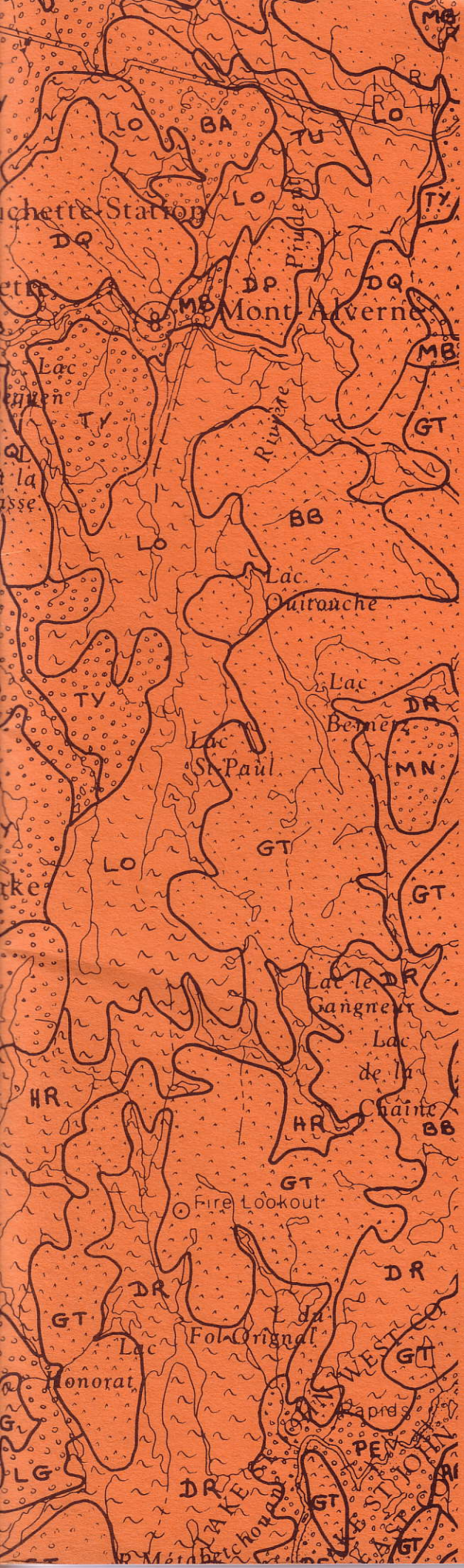

GUIDELINES FOR BIO-PHYSICAL LAND CLASSIFICATION

For classification of forest lands and associated wildlands

DEPARTMENT OF FISHERIES AND FORESTRY
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GUIDELINES FOR BIO-PHYSICAL LAND CLASSIFICATION

For Classification of Forest Lands
and Associated Wildlands

A progress report based on results of Bio-physical
Land Classification pilot projects and discussions of
Subcommittee on Bio-physical Land Classification
National Committee on Forest Land

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CONTENTS

PREFACE

These Guidelines are a revision of the "Outline of Bio-physical Land Classification - Guidelines for Pilot Studies" dated June 1967.

This report is a summary of the basic agreements on classification techniques and procedures that have developed following meetings in 1968 with participants in the Bio-physical Land Classification Pilot Projects, and the meetings of the Sub-committee on Bio-physical Land Classification in Victoria and Winnipeg in 1967, and at Laval University Montmorency Center in 1969.

The pilot studies undertaken during the summers of 1967 and 1968 provided the opportunity to modify the 1967 guidelines on the basis of experience in a variety of landscapes throughout Canada. Classification standards for the description of several bio-physical features have been left open for the present. National guidelines, or standards that will meet regional requirements, will have to be developed as the field program progresses.

Many persons have assisted in the preparation of these "Guidelines", and grateful thanks are extended to all of them.

The major contributors in the various pilot studies are:*

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* See Progress Report, Bio-physical Land Classification Pilot Projects, Canada Land Inventory, ARDA, April 1968.

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GUIDELINES FOR BIO-PHYSICAL LAND CLASSIFICATION

For Classification of Forest Land
and Associated Wildlands

I. INTRODUCTION

The terms of reference of the Subcommittee on Bio-physical Land Classification are:

(1) To examine and review systems of land classification developed and used at national and regional levels.

(2) To present recommendations to the National Committee on Forest Land concerning a suitable physical land classification, of a reconnaissance nature, that will provide a base from which lands can be classified as to their use for Forestry, Agriculture, Recreation, Wildlife and Water Yields.

At recent workshop meetings it was concluded that the term "Wildlands" was subject to misinterpretation both from administrative and technical points of view. It was suggested that the term "Bio-physical Land Classification" be adopted in place of the term "Wildland Classification".

The proposed Bio-physical Land Classification, primarily of a reconnaissance nature, will initially be applied and tested in large, unsettled areas of forest and associated "wildlands". These are the areas in Canada in which very little basic ecological knowledge is available. Many single-resource studies or surveys may have been completed in these areas but overall land resource surveys have not been attempted.

Discussions at subcommittee meetings have led to the general agreement that a land classification that begins with a broad areal appraisal of land resources and provides a summary of data that sets the stage for more detailed work on those areas that warrant closer attention, is the most reasonable and practical one to pursue in a country as large as Canada.

Although emphasis throughout the Guidelines is placed on land patterns and groupings of characteristics for broad land planning, it is clear that more detailed mapping and descriptions can be undertaken, when and if necessary, using the information included in the basic reconnaissance classification framework and accompanying summaries of physical data. (See Part V of this report for examples.)

The following discussions and descriptions are presented as first approximations and they are not to be regarded as inflexible standards. Revisions and additions to regional descriptions of various features will be made as the testing and application of the "Guidelines" continues.

II. GENERAL AIMS AND PROCEDURES

The aim of the present Bio-physical Land Classification projects is to differentiate and classify ecologically-significant segments of the land surface, rapidly and at a small scale (reconnaissance survey); it is to satisfy the need for an initial overview and inventory of forest land and associated wildland resources. This inventory will serve as the ecological basis for land use planning involving future management of lands for forestry, agriculture, recreation, wildlife and water yields.

A Bio-physical Land Inventory that is expected to cover large areas quickly will have to rely on the use of airphotos and airphoto interpretation techniques combined with supporting

field checks. This approach eliminates the possibilities of mapping in detail certain attributes of the soil and vegetation components of the landscape. Emphasis is placed on the classification and mapping of patterns of soil, landform, vegetation and water.

The combination of field observations with airphoto interpretation gives rise to specific problems and adjustments. The total number of field investigations is considerably less than in a conventional survey. The value of each individual field observation is much greater; therefore both its choice and location, and its description and classification are of more critical nature (Vink, 1964). Field investigations in land surveys using airphoto interpretation are never carried out in an absolutely regular pattern; also the size and number of the sample areas selected depends largely on the specific characteristics of the project and the morphology of the terrain.

It is assumed that, in initiating surveys in new areas all available land resource data (soils, climate, vegetation, geology and related subjects) will be studied. It is strongly recommended that pre-field airphoto interpretation be undertaken. Major breaks in the land surface can be delineated, the types and size of contrasting areas of land can be estimated, and points and transects in which field sampling should be initiated can be selected.

III. CLASSIFICATION AND MAPPING UNITS AND LEVELS OF GENERALIZATION

The discussions of the Pilot Projects leaders at Edmonton and Quebec workshops have led to the acceptance of the following terminology, definitions, levels of classification and basic frame of reference.

LEVEL	UNITS OF CLASSIFICATION	PRACTICABLE SCALE OF MAPPING
Level 1	Land Region	1:1,000,000 to 1:3,000,000 or smaller
Level 2	Land District	1:500,000 to 1:1,000,000
Level 3	Land System	1:125,000 (on occasion up to 1:250,000 if landscape pattern permits)
Level 4	Land Type	1:10,000 - 1:20,000

The Land Region (Level 1)

Land Region is presently defined as an area of land characterized by a distinctive regional climate as expressed by vegetation. The Land Region is usually of large areal extent and is inevitably more or less heterogeneous. It is often an aggregation of several distinctive contiguous landscapes.

The climatic information necessary to classify these regions does not exist at present throughout most of Canada. In addition we are not always certain of which ranges, extremes or averages in climatic data are of significance for the various management uses foreseen. In some areas, therefore, investigators may have to rely on gross form or major physiographic variations (and the implied variations in associated climate) to obtain a useful framework of "regional differences". The importance of basic ecological and climatic regions is recognized, but the absence of information needed to develop a regional framework using any one criterion or group of criteria precludes the formulation of a set of national guidelines at this time.

Land regions, as envisaged, are of such a size that they can be mapped conveniently at scales between 1:1,000,000 to 1:3,000,000, or smaller.

The Land District (Level 2)

The Land District is comparable to the "Site District" of Hills (1959), and is defined as an area of land characterized by a distinctive pattern of relief, geology, geomorphology and associated regional vegetation. The Land District is a subdivision of the Land Region based primarily on the separation of major physiographic and/or geologic patterns which characterize the region as a whole. Land Districts have a common pattern of relief, structure or comparable geomorphic evolution.

Land Districts can be conveniently portrayed on maps at scales from 1:500,000 to 1:1,000,000.

Units at levels 1 and 2 have not been described nor mapped in all the pilot projects undertaken. It is evident that in many areas meaningful boundaries will be developed only after the study of interrelationships and patterns at levels 3 and 4 are documented and understood.

The Land System (Level 3)

The Land System is presently defined as an area of land throughout which there is a recurring pattern of landforms, soils and vegetation. This is similar to the Australian definition of a Land System described by Christian (1958). An example of a Land System would be "a rolling, shallow, till plain overlying granite bedrock, characterized by Podzol soils and a yellow birch - balsam fir forest cover". (See also the examples included in Part V of this report).

The majority of the pilot studies have indicated that a mapping scale of 1:125,000 is the most useful one for reconnaissance mapping. There is a possibility that Land Systems could be mapped at a scale of 1:250,000 where the complexity of the glaciated landscape is not a limiting factor.

System Level -- the primary operating level which will provide a preliminary overview of the bio-physical resources of the region. The omission of land type boundaries does not eliminate the need to describe clearly the characteristics and distribution of land types within the geographic patterns of Land Systems. The variety and proportional distribution of land types within each Land System, therefore, should be estimated, described, and summarized in cross section or block diagrams and accompanying tables (See Section V). This information on land types can be used for more detailed surveys of some portions of the region for specific resource management problems whenever the need arises.

The Land System is a complex mapping unit - a broad subdivision of the landscape identifiable and mappable from airphotos primarily as pattern of landforms and vegetation. Within land systems the soil and vegetation are heterogeneous, but repeated distinctive patterns can be identified and related to patterns of landforms. Landforms are areas of land, or topographic features, that are defined in terms of their slopes and slope patterns, the materials that produce the relief, and wherever possible, in terms of their mode of origin. Landforms provide the framework to which patterns and changes in vegetation and soils can be geographically related.

2. DESCRIPTION AND CLASSIFICATION OF FEATURES OF LANDFORMS (LEVEL 3)

It is proposed that the landform and landform patterns be classified and separated on the basis of the following characteristics:

(a) Mode of origin and/or deposition of landforms
(b) Materials of landforms described in terms of:
- texture
- thickness of deposit
- general chemical and mineralogical composition
- compaction of materials

In keeping with the purpose and aims of the Bio-physical Land Classification of forest and related wildlands, it is clear that the Land System will be the working level in most instances, and it is at this level that we should concentrate our present efforts. Land divisions at higher levels will be developed regionally or nationally as the need arises.

The Land Type (Level 4)

The Land Type is presently defined as an area of land, on a particular parent material, having a fairly homogeneous combination of soil (at a level corresponding to the Soil Series) and chronosequence of vegetation. An example of a land type would be "a well drained portion of a gravelly outwash terrace with an Orthic Dystric Brunisol soil supporting lodgepole pine-Vaccinium scoparium vegetation". (See also illustrations in Section V of this report).

The Land Type is the basic unit for which specific use capability ratings will be made.

Land Types are areas of land that can be most readily delineated at scales ranging from 1:10,000 - 1:20,000. In arid areas some land types may be mapped at scales of 1:30,000 to 1:60,000.

IV. GUIDELINES FOR DESCRIPTION AND CLASSIFICATION OF FEATURES OF LAND SYSTEMS (LEVEL 3) AND LAND TYPES (LEVEL 4)

1. INTRODUCTION

The mapping program of the Bio-physical Land Classification will not be carried out at the detailed level of the land type units (Level 4). The present survey will focus on the Land

(c) Topography and relative relief of landforms.

A. Mode of Origin and/or Deposition of Landforms

Considerable discussion has centred on the pros and cons of including a reference to the genesis and glacial history of the landforms in their definition. Difficulties in sorting out the glacial history in some areas have led to a rejection of landform origin as being of any use; but on the other hand, in many areas of Canada the incorporation of an understanding of the development of the landscape and its deposits has been most valuable in mapping large, inaccessible areas. The point is that in using airphotos and airphoto interpretation a knowledge of landform origin permits a prediction of landforms and materials that may be in the vicinity (Lacate 1966, Kowall and Runka 1968). Underlying the definition of landforms which includes origin is the element of prediction; that by knowing about the origin of a unit, one may make predictions about the geographically associated parts within the pattern under study, and about adjacent patterns that fit into the genetic picture of the area (MEXE Report No. 940, 1966).

In areas where little information is available concerning geomorphology then the obvious approach is to describe such areas in general "topographic or terrain" terms; though this should be a temporary measure to be used until new knowledge or new surveys become available.

The following list and grouping of landforms* is one example of a classification of landforms that could be developed at a regional level, and subsequently incorporated into a national set of guidelines. The Geological Survey of Canada

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* Original draft prepared by R.J. Fulton and J.G. Fyles, Department of Energy, Mines and Resources.

has indicated that regional mapping of forest lands will be one of its major priorities, and a more comprehensive set of guidelines should be available in the near future following their review of national and regional requirements.

(i) Post Glacial

STREAM DEPOSITS -

- Alluvial Terrace and Floodplain Deposit: sand, gravel, silt, minor clay and organic material; includes various features of modern floodplains including deltas.
- Fan deposit: poorly sorted gravel, sand, silt and clay; (fine materials generally restricted to gently sloping toe of fan); in a fan shaped deposit.

LAKE DEPOSITS - deposits forming in present day lakes exclusive of fans and deltas (restricted to shore deposits).

- Beach Complex: mainly sand and gravel; includes various beach features such as spits, bars, wave cut benches, etc.

WIND DEPOSITS - material that has been transported and deposited by the wind.

- Silt: silt and fine-grained sand; forms a mantle of uniform thickness; generally termed loess; mapped where more than 5 feet thick (show as pattern where thinner).
- Sand: medium and fine-grained sand; may be duned or form a mantle of uniform thickness; mapped where more than 5 feet thick (show as pattern where thinner).

ORGANIC DEPOSITS - type(s) should be specified (See Section 5 on Wetland Classification for examples).

LANDSLIDE DEPOSITS - materials deposited by large scale mass movements; slide deposits generally lie at or near the foot of the scar from which the material moved.

- Bedrock: blocks and rubble in finer matrix of crushed rock; ridged and hummocky form-slide involving consolidated rock.
- Unconsolidated: gravel, sand, silt, clay or mixture depending on source; hummocky or ridged form-slide involving unconsolidated material.

SLOPE DEPOSITS - materials deposited by various processes of mass movement (on a small scale contrasted with landslides).

COLLUVIUM - loose material accumulated on the surface of other unconsolidated deposits by various processes of mass movement; same general texture as underlying deposits but primary structure obliterated and fines often removed.

TALUS - angular rubble accumulated as a mantle on bedrock or as a cone or fan at the foot of a steep bedrock slope.

(ii) Glacial

GLACIAL LAKE DEPOSITS - material deposited in lakes resulting directly or indirectly from the presence of a glacier (ice dam or tilting due to isostatic depression).

- Hummocky: silt, clay and fine-grained sand; hummocky, ridged and kettled; formed by melting of glacier buried by lacustrine deposit.
- Thick: silt, clay and fine-grained sand; (more than 10' thick), flat to gently rolling surface.
- Veneer: silt, clay and fine-grained sand; (less than 10' thick), too thin to mask underlying topography.
- Beach Complex: mainly gravel and sand; includes various beach and related features.
- Wash: gravel, sand, and boulders; veneer of debris developed by washing action of glacial lake (show as

pattern on underlying deposit).

GLACIAL FLUVIAL DEPOSITS - gravel and sand deposited by glacial meltwater or washed into juxtaposition with ice from an ice-free area.

- Hummocky: irregular hummocky, ridged and kettled topography; includes kames, kame and kettle, eskers, etc.; fluvial material deposited on, within, under or against ice (symbol may be used to show individual esker ridge or kames).
- Valley-wall Terrace: bench of glacio-fluvial material deposited in a position requiring ice on one or more sides for deposition (kame terrace).
- Kettled Terrace Deposit: gravel and sand; flat surfaced but containing closed depressions.
- Level Terrace Deposit: gravel and sand; flat surfaced benches above present river level but not inferred to have been deposited against ice (as contrasted with valley-wall terrace).
- Rill Complex: lag gravel, channel-bottom gravel, areas of unmodified till, small pockets of backwater silt (in general areas of glacial till washed and channelled by meltwater).

GLACIAL TILL DEPOSITS - materials deposited by the direct action of ice; largely till but minor areas of gravel and sand may also be present.

- Drumlinoid: characterized by streamlined and linear features.
- Hummocky and Ridged: characterized by sharp ridges, hummocks and kettles.
- Undifferentiated Drift: areas without the distinguishing features mentioned above.
- Thin Drift: thin till, topographic form controlled by underlying bedrock; may include up to 25% outcrop.

(iii) Marine Deposits

- Marine plains, terraces, veneer deposits, lag deposits, etc.
- Associated spits, bars, deltas, tidal flats.
- Glacio-marine deposits, lag deposits.

(iv) Bedrock

- specify type(s).

B. Description of Materials of Landforms

The materials or patterns of materials within each landform should be described in terms of the following characteristics and groupings:

(i) Texture (the following nomenclature has been accepted by the National Soil Survey Committee, and to minimize overlapping it should be followed whenever possible)

Textural Class Name	Term to describe general range of textures at level 3
Gravels and coarse sands	Very coarse textured
Sand Loamy sand	Coarse textured
Sandy loam Fine sandy loam	Moderately coarse textured
Very fine sandy loam Loam Silt loam Silt	Medium textured

Textural Class Name	Term to describe general range of textures at level 3
Sandy clay loam)) Clay loam)) Silty Clay loam)	Moderately fine textured
Sandy Clay)) Silty Clay)) Clay)	Fine textured
60% Clay)	Very fine textured

(ii) Thickness of Deposit

The term "thickness" will be used with reference to the landform and landform patterns (level 3) and the term "depth" will be reserved for use with reference to soil descriptions (level 4). Class limits for thickness and depth should be set up in each region on the basis of the variability within the landscapes present. It is suggested that when "thickness of a material over bedrock" is used, the type of bedrock and its condition (shattered, porous, impermeable, etc.) should be specified.

(iii) Petrography and Mineralogy

It was decided that national classification standards should not be set up at this time. Classes and/or general descriptions would be established on the basis of regional requirements during the pilot studies, e.g., general descriptive terms such as "derived from weathered granite or derived from limestone" could be used.

(iv) Compaction of Materials

Three general classes have been suggested (Kowall and Runka 1968).

- loose
- semi compact
- compact

C. Topography and Relative Relief of Landforms

It was decided that some combination of relative relief, slope frequency and slope gradients should be attempted. The classes suggested for relative relief are:

Relative Relief

Class	Change in elevation per mile
1	less than 25 feet
2	26 - 150 feet
3	151 - 500 feet
4	501 - 1,000 feet
5	1,001 - 2,000 feet
6	2,001 feet +

In British Columbia, relative relief is more meaningful if it is summarized in descriptive terms indicating range of relief and elevation above sea level within the Land System, although it is recognized that change in elevation per mile may be useful in other areas (Kowall and Runka 1968).

Combined with these classes should be a statement or notation concerning, (1) frequency of slopes per mile (the average condition to give some indication as to whether the land is irregular or composed of one simple slope), and (2) a general description of slope gradients (modal slope) using the following groupings (some subdivisions may be necessary to suit local needs).

Class	Slope gradient
1	0 - 15%
2	16 - 30%
3	31 - 60%
4	61 - 100%
5	101 +

3. SOIL DESCRIPTION AND CLASSIFICATION (LEVEL 4)

In this type of reconnaissance survey, we should try to describe the individual soils and soil patterns in detail at each field check point, even though we may not be able to extrapolate confidently much of this information over large areas.

Wherever possible soil descriptions should follow the classification system and guidelines provided in the reports of the National Soil Survey Committee of Canada (e.g. Report on the Sixth Meeting of N.S.S.C. at Laval University, Quebec 1965). Certain features of the soil should be highlighted when the characteristics of the Land Types are being summarized and described. The features that are of considerable value in characterizing the Land Types, and in making interpretations for various uses at a later stage are:

A. Soil Morphology

Use N.S.S.C. classification as follows: where possible classify at the Soil Subgroup level for all Orders. Where not possible use Soil Great Group for the Chernozemic, Solonetzic, Gleysolic and Organic Orders. Note:- use N.C.F.L. classification for humus-forms (National Committee on Forest Land, 1967).

B. Soil Drainage Classes (use the 6 classes described by N.S.S.C.)

(1) Rapidly drained, (2) Well drained, (3) Moderately well drained, (4) Imperfectly drained, (5) Poorly drained and, (6) Very poorly drained.

C. Moisture Status

Use descriptive terms to indicate telluric water, moisture balance, moisture holding capacity, etc.

clearly define and describe their distribution within the geographic patterns. The concept of the catena, the topographically-related "chain" of units making up the pattern, is probably most useful in describing the vegetation (and soils) within the larger mapping unit (Land System) of the reconnaissance survey.

The major problem in integrating vegetation in the Bio-physical land inventory revolve around:

(1) the absence of a generally accepted description method for vegetation
(2) the absence of a framework classification of Canadian vegetation
(3) the rapid reaction of vegetation to disturbance, and the resultant occurrence of variable vegetation cover on essentially similar kinds of land.

A. Description of the Vegetation

In describing vegetation it is important to pay attention to (a) vegetation structure, (b) species composition, and (c) abundance of individual species. Descriptions should be made in physiognomically uniform plots, large enough to contain the normal variety of species. All descriptions should be kept on file for future use during, as well as after completion of, the survey. For land use interpretations other than forestry there is a need for more emphasis on the description of the shrub layers, and on the description of non-forest vegetation above the tree-line and on bogs.

It has been suggested that some of the plots in the ecological surveys should be permanent (providing time, funds, and crew organization permit such an arrangement). These plots would be of high value for future reference, especially to study succession after logging and/or fire. If the plots and soil pits are carefully located on the airphotos then in most

instances it would be easy to relocate the sample point for many decades after initial examination.

The guidelines for the description of the vegetation are as follows:

(i) Vegetation structure:
The vegetation should be divided in the major strata or sub-strata if distinguishable: e.g., tree layer, shrub layer, dwarfshrub layer, herb layer and moss layer. For each of these strata the predominant height and its total percentage cover should be recorded.

(ii) Species composition:
Species occurring within the plot should be listed for each stratum separately. This listing should be as complete as possible, and herbarium material of provisionally identified specimens should be collected.

(iii) Species abundance:
The following scale is suggested for a rapid estimation of abundance as indicated by density and cover:

r = single specimen only
+ = sporadically occurring
1 = few to common, but covering less than 5%
2 = covering 5 - 25% (if desired a further refinement of the scale can be made: 2- = 5-15% cover; 2 + = 15-25% cover)
3 = covering 25 - 50%
4 = covering 50 - 75%
5 = covering 75 - 100%

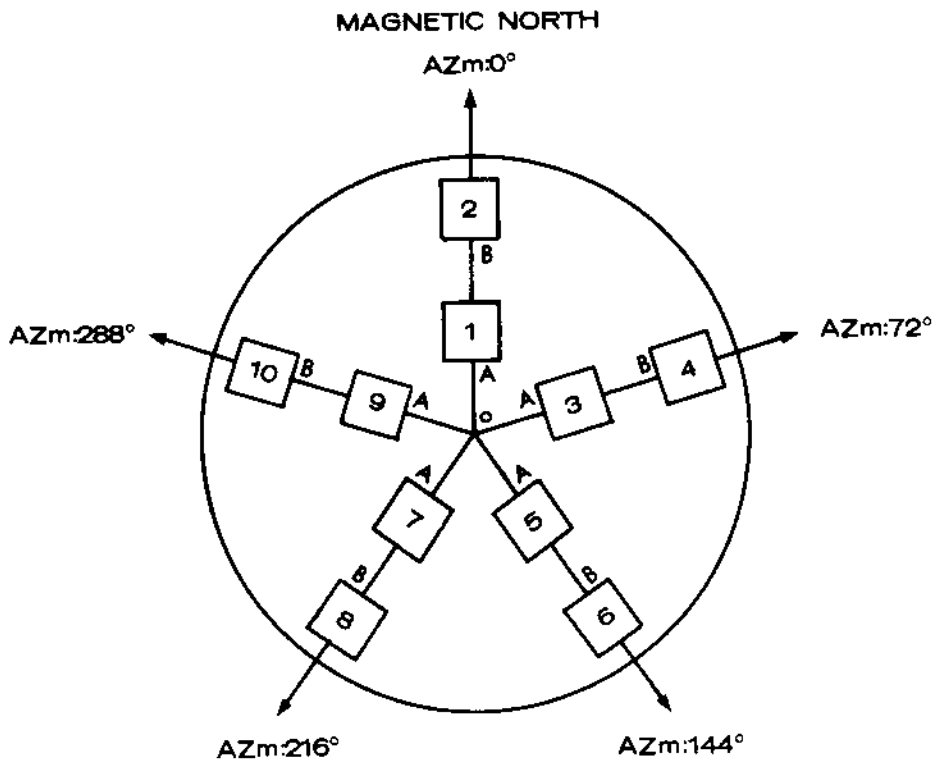
(iv) Species frequency:
As an alternative, it has been suggested that a measure of Species Frequency be used. In the Biophysical surveys in Quebec, Species Frequency has been handled as follows: Ten milacre quadrats are

distributed in the sample plot (see figure 1) and the presence of each species and tree seedlings is recorded. If the observations are recorded in succession in each quadrat (number 1 to 10), the data can be used for successional studies when the plot is permanent. The method can be used by technicians providing they collect all unknown species for further identification.

FIGURE 1

DISTRIBUTION OF MILACRE VEGETATION PLOTS (10 X 10 LINKS)

(Quebec Pilot Project - M. Jurdant)



1/10 ACRE PLOTS: OA = 15 links
OB = 40 links

1/5 ACRE PLOTS: OA = 20 links
OB = 50 links

B. Classification

It is difficult to give hard and fast rules as to how vegetation should be classified. Conditions will vary between geographic areas, and there will be different amounts of background information available for different parts of the country prior to the surveys.

In most cases, each classification should be developed during the survey, as an outgrowth of it. The rule ought to be:- describe first, classify later. The following are tentative guidelines only; the level of sophistication of the classification will necessarily depend on the experience of the investigators and on the time available for the survey.

(i) Make the first subdivision according to dominant cover if dealing with forest or shrub vegetation. Do not try to define types in such a way that they include either more than one cover type, or more than one kind of vegetation (e.g. forested and non-forested communities).

(ii) A further subdivision should be attempted on a structural (physiognomic) basis;
e.g. black spruce forests with almost pure moss carpet
black spruce forests with moss carpet and herbs
black spruce forests with well-developed fern layer
black spruce forests with dwarfshrub layer

(iii) At the Land Type level attempt a further breakdown on a compositional (floristic) basis:
e.g. the balsam fir/moss forests may be subdivided into:
Pleurozium - balsam fir forest
Hylocomium - balsam fir forest
Sphagnum - balsam fir forest

Use should be made of those species whose occurrence

or abundance appear to be indicative of environmental differences.

(iv) Only one or two species names should be used in the type name. Nevertheless, all species found useful for separating the types from others in the same physiognomic unit should be listed.

(v) It should be emphasized again that a classification along the above lines ought not to be made during the early stages of the survey, but only after sufficient field data have been collected to provide a firm basis. The first classification should be provisional and should be checked continually in the field as the survey progresses, and refined or modified as required.

C. Succession

An understanding of trends in the development of vegetation ("succession") provides the basis for predicting future cover and for classing together those units of land with the same potential cover. This is a most important but difficult side of vegetation studies, requiring the services of a competent ecologist. Without dealing adequately with this time aspect, much of the value of the vegetation descriptions and classsifications will be lost.

The purpose is to discover what range of vegetation types, due to history and disturbance, can occupy essentially similar types of land. To be useful, the studies ought to take a short-term viewpoint, specifically excluding long-term primary succession and succession associated with or resulting from irreversible changes in soil condition. It should be noted that descriptions of very early successional stages are of considerable importance in wildlife interpretations.

Successional relationships should be studied in areas where burned, logged and virgin stands can be observed in close proximity on the same surface materials and topographic facets. It will not be possible in all areas to work out successional relationships, and where the evidence is poor it will be best simply to describe the present vegetation without conjecturing about possible changes in the future. Successional relationships should be described in more detail in a separate section of the report, along with detailed information on the structure and floristic composition of the vegetation types.

5. PROPOSED OPEN WATER AND WETLAND CLASSIFICATION *

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The objective of a water and wetland classification is to recognize and group ecologically significant open waters and wetlands into classes that are meaningful to a number of resource managers and users.

The classification system must be oriented to serve the needs of several disciplines, as wild ungulates, fish, waterfowl and furbearers, as well as hydrology, forestry, recreation and agriculture. It is expected that such multi-disciplinary classification can be successful only to a certain level of generalization. Beyond this level, the requirements of each

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discipline become varied and a single classification system may break down. The acceptance of a broad wetland classification by a number of disciplines would contribute greatly to the value of the Bio-physical survey program.

The following principles must be considered when a wetland classification is attempted:

1. The classification should involve water or wetland classes that are significant ecological units from the standpoint of fish, wildlife and vegetation productivity.

2. The classification should be a hierarchical system permitting the workers to go to various levels of detail as desired.

3. The classification should be relatively simple, involving easily recognizable wetland or water areas at the class level.

4. The classification of wetlands and open water should be possible from the interpretation of aerial photographs, at least at the class level. A further breakdown into subclasses and types is also feasible when supported by aerial reconnaissance and ground checking. Site descriptions are obtainable only from ground surveys.

5. The description and mapping of water and wetland classes should be integrated with the description and mapping of the related land components in the Bio-physical Program.

6. The responsibility for the final delineation and appraisal of the wetland components should rest with the resource personnel engaged in the Bio-physical Program.

Such a water and wetland classification is outlined in Table 1. The various classes were based on the examination

of literature,* mainly North American and Swedish, on the authors' experience and on consultations with fish and wildlife biologists and forest ecologists. To a large extent it reflects continental temperate, boreal and subarctic conditions, but not necessarily maritime conditions. Hence this proposal is incomplete, and suggestions for improvement are welcomed.

The classes and subclasses are significant to most disciplines. In a broad reconnaissance survey the classes or patterns of classes may only be mapped, although the subclasses are also readily recognizable. The more detailed information on the particular wetlands may be given as descriptive material during such a broad survey.

In Table I the wetland types, water types and site descriptions are examples only, showing the possible subdivisions of the classes and subclasses. These and other similar types may form the basis of mapping units in more detailed surveys.

In the field pure wetland types are seldom found in large blocks, and the boundaries may be indistinct. Fens may gradually give way to bogs, or marshes to fens. This produces a great number of intergrades, or transitional types of wetlands.

When mapping at a small scale, it is inevitable that different types of terrain be included within a common boundary. These complexes will include wetland-wetland, wetland-dryland, wetland-open water, and dryland-open water areas. Most of these can be identified as recurring patterns in much the same manner as various landform patterns.

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* See Appendix I for references consulted in the preparation of this Classification.

Table I. - Classification of Open Waters and Wetlands

A. Open Waters

Class	Subclass		Drainage System	Basin Topography Horizontal	Basin Topography Vertical	Water Type	Site Description
Standing Open Water	Permanent	Deep Shallow Open Water Marsh	Open	Regular	G. sloping	Soft Hard	% Shoreline in: (1) Rock
	Intermittent	Open Water	Restricted	Irregular	M. sloping	Brackish Saline	(2) Mud (3) Sand & gravel
			Closed	Very Irregular	S. sloping		(4) Peat Vegetation Backshore slope Erosion
Running Water	Permanent	Deep	-	Straight Curved	G. sloping	Clear	Shoreline material
	Periodical	M. Deep	-	Sinuous Meandering	M. sloping	Stained	Vegetation Gradient or
	Intermittent	Shallow	-	Meandering with oxbows Braided Beaded Dendritic	S. sloping	Turbid	velocity Volume of flow Erosion

Table I (Continued)

B. Wetlands

Class	Subclass		Wetland Type	Site Description
Marsh	Fresh	Lakeside Streamside	Deep Marsh Shallow Marsh	Shoreline configuration Zonation of vegetation
	Brackish	Deltaic Seepage	Wet Meadow	Bottom soils Water depths
	Saline	Catchment Tidal		
Swamp	Minerotrophic	Alluvial Lakeside	Alder-Willow Swamp	Water regime Nutrients
	Transitional	Seepage Catchment	Cedar Swamp	Vegetation Soils
		Water track Peat Margins	Hardwood Swamp	
Fen	Flowage	Lakeside Streamside Water track	Inundation fen Floating fen Spring fen	Water regime Nutrients Peat morphology Vegetation
	Soligenous	Seepage Catchment Lowland	Retention fen Flat fen	Permafrost
	Topogenous	Seepage Catchment Lowland Water track	Sloping fen Patterned fen Pond fen	
Bog	Transitional	Bowl bog Hanging bog Flat bog	Sinkhole bog	Water regime Forested or non-forested Vegetation Peat morphology
	Ombrogenous	Raised bog Blanket bog	Wooded island Palsa bog Peat plateau Peat polygon	Nutrients Permafrost

A. Definitions of Terms

Definition - Standing Open Water

Continuous uninterrupted expanses of permanent or intermittent standing surface waters of variable depth (usually exceeding 30 cm) that lack any continuous directional flow and occupy more than 5 per cent of the area of a defined basin in rock, mineral soils or peatlands. The open water portion is generally free of rooted emergent plants which are usually restricted to a fringe around shorelines, islands or reefs. This class includes all lakes and ponds, including water bodies with inlets and outlets. For convenience, open water bodies or land-water complexes may be described according to these proposed size classes:

1. 0 - 5 hectares
2. 6 - 20 hectares
3. 21 - 250 hectares
4. 251 - 2000 hectares
5. >2000 hectares

Definition - Running Water

Surface water with a significant and discernible flow in a definite direction, following a gradient, and usually confined to a defined bed or course. Running water is usually impounded by water eroded banks or shorelines. This class includes all streams, brooks and rivers. Running waters may be grouped into useful size classes based upon stream widths.

Definition - Wetlands

Wetlands are areas of predominantly organic or water-worked soils that are permanently or periodically saturated. The water table persists for a time at or above the ground surface, but it may drop well below the surface for seasonal periods. Standing waters, usually not exceeding 2 m in depth, may be present seasonally or persist over long periods of time.

Wetlands are periodically saturated or inundated by local seepage or ground water flow, or they may receive water from remote sources by stream inflows, surface runoff, or flooding. Usually characteristic kinds of wetland vegetation develop.

I. Marsh

Grassy wet areas, periodically inundated up to a depth of 2 m or less with standing or slowly moving water. Surface waters occur seasonally or persist for long periods. Water levels may fluctuate, but the water table remains within the rooting zone of the plants during at least part of the growing season. The substratum usually consists of mineral or organic soils with a high mineral content, but there is little peat accumulation. Waters are usually circumneutral to alkaline, and there is a relatively high oxygen saturation. Grass and sedge sods may be anchored or floating, but usually are not consolidated, and are frequently interspersed with small areas of open water. The vegetation consists of a variety of emergent non-woody plants such as rushes, reeds, reed grasses and sedges often growing in the center of the basin. Where open water areas occur, a variety of submerged and floating aquatic plants flourish.

II. Swamp

Forested wetlands where standing to gently flowing waters occur seasonally or persist for long periods. The bottom soils are usually continually waterlogged. Waters are often stained, and are circumneutral to slightly acid in reaction, with little deficiency in oxygen or other nutrients. The substrate consists of mixtures of transported mineral and organic sediments with little peat accumulation. Usually the peat, when present, is well decomposed but there is no continuous moss carpet and Sphagnum is not abundant. The understory vegetation usually consists of mosses, ferns, grasses, rushes and sedges. Tree cover includes tall shrubs, hardwoods and conifers. Swamps often occur along the margins of bogs, open waters and streams.