DESCRIPTION OF SOIL-SITE CHARACTERISTICS AND FOREST GROWTH IN SELECTED AREAS OF NORTHWESTERN ALBERTA

by

W.D. Holland Z.J. Nemeth

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T6H 3S5

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W. D. Holland* and Z. J. Nemeth**

Abstract

This report describes and compares selected soil characteristics, such as bulk density, specific gravity, compaction, with forest growth in 5 areas of Northwestern Alberta.

In general the best capability classes (2 and 3) were found associated with ablational material and/or alluvium over till or lacustrine, usually in somewhat favoured climatic locations. The descriptions indicate the lack of high density subsoils such as found in Bt horizons.

Capability Class 4 lands were found under average regional conditions of soil moisture, well-drained to moderately-well-drained soils with average climatic exposure on different parent materials. High subsoil density is common.

Capability Class 5 lands were found under moderate-to-severe growth limitations: rapid drainage on coarse soils, steep slopes, poor-to-very poor drainage, high subsoil density, climatic exposure on different parent materials.

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* Research Scientist and ** Research Assistant, respectively, Northern Forest Research Centre, Canadian Forestry Service, Department of the Environment, Edmonton, Alberta, Canada. T6H 3S5.

Capability Class 6 lands were usually confined to the poorly and very poorly drained till soils, lacustro-till and lacustrine soil sites.

Capability Class 7 was found on very poorly drained organic soils.

During the course of C.L.I. mapping and exploratory studies it was often observed that the lower forest productivities were associated with high subsoil density and shallow rooting. The relationship of abundant rooting and penetrometer reading proved significant for Area 1 and Area 2. Data were insufficient for conclusions pertaining to Areas 3, 4, and 5.

INTRODUCTION

The preparation of a forest land capability map for the Hines Creek - Cherry Point area, map sheet 84D, Alberta, (Figure 1, Area 1) was completed in 1969 according to Canada Land Inventory (C.L.I.) criteria (McCormack, 1968). Exploratory work was carried on during the above survey to examine the relationships between soil bulk density, specific gravity, compaction and porosity to rooting depths and forest productivity. The data suggested that compaction and density of some surface and/or subsurface soils are limiting factors to forest growth in this region of Alberta.

In 1969 this exploratory work was extended to 4 other areas (Figure 1), Whitecourt - Little Smoky River (Area 2), Swann Hills (Area 3), Chinchaga (Area 4), and Footner Lake (Area 5). The sampling in the Hines Creek - Cherry Point area was selective for the best forest growth; the sampling in the other 4 areas was on the basis of Alberta Forest Service permanent sample plots. The work is part of Project No. 258 (NOR 015).

This report presents descriptive data for each area and describes the relationships between selected physical soil characteristics and forest growth found to be of use in classification of productivity.

METHODS

Preparation of the forest land capability map of sheet 84D (Area 1) followed the Canada Land Inventory methods outlined by McCormack (1968). Field checking of air photo interpretation was made by collecting

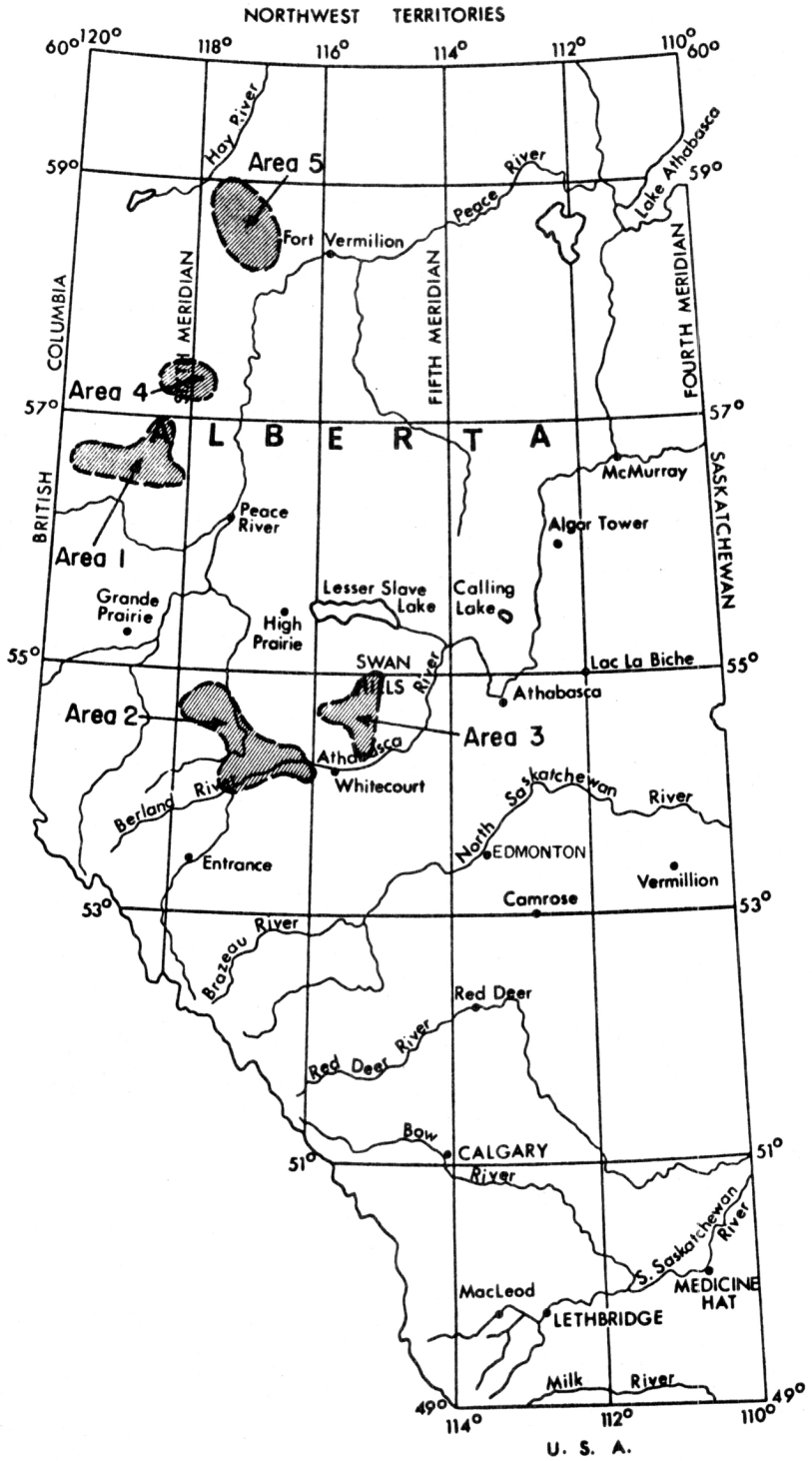


FIGURE 1. LOCATION OF SAMPLE AREAS.

mensurational data and soil descriptions on sites selected for best growth. Other guides used were the soil survey of the area (Reeder and Odynsky, 1965) and the classification of Forest Regions of Canada (Rowe, 1959).

The following soil and site data were recorded:

Soil horizon designation according to N.S.S.C. (1968)

Horizon thickness (max., min., avg.)

Soil colour, using Munsell Colour Charts

Soil texture for each horizon, by manual texturing

Soil structure and soil consistence

Clay films and stoniness

Depth of abundant rooting

Drainage class and soil temperature

Average penetrometer readings of each horizon (samples from Areas 2, 3, 4, and 5 were corrected for variations of actual field moisture),

Parent material

Slope grade, in per cent

Slope position

Aspect

Elevation

Topographic class

Forest stand data for Area 1 was taken from 6 vigorous and undamaged dominant trees at each sample site and included:

Species, species composition

Diameter at breast height (o.b.)

Height (dom.)

Total age

Radial growth last 10, 20 and 30 years

Basal Area using Spiegel relascope (10 factor)

Bark thickness

Crown diameter

Calculated Gross Merchantable Volume and Mean Annual Increment (MAI) at 100 yrs.

Sampling on Areas 2, 3, 4, and 5 was on the basis of Alberta Forest Service permenent sample plots. Soil and site data were recorded on the Site Description Sheet as described for Area 1. Forest stand data were obtained from the A.F.S. including species, height, total age, basal area, number of trees per acre, total and gross merchantable volume. Bulk density and particle density of the mineral soil horizons were determined with a Beckman model 930 air comparison pycnometer. Soil pH was measured with a Model 10 Corning pH meter, using the paste method (Doughty, 1941). Percentage porosity was calculated by the formula $(1 - \frac{\text{Bulk density}}{\text{Particle density}}) \times 100$. Total Exchange Capacity (T.E.C.) and analysis of exchangeable acidity (H) were done on a Metrohm Potentiograph. Analysis of exchangeable calcium, magnesium, sodium and potassium was by a Unican SP 90 Atomic Absorption Spectrophotometer, following extraction with NH_4Ac. Base saturation percent and Ca/Mg + Na Ratio were then calculated.

Gross Merchantable Volume in cubic feet per acre was used to calculate Mean Annual Increment at stand age. These data were converted to M.A.I. at 100 years using MacLeod and Blyth's curves (1955 for white spruce and Smithers' M.A.I. curves (1962) for lodgepole pine.

Linear correlations and linear regression equations followed the methods of Lacey (1959).

Coding and terminology utilized in C.L.I. capability mapping and in this report are described in Appendix I. Soil-site and forest data for individual plots are shown in Appendix II, and in Tables 1 to 5 for Areas 1 to 5, respectively.

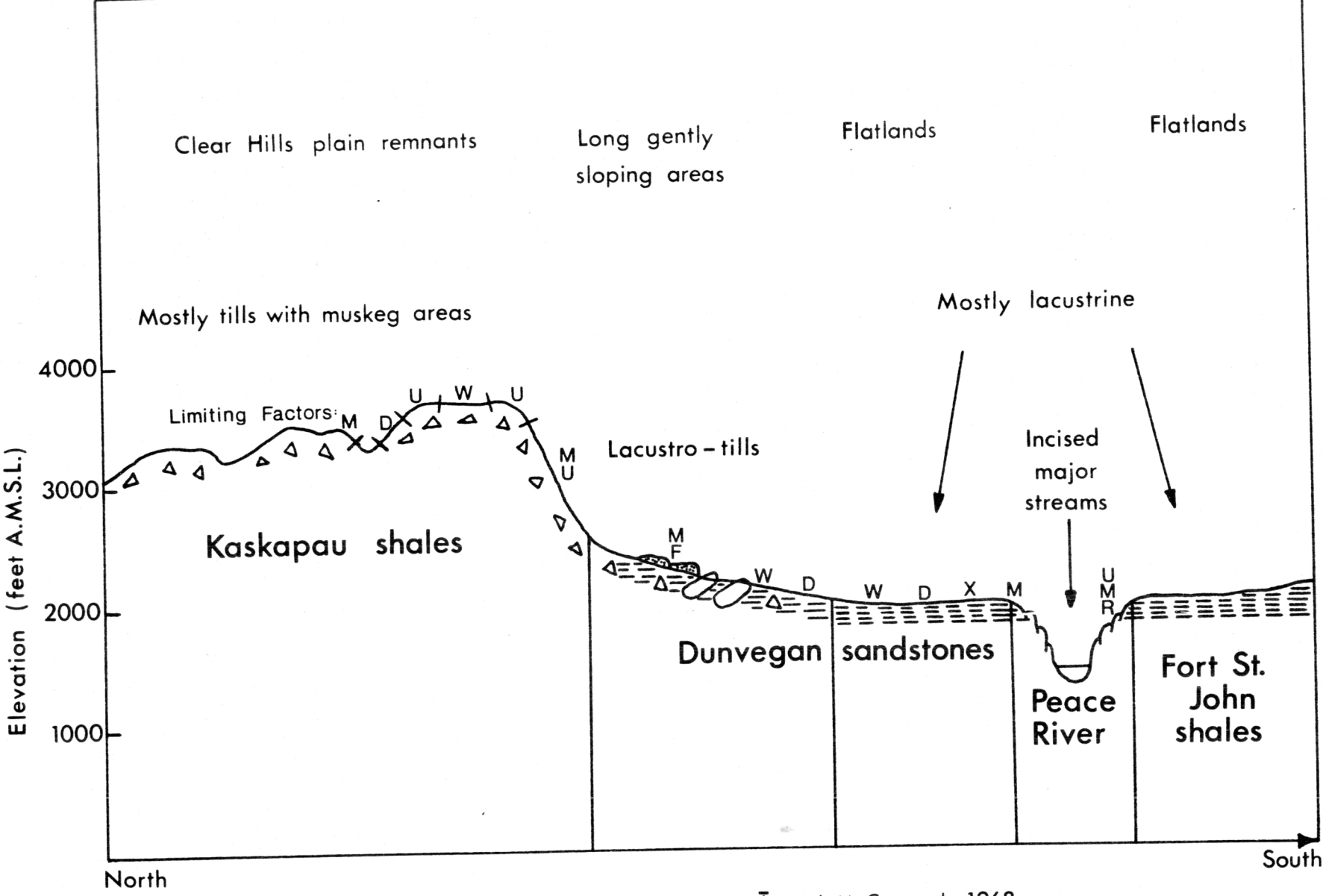
RESULTS

Area 1. Hines Creek - Cherry Point:

This area is part of the Peace River district of northwestern Alberta between latitude 56° and 57° north and longitude 118° and 120° west. It is situated in the Interior Plains (Bostock, 1969) physiographic region and in general consists of relatively high plain remnants (the Clear Hills) in the northern portion, gently undulating flatlands and incised valleys in the southern part (Figure 2). All samples in this area are from the Clear Hills or high plain remnants (see Area 1, Figs. 1 and 2).

The Clear Hills range in elevation from approximately 2400 to 3700 feet, A.M.S.L. The geology, surficial deposits and soils have been described (Lindsay, *et al.*, 1958) and (Reeder and Odynsky, 1965).

Climatically the area is characterized by warm summers and cold winters. Mean annual temperature is 32°F, mean winter temperature



Limiting Factors (to forest growth) are defined in Appendix I and McCormack, 1968.

Figure 2. Diagrammatic cross-section of Area 1, 84-D.

(December, January and February) is -1°F, and the mean summer (June, July and August) temperature is 58°F. The annual precipitation averages about 17 inches, 75 per cent as rain, with June and July being the wettest months. Soil moisture deficiencies do occur. The frost-free period ranges from 105 days at Fairview to less than 60 days in the Clear Hills at higher elevations. The length of the growing season varies from 164 days to less than 154. It is also noteworthy, from the experience of farmers in the area and from limited mobile thermograph traverses, (MacIver, 1970), that cold air and summer frosts frequently occur at lower elevations in the gently sloping and flatland areas of the southern portion of the area. This is assumed to be true also for the numerous hollows and basins that occur throughout the Clear Hills*. Numerous soil temperatures were found to be in the 30°F - 35°F range at depth of 10 - 15 inches during the midst of the growing season.

Rowe (1959) classifies the Clear Hills area as the Lower Foothills section (B.19a) of the Boreal Forest Region. In Section B.19a, lodgepole pine and white spruce are important constituents of the forest. Black spruce, aspen, balsam poplar, and white birch also occur, and balsam fir occurs at higher elevations. The Clear Hills forest has been severely disturbed by fires and cutting. The soils are largely Gray Luvisols, but the nature of the hilly terrain considerably influences such site growth factors as exposure, drainage, and depth of overlay materials. Generalized ecological relationships are shown in Table 1.

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* Mr. MacIver identified numerous frost hollows, or frost pockets, using mobile thermograph techniques in a number of areas in 1969, one of them being in the Clear Hills area and another being in Area 3, the Swan Hills

TABLE 1. GENERALIZED ECOLOGICAL RELATIONSHIPS FOR 84-D (Area 1).

Capability Class	Parent Material	General Soil Series in the Mapping Unit	Drainage	Limiting factor (used singly or in combination)	Vegetation	Comments
2	Ablational Material and/or alluvium over till or lacustrine	High Prairie Complex	Mod. well-Imp. dr.	C	wS, bPo, Willow, Grasses	Included with the Class 3.
		Some Codesa			wS, lP, tA, Alder, Rose	
3	Ablational Material and/or alluvium over till or lacustrine	High Prairie Complex	Mod. well-Imp. dr.	C	wS, bPo, Willow, Grasses	Usually somewhat favoured locations e.g. lower slopes where soil moisture is increased and some climatic protection is available.
		Codesa			wS, lP, tA, Alder, Rose	
		Alluvium			wS, bPo, Alder, Willow	
	Glacial Till	Braeburn, Alcan	Mod. well dr.	C	wS, lP, tA, Alder, Cornus	
4	Ablational Material and/or alluvium over till or lacustrine	Codesa, Peoria	Well dr.-Imp. dr.	M	lP, tA, Rose, Cranberry	Average regional condition of soil moisture, drainage and climate; includes subsoil limitations of compaction.
		Alluvium		W	wS, bPo, tA, Alder, Grasses	
	Alluvial and Aeolian	Tangent	Mod. well dr.	M	wS, lP, tA, Rose, Cornus	
	Glacial Till	Alcan	Well dr.-Imp. dr.	(M	wS, lP, tA, Alder, Rose	
		Murdale		(W (D		
	Lacustro-Till	Hazelmere, Albright	Well dr.-Imp. dr.	(M	wS, bPo, tA, Grasses	
		Donnelly, Esher, Landry		(W (D		
	Lacustrine	Nampa, Falher	Well dr.-Imp. dr.	(M	wS, tA, bPo, Willow, Grasses	
		Doig		(W		
		Judah		(X (D		
	Glacio-Fluvial	Whitelaw, Berwyn	Mod. well dr.	M D	wS, lP, tA, Birch	
5	Alluvial and Aeolian	Leith, Culp, Hart	Rapid-well dr.	M F	lP, tA, Rose, Grasses	
	Alluvial	Alluvium	Rapid, poor, v. poor dr.	(M	wS, bPo, tA, Alder, Grasses	Moderate to severe growth limitations: rapid drainage on coarse soils, steep slopes; poor-to-very poor drainage; sub-soil compaction; climatic exposure
				(W (X		
	Residual and Modified Residual	Boundary Complex	Well dr.	M D	wS, tA, Alder, Cranberry	
	Glacial Till	Alcan, Murdale	Rapid dr.	(M	wS, lP, tA, Rose, Cranberry	
				(U (D		
		Snipe	Poor, v. poor dr.	W	wS, bPo, Willow, Grasses	
	Lacustro-Till	Hazelmere, Albright Donnelly, Esher, Landry	Rapid dr.	(M (D	wS, lP, tA, Rose, Cornus	
		Goose	Poor, v. poor dr.	W	wS, bPo, bS, Willow	
	Lacustrine	Nampa, Falher, Doig	Rapid dr.	(M (D	wS, tA, Rose, Cornus	Eroded bluffs
		Goose, Snipe	Poor, v. poor dr.	W	wS, bS, bPo, Willow, Alder	
6	Glacial Till	Snipe	(poor - (v. poor dr.	W	bPo, bS, Alder, Willow	Excessive wetness in depressional topographic positions.
	Lacustro-Till	Goose				
	Lacustrine	Prestville, Josephine				
7	Organic	Eaglesham			bS, Willow, Dwarf Birch	
		Kenzie	Very poor dr.	W	bS, tL, sp. Moss, Ledum	

A few Class 2 plots were recorded on favourable sites, usually with a gentle slope to the north-east with 24 to 30 inches of relatively soft, friable alluvial or colluvial soil materials overlying the dense and more compact clayey materials. However, so little Class 2 was found that consequently it was included with the Class 3 areas. Class 4 dominates much of the area, with Classes 5, 6 and 7 being quite extensive depending on drainage and other growth factor limitations.

Climatic limitations of low rainfall and heat units apply to the entire area. Most of the area has clayey soils and because the development of a Gray Luvisol soil profile is associated with dense, compact subsurface horizons a further limitation, due to density, was considered to occur and to restrict forest growth. This conclusion was further substantiated by soil penetrometer readings and bulk density data which were gathered in the forested areas. Little distinction of soil density between solodic and non-solodic profiles was observed.

Ratings were based mostly on white spruce, with lodgepole pine being used for sandy areas and other areas of medium texture. Black spruce was the indicator species used in the wetter areas.

Area 2. Whitecourt - Little Smoky River:

This area, south of the Peace River district, lies between latitude 54^{o} and 54^{o} - 45' north and longitude 115^{o} - 45' and 118^{o} west. Situated in the Interior Plains physiographic region, most of the area is rough morainic land with gently rolling topography and hilly slopes. The higher land areas are fairly well drained. Bogs occur on the lower slopes and depressional areas. Gray Luvisols developed on glacial till dominate

the majority of the area sampled. Humic Eluviated Gleysols are common in depressions and lower slopes. A number of samples in the northern part of the sample area were on saline lacustrine materials having generally undulating to depressional topography with only occasional gently rolling slopes. These soils are also dominantly Gray Luvisols.

Elevations of Area 2 varied from approximately 2400 to 3500 feet, A.M.S.L. Further description of this area is given by (Lindsay, et al., 1963).

Climatic data are very sparse for this area, but indicate slightly moister conditions than in Area 1; approximately 20 inches of precipitation occurs near Whitecourt. Frost-free season is comparable to that in the Clear Hills of Area 1. The average frost-free period is 65 days at Whitecourt.

Rowe's classification places this area into Section B19a, the same as for Area 1. This forest has also been disturbed by fire and cutting, and is affected by site growth factor limitations as described for Area 1. Maximum capability classes by parent material are shown in Table 2. The main difference in Area 2 appears to be a somewhat greater supply of moisture than in Area 1.

Area 3. the Swan Hills:

This area is the most easterly of those examined being between 54^{o} - 55' north and longitude 115^{o} - 35' and 116^{o} west (Figure 1). It is composed of relatively high plateau remnants, varying from very steeply sloping to hilly. Gravels, assumed to be of Tertiary age, occur

TABLE 2. MAXIMUM CAPABILITY CLASSES BY PARENT MATERIAL
INDICATOR SPECIES: wS and lP
(AREA 2 - WHITECOURT - LITTLE SMOKY RIVER)

Parent Material	Increasing Soil Moisture			
	Rapidly dr.	Well dr. to Mod. well dr.	Imp. dr.	Poorly dr.
1. Aeolian (loam)	5	4		
2. Outwash				
3. Ablational Material/Till				
4. Residual				
5. Glacial Till		3-4		
6. Lacustrine Lacustro-Till		4	4-5	

at the higher elevations and are mixed with the glacial till at elevations somewhat below the gravel contact line (Figure 3). Occasional outcrops of weathered sandstone occur.

The Swan Hills sample area ranges in elevation from approximately 3400 to 4500 feet, A.M.S.L., thus making it the area of highest elevations sampled in the study.

The climate of this area has limited documentation. In general, the climate is similar to the first two areas to the extent that it is characterized by relatively warm summers, cold winters and a relatively short frost-free period. Annual precipitation averages approximately 22 inches.

Area 3 is also included in the Boreal Forest region of Canada, Lower Foothills section (B19a), as described by Rowe (1959). However, it should be noted that the samples came from the higher altitudes of the section, as evidenced by the presence of balsam fir co-dominants. In the better drained positions, the soils are largely Gray Luvisols and some Podzols. Gleysolic soils and bogs occur in the wetter positions. Further soil descriptions are available (Lindsay, *et al.*, 1963).

Maximum capability classes by parent materials are shown in Table 3.

Area 4. Chinchaga:

This area is in the Peace River district between latitude 57° - 10' and 57° - 20' north and longitude 117° - 55' and 118° - 20' west (Figure 1). The portion sampled is part of the northern edge of the Clear Hills, typically morainic and with gently rolling to hilly

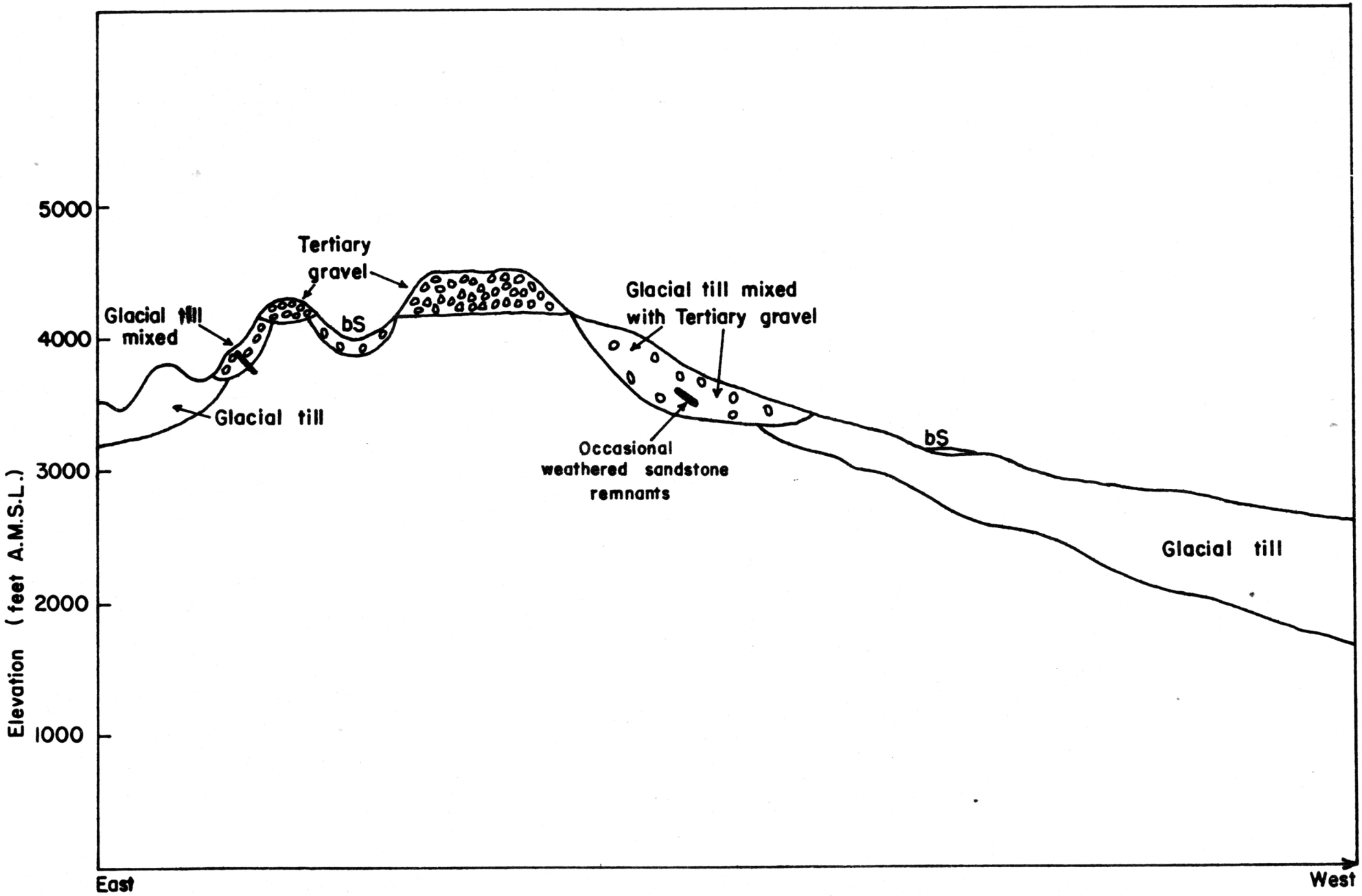

Figure 3. Diagrammatic cross-section of Area 3, Swan Hills.

TABLE 3. MAXIMUM CAPABILITY CLASSES BY PARENT MATERIAL

INDICATOR SPECIES: wS and lP

(AREA 3 - SWAN HILLS)

Parent Material	Increasing Soil Moisture			
	Rapidly dr.	Well dr.to Mod.well dr.	Imp. dr.	Poorly dr.
1. Aeolian				
2. Alluvium		4		
3. Ablational Material/Till				
4. Residual				
5. Glacial Till		3-4	4-5	5
6. Lacustrine Lacustro-Till		4	4-5	

topography. The samples came from a gently rolling part in the vicinity of the Hotchkiss River.

The area ranges in elevation from approximately 2000 to 2500 feet, A.M.S.L. The soils are predominantly Gray Luvisols developed principally on glacial till. Poorly drained soils and soils developed from sandy outwash also occur. Further soil descriptions are available (Lindsay, *et al.* 1958; Reeder and Odynsky, 1969).

The climate of this area is characterized by relatively cold winters, moderately warm summers, and moderately low precipitation. The mean annual precipitation is approximately 15 inches at Keg River Post, which is north of this area. The mean annual temperature is 30.9°F. Approximately two-thirds of the precipitation occurs during the months of May to September, and July and August have the highest precipitation.

The area is classified by Rowe as being in the Boreal Forest Region, Section B19a. Maximum capability classes by parent material are shown in Table 4.

Area 5. Footner Lake:

This area is the most northerly, being located between 58° - 25' and 59° north and longitude 117° - 117° - 40' west. It is also in the Interior Plains physiographic region with the majority of the samples located on a gently rolling to rolling area of glacial till in the vicinity of Watt Mountain. The northern and southern samples are from nearly level lacustrine deposits.

The climate in this area is considerably drier, with 12 - 13 inches of precipitation. The frost-free period and length of growing season, however, are similar to the other areas but the temperatures are colder.

TABLE 4. MAXIMUM CAPABILITY CLASSES BY PARENT MATERIAL

INDICATOR SPECIES: wS

(AREA 4 - CHINCHAGA)

Parent Material	Increasing Soil Moisture			
	Rapidly dr.	Well dr.to Mod.well dr.	Imp. dr.	Poorly dr.
1. Aeolian				
2. Outwash				
3. Ablational Material/Till				
4. Residual				
5. Glacial Till				
6. Lacustrine Lacustro-Till		4	4-5	

Elevations range from approximately 1500 to 2300 feet, A.M.S.L. Gray Luvisol profiles are dominant and descriptions may be found (Lindsay, *et al.*, 1959).

Rowe classifies this part of the Boreal Forest Region as the Hay River Section, B18b. The forest is not as productive as that in the southern areas and generally, by C.L.I. standards, is not higher than Class 5. White spruce is less abundant than further south while black spruce is more common and forms stands on upland sites as well as on lowland habitats. Lodgepole pine also occurs. Aspen and balsam poplar have assumed a dominant position over much of the area in the wake of fires.

Maximum capability classes by parent material are shown in Table 5.

SOIL-SITE AND FOREST PRODUCTIVITY RELATIONSHIPS

In general the best capability classes (2 and 3) were found associated with ablational material and/or alluvium over till or lacustrine, usually in somewhat favoured locations, i.e. lower slopes where soil moisture was more adequate and where some climatic protection was available, as in north-easterly aspects.

Capability Class 4 lands were found under average regional conditions of soil moisture, well-drained to moderately-well-drained with average climatic exposure on different parent materials. High subsoil density is common.

Capability Class 5 lands were found under moderate-to-severe growth limitations: rapid drainage on coarse soils, steep slopes, poor-to-very poor drainage, high subsoil density, climatic exposure on

TABLE 5. MAXIMUM CAPABILITY CLASSES BY PARENT MATERIAL

INDICATOR SPECIES: wS

(AREA 5 - FOOTNER LAKE)

Parent Material	Increasing Soil Moisture			
	Rapidly dr.	Well dr. to Mod. well dr.	Imp. dr.	Poorly dr.
1. Aeolian				
2. Outwash		5		
3. Ablational Material/Till				
4. Residual				
5. Glacial Till		5		
6. Lacustrine Lacustro-Till		5	5	5-6

different parent materials. These limitations occur singly or in combination.

Capability Class 6 lands were confined to the poorly and very poorly drained till soils, lacustro-till and lacustrine soil sites. Excessive wetness is the main limiting factor in depressional topographic positions.

Capability Class 7 was found on very poorly drained organic soils.

During the course of C.L.I. mapping and exploratory studies it was often observed that low productivity was associated with subsoil compaction and shallow rooting - a factor not normally utilized to indicate limitations in C.L.I. mapping. The relationship between depth of abundant rooting and bulk density in the Ae horizon, and between depth of abundant rooting and penetrometer reading in the Bt horizon are shown in Figures 4 and 5 respectively for Area 1. Both relationships proved significant at the 5% level of probability. The relationships between depth of abundant rooting and bulk density in the Ae and Bt horizons proved significant at the 1% level of probability for Area 2 (Figures 6 and 7).

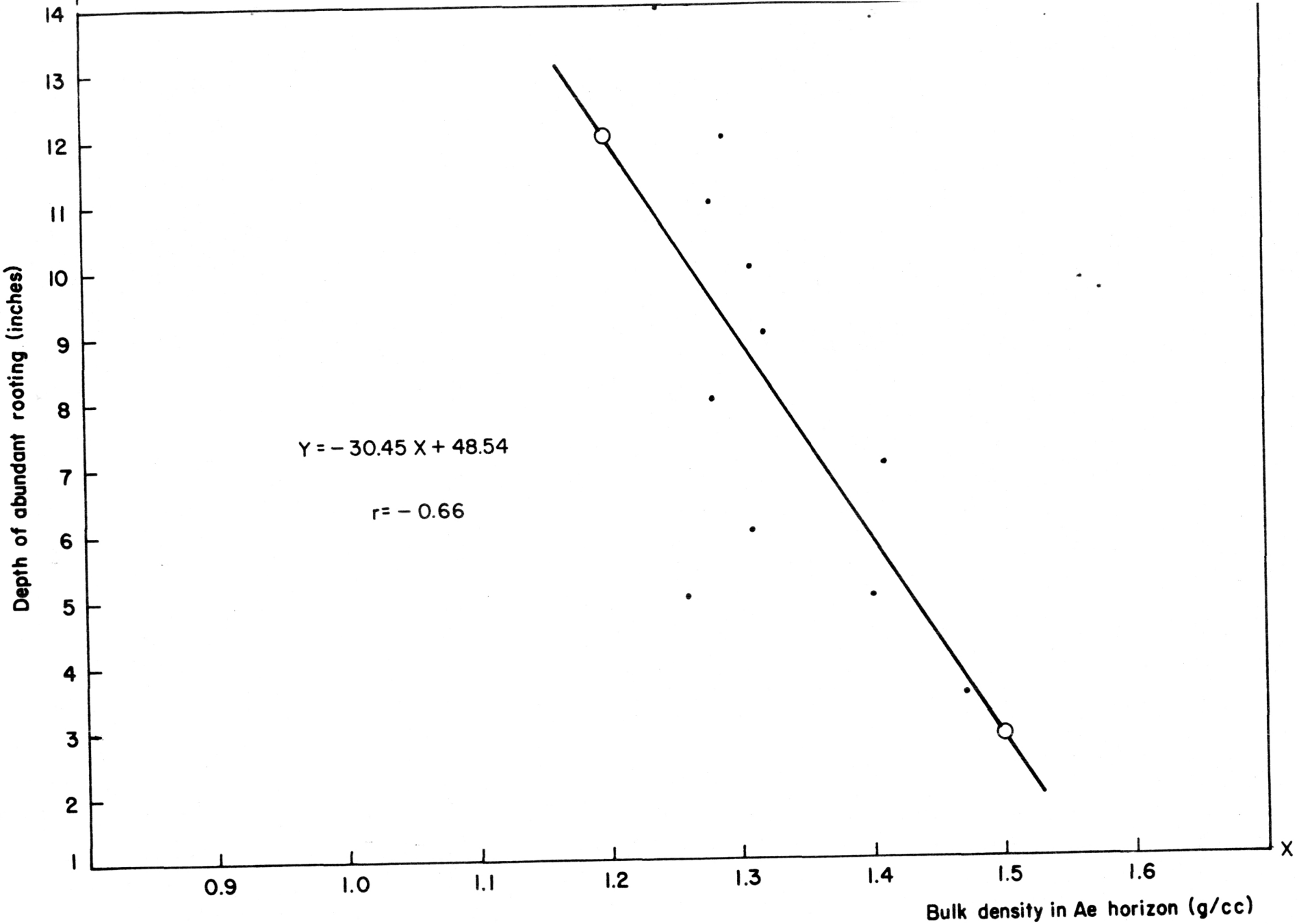

Figure 4. Relationship of bulk density in Ae horizon to depth of abundant rooting, Area 1.

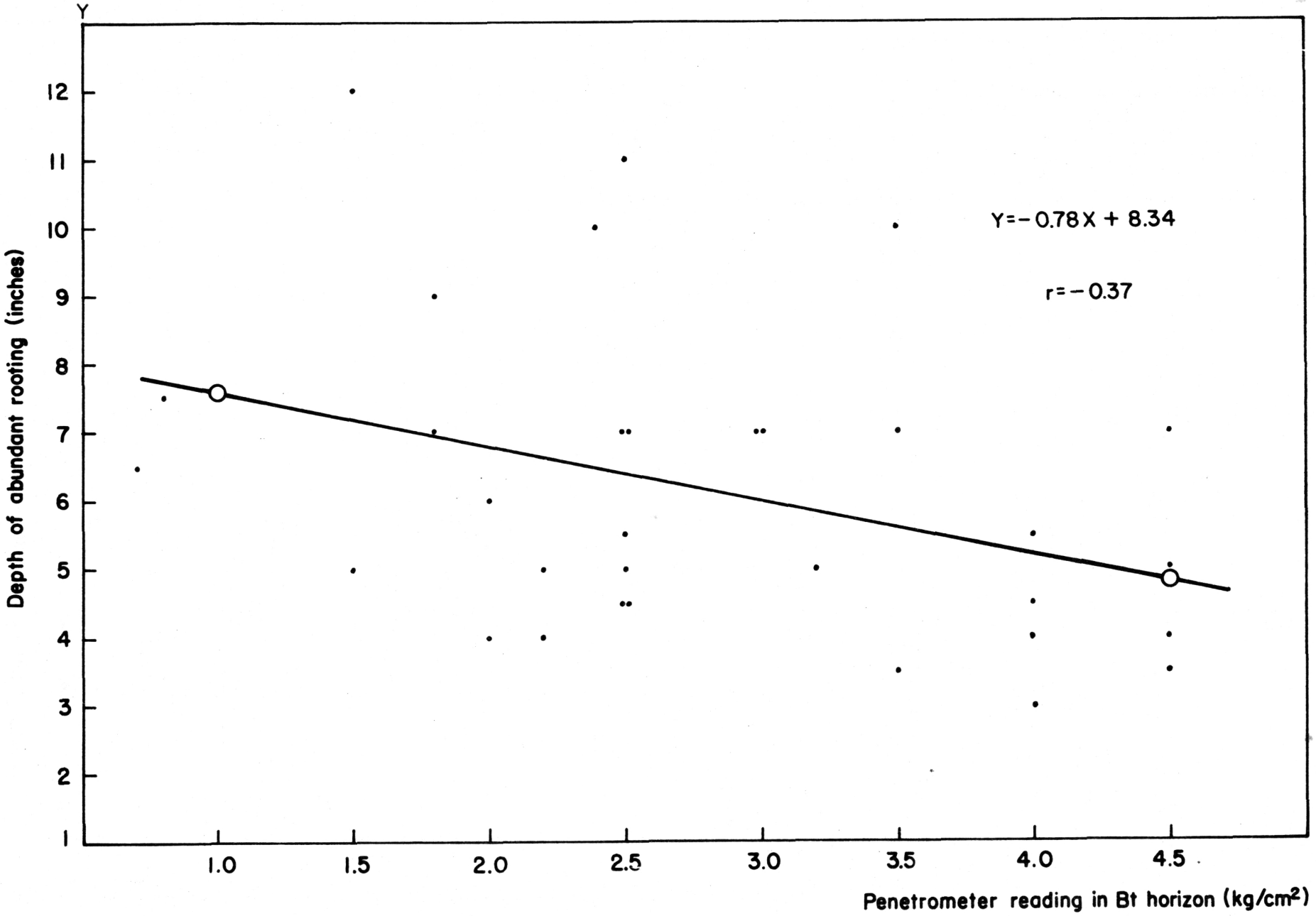

Figure 5. Relationship of penetrometer reading in Bt horizon to depth of abundant rooting, Area 1.

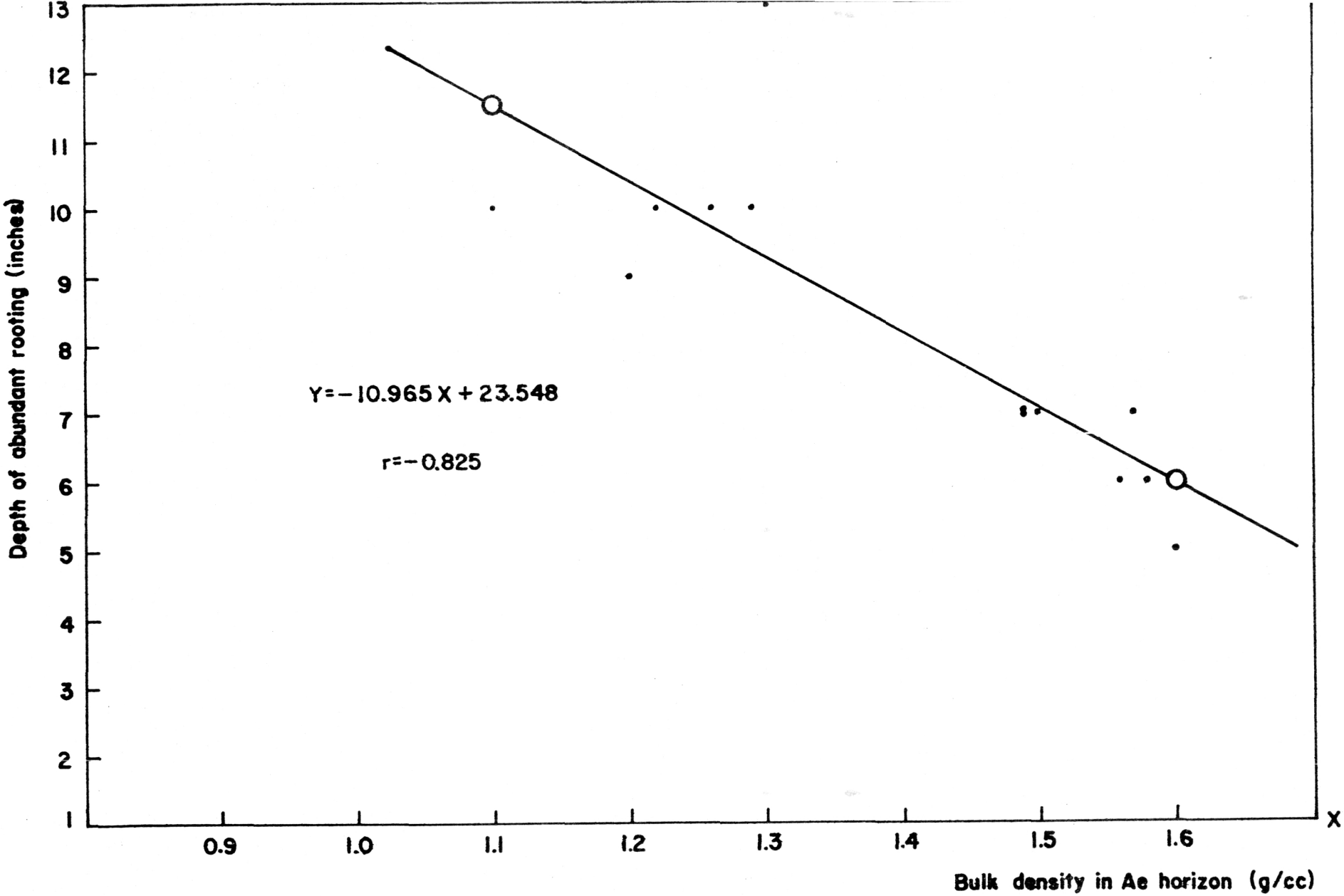

Figure 6. Relationship of bulk density in Ae horizon to depth of abundant rooting, Area 2.

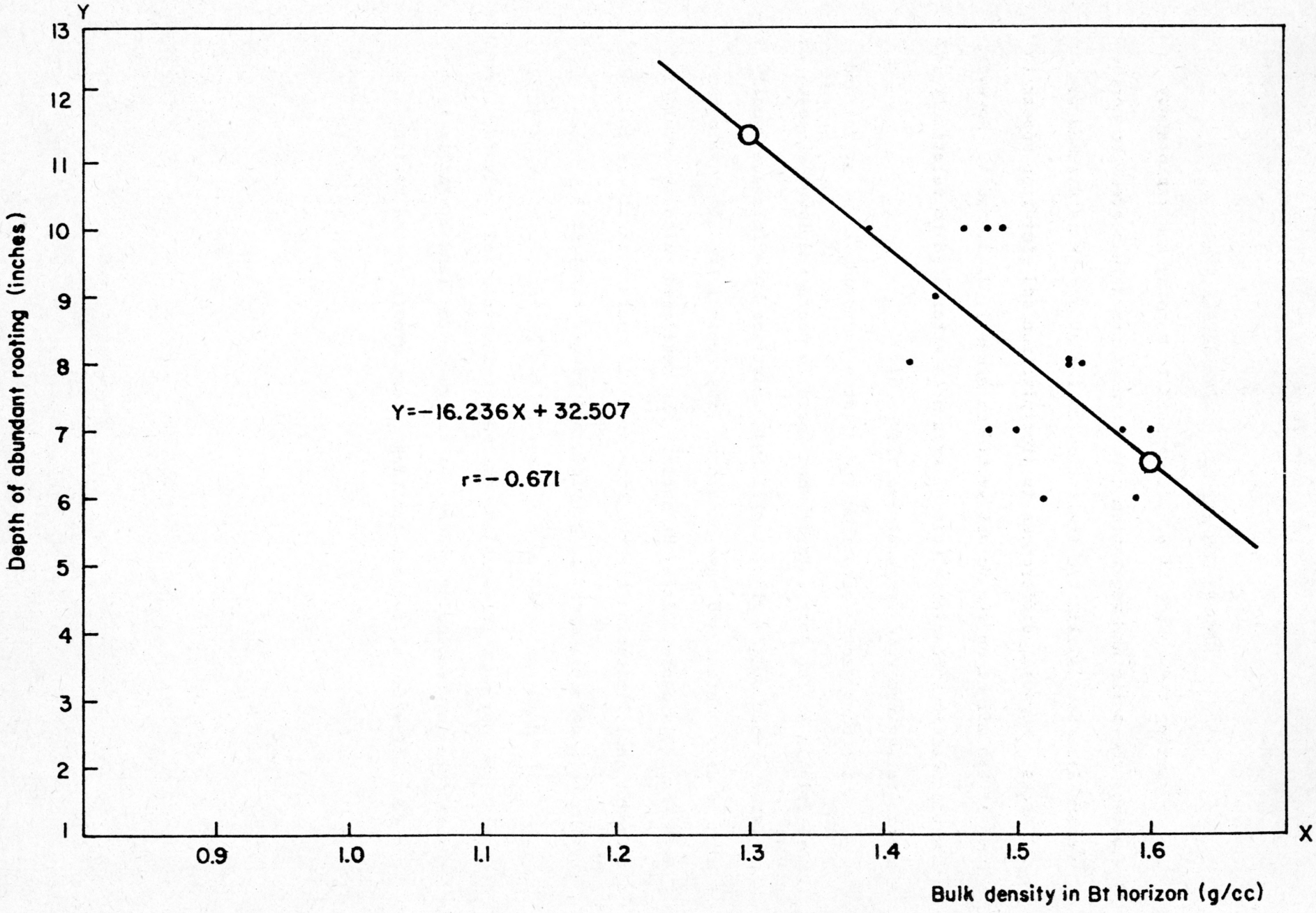

Figure 7. Relationship of bulk density in Bt horizon to depth of abundant rooting, Area 2.

SUMMARY COMPARISONS OF THE SAMPLE AREAS

During the course of C.L.I. capability mapping and exploratory studies, the soils and vegetation have been examined in 5 areas in northwestern Alberta. A climatic limitation to forest growth is assumed for all areas. Regional differences in precipitation and elevation appear to have little effect on the forest growth on areas 1, 2, 3, and 4. However, low productivity, characteristic of Area 5 is attributed to relatively low precipitation and cold temperatures (Table 6).

The best growth occurs on the lighter textured, less compact and more friable soils, particularly when found on protected lower slopes. The soils developed on the glacial till and lacustrine materials are usually high in clay content and have undergone Gray Luvisol profile development. As a result, a dense, clayey Bt horizon has developed which is considered an additional limitation to tree growth. This characteristic is indicated by the bulk density, specific gravity, and penetrometer data.

The data collected do not describe the entire soils - vegetation population, nor does the sampling system permit factorial analysis. Nevertheless the information provides a useful guide for land classification and identification of factors limiting forest growth in the region.

TABLE 6 : SUMMARY COMPARISONS OF THE SAMPLE AREAS

	Area 1	Area 2	Area 3	Area 4	Area 5
Location	Hines Creek-Cherry Point	Whitecourt-Little Smoky River	Swan Hills	Chinchaga	Footner Lake
Geology	Upper Cretaceous: 1. Kaskapau Formation: marine, dark grey shale & carbonaceous shale 2. Dunvegan Formation: marine & non-marine sandstone & shale, rare thin coal seams	Lower Cretaceous: sandstone and shale	Paskapoo Formation: sandstone, shale. Capped by Tertiary conglomerate	Upper Cretaceous: 1. Dunvegan Formation: sandstone 2. Kaskapau Formation: shale	Undivided Early Upper Cretaceous Formations
Physiographic Region	Interior Plains	Interior Plains	Interior Plains	Interior Plains	Interior Plains
Dominant Surface Materials	Ablational Material over till. Tills Lacustro-tills	Tills Lacustro-tills Lacustrine	Tills Lacustro-tills	Lacustro-tills Tills	Tills Lacustrine
Dominant Soil Group	Gray Luvisols	Gray Luvisols	Gray Luvisols	Gray Luvisols	Gray Luvisols
Topography	Gently rolling to hilly	Gently rolling to hilly	Rolling to hilly	Gently rolling to hilly	Gently rolling to rolling
Elevation (M.S.L.)	2400-3700 feet	2400-3500 feet	3400-4500 feet	2000-2500 feet	1500-2300 feet
Mean Annual Precipitation	17 inches	20 inches	22 inches	17 inches	12-13 inches
Mean Annual Temperature	32°F	33°F			29°F
Forest Classification (Rowe)	B.19a	B.19a	B.19a	B.19a	B.18b
Highest C.L.I. Capability Class	3	3	3	4	5
Average C.L.I. Capability Class	4	4	4	4	5

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APPENDIX I

Coding and terminology utilized in C.L.I. capability mapping and in this report:

Parent Material

1. Aeolian
2. Outwash
3. Ablational overlay on till
4. Glacial
5. Lacustro-till
6. Lacustrine
7. Overlay on Lacustrine and Lacustro-till
8. Residual
9. Alluvium

Soil texture in the apparent tree rooting zone:

S (sand)	LS (loamy sand)
Si (silt)	SiL (silt loam)
L (loam)	CL (clay loam)
SL (sandy loam)	SCL (sandy clay loam)
SG (sand and gravel)	C (clay)

Soil Groups (N.S.S.C. 1968):

1.32 Rego Black	4.21 Orthic Ferro-Humic Podzol
3.21 Orthic Gray Luvisol	4.31 Orthic Humo-Ferric Podzol
3.21-2.23 Solodic Gray Luvisol	5.12 Degraded Melanic Brunisol
3.22 Dark Gray Luvisol	5.4-/8 Gleyed Dystric Brunisol
3.22-2.23 Solodic Dark Gray Luvisol	5.42 Degraded Dystric Brunisol
3.2/3 Brunisolic Gray Luvisol	6.11 Orthic Regosol
3.2/4 Bisequa Gray Luvisol	7.11 Orthic Humic Gleysol
3.2/8 Gleyed Gray Luvisol	7.22 Rego Gleysol
3.2-/9 Lithic Gray Luvisol	7.31 Humic Eluviated Gleysol
3.22-/8 Gleyed Dark Gray Luvisol	7.32 Low Humic Eluviated Gleysol

APPENDIX I (continued)

Topography:

d (depressional)	r (rolling)
l (level)	h (hilly)
gu (gently undulating)	m (mountainous)

Drainage Classes:

rd (rapidly drained)	id (imperfectly drained)
wd (well drained)	pd (poorly drained)
mwd (moderately well drained)	vpd (very poorly drained)

Cover Type:

wS (white spruce)	lP (lodgepole pine)
bS (black spruce)	tA (trembling aspen)
bPo (balsam poplar)	

C.L.I. Capability Class (McCormack 1968):

Class 2	91 - 110 cu. ft. per acre per year
Class 3	71 - 90 cu. ft. per acre per year
Class 4	51 - 70 cu. ft. per acre per year
Class 5	31 - 50 cu. ft. per acre per year
Class 6	11 - 30 cu. ft. per acre per year
Class 7	under 10 cu. ft. per acre per year

Subclasses (McCormack, 1968); Forest Growth Limiting Factors:

Climate	A - droughty or arid conditions as a result of climate
	C - a combination of more than one climatic factor (drought and exposure)
	H - low temperatures
	U - exposure

APPENDIX I (continued)

Soil Moisture	M - soil moisture deficiency
	W - soil moisture excess
	X - M and W mixed
Depth of rooting zone	D - physical restriction to rooting by dense soil layer
	R - restriction of rooting zone by bedrock
Other Soil Factors	E - actively-eroding soils
	F - low fertility
	I - soils periodically inundated by streams or lakes
	L - excessive levels of calcium
	N - excessive levels of toxic elements such as soluble salts
	P - stoniness which affects forest density or growth
	S - a combination of soil factors

APPENDIX II

Table 1. Soil-Site and Forest Plot Data - Area 1, Clear Hills - Hines Creek.

Plot No.	Parent Material	Soil Texture	Soil Great Group and Sub group	Topo-graphy	Drainage	Cover Type	Stand Age yrs.	B.A./ Acre sq. ft.	Number of Trees/ Acre	M.A.I. at 100 yrs. cu. ft./acre/yr	C.L.I. Capability Class	Dominant Limiting Factor	Site Index	Main Associated Vegetation
1	3	SL-L	3.2-/3	h	wd-mwd	wS tA	78	140		52	4	D	70	Alder, Shepherdia
2	3	L-CL	7.31	gu	pd	wS tA	101	170		76	3	C	90	Alder, Mountain ash
3	3	SL-CL	3.21-2.23	h	wd-mwd	wS tA	104	190		60	4	D	60	Alder, Rose
4	8	SiL-CL	3.21	h	wd-mwd	wS	77	170		69	4	D	80	Cranberry, Cornus
5A	3	SL-CL	7.32	gu	pd	lP	121	210		56	4	W	80	Alder, Ledum
5B	3	SL-SiC	3.21	gu	mwd	wS lP	105	100		32	5	W	60	Alder, Cornus
6	3	SiL-C	3.21	gu	mwd	wS	109	190		54	4	W	50	Sheperdia, Alder
7A	4	SiL-C	3.21	r	id	wS	113	140		45	5	W	60	Alder, Cranberry
7B	3	SL-L	3.2-/4	h	id	wS	163	110		45	5	D	50	Alder, Cranberry
9	1	S	4.21	r	rd	lP	49*	110		68	4	M	80	Rose
10	1	S	4.21	gu	rd	lP	54*	170		77	3	M	80	Rose
11	5	CL-C	3.22-2.23	l	id	wS tA	80	140		51	4	D	70	Cranberry, Rose
13	4	L-CL	7.11	gu	id	wS bPo	74	160		71	3	C	80	Cranberry, Rose
15	4	L-C	3.21-2.23	gu	id	lP tA	59*	180		94	2	C	90	Alder, Rose
18	8	L-CL	3.22-/8	gu	mwd	wS	79	140		66	4	D	90	Alder, Cranberry
26	6	L-CL	7.11	l	id	wS	92	170		66	4	W	80	Sheperdia, Rose
30	2	SG	4.21	r	rd	lP	58*	210		80	3	M	80	Alder

* Too young stands (under 60 yrs).

Table 1 (continued)

Plot No.	Modal Penetrometer Reading			Bulk density			pH			Remarks
	A	B	C	A	B	C	A	B	C	
	Horizon			Horizon			Horizon			
1	1.0	2.4	4.5	0.99	1.32	1.29	7.2	6.9	6.3	
2	1.0	1.5	1.3	1.29	1.24	1.32	5.4	7.1	7.3	Penetr.reading low because of wet soil
3	2.0	2.5	N.d.	1.28	1.23	1.30	5.9	5.6	4.4	
4	1.3	3.5	4.0	1.31	1.34	1.31	4.5	4.0	3.9	
5A	1.3	1.8	2.0	1.32	1.22	1.33	4.5	4.7	4.5	
5B	1.0	1.5	3.0	1.40	1.26	1.22	5.3	5.0	4.2	
6	2.5	2.5	3.5	1.24	1.29	1.35	5.0	4.7	4.5	
7A	1.5	2.0	3.5	1.31	1.28	1.30	4.4	4.4	4.7	
7B	1.5	3.3	4.5	1.39	1.34	1.31	4.7	4.6	5.2	
9	0.5	0.8	1.2	N.d.*	N.d.	N.d.	5.5	6.0	6.7	loose, sandy soil
10	0.5	0.7	1.0	N.d.	N.d.	N.d.	5.5	5.7	5.8	loose, sandy soil
11	0.8	4.5	4.5	1.26	1.23	1.27	4.6	4.2	5.4	
13	1.5	3.0	4.0	0.88	1.37	1.48	6.5	7.2	7.5	
15	1.5	3.5	4.5	1.47	1.45	1.36	5.6	4.4	4.7	
18	1.5	2.5	4.5	1.41	1.34	1.32	4.5	4.2	3.9	
26	1.5	N.p.**	2.8	1.28	N.p.	1.43	6.3	N.p.	6.7	
30	1.5	2.5	3.0	N.d.	N.d.	N.d.	N.d.	N.d.	N.d.	sand and gravel

* N.d. = No determination

** N.p. = Not present

Table 2. Soil-Site and Forest Plot Data - Area 2, Whitecourt - Little Smoky River

Plot No.	Parent Material	Soil Texture	Soil Great Group and Sub group	Topo-graphy	Drainage	Cover Type	Stand Age yrs.	B.A./ Acre sq. ft.	Number of Trees/ Acre	M.A.I. at 100 yrs. cu. ft./acre/yr.	C.L.I. Capability Class	Dominant Limiting Factor	Site Index	Main Associated Vegetation
1	5	SL-CL	3.21	gu	wd	wS tA	87	190	530	40	5	D	77	Ros , Cornus
2	5	L-CL	3.22	gu	wd	wS tA	89	205	480	59	4	D	73	Cranberry, Cornus
4	5	L-SCL	5.12	gu	wd	wS tA	87	210	510	63	4	M	82	Alder, Rose
5	5	L-CL	1.32	gu	wd	wS lP	117	215	410	56	4	M	67	Devil's club
6	6	SL-CL	3.21	gu	wd-mwd	lP wS	85	190	360	69	4	D	87	Cranberry,Devil's club
7	5	SL-C	3.21	gu	wd-mwd	lP tA	88	175	380	57	4	D	76	Alder, Rose
8	1	L-LS	5.42	gu	wd	lP	93	180	480	53	4	M	73	Cranberry, Rose
9	6	L-SCL	1.32	gu	wd-mwd	lP	92	165	520	46	5	D	71	Alder, Willow, Ledum
11	4	L-CL	5.42	gu	wd-mwd	lP tA	87	145	280	48	5	M	75	Alder,Cranberry
12	4	CL	5.42	l	wd-mwd	wS lP	88	150	260	47	5	M	79	Alder, Rose
13	4	CL	5.42	gu	wd-mwd	tA wS	75	135	280	48	5	D	84	Cranberry, Rose
33	5	LS-C	3.21	gu	wd-mwd	wS tA	90	185	560	48	5	D	75	Cranberry, Rose
34	4	SL-CL	3.21	gu	wd-mwd	tA wS	94	200	420	57	4	D	75	Cranberry, Rose
38	5	SL-CL	5.42	r	id	lP bS	63	115	480	46	5	W	72	Willow, Ledum
43	1	SL-L	5.42	r	wd	lP wS	91	220	820	56	4	M	74	Devil's club, Cornus
241	1	SL	4.31	gu	rd	lP	86	120	360	31	5	M	68	Ledum, Rose
243	4	SL-CL	3.21	gu	wd-mwd	lP	70	145	340	61	4	D	77	Alder, Rose
244	4	SL-CL	3.2-/4	gu	wd	lP	71	115	760	29	6	MF	67	Alder, Ledum
259	6	SL-C	3.21	gu	wd-mwd	wS tA	119	167	170	51	4	D	73	Cranberry, Rose
260	6	SL-SCL	3.2-/9	gu	wd-mwd	wS tA	113	150	160	46	5	R	78	Alder, Cranberry
261	6	L-C	3.22-2.23	l	wd-mwd	wS tA	109	200	290	58	4	D	89	Cranberry, Shepherdia
263	5	SL-CL	3.21	gu	wd-mwd	wS tA	121	210	280	57	4	D	74	Alder, Rose
264	6	CL-C	3.22-2.23	l	mwd	wS tA	118	190	240	55	4	D	69	Cranberry, Rose
267	5	SL-C	3.21	gu	mwd	wS tA	87	190	340	62	4	D	90	Alder, Cranberry
269	5	SL-CL	3.21	gu	wd-mwd	wS tA	103	240	410	64	4	D	78	Willow, Cranberry

Table 2 (continued)

Plot No.	Modal Penetrometer Reading			Bulk density			Base Sat. %			Ca/Mg+Na Ratio			pH			Remarks
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
	Horizon			Horizon			Horizon			Horizon			Horizon			
1	1.0	4.0	3.2	1.50	1.48	1.63	60	33	76	2.7	3.0	2.3	5.0	4.8	4.5	
2	1.2	3.0	3.2	1.20	1.44	1.47	60	72	78	3.9	2.8	5.3	4.7	4.6	4.6	
4	1.2	N.s.*	2.2	N.d.**	N.s.	1.48	55	N.s.	100	9.7	N.s.	3.4	5.4	N.s.	6.3	
5	1.2	N.p.***	1.8	1.30	N.p.	1.48	66	N.p.	92	4.6	N.p.	3.4	5.5	N.p.	5.5	
6	2.0	4.0	4.2	1.57	1.58	1.51	68	76	69	4.0	3.6	3.2	5.0	5.0	4.4	
7	1.2	3.0	2.8	1.29	1.46	1.50	76	57	86	5.1	3.1	4.7	5.6	5.1	5.2	
8	1.5	2.5	2.2	1.48	1.47	N.d.	74	70	78	5.9	4.6	5.1	5.4	4.8	5.1	
9	1.2	N.p.	4.5	1.22	N.p.	1.53	42	N.p.	64	3.4	N.p.	2.6	4.8	N.p.	4.8	
11	N.s.	2.0	3.8	N.s.	1.54	1.48	N.s.	N.d.	60	N.s.	2.5	3.2	N.s.	4.4	4.4	
12	N.s.	2.0	2.8	N.s.	1.45	1.48	N.s.	71	75	N.s.	2.8	2.3	N.s.	5.0	4.3	
13	N.s.	2.5	3.2	N.s.	1.55	1.43	N.s.	85	71	N.s.	4.2	3.2	N.s.	4.7	4.5	
33	1.0	3.5	3.2	1.60	1.49	1.39	N.d.	83	86	3.5	2.8	2.7	5.7	4.8	4.7	
34	1.5	3.5	3.2	1.58	1.52	1.62	85	15	71	2.8	2.3	2.7	5.1	4.8	4.4	
38	1.2	1.2	2.8	1.56	1.59	1.49	41	49	55	3.1	2.3	2.4	N.d.	4.8	4.6	
43	N.s.	1.2	2.0	N.s.	1.51	1.60	N.s.	55	52	N.s.	3.6	2.8	N.s.	5.3	4.9	
241	N.s.	1.5	2.0	N.s.	1.45	1.48	N.s.	55	66	N.s.	4.1	3.4	N.s.	5.8	4.9	
243	1.0	3.2	3.2	1.49	1.50	1.50	43	58	79	3.2	4.4	3.3	4.9	5.1	4.6	
244	1.5	2.0	2.8	1.49	1.60	1.46	43	52	86	3.6	3.4	2.8	5.6	5.3	5.1	
259	1.2	4.5	4.0	N.d.	1.54	1.53	61	56	68	1.6	2.2	1.9	5.1	4.6	4.5	
260	1.0	N.s.	N.s.	N.d.	N.s.	N.s.	100	N.s.	N.s.	7.9	N.s.	N.s.	5.4	N.s.	N.s.	
261	1.0	4.0	2.8	1.26	1.49	1.41	78	72	95	2.4	2.0	1.5	5.2	5.0	5.9	
263	1.0	4.2	N.s.	1.10	1.48	N.s.	68	74	N.s.	4.1	3.4	N.s.	4.7	4.5	N.s.	
264	N.s.	4.0	3.5	N.s.	1.42	1.43	N.s.	62	93	N.s.	1.6	2.1	N.s.	4.6	4.4	
267	1.0	4.2	3.0	N.d.	1.39	1.50	59	73	N.d.	4.9	2.5	2.2	5.1	4.6	6.6	
269	1.0	4.0	3.0	N.d.	1.54	1.54	100	72	70	2.7	2.1	2.3	5.6	4.8	4.7	

* N.s. = Not sampled

** N.d. = No determination

*** N.p. = Not present

Table 3. Soil-Site and Forest Plot Data - Area 3, Swan Hills

Plot No.	Parent Material	Soil Texture	Soil Great Group and Sub group	Topo-graphy	Drainage	Cover Type	Stand Age yrs.	B.A./ Acre sq. ft.	Number of Trees/ Acre	M.A.I. at 100 yrs. cu. ft./acre/yr.	C.L.I. Capability Class	Dominant Limiting Factor	Site Index	Main Associated Vegetation
15	4	SL-CL	5.42	gu	wd-mwd	lP	169	190	400	43	5	F	64	Vaccinium, Cornus
16	4	L-CL	5.42	gu	wd-mwd	lP	43	98	890	52	4	F	50	Willow, Ledum
17	4	CL	5.42	r	mwd	wS	178	135	580	42	5	F	-	Ledum, Vaccinium
18	4	CL	5.42	gu	wd	lP	117	120	590	15	6	MF	45	Vaccinium, Mountain Ash
19	4	L-CL	5.42	gu	id	wS	179	160	580	47	5	W	-	Vaccinium, Mountain Ash
20	4	L-CL	5.42	r	wd-mwd	lP	119	180	1520	15	6	MF	43	Ledum, Vaccinium
21	4	L-SCL	5.42	r	mwd	wS	134	120	370	28	6	MF	-	Vaccinium,Ledum
23	5	L-CL	3.22	l	wd-mwd	lP	68	170	980	51	4	M	69	Ledum, Vaccinium
24	4	L-CL	3.22	gu	wd-mwd	lP bS	118	220	2270	19	6	W	50	Vaccinium,Ledum
25	5	L-CL	5.42	l	mwd	lP	118	235	620	55	4	W	69	Cranberry,Ledum
26	4	L-CL	7.22	l	pd	lP	120	225	800	44	5	W	62	Cranberry, Rose
27	4	L-SiCL	5.42	r	wd	lP	117	215	730	43	5	M	62	Alder, Cranberry
29	4	SL-CL	3.21	l	wd-mwd	lP	68	200	1120	62	4	D	75	Cranberry, Rose
227	4	L-SCL	5.42	gu	wd	lP	111	200	410	53	4	M	70	Cranberry, Rose, Devil's club
230	4	L-SiCL	5.42	r	wd	wS	149	145	250	40	5	F	54	Cranberry, Cornus
231	5	CL	5.42	r	id	wS	122	145	300	34	5	W	52	Cornus
232	4	CL	5.42	gu	id	lP	111	200	600	46	5	W	62	Ledum, Cornus
233	9	L	6.11	l	wd	wS	105	240	600	58	4	I	69	Cranberry, Cornus
234	5	SiC	5.42	r	mwd	wS tA	113	180	520	40	5	D	54	Cranberry, Cornus
235	5	L-CL	5.42	gu	wd	lP	116	225	830	45	5	M	63	Ledum, Vaccinium
236	6	L-CL	5.42	gu	wd	lP	114	205	580	47	5	M	66	Ledum, Vaccinium
237	4	L-CL	5.42	r	wd	wS	101	190	650	39	5	M	58	Cornus

Table 3 (continued)

Plot No.	Modal Penetrometer Reading			Bulk density			Base Sat. %			Ca/Mg+Na Ratio			pH			Remarks
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
	Horizon			Horizon			Horizon			Horizon			Horizon			
15	1.2	1.8	2.5	N.d.**	1.24	1.35	17	18	39	1.3	2.3	2.6	4.7	5.1	4.5	
16	1.2	1.8	2.2	1.30	1.39	1.37	N.d.	11	23	0.7	2.6	2.9	5.3	5.5	5.1	
17	N.s.*	1.8	2.5	N.s.	1.15	1.29	N.s.	11	25	N.s.	2.4	2.4	N.s.	4.3	4.3	
18	N.s.	1.8	2.5	N.s.	1.12	1.28	N.s.	14	5	N.s.	0.4	0.7	N.s.	4.3	4.9	
19	0.8	N.s.	1.5	1.23	N.s.	1.45	52	N.s.	57	2.3	N.s.	2.0	4.2	N.s.	4.4	
20	1.0	1.5	2.2	1.37	1.29	1.38	24	24	22	2.7	2.7	3.1	4.2	5.0	4.6	
21	N.s.	1.2	1.5	N.s.	1.31	1.46	N.s.	13	68	N.s.	1.6	2.1	N.s.	5.2	5.4	
23	1.2	1.8	2.5	1.41	1.50	1.40	61	81	51	5.8	3.1	1.7	5.2	4.7	4.6	
24	1.2	2.0	2.5	1.48	1.39	1.44	41	64	79	2.7	2.8	3.8	4.3	4.6	5.2	
25	N.s.	1.5	2.0	N.s.	1.50	1.41	N.s.	68	59	N.s.	3.4	3.2	N.s.	4.6	4.5	
26	0.5	N.p.***	1.5	1.43	N.p.	N.d.	62	N.p.	70	2.8	N.p.	3.4	4.6	N.p.	4.8	
27	N.s.	1.2	1.8	N.s.	1.43	1.34	N.s.	53	96	N.s.	2.9	5.1	N.s.	5.1	4.6	
29	1.5	2.8	3.2	1.53	1.58	1.60	79	79	93	2.7	1.6	3.0	4.7	4.4	4.5	
227	N.s.	1.2	2.2	N.s.	1.44	1.30	N.s.	50	57	N.s.	3.6	3.8	N.s.	5.0	4.7	
230	N.s.	1.2	2.0	N.s.	1.27	1.23	N.s.	25	51	N.s.	4.6	4.4	N.s.	4.5	4.4	
231	N.s.	1.5	2.2	N.s.	1.05	1.30	N.s.	59	67	N.s.	2.2	3.5	N.s.	4.3	4.7	
232	N.s.	1.2	1.5	N.s.	1.33	1.38	N.s.	54	69	N.s.	3.0	3.2	N.s.	4.6	4.4	
233	N.p.	N.p.	1.2	N.p.	N.p.	N.d.	N.p.	N.p.	55	N.p.	N.p.	1.7	N.p.	N.p.	5.5	
234	N.s.	N.s.	3.8	N.s.	N.s.	1.34	N.s.	N.s.	65	N.s.	N.s.	2.0	N.s.	N.s.	4.1	
235	1.0	1.5	3.0	1.37	1.30	1.37	44	48	74	3.1	2.7	2.2	4.7	4.6	4.6	
236	1.0	1.5	1.8	1.38	1.43	1.48	58	61	71	2.5	2.7	2.6	4.8	4.8	4.6	
237	1.0	2.0	2.8	1.29	1.45	1.24	41	62	72	3.4	2.6	2.1	4.2	4.7	5.0	

* N.s. = Not sampled

** N.d. = No determination

*** N.p. = Not present

Table 4. Soil-Site and Forest Plot Data - Area 4, Chinchaga

Plot No.	Parent Material	Soil Texture	Soil Great Group and Sub group	Topo-graphy	Drainage	Cover Type	Stand Age yrs.	B.A./ Acre sq. ft.	Number of Trees/ Acre	M.A.I. at 100 yrs. cu. ft./acre/yr.	C.L.I. Capability Class	Dominant Limiting Factor	Site Index	Main Associated Vegetation
338	5	SL-CL	3.21	l	wd	wS tA	143	160	230	47	5	D	61	Rose, Cranberry
339	5	SL-C	3.21	gu	mwd	lP wS	133	215	580	53	4	D	71	Alder, Cranberry
340	5	SL-C	3.21	gu	mwd	wS tA	127	230	490	60	4	D	62	Cranberry, Rose
341	6	LS-C	7.32	l	id	wS tA	114	215	420	58	4	W	68	Rose, Cranberry
342	5	L-C	3.22	gu	mwd	wS	128	210	460	55	4	D	69	Rose, Cranberry
343	5	L-C	3.22	r	mwd	wS	153	220	520	60	4	D	65	Cranberry, Cornus
344	5	SL-CL	3.21	l	mwd	wS	124	199	440	51	4	D	60	Rose, Cornus
345	5	CL-C	5.42	l	id	wS	137	190	620	41	5	W	50	Cornus
346	5	LS-C	3.21	gu	wd-mwd	wS	120	230	700	51	4	D	69	Rose, Cranberry
347	5	CL-C	3.21	gu	mwd	wS	96	204	1330	35	5	D	63	Cranberry, Cornus
348	5	CL-C	5.42	l	id	wS tA	118	187	430	49	5	D	59	Shepherdia, Rose
349	5	L-C	3.21	l	wd-mwd	wS tA	109	180	420	51	4	D	74	Shepherdia, Willow

Table 4 (continued)

Plot No.	Modal Penetrometer Reading			Bulk density			Base Sat. %			Ca/Mg + Na Ratio			pH			Remarks
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
	Horizon			Horizon			Horizon			Horizon			Horizon			
338	1.2	3.5	3.5	1.47	1.56	1.55	34	72	55	3.4	2.2	2.3	4.7	4.1	4.1	
339	1.0	4.5	3.8	1.49	1.54	1.55	53	62	61	1.7	1.5	1.7	4.7	4.0	3.9	
340	1.2	4.5	4.5	1.63	1.61	1.56	67	62	67	4.6	3.1	2.8	5.5	4.6	4.2	
341	1.2	N.s.*	1.8	1.57	N.s.	1.49	79	N.s.	100	1.8	N.s.	2.1	5.1	N.s.	6.3	
342	1,2	4.2	3.8	N.d.**	1.62	1.60	82	52	91	5.0	4.4	4.5	4.9	4.9	4.9	
343	1.2	3.5	3.2	N.d.	1.52	1.60	60	82	71	2.7	1.8	1.7	4.8	4.4	4.0	
344	N.s.	4.2	3.2	N.s.	1.57	N.d.	N.s.	68	34	N.s.	2.3	1.8	N.s.	4.3	4.3	
345	N.s.	2.5	2.0	N.s.	1.55	1.51	N.s.	100	74	N.s.	2.3	2.0	N.s.	4.8	4.5	
346	1.2	3.2	3.2	1.47	1.53	1.52	57	72	91	4.5	2.3	1.9	4.9	4.5	5.5	
347	N.s.	3.5	3.2	N.s.	1.58	1.58	N.s.	51	59	N.s.	1.3	1.4	N.s.	4.4	3.6	
348	N.s.	3.2	2.2	N.s.	1.55	1.53	N.s.	45	100	N.s.	1.5	2.3	N.s.	4.7	5.6	
349	1.5	4.5	4.5	1.58	1.60	1.53	77	81	100	2.2	2.1	2.0	5.1	4.6	4.2	

* N.s. = Not sampled

** N.d. = No determination

Table 5. Soil-Site and Forest Plot Data - Area 5, Footner Lake

Plot No.	Parent Material	Soil Texture	Soil Great Group and Sub group	Topo-graphy	Drainage	Cover Type	Stand Age yrs.	B.A./ Acre sq. ft.	Number of Trees/ Acre	M.A.I. at 100 yrs. cu. ft./acre/yr.	C.L.I. Capability Class	Dominant Limiting Factor	Site Index	Main Associated Vegetation
304	4	SiCL-SiC	3.21	gu	mwd	wS tA	104	180	811	35	5	D	62	Cranberry, Rose
306	6	SiC-C	3.2-/8	l	id	tA wS	43	130	1130	-	-	-	-	Willow, Shepherdia
307	6	CL	5.4-/8	l	pd	wS tA	159	175	360	48	5	W	56	Equisetum,Cornus
309	6	L-CL	3.22	r	id	wS	169	135	590	44	5	F	-	Cranberry,Cornus
310	6	SL-C	3.22	r	id	wS	166	145	940	44	5	D,F	65	Equisetum,Cornus
311	6	L-CL	5.42	r	id	wS	132	175	710	36	5	F	45	Rose
312	5	SCL-CL	3.21	gu	mwd	wS tA	51	127	922	49	5	D,F	-	Alder, Equisetum
313	7	L-SiCL	4.31	gu	mwd	lP	51	103	795	48	5	F	71	Alder
314	6	L-C	3.22	gu	mwd	wS tA	70	115	330	33	5	D,F	-	Alder, Cornus
322	5	SL-CL	3.21	gu	wd-mwd	wS tA	103	200	1240	31	5	D,L	60	Cranberry, Rose
327	2	SL-S	5.42	gu	wd	tA wS	89	175	530	43	5	M,L	72	Rose
334	5	SL-CL	3.21	l	wd-mwd	wS tA	89	138	454	36	5	D	65	Cranberry, Shepherdia
335	5	SL-CL	3.21	l	wd-mwd	wS tA	92	160	650	37	5	D,L	67	Cranberry, Rose

Table 5 (continued)

Plot No.	Modal Penetrometer Reading			Bulk density			Base Sat. %			Ca/Mg + Na Ratio			pH			Remarks
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
	Horizon			Horizon			Horizon			Horizon			Horizon			
304	1.5	3.5	3.5	1.51	1.58	1.61	79	95	100	1.8	1.6	3.8	5.2	5.4	8.0	
306	N.s.*	2.5	2.8	N.s.	1.55	1.58	N.s.	85	89	N.s.	1.1	1.2	N.s.	N.d.	5.4	
307	N.s.	1.0	1.5	N.s.	1.43	1.44	N.s.	63	56	N.s.	1.2	1.4	N.s.	4.4	4.1	very wet for penetr. reading
309	1.5	2.0	2.8	1.55	1.49	1.50	23	31	43	1.3	1.5	1.4	4.8	4.4	4.1	acid
310	0.8	4.0	4.5	1.22	1.59	1.68	34	22	24	1.4	0.5	0.8	4.6	4.4	4.3	acid
311	1.5	2.0	2.2	1.56	1.54	1.59	21	24	32	1.0	1.2	1.0	4.1	4.2	4.3	acid
312	2.0	4.5	4.2	1.49	1.61	1.63	42	47	54	1.3	1.3	1.5	4.8	4.4	4.4	acid
313	1.5	2.5	3.5	N.d.	1.50	N.d.	75	8	9	3.1	0.3	0.3	4.9	4.6	4.1	acid
314	2.5	2.8	3.0	1.49	1.55	1.56	27	47	100	1.1	1.1	0.3	5.3	4.8	4.8	
322	2.8	4.0	3.0	N.d.	1.60	1.44	78	100	100	3.3	1.3	9.3	5.1	5.7	7.7	
327	N.s.	1.8	N.d.**	N.s.	1.48	N.d.	N.s.	N.d.	100	N.s.	7.6	6.9	N.s.	7.9	8.1	
334	1.2	3.0	3.2	1.43	1.49	1.52	54	84	100	2.1	2.1	2.0	5.0	5.0	5.9	
335	1.0	3.5	3.0	1.44	1.58	N.d.	67	94	100	1.2	1.6	6.5	5.5	5.5	8.0	

* N.s. = Not sampled

** N.d. = No determination

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