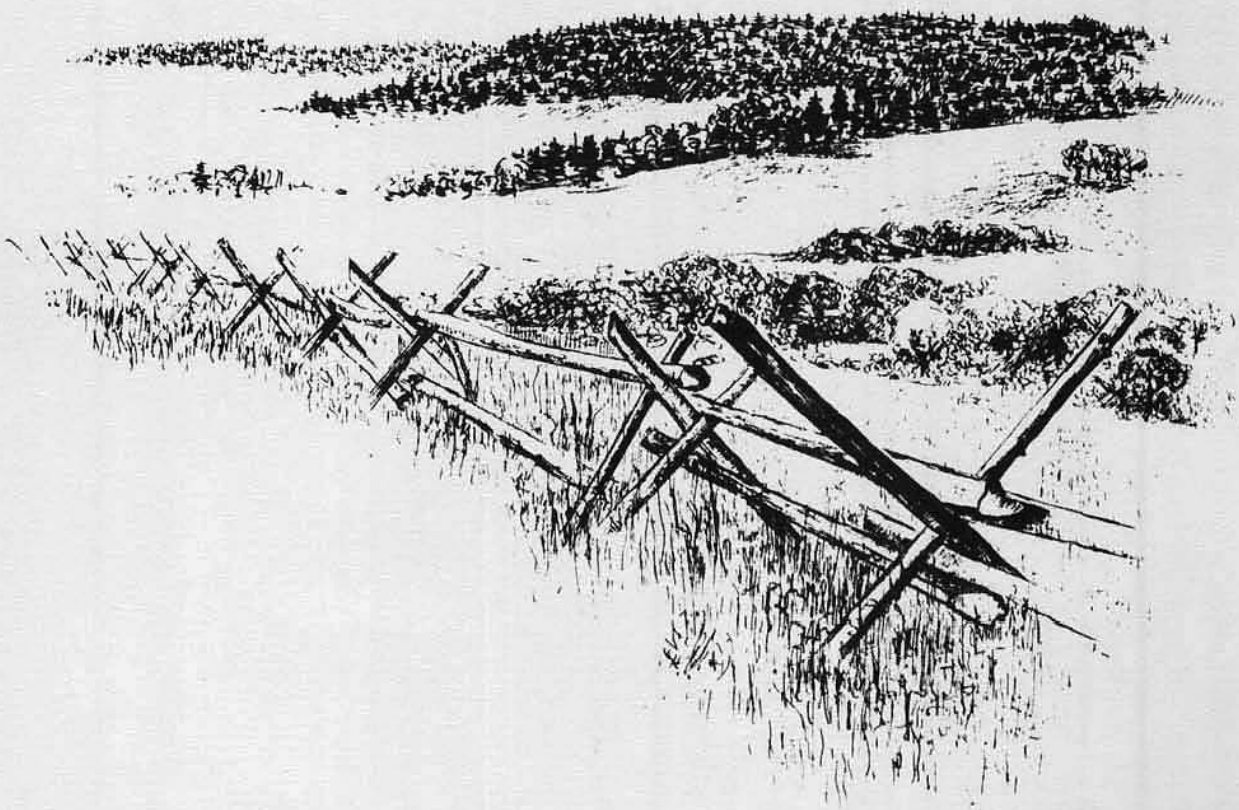
A Soil Resource and Land Use Survey of the

Canim Lake Indian Reserve

L.A. Leskiw, L.Farstad
Edited by: Dr. R.E. Carlyle



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Research Station,
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6660 N.W. Marine Drive,
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Ms. U. Bachinski drafted the figures. Mr. H. Reynolds assisted with the field work. Soil analyses were done by Mr. L. Chan.

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A SOIL RESOURCE AND LAND USE SURVEY

OF THE CANIM LAKE INDIAN RESERVE

Summary

This report presents the results of a survey of the soil resources of the Canim Lake Reserve in British Columbia. A total of 13 soil units are identified, described and mapped (Figure 3).

The soils are grouped into 8 management areas (Figure 4). Each area is described and its agricultural use is discussed. Selected analyses of important topsoils are tabulated (Table 1).

The Reserve has considerable potential for forage production. Yields in Management Area A have been increased by seeding tame grasses and legumes (omitting alfalfa). Still greater yields can be obtained with fertilizer applications.

The profitability of feeding the forage to a beef herd merits investigation.

Re-introducing irrigation to Management Area D should produce five or more tons per acre per year from this 260 acre area. Again, a judicious use of commercial fertilizers is required. Water management must be in the care of trained personnel to achieve maximum yields.

It should be noted that the climate is cool and the frost-free period is short. This causes crop limitations that are not overcome by irrigation or fertilization. Therefore, the growing of cereal crops (except for cattle feed) and commercial vegetables is discouraged.

Increasing forage production requires large capital outlays for irrigation systems, farm machinery, fertilizer, general maintenance and operation. Intensifying the agricultural practices also require social and philosophical adjustments that are not easily achieved. Also, highly trained agricultural personnel are required to manage large scale farming undertakings. For these reasons, it is suggested that changes be carried out in steps as follows;

(a) increase productivity on Management Area A by fertilization and re-seeding where necessary,

(b) install sprinkler irrigation on Management Area D and produce forage crops on this Area,

(c) initially, the forage could be sold and when the management aspects of (a) and (b) are mastered consideration should be given to establishment of a beef feedlot operation.

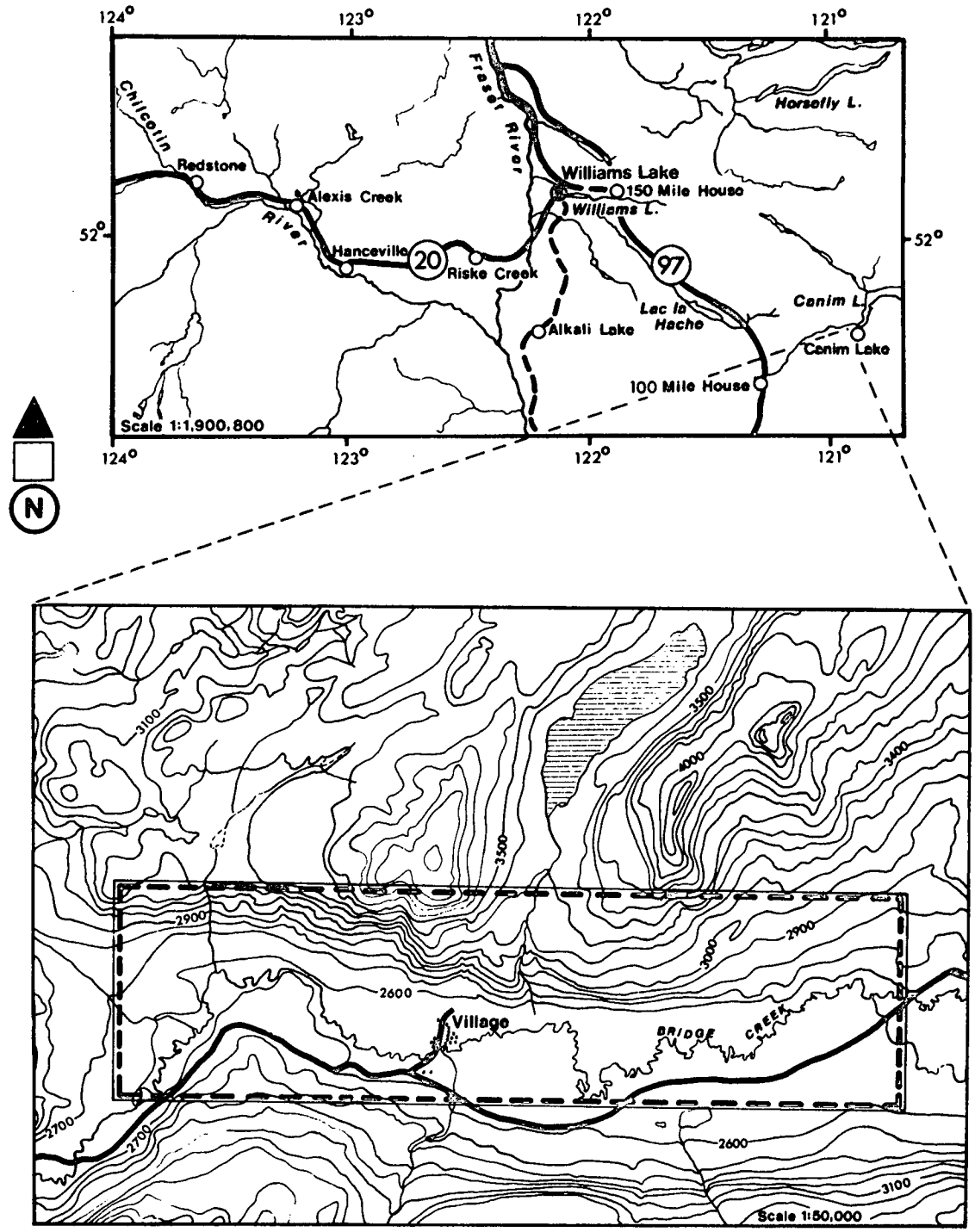

Figure 1. Location map of Canim Lake Indian Reserve 1.

Highway

Reserve boundary

Contour Line

Contour Interval 100 ft.

Aside from agricultural aspects Management Area F has some potential for exploitation of the Canim Lake tourists. Short trail rides and camp outs could be made available. Such a service must be well organized and reliable. Indian lore could be a part of such an enterprise.

Introduction

This report is one of a group describing the soil resources of some of the Indian Reserves in British Columbia. These surveys are done by the Soil Survey Section, Research Station, Canada Department of Agriculture, Vancouver, at the request of the Department of Indian Affairs and Northern Development.

The Canim Lake Reserve has a listed population of 273.

Typical of the Cariboo region, ranching is the main agricultural activity on the Reserve. Beef cattle are maintained on the Reserve but a feedlot is not included. A large herd of horses is kept which yield little or no income or financial gain. Forage in the form of sedges, grasses and clovers is cut each summer on the bottom lands. Some hay machinery is present but maintenance requires improvement. Greater agricultural output is attainable by improved management and the introduction and acceptance of modern intensive farming methods. Development of other land parcels belonging to this Band deserves attention.

The purpose of this report is to outline the soil resources of the Reserve and to suggest soil management procedures which will increase agricultural income. Soil conservation practices are suggested in several instances. Water and fertilizer management is outlined.

Location and Size

Canim Lake Indian Reserve (Figure 1) is located approximately 30 miles east of 100 Mile House, British Columbia. It covers approximately 4600 acres[1] of which 1000 acres are more or less suitable for agricultural development.

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[1] Acreages were measured from aerial photographs.

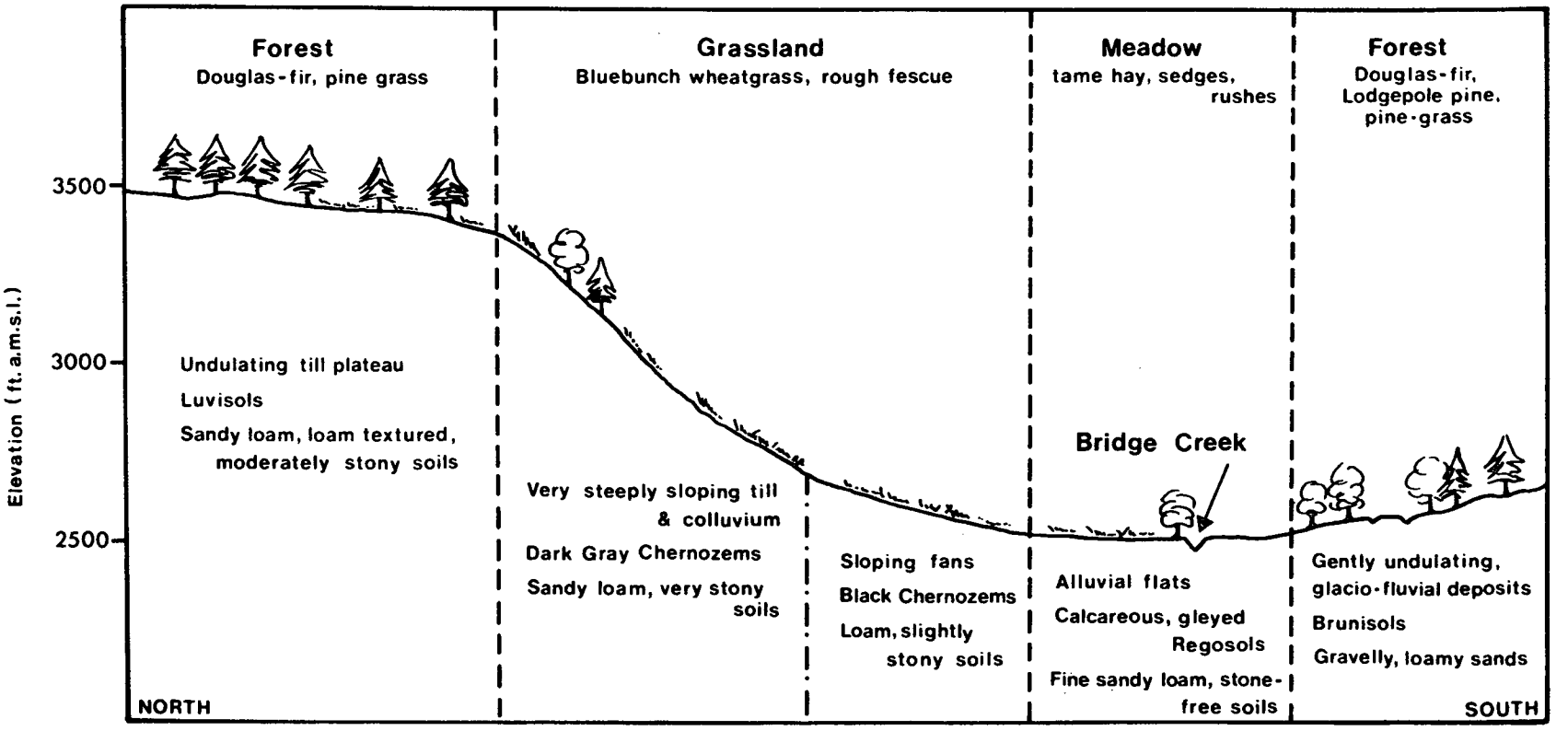

Figure 2. Idealized cross-section of Canim Lake Indian Reserve showing vegetation, landforms, soils, textures, and stoniness.

The nearest town is 100 Mile House through which runs Highway 97. A recent summer recreational development here could be exploited by the Indians in the vicinity.

Canim Lake, located just east of the Reserve is a tourist recreational centre especially for sport fishing. The highway from 100 Mile House to Canim Lake crosses the Reserve.

The Reserve lies within the National Topographic Sheet 92-O/14E.

Nature of the Landscape

The general topography, landforms, vegetation and soils are illustrated on Figure 2.

The Reserve lies in a large valley through which Bridge Creek flows. The southern part of the Reserve is a gently undulating forested area. Adjoining the Creek are extensive alluvial flats which often are flooded in the spring. The northern part of the Reserve has steep slopes with grassland on the west side and forest land predominates to the east.

The alluvial flats at the lowest level form an extensive hay meadow which, at the present time, is the most productive part of the Reserve. The gently sloping alluvial fans to the north are quite fertile and were used to produce hay at one time; now they have reverted to grazing land. With fertilization and irrigation these fans could be very productive.

Immediately south of the low-lying land is an undulating area of sandy deposits supporting mainly pine and fir. The soils are rather infertile but with proper management could produce crops.

The upper steep slopes are useful mainly for grazing with some of the timber being suitable for logging.

Climate

Annual precipitation -	25 inches
May through September precipitation -	13 inches
Annual snowfall -	55 inches
Frost-free period, (9 June - 10 August) -	62 days
Growing degree days above $42^{\circ}F$ -	1760°

The climate is characterized by cold winters and warm summers. The valleys in particular reach fairly high temperatures during the summer periods. The rainfall is reasonably adequate for crop production except that droughts often occur during the summer. Thus, rainfall is a limiting factor in the production of crops adapted to the region. With irrigation, the short frost-free period and low number of growing degree days determine to a large extent what crops can be grown successfully. The southward aspect of the slopes has a tendency to modify the climate.

Common to this region are occasional wet autumns which hamper harvest operations for both hay and cereals.

Cattle require rough shelters during the winter storms.

Vegetation

The native vegetation is forest — Douglas-fir, spruce, lodgepole pine, willow and aspen with some shrubs and an immediate cover of grasses. Sedges and rushes predominate in wet depressional areas. Native wheat grasses and fescues thrive along with similar tame varieties. Some Kentucky Blue Grass appears to prosper in the area.

If water is available a range of crops can be grown. These include cereals (oats and barley), legumes (alfalfa, red, alsike and sweet clovers), and grasses (brome and timothy). Cool weather vegetables can be grown if irrigated but the short frost-free period limits the selection to the hardiest species.

Irrigation Water

Bridge Creek (2) meandering through the Reserve is the main irrigation water source. At one time a diversion ditch

brought water to the Reserve from a small lake to the North. With repairs and some rebuilding this water source might be restored.

The water flow in the Creek though not large is reasonably constant during the summer period. The water quality is good.

In this report, water in the soil is expressed as inches of water per foot of soil. The total amount of water available to plants is known as the Available Water Storage Capacity (AWSC). Technically, it is the difference in soil moisture content between Field Capacity and Permanent Wilting Point.

Water is not uniformly available to plants over the entire range of the AWSC. For example, the first 35 percent of the range may be readily available to a given crop and then become increasingly difficult to take from the soil over the remaining 65 percent of the range. For this report it is assumed that 50 percent of the AWSC is readily available to plants. Evapotranspiration requirement for a forage crop is considered to be 0.20 inches per day for the growing season. In the recommended irrigation requirement for each soil management area, a limited contribution from precipitation is considered but application losses are excluded. If irrigation efficiency is 50 percent, application rates, in terms of irrigation system design, must be doubled (1). The irrigation requirement for the region is considered to be approximately 12 inches.

When the AWSC has not been measured for a certain soil, it is possible to estimate it from soil textures and the depths of the layers making up the plant root zone.

Soil Management Areas

Soils of this Reserve could be grouped in many ways, depending on present and probable use. The present and probable future use of these lands is not intensive. The soils, therefore, have been grouped geographically for broad planning and land use purposes. These groups, called soil management areas, are shown on a map (Figure 4) at the back of this report. In preparing these groupings the kinds of soil, parent material, topography and climate are considered. Each area consists of a single soil or a group of soils which, in a general way, lend themselves to similar systems of management or rotation and have the same potential ability to respond and produce the desired crop. However, within each management area some soils may be included that are markedly different. These are incorporated because the acreage is small or because they occur in small, isolated individual areas, making separate management impracticable.

In this report, each of the eight soil management areas is shown on the map by capital letters (Figure 4). The data used in discussing water requirements, fertilizer rates and crop yields are based on local experience, regional records and soil characteristics.

Management Area A (800 acres)

Management Area A is located in the valley bottom and extends east-west across the eastern half of the Reserve. Bridge Creek flows through this Area so it is bisected by the present and former channels.

The soils are similar in textures being sandy loams or silt loams; all have a tendency to be calcareous.

The topography is nearly level. The water table is shallow and during the spring parts of the Area are flooded. Drainage is imperfect so annual spring cultivation is precluded.

At the present time, the dominating vegetation is a mixture of cultivated and native grasses and sedges which are cut for hay. Flooding and seepage supplies sufficient moisture for hay crops so irrigation is not needed. Tame forage species (reed canary grass, clovers, timothy) could be sown to increase forage yields.

The soils of this Area should respond, profitably, to fertilizer applications; 50 lb./acre of N, P_2O_5 and K_2O is recommended. The drier accessible parts can be fertilized in early spring, otherwise, early fall applications are best.

If two cuttings can be obtained an additional 50 lb./acre of N should be applied after the first cutting. Yields of up to 5 tons per acre can be expected with two cuttings per season.

Soil drainage is not recommended. Although it might improve productivity somewhat, it is doubtful if the increase would justify the cost. Climate rather than poor drainage is the limiting factor in this Management Area. For practicality the Area also includes seven small tracts of soils that are different and would be managed differently if the acreages were larger. Five of these units (Soil 11, Figure 3) are depressional areas located in the alluvial flats near the course of the Creek. Drainage is not practical so this land is best regarded as acreages useful to the natural ecology of the Reserve.

Two more small tracts (Soil 2, Figure 3) are similar to Management Area B and should be seeded to drought-tolerant forage species and used for hay production or pasture.

Management Area B (100 acres)

Management Area B consists of well drained fine sandy loam or silt loam soils (Soil 1, Figure 3) on gently undulating or undulating topography. A few steep slopes also occur.

The Area can be cultivated but not irrigated so its productivity is limited by low rainfall. Small level places within the Area could be irrigated but they are not large enough to justify the installation costs.

Under dry land conditions the best use of this Area is hay production or pasture. It can be improved by seeding it to drought-tolerant grasses.

Management Area C (970 acres)

Management Area C is charactertized by coarse textured soils and gently undulating to undulating topography. The loamy sand, sandy loam and loam soils are low in fertility (Table 1) and water storage capacity.

At the present time this Area is forested but without major logging potential. If cleared the topography is suitable for cultivation and sprinkler irrigation. Assuming clearance was effected, forage crops would require 150 lb. of N, 50 lb. of P_2O_5 and 10 lb. of S per acre. The nitrogen can be reduced if legumes are a substantial part of the crop rotation. This fertilizer can be applied in the spring or preferably as a split application with half in the spring and the remainder after the first cutting. A production of approximately 4 tons/acre/year might be expected.

The available water storage capacity of these soils is about 1.2 inches/foot or 3.6 inches for a 3 foot rooting depth. About 1.75 inches are readily usable by plants, therefore the soil requires 1.75 inches of water about every 20 days. This irrigation interval is suitable provided that rainfall is regular. A better practice is to irrigate every two weeks applying 1.25 inches of water.

Balancing clearing, irrigation installation and annual fertilizer costs against possible yields, it is necessary to conclude that, for the present, this Area should be left uncleared. It provides some grazing and the forest could be used as a supply of fence posts. Also, some wildlife might be encouraged since water is available.

At the south-east corner of this Area (Soil 12, Figure 3), are 30 acres of poorly drained bottom land. The soil is organic and supports a growth of sedges and willows. For the time being this land is useful only as pasture or the sedges can be cut for forage.

Management Area D (260 acres)

This Area is divided into three parts. One large part is in the north-west sector of the Reserve. A second small area is located almost in the centre of the Reserve while the third lies to the north-east. The topography is moderately sloping and all three parts are found at the base of the steep grassland slopes characteristic of the valley walls.

The topsoil is a black or dark gray friable loam, moderately fertile and slightly stony. It overlies a loam or clay loam, friable to firm, subsoil. Lime occurs three feet or more below the surface. With irrigation and fertilization this soil is the most productive on the Reserve.

Water for irrigation can be obtained from Bridge Creek necessitating a pumping system. Alternatively, water is available from a lake north of the Reserve. This source involves renovating and repairing a diversion canal that was used for flood irrigation in the past.

The available water storage capacity of these soils is about 2 inches per foot or 6 inches for a 3 foot rooting depth. Thus, at Field Capacity, approximately 3 inches of water are readily available for crop use. Assuming average evapotranspiration and rainfall, the soil could be irrigated every 5 weeks with 3 inches of water applied. It is more realistic, however, to irrigate every 3 weeks applying 1.75 inches of water. The topography is suitable for sprinkler irrigation which permits a uniform water distribution as well as minimum wastage by leaching.

Grass legume mixtures are ideal for forage production. An annual fertilizer application of 150 lb. N, 50 lb. of P_2O_5 and 10 lb. of S per acre is recommended. A spring application should be adequate. Sulfur is included because the soils are low in this plant nutrient (Table 1). If grasses are grown without legumes the rate of nitrogen fertilizer application should be increased. Forage yields of 6 tons/acre/year might be expected.

In addition to forage, this Area is suitable for the production of oats, barley and cool tolerant vegetables. Occasionally, fall rains cause problems with the harvest of cereals.

Management Area E (140 acres)

This Area occurs near the western edge of the reserve including in its borders the Creek and the related flood plain. The Area is made up of gravelly loamy sand and sandy loam textured soils of low fertility and unsuitable for cultivation. Drainage is good except for a few low spots. There is virtually no accumulation of organic matter in the soil.

The shape of the Area, the gravelly nature of the soils, the flood hazard and dissection by the Creek all discourage agricultural development. All factors considered, it seems best to leave this Area undisturbed using it for pasture. Over-grazing would tend to cause soil erosion.

Management Area F (1500 acres)

Management Area F extends over the north-east quarter of the Reserve and includes a small piece of land on the western border of the Reserve. It consists of loam and sandy loam soils occurring on the moderately and strongly sloping valley walls. The Area is forested and has been partly logged.

Generally the topography is too rugged for cultivation. The Area is useful for grazing but the carrying capacity is low. The Area should be studied for ways to increase the livestock carrying capacity. Some income can be realized from further logging.

Management Area G (800 acres)

This Area is located in the north-west sector of the Reserve. It also includes the steeply sloping valley wall. The vegetation consists of dryland grasses.

The soils are characterized by a range of textures and are generally stony containing angular rocks. The depth to bedrock varies considerably, ranging from a few inches to several feet.

Unfavorable topography and soils discourage improvement of this Area. It would be very difficult to seed or fertilize for pasture improvement. Thus, it may be lightly grazed but this must be controlled carefully or erosion will take place.

Management Area H (30 acres)

Area H is a relatively small piece of land located on the valley bottom on the south-east corner of the Reserve.

The soil is organic and lacks drainage. It supports a growth of sedges and willows and has little or no agricultural value at the present time.

The Area could be improved in a minimal way by removing the willows and fertilizing the sedges. The latter makes good forage if cut and cured before maturity is reached.

Palatable and nutritious pasture is also provided by the sedges.

Improvements for intensive agriculture are possible also. An expensive drainage and water control system would be involved. Once completed the organic soil could be very productive if supplemented by fertilizers. It is a development that can be kept in mind for the future.

Management Area	pH ($CaCl_2$)	Organic Matter %	Nitrogen %	Sulfur %	Potassium me/100g	Phosphorous ppm
A	6.22	8.04	0.387	0.042	0.33	35
A	6.24	55.08	2.116	0.845	0.38	22
A	7.85	10.25	0.518	0.107	0.30	21
C	5.17	5.11	0.197	0.023	1.16	69
D	6.09	9.31	0.579	0.050	0.23	207
H	6.95	91.73	2.826	1.050	1.22	32

Table 1. Canim Lake Indian Reserve: Selected chemical analyses of topsoils of four Management Areas.

Note :

1. Analyses procedures are those commonly used in the laboratory of the Soil Survey Section, Research Station, Canada Department of Agriculture, Vancouver.

2. Each topsoil sample is a composite of four sub-samples.

References

1. British Columbia Irrigation Guide. Published by British Columbia Department of Agriculture, Victoria, British Columbia.

2. Suitability for irrigation of water from lakes and streams in the southern interior of British Columbia. Canada Department of Agriculture, Publication 1179, 1963.

3. The system of soil classification for Canada. Canada Department of Agriculture, Ottawa, Ontario, 1970.

Glossary

alkaline soil - Any soil that has a pH greater than 7.0. See also - reaction, soil.

alluvial fan - A fan-shaped deposit of alluvium laid down by a stream where it emerges from an upland into a less steeply sloping terrain.

alluvium - Material such as clay, silt, sand, and gravel deposited by modern rivers and streams.

available water storage capacity - The range in soil water between field capacity and permanent wilting point. Units: percentage of oven dry weight of soil, inches of water per foot of soil or per effective rooting depth.

calcareous soil - Soil containing sufficient calcium carbonate, often with magnesium carbonate, to effervesce visibly when treated with cold 0.1N hydrochloric acid.

colluvium - A heterogeneous mixture of material that as a result of gravitational action has moved down a slope and settled at its base.

drainage soil - Classes used on Soil Map are as follows:

1) Rapidly drained - The soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions.
2) Well drained - The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year.
3) Moderately well drained - The soil moisture in excess of field capacity remains for a small but significant period of the year.
4) Imperfectly drained - The soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year.
5) Poorly drained - The soil moisture in excess of field capacity remains in all horizons for a large part of the year.
6) Very poorly drained - Free water remains at or within 12 inches of the surface most of the year.

dunes - Wind-built ridges and hills of sand formed in the same manner as snowdrifts.

evapotranspiration - Water transpired by plants, built into plant tissue, evaporated from the soil surface.

field capacity - Soil water content retained by the soil following an irrigation or heavy rain, after downward movement of water has materially decreased. It is the upper limit of soil water available for plant use.

flood irrigation - Application of water by flooding to soil for the purpose of supplying the moisture essential for plant growth.

frost-free period - Average number of days between last spring frost and first fall frost, based on 32°F.

glaciofluvial deposits - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melted ice.

growing degree days (also, degree-days, above 42°F) - The number of degrees above 42 accumulated for all days during the growing season. This expresses the length and warmth of the growing season in a single figure.

growing season - The dates in spring and fall corresponding to a mean temperature of 42°F are used as the start and end of the growing season.

irrigation interval - The number of days between the start of an irrigation at any one spot and the start of the next irrigation at the same spot.

lacustrine deposit - Material deposited in lake water and later exposed either by lowering the water level or by uplifting of the land. These sediments range in texture from sands to clays.

leaching - The process of removing soluble material from the soil by passage of water through the soil.

outwash - Sediments washed out by flowing water beyond the glacier and laid down as stratified drift in thin forest beds. The particle size may vary from boulders to silt.

permanent wilting point - The water content of the soil when plants growing in it are wilted to the point where they will not recover when placed in the dark for 12 hours in an atmosphere of 100% relative humidity. It occurs at about 15 bars of soil moisture tension.

permeability, soil (1) - The ease with which gases, liquids or plant roots penetrate or pass through a bulk mass of soil or a layer of soil. In the absence of precise measurements, soils may be placed into relative permeability classes through studies of structure, texture, porosity and cracking in the soil profile in relation to local use experience. The relative classes presented in this report are estimated and are as follows:

	Possible rates in inches per hour
Slow	less than 0.20
Moderate	0.20 to 5.00
Rapid	over 5.00

pH - The negative logarithm of the hydrogen-ion activity of a soil. The degree of acidity or alkalinity of a soil as determined by means of a glass, quinhydrone, or other suitable electrode or indicator at a specified moisture content or soil-water ratio, and expressed in terms of the pH scale.

reaction, soil - The degree of acidity or alkalinity of a soil, usually expressed as a pH value. Descriptive terms, commonly associated with certain ranges in pH (H_2O) are: moderately acid, 5.6-6.0; slightly acid, 6.1-6.5; neutral, 6.6-7.3; slightly alkaline, 7.4-7.8; moderately alkaline, 7.9-8.4.

root zone - That part of the soil occupied by plant roots.

saline soil - A nonalkali soil that contains enough soluble salts to interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 mmhos/cm, the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5.

soil - (i) The unconsolidated material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

(ii) The naturally occurring unconsolidated material on the surface of the earth that has been influenced by parent material, climate, macro- and microorganisms, and topography, all acting over a period of time to produce soil that may differ from the material from which it was derived in many physical, chemical, mineralogical, biological, and morphological properties.

soil classification - The systematic arrangement of soils into groups or categories on the basis of their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed difference in specific properties.

soil horizon - A layer of soil, approximately parallel to the soil surface, with distinct characteristics produced by soil forming processes.

soil profile - A vertical section of the soil through all its horizons and extending into the parent material.

soil series - This is the basic unit of soil classification, and consists of soils that are essentially alike in all major profile characteristics except the texture of the surface.

sprinkler irrigation system - For design purposes, this includes all equipment required to apply water to the design area from the source of water supplying the system to the revolving sprinklers, nozzles or perforated pipe.

stocking rates - The number of acres needed to graze a 1000-pound cow for 1 month (AUM). They are determined by calculating the amount of available forage, allowing for a 45 percent carryover to avoid damage to the range. About 660 pounds of available forage is needed per AUM.

stoniness - The classes of stoniness are defined as follows:

1) Slightly stony land - There are some stones, but they offer only slight to no hindrance to cultivation.
2) Moderately stony land - There are enough stones to cause some interference with cultivation.
3) Very stony land - There are enough stones to constitute a serious handicap to cultivation and some clearing is required.
4) Exceedingly stony land - There are enough stones to prevent cultivation until considerable clearing is done.
5) Excessively stony land - This land is too stony to permit any cultivation (boulder or stone pavement).

texture, soil - The percentages of sand (S), silt (Si), and clay (C) in a soil determine its texture. Size groups from 2 mm to 0.05 mm in diameter are called sand, those from 0.05 to 0.002 mm are called silt, and those less than 0.002 mm in diameter are called clay.

From: Toogood, J. A.—A Simplified Textural Classification Diagram. Can. J. Soil 38: 54-55. 1958

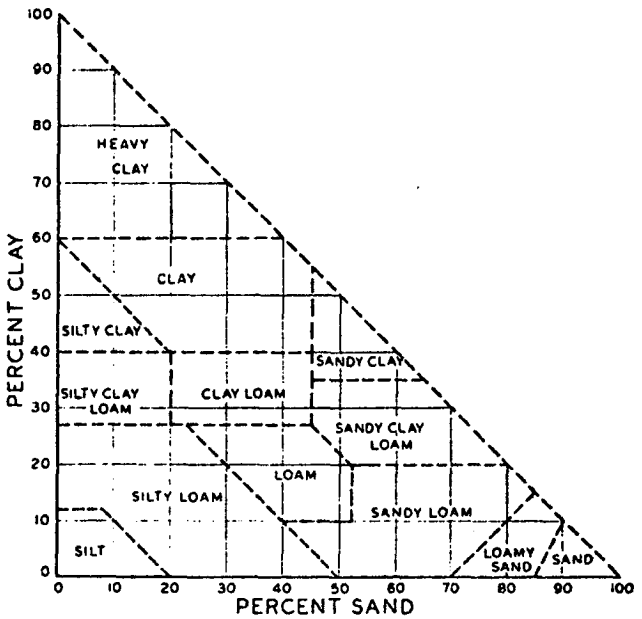

Chart showing proportions of soil separates.

topography - definition of classes used on Soil Map (Fig. 3):

Simple topography Single slopes (regular surface)	Complex topography Multiple slopes (irregular surface)	Slope %
A depressional to level	a nearly level	0 to 0.5
B very gently sloping	b gently undulating	0.5+ to 2
C gently sloping	c undulating	2+ to 5
D moderately sloping	d gently rolling	5+ to 9
E strongly sloping	e moderately rolling	9+ to 15
F steeply sloping	f strongly rolling	15+ to 30
G very steeply sloping	g hilly	30+ to 60
H extremely sloping	h very hilly	over 60

topsoil - The layer of soil moved in cultivation.

wilting point - See permanent wilting point.