent deactivation will only occur on spurs within clearcut blocks, or on existing roads which are not to standard and are not included in the road network.

D. BIODIVERSITY STRATEGIES

1. Biodiversity Strategy from Management and Working Plan #1

A wide variety of plant and animal species live on the Research Forest. Habitat requirements of these species will be recognized and protected in timber management planning by the maintenance of biodiversity.

Biodiversity is defined as:

> "The diversity of plants, animals and other living organisms in all its forms and levels of organization, and includes the diversity of genes, species, and ecosystems, as well as the evolutionary and functional process that link them."[22]

[22] Ibid.

Management for biodiversity is a “coarse-filtre” approach to species management, whereby all natural ecosystem components and processes are retained on the landscape, and structural attributes are retained in the stand.

A biodiversity strategy was developed for the Research Forest in Management and Working Plan #1, and that strategy remains in force until the full integration of biodiversity strategies into the Cariboo-Chilcotin Land Use Plan. It is apparent from the following discussion that the Research Forest strategy currently in place goes beyond the requirements which will be imposed by the implementation of the Cariboo-Chilcotin Land Use Plan.

The goal for management with respect to biodiversity is to provide appropriate representation of forest types ecologically suited to the Research Forest. Definition of "appropriate representation" and "ecologically suitability" is provided by the natural conditions which exist on undisturbed areas with similar ecological characteristics.

Biodiversity guidelines have been devised for forest management on Vancouver Island as a cooperative project between the Ministry of Environment, Lands, & Parks, the Ministry of Forests, and the licensees on TFL # 44 (MacMillan Bloedel Ltd.) and TFL # 46 (Fletcher Challenge Canada Ltd.).[23] Those guidelines form the basis of the following discussion.

Within the context of Use Priority Zones, management for biodiversity will be achieved by manipulation of forest cover at two levels:

- the landscape level, which is addressed in Appendix 5 and the Forest Development Plan;
- the stand level, which will be addressed in each prescription.

Considerations and objectives to begin managing for biodiversity are listed below.

a) Landscape Level Considerations

A Forest Ecosystem Network ensures that the range of natural habitats present in the landscape are maintained by planning a system of reserves and deferrals to allow contiguous representation of mature forest through time. The results of this work are shown in Appendix 8, and summarized in Table 8 below. Steps taken to design and implement a Forest Ecosystem Network which addresses biodiversity across the landscape are shown below:

- identify and map unmerchantable and inoperable timber
- identify and map special habitats
  - environmentally sensitive areas (ESA's)
  - other special habitats
  - riparian management areas
  - reserves for other purposes
- provide linkages of mature forest between reserves

[23] Anon. 1991. Guidelines to maintain biological diversity in TFL #44 and TFL #46. Unpublished. 9pp.

- ensure that all ecosystem associations are represented by reserves and linkages

Table 8: Components of Forested Ecosystem Network.

FEN Component		Gavin Lake Block Area (ha)	Knife Creek Block Area (ha)	Research Forest Total
Reserves	MWP Reserves	131.6	63.0	194.3
	Root Disease[24]	7.9	11.7	54.3
Deferrals	ESA	325.7	67.0	384.7
	Linkages	306.7	0	429.4
	Unmerch./Inop.	145.1	2.8	46.6
	Riparian	28.6	15.1	132.8
Non-Forest	Open Range	0	1.9	1.9
	Lakes	217.1	0	212.4
Total		1162.7	161.5	1456.4
Block Area		6314.7	3487.3	9802.0
Area Involved (%)		18.4	4.6	14.9

(1) Landscape Level Objectives For Even-aged Management

Landscape level guidelines for maintenance of biodiversity under even-aged management are:

- maintenance of 5-20 % of the landscape in early seral stages
- maintenance of 20-40 % of the landscape (including reserves and linkages) in mature and old forest
- identification of seral stages which are poorly represented
- use of special management techniques in riparian zones, to maintain high biodiversity value

(2) Landscape Level Objectives For Uneven-aged Management

Approximately 54 % of the Research Forest is designated for uneven-aged management. Klenner and Kremsater (1993)[25] infer that uneven-aged management can enhance structural diversity within stands, but reduces diversity between stands (landscape level). They state that group selection systems create more structural diversity than single tree selection systems. Because all

[24] Area includes only root disease not included in any other reserve or deferral.

[25] Klenner, W. and L. Kremsater. 1993. Forest Management and Biodiversity; Workshop notes. Ministry of Forests, Kamloops Region.63pp.

of the area under uneven-aged management is within mule deer winter ranges, harvesting will be by single tree selection systems, but diversity will be assured by allowing gaps up to 1 tree length in diameter to be created.

Landscape level guidelines for maintenance of biodiversity under uneven-aged management are:

- maintenance of 30-40 % of the landscape in forests with crown closure greater than 60 %
- maintenance of an intimate mixture of canopy layers throughout the landscape

b) Stand Level Considerations

Considerations for maintenance of stand level biodiversity in support of landscape level objectives (both even and uneven-aged management) are:

- retention of stand structures appropriate to ecological conditions
- manipulation of stocking densities and species composition to implement landscape level objectives
- maintenance or creation of the following old forest attributes through harvesting and silviculture practices (particularly designation of Wildlife Tree Patches and Riparian Management Areas):
  - large live trees
  - standing dead trees
  - coarse woody debris
  - horizontal structural diversity, *i.e.* canopy gaps and clumps
  - a variety of canopy layers where ecologically suitable
  - old trees where ecologically suitable

2. Forest Practices Code Guidance For Biodiversity

a) Landscape Level

The Biodiversity Guidebook[26] provides guidance for conservation of biodiversity by setting out a management system which works at a variety of scales, ranging from Regional to stand levels. This Management and Working Plan fits within the context of Landscape Units and Stand Level plans. Table 10 and Table 12 following show the targets set out in the Biodiversity Guidebook, and report the current condition on the Research Forest.

Since Landscape Units have not yet been defined and implemented for the Research Forest, the guidebook recommends that lower biodiversity emphasis option be employed.

[26] Province of BC. 1995. Biodiversity guidebook. BC Min. For. and BC Min. Env. Jnt Pub..

Table 10: Seral Stage Definitions and Current Conditions on the Research Forest.

Natural Disturbance Type And BEC Zone	Age Definition (years)			Research Forest Current Condition (% of Area)		
	Early	**Mature**	**Old**	**Early**	**Mature**	**Old**
NDT2 ICH	<40	>100	>250	34.9	38.9	0.6
NDT3 SBS	<40	>100	>140	8.7	47.8	6.8
NDT3 SBPS	<40	>100	>140	50.7	30.5	3.6
NDT4 IDF	<40	>100	>250	9.5	53.4	0[27]

b) Rare Ecosystems

Rare ecosystems must be identified and located on the ground. They should be represented at a disproportionately high level within Forested Ecosystem Networks. Rare ecosystems which may be represented on the Research Forest will be listed in the Identified Wildlife Guidebook when it is published. At this time, the only data available regarding rare ecosystems is published by the Conservation Data Centre. That information, however, describes rare plant communities, and so it is assumed to be somewhat different from a list of rare ecosystems. When the Identified Wildlife Guidebook is published, its direction for management of rare ecosystems will be followed.

c) Stand Level

Biodiversity can be maintained at the stand level by maintaining stand structure, species composition, and coarse woody debris. The primary tools for maintaining stand biodiversity is retention of Wildlife Tree Patches and Riparian Management Zones. When landscape units have been designated and biodiversity objectives have been established, then requirements for stand level retention can be eased.[28]

Work is underway at the time of writing to calculate the recommended percentage of each cutblock which needs to be reserved in Wildlife Tree Patches, based upon the proportion of the biogeoclimatic zone available for harvesting (outside of reserves, deferrals, and non-forest) and the proportion of the area which has been harvested without Wildlife Tree Patches.[29] This calculation assumes that landscape units have not been established.

When Landscape Units have been established, of recommended Wildlife Tree Patch area will be done calculated for each of the landscape units within which the Research Forest operates. Until that calculation is completed, the condition of the Research Forest will be used to guide the retention of Wildlife Tree Patch area.

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[27] The Biodiversity Guidebook sets out limits beyond which a stand is considered to be old. These definitions fall down in the case of an all-aged stand, however. Forest cover types in the IDF which are uneven-aged Douglas-fir types are arbitrarily classified as age class 8 or age class 9 in the forest inventory. These ages have no real reflection on the age of the stand, but indicate the structure.

[28] Ibid. pp 60.

[29] Ibid. pp 65.

Table 12: Biodiversity targets from the Biodiversity Guidebook.

Biogeo-climatic Zone	Natural Distur-bance Type	Recommended Seral Stage Distribution (Lower Emphasis)			Patch Size Distribution (% by ha)			Connectivity	Stand Struc-ture	Species Composition
		Early	Mat.+Old	Old	<40 ha	40-80 ha	80-250 ha			
IDFdk3	NDT4	n/a	>17	>13	30-40	30-40	20-30	Mod. to High, but low cross-elev. and low stream riparian.	Multi-storied stands with natural variety of layers and gaps.	Similar to natural condition, deciduous component retained.
ICHmk3	NDT2	n/a	>15	>9	30-40	30-40	20-40	Mod. to High, but low wetland complexes and island remnants.	Even-aged with Wildlife Tree Patches or partial cutting	Similar to natural condition, deciduous component retained.
SBPSmk	NDT3	<66	>17	>7	20-30	25-40	30-50	Low, but high wetland complexes and island remnants.	Even-aged with Wildlife Tree Patches, partial cutting in Fd	Similar to natural condition, deciduous component retained.
SBSdw1	NDT3	n/a	>11	>11	20-30	25-40	30-50	Low, but high wetland complexes and island remnants.	Even-aged with Wildlife Tree Patches, partial cutting in Fd	Similar to natural condition, deciduous component retained.

3. Biodiversity Guidance Emerging From CCLUP

a) Landscape Units

It is clear that biodiversity cannot be managed in isolation. Each block of the Research Forest is smaller than a Landscape Unit as described in the Forest Practices Code. It is therefore important to consider the Research Forest in the context of regional planning. This larger regional view must be considered in managing for biodiversity.

Landscape Units are designated by the District Manager, and are delineated on topographic or geographic features.[30] Draft Landscape Units have been drawn by the Biodiversity Conservation Strategy Committee[31] as part of the implementation of the Cariboo-Chilcotin Land Use Plan. Because the Biodiversity Conservation Strategy has not yet been implemented into the Cariboo-Chilcotin Land Use Plan, the recommended biodiversity emphasis from that report cannot be implemented at this time.

It is useful to examine how the recommended biodiversity emphasis compares to the biodiversity strategy developed in Management and Working Plan #1, which remains in effect until the full implementation of the CCLUP. To that end, Table 13 below shows the direction which will result if the current recommendations of the Biodiversity Conservation Strategy are implemented. The draft Landscape Units which contain the Research Forest are described below in Table 14.

Table 13: Biodiversity targets from the Biodiversity Guidebook, if Biodiversity Conservation Strategy is implemented.

Biogeoclimatic Zone	Natural Disturbance Type	Biodiversity Emphasis	Recommended Seral Stage Distribution		
			Early	Mat.+Old	Old
ICHmk3	NDT2	Lower	n/a	>15	>9
SBPSmk	NDT3	Intermediate	<66	>17	>7
SBSdw1	NDT3	Lower	n/a	>11	>11
IDFdk3	NDT4	Intermediate	<12	>43	>21

It is apparent that, if the Biodiversity Conservation Strategy is accepted in its current state, there will be significant constraints to harvesting in some portions of the Research Forest. Most severely restricted will be the IDF in Knife Creek, and the ICH in Gavin Lake. Operations are already constrained in those portions of the Research Forest, however, by poor age class structure resulting from past logging history which pre-dates the Research Forest.

[30] Ibid. pp 75.

[31] Biodiversity Conservation Strategy Committee. 1996. Biodiversity conservation strategy for the Cariboo-Chilcotin Land Use Plan. Unpub. Rpt.

Table 14: Draft Landscape Units and their attributes from the Biodiversity Conservation Strategy.

Block	Draft Landscape Unit & NDT-BEC Unit	Forested Area Of Landscape Unit (ha)	Area Of Research Forest (ha)	Recom-mended Biodiversity Emphasis	Draft Landscape Unit Seral Stage Condition (%)		
					Early	Mat.	Old
Gavin Lake	Beaver Valley	64,112	2,630	Lower	n/a	47.2	30.9
	2-ICH	4,439			n/a	23.5	9.5
	3-SBS	59,673			n/a	45.4	30.2
	Big Lake	62,496	3,685	Lower	n/a	31.8	20.1
	2-ICH	6,844			n/a	8.3	2.3
	3-SBS	52,680			n/a	34.6	22.3
Knife Creek	Williams Lake	59,860	3,521	Intermediate	28.7	29.9	16.5
	2-SBPS	27,648			52.3	39.3	31.3
	4-IDF (Fir)	26,314			5.7	22.0	-0.1

E. RIPARIAN MANAGEMENT STRATEGIES

Riparian areas are a critical component of biodiversity and wildlife habitat. Riparian areas are described as:[32]

> "Riparian areas occur next to the banks of streams, lakes, and wetlands and include both the area dominated by continuous high moisture content and the adjacent upland vegetation that exerts an influence on it."
>
> "Riparian areas frequently contain the highest number of plant and animals [sic] species found in forests, and provide critical habitats, home ranges, and travel corridors for wildlife. Biologically diverse, these areas maintain ecological linkages throughout the forest landscape..."

Riparian ecosystems serve several critical functions:

- contribute to the "coarse filtre" approach to conservation of biodiversity outlined in Section C above
- protect water quality and stabilize streambanks;

[32] Province of BC. 1995. Riparian management area guidebook. Forest Practices Code. BC Min. For. and Min. Env. Joint Pub. pp 1.

- regulate stream temperatures;
- provide woody debris and nutrient inputs to stream;
- provide fish food.

Riparian ecosystems will be conserved on the Research Forest by adherence to the Forest Practices Code. Specifically, Riparian Management Areas (RMA's) will be designated along each stream, lake or wetland subjected to timber harvesting. These RMA's will vary in width and prescription depending upon the width of the stream and the presence or absence of fish in the stream.

In addition to the stand level approach to RMA's, 132.8 ha of riparian ecosystem have been included in the Forested Ecosystem Network described in Section C1 above.

1. Streams

A riparian inventory has been completed in 1996 for all of the Research Forest. This inventory included descriptions of each stream and stream reach in the Research Forest, and classifies each stream according to the Riparian Management Area Guidebook[33]. Physical description includes water chemistry and temperature, and fish species presence. The inventory was completed according to the Lake and Stream Inventory Procedures.[34] Maps are located at Appendix 6. Table 15 below briefly describes all the streams in the Research Forest which were found to be fish bearing.

2. Lakes

The Research Forest contains ten lakes ranging in size from 0.5 ha to 94.2 ha. While lake classification is the District Manager's responsibility, these lakes have been provisionally classified during the Riparian Inventory, according to the Riparian Management Area Guidebook. Fish presence or absence is derived from local knowledge and implication of fish presence in tributary creeks. Table 16 describes that provisional classification. Lakes will be protected by appropriate RMA's as required under the Forest Practices Code.

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[33] Province of BC. 1995. Riparian management area guidebook. Forest Practices Code. BC Min. For. and Min. Env. Joint Pub.

[34] Anon. 1995. Draft lake and stream inventory standards and procedures. BC Min. Env. Fisheries Branch.

Anon. 1989. Stream survey field guide. Dept. Fisheries and Oceans and BC Min. Env. Joint Pub.

Table 15: Streams found to have fish present within the Research Forest.

System	Stream Name	Location (Ref. Appendix 6)	Stream Class	Fish Species Present
		Gavin Lake Block		
Beaver	None			
Gavin	Gavin Creek	Mainstem Creek west of Gavin Lake (sites 81, 83, 85)	S3	Rainbow Trout
	Un-named Creek	Tributary to Gavin Lake which drains Fire Lake (site 6)	S4	Rainbow Trout
Prouton	Prouton Creek	Mainstem creek between Choate and Prouton Lakes (site 45)	S3	Rainbow Trout Lake Chub Longnose Sucker
Teasdale	Un-named Creek	Teasdale Creek Tributary N. of L 2052, E. Boundary of Gavin Block (site 86)	S3	Rainbow Trout
Watson	None			
		Knife Creek Block		
Jones	Jones Creek	Mainstem creek at each point where it contacts the Research Forest (site 18, 19, 20)	S3	Rainbow Trout
Knife	Knife Creek	Mainstem creek at the point where it contacts the Research Forest (unsurveyed)	Assumed S3	Unknown

3. Wetlands

The Research Forest contains many wetlands which range widely in area. Most of these wetlands have been included in the Forested Ecosystem Network as Unmerchantable or Inoperable Areas (refer to maps

Appendix 8). These wetlands are primarily swamps and marshes in the Gavin Lake block, and swamps or fens in the Knife Creek Block.[35] Most wetlands have not been classified. Although wetlands were not classified in the Riparian Inventory, it is expected that the vast majority are in the W3 category. As such, they will be protected during forest development activities as required by the Forest Practices Code.

Many swamps and marshes are smaller than the minimum type size in the forest inventory, and so have not been noted on forest cover maps. These small wetlands will fall into the Non-classified category because of their surface area, and will therefore not have Riparian Management Areas established. The soils conditions, brush hazard and wildlife values of these unique forest types will, however, be recognized in Silviculture Prescriptions.

Table 16: Provisional lakes classification for the Research Forest.

Lake Name	Area (ha)	Classification	Fish Presence
Choate Lake	6.5	L1	Rainbow Trout (privately stocked) Lake Chub Longnose Sucker
Dorsey Lake	15.6	L1	Rainbow Trout (stocked)
Fire Lake	16.3	L1	Rainbow Trout (stocked)
Gavin Lake	94.2	L1	Rainbow Trout
Little Gavin Lake	15.9	L1	Rainbow Trout
Prouton Lake	40.8	L1	Rainbow Trout Lake Chub Longnose Sucker
Timothy Lake	10.3	L1	Unknown[36]
Un-named lake on Teasdale Ck mainstem	0.5	Unclassified	None
Un-named Lake on Watson Creek	2.3	L3	None
West Lake	10.0	L1	Rainbow Trout (word of mouth)
Total Lakes	212.4		

[35] Province of BC. 1995. Riparian management area guidebook. Forest Practices Code. BC Min. For. and Min. Env. Joint Pub. pp 66.

[36] Breeding loons with chicks have been seen on this lake, but no direct evidence of fish presence exists.

4. Fish

No salmon stocks use the streams in or adjacent to the Research Forest. Salmon habitat is well buffered from development activities on the Research Forest due to large lake systems between the Research Forest and downstream salmon habitat. Department of Fisheries and Oceans has little concern with activities on the Research Forest, provided water quality is maintained.[37]

Many of the ten lakes encompassed by the Gavin Lake block are valuable sport fishing waters. This value will be recognized, and timber management activities will reflect a concern for both water quality and aesthetics on adjacent forested lands.

The Gavin Lake system is a regionally significant fishery, in that it is a natural rainbow fishery which has never been stocked. In addition, fish in this system are down-stream spawning.[38] Much of the spawning and rearing habitat in the Gavin System is within the Research Forest.

Jurisdiction over the sport fishery will remain with Ministry of Environment, Lands, & Parks, and continued stocking and monitoring programs on the Gavin Lake block will be encouraged.

F. IDENTIFIED SPECIES STRATEGIES

Species and communities which are not sufficiently protected by the "coarse filtre" approach of the biodiversity strategy outlined in Section C1 require specific management (a "fine filtre" approach). This means that those species must be identified and managed in a specific way. At this time, the Forest Practices Code Guidebook "*Management Strategies for Identified Wildlife*" is not published. That guidebook will detail strategies for dealing with species at risk -- species which are endangered, threatened, vulnerable, sensitive, or regionally important. The guidebook strategies will include vertebrates, invertebrates, vascular plants, and endangered and threatened plant communities.

Strategies for managing identified wildlife[39] will include direction from higher level plans, creation of wildlife habitat areas[40], or general wildlife measures[41]. Such strategies will be outlined in the guidebook, and the Research Forest is committed to implementing the direction of the guidebook when it is published.

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[37] Pat Harvey, Department of Fisheries and Oceans. Personal Communications (Interim Five Year Development Plan Review) December 1993.

[38] Jack Leggett. MoE Fisheries Biologist. Personal Communications. 94-01-07.

[39] "Wildlife" refers to:
- all vertebrates including mammals, birds, reptiles, amphibians and fish
- crustaceans and mollusks from or in non-tidal waters
- invertebrates or plants listed as endangered, threatened or vulnerable

including the eggs and juvenile stages of those species. (Forest Practices Code Act)

[40] Wildlife habitat areas: mapped areas determined to be necessary to meet the habitat needs of one or more species. [Source: Operational Planning Regulation]

[41] General wildlife measure: a management practice determined to maintain the habitat of one or more species. [Source: Operational Planning Regulation]

In conducting all resource management operations, it is recognized that most species are entirely dependent upon the forest for their subsistence. In this light, it is obvious that management of other forest resources will have strong impacts (either beneficial or detrimental) on wildlife species. Of the other resource management activities carried out on the Research Forest, timber management has the greatest potential for affecting wildlife populations through habitat manipulation.

Where wildlife management is deemed to be the highest priority land use, the habitat manipulation goals will drive timber management decisions. Where timber management is the highest priority land use, decisions will be made recognizing their impacts on wildlife habitat.

1. Rare Species and Communities

Endangered and threatened species which may inhabit the Research Forest are shown at Appendix 3.

2. Winter Range

Winter range carrying capacity is the major limiting factor for mule deer and moose in the Cariboo. Where winter range is identified, those values will be protected and improved where feasible and appropriate.

Both blocks of the Research Forest provide important winter range for mule deer, and to a lesser extent for moose. Those values are recognized in the yield analysis and the Forest Development Plan. Use priorities as described in Section A (above) define mule deer winter range as the highest priority on those compartments which contain winter ranges. Moose winter range is shown as secondary or tertiary use on four compartments in the Gavin Lake Block.

3. Mule Deer Winter Range Management Plans

Mule Deer Winter Range Management Plans will be developed in consultation with the Ministry of Environment, Lands, & Parks and the Ministry of Forests, to govern activities on mule deer winter ranges. These plans will fit inside this Management and Working Plan, but will supersede the Forest Development Plan. The winter range plans will ensure that:

- timber harvesting activities on the mule deer winter ranges are according to the principles outlined by Armleder et al (1986);
- silviculture and protection activities have habitat values as the first consideration;
- research and demonstration activities within the winter ranges will have a wildlife component;

4. Wildlife Management

Mule deer and moose are the main focus of the annual hunting season in the central interior; both of these species are abundant on the Research Forest. The Ministry of Environment, Lands, & Parks will continue to administer the hunting season on both blocks of the Research Forest, which are popular hunting areas.

Existing guiding tenures will be honoured, and input of guides will be sought during the planning process. Administration of guiding rights will remain the responsibility of the Ministry of Environment, Lands, & Parks.

Active traplines are currently operated on both blocks of the Research Forest. Administration of trapping rights will continue to rest with Ministry of Environment, Lands, & Parks. Consultation with trappers, maintenance of biodiversity, and the spatial distribution of timber management activities will ensure continuation of productive traplines.

G. FOREST PROTECTION STRATEGIES

1. Fire

The Research Forest will comply with the Forest Fire Prevention And Suppression Regulation, and will prepare a Fire Preparedness Plan by April 1 each year, as required by Forest District staff. UBC will have the objective of preventing, detecting, controlling, and extinguishing wildfires on the Research Forest within the context of the Fire Preparedness Plan. The Ministry of Forests will retain the responsibility of detection and initial attack within the Research Forest, and the Research Forest will cooperate with the Ministry of Forests to extinguish wildfires.

2. Other Stand Damage

UBC will take all actions necessary to prevent and control the spread of insects and diseases on the Research Forest. Accepting that endemic levels of pest populations are always present in forest ecosystems, the objectives of pest management will be to salvage mortality wherever possible, to avoid the expansion of endemic populations to epidemic levels, to improve productivity by reducing the impact of endemic pest problems such as dwarf-mistletoe, and to minimize the potential for problems in managed stands through good planning.

Recognizing that forest health is a direct function of tree and stand vigour, stand management will consider the maintenance of good tree vigour as a principle objective.

Annual detection flights by fixed wing aircraft combined with frequent field visits will allow the identification of pest problems, or other stand damage such as wind throw. When problems are identified, ground reconnaissance will be carried out to assess the level of damage and potential for further damage. Based on the ground reconnaissance and within the context of this plan, management strategies will be devised as follows:

a) Bark Beetles Strategies

The most significant pest problem confronting the Research Forest continues to be bark beetles. Beetle populations cycle between endemic and epidemic levels through time, and the age and species structure of the Research Forest (Figure 2) is conducive to bark beetle outbreaks.

Strategies for management of Douglas-fir bark beetle focus on:

- **suppression** during periods of high beetle pressure, by harvesting infested areas while the beetles are still under the bark; and

- **maintaining a low population** by anticipating bark beetle activity, and planning direct control through harvesting each year.

Strategies for management of mountain pine beetle focus on:

- **prevention** by harvesting stands of highest hazard first according to the harvest priorities outlined in Table 5, and by rationalizing and prioritizing access development to high hazard areas;

- **suppression** during periods of high beetle pressure, by harvesting infested areas while the beetles are still under the bark in conjunction with pheromone baiting; and

- **maintaining a low population** by anticipating bark beetle activity, and planning direct control by harvesting each year.

Intensive management of bark beetles requires vigilant detection and aggressive harvesting to control the spread during periods of high beetle pressure. Although prevention is the best long term management option, it requires significant conversion of forest cover over long time periods. Since 1989, approximately 30% of the timber harvested from the Research Forest has come directly from bark beetle control activities on a single-tree salvage basis.

Bark beetle control harvesting takes two forms:

- single tree salvage applying to contiguous areas less than one hectare in extent throughout the Research Forest; and

- development of small cut blocks under Silviculture Prescriptions, which appear in the Forest Development Plan in year one or two -- such blocks may require amendment of the Forest Development Plan to allow for timely development.

Annual operations required for managing bark beetles and other contingencies such as windthrow are as follows:

- prompt detection
- prompt salvage
- access developed and maintained
- plan harvest according to risk of loss (Section 52)
- thorough ground reconnaissance
- thorough cleanup
- deploy traps and trap trees as necessary

b) Root Disease Strategies

- identify disease centres and the causal pathogen
- encourage mixed-species stands
- harvest if conversion to non-host species possible
- recognize in inventory and cut control

c) Spruce Terminal Weevil Strategies

- establish spruce in mixed stands or under partial canopy
- encourage moderate over-topping by other species
- do not juvenile space or brush spruce stands
- do not prune spruce stands

d) Root Collar Weevil Strategies

- accept as endemic in all stands
- allow for mortality in initial densities

e) Stem Rust Strategies

- train crews to identify
- remove infected trees at spacing

f) Dwarf Mistletoe Strategies

- identify infected stands prior to harvesting
- slash all lodgepole pine taller than 0.5m or the lowest observed height of infection after logging infected stands
- devise harvest boundaries to reduce perimeter and use infection-safe edges
- goal is incidence reduction, not eradication

g) Growing Season Frost Strategies

- identify frost prone sites before and after harvest
- regenerate Douglas-fir on IDF, SBPS and SBS sites under a canopy
- plant frost tolerant species such as lodgepole pine in frosty positions
- plant Douglas-fir on upland sites or in frost-sheltered positions

h) Rodent Damage Strategies

- regenerate sites promptly
- establish and maintain low stand densities
- avoid peak population cycles for stand tending
- regenerate mixed species

i) Cattle Damage Strategies

- regenerate sites promptly
- do not salt on landings
- use obstacle planting to reduce trampling
- recognize cattle use patterns in reforestation planning

H. RANGE STRATEGIES

1. Range Management

Both the Knife Creek and Gavin Lake blocks of the Research Forest are fully covered by grazing permits. These tenures will not be changed by the existence of the Research Forest, and their administration will remain the responsibility of the B.C. Ministry of Forests. Table 17 following describes range permits operating within the Research Forest.

2. Integration Guidelines

The integration of timber management and range management operations on the forest will relies heavily on co-operation between the individuals involved. Strategies which will enhance this co-operation are discussed below.

a) Standards

Integration of timber and range management results in some loss of productivity to both resources, but an overall gain in return to the public. A loss of trees due to range use is to be expected, but losses must be kept to reasonable limits through management practices.

Table 17: Range permits and production levels for permittees operating on the Research Forest.

Stock Range	Range Unit	Name	Brand		Permit No.	Auth. AUM[42]	Util. AUM
Big & Beaver	Gavin	Bob Hutchinson	LRC	AH	RAN073156	338	338
		Rodear Cattle Co.	RRC	D	RAN072509	446	273
		Fred Tillotson	LHC	U2	RAN073154	1,250	1,250
Horsefly	Edney	Howard J. Briscoe	RHC	RB	RAN0731897	855	855
150 Mile	Knife Ck.	Clint and Karen Thompson	RRC	FR	RAN073159	350	350
		Jared Fletcher	RHC	C/C	RAN072145	404	404
	Knife Ck.	Cliff and Jo Hinsche	LHC	CJ			
			LHC	141			
Total						3,643	3,470

Unacceptable loss due to cattle damage is assessed during a Silviculture Survey, and is defined to be:

1. greater than 10% of the total conifers within an identifiable stratum[43] damaged or killed by cattle;

2. a change in stocking status (from Sufficiently Restocked to Not Sufficiently Restocked) caused by cattle damage; or

3. failure to attain Free Growing status as a result of cattle damage.

b) Fencing

1. drift fences existing on the Research Forest will be maintained by the rancher;

2. any damage done to any fence during Research Forest activities will be repaired by the Research Forest;

[42] AUM figures represent totals for each permit, and do not represent allocations from the Research Forest alone.

[43] Erickson, W.R. 1992. A syonptic survey of cattle use interactions with tree regeneration under various silvicultural and grazing systems. Progress Report. BC MOF Range Branch. pp 84-86.

3. Research Forest activities which remove natural barriers to cattle movement will be mitigated by fencing operations performed by the Research Forest;

4. new drift fences and other range projects may be built on the Research Forest as required to enhance range management activities;

5. research trials may be fenced by the Research Forest as required;

6. all new fences built in mule deer winter range areas (identified in Appendix 5) will have a maximum height of 106 cm (42 in), a bottom strand at 45 cm (18 in) from the ground, and top rails will be placed where warranted.

c) Planning

1. Management and Working Plans, Forest Development Plans, and Silviculture Prescriptions will be discussed annually with ranchers to explore areas of impact and arrive at solutions;

2. grazing plans for permits and licences will be incorporated into Research Forest plans;

3. the Research Forest Manager will provide input into the development of grazing plans;

4. planted trees should be placed within 10 cm of debris such as logs and stumps or on raised mounds whenever possible, and planting on skid trails will make use of the raised edges of the trail;

5. cattle use will be considered when prescribing site preparation -- if disc-trenching is prescribed, the trenches should be oriented along the contours, and trees should be planted high on the hinge of the trench; and

6. the Research Forest Manager may allow new plantations of forest trees a period of time to recover from planting shock before being subjected to grazing, and temporary fencing may be erected to achieve this period of rest if it is not achieved by riding and salt placement.

7. Crop planning to control damage and extend grass production by manipulation of stand density.

d) Grass seeding

1. grass seeding will be carried out using a mix of species and rate prescribed by the District Agrologist;

2. roads and landings to be rehabilitated will be ripped to 30 cm depth and grass seeded to provide forage and ground cover -- trees will generally be planted;

3. roads and landings which are being put to bed will be grass seeded without surface ripping;

4. roadsides, ditches, cut banks and fill slopes will be seeded with grass to reduce erosion and provide forage;

5. selected clearcut areas may be grass-seeded where this activity is mutually acceptable;

6. where feasible, intensively managed grazing by cattle or sheep will be utilized to complement silvicultural objectives for vegetation control.

I. RECREATION STRATEGIES

1. Organized Recreation

Because the Gavin Lake block surrounds Gavin Lake Forestry Centre which is owned and operated by the Gavin Lake Forest Education Society (GLFES), a considerable amount of organized recreation occurs on the Research Forest. Recreation will be enhanced by considering the needs of this group in making forest management decisions, and by consulting with the GLFES regarding activities adjacent to the camp area.

In co-operation with GLFES and the Ministry of Forests, a network of trails will be extended throughout the Gavin Lake Demonstration Area adjacent to the Forestry Centre. Refer to Section K1 below for further information. Compartments adjacent to the Forestry Centre have recreation or view listed as priorities for land use.

2. Public Recreation

The Research Forest provides a variety of recreational opportunities for the general public. Two semi-primitive recreation sites have been developed by the B.C. Ministry of Forests, and will remain the responsibility of the Forest Service. These are described below at Table 18. In addition, cross country skiing, snowmobiling, fishing, hunting, firewood gathering, and other pursuits provide the general public with substantial benefits.

Recreation inventories have been completed by the Ministry of Forests for the area including the Research Forest, and maps are included at Appendix 14.

Recreational opportunities will be maintained and improved by management through co-operation with the Ministries of Forests and Environment, Lands, & Parks. Specifically, this management will include:

- protection of aesthetics in critical areas;
- enhancement of hunting and fishing opportunities;
- access management;
- development of a trail system and demonstration forest;
- development of additional recreation sites.

Table 18: Recreation facilities existing on the Research Forest.

Facility	Location	Picnic Tables	Outhouses	Trails (km)	Other
Camp Sites	Gavin Lake	3	2		Boat Launch
	Dorsey Lake	2	1		Dock, Boat Launch
Gavin Trails	Gavin Lake			20 (non-motorized	Warming Hut
Intensive Silviculture Trail	Fire Lake Road -- 1 km			3.7	With signs and brochures
Shelterwood Trail	Gavin Lake Road 2km			1.5	With signs and brochures
Soils Trail	Gavin Lake			1.0	With soil pits, signs and brochures
Commercial Thinning Trail	End of T20 Road (walk of doom)			1.5	
Mule Deer Trail	Knife Creek -- Big Meadow Road at Subdivision	1	1	1.4	With signs and brochures

3. Visual Sensitivity

The Cariboo Chilcotin Land Use Plan states that forestry operations should avoid or minimize impact on scenic quality. Highway corridors are considered to be of importance to scenic quality, and both blocks of the Research Forest are visible from highway corridors. The Gavin Lake block is the principle view for the Likely highway for a considerable duration. In addition, compartments G3 and G5 (south of Gavin Creek) have View listed as Use 1 and Use 2 respectively.

The Ministry of Forests has prepared a Visual Inventory of portions of the Gavin Lake Block. That map is included at Appendix 15. Parts of the Gavin Lake Block which have scenic values (Dorsey Lake, Fire Lake) have not had any visual inventory prepared, and this will be completed by the Research Forest.

Scenic quality will be managed by:

1. completing the Visual Inventory for the Gavin Lake Block;

2. recognizing important visual elements;

3. employing techniques of good landscape design;

4. use of partial cutting systems where ecologically appropriate and in keeping with stand management objectives;

5. preparation of Visual Impact Assessments as required by the Forest Practices Code.

J. RESEARCH STRATEGIES

Research is one of the three primary objectives of the AFRF, and contributes directly to the education and demonstration objectives. Research is developed on the Forest in three principle ways:

1. The Research Forest operates as a research facility, which hosts researchers who come to the Forest with a project and funding in hand, either solicited or unsolicited. In general, projects have been developed in response to local, regional, or provincial priorities, as established in the Research Advisory Processes (RRAC and FRAC). The Research Forest plays a part in the Regional Research Advisory Processes (RRAC). This category includes about 80% of the research projects conducted.

2. The Research Forest operates a small research program, whereby staff or contractors carry out research which is of strategic importance to the Research Forest. This category comprises about 10% of the research projects conducted.

3. Some projects may not be related to forestry in the strict sense, but require a forest environment in the design. This category comprises about 10% research projects conducted.

Long-term cooperative projects of specific interest to the B.C. Interior are encouraged, and existing projects such as the mule deer project in Knife Creek are protected. Wherever possible, operational activities are exploited for potential research values. This is especially true for harvesting and silviculture activities. Opportunities for research present themselves continuously. When an opportunity presents itself, it is the task of the Research Forest Manager to identify research opportunities, assess their priority, and promote the development of a research project.

Research "topics" are promoted with a variety of people and organizations including:

- Graduate and undergraduate students
- Faculty and staff at the UBC Faculty of Forestry
- Faculty and staff at UBC more broadly
- Other Universities
- Ministry of Forests Cariboo Region
- Ministry of Forests Research Branch
- Ministry of Environment Cariboo
- Ministry of Environment Victoria
- Canadian Forest Service
- Forest Industry
- Forestry Service Industry

It is also the task of the Research Forest Manager to protect future opportunities for research. This will be accomplished by leaving replicated untreated controls on areas being treated, provided the controls will not jeopardize the health of the stand or the success of the operation. This provision applies particularly to silviculture activities.

Research installations may be of two types: controlled experiments; and uncontrolled demonstrations. Both types of activity are important, and the level of control is the decision of the researcher. However, controlled research will always be preferred since the results can be widely applied and the demonstration values are still produced.

Research is funded from outside the Research Forest, except in those cases where the topic is of sufficient importance to the operation of the forest that the Research Forest Manager deems it worthwhile to fund from within the forest. The services of the forest are available to researchers on a cost recovery basis, and operations can be conducted specifically for research trials if sufficient notice and input are provided by the researcher.

Proposed projects are screened by Research Forest staff to ensure compliance with statute and protection of the environment. Staff are directly involved in site selection. Research project locations are mapped and protected so that research installations are not disturbed. An extensive database of projects, investigators, publications and reports is maintained. The nature of the research activities on the forest allows projects to accumulate. New projects can build on the results of old, and completed projects give rise to new opportunities. This synergy, often termed "piggy-backing" is a very valuable commodity for researchers.

1. Research Reserves

Each block of the Research Forest has designated areas outlined on maps at Appendix 5, which will be considered Research Reserves and will remain unmanipulated. Research Reserves are established to preserve research and education opportunities in each of the biogeoclimatic zones represented on the Research Forest. These reserves will only be managed to the extent required to protect the Research Forest as a whole.

K. DEMONSTRATION STRATEGIES

Operations carried out on the Research Forest have demonstration values, and these will be exploited by placing signs which indicate the dates of activities and objectives for the project. Signs will be placed where visible to roads and trails, and aimed at the general public as an audience.

Research is transferred by creation of demonstration trails within research areas. Trails include signs (written for the general public) which describe the research project and its results. Technical details are written in brochures which accompany the signs, to modify the trail to a technical extension opportunity. Such trails serve three functions -- recreation, demonstration to general public, and extension of research to technical audiences.

1. Gavin Creek Demonstration Area

The area shown on the map at Appendix 16 is designated as the Gavin Creek Demonstration Area. This 1063 ha tract is composed of Compartments G3, G4, and G5, and extends beyond the boundaries of the Research Forest north of Gavin Lake. The area is dedicated to demonstration of the management of forest resources, and is operated cooperatively with the Gavin Lake Forest Education Society and the B.C. Ministry of Forests (Horsefly District).

Operations in the Demonstration Area will focus on providing examples of a variety of activities, dealing with the full range of forest resources, in a relatively small area. All activities will therefore necessarily be small in scale.

A plan for the development of the Gavin Creek Demonstration Area was written in 1994[44] with support from the Ministry of Forests Horsefly District. That plan lays out a trail network and lists potential themes and activities for demonstration, as well as providing details of development for trails and facilities.

In order to maximize the demonstration value of operations, the following development criteria apply within the Demonstration Area:

Timber Harvest	General maximum block size = 5 ha
Roads	Maximum slope = 8% adverse, 12% favorable
Demonstration	All activities will be carried out in a manner which maximizes the demonstration benefit, and all activities will have signs mounted to describe them

No other restrictions will apply. This lack of restrictions will permit demonstration of activities which do not fall into the realm of normal practices.

L. EDUCATION

The educational value of the Research Forest lies in the wide range of research, demonstration and operational activities that take place. The Forest is an outdoor classroom used by graduate and undergraduate students from UBC, and students from other universities and colleges. Continuing education of professional and technical audiences is also an important function for the Research Forest. Students enrolled in technical and vocational programs in high-school are welcome to take advantage of the wide variety of activities. Student work experience is also provided to international students and to local high school and college students.

All Forest Resource Management, Forest Science, and Forest Harvesting students are required to take a one-week field course at the Alex Fraser Research Forest during the beginning of third year. This course focuses on stand level processes and prescriptions. Graduate students at the Masters and Doctorate level are encouraged to select projects which have relevance to the B.C. Interior and involve the Research Forest. Students who do select projects on the Research Forest are considered part of the education process. Staff at the Research Forest are available as advisors for undergraduate students who are writing theses or graduating essays.

Linkages to other education programs are being developed, especially with The University of Northern BC and University College of the Cariboo.

In conjunction with the Gavin Lake Forest Education Society, the AFRF offers opportunities for continuing education in a forested residential setting. Assistance in planning and delivering professional development short courses is offered by staff from the Research Forest. All possible cooperation is extended to the Silviculture Institute of BC and BC Forestry Continuing Studies Network.

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[44]Wilder, N. 1994. The Gavin Creek Demonstration Forest: Development and Management Plan. Unpublished BSF Thesis. UBC Faculty of Forestry.

The AFRF encourages elementary and high school teachers and their students to use the Research Forest and its resources in their studies. Wherever possible, staff will assist in planning and guiding field trips and excursions to research projects and demonstrations.

IV. STANDARDS FOR USE

A. ROAD CONSTRUCTION

Attached at Appendix 17 are the engineering specifications for forest roads, taken from current Road Permits. All new roads on the Research Forest will be built according to these specifications.

In excess of 90 km of roads were built on the Research Forest before its establishment in 1987, and do not generally conform with the specifications attached at Appendix 17. The Research Forest will endeavor to secure funding over time to upgrade the roads which are included in the Road Network (Appendix 13) or rehabilitate roads which are not included in the network to restore them to productive forest land.

B. TIMBER HARVESTING

1. Utilization Standards

Minimum felling, bucking, and utilization specifications for the Research Forest are shown below in Table 19. These standards may be varied by the License to Cut, or for a given cut block. Species not listed may be utilized at the Research Forest Manager's discretion, based upon markets and prices available.

2. Soil Conservation Standards

Silviculture Prescriptions will follow the Soil Conservation Guidebook. Periodic harvesting allows most harvesting to be completed in winter on snow pack or frozen ground. This is advantageous in terms of maintenance of soil productivity.

Operational constraints of the Research Forest make achievement of all recommendations set out in the guidebook problematical:

1. Small block areas make maximum road and landing targets difficult to achieve on some sites;

2. Partial-cutting silviculture systems require frequent re-entry on permanent skid trails -- although these trails are generally not bladed structures, they are permanent access, and are therefore withdrawn from the net area to be reforested.

Table 19: Minimum Utilization Specifications for the Research Forest. (Source: SUP 15382).

Species	Min. DSH For Standing Timber And Butt Logs (Cm)	Max. Stump Height (Cm)	Min. Top Diam. For Butt Logs And Top Logs (Cm)	Min. Log Length For Butt Logs And Top Logs (M)	Min. Slab Thickness (Cm)	Min. Slab Length (M)
Pine	15.0	30.0	10.0	3.0		
Spruce	20.0	30.0	10.0	3.0		
Balsam	20.0	30.0	10.0	3.0		
Douglas-fir	20.0	30.0	10.0	3.0		
Cedar	20.0	30.0	10.0	3.0	12.5	3.0
Other Conifers	20.0	30.0	10.0	3.0	12.5	3.0

C. SILVICULTURE

Stocking standards should reflect management objectives, and may vary from time to time and from place to place as a result of changing objectives. Silviculture prescriptions will describe the stocking standards for each Standards Unit in an area to be harvested, in compliance with statutory requirements.

1. Stocking Standards For Even-Aged Management

Attached at Appendix 18 are the general stocking standards for the biogeoclimatic subzones in the Research Forest.[45] Silviculture Prescriptions will normally adhere to these stocking standards, and if they vary from the normal standards, rationale for the variance will be included in the prescription.

1. Redcedar and Subalpine fir Acceptability

   Western redcedar and subalpine fir are a common component of the understory in the ICHmk3, in both unlogged and regenerated stands. Subalpine fir is often a component of the understory in the SBSdw1, but infrequently occupies a canopy position.

[45] Source: Province of BC. 1995. Establishment to free growing guidebook: Cariboo Forest Region. Forest Practices Code. BC Min. For. and Min. Env. Joint Pub.

Both species are merchantable, and are desirable as a component of all stands in the ICHmk3. Neither species is preferred for regeneration, because of relatively low timber productivity and a tendancy towards heart-rot. Normally, target stocking will be met with other more productive species.

If, in the ICHmk3, advanced regeneration is the primary source of cedar and subalpine fir stocking, up to 400 stems/ha of the well-spaced stems can be contributed by cedar and subalpine fir, provided that the minimum stocking standard (MSSp) is met with preferred species.

If a target stand in the ICHmk3 includes cedar or subalpine fir as a preferred species, stands will be regenerated MSSp will be met with cedar and/or subalpine fir regeneration which originates post-harvest. This ensures that stocking will be of young age and high vigour.

Partial cutting silviculture systems in the ICHmk3 may rely on advanced cedar and subalpine fir regeneration, but harvesting will gradually improve the regeneration through improvement cuttings and retention of preferred species.

Regeneration of subalpine fir and cedar is not normally preferred in the SBSdw1, except in Riparian Management Areas.

2. Leave Trees

Trees designated as leave trees in partial cutting methods will be selected on the basis of species, health, vigour, and the ability to respond to the increased resources available after cutting. Criteria described in Appendix 7 provide guidance to leave-tree selection.

3. Minimum Inter-Tree Distance

Natural Regeneration: **Trees can be accepted down to a minimum spacing of 2.0 meters.**

Artificial Regeneration: Trees can be accepted down to a minimum spacing of 2.0 m or the minimum allowed at the time of planting, whichever is less.

Juvenile Spacing: Trees can be accepted down to 0.5 m inter-tree distance (at breast height) to allow for the selection of crop trees, and to promote a clumpy distribution of stems in mule deer winter range.

2. Stocking Standards For Uneven-Aged Management

a) All Species And Sites Except Dry Douglas-fir

Attached at Appendix 18 are the general stocking standards (from the guidebook) for uneven-aged management of all species and sites except IDFxm, IDFdk3, SBPSmk, and SBSdw1 mesic and drier. These stocking standards will apply to all other sites where uneven-aged management is practiced, until sufficient experience has been gathered to refine the stocking standards.

b) Dry Douglas-fir

The uneven-aged stocking standards published in the guidebook are often not appropriate for the stand structure goals designed for the management of dry Douglas-fir (IDFxm, IDFdk3, SBPSmk, and SBSdw1 mesic and drier). The critical measures of stocking in uneven-aged management are residual basal area (RBA) and maximum density in layer 3. If an area is left stocked with an appropriate residual basal area distributed across the range of diameters, and the layer 3 trees are not suffering stagnation, then the site is stocked.

Table 20 below illustrates why the uneven-aged stocking standards from the guidebook do not fit the stand structures designed for the Research Forest. The stand can be fully stocked in terms of residual basal area and still not meet the stems/ha guidelines as published. (Twenty square metres per hectare is used for illustration only -- actual RBA's will vary). This is a function of the low q-factor and the high maximum diameter, which concentrates stocking into the larger diameter classes, and therefore does not require many trees in the small size classes. Table 20 does not include any stocking in layer four, since regeneration may or may not be present at the time of logging, and because uneven-aged management can rely on small amounts of regeneration each year.

Stocking Standards for Uneven-aged Management of Dry Douglas-Fir:

1) Appropriate residual basal area is either:

   - Sixty percent or more of initial basal area; or
   - B-level stocking from Langsaetter's curve, as determined by periodic growth measurements.

2) Maximum density for uneven-aged management is 2,000 stems per hectare in layer 3 (from 1.3 m in height to 7.4 cm dbh).

3) Target stocking for layer 4 is 500 stems/ha;
   Minimum stocking for layer 4 is 300 stems/ha.

4) Leave trees are designated on criteria described in Appendix 7

5) Regeneration Delay is 7 years

6) Free Growing Dates: Early -- 3 years
   Late -- 15 years

7) Minimum Inter-Tree Distance 0.5 m (at breast height)

D. RANGE USE

Appendix 19 provides maps of both blocks of the Research Forest which indicate the areas and season of use for each range permittee.

Table 20: Target stocking for typical dry Douglas-fir uneven-aged management stand

structure goals, compared to the guidebook standards.					
		Target Stocking			
		B = 20	**D = 60**	**q = 1.25**	CUMULATIVE
Layer	Diam Class	STEMS/HA GOAL	BA/HA	STEMS/HA GOAL BY LAYER	GUIDEBOOK TARGET STOCKING STEMS/HA
3	5	86	0	86	1000
2	10	69	1	69	800
1	15	55	1	245	600
1	20	44	1		
1	25	35	2		
1	30	28	2		
1	35	22	2		
1	40	18	2		
1	45	14	2		
1	50	12	2		
1	55	9	2		
1	60	7	2		
	TOTAL	399	20	399	2400

Standards of utilization of the forage resource on the AFRF are as required by the Ministry of Forests. Acceptable utilization is as follows:

- Native forage -- 50 to 60% as compared to ungrazed areas;
- Domestic forage -- 70 to 75% as compared to ungrazed areas;

Grazing exclosures will be installed and monitored to gauge the level of utilization.

Broadcast grass seeding will be carried out within one year of disturbance on all roadsides and landings in cut blocks, and on cut banks and ditch lines outside cutblocks. Seed mixes will differ from the Gavin Lake block to the Knife Creek block, to allow for the difference in biogeoclimatic conditions. The mix employed will be as suggested by Ministry of Forests District Agrologists. Appendix 20 describes the specifications for grass seeding.

Any apparent conflicts which arise between range use and timber or wildlife management will be addressed by the Research Forest Manager and the rancher. If not resolved, the question will be referred to the District Manager of the Ministry of Forests. Reconciliation of damages to range values or to timber, wildlife or other values, will be accomplished according to the guidelines located at Appendix 21.

E. PLANNING

Planning to meet the objectives set out in Part II will be accomplished through the Management and Working Plan and the Forest Development Plan. The Management and Working Plan will be updated and revised every five years; the Forest Development Plan will be updated and revised annually to maintain a constant five year planning horizon. Annual reports will document success relative to the appropriate plans.

Preparation of the planning documents includes inputs from the general public, users of the Research Forest, industry, and government agencies. Table 21 identifies the input categories and sources.

Table 21: Plan preparation and review process.

	Input Category			
Source	Inform	Consult	Refer/ Negotiate	Approve
MOF	D	A,B,C,E	A,B,C,E	A,B,C,E
MOE	D	A,B,C,E	A,B,C,E	
UBC Forestry	D,E	A,B,C		
AFRF Users	D	A,B,C,E	A,C	
Native Indian Bands	D	A,C,E	A,C	
CLMA	D	A		
Public	D	A,B,C,E		
GLFES	D	A,C	A,C	
Neighbors	D	A,C		
AFRF Advisory	D			A,B,C

A = Management and Working Plan....5 years
B = Mule Deer Winter Range Plan....5 years
C = 5 Yr. Development Plan .....annually
D = Annual Report .....annually
E = SP.....annually

Input Categories Defined
Inform: to send a copy of the document.
Consult: to identify concerns, activities etc. through meetings, letters, legal advertising and field visits.
Refer/Negotiate: to discuss and seek consensus.
Approve: to allow plans to proceed into action.

Appendix 22 shows a list of all AFRF permitted users, to whom documents should be referred in compliance with Table 21 above.

V. APPENDICES

Appendix 1: CCLUP Resource Targets Pertaining To The Research Forest

CARIBOO-CHILCOTIN LAND USE PLAN IMPLEMENTATION
COMPARING RESOURCE TARGETS

III. ENHANCED RESOURCE DEVELOPMENT ZONE

(5) Beaver Valley

Total Area: 425,331 ha Total Forest Area: 328,329 ha

OVERLAPS

Mule deer winter range management will overlap with visual quality objectives over most of the key tourism areas.

GRAZING

To maintain the current authorized level of 40,076 AUMs in the polygon.

To maintain the existing proportion of AUMs by Range Unit.

WILDCRAFT

To maintain roaded access to 80% of the polygon.

Access to the rest of the polygon will be walk-in off permanent main roads, or temporary in conjunction with any forest industry development or mineral exploration.

MINING

To maintain access to 100% of the polygon outside of those areas currently reserved from activity.

RECREATION

To maintain 5% of the polygon in a backcountry condition, portions of the Quesnel and Horsefly Rivers and around key lakes.

To maintain the visual quality in the viewshed of highway corridors and key lakes.

TOURISM

To maintain the visual quality in the viewshed surrounding existing tourism operations.

(5) Beaver Valley

FISH AND WILDLIFE

To manage the Horsefly, Beaver, Hazeltine and Edney River watersheds for salmon stocks (approximately 70% of the polygon), through riparian area protection and controls on the rate of harvest.

To manage for the biodiversity targets that will be developed in the Regional Biodiversity Conservation Strategy (see Biodiversity Conservation section). The following seral stage targets will be used in the development of that strategy:

- "old forest" category: 7% to 19% range

- "mature/old forest" category: 17% to 36% range

The actual proportions in this polygon will be dependent on the natural disturbance types and the Biodiversity Guidelines which are developed under the Forest Practices Code. The seral stage targets will be adjusted as the regional Biodiversity Conservation is developed concurrently with the Short Term Timber Availability Plan.

To maintain riparian habitats through the establishment of riparian management zones on all streams, lakes and wetlands as specified under the Forest Practices Code and Riparian Guidelines.

To manage for moose, furbearer, species at risk and other sensitive habitats within the areas identified as riparian buffers, recreation areas, mule deer winter range and lakeshore management zones and throughout the polygon under the biodiversity conservation strategy, including key deciduous stands.

To initiate water allocation planning to address fisheries flow requirements and agricultural needs for competing water uses in this area.

To manage approximately 2 lakes as quality lakes for wilderness fisheries.

To maintain mule deer winter range values through modified harvest regimes over approximately 18% of the forest in this polygon.

TIMBER

The following targets apply to the entire productive forest land base in this polygon.

Polygon	Conventional Harvest	Modified Harvest	No Harvest
5 Beaver Valley	62%	32%	6%

The primary restrictions to timber development will be in the more-populated areas of the polygon due to the considerable interactions with the rural public.

CARIBOO-CHILCOTIN LAND USE PLAN IMPLEMENTATION
COMPARING RESOURCE TARGETS

III. ENHANCED RESOURCE DEVELOPMENT ZONE

(6) Williams Lake

Total Area: 285,225 ha Total Forest Area: 212,400 ha

OVERLAPS

Mule deer winter range management will overlap with visual quality objectives over most of the key recreation and tourism areas.

GRAZING

To maintain the current authorized level of 34,501 AUMs in the polygon.

To maintain the existing proportion of AUMs by Range Unit.

WILDCRAFT

To maintain roaded access to 80% of the polygon.

Access to the rest of the polygon will be walk-in off permanent main roads, or temporary in conjunction with any forest industry development or mineral exploration.

MINING

To maintain access to 100% of the polygon outside of those areas currently reserved from activity.

RECREATION

To maintain 5% of the polygon in a backcountry condition, along the Fraser River.

To maintain the visual quality in the viewshed of highway corridors.

TOURISM

To maintain the visual quality in the viewshed surrounding existing tourism operations.

(6) Williams Lake

FISH AND WILDLIFE

To manage the habitats along the Fraser River mainstem and banks for salmon stocks.

To manage for the biodiversity targets that will be developed in the Regional Biodiversity Conservation Strategy (see Biodiversity Conservation section). The following seral stage targets will be used in the development of that strategy:

- "old forest" category: 7% to 19% range

- "mature/old forest" category 17% to 36% range

The actual proportions in this polygon will be dependent on the natural disturbance types and the Biodiversity Guidelines which are developed under the Forest Practices Code. The seral stage targets will be adjusted as the regional Biodiversity Conservation is developed concurrently with the Short Term Timber Availability Plan.

To maintain riparian habitats through the establishment of riparian management zones on all streams, lakes and wetlands as specified under the Forest Practices Code and Riparian Guidelines.

To manage for grizzly bear, moose, furbearer, species at risk and other sensitive habitats within the areas identified as riparian buffers, recreation areas, mule deer winter range and lakeshore management zones and throughout the polygon under the biodiversity conservation strategy.

To initiate water allocation planning to address fisheries flow requirements and agricultural needs for competing water uses in this area.

To maintain key White Pelican habitat surrounding Natsy Lake.

To maintain mule deer winter range values through modified harvest regimes over approximately 50% of the forest in this polygon.

TIMBER

The following targets apply to the entire productive forest land base in this polygon.

Polygon	Conventional Harvest	Modified Harvest	No Harvest
6 Williams Lake	45%	50%	5%

The primary control on timber development will be mule deer winter range management.

Appendix 2: Scientific Names Of Plants And Animals Cited

Plants

Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Bluebunch wheat grass	*Agropyron spicatum* (Pursh) Scribn.
Cottonwood	*Populus trichocarpa* Torr & Gray
Falsebox	*Paxistima myrsinites* (Pursh) Raf.
Indian paint fungus rot	*Echinodontium tinctorium* Ell. & Ever.
Interior Douglas-fir	*Pseudotsuga menziesii* (Beissn.) Franco *var glauca*
Interior spruce	*Picea glauca* (Moench) Voss *x engelmannii* Parry
Lodgepole pine	*Pinus contorta* Dougl. ex. Loud. *var latifolia*
Lodgepole pine dwarf-mistletoe	*Arceuthobium americanum* Nutt.
Phellinus root disease	*Phellinus weirii* (Murr.) Gilbn.
Pine grass	*Calamagrostis rubescens* Buckl.
Rhizina root disease	*Rhizina undulata* Fr.
Rocky Mountain Juniper	*Juniperus scopulorum* Sarg.
Snowberry	*Symphoricarpos albus* (L.) Blake
Subalpine fir	*Abies lasiocarpa* (Hook) Nutt.
Tomentosus root disease	*Inonotus tomentosus* (Fr.) Gilbn.
Trembling aspen	*Populus tremuloides* Michx.
Western gall rust	*Endocronartium harknessii* (Moore) Hirat
Western redcedar	*Thuja plicata* Donn.
White birch	*Betula papyrifera* Marsh.

Animals

Black army cutworm	*Actebia fennica* (Tausch)
Douglas-fir bark beetle	*Dendroctonus psuedotsugae* Hopk.
Moose	*Alces alces andersoni* Peterson

Mountain pine bark beetle	*Dendroctonus monticola* Hopk.
Mule deer	*Odocoileus hemionus hemionus* Rafinesque
Northern pitch twig moth	*Petrova albicapitana* (Bsk.)
Root collar weevil	*Hylobius warrenii* Wood
Snowshoe	*Lepus americanus* Erxleben
Spruce terminal weevil	*Pissodes strobi* (Peck.)

Appendix 3: Listed Species Of Significance To The Research Forest

			Biogeoclimatic Zone				SIGHTED			
LISTED	**COMMON NAME**	**SCIENTIFIC NAME**	**IDF**	**ICH**	**SBPS**	**SBS**	**Resident**	**Migrant**	**Unknown**	**Location**
B	American avocet	*Recurvirostra americana*	x,d							
B	American bittern	*Botaurus lentiginosus*	x,d		k	d				
R	American white pelican	*Pelecanus erythrorhynchos*	x,d		k	d				
B	Badger	*Taxidea taxus*	x,d	k						
B	Barn owl	*Tyto alba*	x							
B	Bighorn sheep subsp. californiana	*Ovis canadensis californiana*	x,d			d				
B	Bobolink	*Dolichonyx oryzivorus*	x,d	k						
B	California gull	*Larus californicus*	x,d	k	k					
B	Double-crested cormorant	*Phalacrocorax auritus*	x	k						
B	Fisher	*Martes pennanti*	x,d	k	k	d	X			GL, KC
B	Flammulated owl	*Iotus flammeolus*	x,d							
B	Great blue heron	*Ardea herodias*	x,d	k	k	d				
B	Grizzly bear	*Ursus arctos*	x,d	k	k	d			X	GL
B	Gyrfalcon	*Falco rusticolus*	x,d	k						

			Biogeoclimatic Zone				SIGHTED			
LISTED	**COMMON NAME**	**SCIENTIFIC NAME**	**IDF**	**ICH**	**SBPS**	**SBS**	**Resident**	**Migrant**	**Unknown**	**Location**
B	Hudsonian godwit	*Limosa haemastica*	x,d							
B	Lark sparrow	*Chondestes grammacus*	x,d		k					
B	Lesser golden-plover	*Pluvialis dominica*	x,d							
B	Lewis' woodpecker	*Melanerpes lewis*	x,d	k						
B	Long-billed curlew	*Numenius americanus*	x,d		k					
R	Northern long-eared myotis	*Myotis septentrionalis*					X			GL
B	Oldsquaw	*Clangula hyemalis*	x,d	k	k	d		X		GL
B	Painted turtle	*Chrysemys picta*	x,d	k						
R	Peregrine falcon subsp. anatum	*Falco peregrinus anatum*	x,d	k	k					
R	Prairie falcon	*Falco mexicanus*	x,d	k						
B	Red-necked phalarope	*Phalaropus lobatus*	x,d	k	k	d				
B	Rubber boa	*Charina bottae*	x	k						
B	Sandhill crane	*Grus canadensis*	x,d	k	k	d			X	GL
B	Sharp-tailed grouse subsp. columbianus	*Tympanuchus phasianellus columbianus*				d	X			GL
B	Short-billed dowitcher	*Limnodromus griseus*	x,d							

			Biogeoclimatic Zone				SIGHTED			
LISTED	**COMMON NAME**	**SCIENTIFIC NAME**	**IDF**	**ICH**	**SBPS**	**SBS**	**Resident**	**Migrant**	**Unknown**	**Location**
B	Short-eared owl	*Asio flammeus*	x,d	k		d				
B	Surf scoter	*Melanitta perspicillata*	x,d	k	k	d				
B	Swainson's hawk	*Buteo swainsoni*	x,d		k	d				
B	Tailed frog	*Ascaphus truei*		k						
B	Townsend's big-eared bat	*Plecotus townsendii*	x,d	k			X			KC
B	Trumpeter swan	*Cygnus buccinator*	x,d		k	d				
R	Upland sandpiper	*Bartramia longicauda*	x,d	k						
R	Western grebe	*Aechmophorus occidentalis*	x,d	k	k	d				
B	White-throated swift	*Aeronautes saxatalis*	x							
B	Wolverine subsp. luscus	*Gulo gulo luscus*	x,d	k	k	d				

Sources:

List

Julie Steciw BC Environment Cariboo Region. Draft R&B Species Cariboo (96-06-17) based on 1993 R/B Species List. Updated to reflect status changes as of 1996 Species List

Sightings

1. Research Forest Staff
2. Leung, M. and D. Reid. 1995. Amphibians, reptiles, mammals and birds found in the Alex Fraser Research Forest from April 1994 to May 1995. Unpub. rpt.
3. Michaela Waterhouse, Wildlife Ecologist, Min. For. Cariboo Region. Personal Communications 1996.

Appendix 4: History Of Forestry Development On The Research Forest

HISTORY OF FORESTRY IN KNIFE CK.[46]

Stand History And Succession:

The following discussion is based on field observations of the author, and discussions with other people having experience in the area.

Dry belt fir stands are generally uneven-aged in their natural condition, with a clumpy distribution of age groups which results from frequent fire history. Word of mouth indicates that fire frequency in the natural condition was 7-10 years. This frequent fire history had the effect of creating openings, performing some random thinning of the pole layer, and cycling the nutrient capital back into the soil. The very old vets (400+ years old) are resistant to fire damage, as can be evidenced by the large fire scars on many of their butts. Thus a seed crop was usually preserved from the fire, and the denuded patches would be seeded in by the old vets. In occasional droughty periods, the old vets would succumb to fir bark beetle, and the space they occupied would then be available for regeneration.

On the higher elevations, a severe disturbance would have the effect of converting the stand to lodgepole pine, whereas on the lower elevations, the conversion would be to grasslands. In either event, over a lengthy period of time the fir would encroach onto the grasslands, or would ingress into the pine stand in an understory position, eventually dominating the site and becoming uneven-aged.

HISTORY OF FOREST MANAGEMENT IN DRY BELT FIR:

For the period ending in the early 1960's the dry belt fir stands in the Williams Lake area were exploited for railroad ties. Most of this logging was done with horses, and tractors were used to forward the logs to the portable tie mills. The trees selected were of a diameter to allow one tie to be cut, which allowed the horses to skid the logs fairly easily. This type of selection resulted in good stocking remaining in most size classes after logging.

In the 1960's, with the advent of stationary sawmills in town, the technique shifted to diameter limit cutting, whereby all the trees within the cutblock over a certain diameter were harvested; the diameter limit varied from sale to sale. Although this system was usually successful in maintaining advanced regeneration, it often failed to maintain a good representation of thrifty mature trees. Also, this system tended to produce a stand which was patchy in distribution, and hindered the development of a good diameter distribution in the forest.

In the late 1970's it was recognized that the diameter limit approach was not as successful as it should have been, and that signaled the onset of the faller's-select methods. Based upon the principles of selection management, the faller's-select method seeks to remove typically 50% of the volume from all of the diameter classes, and leave the healthiest trees behind to regenerate openings and add increment to the growing stock.

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[46]Excerpts from: Day, J.K. 1989. Management of Dry belt Douglas-fir on the UBC/Alex Fraser Research Forest. Unpublished. 8pp

MANAGEMENT OPTIONS:

Artificial regeneration of large openings in this zone has been very difficult. The combination of high daytime temperatures, low moisture availability, and frequent radiation frost makes plantation of Douglas-fir virtually impossible, and lodgepole pine very difficult. It is therefore recognized that natural regeneration systems are preferred, and this means that pine clearcuts should be regenerated to pine through broadcasting of their serotinous cones, and fir should be regenerated in its own shade through selection management. There is some interest in trying shelterwood management with fir stands which have a poor representation of lower diameter classes.

TIMBER HARVESTING ON MULE DEER WINTER RANGES:

Starting in 1980 a research program was begun by the Ministry of Forests to study the needs and habits of mule deer on winter ranges in the Cariboo, with the objective of finding a way to integrate timber harvesting into the management of winter ranges.

It was found that deer need several components of the forest to support them in the winter:[47] i) the mature and overmature vets, in their clumpy distribution, to provide shelter, snow interception cover, and food in the form of foliage and lichen litterfall; ii) the pole layer to provide protection from the wind and some snow interception; and iii) the regeneration to provide protection from the wind, and hiding cover to reduce harassment. All of these components are important to the viability of the winter range, because each of them is necessary for the survival and health of the deer.

This study found that the best winter ranges are on south or west aspects and adjacent to open range for early spring grazing. In addition, the ranges need a combination of crown closure classes; the combination varies depending on the snow depths anticipated. In this area a ratio of one third of the range should be in the 16-35% crown closure habitat, one third in the 36-65% crown closure habitat, and one third in the >65% crown closure habitat. In other areas where snowfall is heavier, greater emphasis must be placed on the higher crown closure habitats. This ratio is designed to provide sufficient snow interception while providing as much open area as possible to promote the growth of forage.

In the same study it was determined that the deer favor some parts of the topography over others. For example, the deer always favor ridges over gullies, and they prefer areas with clumps of vets rather than well dispersed vets intermingled with areas of younger trees. Putting all of the findings together, a set of guidelines have been devised by which a low volume selection harvest may be undertaken, providing the ratio of crown closure habitats is maintained. The guidelines recommended are:

1. Low volume selective harvesting of small groups of trees, rather than a uniform thinning of mature trees;

2. Single trees may be harvested if they are isolated from other clumps of cover trees;

3. Harvest more heavily in the micro-habitats which are less important to the deer, i.e. gully bottoms and northerly aspects;

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[47] Armleder, H.M., R.J. Dawson, and R.N. Thomson. 1986. Handbook for timber and mule deer management co-ordination on winter ranges in the Cariboo Forest Region. Land Management Handbook No. 13. B.C. Ministry of Forests. Victoria B.C.

4. Lodgepole pine, spruce, and deciduous can be harvested, because they intercept snow poorly, and do not provide food to the deer;

5. Minimize damage to residuals and regeneration;

6. Leave a good representation of large old trees.

HISTORY OF FORESTRY AT GAVIN LAKE[48]

This is a history of the Gavin Lake Forestry Center, owned and operated by the Gavin Lake Forest Education Society. The report covers the changes which have occurred since the 1950's to the present time. It is based upon interviews with people who have lived and worked at that location.

Our history begins with All-Fir Lumber, owned by an American named Mr. Vandivanter. All-Fir operated a sawmill on crown land at the eastern end of Gavin Lake until the early 1960's, and that mill site is now the location of the Forestry centre.

According to Tillie Robertson, who was employed by All-Fir Lumber as a camp cook, the cookhouse, cabins and garage were located on the upper bench. The cookhouse was quite rustic; it had wood heat but lacked running water, and the lighting was provided by gas and coal oil lamps. A small bedroom was provided for the cook. Meat was kept cool in two small propane fridges.

Of the cabins provided for the men, four were built to accommodate married couples, with the other three or four cabins shared by four men each. The cabins were heated by wood, with the men responsible for cutting their own firewood.

When Merrill-Gardner bought All-Fir Lumber in the mid 1960's, they were also operating a logging camp on Horsefly Lake, known as Camp #2. There had been new camp buildings erected at Camp #2 in 1961, including a cookhouse, washhouse, and seven or eight cabins. These buildings were moved to the new logging site at Gavin Lake, which became known as Camp #3. (Hopp, pers. comm.)

The first year at Gavin Lake was a busy one, according to Joe Hopp, a longtime Merrill-Gardner employee. With the sawmill operating and the logging going on, the number of men in the camp rose from 45 to 95 at times. All of the cabins on the site were full and many men brought in trucks with campers to sleep in. Some of the men did commute as the bulk of the crew were local or within reasonable access to the camp. The work week was shortened from 6 days a week to 5 1/2 to accommodate those who had to commute.

Merrill-Gardner (later Merrill-Wagner) continued operating the sawmill for about one year after moving into the Gavin Lake site. With road conditions improving, providing easier access to the large mills in Williams Lake, it was decided that the mill would cease operations and be dismantled. At this time the old cookhouse, cabins and garage on the upper bench were burned, with a light plant being built on the garage site. (Hopp, pers. comm.)

The logging during this history was done in a checker-board fashion. The blocks were approximately 200 acres each in size with patches of reserve timber approximately 1,000 feet wide being left between each block. These reserves were left to accommodate wildlife.

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[48] Adapted from: Anon. 1988. History of Gavin Lake. BC Forestry Association, Cariboo Region. Unpublished.

Some areas were logged leaving non-merchantable trees in place under "intermediate utilization standards". Most logging, however, was done in a clear-cut manner with broadcast burning to follow, in preparation for re-planting. The area north of camp does not look as planned in 1967 due to some problems in burning. As a result of escaped slash burns and subsequent salvage logging, many of the reserve blocks were lost, and a total area of approximately 860 ha was logged in one opening north of camp.

Merrill-Wagner logged in the Gavin Lake area from the early 1960's until 1985. The terrain surrounding Gavin Lake produced fir, spruce, and pine, with the fir being a prime interest for Merrill-Wagner. They let the cedar stand as the wood was not profitable to harvest at that time. The remaining merchantable cedar stands in the Gavin Lake area were logged by Starline Cedar from about 1977 to 1984. In 1987 the UBC/Alex Fraser Research Forest was created in the Gavin Lake area.

As the years passed, with more men commuting to work on improved roadways, it was decided that running the camp was no longer necessary or profitable and the camp was closed in the early 1970's. In 1975, Merrill-Wagner (now Weldwood of Canada) offered the camp to the Canadian Forestry Association of BC (later called the BC Forestry Association), which had been looking for a suitable location to build a camp to carry out its programs of education and recreation. In 1996 the BC Forestry Association reorganized, and became Forest Education BC. At that time FEBC divested itself of its regional operations, and the camp was taken over by a local non-profit society called the Gavin Lake Forest Education Society. The camp continues to operate to provide educational experiences to children of the Cariboo Region.

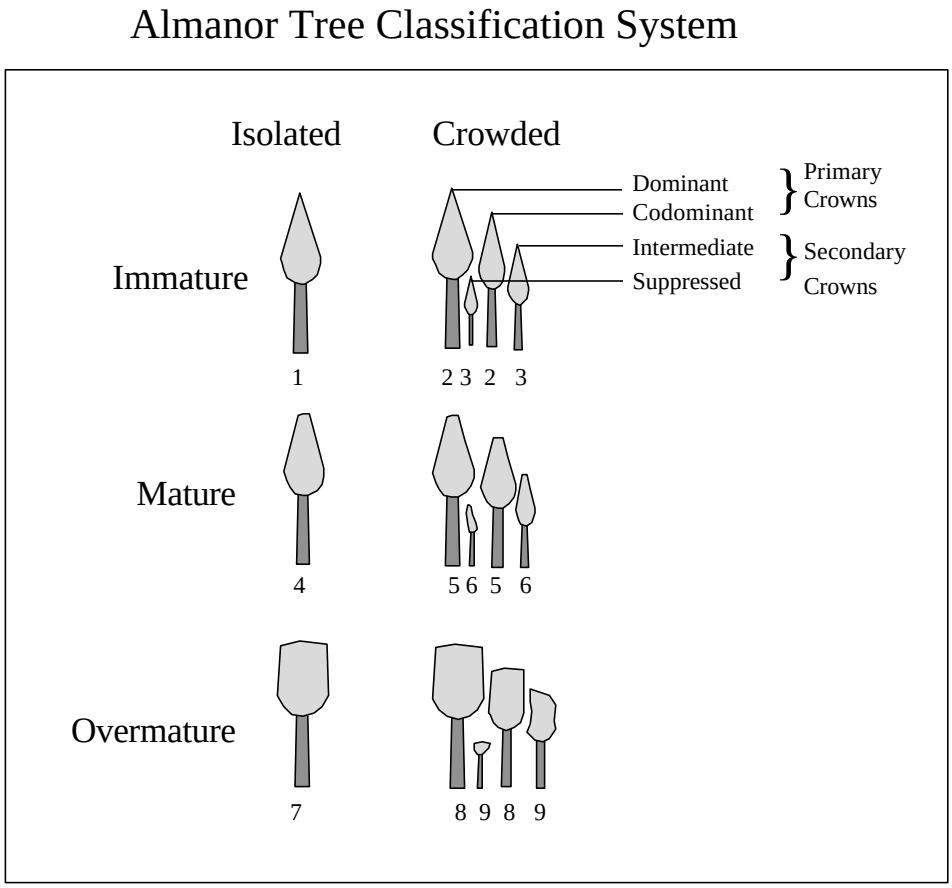
The Gavin Lake site was an ideal spot for this type of camp due to the logging history surrounding it. Some of the oldest plantations in the Cariboo region can be found at Gavin Lake's old Merrill-Wagner logging sites.

Due to the history and setting of the Gavin Lake site, it provides an excellent location for learning about past logging practices and reforestation techniques, as well as more recent developments in forestry.

Appendix 5: Compartments, Use Priority Zones, And Reserves

Appendix 6: Riparian Inventory Maps

Appendix 7: Tree Classification System[49] For Use In Partial Cutting



[49] Mason, J.H. and D. Howell. n.d. CAF timber marking. *In* Collins Almanor forest: 54 years of forest management. Newsletter.

Vigour classification for conifers of the UBC/Alex Fraser Research Forest.

Sp.	Vigor Class	Crown position	Height/ Diam. Ratio (m/cm)	Crown shape	% of live crown or crown density	Bark	Damage
Fd	(G)	D, CD	< 0.8	Sharp pointed	> 30	Reddish, big plates, smooth light gray on upper half	None
	(M)	CD, I	0.8-1.0	Pointed	25-30	Big plates, smooth on upper part of stem	Forked, small cracks
	(P)	I, S	> 1.0	Rounded	< 25	Dark gray, rough, flat	Cracks, conks, canker
Sx	(G)	D, CD	< 0.8	Sharp pointed	> 40	Pink, flat plates	None
	(M)	CD, I	0.8-1.0	Pointed	30-40	Less pink, medium flakes	Forked, small cracks, small brooms
	(P)	I, S	> 1.0.	Rounded to flat	< 30	Dark gray, rough, small flakes	Big cracks, canker, conks
Bl	(G)	D, CD	< 0.8	Sharp pointed	> 50	Smooth, silver, resin	None
	(M)	CD, I	0.8-1.0	Pointed	40-50	Medium smooth	Forked, small cracks
	(P)	I, S	> 1.0	Rounded to flat	< 40	Rough, dark plates	Big cracks, canker, conks
Cw	(G)	D, CD, I	< 0.8	Sharp pointed	Dense *	Long, uniform strips	None
	(M)	I	0.8-1.0	Pointed to round	Medium	Uniform strips	Forked, small cracks
	(P)	S	> 1.0	Flat or spike	Thin	Rough, loose fibers	Big cracks, rot, canker, basal scar
Pl	(G)	D, CD	< 0.8	Sharp pointed	> 30	Light, small plates	None
	(M)	CD	0.8-1.0	Pointed	20-30	Medium plates	Forked, small cracks
	(P)	I, S	> 1.0	Rounded to flat	< 20	Loose large plates	Cracks, canker, pitch tubes

Crown position: D-dominant, CD-codominant I-intermediate S-suppressed

* Because Cw crowns mostly extend well down the bole, density of foliage in the crown is a better indicator of vigor

Appendix 8: Forest Ecosystem Network For The Research Forest

Appendix 9: Active Mining Claims

Appendix 10: Harvest Priority Map

Appendix 11: Allowable Annual Cut Determination

FORPLAN ANALYSIS
ALEX FRASER RESEARCH FOREST
GAVIN LAKE / KNIFE CREEK

by STEVE FINN
Summer 1989

The purpose of this report is:

- to explain the procedure used in building the FORPLAN files;
- to list the assumptions used in the analysis;
- to give a brief summary of the results; and
- to provide suggestions for future FORPLAN projects.

BUILDING THE FORPLAN FILES

This part of the project took about 80% of the total project time and proceeded as follows:

a) Using the 1:20,000 map the boundaries of each particular area (Gavin and Knife) were drawn on the map. With the aid of a digitizer and the Forest Service inventory sheets, each polygon's area was calculated.

b) Each polygon was then entered into a spreadsheet program (Quattro) listing the polygon's species type, species percentages, age class, stocking class, height class, crown closure, site, area in hectares, polygon number, reference age and reference height.

c) When all the polygons were entered for a particular area, "like types" were aggregated together to form Analysis Areas. An Analysis Area is a group of polygons in the same zone with the same or very similar species composition, same age class structure, same site and having the same prescriptions applied to them. A breakdown of the composition of the analysis area is included in Appendix 12. For this study we had three zones: Zone A - Beaver Valley Winter Range, Zone B - rest of Gavin Lake block, Zone C - Knife Creek block.

d) For each Analysis Area an existing stand and regenerated stand yield file was generated using the Forest Service Yield Program. These yield files were then organized and input as the FORPLAN yield files.

e) The main data file for each area was then written. The identifiers were set up as follows:

Level 1 zones

1) Zone A: Beaver Valley Winter Range - uneven age management regime

2) Zone B: rest of Gavin Lake block - clear cuts acceptable

3) Zone C: Knife Creek block - uneven age management regime

Level 2 environmental areas (not used at present)

- could be used in the future to define sensitive environmental areas and to apply specific prescriptions to these areas only.

Level 3 species

- the species used were those defined in the attributes for each individual polygon. In all there are 72 different species combinations used in this analysis. A complete listing of the species combinations is within the main programs.

Level 4 site class

- the site classes were defined by the polygon attributes and were either a Good, Medium, Low or Poor site.

Level 5 age class

- for this analysis, age classes were set up in 10 year age classes up to age 150. Above the age of 150, the age classes were defined by 20 year intervals.

Level 6 not in use

Level 7 reserved FORPLAN level for timber production

Level 8 reserved FORPLAN level for management emphasis

RESOURCES USED

Due to the small number of analysis areas (31) in the Knife Creek block, the entire analysis for that area was able to be completed on the PC version of FORPLAN. The Knife Creek data file was later transferred over to the mainframe version of FORPLAN for the printing of the final results.

With the large number of analysis areas (172) in the Gavin Lake data file, the PC version of FORPLAN was unable to process the data and yield files. The limiting factor was the lack of yield file storage allowed in the PC version. Therefore, the Gavin Lake block had to be run on the mainframe. In my opinion, the necessity of having to move over to the mainframe delayed the completion of this project by a minimum of 1 week. This is due to the mainframe version of FORPLAN being an earlier version than the PC version and thus not as user friendly as the PC version.

I began this project on May 1, 1989 and worked an average of 40 hours a week. The final data run was completed on Sept. 11, 1989. My supervisor, Dr. John Nelson, also spent many hours on this project. Having used FORPLAN previously, his assistance was invaluable in teaching the construction of the FORPLAN files. Dr. Nelson was also instrumental in getting the mainframe version of FORPLAN 'up and running'.

For the PC version of FORPLAN I used Dr. Nelson's 386 computer. However once the switch to the mainframe occurred, I required computing dollars. With each run of the mainframe version of Gavin Lake costing about $80.00, I estimate I used $1,500.00 of computing dollars throughout the duration of this project.

ASSUMPTIONS USED IN THE ANALYSIS

1) All existing stands will regenerate into stands of the same species composition except as follows:

AtFd stands will become	FdAt
AtS	PlSAt
SB	PlS
SCw	PlS
SFd	PlFd
EaFdSB	PlFdEa
Cw leading	FdS
B leading	Pl leading

2) All cedar components of the yield files were kept at or below 150 cubic meters per hectare.

3) Minimum rotations for clearcut stands are 80 years for Pine and 120 years for others. All Pine stands must be logged by age 120.

4) Current NSR in Knife Creek will be PlF by the year 2000. Current NSR in Gavin Lake will be PlS by 1995.

5) Knife Creek and the Beaver Valley Winter Range will be managed on an uneven-aged basis with a harvest cycle every 30 - 40 years, removal cut will be 30 to 40 cu. m. per hectare.

6) The analysis is carried out over a 200 year time frame by 10 year periods.

7) For Knife Creek, areas that were logged during the time 1962 - 1982 are not available until 50 years after harvest.

8) All areas of primary importance to wildlife and recreation were not used in the analysis, i.e. they were not included for timber production. In all they accounted for less than 0.7% of the total block area.

SUMMARY OF RESULTS

Both the Gavin Lake and Knife Creek portions of this project were set up with the following forest constraints:

- non-declining yield

- perpetual timber yield constraint

- long-term sustained yield constraint

Appendix 12: Forplan Aggregate Areas

Appendix 13: Road Network

Appendix 14: Recreation Inventory Maps

Appendix 15: Visual Sensitivity

Appendix 16: Gavin Creek Demonstration Area

Appendix 17: Road Construction And Maintenance Specifications

Appendix 18: Stocking Standards

Appendix 19: Grazing Areas

Appendix 20: Standards For Grass Seeding

Appendix 21: Guidelines To Minimize Cattle-Tree Conflicts

Appendix 22: Referrals To Permitted Users Of The Research Forest

Gavin Lake				
Trapper & Guide Outfitter:	Mr. Shelly Nicol Box 144 Horsefly, B.C. V0L 1L0			
Ranchers:	Mr. Fred Tillotson Box 16 Big Lake, B.C. V0L 1G0	Mr. Bob Hutchinson Box 61 Big Lake, B.C. V0L 1G0	Mr. Dave Fernie Box 15 Big Lake, B.C. V0L 1G0	Mr. Howard Briscoe Box 124 Big Lake, B.C. V0L 1G0
Others:	Ministry of Forests Box 69 Horsefly, B.C. V0L 1L0 Mr. Bob Reinhart 480 Arlington Way Menlo Park, California 94025 USA	Ministry of Environment, Lands, & Parks 540 Borland St. Williams Lake, B.C. V2G 4T1	Dean Clark Binkley UBC Faculty of Forestry 270-2357 Main Mall Vancouver, B.C. V6T 1Z4	Gavin Lake Forest Education Society 72 S. 7th Ave Williams Lake, B.C. V2G 4N5

Knife Creek				
Trapper:	Ms. Kathleen Iverson Box 184 150 Mile House, B.C. V0K 2G0	Guide Outfitter:	Mr. Ron Emmelcamp Box 16 Horsefly, B.C. V0L 1L0	
Ranchers:	Clint and Karen Thompson Box 94 150 Mile House V0K 2G0	Jared and Shelly Fletcher Box 360 150 Mile House, B.C. V0K 2G0 398-3513	Cliff & Jo Hinsche Box 141 150 Mile House, B.C. V0K 2G0 296-3398	
Others:	Ministry of Forests 925 N 2nd Ave. Williams Lake, B.C. V2G 4P7 Dean Clark Binkley UBC Faculty of Forestry 270-2357 Main Mall Vancouver, B.C. V6T 1Z4	Ministry of Environment, Lands, & Parks 540 Borland St. Williams Lake, B.C. V2G 4T1	Harold Armleder, RPF Ministry of Forests 200-640 Borland St. Williams Lake, B.C. V2G 4T1	Mr. Bill Cameron Westcoast Energy 3985 22nd Ave. Prince George, B.C. V2N 1B7