A Soil Resource and Land Use Survey of the

Anahim Indian Reserve

L.A.Leskiw, L.Farstad and J.I.Sneddon
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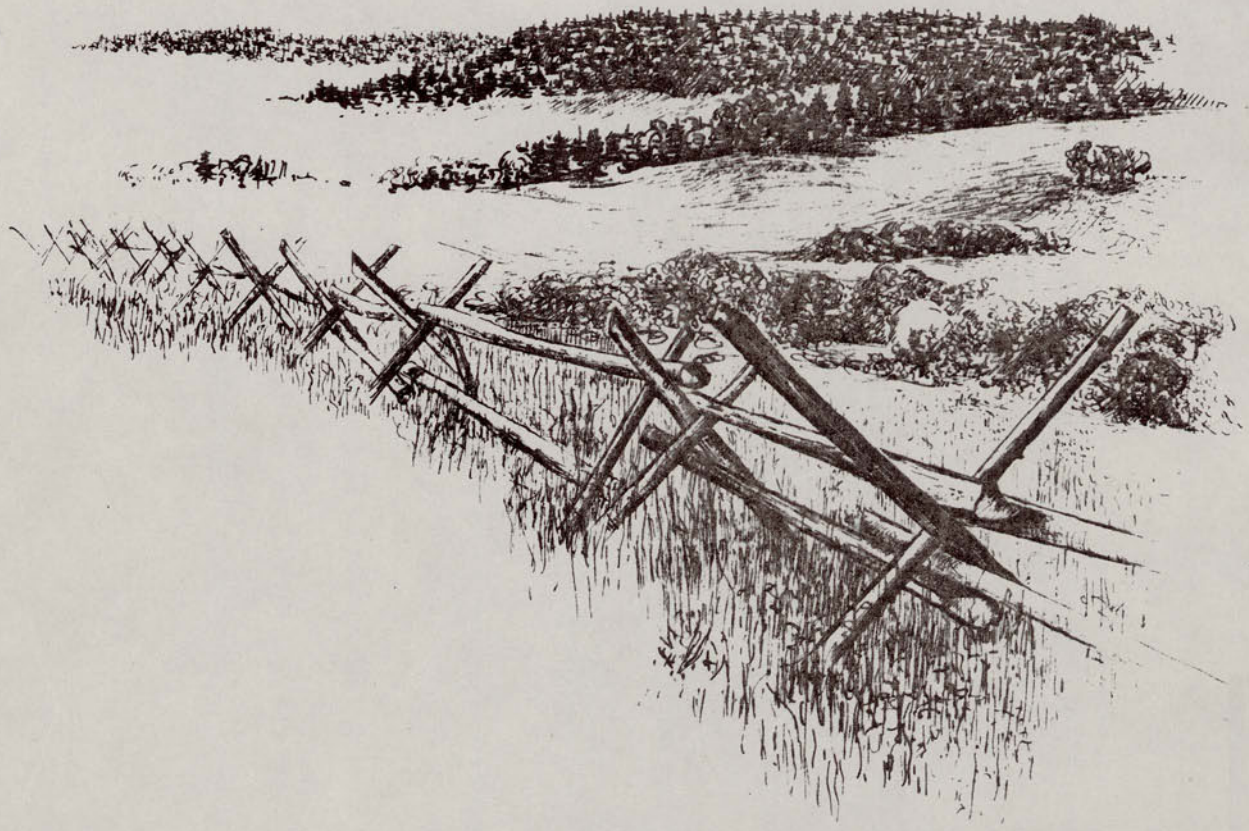

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Research Station,
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A Soil Resource and Land Use Survey of the Anahim Indian Reserve

Summary

This report presents the results of a survey of the soil resources of Anahim Indian Reserve No. 1 in British Columbia. The survey revealed 17 soils[1] which are delineated on a map (Figure 3). The characteristics of each soil are given in the soil map legend.

The report includes descriptions of 9 soil management areas based on soil groupings and agricultural utilization. Suitable crops, irrigation requirements and fertilizer use are indicated in the discussions. Expected yields and special problems are noted.

A large part of the Reserve is non-arable and is best used for livestock grazing. Approximately 1400 acres of grassland and 3700 acres of forest range with potential stocking rates of 2 acres/A.U.M. and 5 acres/A.U.M., respectively, can support an estimated 700 animals per season. However, supplemental winter feeding is necessary and this is a limiting factor in the year-round ranch operation. Thus to attain a greater utilization of the Reserve's soil resources more intensive agricultural methods must be practised. Greater intensification involves irrigation of larger acreages which in turn requires a reliable supply of water.

At the present time creek water is used for the marginal flood irrigation operation. If the irrigable acreage is increased, the Chilcotin River should be utilized for the supply of water. The water flow is rated "B" (large) and the quality as 1 (Excellent) (2). A lift of 200 to 250 feet is required which is not excessive.

With an adequate water supply and more intensive management, it is estimated that 7,500 tons of dry forage can be produced annually. This involves intensive irrigation, the scientific use of fertilizers and careful timing of forage cuttings.

Intensifying and extending irrigation farming requires large capital expenditures. This type of agriculture also involves social and philosophical adjustments that are not easily achieved. Thirdly, highly trained agricultural personnel are necessary to manage any large scale intensive farming undertaking. Therefore, it is suggested that changes be carried out in steps as follows:

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[1] The soils are designated by number because the reconnaisance soil survey of the Alexis Creek Sheet is not completed and final names have not been assigned to all the soils.

1. Install sprinkler irrigation on Management Areas A and B, at the same time retaining flood irrigation for Area C.

2. Produce forage for sale and for the beef cattle belonging to the band. The size of the herd should be closely related to the available grazing land.

3. When the management aspects of (1) and (2) above are mastered, expand sprinkler irrigation to all irrigable areas (Management Areas C, D and F).

4. Consideration could be given to the establishment of a beef feed lot so that the beef herd can be finished on the Reserve for marketing. This entails the purchase of feed grains as they could not be grown in sufficient quantity on the Reserve.

Expenditures to carry out the program outlined above cannot be justified unless an experienced full time manager has clear-cut lines of authority. In particular, he must be experienced in irrigation practice, forage production and machinery maintenance. If an Indian cannot be found with these qualifications, a training program should be started that would permit band members to assume responsibility as soon as possible.

Some traditional Indian activities conflict with the developments advocated in this report. For example, salmon fishing in the spring, and summer rodeos come at times of peak agricultural work. An answer to this problem is not offered here but it must be kept in mind when agricultural developments are planned.

Some interesting non-agricultural aspects were noted during the survey. For example, the Anahim band makes Indian artifacts which are sold to merchants in Alexis Creek, Williams Lake and other towns. These are sold in turn to tourists at a much higher price. Indians could gain substantially by creating their own tourist outlets or establishing a system of commissions when merchants handle their goods.

A few Indians enjoy being hunting guides but exploitation often takes place on an individual basis. This activity could be developed in an official organized fashion.

The recent interest in Wildlife Management suggests that a particular effort should be made to train Indians to participate in these programs, e.g. management of the California Bighorn sheep in the Cariboo. Indian experience and natural heritage could make valuable contributions in this field.

Introduction

This report is one of a group describing the soil resources of some of the Indian reserves in British Columbia. These surveys are carried out 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 Anahim Indian Reserve has a listed population of 629.

Ranching is the principal agricultural occupation but only a fraction of the band may be thus employed. Cattle graze during the summer and part of the winter but winter grazing usually requires supplemental dry forage feeding. Typical of the Cariboo region, cattle usually are sold as feeders.

Fortunately, the Anahim Reserve has a large potential for forage production. Approximately 1500 acres of arable land can be irrigated with water from the Chilcotin River. Thus, the Reserve can produce forage for a resident beef herd and also have a considerable quantity for sale.

The objectives of this report are as follows;

1. to assess the soil resources of the Reserve,

2. to group the soils into management areas including practical management suggestions for each area,

3. to outline irrigation water and fertilizer requirements,

4. to suggest crops adaptable to the soils and climate.

Economic assessments are not included in this survey but the economic soundness of all suggestions always has been kept in mind.

To achieve the objectives, a preliminary discussion was held with the Reserve Chief, Council Members and some of the residents. Next, the soils of the Reserve were systematically mapped and samples collected for chemical analyses. Special attention was given to the present irrigation practices and the possible expansion of this feature. Finally, the soils were grouped into management areas and their distribution mapped.

Location and Extent

The Anahim Indian Reserve is located along the Chilcotin River approximately 70 miles west of Williams Lake in the central interior of British Columbia (Figure 1).

The Reserve totals approximately 7500 acres[1] of which 1500 acres, more or less, are suitable for cultivation.

The Reserve lies within National Topographic Sheets No. 93-B/3E and 92 O/14E.

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[1] All acreages are measured from aerial photographs.

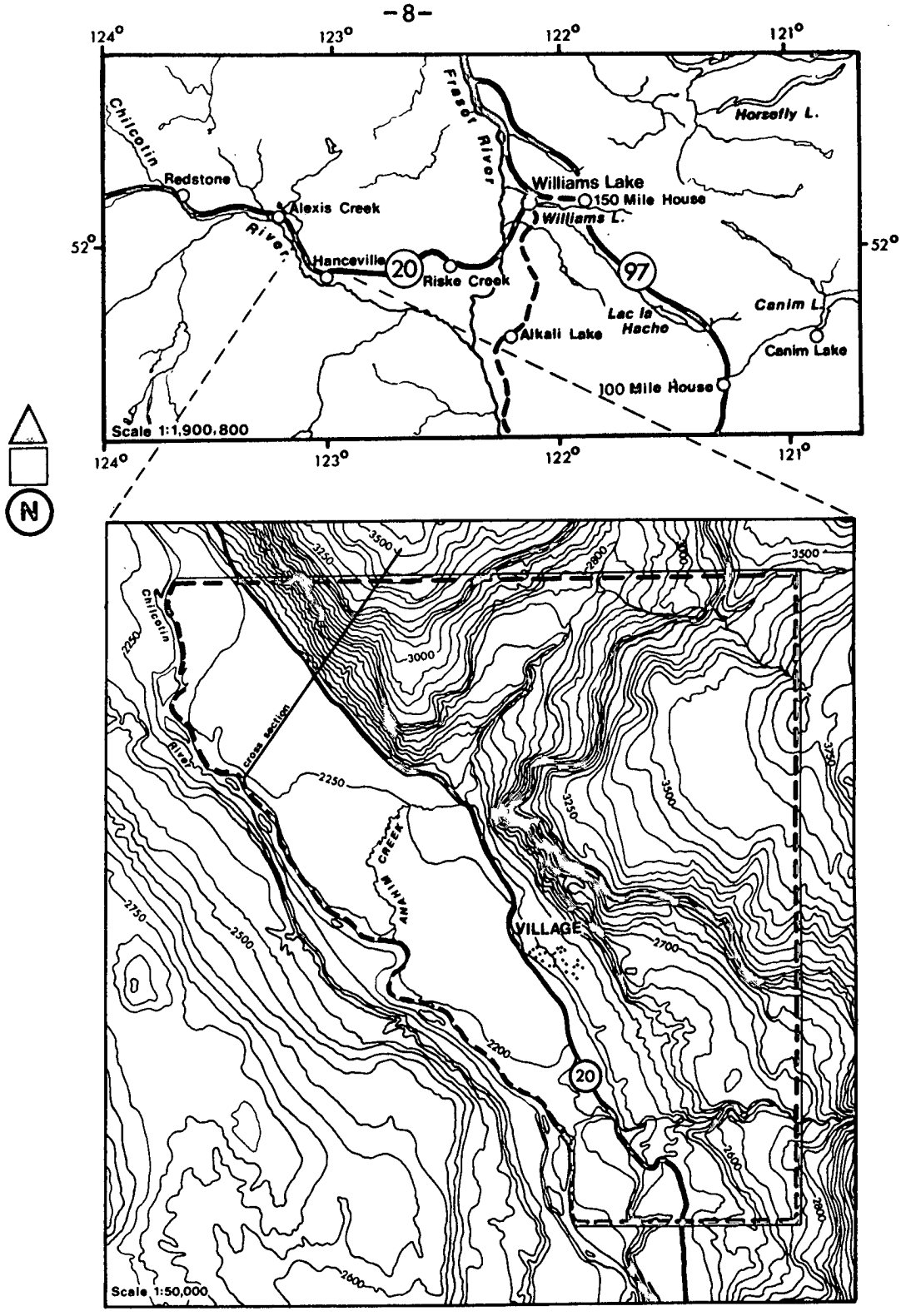

Figure 1. Location map of Anahim Indian Reserve.

Highway

Reserve boundary

Contour Line

Contour Interval 50 ft.

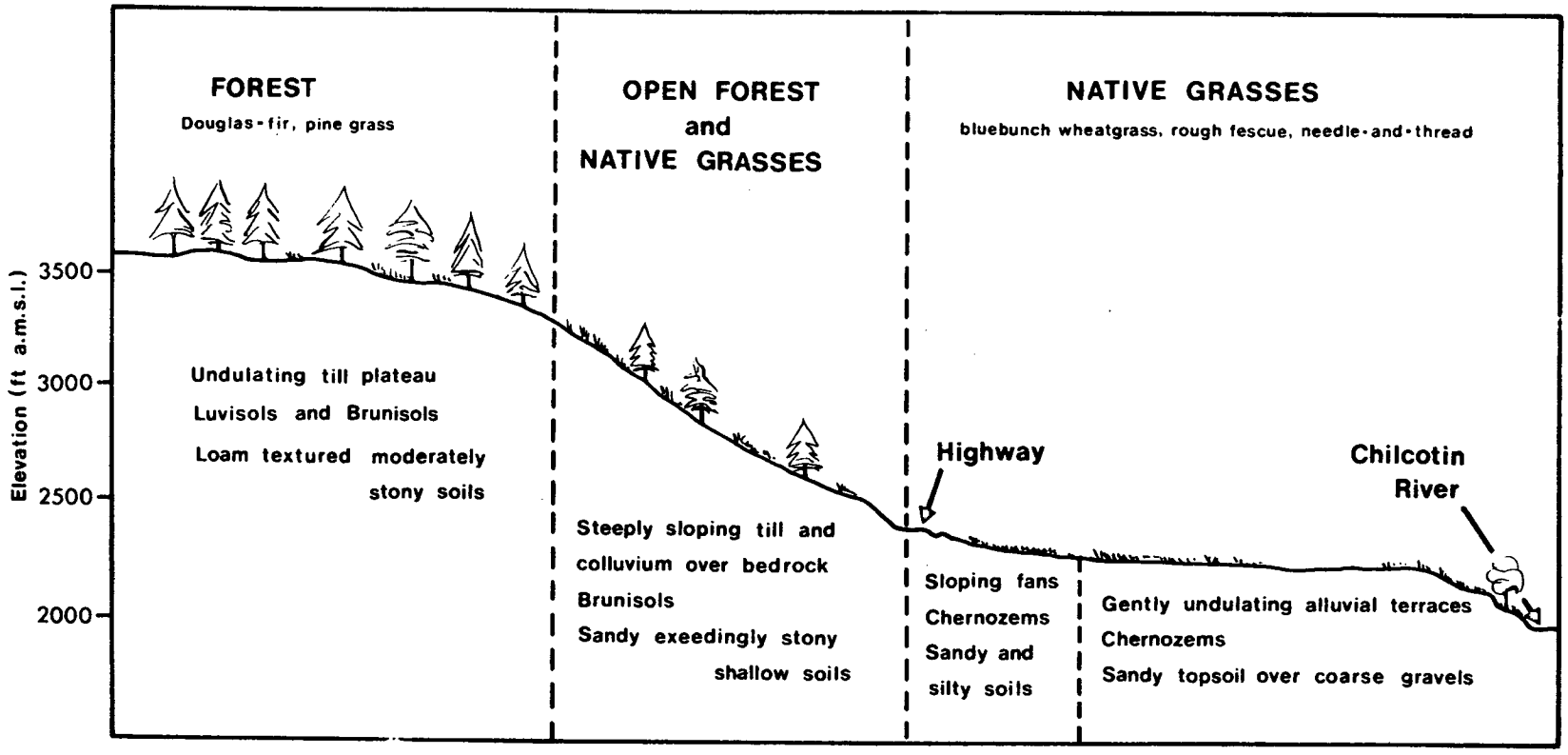

Figure 2. Idealized cross-section of Anahim Indian Reserve showing vegetation, landforms, soils, textures, and stoniness.

Nature of the Landscape

The Chilcotin River forms the southwest border of the Reserve. Highway No. 20 runs parallel but northeast of the river and cuts diagonally through the Reserve. Rising up from the river are a number of alluvial terraces where the important agricultural areas are found. Very steep slopes then lead to a relatively flat plateau at an elevation of approximately 3200 feet.

The parent materials which form the agriculturally important terraces have been deposited by flowing water and are divided into two groups: soils occupying the gravelly terraces of the Chilcotin River and soils developed on the silty deposits of the tributary streams including the fan of Anahim Creek as well as the gently sloping deposits of the upper terrace positions.

The soils of the steep slopes leading to the upland plateau are stony and bedrock is frequently shallow or exposed. A sparse growth of trees and grass helps to prevent severe erosion on the slopes.

The upland plateau is forested and is characterized by undulating topography and loam to clay loam soils.

Figure 2 illustrates a topographical cross section of the Reserve.

Climate

Annual precipitation	-	11.5 inches
May through September precipitation	-	7.4 inches
Annual snowfall	-	45 inches
Frost-free period	-	80 days
Growing degree days above 42° F	-	2115°

The climate is characterized by cold winters and short relatively hot summers. It is well suited to cattle production and cultivation of forage crops. Cereals are grown for animal feed but not for export. All crops require irrigation if reasonable yields are to be obtained.

Strong winds from the west result in a high evapotranspiration factor. Also, these winds must be considered in the design and management of irrigation sprinkler systems.

Vegetation

The upland plateau is forested, the dominant species being Douglas-fir and lodgepole pine. Some of this has been cut for lumber. Pine grass is also present and provides limited grazing.

Parts of the lower terraces are cultivated and grow a wide range of forage crops which include alfalfa, alsike, sweet clover, brome and timothy grasses. Cereal grains are mostly confined to oats and barley. Bluebunch wheatgrass is native to the bottomlands and commonly extends up the slopes.

Range Resources

Aside from the arable acreage, the Anahim Reserve contains approximately 1400 acres of grassland range and 3700 acres of forest range. Bluebunch wheatgrass and rough fescue are the principal species on the grassland. Also, there is an abundance of forbs including lupines. If in good condition this type of range has a potential stocking rate of 1.1 acres/A.U.M. (4). It is best used for spring and fall grazing. The heavy use of grassland range results in the displacement of wheat grass and fescue by less desirable perennial grasses. Severe overgrazing brings about a weed cover dominated by unpalatable perennial forbs mixed with annuals. This lowers the stocking rate to more than 2 acres/A.U.M.

The forest grazing land is characterized, generally, by many open tree stands. These areas have a well-developed undercover of shrubs and herbs. Pine grass is prominent but many broad-leafed plants are evident. These include vetch, peavine, aster, wild rose and willow, all contributing to the forage supply. Because of the short frost-free period, the duration of use is relatively short — mid-June to the end of September. If the forest range is in good condition the stocking rate is 4 acres/A.U.M., (4). With over-grazing there is a marked decline in the more palatable species especially among the forbs.

Another feature of the forest range is hay meadows and small openings where the vegetation varies with the soil moisture content. In the meadows which tend to be wet into the summer, sedges may predominate. Where drier conditions prevail oat grass is a prominent species and herbage production is sufficient for a stocking rate estimated at 1 acre/A.U.M.

The Anahim Indians also own a number of hay meadows scattered throughout the forested Crown lands. These provide considerable amounts of hay for supplemental winter feeding as well as the late fall and early winter grazing.

In the average ranch operation, the grasslands are grazed in the spring and fall, the timber ranges in summer and a combination of meadow and range grazing with stored hay provides winter forage. On the Anahim Reserve, the size of the beef herd is determined largely by the livestock stocking rate of the grazing land, i.e. grasslands and forest grazing including hay meadows. Using irrigated arable land, a surplus of forage can be produced for supplemental winter feeding. Thus the proper management of the range lands largely determines the size of the beef production operation.

Good range management embodies two principles. First, grazing should be moderate during the growing season. Enough plant foliage should be left so that individual plants can manufacture and store food as well as protect the crowns from exposure. Secondly, grazing ranges require rest particularly after close cropping. This permits the plant to resume growth and store food in the roots; it can be done any time during the growing season.

The demand for livestock products is steadily increasing and prices have improved. By intensifying the management of both range and cultivated lands the Anahim Reserve can maintain more than 500 head of cattle. The key to success with an operation this size is careful range management combined with an intensive forage production program on the arable land. Also, emphasis should be placed on pounds of saleable product rather than the number of cattle as an index of livestock production.

Cultivation Practices

Soils in all of the management areas suited for crop production may be cultivated with modern equipment such as plows, discs and cultivators using methods normal to the region. A disc with seeding attachment or seed drill may be used for sowing cereal crops whereas a spreader may be used for sowing forage crops. Because of fall weather conditions, swathing is required for cereal crops. A swather or mower and rake, and baler are used to harvest the forage.

Fertilizers may be applied with a spreader or a fertilizer attachment on a seed drill. The soil should be moist or irrigated immediately following fertilization to minimize volatilization of the nitrogen fertilizers. Over-irrigation, however, will result in the loss of fertilizers by leaching, particularly if the soil is rapidly permeable.

Clean, germination tested seed adapted to the region should be used. Seeding and fertilizer rates can be reduced for cover crops.

In seeding areas for dry land pasture the soil surface should be disturbed usually by a disc. Seeding is done by spreader either early in the spring or late fall, so that sufficient moisture is available to germinate the seed and permit a vigorous seedling development.

Soil fertility can change according to cultural practices. Thus, the cultivated soils should be sampled regularly and analyzed for available plant nutrients. The services of the local District Agriculturist should be utilized. This official also can supply useful publications.

Irrigation

The Chilcotin River is a good source of water for irrigation. It has been rated as suitable for all soil types and all crop plants that do not require an acid soil. This River also has a reliable flow, rated "B" (2). On the other hand, the Anahim Creek, during dry years, is not a dependable water source for large scale irrigating.

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).

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 nine 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 (700 acres)

Management Area A covers the extensive sandy and gravelly terraces located west of the Indian village. The soils are characterized by a sandy loam or silt loam surface layer overlying a very gravelly subsoil. This finer textured surface material is generally less than 10 inches deep but varies from a few inches to 4 feet over very short distances.

Results of chemical analyses (Tables 1 and 2) indicate that these soils do not have problems with salinity, acidity, etc. The soils, if irrigated, require fertilizers containing nitrogen, phosphorus, and potassium to maintain nutrient levels for optimum crop yields. For forage crops

(grass-clover, grass-alfalfa mixtures), 50 lb. of N, 50 lb. of P_2O_5, and 100 lb. of K_2O should be applied per acre in spring or half this amount in spring and the remainder after the first cutting. For grass crops an additional 200 lb. of N is recommended.

Macro-topography of the flats is nearly level, but the micro-relief varies considerably being of a wavy nature caused by irregularities in stream flow during the period of deposition.

The soils of Area A require very shallow cultivation keeping the number of operations to a minimum. Otherwise, the very gravelly subsoil will be brought to the surface making the soil less suitable for crop growth. On this basis, forage crop production is recommended. Cereals may be grown as cover crops.

Area A is well suited for a wheel-move sprinkler irrigation system. Levelling of dips and ridges may be necessary in a few places. The soils are permeable and no drainage problems should arise.

The available water storage capacity of soils in Area A is extremely variable due to the varying depth of sandy and silty surface material. A reasonable estimate is 3 inches within the top 3 feet of soil. Since about half of this is readily available for plant use, the soil requires irrigation when 1.5 inches of water are used by the crop. Assuming that the crop uses 0.20 inches of water per day, during peak consumption, the soil must be irrigated at 9 or 10 day intervals at which time 1.5 inches of water are required. It is most important to irrigate at this rate during June, July, and August when water consumption is highest. Over-irrigating, particularly following fertilization, should be avoided to reduce nutrient leaching from the rooting zone.

Forage yields of 5-6 tons/acre/year may be expected from Area A with proper fertilization and irrigation.

Management Area B (220 acres)

This area is characterized by well drained sandy and silty soils occurring on gently sloping alluvial fans. The topsoil is a dark gray, friable, granular sandy loam or silt loam which is relatively high in organic matter. The subsoil consists of a friable loam, silt loam or clay loam. Lime occurs at a depth of approximately 20 to 30 inches. At the lower ends of the fans, the gravelly and sandy beds of the terraces occur at about a 4 foot depth but are deeper upslope.

Chemical analyses (Table 1) indicate that these soils, like the soils in Area A, do not contain excessive amounts of salts. Fertilizer applications are necessary for optimum crop yields. About 50 lb./acre of N and 50 lb. /acre of P_2O_5 is recommended for grass-legume mixtures. Up to 250 lb. /acre of N may be applied for grasses alone. One-half the fertilizers should be applied in the spring and the remainder after

the first cutting. For cereal crops, 50 lbs. of N and 15 lbs. of P_2O_5 should be applied in the spring. Potatoes would require about 200 lbs. / acre of N and 120 lb. /acre of P_2O_5.

The available water storage capacity of these soils is about 2 inches of water per foot depth or 6 inches in the 3 foot rooting zone. Thus about 3 inches is readily available for crop use. Therefore 3 inches of water in addition to rainfall should be applied at approximately 18 day intervals. Less water would have to be applied for a shorter irrigation frequency, for example, 2 inches of water for a 12 day period. A sprinkler irrigation system is most suitable for this Area.

The soil texture, topography and lack of stones make this Area well suited to intensive cultivation. Vegetables, cereals, or forages may be grown. Since the climate is marginal for commercial vegetable production, vegetables should be grown for local use only. This is the most suitable Area for cereal production on this Reserve. Forage production of 6 tons/ acre/year and oats and barley production of 60 to 100 bushels/acre can be expected from this Management Area.

Management Area C (500 acres)

The soils occurring in Area C are developed on the silty and sandy deposits of the tributary streams. These are imperfectly drained, calcareous soils which are presently flood irrigated and used for forage production.

A few irrigation ditches and meandering stream channels dissect the gently undulating region of these soils.

Characteristically, the topsoil is a dark gray or black friable loam or silt loam, which has a fairly high organic matter content and may be calcareous. The subsoil is a calcareous, dark grayish brown, friable, loam or silt loam. Although gravel beds were not observed within the uppermost 6 feet, they probably occur at a greater depth.

Laboratory analyses (Table 2) indicate that the main limitation of these soils is alkalinity caused by a high lime content. This somewhat restricts the choice of crops but should not lower the yields of suitable crops. Also, phosphorus availability is markedly reduced by the presence of lime so that applications of a high-phosphate fertilizer such as 11-48-0 are recommended. Annual applications of about 50 lb. N/acre and 100 to 120 lb. P_2O_5/acre should be added for grass-legume mixtures. Up to 250 lb. N/acre is recommended for grasses. Fertilizers should be applied in spring and midsummer after the first cutting.

The available water storage capacity for these soils is estimated to be 2 inches of water per foot depth. Based on a 3 foot rooting depth, about 3 inches of water is readily available for crop growth when the soil

is at field capacity. Thus, about 3 inches of water must be applied every 3 weeks or 2 inches every 2 weeks if a shorter rotation period is desired.

The practise of flood irrigation is not recommended. This system tends to flood soils excessively in May and June causing poor aeration and retarded forage growth. In fact, alfalfa does not survive under these conditions. Another major disadvantage of the present system is early exhaustion of the water supply so that by August the soil moisture cannot be replenished in adequate quantities for maximum crop growth. A sprinkler irrigation system is recommended for this Area permitting controlled uniform distribution of water throughout the growing season. It also may reduce the amount of lime in the topsoil.

Even with sprinkler irrigation, localized areas may flood for a short time in spring thus annual cultivation should be avoided. On this basis, forage crop production is recommended. The species grown should be suited to the slightly alkaline conditions. Forage yields of 5-6 tons/acre/year may be expected on this Area.

Management Area D (50 acres)

Area D consists of moderately saline, imperfectly drained soils occurring on nearly level, silty deposits. Generally the Area is similar to Area C, except that the soils in Area D are considerably more saline.

As a result, salt tolerant forage crops (alfalfa, reed canary grass, bromegrass) should be grown. Cultivation should be minimal to prevent further increases in salinity. Proper rates of irrigation are important in controlling salinity; over-irrigation could be harmful. About 2 inches of water applied every 2 weeks by sprinkler irrigation is recommended. Fertilizer applications may be slightly lower than those recommended for Management Area C. Yields of 3 tons/acre/year may be expected. This yield would not justify a separate irrigation installation. However, Area D lies between Areas B and C so irrigation is not expensive and considerable forage can be produced.

Management Area E (50 acres)

Management Area E , consisting of poorly drained, calcareous, silty and clayey deposits occurs in a nearly level to depressional region. The vegetation is sedges and willows. A few shallow meandering stream channels cut through the Area.

The soils are characterized by a dark gray, calcareous, humified, silt loam surface layer overlying a brownish gray, calcareous, silt loam or silty clay loam subsoil. A shallow water-table and natural flooding results in poor drainage.

Since this Area is naturally fairly wet, irrigation is not necessary. Cultivation should be restricted to the establishment of a productive forage such as reed canary grass. Annual cultivation is not recommended. Fertilizer applications can be expected to increase productivity — 100 lb. N/acre plus 80 lb./ P_2O_5/acre in early fall, immediately following cutting are recommended.

Management Area F (70 acres)

Management Area F, occurs on the gently undulating gravelly terraces south and southeast of the Indian village. The soils are well drained and are characterized by dark gray, silty topsoils overlying very gravelly and sandy subsoil. They are quite similar to the soils of Area A except that calcareous material extends to the surface. Part of this Area was flood irrigated at one time for hay production but now only weeds remain.

Chemical analyses (Table 2) indicate that these soils contain considerable amounts of lime which could be detrimental to some crops. Again, because of the lime, high application rates of phosphorous are necessary. Fifty lb. N/acre and 80 lb. P_2O_5/acre applied annually are recommended with half applied in spring and the remainder after the first cutting.

Water requirements are similar to those suggested for Area A. That is, about 1.5 inches of water should be applied every 9 days. The sprinkler irrigation method is required here. Flooding would be unsuccessful due to the rapid permeability of the soil. Forage yields of 4-5 tons/acre/year may be expected.

Management Area G (1400 acres)

A number of different soil units (3, 4, 10, 11, 15 and 16, Figure 3) occur within Area G. They are grouped into one management area because grasses dominate the vegetation making livestock grazing the most suitable use of this land. Climatic factors tend to limit the grazing to the spring and fall seasons.

One portion of this Area consisting of soils 3 and 4 (Figure 3) occurs on the lower terraces along the Chilcotin River. The terraces are gently undulating and somewhat channeled. Steep slopes of varying length occur between terrace levels.

The grassland parts of these terraces can be irrigated and used for forage production using the same irrigation and fertilizer recommendations as given for Management Area A. However, the irrigable tracts are not extensive so irrigation may not be economically sound. If so, the Area can be seeded to drought-tolerant pasture species for grazing.

The wooded acreage on these terraces also provides grazing. The economic soundness of clearing and irrigating is questionable. Also, the meadows are small and drainage would be difficult and expensive. As they are, they support a fairly lush growth of sedges with limited grazing value.

The second portion of Area G encompasses the Indian village. Near the village, soil unit 11 (Figure 3) occurs on the slope and flat region immediately below the village. The soils are saline and calcareous as indicated by patches of white salt crust. This salinity is sufficient to be detrimental to most agricultural crops so it is best sown to salt-tolerant dryland grasses. This treatment provides vegetative cover, prevents erosion and provides some grazing. Also, since it lies at the entrance to the village, the general appearance would be improved greatly.

Soil units 9 and 10 (Figure 3) include the village and the gently sloping region extending back to and along the valley wall. The soils in this gently sloping part are irrigable but a practicable water supply is not available. The cost of pumping water from the Chilcotin River would be prohibitive. Thus, this acreage should be used for pasture. Some re-seeding and proper management could improve the stocking rate.

The wooded and grassland regions along the valley of Anahim Creek constitute the third major part of Area G. The topography ranges from gently undulating to steeply sloping. The soils (Soils 13 and 15, Figure 3) are generally well drained sandy loams, clay loams or loams. There are no salinity, alkalinity or acidity problems with these soils. Localized small areas are suited to small irrigation schemes but there is no potential for extensive development. The best use of this land is grazing which can be improved by seeding the grassland parts and avoiding over-grazing.

Summarizing, there are approximately 1100 acres in Area G. The present range condition is poor having an estimated stocking rate of 3 to 4 acres/A.U.M. With proper management the stocking rate of the range could be improved to 2 or even 1.5 acres/A.U.M. providing considerable spring and fall grazing. This can be supplemented by early spring and late fall pasturing on the irrigated forage producing lands, i.e. Management Areas A, B, C and D.

Management Area H (970 acres)

Management Area H includes the very steeply sloping valley walls and a few gullies on the lower levels. The soils are characterized by a wide range of textures and are generally stony containing mostly angular rocks. Depth to bedrock varies considerably ranging from a few inches to several feet. Nevertheless, topography is the main factor limiting agricultural improvement of this Area.

While the slopes provide limited grazing, over-use must be avoided to prevent severe soil erosion. Seeding or fertilization is not recommended.

Management Area I (3700 acres)

Management Area I occurs on the moderately well drained soils (soil units 15, 16 and 17, Figure 3) of the upland forested region. The topography ranges from undulating to rolling. The soils are loam to clay loam textured.

A fairly lush growth of pine grass provides considerable grazing growth during the summer months. This grass stand is fairly accessible by old logging roads and trails.

The Area has been logged incompletely, many of the best trees having been removed. A long time would be required to replace the stand for further logging.

Clearing this Area for crop production is not recommended. The frost-free period is too short for most agricultural crops. Thus, grazing is the best use for this extensive Area. It has an estimated stocking rate of 5-6 acres/A.U.M.

Management Area	pH ($CaCL_2$)	Organic Matter %	Nitrogen %	Sulfur %	Phosphorous ppm	Potassium me/100g
A	6.13	2.89	0.177	0.024	45	0.46
B	6.18	2.94	0.175	0.026	55	0.27
B	7.06	3.59	0.198	0.024	111	2.94
B	6.55	3.78	0.187	0.038	90	2.07
C	7.74	5.29	0.290	0.034	128	1.28
E	8.40	8.37	0.397	0.057	109	5.60
F	7.83	6.15	0.327	0.048	44	0.95

Table 1. Anahim Indian Reserve: Selected chemical analyses of topsoils of five management areas

Notes

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 subsamples.

Management Area	Conductivity mmhos /cm	Saturation Extract me/liter HCO_3^-	Cl^-	SO_4^+	Ca^{++}	Mg^{++}	K^+	Na^+
C	0.954	8.95	2.50	2.57	1.56	3.76	0.24	7.10
E	1.989	13.70	3.40	7.37	0.16	5.19	3.42	14.19
F	0.475	5.45	2.40	1.03	1.97	3.01	0.35	0.68

Table 2. Anahim Indian Reserve: Selected chemical analyses of calcareous topsoils

Notes

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 subsamples.

References

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

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, 1970. Queens Printer, Ottawa, Ontario.

4. Tisdale, E. W., A. McLean and S. E. Clarke. 1954. Range resources and their management in British Columbia. Journal of Range Management, Vol. 7, No. 1.

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, and 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 differences 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 rate - The number of acres needed to graze a 1000-pound cow for one 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

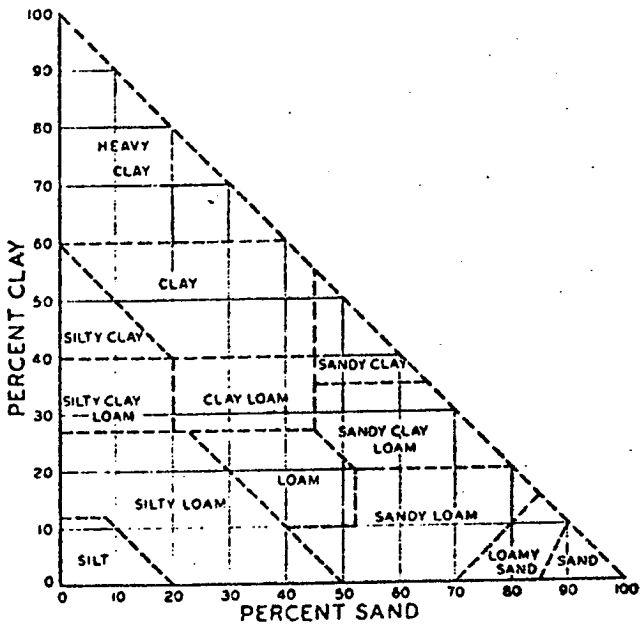

Chart showing proportions of soil separates.

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.