MANAGEMENT POLICIES AND GUIDELINES FOR THE KANANASKIS FOREST EXPERIMENT STATION

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ABSTRACT

This report provides policies and guidelines to be followed in the management of the Kananaskis Forest Experiment Station. To facilitate management the land has been divided into zones designating exclusive, dominant, or co-dominant use for research areas and reserves, watershed protection, timber production, wildlife habitat,and travel influence (aesthetics). In addition, a public awareness program aimed at increasing public understanding of the forest has been developed.

RESUME

Le présent rapport expose les politiques et les lignes directrices à suivre dans l'aménagement de la Forêt expérimentale de Kananaskis. Afin de le faciliter, on a divisé le territoire en zones désignant l'usage exclusif, dominant et codominant des aires vouées à la recherche et aux réserves, à la protection des bassins versants, à la production du bois de sciage, à l'habitat de la faune et à l'esthétique intéressant les visiteurs. De plus, un programme d'éveil du public, visant à augmenter sa compréhension de la forêt, a été mis sur pied.

PREFACE

This report has been prepared as a source of information on policy and guidelines for management of the Kananaskis Forest Experiment Station. It will be useful primarily to people with an interest in the technical aspects of the administration of the property.

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INTRODUCTION

Strong public interest in and concern about land use on the Eastern Slopes of the Rocky Mountains, increased recreational activity in the Kananaskis Valley, and the construction of Highway 940 (the new Kananaskis Highway) have made it necessary to review management policies and guidelines for the Kananaskis Forest Experiment Station.

The new approach includes zoning in accordance with principles of integrated use, with special consideration for timber management, watershed protection, wildlife habitat, and landscape aesthetics. A public awareness program emphasizing interpretation of the use and management of forests and forest land is also incorporated.

DESCRIPTION OF THE AREA

LOCATION, SIZE, AND LEGAL STATUS

The Kananaskis Forest Experiment Station is located 45 miles west of Calgary, Alberta, and about 6 miles south of the confluence of the Kananaskis and Bow Rivers[1]. It is easily accessible from Calgary via the Trans-Canada Highway and Highway 940. Geodetically, the Research Forest headquarters is situated at latitude 51° 2'N and longitude 115° 3'W, at the foot of the north slope of Barrier Mountain.

The Government of Canada received title to the research forest land in 1934. Major boundary revisions were made in 1952 and 1961,

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[1] See Appendix I for metric conversions.

and the Research Forest now comprises some 23.86 square miles or 15,270 acres along the east bank of the Kananaskis River and the east side of Barrier Lake. With the construction of a major new highway and an increase in road right-of-way to an average of about 200 feet, approximately 300 additional acres have recently been withdrawn from the Research Forest.

While protection and management regulations were formerly governed by "Forestry Regulations" under authority of the Department of Forestry Act (1960), the most recent legislation relating to Forest Experimental Areas is contained in the Forestry Development and Research Act (1970).

OTHER JURISDICTIONS

Figure 1 shows the location of different land jurisdictions on and adjacent to Research Forest property.

Provincial Government

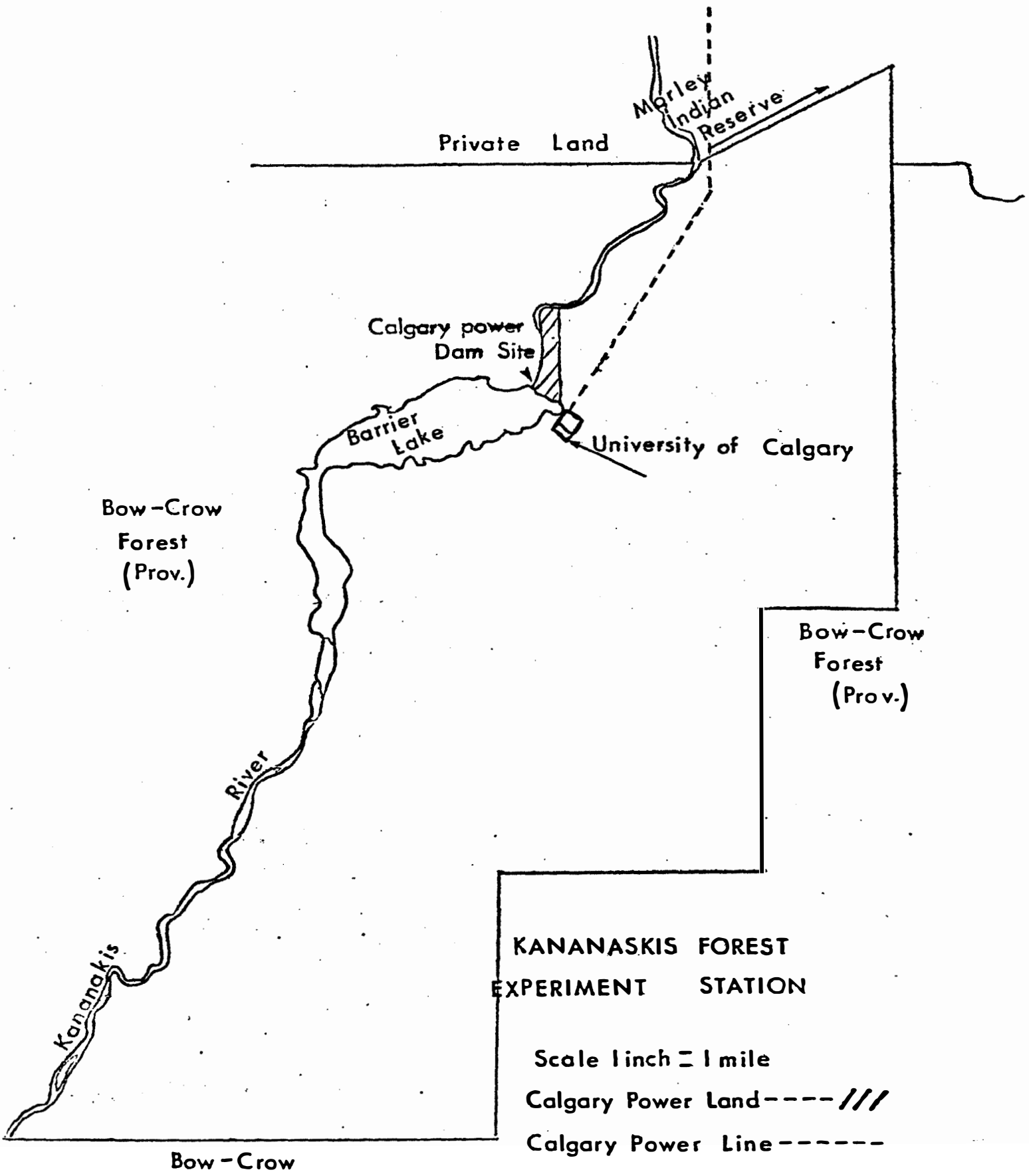
According to the terms of an annually renewable fire protection agreement between the Canadian Forestry Service and the Alberta Forest Service (A.F.S.) "all (provincial) forest officers and any other person authorized by statute may enter on the protected land at any time to carry out the purposes of the protection agreement."

Initially hunting was prohibited on the Research Forest. Hunting is now allowed and authority to administer fish and wildlife regulations rests with the Province, by arrangement.

Alberta Transportation has recently taken over responsibility

JURISDICTIONAL BOUNDARIES

FIGURE 1



for main road maintenance from Alberta Energy and Natural Resources.

The Research Forest borders the Bow-Crow Provincial Forest on three sides; therefore land-use practices on the separate properties can have considerable mutual impact.

The University of Calgary

In 1967 the Governor General in Council authorized a 20-year renewable lease to the University of Calgary for certain lands on the Research Forest to establish an Environmental Sciences Centre. The original lease included an area of 5.82 acres, and an amendment (1970) increased this to 8.56 acres. A right-of-way containing 0.83 acres was obtained with the original lease for the purpose of access. The University of Calgary must receive prior approval (ordinarily in writing) to use the non-leased land or the facilities of the Research Forest.

Calgary Power Ltd.

Coincident with construction of a 13.8-kw powerline which supplies the Research Forest, Calgary Power Ltd. was granted by Letters Patent an easement to construct and maintain the system. Recent relocation of parts of the line has not changed the status of this jurisdiction.

The final license for the Barrier power development was issued to Calgary Power Ltd. in 1949. Under the agreement the maximum flood level of Barrier Lake is given as 4515 feet a.s.l. The Research Forest boundary along Barrier Lake is formed by the

4518-foot contour, leaving only 3 feet in elevational difference between maximum water level and Research Forest property. Calgary Power Ltd. has rights of access to the lake for maintenance purposes along the entire shoreline. This agreement holds the company responsible for any action resulting in damage to Research Forest property.

Stony Indian Reserve

The Morley Reserve is adjacent to the north, having a common boundary (of approximately 2 miles), with the Research Forest.

PHYSICAL FEATURES

Information on the climate, physiography, hydrology, geology, and soils of the Research Forest has been summarized in a report by Kirby (1973). Stalker (1973) published additional information on surficial geology of the area.

Table 1 gives a climatic summary for the Research Forest area.

SOIL EROSION RISK

Rothwell (1972) prepared a relative erosion risk map (Figure 2) for soils on the lower elevation portion of the Research Forest (mainly below 5500 feet a.s.l.), using information on surficial deposits (Duffy and England, 1967) slopes, physical soils data and aerial photo interpretation, following the method of Rutter (1968). He concluded that 66% of the lower elevation portion of the Research Forest has a low erosion risk, 30% a moderate risk, and 4% a high risk. Slope is the major contributing factor to erosion risk on the

Table 1. Monthly and annual climatic summaries for Kananaskis, lat. 51° 2'N, long. 115° 3'W., elev. 4560 ft. MSL, for the period of record (1939-1970). After Powell in Kirby (1973).

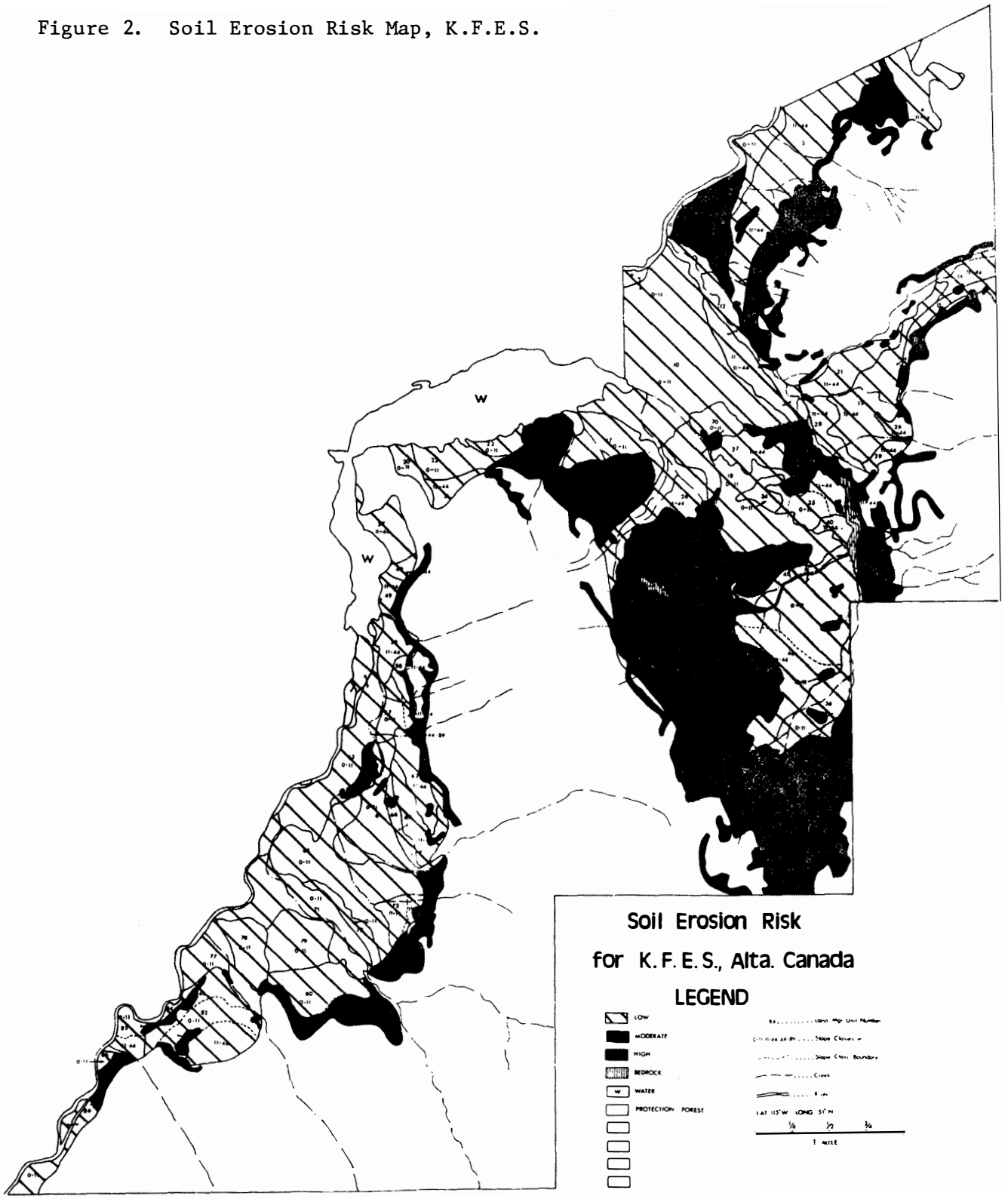
TEMPERATURE °F[1]	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
Daily mean	14.1	20.3	24.9	35.7	45.1	51.5	57.8	55.7	48.7	40.8	27.4	21.6	36.9
Extreme maximum	59	61	64	75	82	88	93	92	86	80	66	64	93
Extreme minimum	-50	-42	-41	-24	-7	23	23	28	15	-8	-32	-44	-50
PRECIPITATION inches[1]													
Total	1.11	1.37	1.39	2.48	2.69	4.22	2.51	2.70	2.24	1.42	1.14	1.18	24.45
Snowfall	10.85	13.71	12.83	19.92	9.00	1.53	0.00	0.16	3.58	9.76	10.67	10.86	102.84
SUNSHINE DURATION hours[2]													
Average	65	130	154	246	214	229	308	254	163	121	71	61	2016
Per cent of possible	26	49	41	59	45	48	62	57	43	37	27	25	43
Years of data	2	3	3	1	2	5	5	5	5	2	1	1	
WIND SPEED mph[3]													
Mean	6.5	6.7	5.9	5.9	5.3	5.9	5.0	4.8	5.1	7.1	7.2	7.7	6.0
WIND DIRECTION FREQUENCY %[3]													
North	8	9	10	8	8	8	7	8	5	5	6	6	7
Northeast	9	10	9	5	9	10	7	9	9	6	7	8	8
East	13	15	11	10	14	13	14	14	14	10	9	9	12
Southeast	9	6	6	3	8	10	10	9	9	8	8	10	8
South	4	4	6	4	6	5	8	9	7	5	4	5	6
Southwest	28	27	28	39	23	24	26	26	29	39	38	37	30
West	18	16	21	18	26	19	17	15	15	15	18	17	18
Northwest	5	5	10	9	8	8	9	7	7	6	5	5	7
Calm	10	9	6	4	4	3	2	3	5	5	6	6	5
Years of wind data	13	14	12	10	17	21	22	23	15	16	11	12	-

[1] Data for period August 1939 to February 1970.

[2] Data for 1939-1941, 1946-1947 and 1968-1969. Largely summers only.

[3] Data for 1939-1941, 1946-1969 (summers only 1946-1954).

Figure 2. Soil Erosion Risk Map, K.F.E.S.



soils concerned. All slopes in excess of 40% should be considered to present high erosion risk for purposes of land use planning and management of the Kananaskis Research Forest.

LAND UNITS

For purposes of management planning there are two broad land units recognized on the Kananaskis Research Forest (Figure 3). Units I and II form a framework for the land use zoning presented later, where they are referred to as the Active Management Area and the Restricted Management Area respectively.

Unit I is basically the Working Plan Area of Krewaz (1967)[2] with some refinements. This area is expected to accommodate land uses such as forestry operations for timber production with minimal risk of environmental degradation. Physiographically the unit is composed of valley bottoms, terraces,and elevated plateaus, mainly between 4550 and 5500 feet a.s.l. Slopes are moderate (up to 40%). The climate is relatively favorable to vegetative growth and regeneration, and vegetative cover is extensive. Soils are relatively deep and soil erosion hazard is low to moderate. The unit is generally easily accessible on foot or by mechanical means, and a basic road network exists.

Unit II is the Protection Area of Krewaz (1967) with some refinements. It presents considerably greater risks of environmental degradation from any land use which disturbs soil or vegetative cover than does Unit I. Physiographically the unit is characterized by

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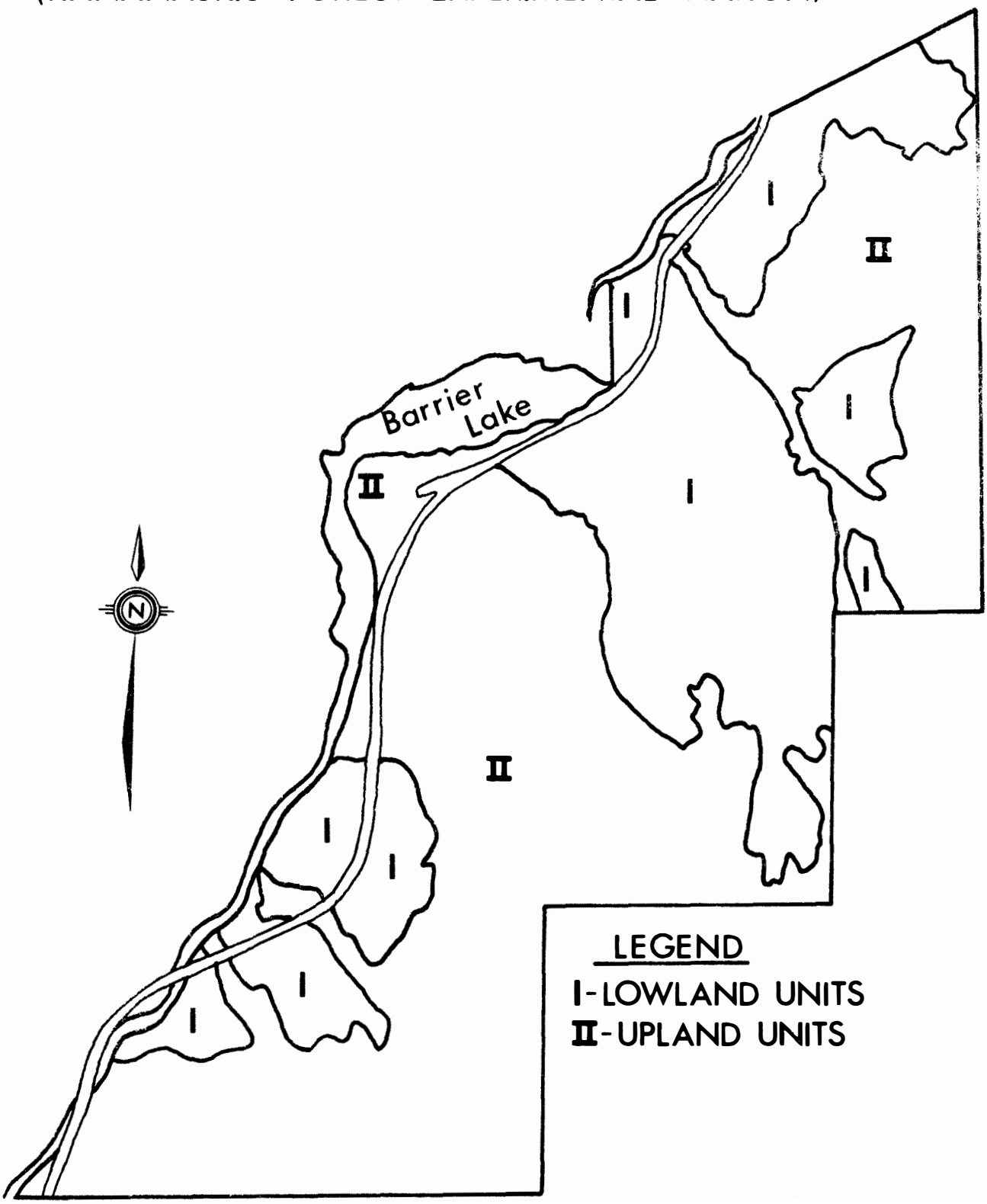
[2] Krewaz, J. 1967. Management plan. Kananaskis Research Forest. Can. Dep. For. Rural Dev.,For. Br.,For. Res. Lab. Intern. Rep. A-10. 22 pp. + App.

FIGURE 3

LAND UNITS

(KANANASKIS FOREST EXPERIMENTAL STATION)



Scale 1 inch = 1 mile

1973.

valley slopes and mountains, mainly above 5500 feet a.s.l. Slopes are steep, often exceeding 40%. The climate is relatively unfavorable to vegetative growth and regeneration. Vegetative cover is sparse or absent in many places. Soils are relatively shallow and the risk of erosion is high in many areas, with considerable current active erosion. Unit II is accessible on foot with moderate difficulty and largely inaccessible by mechanical means because there is no basic road network.

THE FOREST

Native Tree Species and Habitat Types

Relatively few commercial tree species are indigenous to the Research Forest. Lodgepole pine *(Pinus contorta* Dougl. var. *latifolia* Engelm.) and the spruce complex *(Picea engelmanni* Parry - *Picea glauca* (Moench) Voss var. *albertiana* (S. Brown) Sarg. and natural hybrids) comprise the bulk of the growing stock, both by volume and area. Douglas-fir *(Pseudotsuga menziesii* (Mirb.) Franco), alpine fir *(Abies lasiocarpa* (Hook.) Nutt.), trembling aspen *(Populus tremuloides* Michx.), and balsam poplar *(Populus balsamifera* L.) are minor commercial components of the forest. Whitebark pine *(Pinus albicaulis* Engelm.), limber pine *(Pinus flexilis* James), alpine larch *(Larix lyallii* Parl), and western white birch *(Betula papyrifera)* Marsh var. *commutata* (Paegel) Fern.) occur sporadically. Mountain birch *(Betula occidentalis* Hook.) and mountain alder *(Alnus tennufolia* Nut.) are also found, usually in shrub form on sites with an above-average moisture supply such as on north-facing slopes and seepage

areas. Willows (*Salix* spp.) are largely associated with the valley bottoms of water courses or moist sites such as seepage areas but do occur sporadically throughout the area on more open sites.

Ogilvie (1962)[3] classified the forest area into habitat types. Stands at lower elevations on warm, dry soils represent the *Arctostaphylos* type. Steep, north-facing slopes at lower elevations and the lower, moister valley slopes conform to the *Hylocomium-Cornus* type. The higher slopes with well-podzolized soils represent the *Menziesia* type. There are occasional stands near the timberline which represent the *Vaccinium scoparium* type. Stands bordering creeks with alluvial material and gleisolic soil profiles represent the *Equisetum* type, and small areas with impeded drainage and semi-bog conditions represent the *Equisetum-Ledum* type. Local seepage areas on the upper valley slopes, where groundwater is high in the soil profile, conform to the *Ledum-Espetrum* habitat type.

Table 2 gives a summary of forest cover types by height and density class. Approximately 74% of the area is forested, and 73% of the forest cover is dominated by lodgepole pine.

Growth and Yield

Cover type, age, and site index data were compiled for the area shown in Land Unit I (Figure 3)--the Active Management Area. This area comprises 35% of the entire Research Forest.

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[3] Ogilvie, R.T. 1962. Spruce-fir habitat types of the Rocky Mountains north of the Oldman River. Can. For. Serv. Unpubl. Rep.

TABLE 2 DISTRIBUTION OF FOREST COVER AND NON-FOREST LAND BASED ON LITHOGRAPHED MAP OF K.F.E.S. - 1962[1]

Cover Type	Height Class feet	Acreage by Density Class[2] A	B	C	Total Acreage	Percentage of Total Acreage
Lodgepole Pine	up to 30'	104.0	138.0	1115.5	1357.5	8.9
"	31 - 45'	455.6	256.9	1579.2	2291.7	15.0
"	56 - 60'	63.6	584.1	1707.6	2355.2	15.4
"	61 - 80'	-	20.3	-	20.3	0.1
Total:		623.2	999.3	4402.2	6024.7	39.4
Lodgepole Pine	up to 30'	29.7	-	-	29.7	0.2
White Spruce	31 - 45'	169.0	429.9	151.4	750.3	4.9
"	46 - 60'	78.4	507.0	238.0	823.4	5.4
"	61 - 80'	-	114.9	77.1	192.0	1.3
Total:		277.1	1051.8	466.5	1795.4	11.8
White Spruce	up to 30'	55.4	35.2	-	90.6	0.6
Lodgepole Pine	31 - 45'	173.1	192.0	18.9	384.0	2.5
"	46 - 60'	255.5	612.5	63.5	931.5	6.1
"	61 -80'	56.8	87.9	-	144.7	0.9
Total:		540.8	927.6	82.4	1550.8	10.1
White Spruce	up to 30'	47.3	16.2	-	63.5	0.4
"	31 - 45'	104.1	144.7	-	248.8	1.6
"	46 - 60'	252.8	193.3	-	446.1	2.9
"	61 - 80'	236.6	193.4	18.9	448.9	2.9
"	81 - 100'	-	4.0	-	4.0	0.03
Total:		640.8	551.6	-	1211.3	7.9
Aspen	up to 30'	102.7	114.9	-	217.6	1.4
Black Poplar	31 - 45'	74.4	36.5	91.9	202.8	1.3
"	46 - 60'	12.2	102.7	127.1	242.0	1.6
"	61 - 80'	6.7	-	-	6.7	0.04
Total:		196.0	254.1	219.0	669.1	4.3
Total of all Cover Types:					11251.3	73.6
Non-Forest Land						
Rock Outcrops					3050.2	19.9
Sand and Gravel (Gravel Pit, Treed Gravel)					453.0	3.0
Cut-over					121.7	0.8
Potential Productive					39.2	0.3
Treed Meadow					106.8	0.7
Muskeg					28.4	0.2
Water					36.5	0.2
Clearings					81.1	0.6
Erosion					101.4	0.7
Total of Non Forest Land:					4018.3	26.4
Total: Forest and Non-Forest Land					15269.6	100.0

[1] See Appendix I for metric conversion data.
[2] Density classes are by percent crown closure: A = 0-30
B = 31-70
C = 71-100

Growth and yield data, yield tables developed for major species,and a complete age-class summary are given in Appendix II. On the average, growth of both pine and spruce on the Research Forest is slow, reaching a maximum of 35 to 40 total cubic feet per acre per year at 60-70 years of age. There are restricted high-site areas where annual growth may reach 70 cubic feet per acre. Table 3, which summarizes Canada Land Inventory (C.L.I.) growth ratings for the Research Forest and surrounding area, is in general agreement with growth shown in Appendix II. The productivity of the Research Forest as a whole (based on C.L.I. data) is similar to that of the Bow Forest District but differs considerably from the Crowsnest Forest and the combined Provincial Forests.

Yield data for pine and spruce indicate the expected trend of higher initial yields for pine, with spruce growing more slowly initially but sustaining yield increase longer and reaching higher yields than pine. Yield data for lodgepole pine compare favorably with previous calculations of 3,039 total cubic feet for the most frequently sampled stratum (40 to 60 feet, approximately 90 years of age) (Kirby, 1973). Data are also comparable to scaled volumes from a 212-acre cut of pine in 1969-71 (averaging 95 years of age) where gross and net volumes per acre were 3,200 and 2,400 cubic feet respectively, in a post-pole operation.

Even by age 100 the potential yield of sawlogs from lodgepole pine is limited (see Kirby, 1973 - stand and stock tables). The

Table 3. C.L.I. Capability for Forestry - Per cent of Area[1]

	Area ('000) acres	Capability Classes[2] 3	4	5	6/7	Total
Total Research Forest	15.3	0.0	2.2	59.1	39.7	100.0
Active Management Area (A)	5.3	0.0	4.8	82.4	12.8	100.0
Bow Forest	2117.0	0.5	13.1	44.9	41.5	100.0
Crowsnest Forest	871.0	0.0	9.4	25.8	64.8	100.0
Bow-Crow Forest	2988.0	0.3	12.0	39.4	48.3	100.0

[1] See Appendix I for metric conversions.

[2] Classes 3, 4, 5, 6 and 7 represent mean annual increment (m.a.i.) of 80, 60, 40, 20, and < 10 cubic feet per acre respectively on an 80-year basis. Classes 6 and 7 are considered non-productuve forest land for purposes of continuous crops of commercial timber products.

primary products from pine are posts, rails, poles, ties,and pulpwood. Spruce will produce commercial volumes of sawtimber by age 140 on average sites.

Appendix II indicates a total inventory of approximately 16,000,000 cubic feet and an annual increment of approximately 149,000 cubic feet on the Active Management Area of the Research Forest. Total annual increment could be used as a guide to volume available for cutting each year once rotation age (maturity) was established.

For lodgepole pine, maturity could be set at 100 and the age of overmaturity at 130 years. Under these conditions approximately 2,000 acres (50%) of the pine and pine-spruce forests of the Active Management Area were mature in 1974 and 85 acres were overmature. In the absence of cutting or fire there would be an inventory of 3,554 acres of overmature pine on the area within the next 40 years, which would be approximately 90% of the total pine inventory.

For spruce, maturity could be set at 140 years, and overmaturity at 230 years. Under these conditions there are 569 acres (62%) of spruce and spruce-pine stands currently undermature and 359 (38%) overmature. The overmature spruce has been partially cut for sawlogs in the past 30 years and offers limited prospects for a commercial sawlog operation. Within 40 years approximately 580 acres (62%) of spruce forests will be overmature, in the absence of cutting or fire.

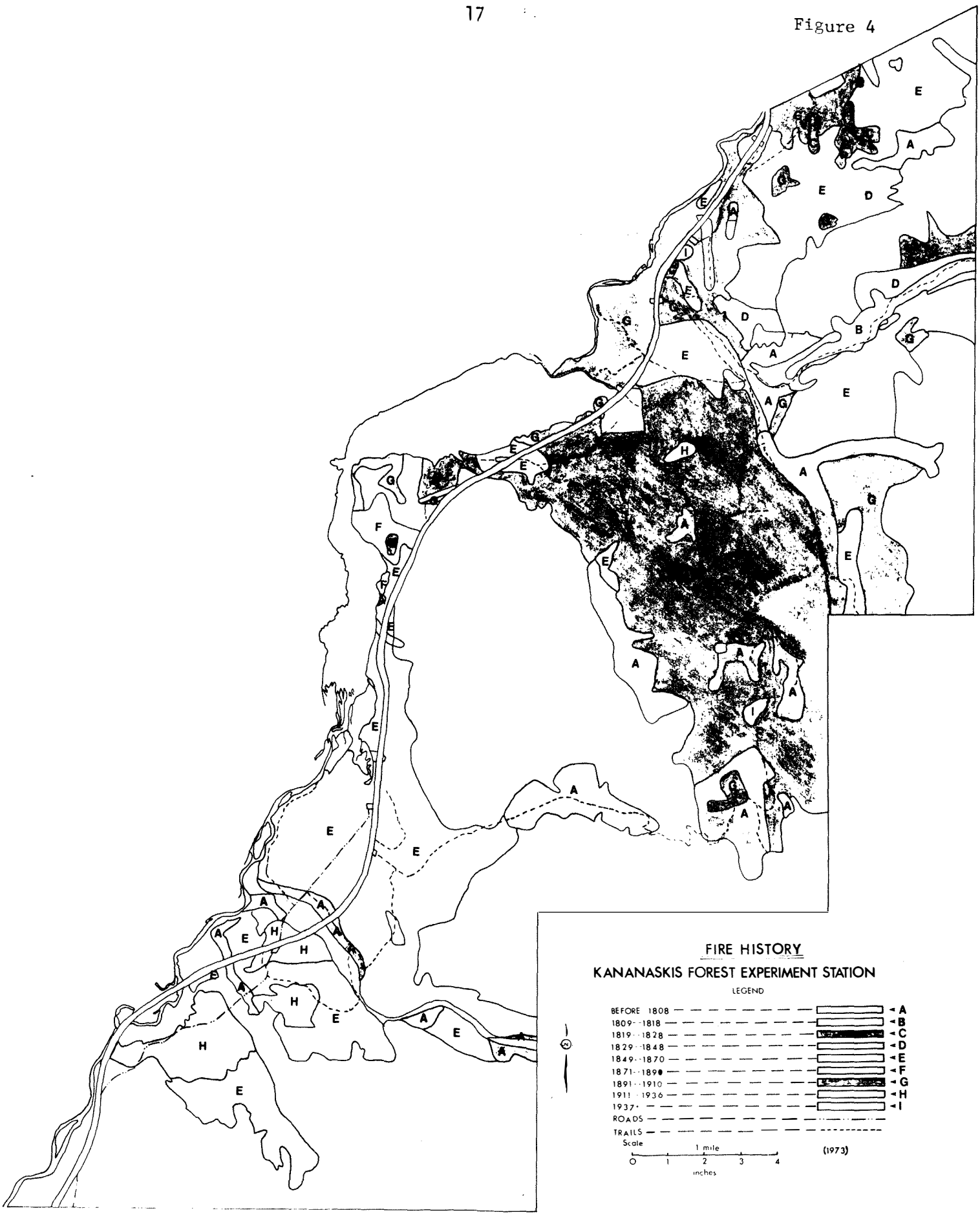
History: Fire, Insects, and Diseases

The Kananaskis valley has been strongly affected by wildfires in the past. Frequent drought periods associated with strong winds, dense vegetation, and lightning storms have made the valley most vulnerable.

Forest stands originated mostly after fire and are therefore mainly even-aged. The fire history map (Figure 4) is based on the present age of dominant tree species, fire scars on trees which survived previous fires, and past records. The last major fire was the Galatea fire in 1936. This fire destroyed large areas just south of the present Research Forest and a small area within the present boundaries. There have been no fires of consequence since 1936.

The most notable forest tree disease on the Research Forest is dwarf mistletoe *(Arceuthobium americanum)*, occurring most frequently on lodgepole pine. This parasite is prevalent throughout forests of the Eastern Slopes and causes considerable mortality and growth loss to commercial tree species (Baranyay, 1970). Other major disease problems include the heart and butt rots *Polyporus tomentosus*, *Fomes pini*, and *Armillariella mellea*. They are most commonly associated with mature and overmature stands and appear to be most prominent on poor sites. Wood stains, considered incipient decay, and heart rot were abundantly evident in recently logged 95-year-old lodgepole pine. In some stands the mortality of merchantable trees was estimated to be 20%, and such mortality can be expected to increase as stands age further. Extensive blowdown caused by high winds in

Figure 4


FIRE HISTORY
KANANASKIS FOREST EXPERIMENT STATION
LEGEND
BEFORE 1808 — A
1809--1818 — B
1819--1828 — C
1829--1848 — D
1849--1870 — E
1871--1890 — F
1891--1910 — G
1911--1936 — H
1937- — I
ROADS
TRAILS
Scale
1 mile
0 1 2 3 4
inches
(1973)

the fall and winter of 1975-76 was evident in lodgepole pine aged 80 years and older. Stem breakage was common at points of weakness caused by heart and butt-rots.

No serious insect outbreaks have been reported in the past on the Research Forest. However, continuing deterioration of mature stands will increase the risk of such outbreaks in the future.

OUTLINE FOR MANAGEMENT

PREVIOUS MANAGEMENT AND PROTECTION PLANS

In the past there have been several broad and informal working plans prepared for the Research Forest. These plans provided only general guidelines for management and operations, being aimed primarily at serving specific research objectives.

The management plan of 1967 (Krewaz, 1967) was the first formal plan for long-term operational management of the Research Forest. However, the plan, based on strip cutting and balanced even-aged forest management, proved to be too rigid in the light of changing public demands for forest land use and concern about landscape aesthetics in the area, so the plan was not fully implemented.

Protection plans as such have not been prepared for the Research Forest. However, fire protection has always ranked high in administrative priority.

RECENT OPERATIONS

Research activities on the Kananaskis Research Forest climaxed in the early and mid-1960's. Operationally, the 1967 management plan (Krewaz, 1967) revitalized logging, road construction, and general

silvicultural activities and placed more emphasis on demonstrations. Deviation from that plan coincided with cutbacks in funding in 1970. Activities since then have concentrated on a reforestation program and on a road maintenance program. Details of recent operations are given by Froning (1975).[4]

INVENTORY

Forest inventory information, based on a working plan survey and line plots established on the Research Forest between 1936 and 1938, is presented in detail by Kirby (1973). The line plots were remeasured in 1946 and 1961-62 and there is sufficient information available now to preclude the need for remeasurement in the near future for purposes of timber management. Future inventories should be designed to provide detail on specific aspects of property management, including any of the uses specified in this report.

CURRENT MANAGEMENT POLICY

Recent public hearings held under the auspices of the Alberta Environment Conservation Authority have indicated considerable public interest in and concern about resource use policies, management practices, and environmental quality within the Eastern Slopes. This concern explicitly includes forest land and resources (Alberta Environment Conservation Authority, 1974), indicating a need for a review of management policy and guidelines for the Research Forest, which lies within the above area.

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[4] Froning, K. 1974. Operational Report - Kananaskis Forest Experiment Station. 1969-1974. Northern Forest Research Centre. Unpubl. Rep.

Current policies are as follows:

1. Research and demonstration in the physical and biological sciences will continue to have high priority.
2. The property will be used as a site for the development of a C.F.S. Public Awareness Program, to the extent that such a use is compatible with continued high priority for forest research and demonstration.
3. Demand for use of the property for recreation purposes will be met by providing for low-intensity uses such as hiking, snowshoeing, and cross-country skiing where these will not conflict with other major use objectives. Camping and picnic sites for general public use will not be provided and open fires will be prohibited. The public will be directed to such facilities currently provided by Alberta Energy and Natural Resources, Alberta Parks, Recreation and Wildlife, and Alberta Transportation.

   Snowmobiles will be restricted to specific roads in view of potential damage to forest regeneration, research facilities and interpretive trails and facilities, and the cost of policing snowmobile use of the property.
4. The appearance of the property, particularly areas and facilities visible from the new Kananaskis Highway, will be maintained and improved as a contribution to aesthetics, which is recognized as an important aspect of travel in the Kananaskis area.
5. The property will be protected from fire, insect,and disease damage. Fire stores will be maintained and the initial fire attack role of C.F.S. staff will be continued.

6. Any activities which will alter the appearance of the landscape, including all construction and timber harvesting, will be reviewed by qualified personnel at both planning and operating stages for their impact upon landscape aesthetics. This will include input by the Program Management Committee of the N.F.R.C. in Edmonton.
7. All construction and timber harvesting will be undertaken so as to minimize adverse effects on air, soil, and water.[5]
8. The storage of pesticides will follow current practices at N.F.R.C. and use of all pesticides will be governed by published guidelines (Chemical Control Research Institute, 1972), and operational use of pesticides will be carried out under permit from the Pesticide Chemicals Branch, Alberta Environment. Research use will follow established practice at the N.F.R.C.
9. The disposal of oil, gasoline, or chemicals shall be in approved locations, to minimize risks of contaminating water.

MANAGEMENT GUIDELINES FOR SPECIFIC USES OR RESOURCES

The six major uses or resources currently requiring consideration at the Research Forest are;

1. Research areas and other reserves
2. Watershed
3. Forestry
4. Wildlife

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[5] Road standards are being developed for the area (Appendix III). Operating guidelines including watercourse and lakeshore reserves will meet the standards of Alberta Department of Lands and Forests (1973), special operating conditions of timber licenses and commercial timber permits, circular T-28 and standards set by Environment Canada (1972).

5. Travel influence (landscape aesthetics)

6. Public awareness

Management guidelines for each of the above are outlined below, with particular reference to timber management practices in each case.

Research Areas and Reserves

Research areas will be managed in accordance with the objectives of the projects concerned.

There are three kinds of reserves: ecological, demonstration, and special. Ecological reserves could be used for scientific and educational purposes and managed to maintain the ecosystem concerned as nearly as possible to the state in which it was initially reserved. This could include active management such as prescribed burning or removal of invading plant species. Consideration should be given to cooperating with the Canadian Institute of Forestry (C.I.F.) in registering areas of interest to them (See Weetman and Cayford (1972)).

Demonstration reserves will be managed to meet the objectives of approved demonstrations, which may include timber management practices such as pruning, thinning,and species removal or addition, as well as harvest cutting of timber species.

Special reserves are committed exclusively to uses such as sewage and garbage disposal and housing or laboratory facilities.

Research areas and reserves are all excluded from regular timber management.

Watershed

There will be no active watershed management for quality, regime,

or quantity of water produced except as part of approved research projects or to meet specific public awareness objectives. Special protected status will be given to watercourse, pond, and lakeshore areas and to the headquarters water supply recharge and discharge area from which all activities other than approved research or demonstrations will be excluded.

With respect to timber management, reserve guidelines cited earlier and road standards being developed will be applied. Erosion risk information compiled by Rothwell (1972) will be given special consideration with the result that conventional logging with wheeled or tracked equipment will be confined to slopes of 40% or less. Cable logging will be given consideration on steeper areas.

Forestry

Forest management for commercial timber production will be confined to the Active Management Area (basically Land Unit I, Figure 3). No regular timber cutting on either a volume or area basis will be applied on the property.

Criteria to be considered in setting cutting priorities in the future will be:

1. Requirements for research projects and the public awareness program.
2. Silvicultural needs with respect to forest maturity, health, and vigor. Maturity must be judged in terms of economic and biological criteria.
3. Requirement for watershed protection and maintenance or improvement of landscape aesthetics.

Since lodgepole pine, which occupies the bulk of forested land, is either mature or approaching maturity there may be a special need in the near future for cutting priority aimed at sustaining forest health.

General silvicultural objectives are as follows:

1. Even-aged silvicultural systems--mainly clearcutting--will be applied in cutting and regeneration of the forest.
2. Regeneration of desired tree species will be established by appropriate means immediately after cutting to standards of stocking at least equal to those required by Alberta Energy and Natural Resources.
3. Intermediate stand treatment for timber production purposes will be undertaken only if it can be justified financially in terms of product yield and quality, over the rotation. Treatment for other purposes will be justified in terms of specific objectives for research projects and the public awareness programs.
4. A long-term objective will be to diversify the composition, age class, and spatial distribution of stands using native tree species including Douglas-fir, spruce, larch, aspen, and poplar on suitable sites. This diversity will tend to increase fire, insect, and disease resistance; increase research and public awareness opportunities; and maintain or improve the physical attractiveness of the area.

A policy of immediate reforestation after logging will be followed. This will generally involve conventional and proven techniques, but there may be deviation for research programs and demonstration

purposes which will not be the most economical or practical when judged operationally. Such special requirements will be considered when formal project proposals are presented for discussion.

Scarification with barrels or anchor chains or a combination of the two has proven to be reliable on most sites for lodgepole pine regeneration. In order to further reduce slash hazard and to render cut blocks more pleasing aesthetically, drum-chopper treatment should be considered as well. Such equipment could be arranged in tandem with scarifiers with a minimal cost increase.

Spruce and spruce-fir sites will be scarified and planted within one year of logging. Planting of container-grown spruce seedlings is considered standard treatment because seed supplies and climatic conditions are too variable to be reliable. Furthermore, spruce and spruce-fir sites are relatively small and they are subject to invasion by highly competitive vegetation. Planted container-grown seedlings are known to establish quickly, providing a good chance for success.

For the Research Forest as a whole, forests will be protected from wildfire and be subject to sanitation and salvage cutting where necessary to contain insect or disease epidemics which might spread within or outside the property boundaries.

Wildlife

There will be no active wildlife management for habitat improvement or maintenance for wild ungulates, fish, or birds except as part of approved research projects or to meet specific public awareness objectives.

With respect to timber management, there will be continuing consultation with the Canadian Wildlife Service (C.W.S.) for combining timber and ungulate management on the Research Forest for specific research or demonstration purposes.

Travel Influence

Emphasis will be on developing, protecting, and managing all areas in the foreground, middle, and background views from the new recreation highway to maintain or enhance the appearance of the landscape.[6] Areas visible only from travel routes within the forest will have less stringent requirements for maintaining their natural appearance, since management activities can be interpreted to the traveller on internal routes.

With respect to timber management, aesthetics is of major importance. Therefore:

1. Visually pleasing native trees and shrubs will be favored in long-term planning, particularly in foreground areas bordering major access routes. In many cases this will involve managing against natural tendencies to lodgepole pine monoculture.
2. Clearcut areas and landings will not be located closer than 3 chains from the edge of the right-of-way on the new highway. They can be located right up to interior access routes.

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[6] On this subject, the following guidelines are available: Litton, 1968; Potter and Wagar, 1971; U.S. Department of Agriculture, 1972.

3. Clearcuts in the middle or background visibility areas of the new highway will not exceed 30 acres, and will be designed to suit the landscape. Each cutting plan will be assessed separately for visual impact and block size. Contiguous areas cannot be cut until regeneration is 3 to 5 feet tall on previously cut areas. This will require cutting cycles in excess of 20 years in some cases.
4. Logging roads will have minimum line-of-sight alignment from the main highway.
5. No painting or other "unnatural" marking of timber will be permitted where it is visible from the new highway.
6. Any radical changes in the appearance of the landscape from the new highway caused by wind, wildfire, insects and diseases, or cutting will be interpreted with prominent signs.

Public Awareness

The objectives are to utilize the facilities, land, and relevant research and demonstration information to develop a program which will better inform the public about the use and management of forests and forest land.

All planning, construction, and operation for timber management that impinges on the public awareness program must demonstrate integrated use and must comply with guidelines which can be cited and explained to the public. This applies especially to cut layout, road construction, and pesticide use. Progress to date on the Public Awareness Program is given by Brace (1976).

ZONING THE RESEARCH FOREST

The philosophy adopted in this plan is that zoning for exclusive use should be minimal, applying mainly to the headquarters site and the associated sewage lagoon and garbage disposal area, research areas, and ecological reserves. A combination of uses will be favored in specific zones.

Initial zoning was undertaken in September 1971 by a group of specialists in watershed, wildlife management, landscape architecture, and timber management. Information obtained was combined with C.L.I. data, further on-site investigation in the summer of 1973, recent (1972) infrared Ektachrome photography and mapping, and a literature review, to prepare zone maps for research areas and reserves, watershed, forestry, wildlife, and travel influence.

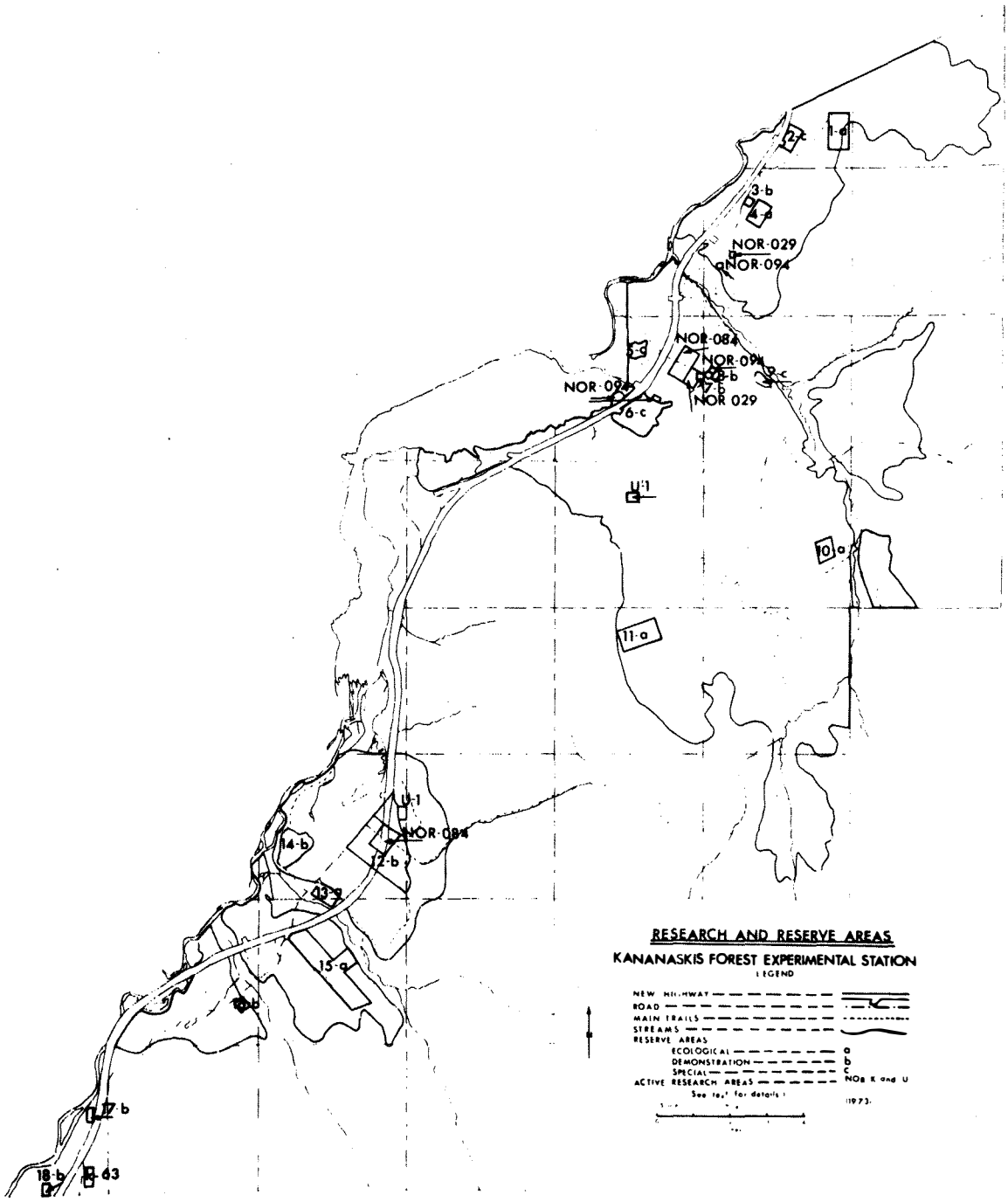
Research areas and reserves (Figure 5) were mapped using research projects and a selection of reserves which include ecological reserves, demonstration areas, and special reserves.

There were five research areas designated in 1974 which are still reserved. In the future, new research sites will be added as projects are approved by the Director, N.F.R.C., and abandoned areas will return to the zone within which they are located.

There is a total of 18 ecological, demonstration, and special reserves, varying in size from 1.3 to 61.3 acres. Research and reserve sites total about 400 acres, 2.6% of the entire Research Forest area. They are listed individually in Appendix IV.

FIGURE 5

RESEARCH AND RESERVE AREAS



The watershed map is shown in Figure 6. The areas of primary concern are the recharge and discharge area for the headquarters water supply, and the shorelines of streams, lakes, and ponds. Management guidelines for these were cited earlier. Land use on other parts of the Research Forest which could disturb vegetation or soil will be controlled for impact on water.

The forestry zone map shown in Figure 7 was prepared on the basis of Land Units (Figure 3) and the forestry map shown in Figure 8 was prepared from C.L.I. data[7]. This information was combined for purposes of zoning.

Figure 9 shows zones for ungulate range data provided by the C.W.S., along with areas of primary sports-fishing potential, and Figure 10 shows ungulate capability based on C.L.I. data.[7] This information was also combined for purposes of zoning.

The travel influence map (Figure 11) shows areas on the Research Forest which are visible as foreground, middle, and background from the new highway. The visibility survey was carried out in 1973. Approximately 70% of the area is visible from the new highway. Therefore any land use practice which changes the appearance of the landscape is likely to be seen by the travelling public.

Initial zoning was followed by preparation of a map of combined management zones (Figure 12), using the map overlay method. Priorities of use were assigned in terms of research policy, the capability rating of the land for a particular use, and potential conflicts between uses. No economic criteria were applied.

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[7] Details of C.L.I. ratings for forests and ungulates may be found in Canada Department of Forestry and Rural Development, 1967, 1970; and on the relevant map sheets for the Research Forest area.

FIGURE 6

WATERSHED

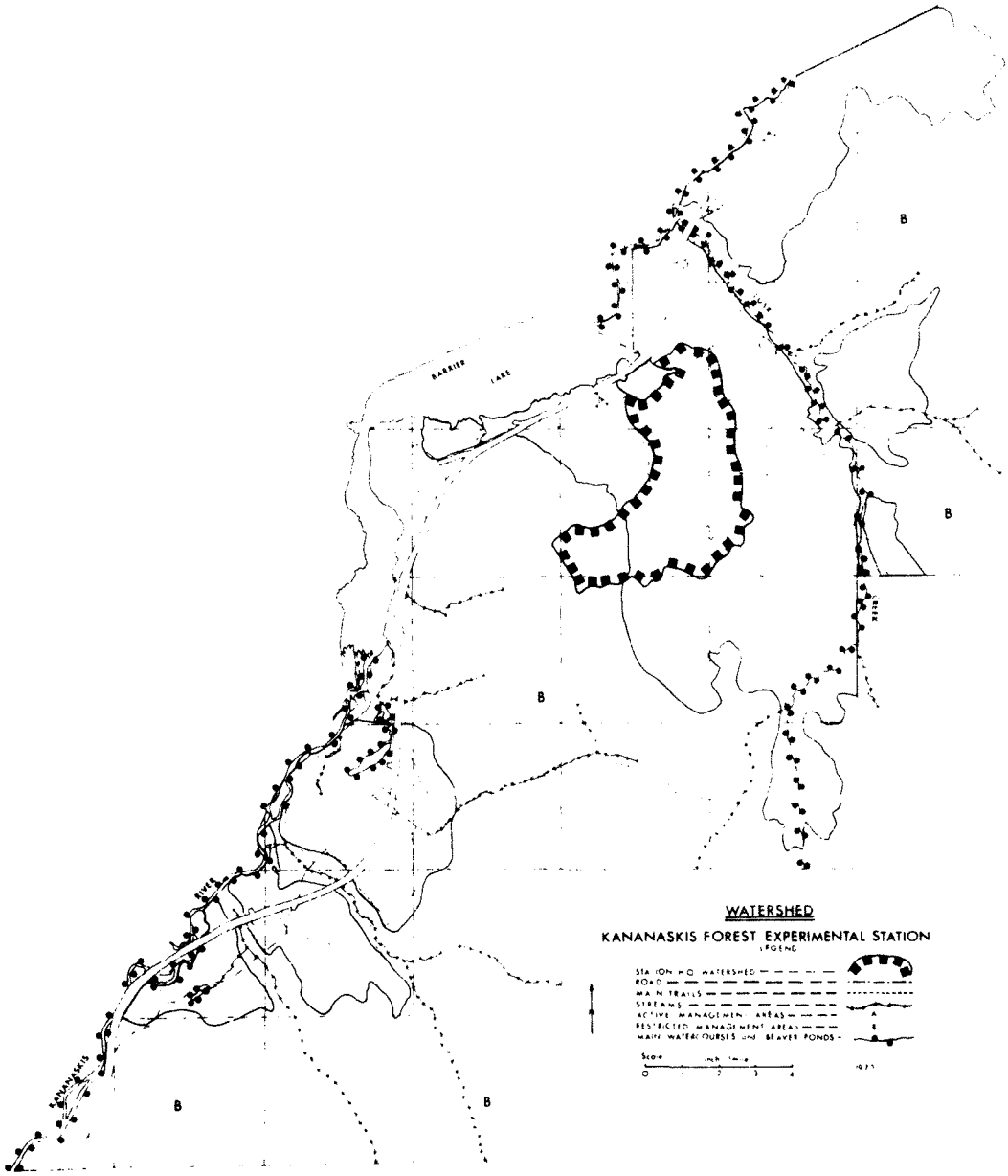


FIGURE 7

FORESTRY

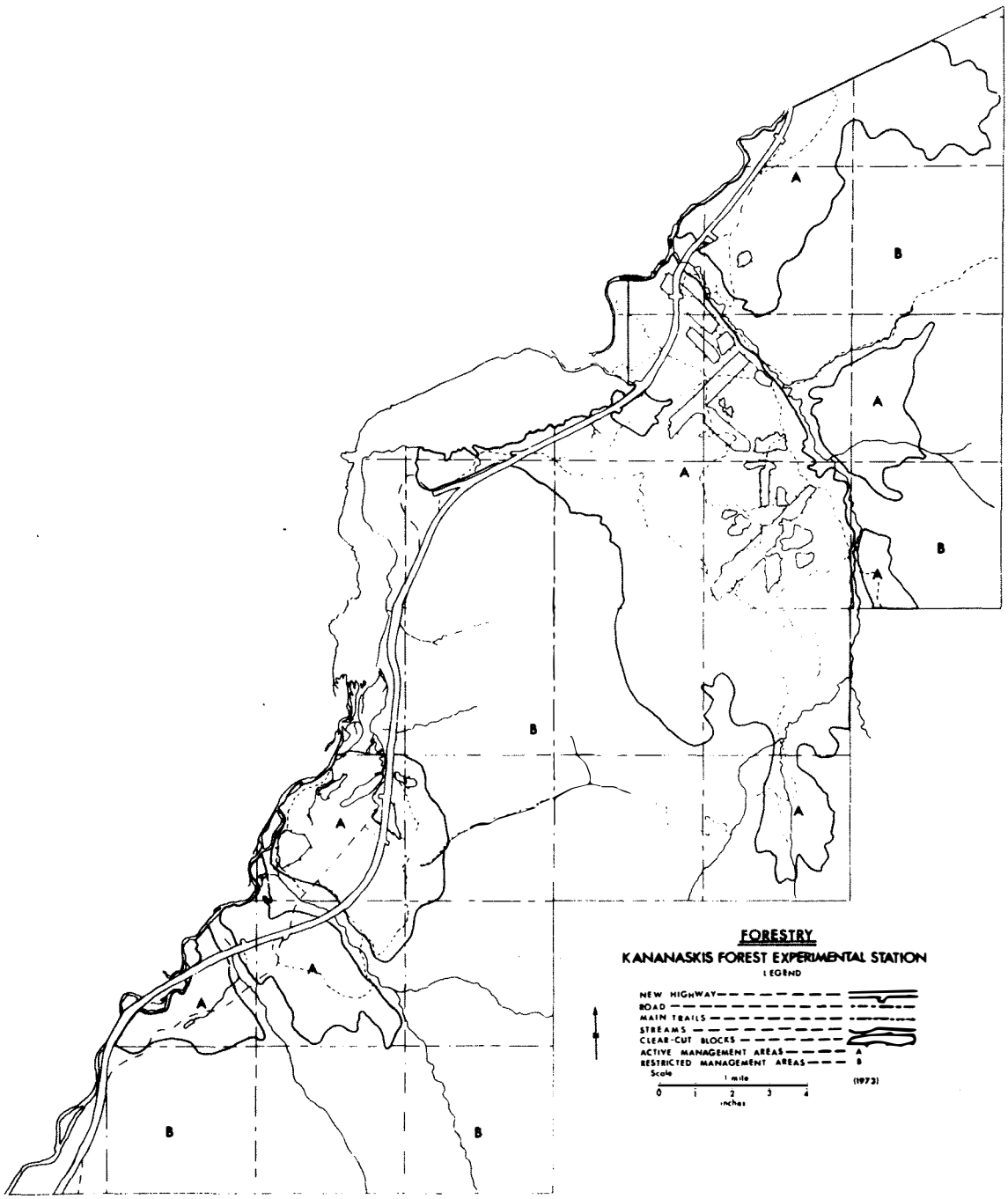
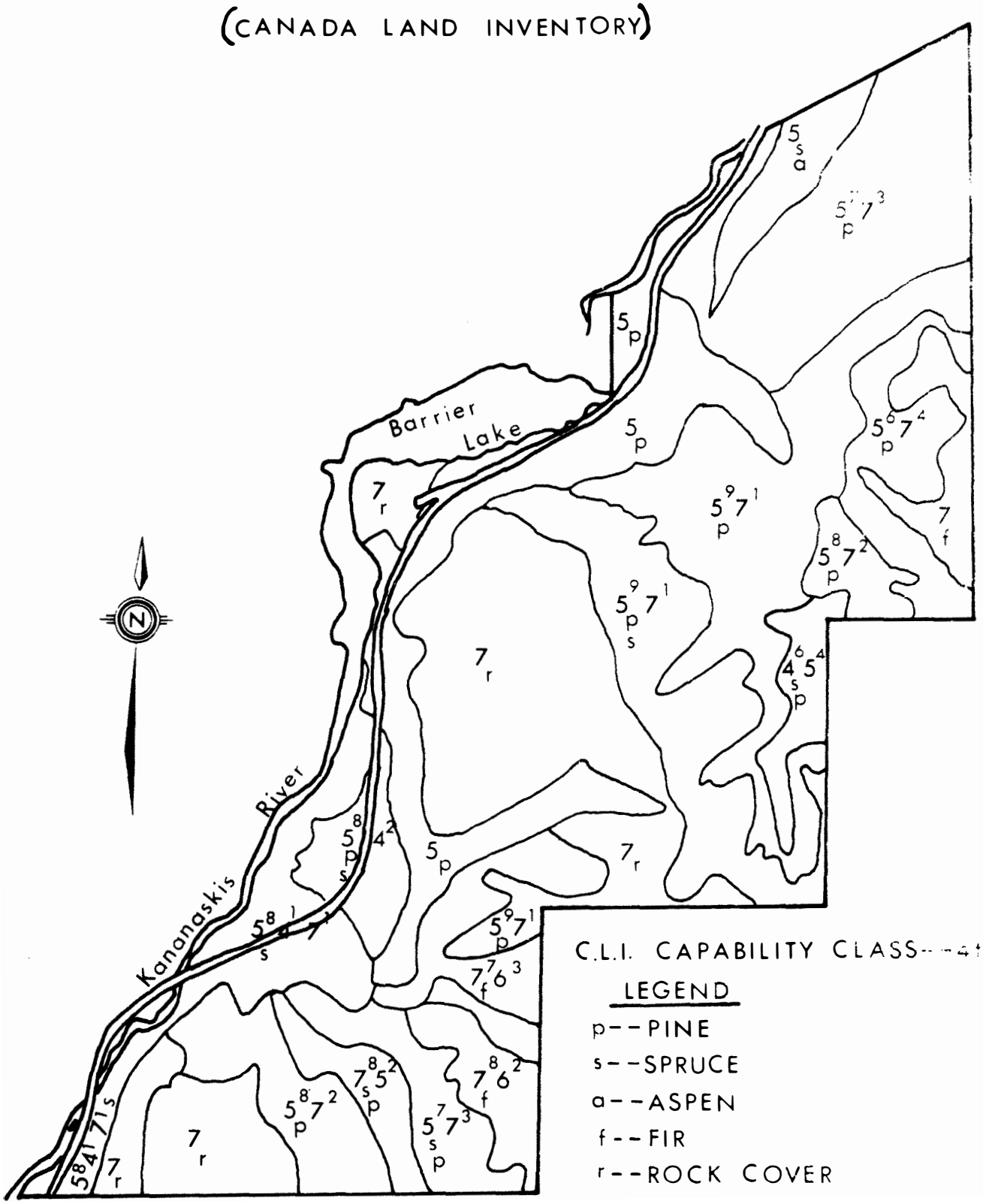


Figure 8

FORESTS
(CANADA LAND INVENTORY)



Scale 1 inch = 1 mile

1973.

FIGURE 9

WILDLIFE

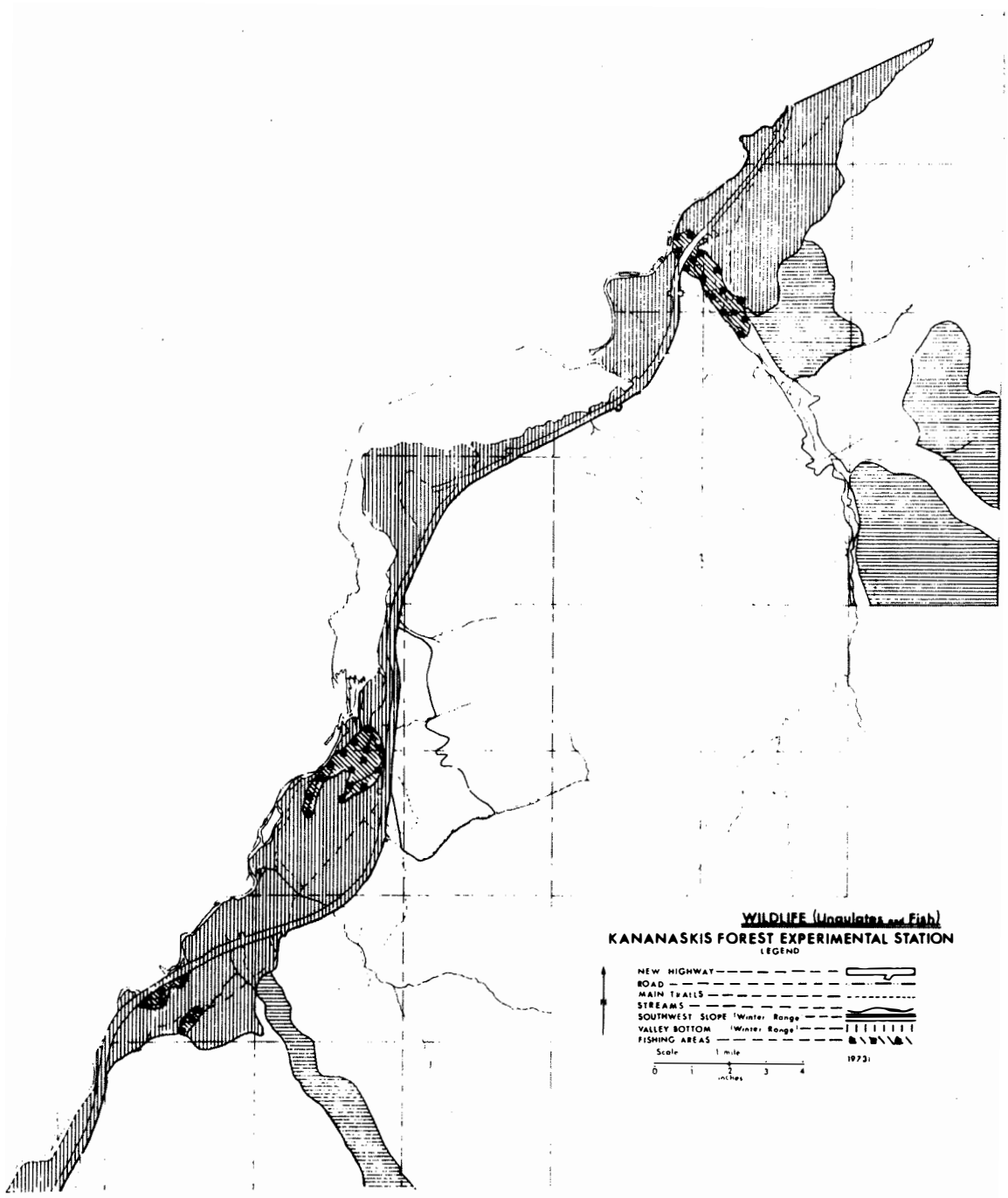
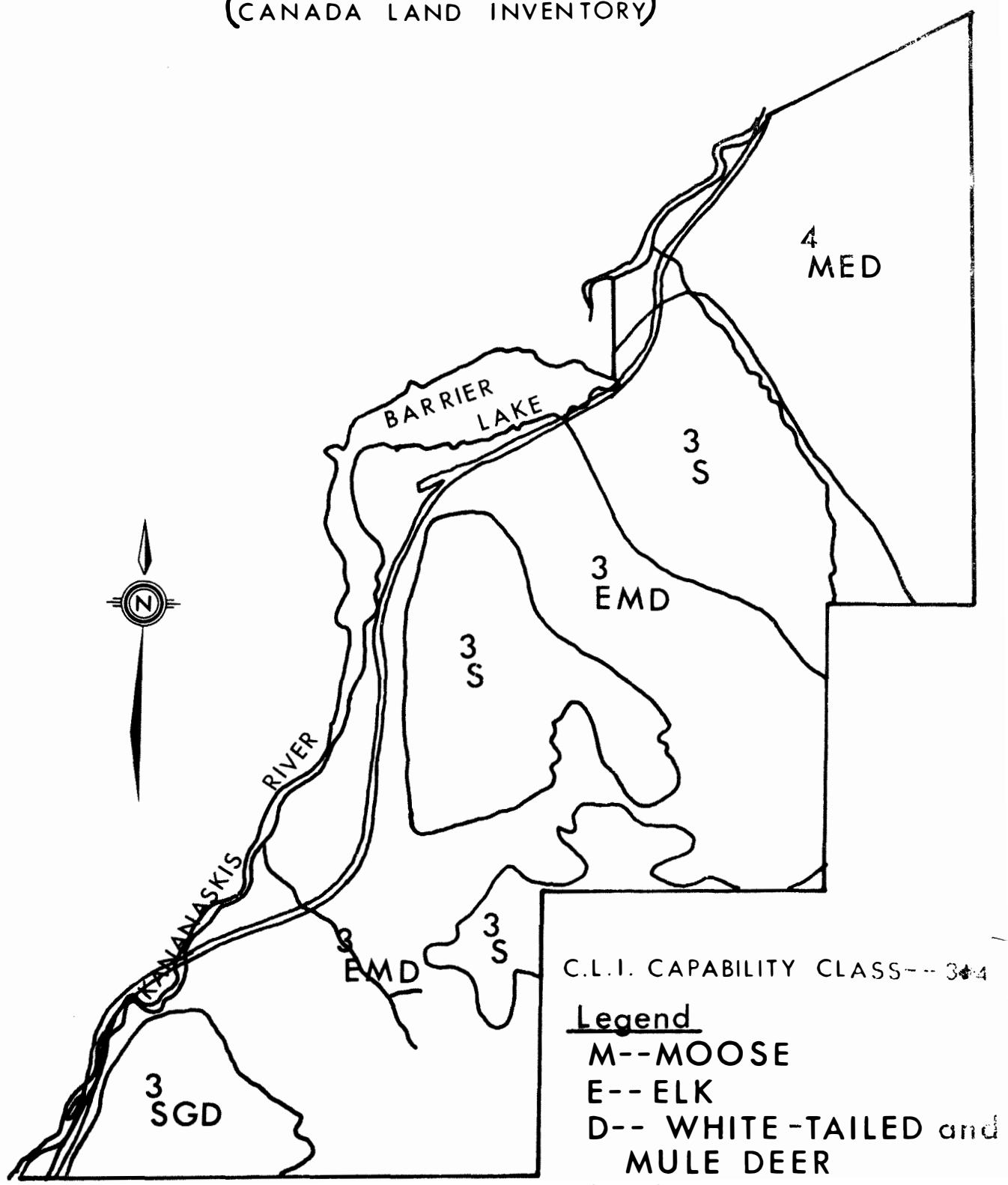


Figure 10

UNGULATES

(CANADA LAND INVENTORY)



C.L.I. CAPABILITY CLASS-- 3-4

Legend

M--MOOSE
E--ELK
D-- WHITE-TAILED and MULE DEER
S--SHEEP
G--GOAT

Scale 1inch= 1mile

1973.

FIGURE 11

TRAVEL INFLUENCE

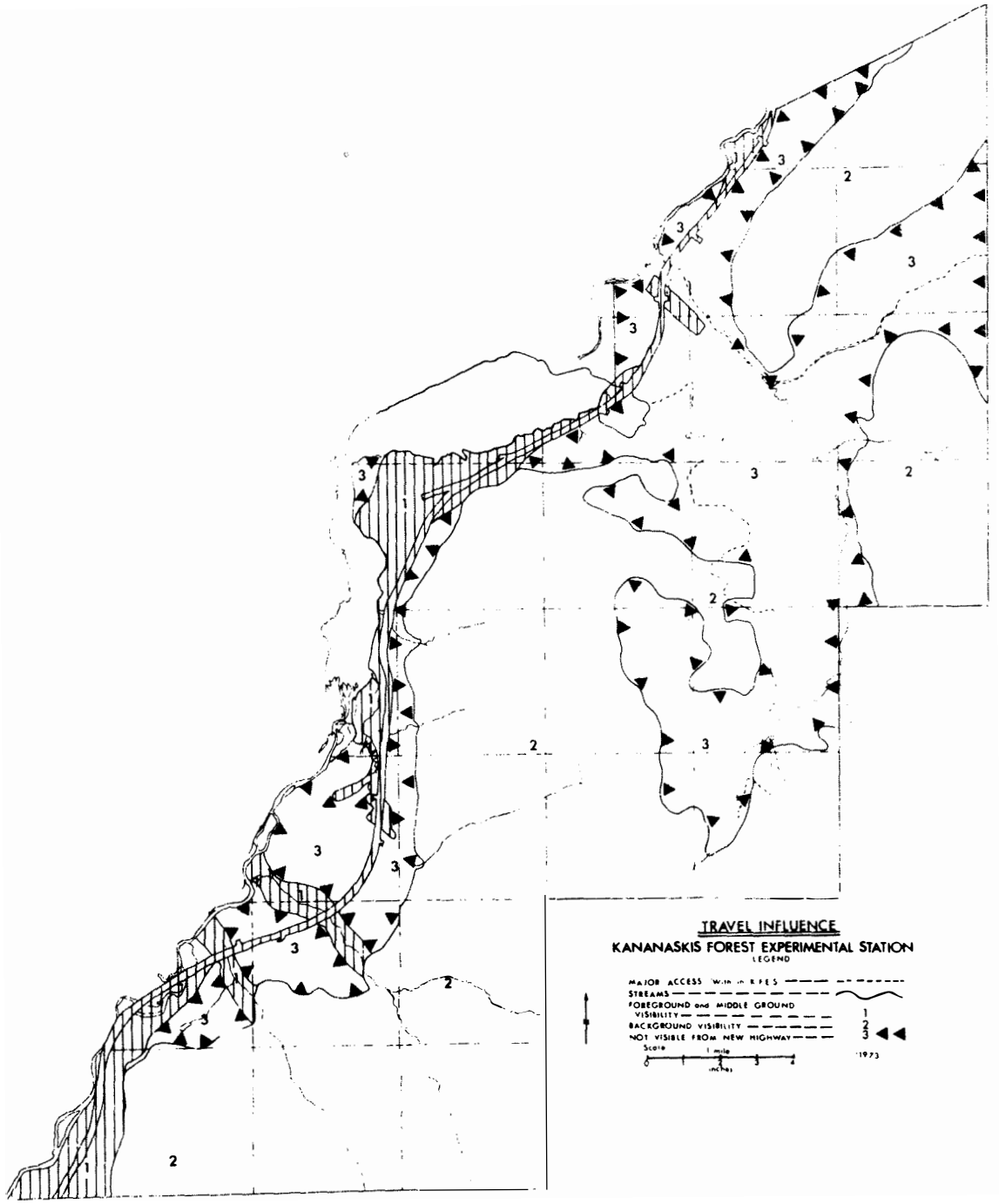
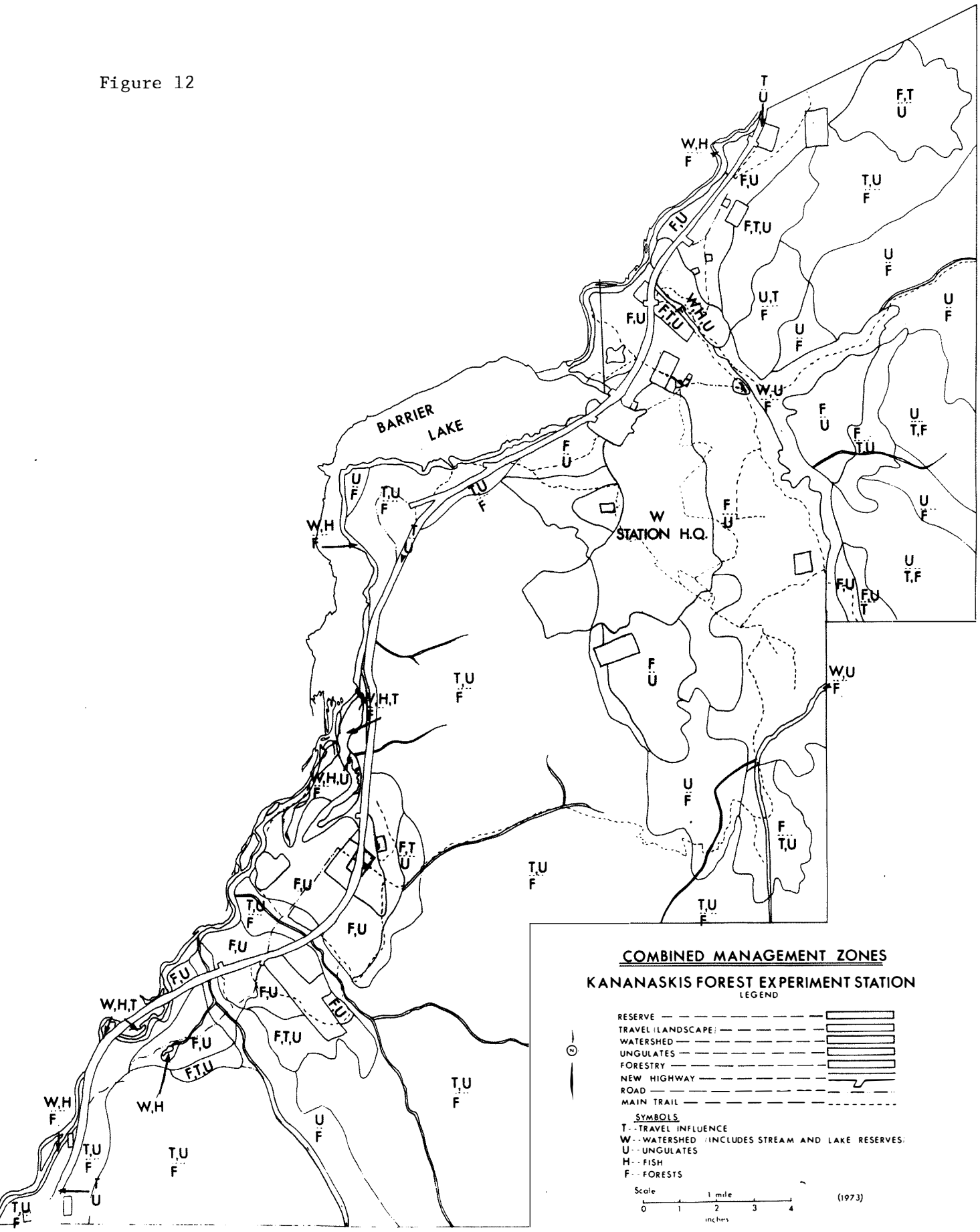


Figure 12


BARRIER LAKE
W STATION H.Q.
COMBINED MANAGEMENT ZONES
KANANASKIS FOREST EXPERIMENT STATION
LEGEND
RESERVE
TRAVEL (LANDSCAPE)
WATERSHED
UNGULATES
FORESTRY
NEW HIGHWAY
ROAD
MAIN TRAIL
SYMBOLS
T--TRAVEL INFLUENCE
W--WATERSHED (INCLUDES STREAM AND LAKE RESERVES)
U--UNGULATES
H--FISH
F--FORESTS
Scale
1 mile
0 1 2 3 4
inches
(1973)

Priorities shown in Figure 12 are as follows:

$$\frac{\text{D CD}}{\text{S}} = \frac{\text{Dominant Codominant}}{\text{Subordinate}}$$

A single rated use indicates *exclusive* priority. Exclusive priority was given to research areas and reserves as a matter of policy. Dominant or codominant priority were assigned as follows:

1. Travel Influence (T) - areas visible in the foreground of middle-ground from the new highway, and areas visible on background if within one mile of the highway.
2. Ungulates (U) - areas rated as winter range (bottomlands and southwest slopes) by a wildlife biologist, and rated 3 or 4 by C.L.I.
3. Fish (H) - areas considered (by local knowledge) to have good sports-fishing potential.
4. Watershed (W) - areas along primary and secondary streams and along Barrier Lake, and the headquarters watershed area. Otherwise watershed was not rated but watershed protection considerations are built into other uses throughout the area, with codominant status.
5. Forestry (F) - areas rated as C.L.I. capability 4 and 5, located on relatively deep soils of low to moderate erosion risk, in climatic conditions relatively good for forest growth, on developed access.

The above procedure often resulted in two or more uses being given codominant status. In such cases the dominant use, if any, will be decided at the operational stage of management by a committee of experts in the relevant disciplines.

No specific allocation of land was made for the public awareness program as it will be designed to make use of other zones. Permanent installations are mainly within the headquarters area reserve.

Subordinate priority was assigned to uses with relatively low capability ratings on a given area, which required some consideration in management (such as Class 7 forest land in visible background zones) and to uses which appeared to conflict seriously with other uses of equal capability rating in a given area. In such cases the order of preference for codominance or dominance was watershed, travel influence, ungulates, and forests.

Conflicts are difficult to foresee in many instances, and will be resolved by a committee as the need arises. Uses rated as codominant are expected to be generally compatible in an "integrated use" approach to management, although a certain degree of conflict is inevitable.

Emphasis was on flexibility in zoning, recognizing that needs and priorities change with time. One major source of interference with this plan could be mineral exploration and development for coal and petroleum, for which potential exists and leases are held (Nowicki, 1973).

OPERATING PLAN

An operating plan is being prepared for the Research Forest. It will contain a schedule for the operation, maintenance, and upkeep of woods, buildings, and facilities and a plan for timber management, including a cutting plan.

The timber management plan will be prepared within the policies, guidelines, and zoning priorities previously discussed. The main objective will be to sustain forest health and to this end a periodic harvest will

be scheduled with special attention to the removal and regeneration of those mature and overmature pine stands in which disease and windthrow are causing rapid deterioration.

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APPENDIX I

METRIC CONVERSION TABLES (BOWEN, 1974)

Canadian yard/pound units and their metric (SI and derived) equivalents

Length		
1 chain (22 yd)	=	20.116 8 m (exactly)
1 foot	=	0.304 8 m (exactly)
1 inch	=	2.54 cm (exactly)
1 mile	=	1.609 34 km
1 yard	=	0.914 4 m (exactly)
Area		
1 acre	=	0.404 686 ha
1 mil-acre	=	4.046 86 m²
1 square foot	=	0.092 903 0 m²
1 square inch	=	6.451 6 cm² (exactly)
1 square mile	=	2.589 99 km²
1 square yard	=	0.836 127 m²
Volume or Capacity		
1 cord (128 stacked ft³)	=	3.624 56 m³ (stacked)
1 cubic foot	=	0.028 316 8 m³
1 cubic yard	=	0.764 555 m³
1 cunit (100 ft³ of solid wood)	=	2.831 68 m³
1 gallon	=	4.546 09 *l* (exactly)
Mass or Weight		
1 ounce (avoirdupois)	=	28.349 5 g
1 pound (avoirdupois)	=	0.453 592 kg
1 ton (2,000 lb)	=	0.907 185 t
Other		
1 cord per acre	=	8.956 47 m³ (stacked)/ha
1 cubic foot per acre	=	0.069 972 5 m³/ha
1 mile per gallon	=	0.354 006 km/*l*
1 pound per cubic foot	=	16.018 5 kg/m³
1 square foot per acre	=	0.229 568 m²/ha
1 ton (2,000 lb) per acre	=	2.241 70 t/ha

Metric (SI and derived) units and their Canadian yard/pound equivalents

Length		
1 cm (centimetre)	=	0.393 701 inch
1 km (kilometre)	=	0.621 371 mile
1 m (metre)	=	0.049 709 7 chain (of 22 yd)
1 m (metre)	=	3.280 84 feet
1 m (metre)	=	1.093 61 yards
Area		
1 cm² (square centimetre)	=	0.155 000 square inch
1 ha (hectare)	=	2.471 05 acres
1 km² (square kilometre)	=	0.386 102 square mile
1 m² (square metre)	=	0.247 105 mil-acre
1 m² (square metre)	=	10.763 9 square feet
1 m² (square metre)	=	1.195 99 square yards
Volume or Capacity		
1 *l* (litre)	=	0.219 969 gallon
1 m³ (cubic metre)	=	35.314 7 cubic feet
1 m³ (cubic metre)	=	1.307 95 cubic yards
1 m³ (cubic metre)	=	0.353 147 cunit (of 100 ft³ of solid wood)
1 m³ (stacked), (stacked cubic metre)	=	0.275 896 cord (of 128 stacked ft³)
Mass or Weight		
1 g (gram)	=	0.035 274 0 ounce (avoirdupois)
1 kg (kilogram)	=	2.204 62 pounds (avoirdupois)
1 t (tonne)	=	1.102 31 tons (of 2,000 lb)
Other		
1 kg/m³ (kilogram per cubic metre)	=	0.062 428 0 pound per cubic foot
1 km/*l* (kilometre per litre)	=	2.824 81 miles per gallon
1 m²/ha (square metre per hectare)	=	4.356 00 square feet per acre
1 m³/ha (cubic metre per hectare)	=	14.291 3 cubic feet per acre
1 m³ (stacked)/ha, (stacked cubic metre per hectare)	=	0.111 651 cord per acre
1 t/ha (tonne per hectare)	=	0.446 090 ton (of 2,000 lb) per acre

Selected metric (SI and derived) units and ratios, their symbols and uses for Canadian forestry

Unit or Ratio	Symbol	Measurement Use
centimetre	cm	Diameter of single trees Average diameter of trees in stands Diameter of logs, bolts and poles
cubic metre	m^3	Volume of single trees, stands of trees, logs, wood products and liquids
cubic metre per hectare*	m^3/ha**	Volume of stands of trees per unit area
cubic metre per hectare per year	$m^3/(ha \cdot a)$	Current, mean, and periodic annual increments (c.a.i., m.a.i., and p.a.i.) of stands of trees per unit area
gram	g	Mass (weight) of trees, branches, fertilizers, etc.
hectare*	ha	Area of land (instead of the acre)
kilogram	kg	Mass (weight) of trees, branches, fertilizers, etc.
kilometre	km	Distance (instead of the mile)
litre***	l or *l*	Volume of liquids
metre	m	Height of single trees Distance (instead of the foot or chain) Average height of stands of trees Length of logs, bolts, poles and lumber
millimetre	mm	Length of panels Width and thickness of lumber and panels
square centimetre	cm^2	Area (instead of the square inch)
square kilometre	km^2	Area (instead of the square mile)
square metre	m^2	Area (instead of the square foot) Basal area of single trees and stands of trees Quadrats (area of reproduction and other vegetation)
square metre per hectare	m^2/ha	Basal area of stands of trees per unit area of land
stacked cubic metre	m^3 (stacked)	Volume of stacked wood (instead of the cord)
stacked cubic metre per hectare	m^3 (stacked)/ha	Stacked volume of wood per unit area
tonne****	t	Mass (weight) of wood, etc.
tonne per hectare	t/ha	Mass (weight) of wood, etc. per unit area

**Although the hectare (ha) is not an SI unit, it is to be used with the International System of Units for a limited time. One hectare = 10 000 square metres (m^2).*

***Ratios of this type may also be expressed as $m^3 \cdot ha$.*

****Although the litre is not an SI unit and is not recommended for high-precision measurements, it is used with the International System as a special name for the cubic decimetre (dm^3). Its symbol is l or l. The script "l" of the word "litre" written out in full is also recommended when confusion might result from the use of the lower case l (ell) for the numeral 1 in typewritten documents. One litre = 0.001 cubic metre (m^3) = 1 decimetre (dm^3).*

*****Although the tonne (t) is not an SI unit, it is used with the International System of Units. It is not to be taken as the French interpretation of the short ton of 2,000 pounds. One tonne = 1 000 kilograms.*

APPENDIX II

GROWTH, YIELD, AND AGE CLASS DATA

Table 1. Mean Annual Increment and Total Yield by Cover Type - Trees 1"+ - K.F.E.S.[1] - 1974[2]

PINE

Age Class (yrs)	Acres	M.A.I. (cu. ft./ac)	Total Increment (cu. ft./ac)	Yield (cu. ft.) (per acre)	(total)
0- 20	211	10.0	2,110.0	100	21,000
21- 40	7	15.0	105.0	450	3,150
41- 60	27	32.2	869.4	1,610	43,470
61- 80	112	35.4	3,964.8	2,480	277,760
81-100	1,223	32.9	40,236.7	2,960	3,620,080
101-120	1,306	29.7	38,788.2	3,270	4,270,620
121-140	7	26.8	187.6	3,480	24,360
200+	-	-	-	-	-
Total	2,893		86,261.7		8,260,540

PINE - SPRUCE

0- 20	-	-	-	-	-
21- 40	-	-	-	-	-
41- 60	1	32.2	32.2	1,610	1,610
61- 80	20	35.4	708.0	2,480	49,600
81-100	373	32.9	12,271.7	2,960	1,104,080
101-120	556	29.7	16,513.2	3,270	1,818,120
121-140	4	26.8	107.2	3,480	13,920
200+	85	0	-	3,926	333,710
Total	1,039		29,632.3		3,321,040

SPRUCE

0- 20	39	2.5	97.5	25	975
21- 40	5	11.3	56.5	240	1,200
41- 60	-	-	-	-	-
61- 80	-	-	-	-	-
81-100	172	34.2	5,882.4	3,080	529,760
101-120	48	31.4	1,507.2	3,450	165,600
121-140	-	-	-	-	-
200+	191	0	-	3,926	749,866
Total	455		7,543.6		1,447,401

SPRUCE - PINE

0- 20	-	-	-	-	-
21- 40	-	-	-	-	-
41- 60	-	-	-	-	-
61- 80	9	37.1	333.9	2,600	23,400
81-100	123	34.2	4,206.6	3,080	378,840
101-120	173	31.4	5,432.2	3,450	596,850
121-140	6	28.5	171.0	3,700	22,200
200+	162	0	-	3,926	636,012
Total	473		10,143.7		1,657,302

Table 1. (Continued)

			OTHER (ASPEN - POPLAR)		
0- 20	-	-	-	-	-
21- 40	-	-	-	-	-
41- 60	80	32.2	2,576.0	1,610	128,800
61- 80	4	35.4	141.6	2,480	9,920
81-100	300	32.9	9,870.0	2,960	888,000
101-120	90	29.7	2,673.0	3,270	294,300
121-140	14	26.8	375.2	3,480	48,720
200+	6	0	-	3,926	23,556
Total	494		15,635.8		1,393.296
Grand Total	5,334		149,317.1		16,079,579

[1] Table derived by applying mean annual increment (M.A.I.) data and yield data from Appendix III, using the pine and pine-spruce data for aspen-poplar.

[2] See Appendix I for metric conversion.

Empirical Yield Tables - K.F.E.S.[1] (Per Acre Values)[2]

Total Age (yrs)	Pine and Pine-Spruce						Spruce and Spruce-Pine					
	Trees 1"+			Trees 4"+ Dbh			Trees 1"+			Trees 4"+ Dbh		
	Dbh (in.)	Vol. (cu. ft.)	M.A.I. (cu. ft.)	Dbh (in.)	Vol. (cu. ft.)	M.A.I. (cu. ft.)	Dbh (in.)	Vol. (cu. ft.)	M.A.I. (cu. ft.)	Dbh (in.)	Vol. (cu. ft.)	M.A.I. (cu. ft.)
10	0.5	100	10.0	4.1	25	2.5	0.6	25	2.5	4.4	15	1.5
20	1.1	230	11.5	4.2	75	3.8	1.2	120	6.0	4.8	90	4.5
30	1.6	450	15.0	4.4	250	8.3	1.7	340	11.3	5.1	250	8.3
40	2.1	950	23.8	4.5	675	16.9	2.1	770	19.2	5.4	650	16.2
50	2.5	1,610	32.2	4.7	1,250	25.0	2.5	1,520	30.4	5.7	1,300	26.0
60	2.9	2,120	35.3	4.9	1,650	27.5	2.8	2,200	36.7	6.0	1,950	32.5
70	3.3	2,480	35.4	5.1	2,000	28.6	3.1	2,600	37.1	6.2	2,420	34.6
80	3.6	2,760	34.4	5.4	2,320	29.0	3.4	2,850	35.6	6.4	2,700	33.8
90	3.9	2,960	32.9	5.6	2,580	28.7	3.6	3,080	34.2	6.6	2,960	32.9
100	4.2	3,130	31.3	5.9	2,800	28.0	3.8	3,280	32.8	6.8	3,170	31.7
110	4.5	3,270	29.7	6.2	2,980	27.1	4.0	3,450	31.4	6.9	3,350	30.4
120	4.7	3,380	28.2	6.4	3,170	26.4	4.2	3,600	30.0	7.1	3,540	29.5
130	4.9	3,480	26.8	6.6	3,330	25.6	4.3	3,700	28.5	7.2	3,650	28.1
140							4.4	3,750	26.8	7.3	3,750	26.8
200+								3,926				

[1] Tables developed from 412 line plots at K.F.E.S., using a height-diameter function of the form ($H = a + bD + cD^2$) and applying volume functions taken from Smith, J.H.G. and D.D. Munro, 1965. Point sampling and merchantable volume factors for the commercial trees of B.C. Faculty of Forestry, UBC, (unpublished ms). Tables apply to site indices 40, 50 and 60 combined as there were not enough data to separate the classes, (indices based on stump age 70, Kirby 1973).

[2] See Appendix I for metric conversions.

Acreage by Age Class and Cover Type - K.F.E.S. - 1974
Active Management Area[1]

Cover Type	Age Class 0-20	21-40	41-60	61-80	81-100	101-120	121-140	221-240	261-280	300+	Total
	Acreage										
Pine	211	7	27	112	1,223	1,306	7	-	-	-	2,893
Pine-Spruce	-	-	1	20	373	556	4	83	-	2	1,039
Spruce-Pine	-	-	-	9	123	173	6	158	1	3	473
Spruce	39	5	-	-	172	48	-	75	-	116	455
Aspen-Poplar	-	-	80	4	300	90	14	-	6	-	494
Total	250	12	108	145	2,191	2,173	31	316	7	121	5,354

[1] See Appendix I for metric conversions.

APPENDIX III

ROAD STANDARDS - KFES

A set of road standards is being developed with a view to providing multipurpose roads for forest management, research, and public travel. For this purpose, a modification of U.B.C. road standards is being applied (Table and Figure attached). In addition A.F.S. road requirements for Forest Management Areas (Alberta Department of Lands and Forests, 1973) and guidelines for logging and road construction in watershed areas (Rothwell, 1971) are being used for specifications on ditch stabilization and culvert sizes.

A road improvement schedule will be adopted giving priority to roads causing environmental degradation and to safety standards on roads. Any road improvements required for timber extraction can be partially financed from stumpage revenue.

For purposes of public safety gates will be installed to control public access on all internal roads except the Stony Creek road.

Road Standards for the Kananaskis Research Forest
Adapted from: Adomovich and Webster (1968)

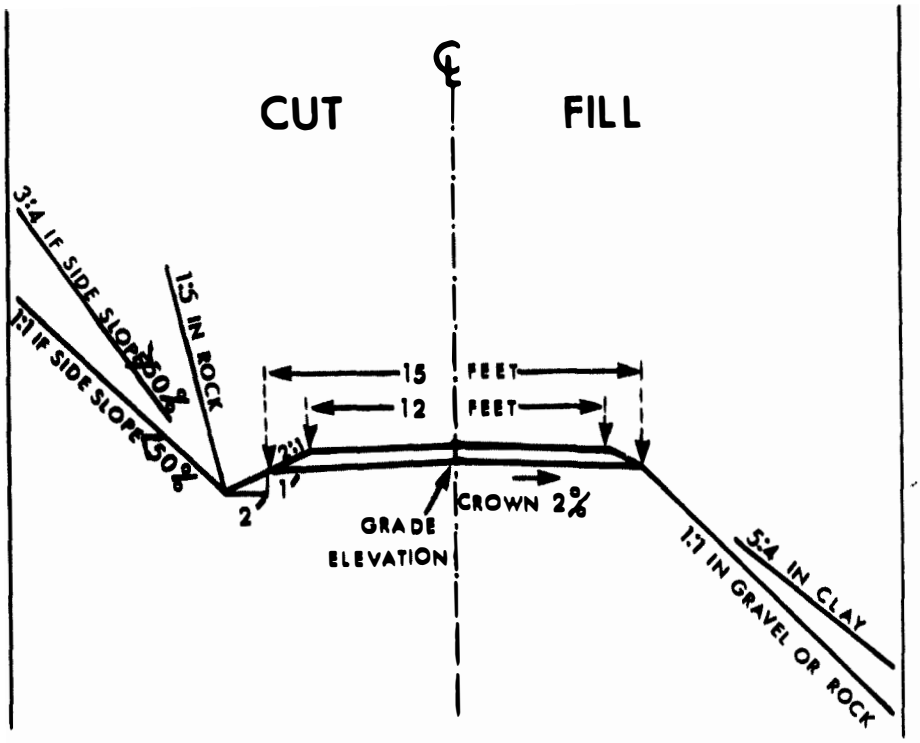
Design Element	Unit	Road Types[1] Secondary Roads	Branch Roads	Access Spurs
Design speed	(mph)	25	15	10
Horizontal Sight Distance	ft	160	100	60
Slight Distance for Vertical Curves	ft	250	200	100
Absolute Minimum Radius	ft	80	72	45
Minimum Radius Due to Design Speed	ft	125	65	45
Widening in Curves	1 ft for each 10° of curvature.			
Maximum Favourable Grade	%	12	14	25
Maximum Adverse Grade	%	8	8	12
Subgrade Width in Fill	ft	20	15	12
Surface Width	ft	15	12	10
Ditch Width in Soil	ft	3	3	2 if any
Ditch Width in Rock	ft	2	2	1.5
Ditch Depth	ft	1	1	1
Minimum Surfacing Depth	in.	6	6	As required
Crown	%	2	2	2 or 4
Sideslopes	As shown on typical cross-section of branch roads			
Right-of-way	ft	33	33	As required

Brush Disposal: Right-of-way to be cleared of all woody growth except for stumps left in the ground. Disposal by burning.

Revegetation: All bared surfaces except running surfaces of roads. Seed mixture: As conventionally used by Highways Dept. in national parks.

Cut and Fill Slopes: As indicated in Figure attached.

[1] There is an additional class of road - 4-Wheel Drive Fire Access - which differs from Access Spur in allowing 25% adverse grade and having a 10 ft subgrade and an 8 ft surface width.



Typical cross-section of branch roads - U.B.C. Forest.

APPENDIX IV

RESEARCH AREAS AND RESERVES

Research projects active in 1974 and still on the reserve list include:

- NOR-029 (6.3 acres) — Epidemiology of Dwarf Mistletoe (*Arceuthobium americanum*)
- NOR-094 — Aerobiology of the Comandra Blister Rust *(Cronartium comandrae)*
- NOR-084 (32.5 acres) — Studies in Forest Hydrology
- K-63 (5.0 acres) — Lodgepole Pine Debudding
- U-1 [1] (2.0 acres) — Soil Movement Studies (H. Harris, U. of Calgary)

Ecological reserves and demonstration reserves include:

(1a) A 20.0-acre overmature white spruce stand which includes trembling aspen and Douglas-fir as significant components.

(3b) A 2.5-acre exotic plantation containing Colorado spruce and Norway spruce. This is part of an old arboretum. (K-35).

(4a) A 11.3-acre bog area containing a variety of mosses, herbs, and shrubs as well as white spruce, balsam poplar, lodgepole pine, and Douglas-fir.

(7b) A 1.3-acre arboretum containing Scots pine, Colorado spruce, Norway spruce, and Douglas-fir. (K-35).

(8b) A 1.3-acre area containing lodgepole pine pruned in 1938.

(10a) A 10.6-acre site in lodgepole pine stand characterized by unusual micro-relief.

(11a) A 60.0-acre mixed coniferous stand aged 200 to 230 years containing white spruce, alpine fir, and lodgepole pine. Succession to alpine fir is evident.

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[1] This area involves two sites, one of which is adjacent to a container planting demonstration.

(12b) A 10.6-acre lodgepole pine stand, thinned in 1941 and later designated project K-57.

(13a) A 10.0-acre outwash site on Wasooch Creek with whitebark pine occurring as individual trees and in clumps, in mixture with lodgepole pine and white spruce.

(14b) A 25.0-acre site logged and burned in 1969 for the purpose of study NOR-001, "Artificial and Natural Regeneration of a Cutover and Burned Lodgepole Pine Site."

(15a) A 61.3-acre lodgepole pine area representing three density classes, three height classes,and three parent material classes.

(16b) A 3.8-acre plantation of Scots pine and lodgepole pine. (K-35).

(17b) A 3.1-acre larch and Siberian birch plantation. (K-62).

(18b) A 3.8-acre seasonal planting experiment - white spruce. (K-67).

Special reserves include:

(2c) An 8.8-acre site including the old administrative headquarters of K.F.E.S.

(5c) An 18.8-acre site containing the new sewage lagoons.

(6c) 37.5-acre site including the present headquarters.

(9c) A 4.4-acre site for the garbage dump.