PROGRESS OF THE CANADA LAND INVENTORY IN ALBERTA

by
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FOREWORD

"The Canada Land Inventory is a comprehensive survey of land capability and use for various purposes"[1]. This reference in describing the objectives, scope and organization of the inventory, emphasizes cooperation and coordination within the program if it is to be successful.

Since the inception of the Canada Land Inventory in Alberta there has been a need for the pooling of information and ideas in keeping with the objectives of the program. Therefore a meeting for this purpose was held on 10 January 1967 to familiarize the various groups of the Canada Land Inventory with each others work. This should result in an improved perspective of the work in ones own group, as well as an appreciation of his Canada Land Inventory colleague's contribution. This in turn should strengthen the Canada Land Inventory program as a whole.

The proceedings of the meeting are reported here and include the background, accomplishments, and plans for the future of the current land use, agriculture, recreation, wildlife and forestry classification programs of the Canada Land Inventory in Alberta. These classifications were initiated as a result of the Agricultural Rehabilitation Development Act (now commonly called ARDA) of 1961 in which a Federal-Provincial program of land use, soil and water conservation, rural development and research was established.[2]

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[1] Canada Department of Forestry. 1965. The Canada Land Inventory. Objectives, scope and organization. Report No. 1, Pub. No. 1088.

[2] Anon. 1965. Federal-Provincial rural development agreement. Canada Dept. Forestry, Ottawa. 29 pp.

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THE PRESENT LAND USE

MAPPING PROGRAM

by

A.H. LAYCOCK

INTRODUCTION

In 1940 the U.S. National Resources Planning Board produced a book on Land Classification in the United States in which five categories of classifications were discussed. These were: (1) Land Classification in terms of Inherent Characteristics - i.e. what have we to work with in terms of soils, slopes, vegetative cover, climate, water, etc.?; (2) Land Classification in terms of Present Use - the kind and characteristics of use: what are we doing with the land now?; (3) Land Classification in terms of Use Capabilities - what can we do in each of a number of alternative uses with the resources at hand?; (4) Land Classification in terms of Recommended Use - in which we decide between alternatives according to demand patterns - what is the best use?; and (5) Land Classification in terms of Program Effectuation - we know what we have and what we want: now how do we proceed from present use to best use? What are the most effective and least painful stages?

The place of "Present Land Use" classification and mapping in the wider perspective then, is that it gives us a starting point from

which we might proceed in planning better use. To a considerable degree it also provides us with an index of inherent value because land use intensity varies in part with the past and present users evaluation of the land. It may indicate something of use capability; it may be the recommended use in terms of present technology and demand patterns and we should consider the choice of the present user before recommending other use because we might have some major problems in program effectuation if we don't. We are safe in using it as a starting point (if the survey is reasonably current, reliable and provides the information needed) and should consider these other aspects in evaluation and planning. It is quite apparent that this is a part of a larger study rather than a complete study in itself and that a high degree of integration with other studies is needed if it is to be of major value in planning future land use.

Present land use mapping apparently dates back to early Babylonian and Egyptian times, but we are probably most familiar with the mapping program of Dudley Stamp in Britain before and after World War II. It proved very useful in shifts to greater local food production, in planning evacuation procedures and airfield and military camp location, in re-building and in other ways during and after the war.

The International Geographical Union promoted land use mapping programs, particularly in compiling a 1:1,000,000 map of much of the world, after the war, and the Geographical Branch in Ottawa started mapping on various scales in the 1950s. The exploratory surveys of Lloyd

Reeds[1] and others were followed by the production of a series of 1:50,000 and several other scale maps of selected areas. On the whole, the 1:50,000 maps were much more successful than those on smaller scales - e.g. 1:500,000, because of the level (or choice) of generalization and complexing employed in the latter. It was based largely upon ground surveying with supplementary use of air photos, and largely for this reason it proved much too expensive and time-consuming to be applied very widely.

DEVELOPMENT OF MAPPING PROGRAM

When the Canada Land Inventory program got started, the Geographical Branch shifted its program and contracted to map the settled and fringe areas of eastern Canada using a classification better oriented to air photo use and the time and funds available, but action in western Canada was not planned for that time.

In 1964, after various discussions with Canada Land Inventory personnel, I submitted a proposal for a pilot study for land use mapping in the Edmonton area and west to the Rockies (140 map areas - Figure 1).

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[1] Reeds, L. G. 1954. Land classification as part of a geographical survey of the Avalon Peninsula of Newfoundland. Geographical Branch, Dept. Energy, Mines and Resources, Ottawa. Geographical Bulletin 5, 59 - 78.

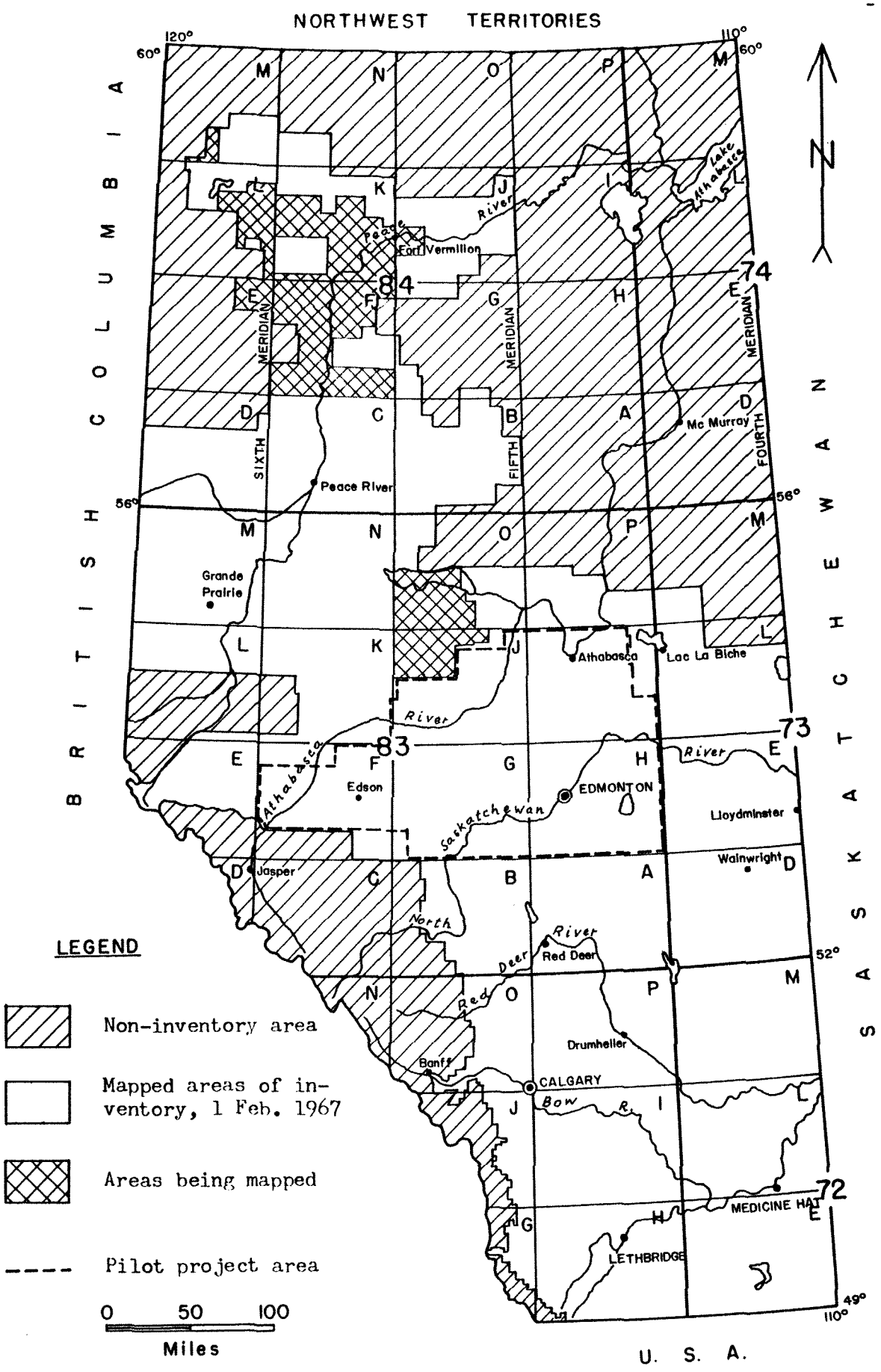

Figure 1 - Present Land Use Mapping Program for Alberta

This gave a fair cross-section of Alberta patterns and sample of mapping problems. We revised the Geographical Branch classification a bit for prairie conditions and for better mapping from air photos (e.g. we saw little point in separating barley for feed and barley for sale or oats for grain and for feed). The Geographical Branch has modified its classification accordingly in a few cases. We still have some differences - e.g. they are complexing cereal grains and improved pasture (indicating %'s of each in a unit). We feel that we can tell the difference in most cases, believe that complexing is often just a means of avoiding a decision, and recognize the later problems for computer analysis and relationship development when complexed patterns are integrated. We spent more time on checking patterns in the field and in developing mapping procedures in the pilot project than we have since. Our pilot project went reasonably well. We finished the contract within the time and budget allocated.

In the spring of 1965 before the pilot project was finished, we started mapping the rest of the settled and fringe areas of Alberta - a total of over 160,000 square miles of 60% of the Province. In all there are 582 map sheets on a 1:50,000 scale and 193 on a 1:63,360 scale in the program and we are now working on the last 40. Until a few months ago I had expected that we would complete the project within the time and budget of the contract. Because of photo procurement problems largely, we may not quite meet either, but it will be close. It might be noted that since the contracts were arranged, approximately 4,000,000 acres has been added to the inventory area in Alberta. We have spent

time and effort on co-ordination meetings with Ottawa, Saskatchewan and B.C. personnel and boundary checking with the latter two has also been time-consuming. In addition we have prepared a number of maps showing land use changes at Ottawa's request and have experimented with complexing and scale reduction for possible publication. Publication in color need not involve any complexing or detail changes from the 1:50,000 and 1:63,360 scales, the costs would be much lower because only 15 complete maps and 23 part maps would cover the province and these maps would be much more convenient to use.

At present we do not know whether any of these 1:250,000 maps will be published or not. We hope that they will be and we are pleased with the apparent demand for these maps. It might also be noted that I am preparing a land use map of Alberta based on the 1:50,000 and 1:63,360 maps on a scale of 1:2,000,000 for the Atlas of Alberta. In this map, some complexing is necessary. The mapping units are for 15 categories noted as follows:

	Over 50% of the Area	10 - 49% of the Area
(1)	Cropland	
(2)	"	Unimproved Pasture
(3)	"	Both Unimproved Pasture & Wildland
(4)	"	Wildland
(5)	Unimproved Pasture	
(6)	" "	Cropland
(7)	" "	Cropland and Wildland

	Over 50% of the Area	10 - 49% of the Area
(8)	Unimproved Pasture	Wildland
(9)	Wildland	
(10)	Wildland	Cropland
(11)	"	Cropland & Unimproved Pasture
(12)	"	Unimproved Pasture
(13)	Urban (cities only with areal scale)	
(14)	Military Reserves	
(15)	Water	

Added to this are round and square colored symbols indicating that below or above 10% of the area is in one or more of the following: Cropland, Unimproved Pasture, Wildland, Improved Pasture, Horticulture, Outdoor Recreation, Wildlife, Watershed Management, Urban (towns), Forestry Operations and Mining Operations. This map is now well along and should be available in published form within a year. A part of it will appear in the Albertan Geographer within a few months.

If anyone wants ozalid copies of the 1:50,000 and 1:63,360 scales, arrangements can be made for them to be made and sold at cost (through the Technical Division of the Dept. of Lands and Forests).

We have been very fortunate in our personnel for the project. When we started we realized that the Geography Department had a number of able graduate and undergraduate students who might have time available for the study. In the several years since, the Department has grown so that we now have 42 M.A. and M.Sc. candidates, 6 Ph.D. can-

didates and an increasing number with training in air photo interpretation. These people available for work in summers, part-time during the academic year, during thesis completion stages following course-work completion, and in a few cases after receiving degrees before going to other jobs or further training. Two of the originals might be noted. Mr. C. Hutton completed his M.A. in the first winter with us, and then stayed as co-ordinator and supervisor of work on a full-time basis until September 1966 when he joined the Geographical Branch in Ottawa as director of their program. Mr. Austin Lupton was with us the first winter and then he focussed a bit more upon his M.A. degree completion, and he is now working on a Ph.D. in our Department while working part-time on supervising mapping of agricultural patterns for the Atlas of Alberta. Larry Stene, who joined our group while completing his M.Sc. thesis a year ago, took over from Mr. Hutton in September and is doing very well, particularly considering the problems we have had in photo procurement in the past 6 months.

DESCRIPTION OF CLASSIFICATION

The classification used in this study is described in Appendix I. Most of the categories are now reasonably straightforward and interpretation can be quite reliable if the photos are good. The differences between A (Cropland) and P (Improved Pasture) are sometimes not distinct, particularly if May or October photography has been used, but if the proportions are reasonable it may not matter

greatly if some errors are made for specific plots because of the changes that take place from one year to the next. We prefer making a decision for each area rather than complexing. In most cases the relationships that may be established through computer use at a later date will be more useful if complexing is kept at a minimum. Then too, improved pasture occupies a comparatively small part of the land in most areas thus our problem is less acute than that of the Geographical Branch in eastern Canada where more complexing is employed.

Our procedures are different in several respects from those employed by some of you. Our interpreters plot their interpreted patterns directly upon the 1:50,000 and 1:63,360 topographic and planimetric maps available rather than upon the photos from which technicians might transfer the patterns to maps at a later date. This makes the interpreter more directly responsible for the map patterns, is a means of avoiding transfer errors and is a means of greatly speeding up the whole process. It is true that there is some time consumption by relatively high priced staff in superimposing grid information on photos in relatively unsurveyed areas. But the output per unit cost is still much better than by the other method, partly because of the smaller investment in equipment, space and administration. The rough map is then checked for boundaries, labelling, line closure, pattern consistency with adjoining sheets (pattern changes must be based upon actual land use changes and not upon differences in interpretation between interpreters). Some of these maps are field checked. The rough

map is then copied (by tracing) on a cronaflex or autopositive base and this copy is closely checked for complete labelling, line closure, boundary closure etc. so that it will be unnecessary for Ottawa to return any maps to us for correction or completion. We retain sepia prints so that we may arrange for ozalid copies to be made at any time.

There are many other procedural patterns that may be of interest to at least some of you and I hereby invite you to see our group in action at 11034 - 87 Ave. at almost any time. Information on procedures and problems may also be obtained from an article by C. Hutton (Albertan Geographer No. 2, 1965-66, pp. 31-40).

PROBLEMS

Some of the problems we have had have been noted. None are insurmountable, but those that hold up our progress in ways we can't do much about are most vexing. In the summer of 1965 we had a major problem getting cronaflex maps from Ottawa. We were led to believe that the delays were temporary thus we disrupted our interpretation schedules to provide some mapping on 1:63,360 sheets for which mylar copy sheets were available from the Provincial Government. In this way we would have at least some work for checkers to do and so we could keep the checkers on staff for when the cronaflex maps did arrive. The cronaflex maps did not arrive (except for a very small dribble) that summer and the output of both the checkers and interpreters suffered. The problem regarding air photo procurement is still

a greater one. We had hoped that the new flying scheduled for 1965 and 1966 would have been available, but only part of the area involved was flown - some 1965 contracts have not yet been completed. We did arrange for quite a bit of new flying in co-operation with the Department of Lands and Forests, but the bids were very high and no contracts were let. In retrospect, all of the gap areas should have been included in new photo contracts at the start of the program. The extra cost would have been roughly balanced by more efficient interpretation sequences, fewer administrative problems and costs and earlier project completion and we would have had more up-to-date coverage for a number of areas. As it was, we tended to jump around excessively in our production sequence and this leads to excessive time consumption in boundary checking and re-orientation to photo patterns in new areas for too many interpreters. In addition, since we have had to fall back on the use of older photos for some areas, the final maps are too far apart in date for a composite map to be as useful as it should be. In some areas - e.g. the Northern Peace River region and the Special Areas north of the Red Deer River near the Saskatchewan border - subsequent mapping may be done in a year or so when new photos are available. Since these are areas of rapid land use change, some very useful comparisons might then be made.

PLANS FOR THE FUTURE

Our plans for the future are not well defined. We will try to finish this project as soon as possible, not much beyond the March 31st deadline. After that our group will disband and our maps will be processed and used by others in a number of ways. A number of them have already been processed for computer use in Ottawa, and we expect that the rest will be soon. We hope for early publication at a 1:250,000 scale - in fact we had anticipated participating in the preparation of these for publication. It will be very unfortunate if the heavy expenditures in providing the 1:50,000 and 1:63,360 maps is not followed by publication on a smaller scale so that the major benefits of the mapping effort and expense can be realized.

At present, we do not have any other project under review for work to be done this summer or the following winter. Several have been considered and discussed, but no proposals have been submitted. We have several other departmental studies in progress (e.g. Water Balance studies for the National Research Council), but there is a reserve of competent students who might serve usefully in other inventory and planning studies. Let us know if you need help. We hope that some of us will participate in other ARDA studies in the future.

In conclusion, we believe that we have done a good job on this

project and have been flattered by comparisons made concerning output efficiency, work quality etc. by various people who have been in a position to compare our work with that in progress elsewhere. We hope that you may find our materials and experiences useful and that you may be able to avoid a few of our problems as a result of our having put them before you. Our mapping program appears in Figure 1.

APPENDIX I

CANADA LAND INVENTORY FOR ALBERTA

PRESENT LAND USE CLASSIFICATION

Mapping Symbol

1. Urban. Land used for urban and associated non-agricultural purposes.

B a. Built-up areas. Land occupied by the built-up portions of cities, towns and villages, as well as isolated units away from settlements, such as manufacturing plants (e.g. gas processing), rail yards and military camps. Open fields and parks within built up areas are included.

E b. Mines, quarries and gravel pits. Land used now or in the past for the extraction of earth minerals.

O c. Outdoor Recreation. Land used for private or public outdoor recreationsl purposes. Summer cottages and associated beach areas, parks and golf courses are included.

H 2. Horticulture. Land used for the intensive production of vegetables and small fruits. Market gardens, nurseries, flower-growing areas and sod farms are included.

G 3. Orchards and Vineyards. Land used for the production of tree fruits and grapes.

Mapping Symbol

A 4. Cropland. Land used primarily for cash crops, usually in rotation but including both cash and feed grains. Oilseeds, sugar beets, potatoes, field vegetables, associated fallow and land in the process of being cleared for cultivation are included.

P 5. Improved Pasture and Forage Crops. Land used primarily for the production of improved pasture, hay and other forage crops. Cultivation and planting have occurred in a recent year.

K 6. Unimproved Pasture and Range Land. Primarily open grassland, whether grazed or not, but scrub and woodland are classed as range land if evidence of grazing exists. Abandoned farms and intermittently wet hay land (sloughs) are included.

7. Woodland. Land covered with tree or scrub growth.

T a. Productive woodland. Land bearing forest with over 30% crown cover and 20 feet in height plus artifically restocked and planted areas regardless of age.

U b. Non-Productive Woodland. Land with sparse or scrub growth (i.e. less than 30% crown cover or less than 20 feet in height) that shows no evidence of grazing (see 6). Largely recently cut-over or burnt-over land. Treed muskeg is included.

Mapping Symbol

M 8. Swamp, Marsh and Bog. Open wetlands except for those showing evidence of haying activity in the drier years. (see item 6)

9. Unproductive Land. Land that is biologically unproductive in its present state.

S a. Sandflats, dunes, and beaches. Exposed sand surfaces predominate.

L b. Rock and other unvegetated surfaces. Rock barrens, badlands, eroded river banks, etc.

X 10. Water Surfaces. Excluding temporarily flooded hay meadows, etc.

SOIL CAPABILITY FOR AGRICULTURE

by

J.D. LINDSAY

INTRODUCTION

There are a number of interpretative groupings that can be made from basic soil survey information. In the past most of these groupings have been associated with agriculture, primarily because the agriculturist has been the main user of soil survey data. Such interpretative classification as agronomic groupings, soil rating groupings, and now more recently soil capability groupings have been evolved from soil survey data. However, it seems that disciplines other than agriculture may have an interest in or would benefit from soils information provided it is interpreted so as to be of use to them. Each of these disciplines is likely to have an interest in different properties of the soil, therefore the interpretations will necessarily have to be based on what information is required. The plasticity of clays, the permeability of soils, nature and depth of the soil parent material, presence of salinity, and soil drainage are but a few of the properties of soil that if necessary could be grouped into an interpretative classification from basic soil information.

It is one of these interpretative classifications, a soil capability classification for agriculture, on which I shall be speaking today. This work has been underway since 1963 at which time the National Soil Survey Committee developed the system of soil capability classification

for agriculture in co-operation with the federal and provincial ARDA administrations.

DEVELOPMENT OF CLASSIFICATION SYSTEM

The soil capability classification for agriculture is developed from soil-mapping units in which the mineral soils are grouped into seven classes according to their potentialities and limitations for producing crops. The first three classes are considered capable of production of common cultivated crops, the fourth is marginal for sustained arable agriculture, the fifth is capable of use only for permanent pasture and hay, the sixth is capable of use for wild pasture, while the seventh is for soil and land areas considered incapable of use for arable culture or permanent pasture.

While the soil areas in classes one to four are capable of use for arable culture they are also capable of use for perennial forage crops. Also, soil areas in all classes may be suited to forestry, wildlife, or recreation.

The capability classification consists of two main components - the capability class and the capability subclass.

The class is a grouping of subclasses that have the same relative degree of limitation or hazard. The limitations become progressively greater from Class 1 to Class 7.

The subclasses, on the other hand, are a grouping of soils with

similar kinds of limitations or hazards. The subclass, therefore, provides information on the kind of conservation problem or limitation.

The subclasses, of which they are eleven, actually establish the class level. These subclasses include adverse climate (c), undesirable soil structure (d), erosion (e), low fertility (f), periodic inundation (i), moisture limitation (m), salinity (n), stoniness (p), consolidated rock (r), topography (t), and excess water (w).

A detailed description of Classes 1 to 7 and the subclasses may be found in "Soil Capability Classification for Agriculture", Canada Land Inventory Report #2, 1965, Canada Department of Forestry, Ottawa.

PARAMETERS FOR THE CLIMATIC SUBCLASS

The establishment of parameters for the climatic subclass is one of the most difficult problems. In Alberta the two main climate characteristics affecting crop growth are drought and frost (lack of heat). The southern portion of the province, the prairies, is faced from time to time with the problem of drought while crops in the central, western, and northern portions are on occasion subject to varying degrees of frost damage.

On this basis the province has been stratified into climatic zones. In the south, depending on the amount of precipitation and evaporation, two climatic zones designated as 2A and 3A on the accompanying map, have been delineated, the 3A area being somewhat drier and more of

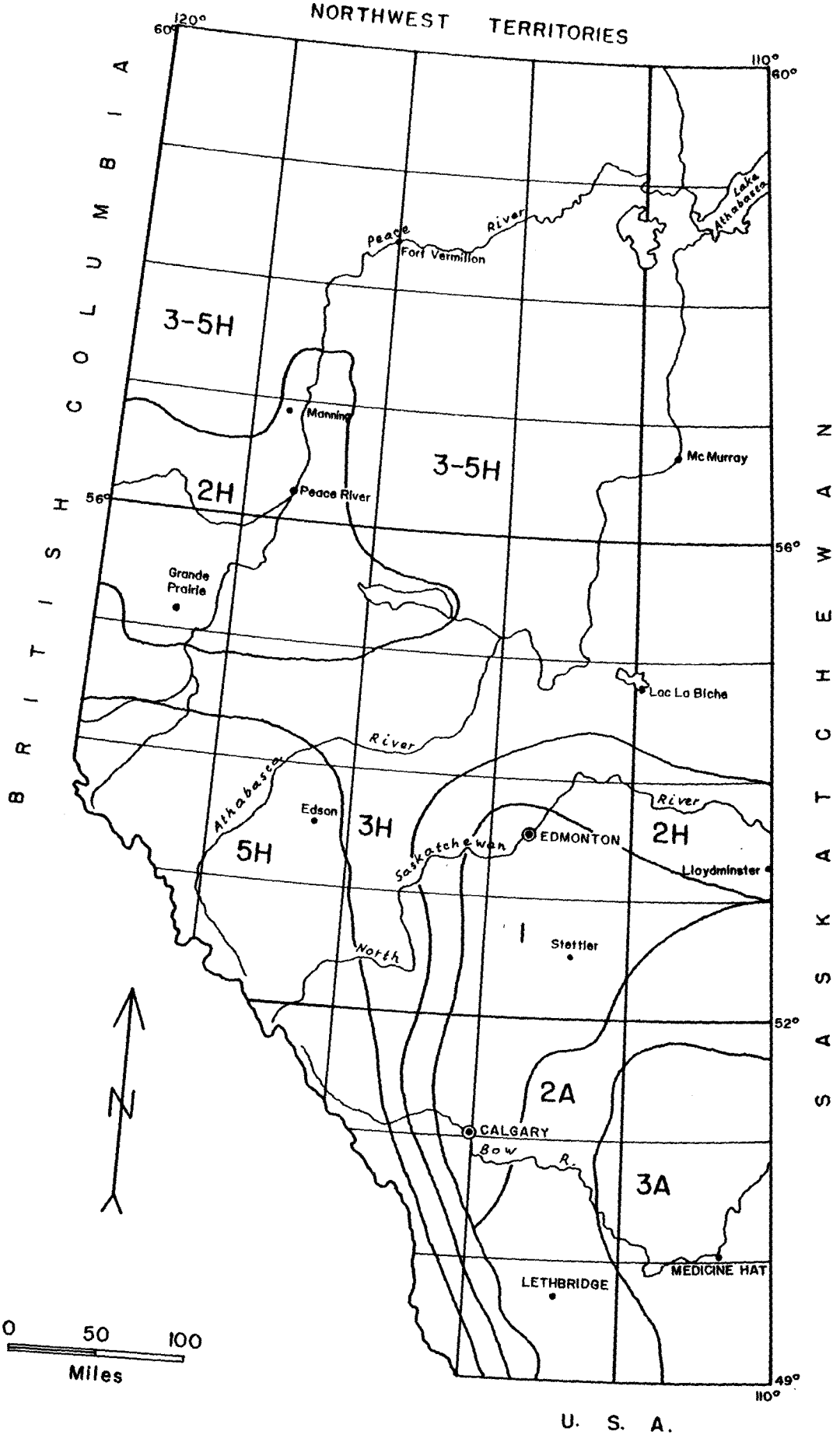

Figure 1 - Map of Alberta Indicating Climatic Zones

a drought hazard than the 2A area. The climate in the Edmonton - Stettler - Calgary region (Figure I) is considered to be the "median climate", that is the one in which the temperature and precipitation are such as to bring field crops to maturity without serious risk of partial or total crop failure. To the north and west of Edmonton the climate becomes limiting, not because of drought but rather because of frost hazard or lack of sufficiently high growing season temperatures to mature all crops. These climatic regions have been designated as 2H, 3H, and 5H. For a time attempts were made to establish a 4H climatic zone but the lack of data for establishing parameters for such a zone suggested that it should, at this time, be deleted from the classification.

Initially it was hoped to establish the climatic zones by the simple criteria of using frost-free days. However, owing to the inadequacy of the data, both the amount and reliability, it became obvious that another approach to the problem had to be evolved. We are now using the Hopkins[1] formula for determining frost-free days and degree days above 42° Fahrenheit. The basic premise of this formula is that the frost-free days and the degree days above 42° Fahrenheit decrease directly with latitude and increasing elevation, but the opposite effect occurs with increasing longitude. In simpler terms this means that as one goes north

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[1] Hopkins, J. W. 1938, Agricultural Meteorology: Correlation of air temperature in central and southern Alberta and Saskatchewan with latitude, longitude, and altitude. Canadian Journal of Research Sec. 6, Vol. 16.

and at the same time increases in elevation the frost hazard is greater, but as one goes west assuming no increase in elevation the frost hazard decreased. On this basis the climatic zones have been defined as follows:

Climate Zone		
1	90 frost-free days 2100 degree days above 42°F	wheat, barley, and oats
2H	75-90 frost-free days 1900-2100 degree days above 42°F	wheat, barley, and oats with some risk to wheat
3H	60-75 frost-free days 1650-1900 degree days above 42°F	barley and oats severe risk to wheat
5H	60 frost-free days 1650 degree days above 42°F	forage crops
2A	water deficiency of 5-7 inches	wheat, barley, oats
3A	water deficiency 10 inches	wheat, barley, oats with greater risk of drought

The following are some specific examples of the soil capability classification based on the soil and climatic factors covered in the foregoing discussion.

Climatic Zone	Great Soil Group	Texture	Sub-classes: Moisture	Soil Structure	Topography	Capability Classification
3A	Brown	clay			T1	3c
3A	Brown	loam	m		T2	4m
2A	Dark Brown	clay loam			T3	3t
1	Black	loam			T2	2t
2H	Black	loam			T2	2c
3H	Dark Grey	clay loam			T4	4t
3H	Grey Wooded	clay		d	T2	4d
3H	Grey Wooded	loam		d	T4	$5^{t}d$
5H	Grey Wooded	clay			T3	5c

PAST PRESENT AND FUTURE PLANS

The past, present, and future plans of the Alberta Soil Survey with regard to the Soil Capability Classification are indicated on Figure 2. There are no future plans beyond the completion of the classification of presently cultivated lands and the adjacent fringe areas.

The map sheets completed to date have been primarily confined to the scale of 1:250,000 although in the future an attempt will be made to submit data on both the 1:250,000 and 1:50,000 scales. The

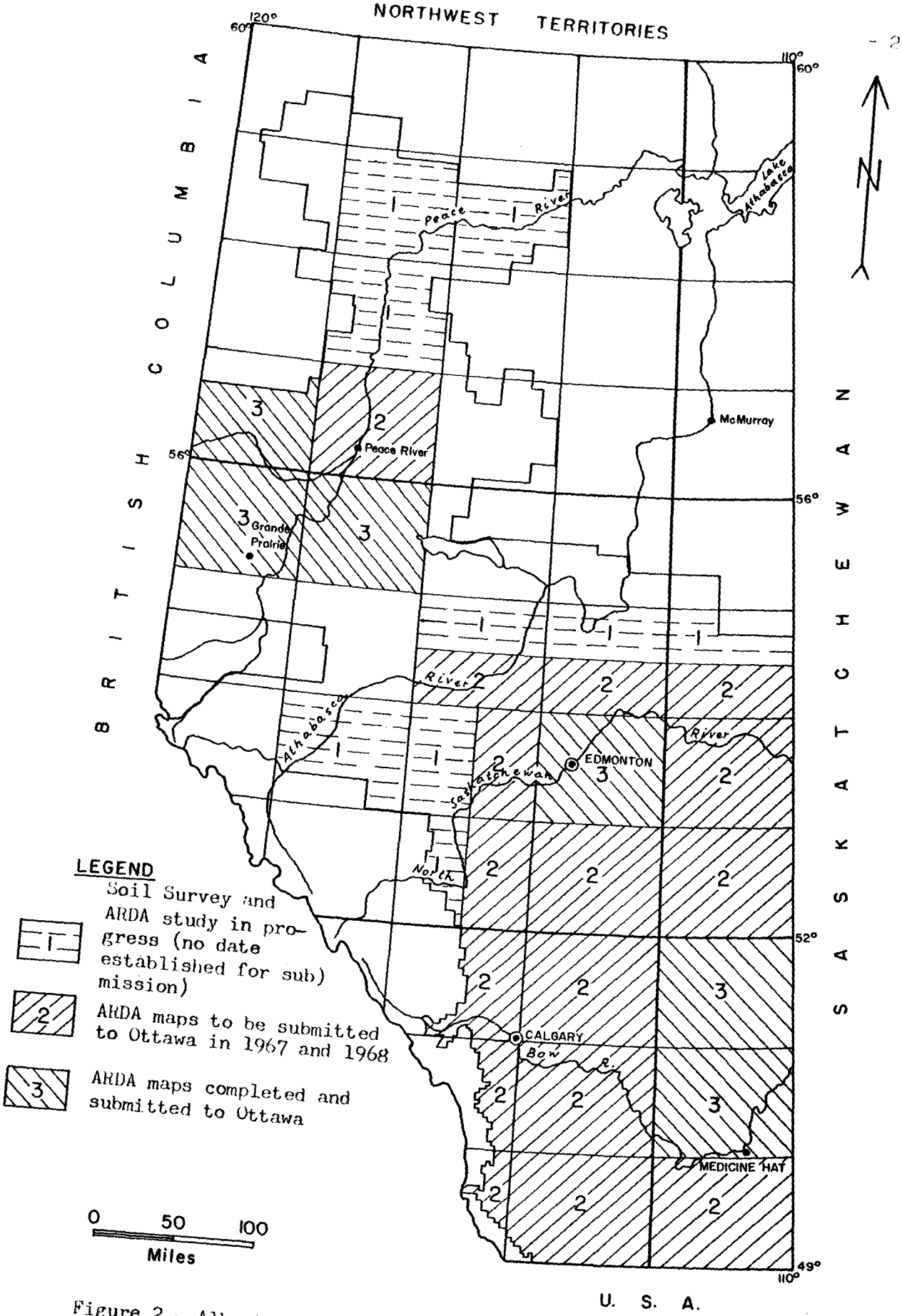

Figure 2 - Alberta Soil Survey, Indicating Soil Capability Classification Mapping for Agriculture

1:50,000 scale maps have the obvious advantage of allowing the inclusion of more detail and at the same time the soil limitation or hazard specifically expressed in that the subclass symbols d, f, m, or n are applied. For the 1:250,000 any one or combination of soil factors is simply shown by the symbol S.

COOPERATION BETWEEN CANADA LAND INVENTORY GROUPS

One of the definitions given in Webster's dictionary for co-operation is: "The conscious or unconscious behaviour of organisms living together and producing a result which has survival value for them." If this definition is taken literally then the Canada Land Inventory groups must assume co-operation is a prerequisite to survival. If soils information is of value or use to disciplines other than agriculture then let us assume that the co-operation of the soils people will be forthcoming.

RECREATIONAL LAND INVENTORY

PROGRAM - BACKGROUND

WORK ACCOMPLISHED AND

PLANS FOR THE FUTURE

by

R. SABINE

INTRODUCTION

"The fundamental question to be answered in terms of the development of recreation resources is development for whom? Are recreation resources viewed primarily as an economic asset? Are they developed primarily in terms of potential dollar return? Does exclusiveness of use further national goals? Is recreation a secondary issue, an additional benefit accruing from development based on other considerations? Does development primarily for recreation use have a low priority with our governments? Is such development related specifically to Canadian needs and aspirations? Does the pattern of development frequently represent arrested cultural growth in Canada? Indeed at the municipal, provincial and federal levels of governments is there any over-all policy governing the development and use of our recreation resources?"[1]

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[1] Farina.J. 1961. The Social and Cultural Aspects of Recreation. Resources for Tomorrow, Vol. 2, p. 948.

BACKGROUND

At the Resources for Tomorrow Conference held in Montreal, October 23 - 28, 1961, it was concluded that recreation is as legitimate form of land use as agriculture, forestry and wildlife. The damand for and the use of natural resources for recreation have grown and will continue to grow. The lack of inter-communication and over-all purpose in the administration of recreation leads to a need for study and for overhauling organization.

Although industrial research may have less impact in some resource sectors, any reference to co-ordination and administrative problems brings to the fore questions of the multiple use of water and land, and the whole field of wildlife and wilderness conservation and the related industries of recreation and tourism. As far as tourism is concerned, although statistics showed that foreign visitors spent $420 million in Canada in 1960, it has been estimated that Canadians themselves are the most important tourist customers, and that they comprise between 80 and 93 per cent of the travelling public on highways in Canada. Besides this, as far as recreation and wildlife activities are concerned, there is little doubt that they will provide more employment and income to the working public as living standards and leisure time increase in Canada. Because of these facts there is an apparent need for a national survey of natural recreational potential in Canada.

During the Federal-Provincial Parks Conference, held in Ottawa,

1963, Mr. C.S. Brown was appointed National Co-ordinator and Chairman for the Recreation Sector of the A.R.D.A., Canada Land Inventory. In 1964, he appointed a committee of four of Bob Ahrens (Western Canada), Gordon Taylor (National Parks Representative), Maurice LeFebvre (Eastern Canada), and Bob Bishop (Maritimes). These five people drew up the original Land Capability Classification for Recreation which Alberta and a number of the provinces used in their pilot projects. This tested classification system was then revised in east-west meetings held in Vancouver, B.C. and Wolfville, Nova Scotia in October and November, 1965. Following this, in February, 1966, a national meeting was held in Ottawa where the revisions made in Vancouver and Wolfville finally culminated in the classification presently in use.

The objectives of the land capability classification for outdoor recreation, as listed by C. S. Brown,[2] are five in number.

(1) To provide an authentic and reliable overview of the quantity, quality, and distribution of the recreation resources in the settled portions of the Canadian provinces.

(2) To indicate, on a meaningful basis, a comparative level of recreation use capability for all non-urban lands. (National Parks and some Forest Reserves are still omitted).

(3) To indicate the type of recreation use to which land is suited.

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[2] C. S. Brown. 1966. Canadian land capability classification for outdoor recreation. Canada Land Inventory. Canada Dept. Forestry. Ottawa. p.1.

(4) To identify those lands or features possessing outstanding or unique recreation values.

(5) To aid governments, with this basic information, in the formulation of programs and policies related to their promotion, development and regulatory functions concerning recreation lands. "The information acquired can serve as a basis for the reservation of recreation lands for public use, their disposition consistent with the best public interest, or alternatively, their allocation under multiple use management, programs."

Two Ontario agencies developed and tested other approaches. These were tried in Alberta, but without success. Firstly, the 1:50,000 scale maps which were used are too small a scale to facilitate the detail demanded by their approaches. Secondly, Alberta's conditions are not similar to those of Ontario's.

BASIS OF CLASSIFICATION

The most satisfactory basis on which lands of recreational capability can be defined to cover all types of recreational features to meet the particular needs of the Canada Land Inventory, is the "intensity of use or average annual total quantity of use per unit area which could

be generated under perfect market conditions[3] and sustained by an area or recreation feature." [4]

This is a difficult concept to express in precise terms, yet it is the most practical basis for classifying natural capability of land to meet the Canada Land Inventory's need for a physical indication of the probable economic potential of land for recreation.

The considerations involved in anticipating the total quantity of annual use a land unit could sustain under perfect market conditions go well beyond available data and challenge objective measurement at this stage of recreation research in Canada. Under such perfect market conditions, a spectacular phenomenon, a superb view, an Olympic standard ski area and an extensive good bathing beach are similar enough in their power of attraction to rank in the highest capability category. Each is sufficiently unique to result in a comparably high economic value accruing to it and to the land adjacent to it.

It is also possible for a combination of two features in close proximity to one another, but each of slightly lower quality than the best, to attract a total annual use comparable to one superior feature.

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[3] Perfect Market Conditions implies that market or demand conditions, such as location in relation to population centers, and accessibility, are equal for all areas, and therefore do not influence the relative capability of an area.

[4] Brown, C. S. op cit., p.2.

An extensive high quality beach, bounded by land well suited to complementary uses such as camping, hiking, riding or lodging has a greater capability than a beach lacking such other attractions. Furthermore, an extensive beach, as the nucleus of a recreation area, would sustain greater intensity of use or total use per unit of total area than would a small beach. Also, the better the beach in terms of size and quality, the larger the land unit with comparable capability. Therefore, both size and quality of both site and setting influence capability.

The other factor determining use capability is the carrying capacity, or the ability to sustain use without deterioration of the feature, or the quality of the recreation experience provided to the user. Generally, standards of optimum use intensity by activity can be defined in relation to both average user preference to optimum physical carrying capacity of land or site under various climate, soil and cover conditions.

For the purposes of this program the activities for which land capabilities are classified are those which are resource based and are now established as popular in the general public eye. Below is a list of these activities. Those appearing on the first column are generally more critical in their resource needs or more likely to result in intensive land use, than these in the second column. They are, therefore, given more careful consideration in developing classification techniques.

Family Bathing	Primitive Camping
Snow Skiing	Gathering and Collecting

Sight Seeing or Viewing Attractions	Ice Skating, Sledding, Tobogganing
Summer Cottaging	Hiking
Boating, Sailing, Water Skiing	Horseback Riding
Fishing	Driving for Pleasure
Organized Public or Group Camping	Picnicking
Hunting	Nature Walks
Canoeing	Walking for Pleasure

Apart from this is the actual Land Capability Classification for Recreation with its "attraction" or "feature" symbols.

LAND CAPABILITY CLASSIFICATION FOR RECREATION

The national system requires that only the capability class and the kinds of recreation features be indicated. As outlined herein it contains only these elements and a separation of all units between shorelands and uplands (for computer purposes). This section describes each of the seven classes.

Class 1 - Areas in this class have a very high capability for outdoor recreation.

Class 1 lands constitute the highest quality resources for outdoor recreation in the region and have natural capability to attract and sustain very intensive use. They may be shorelands with excellent natural capability for public beach and shore based recreation uses; or lands with an excellent natural capability for professional and amateur

skiing; or lands which provide viewing opportunities, or contain special interest features of highly outstanding and unique quality; or any combination of these.

Lands which have high capability for intensive use through two or more seasons due to the presence of two or more recreation features each of which would independently rate Class 2 may in instances rate Class 1.

Class 2 - Areas in this class have a high capability for outdoor recreation.

Class 2 lands are not of the highest quality for recreation in the region, but are relatively outstanding and capable of attracting and sustaining moderately intensive use. Modest improvements to the resource base may be necessary to realize the full potential. They may be shorelands with good natural capability for public beach and shore based recreation activities; or lands with good natural capability for competitive and amateur skiing; or lands which provide viewing opportunities or contain special interest features of outstanding quality; or any combination of these.

Class 3- Areas in this class have a moderately high capability for outdoor recreation.

Class 3 lands will normally have limited capability for intensive use of a public nature without significant capital inputs but are more likely to attract and sustain a high total annual use. They may be shorelands with moderate to high capability for shore based activities

such as swimming, boat launching and camping, or for intensive private or commercial lodging use; or lands with capability for moderate to high total annual use associated with particular recreation attractions or exceptional viewing opportunities; or any combination of these.

Class 4 - Areas in this class have a moderate capability for outdoor recreation.

Class 4 lands will not normally engender intensive use without major capital inputs, but may engender moderately high total annual use in dispersed activities. They may be shorelands with low to moderate capability for private lodging or camping associated with access to water suited to boating and/or swimming though some improvements will be necessary for access to, or use of, the water. They may be shorelands with moderate to good capability for lodging fronting waters with low capability for shore based activities other than viewing. Or they may be lands with good to excellent capability for dispersed activities, including shorelands or other lands with high scenic quality on an extensive scale, but lacking capability to rate higher.

Class 5 - Areas in this class have a moderately low capability for outdoor recreation.

Class 5 lands lack the natural aesthetic quality or the recreation features to engender intensive use, but may have moderate to good capability for a number of dispersed activities. They may be pleasant for touring, walking or riding or good for hunting, stream fishing or gathering and collecting. They will seldom warrant capital improvement

except in a high demand situation. They may provide a fully satisfactory buffer zone for an intensive use area.

Class 6 - Areas in this class have a low capability for outdoor recreation.

Class 6 lands lack natural aesthetic quality and recreation features, but may have low to moderate capability for one or more dispersed activities. They will normally be uninteresting and may present serious restrictions and offer little incentive to exploration or use.

Class 7 - Areas in this class have a very low capability for outdoor recreation.

Class 7 lands will have practically no natural capability for any popular types of recreation activity due to an almost complete lack of recreation features. They may, however, have some capability for very specialized activities with recreation aspects such as study of biological or other phenomena or gathering of specimens, or they may merely provide open space.

RECREATION FEATURES

Attractions or "recreation features" from Brown[5] are grouped to

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[5] Brown, C.S. op cit., p. 6-10.

a degree as follows: water or shoreland use features; upland use features; visual attractions. The reader may find them more usefully listed alphabetically. It may be found necessary to add to the list with further experience. Where possible the letter symbol used relates to the feature or use.

B Bathing beach: wet and dry beach conditions suited to family bathing, at normal water levels, in terms of water quality, beach slopes and beach materials.

D Shoreland with deeper water inshore suitable for swimming or boat launching.

N Shoreland suited to family cottage or other lodging use.

Y Boating area: shorelands providing access to a water body capable of accommodating popular forms of family boating activity.

A Angling area: land providing access to water with natural capability for production or harvesting of sport fish.

C Canoeing area: land providing direct access to a stream, river or other waterway with good natural capability for canoe tripping.

W Wetland: with significant capability for wildlife viewing or hunting.

T Thermal springs.

J Gathering and collecting: areas offering particular opportunities for such activity.

K Camping: terrain suited to organized camping (generally to be used only when such terrain is near or in the same unit with another attraction).

S Skiing areas: slopes and climatic conditions capable in normal seasons of providing skiing opportunities.

O Upland with significant capability for wildlife viewing or hunting.

M Upland area containing frequent small water bodies.

Z Major permanent, non-urban, man made structures of recreational interest.

Q Patterns of topography and land form, or land and water, exhibiting interesting diversity of landscape.

E Areas exhibiting representative and unique types of natural vegetation.

L Natural landform features of particular interest - other than rock formation: such as hoodoos, slump zones, eskers, sand dunes, badlands, etc.

H Historic site: an historic or prehistoric site or feature of a level of significance recognized by provincial or national government authorities.

P Areas exhibiting pleasing or interesting diversity of cultural landscape patterns.

R Rock formation of interest; such as caves, crevasses, exposed stratification, folding, fossil deposits, etc.

V Viewpoint or overlook: a promontory or vantage point which provides a superior view of a feature, landscape or seascape; or a corridor or other area which provides frequent good viewing opportunities.

G Glacier or area offering a glacier view or experience.

F Waterfalls or rapids.

X Recreation features or particular interest or use capability not included more specifically elsewhere.

BASIC POINTS OF THE CLASSIFICATION

1. The suitability of land for major modification will not be considered. For example, removal of boulders or vegetation from a beach can be considered as normal management practice; but the potential of a valley for a reservoir development cannot be evaluated.

2. Location and present access will not influence ratings as the classification is based on natural capability.

3. Any major permanent man made structure in a non-urban setting may be rated as a recreation feature.

4. The possibility that major capital inputs to land, as well as natural events and processes, may alter the degree and kind of capability for recreation suggests the need for revision of inventory records when significant landscape transformation occurs.

5. The system adopted must enable rapid and efficient rating of the extensive areas in Canada lacking significant recreational values.

6. Areas to be rated high due to snow skiing capability should be restricted to slopes with vertical drops adequate in extent to acommodate all types of skiers.

7. Finally, the inventory must make no pretense to be all-inclusive or thorough in mapping phenomena which are not evident from airphoto interpretation or related field work or known to local authorities.

WORK ACCOMPLISHED TO DATE

A brief outline of the mapping procedure might be appropriate here. The actual mapping (on 1:50,000 topographic base maps) is divided almost equally between (a) airphoto interpretation and (b) field work. We have found that with the scale of aerial photography available to us it is almost impossible to map the high capability areas with the accuracy desired. They are invaluable, however, in facilitating rapid scanning of low capability areas and in pin pointing potential high capability areas so that we might make the best possible use of our field work time. These two steps are then followed by:

(c) boundary checking.

(d) complexing the information from the 1:50,000 base maps to 1:250,000 topographic maps.

(e) transferring the information from the 1:50,000 and 1:250,000 topographic maps onto auto-positive maps of corresponding scale.

(f) writing a 1,000 word report discussing regional setting, physical geography, fish and wildlife, settlement and land use, and recreational capability to accompany each block of one 1:250,000 and sixteen 1:50,000 auto-positive map sheets.

(g) reproduction of five copies of each auto-positive map sheet for provincial use.

(h) the auto-positive maps and report are sent to Regina for final checking by the Western Regional Co-ordinator and then on to Ottawa where the maps are redrafted onto the material that will be fed into the computers.

To date we have completely finished 83H (Figure 1). Eighty-three G is in the final stage of checking before being reproduced and sent to Regina. Eighty-three B, F, J, N, and D have completed step (e) above. Eighty-three A, L and M have completed the interpretation and field checking, while 82P and 83 I have only been interpreted.

Our seemingly slow progress is due to the major set-back we encountered this past spring when the revised classification (previously mentioned) came into effect. All the maps had to be redrafted with a minimum of duplicated airphoto interpretation and field work. The final outline for the 1,000 word report was not received until August 25, 1966.

PLANS FOR THE FUTURE

The outlined program for the next three years is shown in Figure 1 and is as follows:

1967 - 68	To complete	72 E, L, M, 73 D, E, L, M, 82 H, I 83 E, K, I, P.
1968 - 69	To complete	82 G, J, O, 84 B, C, D, E, F, G.
1969 - 70	To complete	84 J, K, L, M, N, and to tidy up all the loose ends of the project. One of these loose ends will be a revised A.R.D.A. boundary which we just recently received but which I understand has been in use for some time.

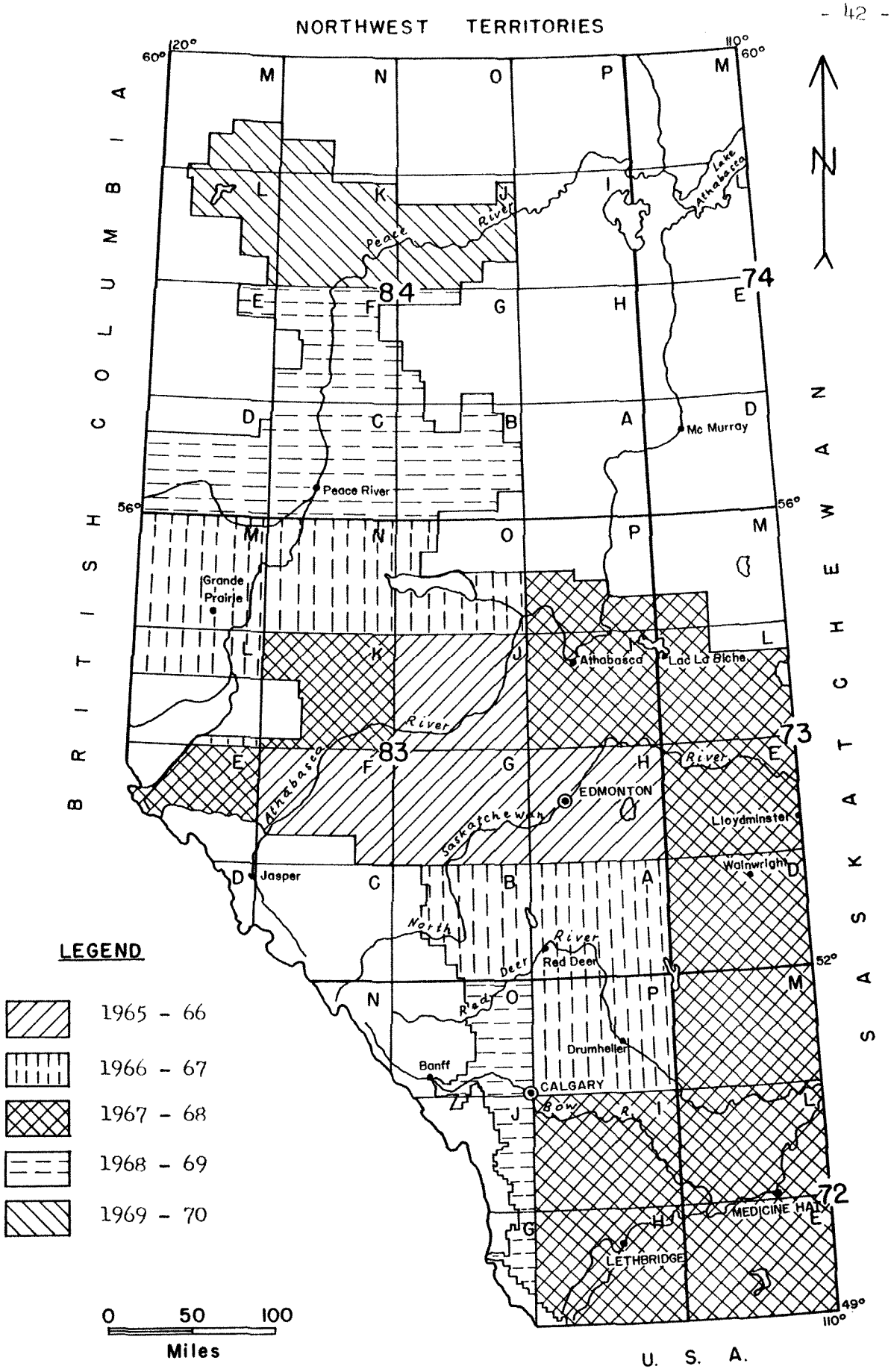

Figure 1 - Map of Alberta Showing the Recreational Land Classification Program within the Canada Land Inventory Boundary

Authorization has now been given to incorporate sport fish capability mapping into the Canada Land Inventory Program. At this point it is uncertain in what manner sport fish capability data can best be published.

COOPERATION BETWEEN CANADA LAND INVENTORY GROUPS

I would think that there most certainly is need for co-operation between the various Canada Land Inventory groups for three main reasons.

(1) To avoid meaningless duplication of work.

(2) To provide valuable information to each other. For example, recreation can make use of the water fowl survey of the Land Capability Classification for Wildlife.

(3) Co-operation is needed between the Canada Land Inventory groups if they are to determine the best land useage in an area.

LAND CAPABILITY CLASSIFICATION FOR WILDLIFE

by

R. G. Weatherill, W. K. Hall and R. D. Jakimchuk

BACKGROUND

The classification of land for its capability to produce wildlife is restricted to wild ungulates and waterfowl; a separate classification system being used for each component.

The term "wildlife" will consist of all species of mammals, birds, reptiles, amphibians and fish. The concept can also include invertebrates and floral aspects of the environment. But for simplification, land units are rated in regard to their capabilities to produce only ungulates and waterfowl. It is also recognized that in some parts of Canada, upland game birds and other wildlife species not included in this inventory may assume equal or greater importance in economic and/or social value. Nevertheless, for nation-wide, comparative purposes, the restriction of the inventory to ungulates and waterfowl seems to best serve current needs for information of this nature.

The basic approach to the land capability classification system, developed through consultation between Federal and Provincial administrations and professional wildlife biologists was endorsed by all provincial representatives at a meeting held in Ottawa on February 21st and

22nd, 1966. Various modifications were incorporated at this meeting while others were introduced by the National Advisory Sub-committee on Land Capability Classification for Wildlife. The system outlined here was ratified by all Provincial and Federal representatives at a meeting of this sub-committee in Quebec City on July 11th, 1966, for national use during the balance of the Canada Land Inventory (Benson 1965, 1965a).

Wildlife is part of, and depends upon, the ecosystem within which it is found. A land capability classification system for wildlife must identify the basic factors which are essential to the continued existence of the ecosystem.

Physiographic features which are significant for waterfowl and ungulates are used to separate the land surface into units for classification. Although wildlife directly depends upon the plant community in which it lives, the latter is in turn dependent upon physical characteristics of the environment, such as soil composition, climate and togpography. Because it is known that plant communities can be manipulated through management to stages of seral succession which are productive for wildlife and because such management is limited by the physical characteristics of a given site, land capability ratings are applied to land surface units described in physical terms, significant from a wildlife standpoint.

In view of the need to ultimately consider the alternative uses of land, the present classification system ignores the present

ownership and use of land. The capability ratings are established upon ecological conditions which can be expected to prevail if the land unit under consideration were to be established for the primary purpose of producing ungulates or waterfowl. It is acknowledged however, that some major, long-lasting human influences are virtually irreversible and must be considered as part of the ecological picture for purposes of this classification. Under such conditions, capability ratings are not assigned on the basis of pristine conditions which are no longer applicable to the general ecology of the area or to good wildlife management practices. It is also acknowledged that the effects of some agricultural practices over large areas in some provinces are too large and well established not to be considered as permanent limiting factors to ungulates. Such use over broad areas may be the basis for eliminating these areas from the present inventory. Similarly, cities, towns, villages, and densely populated urban areas, where present use is prohibitive for wildlife production and where irreversible changes in the environment are prevalent, may be omitted from consideration in the capability classification.

ASSUMPTIONS AND PROCEDURES

Certain assumptions and procedures must be understood by those applying the accompanying classification and by those using it. These are:

1. The separation of the land surface into units for classification will be on the basis of physical characteristics significant from a wildlife standpoint.

2. Delineation of each unit will be on the basis of all known or inferred relevant information about the unit. This may include such things as parent material, soil profile, depth and moisture, fertility, landform, climatic factors, vegetation, etc. References to parent material, soil depth, etc. refer only to their effect on vegetation useful to wildlife.

3. Research data, recorded observations and experience, are used as the basis for placing land units in capability classes and sub-classes. Where such information is lacking, classes and sub-classes are assigned on the basis of experience gained with similar factors elsewhere.

4. Good wildlife management practices, which are feasible and practical are assumed. Such good practices include those concerning land and animal species with the objective of producing optimum sustained yields of the species concerned. Present production is useful for classification purposes only when it reflects productivity on sites in ideal conditions.

5. Difficulty in obtaining access, land ownership, or distance from cities or roads do not affect capability ratings. Excessive or insufficient hunting pressures offer no limitation to the capability of a unit.

6. The degree of limitation determines the class designation. The sub-class is the factor which causes the limitation. Thus there may be many different land units, with the same degree of limitation, hence the same class - but the nature of the limitation may be quite different in each, as shown by the sub-class.

7. The level of detail provided by wildlife land capability maps is determined by the scale at which they are produced.

8. Capability ratings are subject to change as new information becomes available.

9. Indicator species of ungulates for which the capability ratings are assigned will be shown, when possible.

The classification framework is comparable to those developed by other sectors of the Canada Land Inventory, and consists of seven capability classes and a series of sub-classes. Classes indicate the

degree of limitation present. Sub-classes (designated by letters following the class) tell what the limitation is. Class 1 lands have no limitation for wildlife. Class 7 lands have limitations so severe that they preclude wildlife. The range of classes in between indicates varying degrees of capability as a result of one or more sub-class limitations present.

LAND CAPABILITY CLASSIFICATION FOR WATERFOWL

The scope of the waterfowl classification includes the assessment of land capability for producing both ducks and geese.

The unit of classification may comprise a land form unit such as a glacial moraine or an individual marsh or wetland. The land unit approach is often used in Alberta where potholes and marshes are numerous. In such a case the land is rated according to its capability to produce suitable habitat and emphasis is placed on the abundance, permanence, interspersion and quality of potholes and marshes within the unit.

Larger marshes and lakes may be classified separately in view of their individual habitat components. In classifying individual water areas the emphasis shifts to such habitat consideration as water depth, quality and quantity of aquatic vegetation, edge, cover and water stability.

WATERFOWL LAND CAPABILITY CLASSES

Class 1 - Lands having no significant limitations to the production of waterfowl.

Capability on these lands is very high. They provide a wide variety and abundance of important habitat elements; rolling topography is well suited to the formation of wetlands. Predominant water areas on these lands are both shallow and deep permanent marshes in association with deep, open water areas with well developed marsh edge.

Class I S - Water areas in this special class also serve as important migration stops.

Class 2 - Lands having very slight limitations to the production of waterfowl.

Capability on these lands is high. Slight limitations are due to climate, fertility or permeability of the soils. Topography tends to be more undulating than rolling; a higher proportion of the water areas are small temporary ponds or deep open water areas with poorly developed marsh edge.

Class 2 S - Water areas in this special class also serve as important migration stops.

Class 3 - Lands having slight limitations to the production of waterfowl.

Capability on these lands is moderately high but productivity may be reduced in some years because of occasional droughts. Slight limitations are due to climate or to characteristics of the land which affect the quality and quantity of habitat. These lands have a high proportion of both temporary and semi-permanent shallow marshes poorly inter-

spersed with deep marshes and open water bodies.

Class 3 S - Water areas in this special class also serve as important migration stops.

Class 3 M - Lands in this special class may not be useful for waterfowl production but are important as migration or wintering areas. This class has no subclasses.

Class 4 - Lands having moderate limitations to the production of waterfowl.

Capability on these lands is moderate.

Limitations are similar to those in Class 3 but the degree is greater. Water areas are predominantly temporary ponds and/or deep open waters with poorly developed marsh edges.

Class 5 - Lands having moderately severe limitations to the production of waterfowl.

Capability on these lands is moderately low.

Limitations are usually a combination of two or more of the following factors: climate, soil moisture, permeability, fertility, topography, salinity, flooding, or poor interspersion of water areas.

Class 6 - Lands having severe limitations to the production of waterfowl.

Capability on these lands is very low. Limitations are so severe as to be easily identified. They may include aridity, salinity, very flat topography, steep sided lakes, extremely porous soils and soils containing few available minerals.

Class 7 - Lands having such severe limitations as to preclude waterfowl production.

Capability on these lands is negligible or non-existent. Limitations are of such severe nature as to preclude or nearly preclude waterfowl production.

WATERFOWL LAND CAPABILITY SUBCLASSES

With the exception of Class 1, the classes are divided into subclasses according to the nature of the limitations which determine the class. The following subclasses are used to denote significant limiting factors which may affect either waterfowl or the ability of land to produce suitable habitat conditions.

Subclass "A", Aridity - The limitation is an arid condition of the land or the susceptibility of the land to periodic droughts which results in low pond water levels or premature drying of marshes in the breeding season.

Subclass "B", Free Flowing Water - Limitation is usually due to fast or excess water flow which inhibits development of marsh habitat along the stream edge. It may also be due to a lack of flow through low lying land which results in habitat of poor quality.

Subclass "C", Climate - A combination of adverse climatic factors may act to reduce favourable habitat and the production and survival of waterfowl.

Subclass "F", Fertility - Limitation is a lack of nutrients in the soil and water for optimum plant growth.

Subclass "G", Landform - Poor distribution or interspersion of marshes or basins necessary for optimum waterfowl habitat can be a limiting factor of the land.

Subclass "I", Inundation - Limiting factor is excessive water level fluctuation, drawdown or tidal action which adversely affects the habitat or the nesting success of waterfowl.

Subclass "J", Reduced Marsh Edge - Limitations are topographic features which adversely affect the width or development of optimum marsh conditions along the edge of water areas.

Subclass "M", Soil Moisture - Poor water holding capacity of soils which adversely affects the formation and permanency of water areas.

Subclass "N", Salinity - Excessive salinity, alkalinity, acidity, lack of essential trace elements or abundance of toxic elements may limit the development of plant and animal communities essential for waterfowl production.

Subclass "R", Soil Depth - Restriction of the rooting zone by bedrock or other impervious layers may limit development of suitable plant communities.

Subclass "T", Adverse Topography - Either steepness or flatness of the land may limit the development of permanency of wetlands.

Subclass "Z", Water Depth - Excessively deep or shallow waters limit the development of optimum waterfowl habitat.

LAND CAPABILITY CLASSIFICATION FOR UNGULATES

Class 1 - Lands having no important limitations to the production of ungulates Class 1 lands are high to very high in capability for producing wide variety and/or abundance of food plants and other wildlife habitat elements. These areas have a very high capability. Class 1 areas that are winter ranges upon which much of the surrounding range is dependant shall be designated as Class 1 W.

Class 2 - Lands having very slight limitations to the production of ungulates. Class 2 lands may have slight limitations due to climatic or other factors. Capability is high. Areas that are winter ranges necessary to animals from surrounding ranges should be designated as Class 2 W.

Class 3 - Lands having slight limitations to the production of ungulates. Class 3 lands may have limitations which moderately affect available moisture or nutrients. Soil may be somewhat shallow. Climatic factors may limit populations. Poor exposure (aspect) may be a factor in winter. Productivity may be reduced in some years. Capability is moderately high. Areas that are winter

ranges and which are necessary to animals from surrounding ranges should be designated as Class 3 W.

Class 4 - Lands having moderate limitations to the production of ungulates. Class 4 lands may be limited by soil depth, fertility, excessive or deficient soil moisture. Aridity may also be a factor causing reduction in browse species. Climate may cause herd reduction directly or indirectly by affecting nutrition and productivity in some years. Exposure may be an important factor. Capability is moderate.

Class 5 - Lands having moderately severe limitations to the production of ungulates.

Class 5 lands usually combine two or more limitations of climate, soil moisture, fertility, depth to bedrock or other impervious layer, topography, flooding, exposure or toxicity. Capability is moderately low.

Class 6 - Lands having severe limitations to the production of ungulates. Limitations in this class will be so severe as to be easily identified. Soil depth may be negligible, climatic factors may be so extreme as to severely reduce populations. Other possible limitations are equally severe. Productivity is negligible.

Class 7 - Lands having limitations so severe as to preclude ungulate production.

These areas do not produce food plants and other wildlife habitat elements.

UNGULATE LAND CAPABILITY SUB-CLASSES

Sub-class "M" - indicates limitations due to poor soil moisture (excessive or deficient).

Sub-class "I" - indicates limitations caused by flooding, drawdown or tidal action.

Sub-class "Q" - indicates limitations due to snow depth.

Sub-class "A" - indicates limitations due to aridity or droughtiness (climate).

Sub-class "C" - indicates limitations due to a combination of climatic factors.

Sub-class "F" - indicates limitations of soil fertility to the growth of suitable food and cover plants.

Sub-class "N" - indicates limitations due to excessive salinity, restrictions of essential elements or toxic elements (the latter usually in plants).

Sub-class "R" - indicates limitations due to depth to bedrock or other impervious layer.

Sub-class "T" - indicates limitations due to topography.

Sub-class "U" - indicates limitations due to exposure or aspect.

Sub-class "G" - indicates limitations due to unfavourable landform patterns. This may include poor proximity of seasonal ranges, cover, etc.

PROGRESS

Ungulate Project

The map sheets of Wainwright, Vermilion, Edmonton and Red Deer are now in the final stages of mapping. The 1/50,000 maps are completed and the grouping and recording on the 1/250,000 is now underway.

Waterfowl Project

To date, the above map sheets plus the Drumheller map are completed for the waterfowl inventory.

FUTURE

Generally speaking, both the waterfowl and ungulate work will proceed to the south and southwestern part of the Province for the next year. On completion of that area, the northern map sheets will be completed. Figure 1 and 2 show the progress and future plans of the land capability classification for wildlife in Alberta.

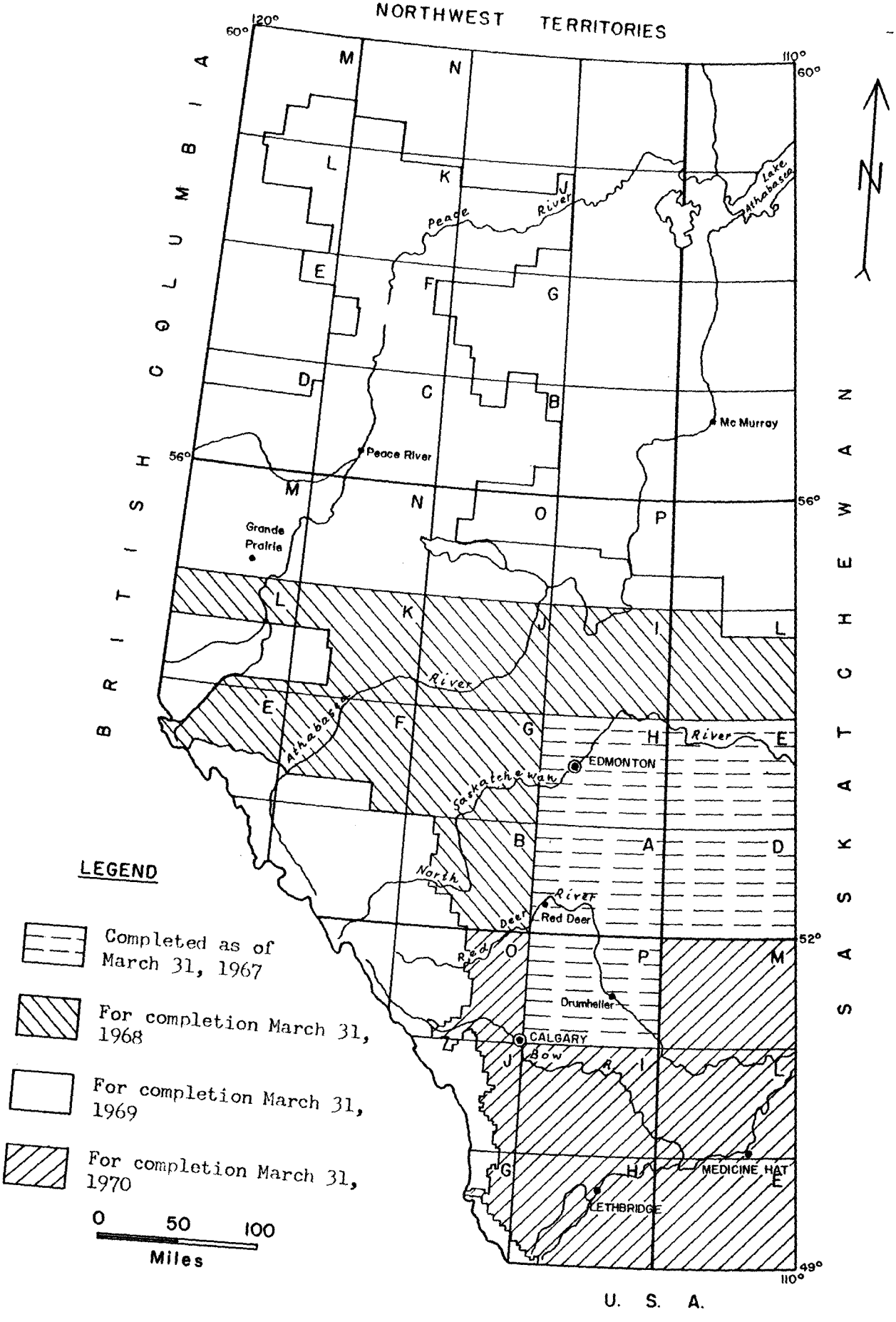

Figure 1 - Land Capability Classification for Wildlife (Waterfowl) within the Canada Land Inventory Boundary

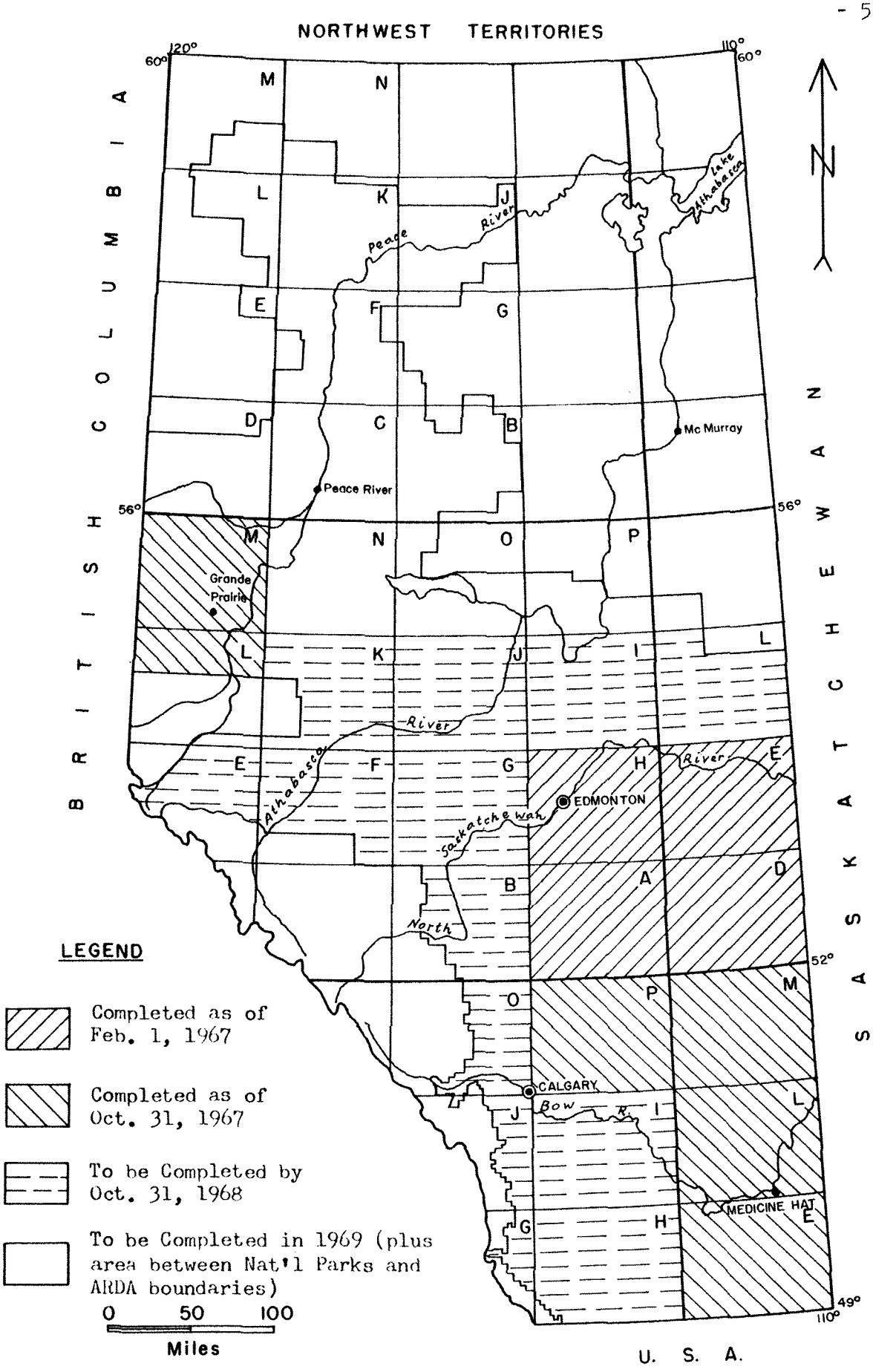

Figure 2 - Land Capability Classification for Wildlife (Ungulates) within the Canada Land Inventory Boundary

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LAND CAPABILITY CLASSIFICATION

FOR FORESTRY

by

J.R. PROKOPCHUK

INTRODUCTION

A classification of land capability for forestry within the Canada Land Inventory will provide an improved technical basis for land use planning. It will indicate land on which intensive forest management practices are economically justified. This inventory will not provide the detailed information required for management of individual parcels of land, but it will supply essentials to land resource development planning at the municipal, provincial and federal levels. Details of the Land Capability Classification for Forestry are given by McCormack (1965, 1965a).

In this paper I will discuss briefly the Land Capability Classification for Forestry under the following headings:

I Rating System
- A. Capability Classes
- B. Capability Subclasses

II Field work and Results

III Progress and Difficulties

IV Plans for the Future

V Suggestions

RATING SYSTEM

A. CAPABILITY CLASSES

The most significant unit recognized in the three dimensional form is the land form. It is characterized by a distinctive type of relief, texture and soil, moisture conditions and usually a specific vegetational complex. Similar soils are developed on similar topographic positions from the weathering of similar materials under similar climatic conditions. Consequently similar land forms should have similar sites and similar growing conditions. Therefore a separation of land surface into homogeneous units based on physical characteristics can be made. Such information can be obtained from existing and very valuable soil survey reports prepared by the Research Council of Alberta. It can also be achieved by means of photo interpretation. Both methods are used as preliminary work for the capability classification. The assignment of a capability class to each land form is done on the basis of all available information.

Before going into the classification system itself, I would like to elaborate on the background of this system. The productivity figures are based on a sawlog economy with white spruce as the dominant species. Therefore 100 years is the rotation age for that species in Alberta. Productivity classes are based on gross merchantable cubic foot volume to a minimum diameter of four inches inside the bark of fully stocked stands and will be expressed in units of Mean Annual Increment (M.A.I.) This frequently used abbreviation is a common method of expressing growth.

M.A.I. means the mean annual increment of well-stocked stands at or near rotation age. Because 100 years was accepted as the rotation ages for spruce, the M.A.I. means the average increase in volume of a stand at a 100 years. "Gross merchantable volume" was mentioned before. This means volume of a tree or stand at 1 foot stump to 4 inches top. In answer to the question of what constitutes a fully stocked stand, it was decided that basal area was the most reliable factor to judge stocking by. A basal area factor of 170+ square feet per acre was accepted as the minimum for a fully stocked stand.

The capability rating for forestry consists of 7 classes expressed in units of M.A.I. per acre. They are as follows:

Class 7 - capable of producing 0 - 10 cubic feet per acre per year.
Class 6 - " " 11 - 30 " "
Class 5 - " " 31 - 50 " "
Class 4 - " " 51 - 70 " "
Class 3 - capable of producing 71 - 90 cubic feet per acre per year.
Class 2 - " " 91 - 110 " "
Class 1 - " " 111 + " "

The ratings are based on productivity of white spruce. Only where white spruce does not produce as well as pine or black spruce, will these other species be used. During the past two years an attempt was made to determine the maximum capability class for Alberta. There are known to be sites capable or producing in the category of Class 2, but their areas

are too small to be mapped separately. If Class 2 is our maximum productivity it would be necessary to show a meaningful limiting factor for Class 3. With our present limited knowledge of factors influencing growth, it would be very difficult to assign an appropriate factor to Class 3. Under these circumstances, we decided to accept Class 3 as our maximum capability.

B. CAPABILITY SUBCLASSES

Each capability class, with the exception of our maximum Class 3, will have 2 subclasses assigned to it. Subclasses are class divisions that have limitations to forest growth. The following limitations are used:

1. Climate

Under this heading there are four subclasses- temperature (H), precipitation (A), exposure (U), and a combination of more than one factor (C):

Subclass H - will be used very rarely due to lack of information on temperature movements and maximums and minimums required for optimum growth. This factor will occur on our maps only for the larger muskegs and a small portion of better drained soils surrounding the same.

Subclass A - was not used in the area completed to date and it is doubtful if it ever will be used for the remaining areas.

Subclass U - Here we consider two exposures, one is wind and another sun. Wind exposure will exist in the mountains. Exposure to the sun will depend on degree of slope, direction of slope and present vegetational cover.

Sub-class C - This limiting factor will be used only as a last resort whenever the interpreter is definitely unable to assign any of the other three factors.

2. Soil Moisture

Subclass M - Deficiency of soil moisture is indicated.

Subclass W - Excess of soil moisture is indicated.

These two limiting factors will be frequently used in the determination of capability classes. "W" is used with white spruce in the lowest rating of Class 5, but if productivity drops below this for white spruce, we switch to black spruce. The highest rating for black spruce is 6W. The capability of black spruce could be even better than 6 under more favourable conditions but it loses dominance to other species.

Subclass X - Applies to an area where M and W are too intimately associated to be separated.

3. Permeability and Depth of Rooting Zone

Subclass D - Indicates a limitation due to density, or some layer other than bedrock which limits rooting depth and would apply to solonetzic soils. This subclass may be used with Class 7 on solonetz, with Class 5 and 6 on solodized solonetz and with Class 5 and 4 on solods.

Subclass R - Limitation due to the restriction of the rooting zone by bedrock. This factor will be applied only if bedrock comes within 18 - 24 inches of the surface.

Subclass Y - Limitations due to intimate patterns of shallowness or compaction or other restricting layers. It is unlikely that this limitation will occur.

4. Soil Fertility or Toxicity

Subclass F - Limitation of nutrients for optimum growth.

Subclass L - Limitation to growth because of excessive calcium in the soil.

Subclass N - Limitations due to toxic elements, for example soluble salts.

Because of limited knowledge of the nutrient requirements of the index tree species and elements toxic to them, only two limiting factors can be applied in the capability classi-

fication. "F" is applied in pure sands and very coarse textured parent materials and "N" for solonetzic soils.

5. Stoniness

Subclass P - Limitation to growth due to stoniness will be used where surface gravel layers of more than 24 inches with little matrix overlayer some other parent material.

Subclass I - So far it does not appear to be an important limitation. Flooding could be damaging, but also beneficial. It depends on intensity, frequency and duration of the inundation.

FIELD WORK AND RESULTS

In 1965 information on the productivity of various parent materials was collected south of Grande Prairie and in the Sturgeon Lake areas. A total of 129 one quarter acre plots in well selected and fully stocked spruce-aspen stands between 80 and 149 years age range were established and the soil profile described. Because age readings were done at 1 foot height, it was necessary to use MacLeod and Blyth's (1955) conversion tables to obtain a total age. Some adjustments also had to be made to conform with the capability classes based on M.A.I. at 100 years. These calculations were made by using M.A.I. curves calculated and drawn by the Canada Department of Forestry in Calgary.

The plots were grouped by parent material, topographic and drainage classes, and the capability for each parent material was then established.

The results of this field work were not too consistent. It appeared that there was no strong correlation between parent material and volume or M.A.I. Regardless of parent material and topographic position, the productivity of the intermediate classes did not show a significant variation. It ranged from a low Class 4 to a low Class 3 (from 53 to 73 cubic feet per acre per year). Drainage classes however reflected some differences in productivity within the same parent materials.

After completion of the first years field work we felt that more data was required to strengthen our figures particularly for certain parent materials. Therefore two projects were undertaken during the summer of 1966. In the first, 69 soils were described on Permanent Sample Plots in the Lodgepole, Whitecourt, Valleyview and Clear Hills areas to supplement data from previous years. The second project compared productivity of several parent materials in the High Level area with those in the Grand Prairie Area. Thirty-two productivity plots (with soil descriptions) were established and soils described only on a further 35 Permanent Sample Plots from the High Level area.

The compilation of 1966 field work has been completed, but is still to be analyzed, so that final results are not yet available. However it is evident that productivity in the High Level area is below that of Grand Prairie. This could possibly be attributed to a regional climate.

PROGRESS AND DIFFICULTIES

To date (31 December, 1966) the following (Figure 1) capability classification on 1 mile = 1 inch maps have been prepared:

Map sheets 83 - K - 3, 6, 11, 13, 14 and a portion of 12

Map sheets 83 - L - 13, 14, 15, 16 and portions of 9, 10, 11 and 12.

All 16 map sheets in block 83 - M

All 16 map sheets in block 83 - N

A broadening of 1 inch = 1 mile maps, that contain more or less detailed typing, is necessary to conform to the required standards for 1:250,000 scale mapping. This is a complexing procedure and consists of grouping two or more small areas of different capability classes into one large unit to comply to these standards. For example, an area of 3,000 on the detailed map consisting predominently of 2,400 acres of capability class $^{4\ W}_{w\ S}$ (Class 4, limitation W - excess soil moisture, for white spruce) and four patches of approximately 150 acres each of Class $^{7\ W}_{b\ S}$ (Class 7, limitation W - excess soil moisture, for black spruce) will be shown on a complexed map as one unit and will by symbolized by $^{4^{8}W}_{wS}\ ^{7^{2}W}_{bS}$ (the superscripts indicate 80 percent Class 4 and 20 percent Class 7). Capability classification 1 mile = 1 inch complexed maps have been prepared for blocks 83 - K (as above) and 83 - L (as above).

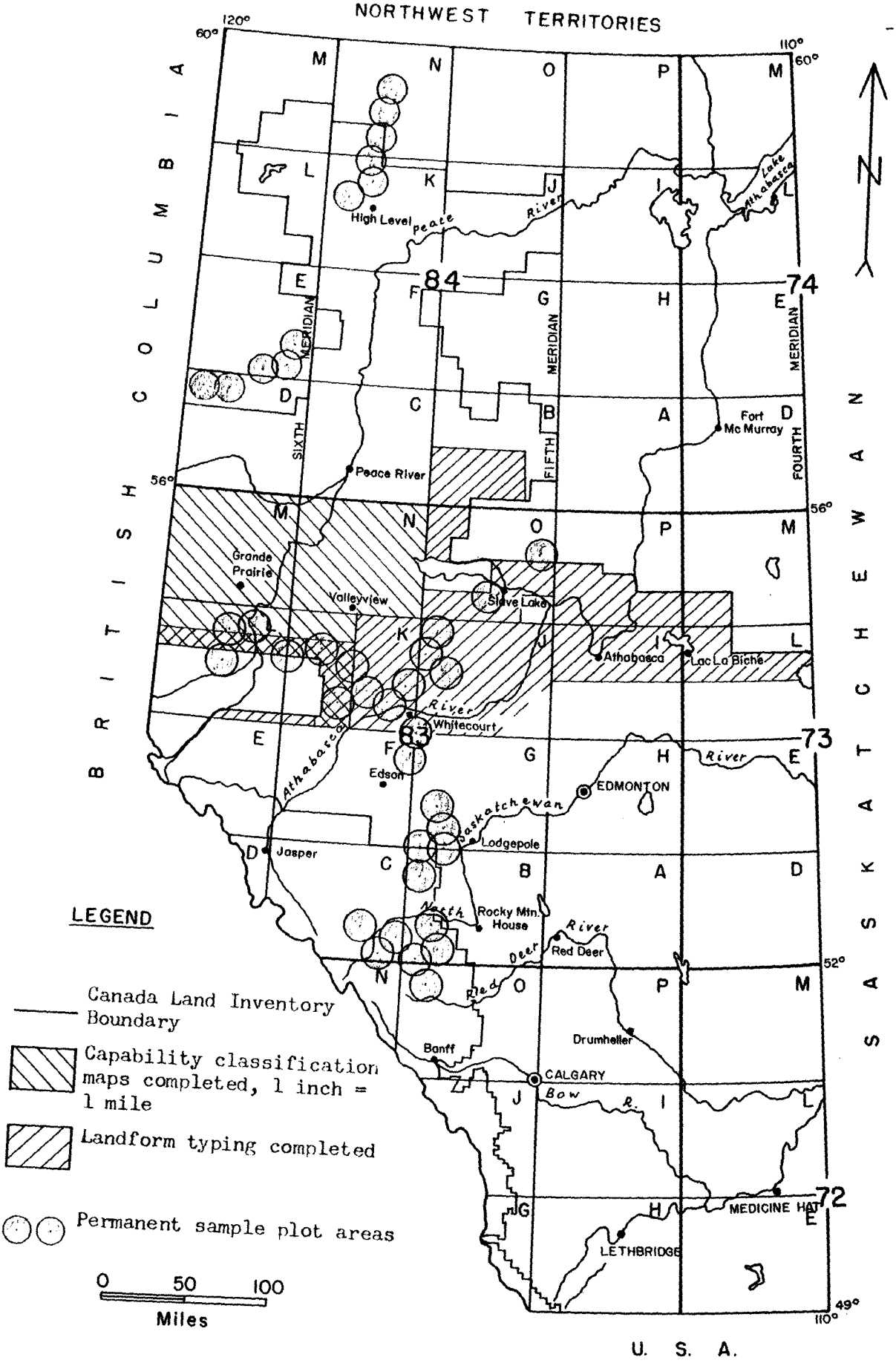

Figure 1 - Land Capability Mapping for Forestry and Location of Permanent Sample Plot Areas

Land form interpretation has been made of E $\frac{1}{2}$ of block 83 - K; 83 - J with the exception of S.E. corner which is predominantly cultivated; portion of 73 - L and 73 - M within the Canada Land Inventory boundary; 83 - O - 4, 7, 8 and portion of 12 and 13 within the inventory boundary; and 84 - B - 2, 3, 4, 5, 6 and 7.

Before the end of this year 20 completed capability maps 1 mile = 1 inch were sent to Ottawa for computer processing. During the past two years we encountered problems, but these were not unique to this province. It is generally agreed that the growth of forests cannot be fully understood without a knowledge of forest soils. Forest soil suitability and productivity cannot be assessed without an understanding of the biological nature of the forest cover. Therefore a thorough knowledge of the complex relationships between tree species and their environment is required from the foresters engaged in the soil capability work. Such skilled and experienced foresters are scarce.

We have experienced difficulties in locating areas suitable for our sampling. The requirements of age, stocking, species, parent material, etc. made the selections of suitable stands extremely time consuming. Access to many of these plots was difficult and required specialized transportation. It has been mentioned bedore that we faced also a problem to find an appropriate limiting factor for Class 4.

PLANS FOR THE FUTURE

In 1967 it is planned to describe the soils on 250 Permanent Sample Plots. Their locations are shown on the map (Figure 1). We intend to complete the capability classification of $E\frac{1}{2}$ of 83-K, 83-O, 83-P, 83-J, 83-I, 73-L, 73-M and a narrow strip of 83-L within the inventory boundary. Complexing of the large scale maps for the final 1:250,000 scale will be done for the same area as well.

Land form interpretation will proceed towards the north of the area completed to date. Using the most recent and suitable 2 inches = 1 mile scale photographs we will be able to cover approximately 15,000 square miles by the end of 1967. Land form interpretation done previously and that planned will be sufficient to provide work for two or more foresters working on capability classification.

SUGGESTIONS

In conclusion may I say that we are proceeding towards our goal but we feel strongly that much more research is required to fulfill our objectives successfully. Research in the field of forest soils and tree relationship, soil moisture, soil temperature, soil nutrients would provide us with the necessary knowledge to assign limiting factors of growth more accurately. A continuation of field workshops similar to the one held in 1966 is an excellent way to coordinate the work between neighbouring provinces, and to provide an opportunity to discuss problems and solutions with people doing the same work in other areas.

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