Canada

GEOGRAPHICAL PAPER No. 31
(Étude géographique n° 31)

Canadian Land-Use Mapping

Cartographie de l'utilisation des terres au Canada

N. L. Nicholson
I. H. B. Cornwall
C. W. Raymond

GEOGRAPHICAL BRANCH
Department of Mines and
Technical Surveys, Ottawa

Price: 75 cents

Canada

GEOGRAPHICAL PAPER No. 31
(Étude géographique n° 31)

Canadian Land-Use Mapping

Cartographie de l'utilisation des terres au Canada

N. L. Nicholson
I. H. B. Cornwall
C. W. Raymond

GEOGRAPHICAL BRANCH
Department of Mines and
Technical Surveys, Ottawa

Price: 75 cents

99173-7—1

P R É F A C E

During recent years the Geographical Branch has been actively engaged in a Canadian land-use mapping program. Basic information on the present use of land in various parts of the country has been obtained through direct field mapping, statistical analysis, and airphoto interpretation. Subsequently the data have been compiled on maps of various scales in preparation for publication in color.

This paper provides a brief description of the background and purpose of the land use mapping program of this branch. It states the reasons for the selection of various map scales, and outlines the time, methods and procedures involved in mapping the land-use data. Finally, it clarifies those categories where difficulties arose in adapting the world land-use classification to Canadian conditions. It is felt that this information will not only enhance the value of the land use maps, but will also be of interest to those engaged in similar projects elsewhere. The paper is intended to serve as a working key or handbook to be used in conjunction with the land-use maps as they are published.

N. L. Nicholson,
Director,
Geographical Branch.

Au cours des dernières années, la Direction de la géographie a donné une nouvelle ampleur à son programme de cartographie de l'utilisation des terres au Canada. L'information de base sur l'utilisation actuelle des terres dans les différentes régions du pays a été obtenue à partir de données recueillies sur le terrain, de l'analyse des statistiques, et de l'interprétation des prises de vue aériennes. Par la suite, toutes ces données ont été compilées et reportées sur des cartes à échelles variées en vue de leur impression en couleur.

Cette étude présente un bref aperçu des événements qui ont précédé la mise sur pied de ce programme de cartographie et des buts que poursuit la Direction, donne les raisons qui ont conduit au choix des différentes échelles, et souligne les méthodes et le temps employés dans la préparation des cartes. Elle apporte, en outre, des éclaircissements sur certaines des catégories qui ont posé le plus de difficulté dans l'adaptation de la classification internationale de l'utilisation des terres aux conditions existantes au Canada. Cet ouvrage constituera sans aucun doute un apport à la valeur des cartes de l'utilisation des terres et sera d'un grand intérêt pour ceux qui sont engagés à la réalisation de projets semblables. Enfin, nous espérons qu'il servira de guide ou de manuel à l'étude des cartes sur l'utilisation des terres au fur et à mesure que celles-ci seront publiées.

N. L. Nicholson,
Directeur,
Direction de la géographie.

99173-7—1½

TABLE OF CONTENTS

TABLE DES MATIÈRES

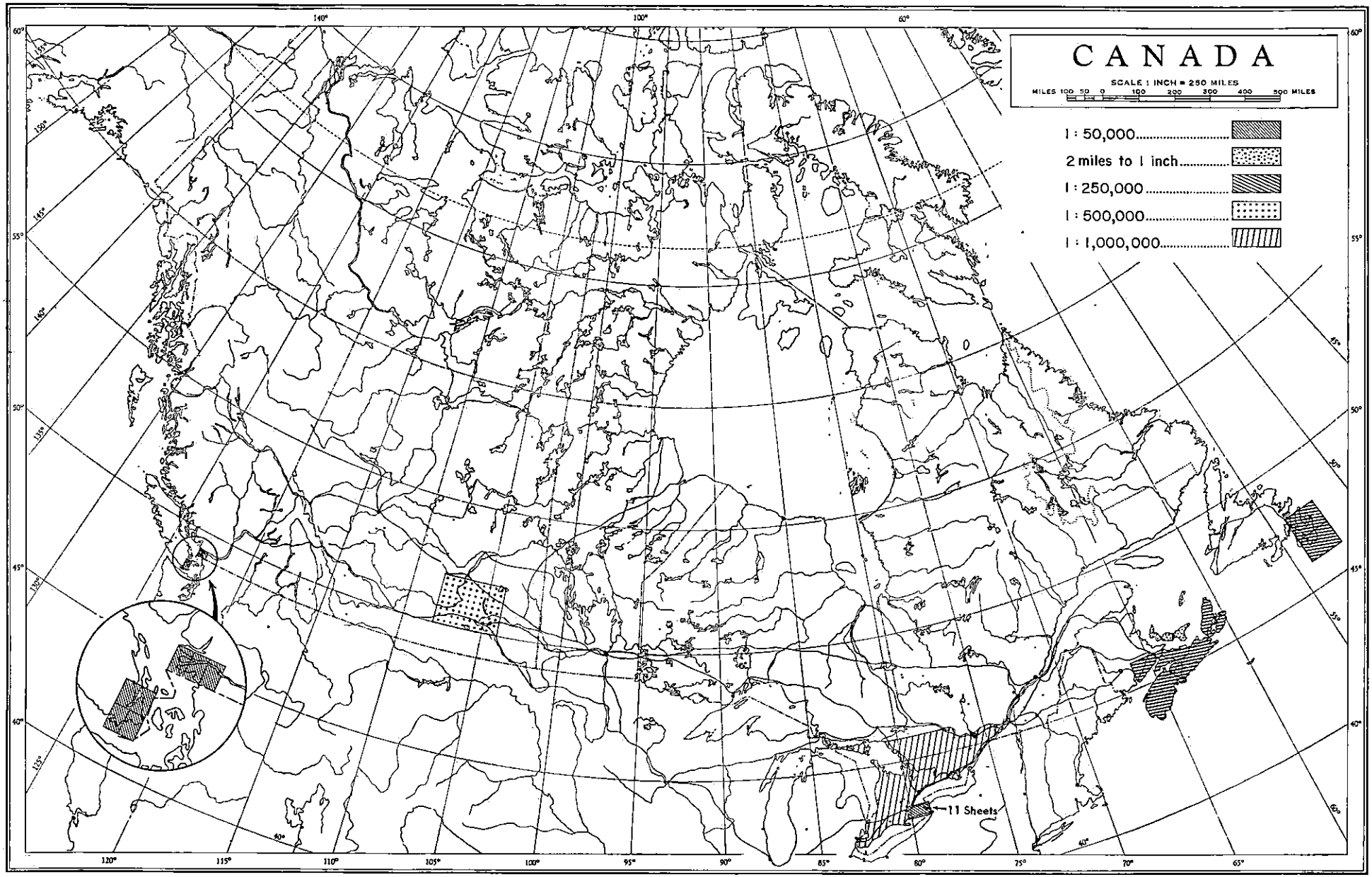

Figure 1. Areas for which land-use mapping was completed or was in progress, 1960.

Étendues cartographiées ou en voie de l'être à la fin de 1960.

CANADIAN LAND-USE MAPPING

INTRODUCTION

For many years, both federal and provincial government agencies have been involved in the production of maps showing the types of soils, geology, topography, and the different kinds of forests in various parts of Canada. Such inventories, together with the Canadian census data, have proved of great value in the planning and development of national growth. However, they achieve their full significance only when studied in the light of the actual land use. The trial and error methods through which much of Canada was settled and developed have contributed to many current land-use problems of both local and national significance. The production of maps showing present day land use will assist greatly in the understanding and solution of such problems, and will provide a valuable aid to the planning of future development. The main emphasis is on maps because there is no other way of showing actual location and distribution of the varying types of land use and any changes proposed will involve changes in the pattern of distribution shown on the map.

The need for an objective, fact-finding approach to land-use problems was recognized in the USA immediately after World War I[1] but the purely objective type of land-use mapping had its earliest precedent in the British Isles. Beginning in 1930 the whole of the United Kingdom was field-mapped in great detail under the direction of Dr. L.D. Stamp, now Professor Emeritus of Social Geography, London School of Economics, University of London. The information was published on the scale of 1 mile to 1 inch and was accompanied by a series of explanatory memoirs. Later, a series of maps on a scale of 10 miles to 1 inch was compiled by generalizing the data from the more detailed sheets. A number of other land-use surveys were undertaken in other parts of the world during the same period,[2] and although the methods varied greatly, the need and purpose of such surveys became widely recognized.

At the 7th General Assembly of the International Geographical Union, held in 1949, a commission was appointed to study the possibility of a world land-use survey. Three years later, the World Land Use Commission presented its first report to the 8th General Assembly; a more extensive report was published for the 9th General Assembly in 1956. Among the conclusions and proposals of the commission are the following:

> "... we consider that present factual knowledge is inadequate to serve as a proper foundation for schemes of improvement and development .... Since all development and redevelopment must obviously start from the present position, we believe that the two immediate and prime essentials are an exact knowledge of the present position and, as far as possible, an understanding of the reasons for that position.
>
> We therefore consider that for all parts of the world there should be a survey of land use together with an interpretation. This involves (a) maps embodying the survey and (b) explanatory memoirs.
>
> We therefore propose a world organization under the auspices of the International Geographical Union to carry out the programme.
>
> The first object of the survey will be to record the present use of land in all parts of the world on a uniform system of classification and notation, with such amplification as may be necessary locally. The Survey will be carried out on the most appropriate scale available to secure accuracy and will be based essentially on field work, together with the interpretation of such materials as air photographs.
>
> The second object of the Survey is to secure the publication of results ... on the scale of 1:1,000,000 (approximately 16 miles to the inch) which it is proposed to publish. It is planned that this series of maps shall eventually cover the whole world."[3]

The World Land Use Commission also agreed on a world land-use classification (see Appendix I) or master key, in order to secure uniformity in the land use categories and colors used on the final maps. Although the master key is sufficient for maps on the 1:1,000,000 scale, it is intended that it should be enlarged according to the needs indicated by local conditions and the scale of maps on which the survey is being carried out. Hence, cropland which appears as brown on the 1:1,000,000 scale, may be subdivided into hay, grain, potatoes etc., on a large-scale map by using various shades of brown.

Canada, as a member of the International Geographical Union, took cognizance of this report and the Geographical Branch began to experiment "in pilot land use surveys in several parts of the country ... by using the sampling method and interpreting larger areas by detailed studies of typical samples."[4]

In the meantime, there was a growing awareness of the need for such an approach from many groups and organizations in Canada. This culminated in the appointment of a Special Committee of the Senate of Canada ... "to consider and report on land use in Canada and what should be done to ensure that our land resources are most effectively utilized for the benefit of the Canadian economy and the Canadian people."[5]

Among the many submissions made to this committee was a brief from the Geographical Branch on land-use mapping surveys, which put forward a specific program for Canada. In its 1959 report, the committee recommended ... "that it be called to the attention of the proper authorities the need of a systematic

land use survey based upon appropriate factors to provide for an economic classification of the land according to its use suitability."[6]

The interest of the federal government in these problems was further evidenced when the Minister of Mines and Technical Surveys made the following statement to the House of Commons Standing Committee on Mines, Forests and Waters:

> "A number of other geographical studies or projects come to my mind, but I should like to dwell on one of them which, I believe, could be of great importance to Canada. This is the undertaking of a land use survey of all Canada.
>
> I also believe that a country like ours, large in size and plentiful in resources as it is, must make the most valuable use of the land available. This is especially true in developing a solid basis for forestry, agriculture and community development. It is particularly apparent where lands which should be in forest are denuded, leading to serious erosion problems. It is also apparent in the rapid depletion of valuable agricultural land for industrial and municipal use. A proper realistic approach to this problem will protect the natural heritage of our land for future generations.
>
> I plan to study the possibility of such a project, which could be undertaken by our Geographical Branch, possibly in co-operation with the provinces. It would supplement the soils, forestry, geological and other resources maps that now cover a major portion of Canada's inhabited land. The land use maps would be presented on scales equivalent to existing topographic maps."[7]

In its 1959 report, this Committee recommended as follows:

> "None the less important are the land use and classification surveys which the Geographical Branch is carrying out. For the geography of the land is constantly changing and in this process of change, development and redevelopment such surveys are vital in providing objective reports of the existing situation from which our national progress can proceed in an orderly fashion. But your Committee is convinced that it would be in the national interest to accelerate this work on a country-wide basis so that we will build up a geographical series of land use maps similar to the series of geological, soils, topographical and forestry maps now in existence. The land use maps should be on scales similar to these other series, ranging from approximately 1 mile to 1 inch to 4 miles to 1 inch in southern Canada, and 8 miles to 1 inch in northern Canada. Such a programme would not only be of service to the people of Canada but would also be of benefit to those who are concerned with the total world picture and are endeavouring to encourage the individual countries to produce such records."[8]

In the implementation of this program, the Geographical Branch has made every effort to follow the recommendation of the World Land Use Commission and yet, at the same time, ensure that the resulting maps and reports would be of maximum benefit to the Canadian people, both from the national point of view, as well as the provincial point of view. Figure 1 shows the progress that has been made by indicating those parts of Canada in which land-use mapping was either completed or in progress at the conclusion of the 1960 field season.

GEOGRAPHICAL BRANCH

SCALES

The World Land Use Commission of the International Geographical Union recommended that land-use maps be published at 1:1,000,000 as this "... is the only scale on which maps are available for all the world and is sufficiently large to present the global picture".[2] In accordance with this recommendation a land-use map of southern Ontario has been published by the Geographical Branch at 1:1,000,000[9]; in addition, land-use maps on several larger scales are being planned, or are in production. Land-use maps of eight Canadian cities on the scale of 1:100,000 were included in the recently published Atlas of Canada.[10] With one exception, future publication is planned on three National Topographic Series scales, the choice of publishing scale depending on the intensity of land use of the area to be mapped. The exception is Prince Edward Island which will be published at 2 miles to 1 inch (1:126,720). This scale permits comparison with the soils map at the same scale and allows a more detailed presentation of the agricultural land-use pattern than would be possible with a smaller scale.

The 1:50,000 scale has been chosen for densely settled areas with complex land-use patterns, and 1:250,000 for more sparsely settled areas where limited generalization of the data will not greatly detract from the value of the final map. The 1:500,000 scale is planned primarily for Western Canada where large areas of similar land use require less generalization.

The number of sheets required to cover a given area is an important point for consideration (Figure 2). There is no denying the advantages of large-scale maps for such areas as the lower Fraser Valley and the Niagara peninsula. However, to achieve a wide coverage quickly much of the country must be mapped at smaller scales. Fortunately, much of Canada lends itself to this treatment without serious loss of detail, thus greatly reducing the number of sheets to be printed.

LEGENDS

As mentioned in the introduction, all land-use legends used by the Geographical Branch are in accordance with the World Land Use Classification (see Appendix 1). Within the major categories a number of sub-categories have been used, particularly in areas with a complex land-use pattern where publication is planned at scales larger than 1:1,000,000.. Table 1 shows a complete list of the Canadian categories in relation to the world land-use classification. Through the use of screens in the printing process (see Figure 3), 23 distinct shades have been derived from 9 basic colors. (Figures 3, 4 and 5 in pocket).

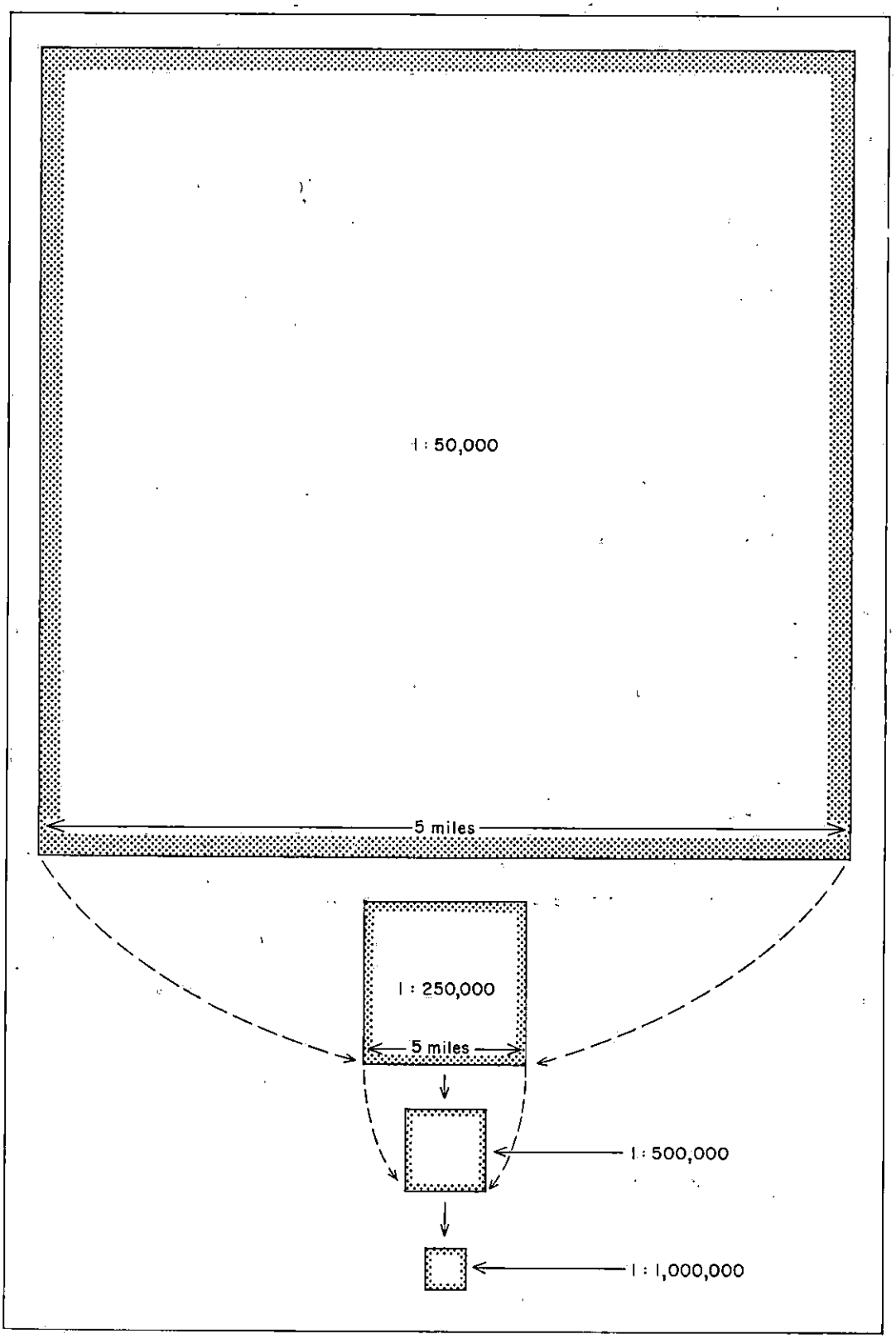

Figure 2. A graphic illustration of the space required to show an area of 25 square miles on maps at various scales.

Dessin graphique montrant l'espace requis aux diverses échelles pour représenter une superficie de 25 milles carrés.

Table 1. World land-use classification and Canadian land use categories

World Land-Use Classification	Canadian Land-Use Legend
Settlements and associated non-agricultural lands (dark and light red)	Urban (red) a. Industrial (dark red) b. Commercial (bright red) c. Residential (medium red) d. Recreational (light red) e. Associated non-agricultural land (pale pink)
Horticulture (deep purple) Tree and other perennial crops (light purple)	Tree Fruits and Horticulture (purple) a. Horticulture (dark purple) b. Vineyards (medium purple) c. Orchards (light purple) d. Other - blueberries, hops, etc. (pale mauve)
Cropland a. Continual and rotation cropping (dark brown) *b. Land rotation (light brown)	Cropland (brown) a. Hay (dark brown) b. Grain (light brown) c. Other - oil seeds, potatoes (medium brown) d. Other - tobacco etc. (medium brown)
Improved permanent pasture - managed or enclosed (light green) Unimproved grazing land a. Used (orange) b. Not used (yellow)	Pasture a. Improved pasture (light green) b. Open grassland - unimproved grazing land, used* (orange) c. Scrub grassland - unimproved grazing land, unused* (yellow)
Woodlands a. Dense (dark green) b. Open (medium green) c. Scrub (olive green) *d. Swamp forests (blue green) e. Cut-over or burnt-over forest areas (green stipple) *f. Forest with subsidiary cultivation (green with brown dots)	Woodlands (green) a. Dense (dark green) b. Open (medium green) c. Scrub (olive green) d. Cut-over and burnt-over (dark green stipple)
Swamps and marshes, fresh- and salt-water, non-forested (blue)	Water (blue) a. Water (blue) b. Swamps and marshes (light blue)
Unproductive land (grey)	Unproductive (grey)

*Categories that do not occur in Canada.

*The term grazing land will be used for the land-use maps of the grazing areas in the prairies and central British Columbia.

Urban

Five urban categories (industrial, commercial, residential, recreational, and associated non-agricultural land) are available for use on the 1:50,000 scale. Because of scale limitations, a combination of the industrial and commercial categories has been found necessary at the smaller scales. The first four categories are self-explanatory. Associated non-agricultural land includes such items as airports, railway marshalling yards, and military camps.

Tree Fruits and Horticulture

Four sub-categories are available under this heading. Orchards and horticulture are the two that occur most commonly in Southern Canada. A separate category has been made for vineyards, an important crop in the Niagara peninsula. One furthern category has been added to distinguish between horticultural specialities in areas where their acreage is significant (e.g. blueberries in Nova Scotia; strawberries in the lower Fraser Valley).

Cropland

Four categories are available. Hay and grain are standard items in the agricultural land-use of most southern Canadian regions. The two additional shades permit the distinction of up to two specialty crops in areas where their acreage is extensive (e.g. potatoes in Prince Edward Island, soybeans and tobacco in southern Ontario.)

In the Prairie Provinces, summer fallow is a major land-use item. However, certain difficulties have arisen in mapping this category elsewhere, and census reports indicate that the area in summer fallow is considerably overstated in many parts of the country. In the Niagara peninsula some townships recorded as much as 8 per cent of their improved acreage in this category in the 1956 census although only negligible acreages of summer fallow were noted during the field investigations. However, the census included within the summer fallow category those fields that were sown to a legume crop such as buckwheat (grain) or clover (hay) with the intention of ploughing it under, as well as areas of open grassland the operator intended to plough later in the season. In all such cases the land has been mapped according to its apparent use. Where fallow land was observed, its previous use was established. In the Atlantic Provinces the summer fallow acreage is negligible and has been ignored. However, in areas where highly detailed field investigations have permitted frequent interviews (e.g. southeastern Vancouver Island) the summer

fallow acreage may be shown as a separate cropland category on the final land-use map.

Pasture

A number of problems have arisen in attempting to map the pasture and grazing land categories according to the definitions provided in the world land-use classification.

Improved Pasture

Improved permanent pasture such as is found in the United Kingdom and Western Europe seldom occurs in Eastern Canada. Although improved pasture is a very significant item in the agricultural land use of this country it is usually managed in rotation with other crops. It is common practice to use hay fields for pasturing livestock after the first hay crop has been cut. As only the primary use is mapped, great care must be taken later in the season in distinguishing hay from pasture. Although it would have been possible to indicate improved pasture by another shade of brown under the "continual and rotation cropland" category it was felt that this would detract from the visual impact of the final map. It was therefore decided to show all improved pasture in the light green assigned to the improved permanent pasture category in the world land-use classification.

Unimproved Grazing Land

According to the world land-use classification this category was established with the vast natural grassland areas of the world primarily in mind. In the prairies of Western Canada and parts of central British Columbia there are large acreages of natural grassland that clearly fit the definition and will be mapped accordingly. In Eastern Canada, however, areas of natural grassland are scarce and it was felt that stony or steeply sloping fields that had been cleared for the purpose of rough grazing should be included in the category, even though such areas return to tree growth when left untended.

At the same time it was realized that one of the most significant factors in Canadian land use was the abandonment or disuse of land formerly under cultivation (e.g. Nova Scotia's improved farmland acreage has decreased by more than 50 per cent since 1901). This trend is widespread not only in rural districts that are agriculturally marginal, but also in more densely settled areas where property adjacent to urban settlements is held for speculative purposes (see Figure 4). It was considered that this problem should be recognized if the final land-use maps were to serve their full purpose. In both rural and suburban districts, such areas of so-called abandoned land typically occur as weedy, run-down hay fields with scattered bush

growth. Although many of these grassland areas are used for occasional livestock grazing, many others are entirely idle. Consequently it was decided that the unimproved grazing land used (orange) and the unimproved grazing land unused (yellow) categories of the world land-use classification should be used to represent these transitional areas on the Canadian land-use maps.

Further problems arose in field mapping the grazing land categories. Short of an interview with the owner it proved difficult, if not impossible, to determine whether or not such land had been used for livestock grazing. Moreover, because the abandoned acreage typically occurs in a large number of small scattered areas it was felt that interviews would prove too time-consuming if the field-mapping program were to proceed with reasonable speed. It was therefore decided that such transitional areas should be classified on a visual basis and the names of the unimproved grazing land categories altered to fit this new concept. Hence the unimproved grazing land used (orange) and unimproved grazing land unused (yellow) will appear in the "open grassland" and "scrub grassland" categories.

"Open grassland" (orange) includes those areas covered with old uncut hay and weeds, and with or without scattered bushes not exceeding 4 feet high. Although such land can be ploughed without extensive clearing in most instances, it has usually remained uncultivated for several years (see Figures 6, 7, 8, 9).

"Scrub grassland" (yellow) includes areas covered with old uncut hay and weeds, and with scattered bushes, most of which are more than 4 feet high. Although the bushes are too scattered to be classified as scrub, they are sufficiently dense to prevent cultivation of the land in its present state (see Figures 10, 11, 12, 13).

In areas with complex land-use patterns, the two grassland categories will be combined on land-use maps published at the smaller scales.

Woodland

The four woodland categories (dense, open, scrub, cut-over/burnt-over) that have been used comply fully with the definitions of the world land use classification. Detailed information for Nova Scotia and Ontario has been readily obtained from recent provincial forest inventory map sheets. The scrub and cut-over/burnt-over categories are mapped as such on the inventory sheets and the dense and open categories have been derived from the canopy density information (less than 25 per cent crown cover is mapped as "open"; more than 25 per cent crown cover is mapped as dense). In the cases of Prince Edward Island and Vancouver Island where provincial forest inventory sheets are not available airphoto interpretation has

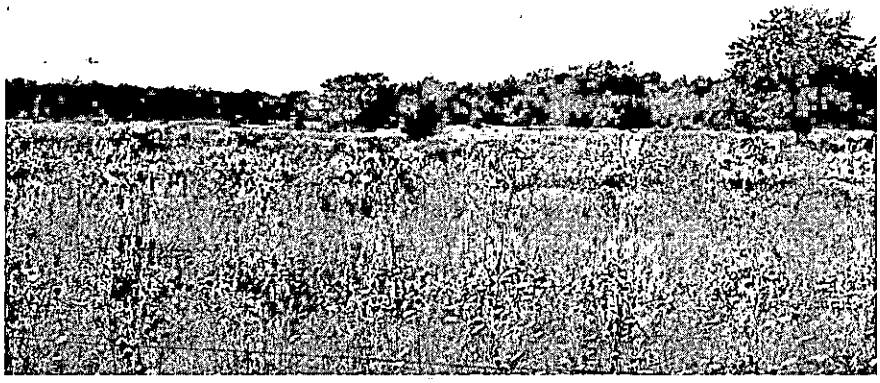

Figure 6

Uncut, weedy hayfields in the Niagara peninsula with low bush growth just beginning to appear.

Champ de la péninsule de Niagara couvert de mauvaises herbes et de foin non coupé. On aperçoit les jeunes arbustes qui commencent à paraître.

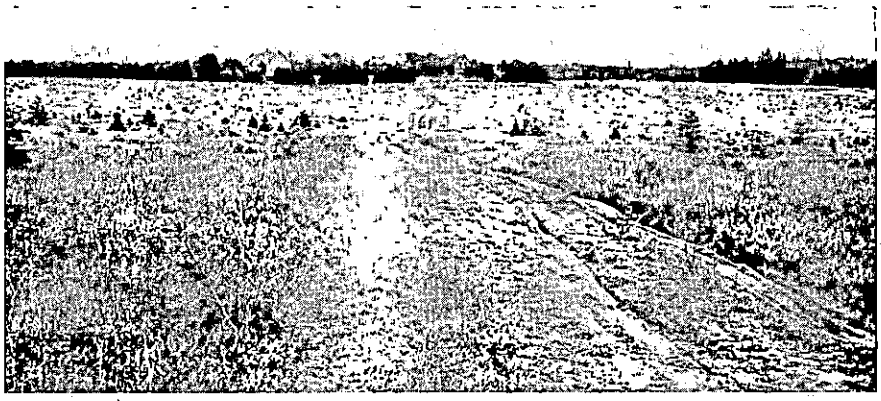

Figure 7

Former hayfield with scattered bush growth not more than 4 feet high, illustrating the most advanced stage in this category.

Champ de foin abandonné maintenant parsemé d'arbustes n'excédant pas quatre pieds de hauteur. Cette photo illustre le stade le plus avancé de cette catégorie.

OPEN GRASSLAND—Types of neglected farmland mapped within the open grassland category.

Prairie découverte—Types de fermes abandonnées classés sous la catégorie de prairie découverte.

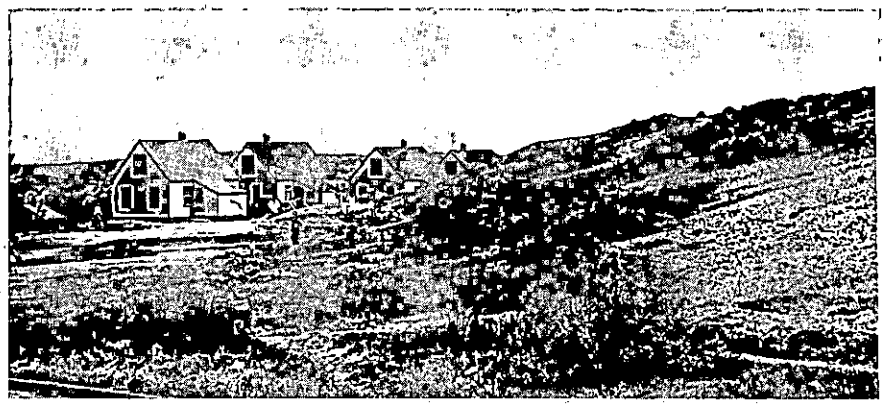

Figure 8

An example of open grassland in the Halifax urban area.

Prairie découverte sise dans la région urbaine de Halifax.

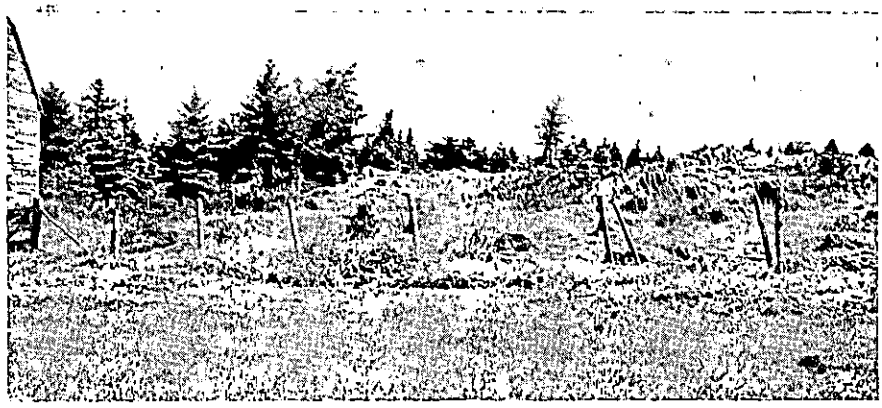

Figure 9

Numerous rock exposures show that the ground was cleared solely for rough pasture.

La présence de nombreuses roches sur ce terrain indique que celui-ci a été déblayé pour servir uniquement de pâturage.

Figure 10

A field in the Niagara peninsula with uncut grass, weeds, and scattered bushes exceeding 4 feet in height, illustrates the least advanced stage in the category.

Champ de la péninsule de Niagara couvert de mauvaises herbes et d'arbustes clairsemés, hauts de plus de quatre pieds. Ce champ représente le stade le moins avancé au sein de cette catégorie.

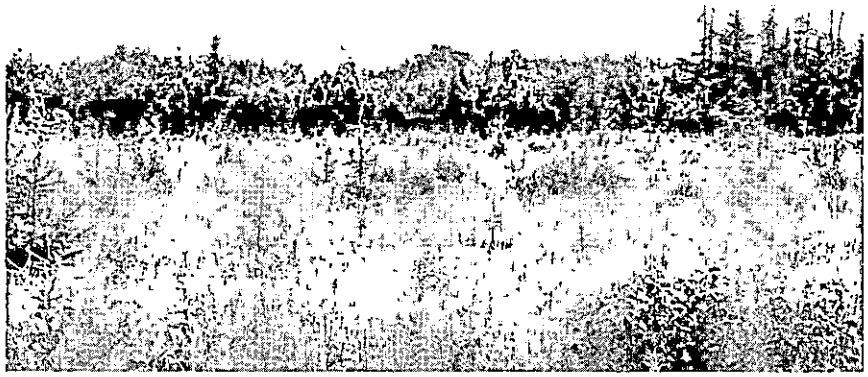

Figure 11

This terrain illustrates the most advanced stage in the category of scrub grassland; bush growth in foreground is much more than 4 feet high but is too scattered to be classified as scrub.

Au premier plan, les arbustes bien que plus de quatre pieds de hauteur sont trop clairsemés pour être classés comme brousse. Ce terrain s'identifie au stade le plus avancé des prairies à brousse.

SCRUB GRASSLAND —Types of unused or abandoned farmland included within the scrub grassland category.

Prairie à brousse—Types de fermes non utilisées ou abandonnées classés sous la catégorie de prairie à brousse.

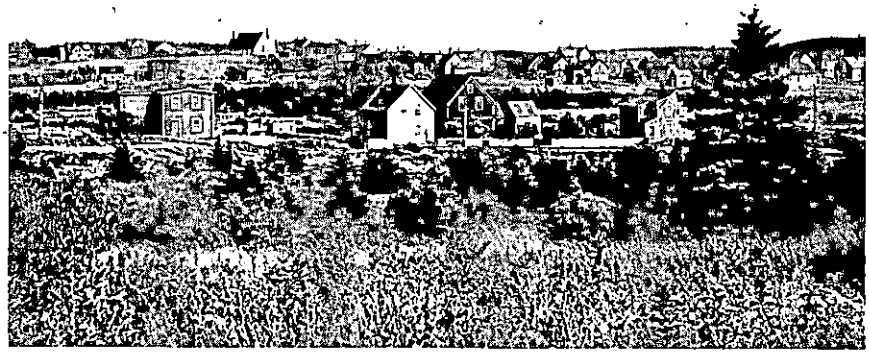

Figure 12

An example of scrub grassland in the Halifax urban area.

Prairie à brousse sise dans la région urbaine de Halifax.

Figure 13

A hillside near Truro, Nova Scotia, included in the scrub grassland category.

Flanc de coteau des environs de Truro, Nouvelle-Écosse, rangé dans la catégorie de prairie à brousse.

been undertaken by branch personnel.

Swamps and Marshes

This category may be readily determined from either the forest inventory map sheets or airphoto interpretation.

Unproductive

This category includes areas of barren rock, barren and heath (e.g. Cape Breton Island), and sand beaches.

Special Boundaries

In order to make the land-use maps more meaningful, a number of special boundaries will also appear on the 1:1,000,000 and 1:50,000 sheets.

The delineation of the principal Indian reserves is especially important. Due to differing cultural factors the land-use pattern on such reserves is usually quite different from the pattern in surrounding areas (see Figure 5).

The demarcation of national and provincial parks, and provincial forest preserves is also important because of the special restrictions on land use, and on timber cutting policy and practice in these areas.

Areas under crown timber licences are indicated in order to enhance the value of the forestry information.

The Prince Edward Island maps will show oyster beds that are leased by the government to private operators for commercial seeding in the shallow bays and river estuaries of the province.

Appropriate symbols may also be added to the 1:50,000 scale land-use maps to indicate specialty items such as poultry farms, fur farms and greenhouses, which are important rural land-use items although they occupy only limited acreages.

METHODS

In its 1956 report the World Land Use Commission stressed the need for completing, as quickly as possible, factual field surveys as the basis for published land-use maps. This policy has been followed by the Geographical Branch in the Atlantic Provinces, the Niagara peninsula, the lower Fraser Valley and

Vancouver Island where publication is planned at 1:50,000, 1:126,720 and 1:250,000.

A field party usually consists of one or two geographers, each travelling in a separate vehicle. To achieve maximum mapping speed, information is recorded by means of symbols on large-scale airphotos and is based on observation with a minimum of personal interviews. Usually no attempt is made to transfer data to smaller scale base maps in the field. This part of the work is done in Ottawa as the material is sent in.

At a publishing scale of 1:500,000 much can be done from airphotos with the aid of photo interpretation keys. It is essential, however, that the airphoto interpretation be followed by traverses and careful field checks in doubtful areas. Although ground observations must be made, less time is required than in detailed field-by-field mapping.

Although Canadian land-use field-mapping is very spotty in distribution it was considered that an effort should be made to publish on the 1:1,000,000 scale. A method was devised for mapping at this scale from statistical data,[11] thereby avoiding the time-consuming tasks of field-mapping, airphoto interpretation, and generalization from the photographs to the final scale. A land-use map at the "million" scale is far removed from the reality of the earth's surface which it represents (see Figure 2). In view of the high degree of generalization necessary in plotting field-mapped data on the 1:1,000,000 scale it was felt that the use of good statistical data in conjunction with other geographical information would produce a similar result more efficiently. It should be remembered however that where this method was used most successfully, field work had been carried out by workers in various disciplines. The results of their work was used in interpreting the statistical data.

Cartographical Procedures

The procedures used in the Geographical Branch are designed to achieve maximum accuracy in the shortest possible time, employing semi-skilled cartographers rather than experienced draftsmen.

A primary requirement is a simple base map produced on a very stable, semi-opaque photographic plastic called cronaflex. As original National Topographic Series negatives are used, it is possible to eliminate vegetation and contour lines, both of which are confusing and unnecessary at this stage of compilation.

In the preparation for publication at the larger scales (1:50,000, 1:126,720 and 1:250,000), the first step is the transfer of field data, in color, to 1:50,000 scale maps. Later steps are facilitated by the

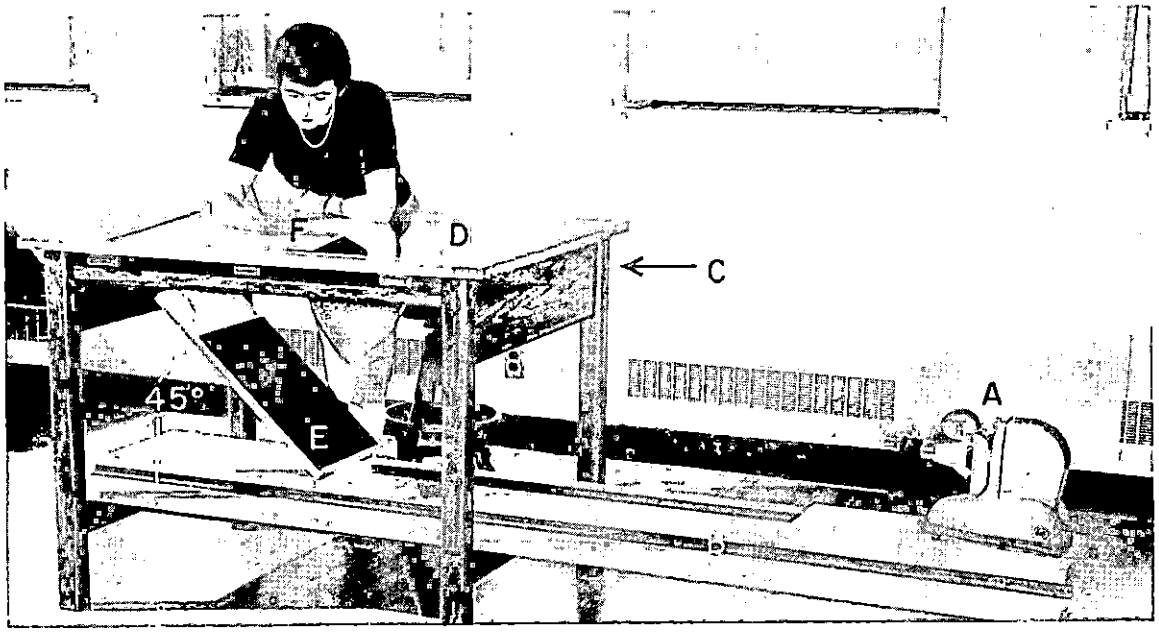

Figure 14. Reflex map reducer. (A) 35 mm. projector with color slide of map to be reduced. The projector is mounted on a movable platform that slides on track (B) for variation of scale. (C) Light-table with clear glass top (D). (E) Mirror on hinged support set at 45° angle to reflect the projected image onto the semi-opaque cronaflex base map (F).
(Patent applied for.)

Appareil de réduction de cartes de type "reflex". (A) Projecteur 35 mm. avec diapositive en couleur de la carte à réduire. Le projecteur est placé sur une plate-forme amovible, laquelle est installée sur une piste, et qui peut être déplacée (B) selon l'échelle. (C) Table lumineuse recouverte (D) d'une vitre claire. (E) Miroir placé à un angle de 45 degrés pour réfléchir l'image sur la carte de base semi-opaque, fabriquée de matériel "cronaflex" (F).
(Demande de brevets déposée.)

use of greatly contrasting colors. For publishing scales of 1:126,720 and 1:250,000 further reduction and generalization of the 1:50,000 manuscript map are necessary. To achieve this the map is photographed on a 2" x 2" color slide (Ektachrome 127) which is projected onto the cronaflex base in a reflex map reducer (Figure 14). The resulting map is a reduction of the original 1:50,000 map with whatever generalization is needed to meet such mechanical requirements as minimum size of colored area, scribing and color registration.

In order to expedite the final printing process, the first stages of color separation are carried out by Geographical Branch personnel. The land-use categories are transferred to a number of vandyke prints of the original black-line base (no more than three categories per print) using contrasting colors, such as red, green and blue. This process also provides a valuable check on the boundaries of the land-use categories and results in a series of maps showing the distribution of individual categories that prove useful in subsequent analysis and research.

Less generalization is required in mapping the prairies. Consequently these areas are being mapped at 1:500,000, and the land-use data transferred directly from the photos to the printing scale. The procedure followed in producing the black-line base and the colored vandyke maps is the same as for other scales.

Each major step in the mapping procedure is checked three times. This is time-consuming but results in a high degree of accuracy and a minimum of error at the color-proof stage. Experience to date indicates that the following man-working days are needed in the office to complete the mapping procedures described above.

TABLE 2

Number of man-working days — land-use mapping

	1:50,000	1:250,000	1:500,000
Compilation	20	60	90
Black line	8	8	8
Coloring vandykes	20	20	20
Total	48	88	118

SUMMARY

With the rapid development and redevelopment of Canadian land resources since World War II the need for accurate land-use information has become widely recognized. In response to this need the Geographical Branch has embarked on a land-use mapping program. Through direct field mapping, statistical analysis and airphoto interpretation, detailed information has been collected and compiled for a wide variety of Canadian areas in preparation for the publication of colored land-use maps.

In the interests of international uniformity, every effort has been made to adhere to the classification established by the World Land Use Commission of the International Geographical Union. Although certain difficulties have arisen in adapting the world land-use classification to Canadian conditions (particularly in the grazing land categories), its major categories and colors have been closely followed.

At the present time, map publication is proceeding at five different scales. The first published map sheet (Land Use of Southern Ontario) is at 1:1,000,000 in accordance with the recommendations of the World Land Use Commission. Where detailed field mapping has been undertaken, publication is planned at

one or other of four larger scales (1:50,000, 1:126,720, 1:250,000, and 1:500,000) depending on the complexity of the land-use pattern.

Various methods have been devised to expedite the compilation of the land-use information. The reflex map reducer, a device developed in the branch, has greatly shortened the time required in generalizing field data to the final printing scale. The execution of the preliminary stages of color separation by branch personnel has accelerated the final printing process. Land-use maps of Nova Scotia, Prince Edward Island, the Niagara peninsula, south-central Saskatchewan, and the lower Fraser Valley are now in the final stages of preparation. It is planned that descriptive regional reports will eventually accompany the printed land-use maps.

Appendix I

THE WORLD LAND-USE CLASSIFICATION

The following description is extracted from the Report of the Commission on World Land Use Survey for the period 1949-1952. [3]

1. Settlements and Associated Non-Agricultural Lands (dark and light red)

Whilst on the 1:1,000,000 map it will not be possible to do more than indicate by one color (dark red) the areas covered by cities and towns, in industrial and developed countries where large-scale maps are available it may be desirable to distinguish between different types of settlement on the survey maps. According to need, local classifications may be used to distinguish between different phases of urban land use of functional zones.

Extensive surface mining areas including land devastated owing to mine operations should be indicated in light red and explained in accompanying notes.

2. Horticulture (deep purple)

This category should be used to include all intensive cultivation of vegetables and small fruits (as distinguished from tree fruits). The category, therefore, covers such agriculture as truck farming in America, market gardening in Britain and other European countries, as well as the production from larger gardens and allotments, whether the crops are grown for sale or not. Where vegetables are grown in rotation with ordinary farm crops the area should be recorded as category 4, cropland. This category of horti-

culture also includes the "garden cultivation" of tropical villages - for example, in Africa, Malaya, etc., where the village compound usually includes mixed vegetables such as yams, potatoes, with fruit and sometimes with small numbers of palm trees, cocoa trees, bananas, etc.

3. Tree and Other Perennial Crops (light purple)

A very wide range is covered by this category and the land to be included will differ very much from one part of the world to another, so that in each different survey, or on each survey sheet, the crops concerned should be named or indicated by means of symbols. In the tropics there will be included, amongst others, rubber plantations, cocoa plantations, coffee plantations, tea gardens, palm oil plantations, coconut groves, citrus orchards, cinchona plantations and banana plantations. In middle latitudes the category will include citrus orchards, orchards of deciduous fruits - such as apples, pears, plums, cherries, peaches, apricots and figs - also olive groves and vineyards of different types. The category should also be used to include the groves of "cork oaks" (as in Portugal) and also such rare cases as plantations of pine trees grown especially for the production of resins and turpentine. The category should also be used to include such perennial crops or cultivations grown without rotation as sisal and manila hemp, but sugar cane or alfalfa, although grown on the same piece of land for a number of years, should be recorded as growing on cropland.

4. Cropland

(a) Continual and rotation cropping (dark brown)
(b) Land rotation (light brown)

The cropland will include both plowed land and land cultivated by hand. By continual crops we mean, for example, rice, which is often the only crop grown year after year on the same land, also sugar cane and such mono-cultural crops as wheat and corn. By rotation crops we include those grown in a fixed or variable rotation, including fodder grass, clover and alfalfa, which may occupy the land for two or three years. Crop rotation includes "current fallows", that is land which is rested for a short period (not exceeding three years). All the above are to be shown in dark brown.

By land rotation we understand the system whereby cultivation is carried on for a few years and then the land allowed to rest perhaps for a considerable period before the scrub or grass which grows up is again cleared and the land recultivated. In such areas, however, the farms or settlements from which cultivation takes place are fixed and the cultivation of the land is the dominant occupation. The secondary growth

which is allowed to appear has little or no economic importance. This is in contrast to the forest with subsidiary cultivation mentioned later.

5. Improved Permanent Pasture (Managed or Enclosed) (light green)

This is a type of land use well understood in countries like New Zealand and Britain where controlled grazing is carried on in small enclosed fields the grass being managed by manuring, sometimes by reseeding, by liming, or in other ways. Often the grasses, including clovers, have been introduced so that the pasture is not "natural". Some land of this sort is grazed; other is cut for hay or dried grass. In other countries, such as the United States, this category of land is less distinctive but would include land such as the intensively stocked grasslands of the dairy belts.

6. Unimproved Grazing Land (orange and yellow)

This may be described as extensive pasture or range land. It may be enclosed in large units but is not as a rule in small fields. It is not fertilized or deliberately manured though it may be periodically burnt over. The vegetation is that which is native to the locality although the characteristics of the vegetation have often been modified by grazing or occasionally by the introduction of non-local plants.

A great range of vegetation is included, from tropical savanna to arctic tundra, and as far as possible the type of vegetation should be described on the map or accompanying notes. For example, this category will include savanna (or grassland with scattered trees where the grass is dominant), tropical grassland, (e.g. Llanos), steppe land, dry pampas, and short grass prairie. The category will also include such range lands as bunch grass and sage brush and creosote bush, as well as the vegetation of the High Veld and the Karoo of South Africa. It will include the heather moorlands and heath lands and grass moorlands of Europe. It is clear that special care must be taken to distinguish these very varied types.

There are many areas of such land which at present are not used in different parts of the world though they differ but little from those which are used for grazing. This difference should determine the color, orange for used and yellow for not used.

7. Woodlands (different shades of green)

Forest and woodland will be found to differ very greatly from one part of the world to another. The main categories suggested refer to the morphological character of the forest, independently of the age of the tree.

(a) Dense. Forests where the crowns of the trees are touching (dark green)

(b) Open. Where the crowns of the trees do not touch and the land between is occupied by grass or other ground vegetation. Where, of course, the trees are very sparse such land comes into category 6 (Grazing land) (medium green)

(c) Scrub. Is used to designate vegetation such as the maquis of Europe, chaparral of North America, mallee and mulga of Australia and the acacia thorn scrub of Africa and India (olive green)

(d) Swamp forests, both fresh water and tidal (mangrove) (blue green)

(e) Cut-over or burnt-over forest areas not yet fully reclothed. (stippled with the green of the respective color)

(f) Forest with subsidiary cultivation (green with brown dots)

(i) Shifting cultivation, where patches of land are recleared for cultivation from time to time, usually but not always, by wandering tribes.

(ii) Forest-crop economy. Somewhat similar is the system, for example in parts of eastern Canada, where holdings consist mainly of woodland but where some cultivation is carried on subsidiary to the working and management by replanting of the forest land.

The type of forest, whether dense, open, scrub, can usually be distinguished by symbols into the following: (e) evergreen broad-leaved, (sd) semi-deciduous, (d) deciduous, (c) coniferous, (m) mixed coniferous and deciduous. In addition, in many parts of the world it should be possible to name the dominant species or groups of trees and indicate the type of undergrowth. It may also be possible to indicate in broad outline where forest land is being commercially exploited.

8. Swamps and Marshes (Fresh-and Salt-Water, Non-forested) (blue)

9. Unproductive Land (grey)

A great variety of land is also included in this category. Considered in relation to land use it appears bare, and though it may support lowly forms of plant life is essentially unproductive. Barren mountains, rocky and sandy deserts, moving sand dunes, salt flats, and icefields are examples. Potential use, such as land capable of irrigation, may be indicated and considered in the memoir but it is the present position which should be mapped.

Important Note

Where land falls into two categories, as olive groves with cultivation of wheat between the trees, this should be indicated by a combination of the appropriate colors.

Appendix II

PAPERS ON LAND USE BY GEOGRAPHICAL BRANCH STAFF

Atlas of Canada. Geog. Br., Dept. Mines and Tech. Surv., Ottawa.
1957 : Plate 100. Quebec City land use, 1955; Montreal land use, 1955.
Plate 101. Ottawa land use, 1955; Toronto land use, 1955.
Plate 102. Winnipeg land use, 1955; Edmonton land use, 1956.
Plate 103. Vancouver land use, 1955; Victoria land use, 1955.
Plate S 1 . Land use of Southern Ontario, 1960.

Cornwall, Brooke
1956 : A land use reconnaissance of the Annapolis-Cornwallis Valley, Nova Scotia. Geog. Bull. 9, 22-51.

Forward, C.N. and Raymond C.W.
1959 : Small-scale land use mapping from statistical data. Econ. Geog. v. 35, no. 4, 315-321.

Nicholson, N.L.
1955 : Rural settlement and land use in the New Glasgow region. Geog. Bull. 7, 38-64.

1957 : Land use mapping surveys (a brief). in Proc. Special Committee of the Senate on land use in Canada, December 12.

1959 : Land use mapping in Canada. in Proc. IGU Regional Conference in Japan 1957, 564-570.

Raymond, C.W.
1960 : Agricultural land use in the upper Saint John River Valley, New Brunswick. Geog. Bull. 15, 65-83.

Reeds, Lloyd, G.
1954 : Land classification as part of a geographical survey of the Avalon Peninsula of Newfoundland. Geog. Bull. 5, 58-78.

Watson, J. Wreford
1952 : Land use surveys in Canada, in Proc. 8th Gen. Assembly and 17th Int. Geog. Congr. IGU, Washington, D.C., 182, 184.

Weir, Thomas R.
1953 : The physical basis of ranching in the Interior Plateau of British Columbia. Geog. Bull. 3, 1-22.

1955 : Ranching in the Southern Interior Plateau of British Columbia. Geog. Br., Dept. Mines & Tech. Surv., Ottawa, Mem. 4.

1956 : Land use and population characteristics of central Winnipeg. Geog. Bull. 9, 5-21.

Wood, Harold, A.
1956 : The St. Lawrence Seaway and agricultural geography in the Cornwall-Cardinal area, Ontario. Geog. Bull. 9, 74-98.

REFERENCES

1. Land Classification in the United States. National Res. Bd., Washington, 1941.

2. Proc. of the Special Committee of the Senate on Land Use in Canada, December 12, 1957.

3. Report of the Commission on World Land Use Survey for the period 1949-1952, International Geographical Union, in cooperation with UNESCO, Worcester, 1952.

4. Watson, J. Wreford
1952 : Land use surveys in Canada. Proc. 8th Gen. Assembly and 17th Int. Geog. Congr. IGU, Washington, D.C. p. 182, 184.

See also:
Nicholson, N.L.
1959 : Land use mapping in Canada. Proc. IGU Regional Conference in Japan, Tokyo, p. 564-570.

5. Debates of the Senate, February 17, 1959, p. 163.

6. Debates of the Senate, Report of the Special Committee on Land Use, July 16, 1959 (Appendix), p. 1086

7. House of Commons, Standing Committee on Mines, Forests and Waters, Minutes of Proceedings and Evidence, no. 14, July 14, 1958 p. 384.

8. House of Commons, Standing Committee on Mines, Forests and Waters, Minutes of Proceedings, no. 25, May 25, 1959, p. 721.

9. Atlas of Canada. Geog. Br., Mines and Tech. Surv., Ottawa, 1957. Plate S 1. Land Use of Southern Ontario (1960).

10. Atlas of Canada. Geog. Br., Mines and Tech. Surv., Ottawa, 1957. Plates 100, 101, 102, 103.

11. Forward, C.N. and Raymond, C.W.
1959 : Small-scale land use mapping from statistical data. Econ. Geog. v. 35, no. 4, 315-321.