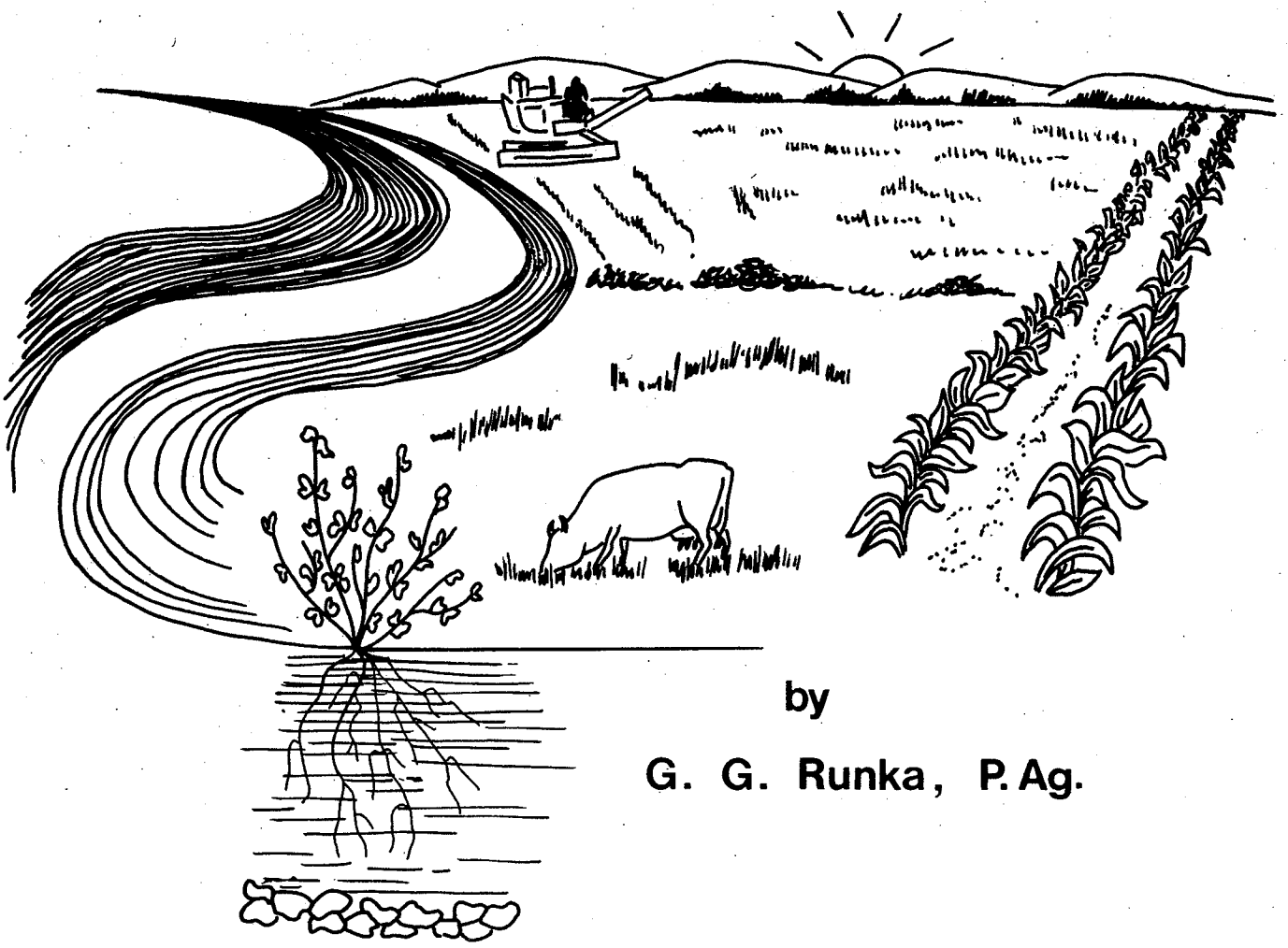
METHODOLOGY

LAND CAPABILITY FOR AGRICULTURE

B.C. LAND INVENTORY (CLI)

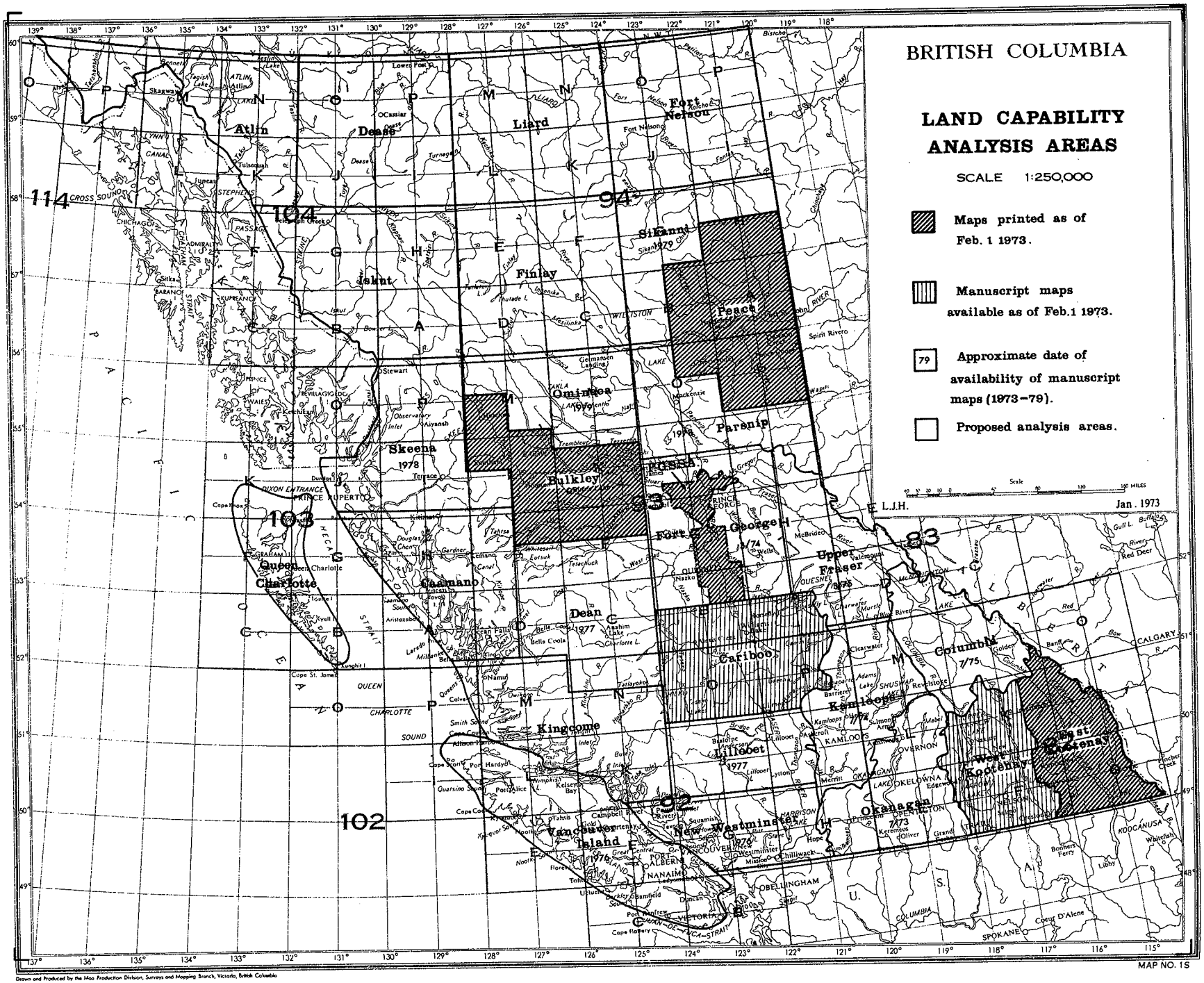


by

G. G. Runka, P. Ag.

January, 1973

Soil Survey Division
B C Department of Agriculture
Kelowna, B.C.


BRITISH COLUMBIA
LAND CAPABILITY ANALYSIS AREAS
SCALE 1:250,000
Maps printed as of Feb. 1 1973.
Manuscript maps available as of Feb.1 1973.
79 Approximate date of availability of manuscript maps (1973-79).
Proposed analysis areas.
E. L.J.H.
Jan. 1973
MAP NO. 1S
Drawn and Produced by the Map Production Division, Surveys and Mapping Branch, Victoria, British Columbia
Atlin
Dease
Liard
Fort Nelson
Finlay
Peace
Parsnip
Omineca
Bulkley
Skeena
Kitimat
Fort George
Upper Fraser
Dean
Caribou
Columbia
Kamloops
East Kootenay
West Kootenay
Okanagan
Lillooet
Kingcome
Queen Charlotte
Casamano
New Westminster
Vancouver Island
114
104
94
103
93
83
102
92
PACIFIC OCEAN
PRINCE RUPERT
PRINCE GEORGE
VANCOUVER
VICTORIA
KAMLOOPS
OKANAGAN
CALGARY
SPOKANE

METHODOLOGY

LAND CAPABILITY FOR AGRICULTURE

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Soils Division,
B. C. Department of Agriculture,
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INTRODUCTION

The methodology used by the Agriculture sector B. C. Land Inventory (CLI), is described. This publication is intended as supplementary information and should be used in conjunction with the Soil Capability Classification for Agriculture Report No. 2, CLI (2) and B. C. Climate Capability Classification for Agriculture (9). Canada Land Inventory (2) describes the soil capability for agriculture as designed for national use (note the assumptions). The unique climate - soil combinations of B. C. have made some modifications to the national guidelines (2) necessary for uniform application of the technical classification within the province (See section 2 i-iv).

In this classification, lands are grouped into seven classes according to their potentialities and limitations for agricultural use depending on inherent soil and climatic characteristics. The first three classes are considered capable of sustained production of a wide range of common cultivated crops. Range of crops decreases from Class 1 to 3. The fourth class is marginal for sustained arable culture and is capable of producing only a narrow range of crops (usually includes hardy cereals and most forages), while the fifth class is capable of use only for permanent pasture and/or hay (or a single speciality crop) - extremely narrow range of cropping possibilities. The sixth class is capable of use only for natural sustained grazing, while the seventh class is considered incapable of use for cultivated crops or grazing. Limitations are indicated as subclasses.

Please remember the agriculture capability classifications take into account the range of crops possible, and not productivity (i.e. yield/acre) of any crop.

Climate information (maps and data) is provided by the Climatology Section, B. C. Land Inventory (CLI), Parliament Buildings, Victoria. Soil survey information (maps and data) and capability classification is provided by the staff of the Soil Survey Division, British Columbia Department of Agriculture, Court House, Kelowna, and the Soil Survey Unit, Canada Department of Agriculture, 6660 N. W. Marine Drive, Vancouver.

The province is divided up into several regions (Figure 1) and priorities set so that fieldwork is completed for all BCLI sectors by appropriate deadlines so that land capability analysis (See Section 4) can be carried out.

METHODS OF INVENTORY

The capability classification using all available climate and soil information is applied to all lands, not only those presently cultivated or otherwise used for agriculture. Research data, soil surveys, climate inventory, and experience are used as a basis for placing lands in capability classes and subclasses. Where the above information is not available and access is limited, heavy reliance is placed on aerial photo interpretation and extrapolation in accordance with experience gained on similar soils with similar climatic restrictions elsewhere. Your attention is directed to the basic assumptions as indicated on Page 5, Report No. 2, CLI, Soil Capability Classification for Agriculture (2). To avoid making serious errors in interpretation and use of agricultural capability maps and reports, a thorough understanding of these assumptions is essential. In applying the agriculture capability classification in British Columbia important modifications were made. (a) In the areas designated in Figure 2 all arable land, whether presently irrigated, dry

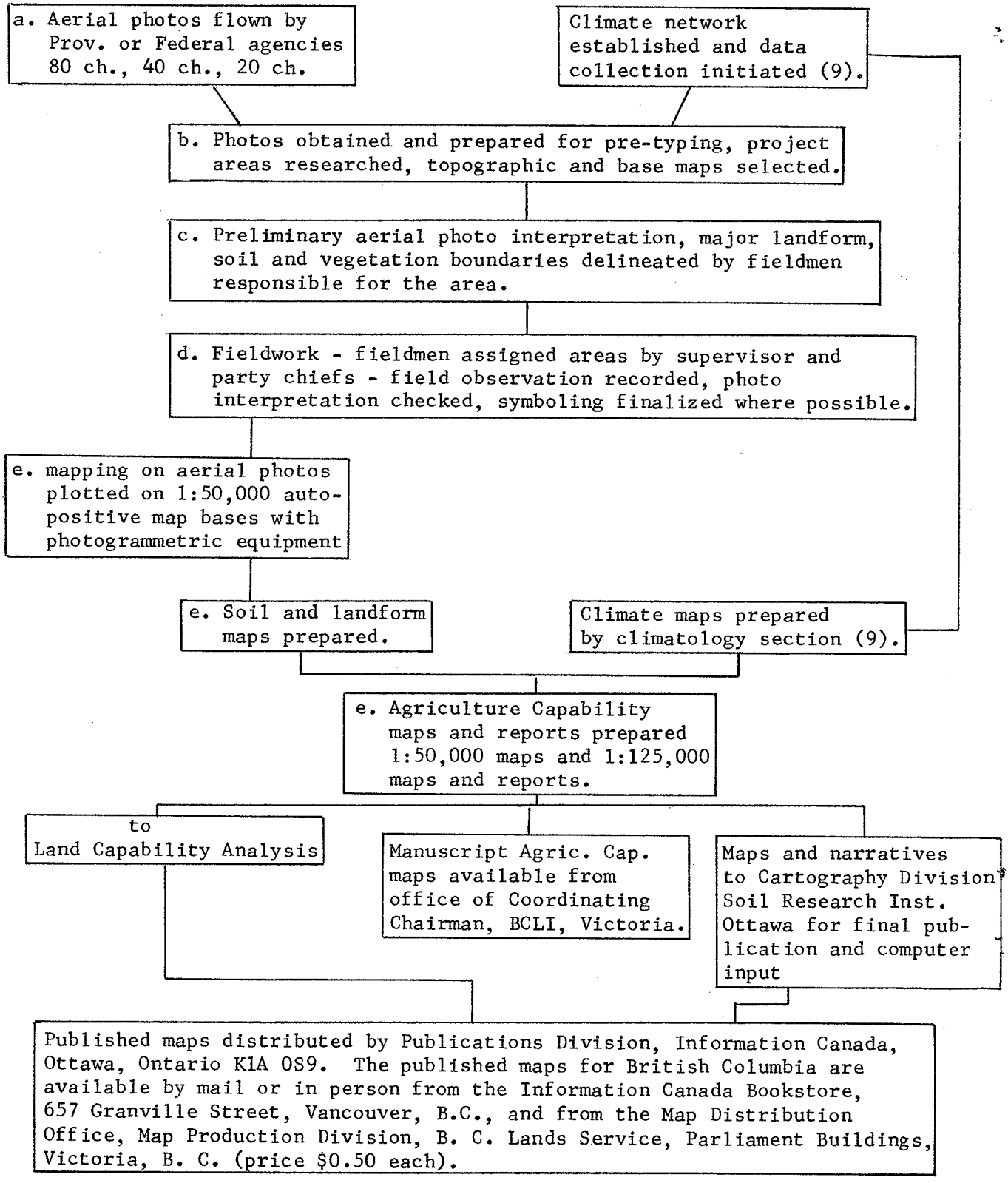
farmed or unimproved was given two ratings - one for dry farming and a second for irrigated conditions. Where all land is irrigated i.e. parts of Irrigation Districts only the irrigated rating is shown. (b) Most areas of the province have or will have organic (peat, muck, etc.) soil capability ratings (13). (c) The classification was expanded to take into account lands capable of tree fruit and grape production in those areas climatically suitable (9). (d) A land capability for grazing classification of native forage plants was deemed necessary but has had little application to date (14).

As one moves southward within the province and climatic qualities improve, productivity of most crops increases because of the longer growing seasons and higher associated heat units. For this reason the lower capability classes (4 and 5; same range of crops but higher annual yields) become more valuable. This is not apparent from the agriculture capability classification which takes into account only the range of crops possible, and not their productivity, e.g., three cuts of alfalfa rather than one or perhaps two further north.

Fieldwork, Mapwork and Project Flow Chart

Typical Project Flow Chart (Land Capability for Agriculture)

- time span approximately 3 years - to manuscript stage.



(a) When a project is planned well in advance, new photographs are flown the year prior to the survey unless recent photographs have been flown for other purposes. For general reconnaissance fieldwork 80 chain photography is the most desirable while for more detailed mapping, 40 chain and 20 chain photos are required. Photos are flown and supplied by Air Surveys Division, Department of Lands, Forests and Water Resources, Victoria or National Air Photo Library, Department of Energy, Mines and Resources, Ottawa.

(b) All previous reports and maps on soils, land, geology, vegetation and climate are researched and where applicable various map boundaries are placed on the aerial photos. Topographic maps at scales of 1:50,000, 1:126,720 and 1:250,000 are obtained.

(c) Initially photographs are given a preliminary stereoscopic examination. This gives the interpreter a chance to become acquainted with the area. Examination and rough delineation of landform boundaries using all elements of the air photo pattern is carried out. The aerial photo interpretation at this stage involves a deductive and inductive evaluation of the five main elements (drainage, erosion, tone, topography, vegetation and land use) as depicted on the photographs. It is within this geomorphic-land-form framework identifiable on aerial photographs that known information on soils, vegetation and land capability is extended and extrapolated to adjacent landscapes. A base is thus formed for organized field checking and modification as necessary.

(d) About four to six months are spent by pedologists in the field observing and recording land characteristics including soils, parent materials, topography, vegetation, crop range, etc. Use of aerial photographs is the key to all fieldwork and the ability to interpret from them is essential.

Landforms delineated on the aerial photographs serve as the basic unit for soil mapping, land classification and the eventual application of agriculture capability ratings. Further separation and extrapolation is possible with aerial photos within these basic units, e.g., colour tones, are often correlated with soil textures and drainage. Using this approach the landscape is separated into meaningful units and described for interpretive and predictive purposes, such as, soil capability for agriculture ratings.

All factors of the ecosystem affecting the capability of the land for production of agricultural crops must be taken into consideration when applying the capability rating and limitation(s) in the field, e.g., frost-free period, present crop range, precipitation, topography, stoniness, salinity, etc. The more information available to the field man the more accurate the agriculture capability classification.

(e) map production -

(1) Following the field season all landform and soil mapping is checked and finalized on the photographs.

(2) The soil-landform information is plotted on 1:50,000 autopostive base maps using the Kargl Reflecting Projector or the Kail plotter by BCLI staff in Victoria.

(3) These plotted 1:50,000 bases are returned to the pedologist and he combines the research information, soils mapping and climate mapping which results in the final agriculture capability map indicating class and subclass limitation. Either climate or soils can be the overriding factor or it may be a combination of both which results in the final capability class or subclass.

(4) The 1:50,000 capability maps are photographically reduced to 1:125,000 scale for convenience and publication.

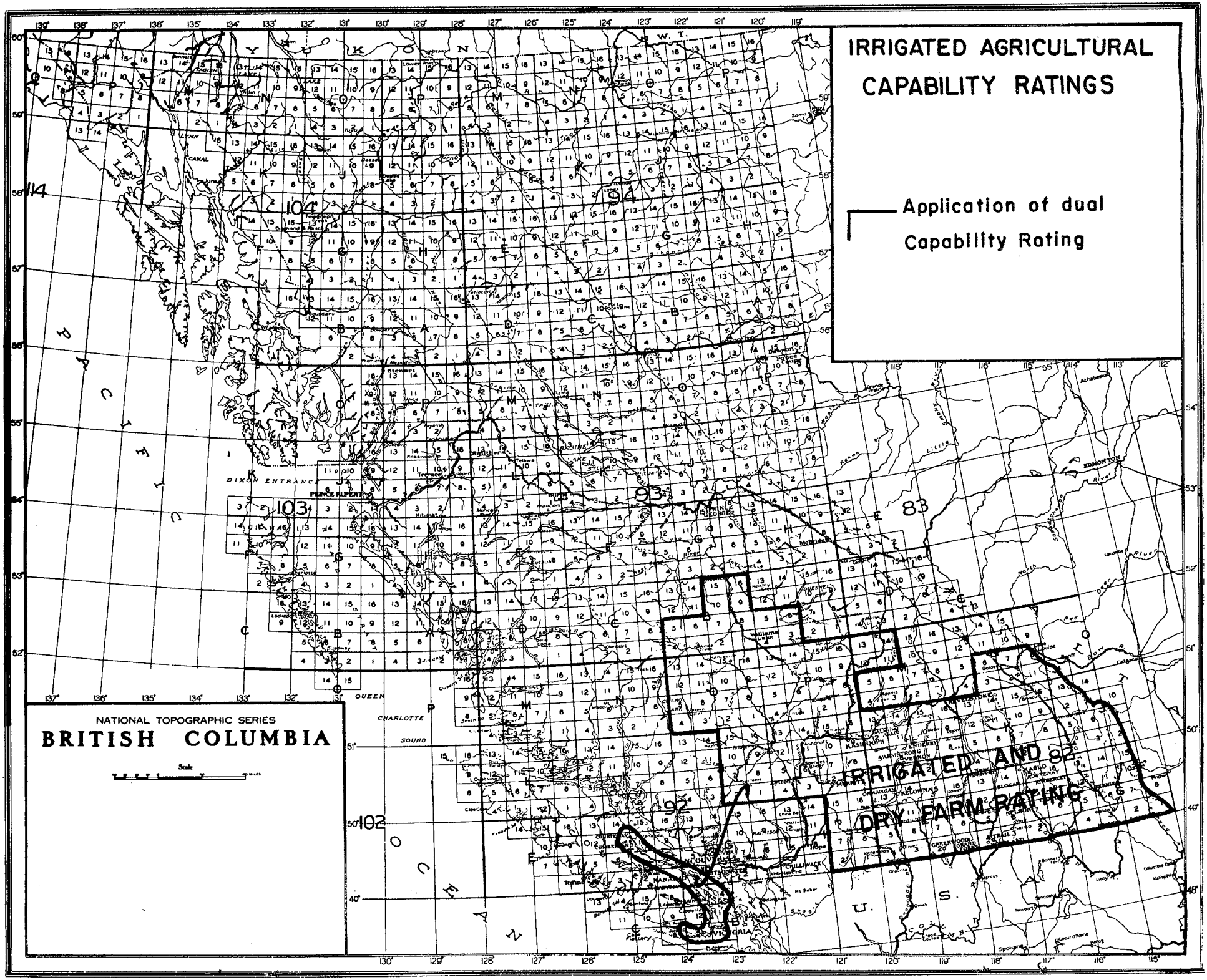
B. C. Classification Modification and Assumptions

i. Irrigated and Dry Farm Rating

In those areas designated in (Figure 2) all arable land, whether presently irrigated, dry farmed or unimproved is given two ratings - one for dry farming and a second for irrigated conditions. Where all land is irrigated i.e. parts of Irrigation Districts only the irrigated rating is shown. It was assumed that many areas in the remainder of the province would benefit from irrigation in terms of increased productivity but in general crop range would not be affected. Since improvement practices are not feasible for Class 6 and 7 areas, they are only given one rating. The irrigation rating was applied without taking into consideration the availability of water as this involves hydrological and economic feasibility studies which are beyond our competence. The dual rating system was adopted to facilitate a more practical classification where climatic droughtiness and low soil moisture holding capacities are counteracted by irrigation water application as a matter of general practice. We can assume increased production of a wider range of crops under irrigation and thus usually higher capability classes in areas which are either climatically or edaphically moisture deficient.

ii. Capability of Organic Soils for Agriculture (13)

The national classification does not provide for rating organic soils except to indicate their location on the capability maps. Organic soils are those which contain more than 30% organic matter and are


IRRIGATED AGRICULTURAL
CAPABILITY RATINGS
Application of dual
Capability Rating
NATIONAL TOPOGRAPHIC SERIES
BRITISH COLUMBIA
Scale
IRRIGATED AND
DRY FARM RATING
PACIFIC
OCEAN
U. S.
DIXON ENTRANCE
QUEEN CHARLOTTE SOUND
114
104
94
103
93
83
102
92
82

deeper than 18". They are commonly known as peats, mucks, meadows, muskegs, etc.

Most areas of B. C. have been rated according to the classification appended (13). Dual ratings are applied - one in the natural state and a second assuming reclaimed conditions.

iii. Land Capability for Tree Fruit and Grape Production

In climatically suitable areas (9) the crop range (national guidelines (2)) was expanded to include tree fruits and grapes. The factors of topography and stoniness were not considered as severe a limitation to tree fruits and grapes and therefore were rated less severely. Ratings are biased in terms of these orchard crops at the expense of other crops. Within these suitable climates however, lands exist which have soils unsuitable for tree fruits, but which are capable of producing a wide range of other crops and these lands were rated without consideration for tree fruits. Examples of such lands are those soils with fluctuating water tables, moderate flooding hazard or frost pockets which may be too severe for tree fruits or grapes, but quite suitable for annual crops.

iv. (Tentative) Land Capability for Grazing (14)

It was obvious even in early stages of the inventory that some classification was needed to subdivide the land's capability for the grazing of native forage plants by domestic livestock, especially as most of the grazing lands fall within CLI Capability classes 5 and 6. It took some time to devise a useful classification and the appended (14) is a compromise which is being applied to our 1972 fieldwork area for the first time. At this stage it appears useful, but future use and criticism may result in modifications.

MAP USE AND CARTOGRAPHIC CONVENTIONS

Two maps are produced indicating Land Capability for Agriculture in B. C.:

(a) Manuscript maps at the scale of 1:50,000 (just a little larger than 1 mi. = 1 inch). These are used for provincial or local use as well as computer input in Ottawa. Available from Coordinating Chairman, BCLI, B. C. Department of Agriculture, Parliament Buildings, Victoria.

(b) Manuscript maps at a scale of 1:125,000 which are a direct photographic reduction of (a) above are available from Coordinating Chairman, BCLI, B. C. Department of Agriculture, Parliament Buildings, Victoria. These are eventually published in color by Ottawa, i.e. Elko sheet 82G/SW.

When delineating units on aerial photos the fieldman has to keep in mind the level of detail which can be shown on the maps, the smallest unit is approximately ½" x ½", which on a 1:50,000 scale map is nearly 160 acres. In some valleys where it is possible to symbol outside the map unit a few smaller areas are indicated.

On the published maps each capability class has a distinctive color, but no color differentiation is possible on the black and white manuscript maps. Refer to a published map legend as an aid in interpreting the classification symbols on the manuscript maps.

Some B. C. cartographic conventions and their meanings follow:

(1) Irrigated ratings

(a) on black and white manuscript maps these are indicated by rounded brackets i.e. 5^{M}_{P} (4^{P}_{M})

dry farm rating ↗ ↖ irrigated rating

(b) published maps: black printing = dry farm rating; red printing = irrigated rating

(2) Convention re: Organic soils

(a) on black and white manuscript maps an O precedes the capability class i.e. 04w on presently improved areas.

In areas presently unimproved a dual rating is indicated

05^{W}_{F} natural state

$[04^{F}_{W}]$ drained rating-square brackets

or

05W natural state

([03W]) drained and irrigated (rounded and square brackets)

(b) published maps indicate 0 only - therefore rating of organic soils is indicated on provincial manuscript maps only.

(3) Convention re: Climate Class 5(5c) areas

Although this land has severe climate limitations it is useful to separate those 5c areas which have additional soil limitations from those which do not, i.e. 5c where no soil limitation occurs but 5^{c}_{T} or 5_{β} where soil limitations also occur. This was adopted during the 1970 field season so any maps prepared before that date do not have this symboling.

(4) Land capability for grazing maps will be distributed as black and white 1:125,000 manuscript maps when and where available.

LAND CAPABILITY ANALYSIS

The race for space is on; land is a limited resource and with increasing populations all forms of land use become more competitive. Any given area of land can have a multitude of potential uses and all may need to be considered in planning the management of a land resource.

An interdisciplinary group including all sectors involved in the Canada Land Inventory (agriculture, forestry, recreation, wildlife-ungulates, waterfowl and present land use) have been assigned the task of comparing physical attributes on common tracts of land. The result is a capability analysis cartographically presented as a composite map indicating highest physical capability for tracts of land in regions where all sectors have completed capability mapping.

The technique involves round-table discussions and overlaying a series of transparent capability maps for the various sectors. The result is a composite intersector capability map, which has many limitations, but forms a useful physical base for decision making in land administration and land use planning. At all times the purpose is to let the land indicate its inherent capability for the various uses. No consideration is given to land resource uses other than those included in the BCLI program except perhaps in the narrative.

Note the narratives and legends on the LCA maps-example: Bulkley Area re: assumptions, use, possibilities and limitations.

General guidelines for allocating land to agriculture, with minor modifications although varying from region to region, are as follows:

1) Class 1 to 3 is considered prime capability.

2) Class 4 is considered moderate capability.

3) Class 5 is considered limited capability.

4) Allocate to agriculture large blocks of land rather than isolated pockets (minimum unit size).

5) Native range indicated where capabilities for domestic livestock and wildlife grazing are near equivalent.

6) Compatibility between agriculture and other sectors is not good when considering classes 1 to 5 because it is difficult to have complementary uses in cultivated areas.

7) Waterfowl and agriculture often are complementary where drainage of potholes, etc. has not destroyed prime waterfowl habitat.

8) Recreation conflicts are usually site specific and involve small acreages of land. Agriculture is often complementary where the management of agricultural lands provides a pleasing pastoral setting.

REFERENCES

(1) Canada Department of Agriculture, 1970. The System of Soil Classification for Canada. Queen's Printer.

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(3) Canada Land Inventory, 1970. A Guide for Resource Planning (general pamphlet on all sectors) Department of Regional Economic Expansion.

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(5) Hoffman, D. W., 1971. The Assessment of Soil Productivity for Agriculture, CLI, Department of Land Resource Science, University of Guelph.

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(13) Sneddon, J. I. et al, 1969. Proposed B. C. Capability Classification of Organic Soils for Agriculture, B. C. Soil Capability Committee for Agriculture and Forestry.

(14) Young, G. K. et al, 1973. Land Capability for Grazing (Tentative), Soil Survey Division, B. C. Department of Agriculture.

APPENDIX

I Proposed Capability Classification of Organic Soils for Agriculture by the Subcommittee on Organic Soil Capability Classification, of the Soil Capability Committee for Agriculture and Forestry, C. H. Brownlee, A. B. Dawson, H. A. Luttmerding, A. L. van Ryswyk and J. I. Sneddon (Chairman).

CAPABILITY CLASSIFICATION OF ORGANIC SOILS FOR AGRICULTURE

For a complete and comprehensive survey of land capability for the Canada Land Inventory it is essential that a capability classification system be established for organic soils. The following is a system which parallels the mineral soil capability classification* while recognizing the properties peculiar to organic soils.

Introduction to the Capability Classification of Organic Soils

Organic soils in this classification are grouped into seven classes, according to their potentialities and limitations for agricultural use.

Organic soils will be given two ratings (1) in the native state and (2) an estimated rating after reclamation (where not already in effect) in brackets. Where reclamation is not feasible the soils will be given a single class rating. Where reclamation occurs, the soils will be given a single class rating in brackets. (Soil classes 1 to 7 in the native state may be upgraded one or more classes with reclamation).

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*Soil Capability Classification for Agriculture, ARDA Report No. 2, Canada Department of Forestry, Ottawa, 1965.

Shallow organic soils occur which will have an organic soil capability rating in the native state and a mineral soil capability rating as the estimated rating after reclamation.

The capability classification of organic soils is based on the same assumptions as those for mineral soils with the deletion of the second sentence in Assumption 4 which is as follows: "The term 'feasible' implies that it is within present day economic feasibility to make such improvements and it does not require a major reclamation project to do so." The man in the field is not in the position to make decisions on the engineering aspects of reclamation and its economic feasibility. Most organic soils will require some minor or major reclamation for arable agriculture.

The terms "well, moderately and poorly decomposed" refer to the Humisol, Mesisol and Fibrisol Great Groups of the Organic Order as defined by the National Soil Survey Committee of Canada.

CAPABILITY CLASSES

Class 1 Organic soils in this class have no significant limitations in use for crops.

Soils in this class are well decomposed and have excellent water table control. They are easily maintained in good tilth and productivity. They are moderately high to high in productivity for a wide range of crops adapted to the region. This class is of rare occurrence and is limited to areas where excellent reclamation has been achieved.

Class 2 Organic soils in this class have moderate limitations that restrict the range of crops.

Soils in this class are well decomposed and have good water table control.

Limitations are moderate and soils can be managed and cropped with little difficulty. The soils are moderately high in productivity for a fairly wide range of crops adapted to the region. The limitations of soils in this class may be one of the following: adverse regional climate; slow permeability; fertility correctable with consistent light applications of fertilizers and/or soil amendments; occasional damaging overflow; poor drainage resulting in some minor crop failures. This class is of minor occurrence and is limited to areas where good reclamation has been achieved.

Class 3 Organic soils in this class have moderately severe limitations that restrict the range of crops or require special management practices.

Soils in this class are generally well to moderately decomposed and have more severe limitations than those in Class 2. Under good management these soils are fair to high in productivity for a fairly wide range of crops adapted to the region. In this class, the choice of crops, the application and maintenance of good management practice, cultivation, planting, harvesting are limited by a combination of two of those limitations described under Class 2 or one of the following: moderate climatic limitations; slow permeability; low fertility correctable with consistent moderate applications of fertilizers and/or soil amendments; frequent overflow with some crop damage; moderate salinity; restricted rooting zone; poor drainage resulting in some crop failures; woodiness sufficiently restricting to handicap cultivation and necessitating periodic removal. This is generally the highest class for organic soils in the native state.

Class 4 Organic soils in this class have severe limitations that restrict the range of crops or require special management practices or both.

Soils in this class are generally moderately to poorly decomposed and have such limitations that they are only suitable for a few crops or the yield for a range of crops is low, or the risk of crop failure is high. Limitations may seriously restrict cultivation, planting and harvesting. These soils are low to medium in productivity for a narrow range of crops, but may have high productivity for a specially adapted crop. The limitations include the adverse effects of a combination of two or more of those described in Classes 2 and 3 or one of the following: moderately severe climate; very slow permeability; low fertility correctable with moderate to heavy applications of fertilizers and/or soil amendments; frequent overflow with severe crop damage; severe salinity causing some crop failures; very restricted rooting zone; very poor drainage resulting in frequent crop failures; extreme woodiness requiring continuous clearing to permit annual cultivation.

Class 5 Organic soils in this class have very severe limitations that restrict their capability for the production of perennial forage and other specially adapted crops.

Soils in this class are generally moderately to poorly decomposed and have such serious limitations that they are not capable of use for sustained production of annual field crops. However, these soils may be improved for the production of native or tame perennial forage or other specially adapted crops. The limitations in Class 5 include the adverse effects of one or more of the following: severe climate; low fertility correctable with moderate to heavy application of fertilizers

and/or soil amendments; very frequent overflow; severe salinity permitting only salt tolerant forage crops to grow; very poor drainage resulting in very frequent crop failures; woodiness or shallowness to bedrock that make annual cultivation impractical.

Class 6 Organic soils in this class, in the native state, have no capability for arable agriculture, but are capable of producing native perennial forage and some natural grazing if feasible.

Soils in this class, in the native state, are generally poorly to moderately decomposed and have such serious climatic soil or other limitations as to make impractical the application of improvement practices. However, depending on the limitations, these soils may sometimes be reclaimed and utilized for arable agriculture. The limitations include the adverse effects of one or more of the following: very severe climate; very frequent overflow, allowing less than ten weeks effective grazing; severely saline land producing only edible salt tolerant native plants; very poor drainage with water at or near the surface most of the year; woodiness or shallowness to bedrock that makes cultivation impractical.

Class 7 Organic soils in this class, in the native state, have no capability for arable agriculture or natural grazing.

Soils in this class, in the native state, are generally poorly decomposed and have such serious climatic, soil or other limitations as to make impractical the application of improvement practices. However, depending on the limitations, these soils may sometimes be reclaimed and utilized

for arable agriculture. The limitations include the adverse effects of one or more of the following: very severe climate; land inundated for most of the year; very severely saline land; very poor drainage with water at or near the surface most of the year; woodiness or shallowness to bedrock that makes cultivation impractical; permafrost.

CAPABILITY SUBCLASSES

B. Wood in the form of trunks and stumps, in sufficient quantity and size, throughout the control section (as defined by the N.S.S.C.) which affects reclamation and use.

C. Climate - as defined for mineral soils.

D. Permeability - water movement is restricted by a strongly contrasting organic layer(s) or by a mineral layer(s) within or beneath the control section.

F. Low fertility is an inherent property of many organic soils though this can be overcome by the use of fertilizers and/or soil amendments. The limitations may be due to lack of available plant nutrients, high acidity or high alkalinity, high levels of carbonates or presence of toxic compounds. Generally, fertility increases with degree of decomposition and with increase in mineral content.

I. Inundation - as defined for mineral soils.

L. Decomposition - poorly decomposed soils have limited agricultural use.

N. Salinity - as defined for mineral soils.

R. Consolidated bedrock - soils where bedrock occurs within the control section (as defined by the N.S.S.C.).

S. Adverse soil characteristics - as defined for mineral soils.

T. Topography - as defined for mineral soils.

W. Excess water - soils where excess water other than that brought about by inundation is a limitation to their use for agriculture. Excess water may result from inadequate soil drainage, a high water table, seepage or runoff from surrounding areas.

X. Cumulative minor adverse characteristics - as defined for mineral soils.

Z. Permafrost - soils which are perennially frozen within the control section (as defined by the N.S.S.C.).

II LAND CAPABILITY FOR GRAZING (TENTATIVE)

Basis for Classification

(1) The separation of the land surface into homogeneous units is on the basis of physical characteristics.

(2) The assignment of each unit to a class on the basis of all known or inferred information about the unit, including subsoil, soil profile, depth, moisture, soil fertility, landform, climate and vegetation.

(3) Except for Class 1, the limitations are shown or implied. Different types of land may have the same capability rating, but for different reasons. The types of limitation are shown in the subclass.

(4) Associated with each capability subclass is a productivity range based on data compiled through independent range productivity research projects. Productivity ranges are expressed in gross pounds palatable native forage produced per acre per year.

(5) Productivity ranges are derived from measurements of undisturbed native forage in grassland areas and under well stocked forested lands; the implication is that only good management produces such stands.

(6) In a capability class, location, access, distance to markets, size of units and ownership are not considered. Present cover or production are used only as additional information for rating capability.

(7) Access to water is very important but is not considered in this classification.

(8) Classification is based on natural state of the land without improvements such as fertilization, drainage or other amelioration. "Forest competition" limitation is used on those lands having forest cover. The limitation becomes increasingly important from Class 2 through Class 5. It denotes the decreasing production of native forages within each climax community or long-term sere; or a decrease in time and interval (approaching zero) or native forage production after disturbance (such as fire or logging), from Class 2 through Class 5.

(9) Introduction of exotic plant species, irrigation of range, or other such improvements are not considered.

"Basis for Classification" are adapted from "Land Capability Classification for Forestry" CLI Report No. 4, 1970.

Capability Classes

Class 1 Lands having no important limitations to the growth of native forage plants.

Modal soils are deep, permeable, of medium texture, moderately well to imperfectly drained, have good water holding capacity and are naturally high in fertility. Their topographic position is such that they frequently receive seepage and nutrients from adjacent areas. They are not subject to extremes of temperature and evapotranspiration. Productivity is usually greater than 1000 lb./acre/year natural forage. This class is commonly found on black chernozem soils in the upper grassland, and organic soils

and regosols found on floodplains.

Class 2 Lands having slight limitations to the growth of native forage plants.

Modal soils are deep, well drained to moderately well drained, or medium to fine texture and have good water holding capacity. The most common limitations (all of a relatively slight nature) are: adverse climate, soil moisture deficiency, restricted rooting depth, light forest competition, somewhat low fertility and the cumulative effects of several minor soil characteristics. Productivity is usually from 500-1000 lb./acre/year natural forage. This class is commonly found on dark brown chernozem soils in the middle grassland, and gray luvisol soils in the Interior Douglas-fir zone, and saline soils found on saline seepage areas.

Class 3 Lands having moderate limitations to the growth of native forage plants.

Soils may be deep to somewhat shallow, well drained to imperfectly drained, of medium to fine texture with moderate to good water holding capacity. They may be slightly low in fertility or suffer from periodic moisture imbalances. The most common limitations are: adverse climate, restricted rooting depth, moderate forest competition, moderate deficiency or excess of soil moisture, somewhat low fertility, impeded soil drainage, exposure and occasional inundation. Productivity is usually from 250-500 lb./acre/year native forage. This class is commonly found on brown chernozems in the lower grassland, on Eutric Brunisols in the Ponderosa pine-bunchgrass zone and lower Interior Douglas-fir zone and on brunisolic gray brunisols in the long term lodgepole pine sere

of the Engelmann spruce-subalpine fir zone.

Class 4 Lands having moderately severe limitations to the growth of native forage plants.

Soils may vary from deep to moderately shallow, from excessive through imperfect to poor drainage, from coarse through fine texture, from good to poor water holding capacity, from good to poor structure and from good to low natural fertility. The most common limitations are: deficiency or excess of soil moisture, adverse climate, restricted rooting depth, forest competition, poor structure, excessive carbonates, exposure of low fertility. Production usually ranges from 125-250 lb./acre/year native forage. This class is commonly found on Eutric and Dystric Brunisol soils in the Ponderosa-pine-bunchgrass, Interior Douglas-fir and Engelmann spruce-subalpine fir zones.

Class 5 Lands having severe limitations to the growth of native forages.

Soils are frequently shallow to bedrock, stony, excessively or poorly drained, of coarse or fine texture, may have good water holding capacity and be low in natural fertility. The most common limitations (often in combination) are: deficiency or excess of soil moisture, shallowness to bedrock, adverse regional or local climate, low natural fertility, exposure, forest competition, excessive stoniness and high levels of carbonates and/or salts which may preclude the growth of native forages. Soils in this class are considered unsuitable for grazing due to over-riding climatic and environmental limitations. Productivity is usually from 0-125 lb./acre/year native forage and not necessarily on a sustained yield basis. This class is commonly found on Eutric, Dystric, Sombric, and alpine brunisols in the Ponderosa pine-bunchgrass, Interior Douglas-fir, Engelmann spruce-subalpine fir and alpine tundra zones.

**"Capability classes" are adapted from "Land Capability for Forestry". CLI Report No. 4, 1970.

Indicator Species: (subject to revision with additional information)

Lower Grassland:	Big Sagebrush Bunchgrass	) GB
Middle Grassland:	Bunchgrass Bluegrass	) pB
Upper Grassland:	Bunchgrass Fescue	) fB

Ponderosa Pine - Bunchgrass - pP - bG

Interior Douglas-fir (Pinegrass) - dF - pG

Interior Western Hemlock - wH

Engelmann spruce Subalpine Fir: eS - alF

Lodgepole pine sere (Pinegrass): lP - pG (long term)

Alpine Tundra - aT

Organics - O

Saline Seepage area

Floodplains

Capability Subclasses:

Climate

A - drought or aridity caused by aspect, landform position or exposure, or combinations of these; also includes regional climatic drought.

H - accumulations of deep snow or a short, cool growing season or both.

Soil Moisture

M - soil moisture deficiencies attributable to soil and land characteristics.

W - an excess of soil moisture, other than that caused by inundation.

Permeability and Depth of Rooting Zone

D - structure or permeability of the soil, either singly or in combination which restricts rooting depth.

R - the restriction of the rooting zone by bedrock.

Soil Fertility

N - toxic elements, such as soluble salts.

Stoniness

P - indicates a limitation to growth because of stoniness.

Inundation

I - soils subject to inundation by streams or lakes for long periods.

Erosion

E - unstable land, that is areas of active erosion or slumping.

Vegetation Competition

V - soils limited for native forage production by excessive competition.

***"Capability Subclasses" adapted from "Land Capability for Forestry". CLI Report No. 4, 1970.