REPORT

Andy Kjearsgaard

OF THE MEETING OF THE

NATIONAL SOIL SURVEY COMMITTEE OF CANADA

FEBRUARY 22 to 27, 1960

Held at the
ONTARIO AGRICULTURAL COLLEGE, GUELPH

TABLE OF CONTENTS

Proceedings of the Fourth National Meeting of the

National Soil Survey Committee of Canada

Foreword - A. Leahey and P.C. Stobbe, Chairman and Secretary, respectively, of the N.S.S.C.

The fourth national meeting of the National Soil Survey Committee of Canada was held during the week of February 21 to 27, 1960, in the Soils Building of the Ontario Agricultural College. The first three days of the week were devoted to meetings of nine subcommittees and the last three days to plenary sessions. All soil survey organizations in Canada were represented at the meeting.

The main task of the meeting was to work on the development of the national taxonomic system of soil classification which was first proposed at the third national meeting in 1955. Discussion and action on soil classification was limited to the development of the three higher categories, which deal with the classification of profile types. Coupled with this was a revision of soil horizon designations. Hence, these proceedings are almost entirely devoted to the above matters. The progress made at the Guelph meeting may be judged from the fact that at its last plenary session the meeting agreed "that as soon as the classification table is released by the chairman of the N.S.S.C., it will be deemed to be in force". The publication of these Proceedings officially releases the classification table.

The reports contained in these Proceedings with the exception of the one on Organic soils are those revised and accepted by the plenary sessions. Hence, the results of the discussions are embodied in the reports. The report on organic soils was presented for study purposes only and hence, is not included in the agreement mentioned in the preceding paragraph.

This N.S.S.C. system for mineral soils will cover nearly all the soil series we have established to date. However, there are certain mineral soils in Canada that are not included in the system. These are: a few strongly acid black soils; sierozem-like soils in the dry valleys of southern British Columbia and certain soils in the high forested plateaus and mountains in the same region; alpine soils and the soils of the far north. When sufficient information is obtained on such soils we hope the present system can be expanded to take care of them.

We expect that the development of an adequate classification for organic soils will receive increasing attention within the next few years. In general, Canadian pedologists are not willing to accept any system proposed to date for the classification of these soils.

Soil horizon designations have been a subject of study and debate for some years. The revised system proposed here will be used in conjunction with the revised classification system. Authors of soil survey reports may find it desirable or necessary to use the former system (capital letters with number subscripts) as well as the new system for a few years. This may also hold true for scientific papers.

The reports of the various subcommittees on soil classification are mainly concerned with differentiating characteristics used to separate the different classes at the Order, Great Group, and Sub-group categories. Adequate descriptions of the soils in each class will be published at a later date. It is hoped that the handbook on soil classification mentioned in the report on publications can be written and compiled during the coming winter season.

The differentiating characteristics used in establishing the various classes of the classification system presented here, are based largely on soil morphology, but in some cases, on certain chemical properties. Nevertheless, there is a strong genetic bias in this system as the selection of criteria for the separation of the various classes is based to a considerable extent on our concepts of soil genesis. Thus relatively small differences in soil properties may be given more weight than larger differences if the small differences more clearly reflect the environmental conditions under which a particular soil has developed.

The names used in the classification system are for the most part those which have been used in Canada for many years. However, a number of new names have been introduced, particularly at the sub-group level. Only two well-established names have been dropped. These are the Degraded Black, formerly a sub-group which has been given the status of a great group under the name of Dark Grey and the Brown Podzolic great group, which has been renamed the Acid Brown Wooded great group.

The classification system presented here represents the collaborative efforts of many soil scientists, representing all the soil survey establishments in Canada, to devise a national taxonomic system of soil classification. In order to reach this goal probably everyone concerned had to sacrifice some cherished concepts. Thus this classification system may not entirely be satisfactory to the individual soil scientists who are responsible for it, but it does represent the best collective viewpoint on soil classification in Canada at the present time.

SOIL HORIZON DESIGNATIONS

W. E. Bowser,
Chairman, Sub-committee on Soil Horizon Designations

This is the third report of the Soil Horizon Committee. During the interval between the first report in 1955 and the present the use of letter suffixes to differentiate horizons has had a fair trial and the survey units have voted unanimously in favor of using them. During this same period survey groups in other countries have given considerable study to this genetic or interpretive system of horizon nomenclature.

More than one method of approach has been and is being suggested and there is a diversity of opinion in Canada and elsewhere as to the most desirable method to pursue. Briefly, these methods can be summarized as follows:

1. Retain the three major horizon designations A, B, and C, representing a vertical sequence, and use independent lower case suffixes to differentiate the horizons occurring within the major separations.

2. A modification of 1 above is to retain A, B, and C used in specific combinations with lower case letters. Each combination to be individually defined. The three master horizons then each becomes a grouping of a number of specific horizons.

3. A modification of 2 above is to add at least three additional capital letters to designate horizons that could not logically be fitted into a generalized definition of A, B, and C.

4. Discard the A, B, and C sequence and recognize by capital letters (master horizons) some eight or ten processes. Lower case letters to be used with these for more specific separations.

It would seem desirable to have an International Committee study proposed systems of horizon nomenclature with the aim of evolving a generally acceptable framework.

Certain suggestions made by the Horizon Committee at Guelph received approval; on other suggestions there were differences of opinion. Following the meeting revised definitions were circulated to the survey units and opinions on these were also divided. However, certain trends were gleaned from the replies and where possible these were incorporated into the report as now submitted. Some of these were:

1. The lime and salt concentration horizons should be recognized, in most instances, as a component of the C group.

2. The term weathering has been deleted from the master horizon definitions.

Since there was such a wide diversity of opinion as to the general definition of the B horizon none is now offered. Five pedogenic processes that occur in Canada have been listed as making up the B group.

m - A horizon characterized by the loss of water soluble materials only. Usually slightly altered by hydrolysis and/or oxidation (mellowed). Always used alone

n - A horizon containing over 15% exchangeable sodium or more exchangeable sodium plus magnesium than calcium (natrium).

A Bn horizon is characterized by a prismatic or columnar structure which exhibits pronounced coatings and stainings on the surface of the peds and in addition has a hard to very hard consistence when dry. An B̲n horizon is characterized by high reaction, black coatings and becomes massive and hard on drying.

p - A relic (not currently dynamic) horizon to be used as a prefix (paleosol). For example, an Ah horizon that underlies the present solum.

q. - A quasi cemented pedogenic horizon.

r - An inherited consolidated layer (rock). Always use with C.

s - A horizon enriched with salt including gypsum (salt).

t - A horizon enriched with silicate clay (ton).

w - A water saturated layer; the apparent water table (water).

z - A permanently frozen layer (zero).

Notes;

1 - Lithologic changes, to be indicated by Roman Numeral prefixes (I to be assumed).

2 - Transition horizons need capitals only, and
(a) If transition gradual use i.e. AB.
(b) If transition interfingered use i.e. A and B
(c) If desired, dominance can be shown by order i.e. AB and BA.

3 - Horizon subdivisions to be shown with Arabic Numerals used as suffixes.

4 - Capitals used alone indicate that no further separations were made.

5 - If more than one lower case suffix is required and if one only is a weak expression then the j is to be linked to that suffix with a bar i.e. Ahe̅j.

6 - In bi-sequa profiles the first sequum designations are to be bracketed.

7 - It is to be noted that position is required with respect to A but not B or C.

8 - Note that some new lower case letters appear and some have been changed from our previous report. All, as used, have been suggested by some workers. In part, the changes are suggested to reduce all to one letter symbols to avoid confusion. One exception is the cc for cemented concretions.

9 - Note that g covers all gleying. When used with A or B it indicates that other pedogenic processes have been operative and should be indicated. When used with C it indicates that gleying is dominant and has virtually prevented the operation of any other process.

10 - Not all conditions are covered; it is still necessary to write profile descriptions.

Ah Sand
Ae
II Ac Till
II Bt

Outline of the National System for Classifying Canadian Soils (as of February 27, 1960)

The general principles of the system is given in the 1955 Proceedings of the national meeting at Saskatoon. This system has 6 categories, namely, the soil type, the soil series, the soil family, the sub-group, the great group, and the order. The present statement deals with the classification and nomenclature of the three higher groups; i.e. the order, the great group, and the sub-group. These three categories deal specificially with the recognition and classification of types of profiles. The differentiating characteristics used in establishing the classes in the three categories are presented in the reports of the sub-committees.

Order	Great Group	Sub-group
1. Chernozemic Soils	1.1 Brown	1.11 Orthic Brown
		1.12 Rego "
		1.13 Calcareous Brown
		1.14 Eluviated "
		1.15 Saline "
		1.18 Gleyed "
	1.2 Dark Brown	1.21 Orthic Dark Brown
		1.22 Rego " "
		1.23 Calcareous Dark Brown
		1.24 Eluviated " "
		1.25 Saline " "
		1.28 Gleyed " "
	1.3 Black	1.31 Orthic Black
		1.32 Rego "
		1.33 Calcareous Black
		1.34 Eluviated "
		1.35 Saline "
		1.38 Gleyed "
	1.4 Dark Grey	1.41 Orthic Dark Grey
		1.42 Rego " "
		1.43 Calcareous Dark Grey
		1.45 Saline " "
		1.48 Gleyed " "
2. Solonetzic Soils	2.1 Alkali Solonetz	2.11 Brown Alkali Solonetz
		2.12 Dark Brown Alkali Solonetz
		2.13 Black " "
		2.14 Dark Grey " "
		2.18 Gleyed " "

Order	Great Group	Sub-group
	2.2. Solonetz	2.21 Brown Solonetz
		2.22 Dark Brown Solonetz
		2.23 Black "
		2.24 Dark Grey "
		2.28 Gleyed
	2.3 Solodized Solonetz	2.31 Brown Solodized Solonetz
		2.32 Dark Brown " "
		2.33 Black " "
		2.34 Dark Grey " "
		2.35 Grey Wooded Solodized Solonetz
		2.38 Gleyed " "
	2.4 Solod	2.41 Brown Solod
		2.42 Dark Brown Solod
		2.43 Black "
		2.44 Dark Grey "
		2.45 Grey Wooded "
		2.48 Gleyed "
3. Podzolic Soils	3.1 Grey Brown Podzolic	3.11 Orthic G.B.P.
		3.12 Minimal G.B.P.
		3.13 Brunisolic "
		3.14 Bisequa "
		3.18 Gleyed "
	3.2 Grey Wooded	3.21 Orthic Grey Wooded
		3.22 Dark " "
		3.23 Brunisolic Grey Wooded
		3.24 Bisequa " "
		3.28 Gleyed " "
		3.29 Peaty " "
	3.3 Humic Podzol	3.31 Orthic Humic Podzol
		3.32 Humus Podzol
		3.38 Gleyed Humic Podzol
		3.39 Peaty Humic Podzol
	3.4 Podzol	3.41 Orthic Podzol
		3.42 Minimal "
		3.43 Orstein "
		3.44 Textural "
		3.45 Bisequa "
		3.47 Podzol with Permafrost
		3.48 Gleyed Podzol
		3.49 Peaty Podzol

Order	Great Group	Sub-group
4. Brunisolic Soils	4.1 Brown Forest	4.11 Orthic Brown Forest
		4.12 Degraded " "
		4.18 Gleyed " "
	4.2 Brown Wooded	4.21 Orthic Brown Wooded
		4.22 Degraded " "
		4.27 Brown Wooded with Permafro
		4.28 Gleyed Brown Wooded
	4.3 Acid Brown Wooded	4.31 Orthic Acid Brown Wooded
		4.37 Acid Brown Wooded with Pern fr
		4.38 Gleyed Acid Brown Wooded
	4.4 Acid Brown Forest	4.41 Orthic Acid Brown Forest
		4.48 Gleyed " " "
	4.5 Concretionary Brown	4.51 Orthic Concretionary Brown
		4.58 Gleyed " "
5. Regosolic Soils	5.1 Regosol	5.11 Orthic Regosol
		5.12 Mull Regosol
		5.13 Mor Regosol
		5.14 Organo Regosol
		5.15 Saline Regosol
		5.17 Regosol with Permafrost
		5.18 Gleyed Regosol
6. Gleysolic Soils	6.1 Meadow	6.11 Orthic Meadow
		6.12 Calcareous Meadow
		6.13 Saline Meadow
		6.14 Degraded Meadow
		6.19 Peaty Meadow
	6.2 Dark Grey Gleysolic	6.21 Orthic D.G.G.
		6.22 Saline "
		6.23 Degraded "
		6.29 Peaty "
	6.3 Gleysol	6.31 Orthic Gleysol
		6.32 Calcareous "
		6.33 Saline "
		6.34 Rego "
		6.39 Peaty "
	6.4 Eluviated	6.41 Humic Eluviated Gleysol
		6.42 Low Humic Eluviated Gleysol
		6.43 Ferralitic " "
		6.49 Peaty " "

REPORT ON THE CLASSIFICATION OF CHERNOZEMIC AND SOLONETZIC SOILS

J.S. Clayton,
Chairman, Subcommittee on Chernozemic and Solonetzic Soils*

CLASSIFICATION OF THE CHERNOZEMIC ORDER OF SOILS

Order 1:

Soils with chernozemic Ah horizons and B or C horizons of high base saturation with a cationic ratio of calcium to other ions significantly greater than 1. Well to imperfectly drained soils developed under xero- or meso-hyllic grasses and forbs or under grassland-forest transition. Soils with solonetzic B horizons are excluded from the order.

For convenience the sub-group types of profiles are listed below as they occur in each great group.

Orthic:	Ah, Bm, Ck, C, or Ah, Bmj, CK, C.
Rego:	Ah, CK, C, or Ah, C.
Calcareous:	Ah, Bmj, Ck, C.
Eluviated:	Ah, Ae, Bt, Ck, C.

An L-H horizon may occur in the Dark Grey great group. Salinized (s) and gleyed (g) horizons may occur in all profile types. While these are listed as sub-groups they should not be used alone but in conjunction with all other sub-group profiles.

e.g. 1.11/5 Saline Orthic Brown
1.11/8 Gleyed Orthic Brown

Great Groups		Sub-groups
1.1	Brown	1.11 Orthic Brown
	Soils with Ah or Aa horizons with dry colour Munsell values from 4.5 to 5.5 grey or greyish brown. Usually associated with a xerophyllic vegetative cover of grasses and forbs.	1.12 Rego Brown
		1.13 Calcareous Brown
		1.14 Eluviated Brown
		1.15 Saline Brown
		1.18 Gleyed Brown
1.2	Dark Brown	1.21 Orthic Dark Brown
	Soils with Ah or Aa horizons with dry colour Munsell values from 3.5 to 4.5 dark grey or dark greyish brown. Usually associated with a meso-phyllic vegetative cover of grasses and forbs.	1.22 Rego Dark Brown
		1.23 Calcareous Dark Brown
		1.24 Eluviated Dark Brown
		1.15 Saline Dark Brown
		1.18 Gleyed Dark Brown
1.3	Black	1.31 Orthic Black
	Soils with Ah or Aa horizons with dry colour Munsell values darker than 3.5, very dark	1.32 Rego Black
		1.33 Calcareous Black
		1.34 Eluviated Black

* Mr. H. Crampton

	Great Groups	Sub-groups
1.3	Black (Cont.)	
	grey, very dark greyish brown, very dark brown, or black. Usually associated with a meso-phyllic vegetation of grasses and forbs.	1.35 Saline Black 1.38 Gleyed Black
1.4	Dark Grey	
	Soils with Ah or Aa horizons with dark surface colours of Munsell values darker than 4.5 which rub to lighter colour or with Aa horizons of value darker than 5.5. A thin L-H horizon forest residue may occur above the chernozemic Ah. Usually associated with a cover of grasses, forbs and trees characteristic of grassland-forest transition. (Formerly termed degraded Blacks).	1.41 Orthic Dark Grey 1.42 Rego Dark Grey 1.43 Calcareous Dark Grey 1.45 Saline Dark Grey 1.48 Gleyed Dark Grey

Criteria and Definitions to be used with Order 1

Order 1: Chernozemic

Definition:

Well to imperfectly drained soils developed under xero- or meso-phyllic grasses and forbs or under transition grassland-forest vegetation. The Chernozemic soils are characterized by the occurrence of dark colored humus-mineral surface horizons, (Ah or Aa) of high base-saturation with a cationic ratio of calcium to other ions significantly greater than 1 and with flocculated surface structures that do not become massive on wetting and drying. Carbon-nitrogen ratio is 17 or less if virgin and usually does not exceed 13 if cultivated. The thickness and darkness in colour of the Ah horizon must be sufficient to produce an Aa horizon of at least 5 inches in thickness, one Munsell unit darker in value than the C horizon and should be lower in chroma than the B horizon if present. The high base-saturatio of the A horizon is apparently maintained by annual cyclic growth and decomposition of a vegetative ground cover dominated by xero- or meso-hyllic grasses and forbs. Soils with solonetzic B horizons are excluded from this order.

Definitions for Separation at the Great Group Level

The Great Group profiles under this Order are based on the recognition of significant differences in the darkness in colour of Ah or Aa horizons, all conforming to the description given for the A horizons under the Order, but differing in colour. An increasing darkness of surface horizons may be closely associated with increases in organic matter content, and a shift from xero- to meso-phyllic vegetative cover, indicative of an increase in soil moisture efficiency and in humidity of the soil climate. These differences have been used for most of the major zonal subdivisions in the grassland region.

These subdivisions are arbitrarily based on differences in colour measurable by Munsell Charts, and for practical reasons of field classification are related to cultivated Aa horizons. It is implied that virgin soils will have Ah horizons of sufficient thickness and darkness in colour to result in an Aa horizon of specific Munsell colour value. The following subdivisions are suggested based on dry, crushed or rubbed colours. It is not known at present if moist colours should be considered for critical separations.

1.1 Brown

A soil with an Ah horizon of sufficient thickness and darkness in colour to give a grey or greyish brown Aa horizon with a range in Munsell colour value from 4.5 to 5.5. Usually, but not exclusively associated with a mixed xero- and meso-phyllic vegetative cover of grasses and forbs.

1.2 Dark Brown

A soil with an Ah horizon of sufficient thickness and darkness in colour to give a dark grey or dark greyish brown Aa horizon with a range in Munsell colour value from 3.5 to 4.5. Usually associated with a meso-phyllic vegetative cover of grasses and forbs.

1.3 Black

A soil with an Ah horizon of sufficient thickness and darkness in colour to give a very dark grey, very dark greyish brown, very dark brown, or black Aa horizon with a range in Munsell colour values darker than 3.5. Usually, but not exclusively associated with a meso-phyllic ground vegetative cover of grasses and forbs, but may also include light discontinuous tree cover.

1.4 Dark Grey

The virgin A horizon may have a colour on the surface of the peds comparable to the Dark Brown or Black soils, (values darker than 4.5), but will crush or rub out to a greyer or browner colour of higher value or chroma, ranging in Munsell values from 3.5 to 5.5. A "salt and pepper effect" i.e. lighter greyish spots or bands may be observable in this type of horizon, and it may exhibit a tendency to blocky or platy structure, which crushes to a granular condition. Where these latter conditions are significantly expressed it may be possible to separate an Ahej horizon from the Ah. Such soils should have Ah, or L-H, Ah horizons of sufficient thickness and darkness in colour to give an Aa horizon with a range of Munsell colour values darker than 5.5.

These soils in their original or undisturbed state support a mixed vegetation of grasses, forbs and trees but with a dominant ground cover of meso-phyllic grasses and forbs characteristic of transition areas between grassland and forest vegetation. Depending on the extent and development of tree cover, these soils in virgin state may have an organic, L-H, horizon, but are mainly characterized by an amphistratic Ah horizon of humus-mineral character.
(Note: These soils have been frequently referred to as degraded or wooded blacks.)

Definitions for separation at the Sub-Group Level

The surface A horizons of Chernozemic soils may be underlain by the following sequence of significant horizons, C; B, C, Ae, Bt, C. Thin horizons which would be destroyed under cultivation are not considered critical for separation. The B and C as well as the A horizons should be of high base status, dominated by bivalent cations, particularly calcium and with structures characterized by well-aggregated peds with flocculated coloidal material. The B horizons when present are coloured, and are usually prismatic in macro- and granular in micro-structure. They may be, but are not necessarily, weakly textural. Soils with solonetzic, Bn horizons are excluded from the Order.

The subsurface horizons are characteristically neutral to slightly alkaline in reaction but leaching or eluvial processes may result in a degree of decalcification of the upper horizons resulting in slightly acidic Ae and B horizons. A Ck subhorizon with free carbonates is usually present but the presence of free carbonates within the solum is not an essential criterion.

The major horizon characteristics developed through leaching are used as criteria for the separation of the Chernozemic soils at the Sub-group level into four profile types with the following horizon sequences: Ah, Ck, C; Ah, Bm̄j, Ck, C; Ah, Bmt̄j, Ck, C; and Ah, Ae, Bt, Ck, C; soils.

Rego Chernozemic Profile types: Ah, Ck, C or Ah, C.

Soils with Ah or Aa horizons as defined in the Order and Great Groups underlain by C horizons. No significant depth of colour B is permitted. These profiles may be further separated on the basis of the occurrence of salts, or of gleyed (imperfectly drained) horizons. Grumic or self-mulching characteristics may occur in Rego profiles of high clay content.

In profiles on well-drained sites or with excessive surface drainage, the A horizon is commonly free of lime and overlies a weak Ck horizon of carbonate accumulation above the calcareous parent material. In the gleyed (imperfectly drained) rego-profiles, carbonates of secondary orgin frequently extend into the A horizons due to precipitation from the rise of saturated solutions of lime bearing waters.

In profiles with Grumic characteristics because of the self-mulching properties of the solum and the sloughing of surface material into cracks, the Ah horizon is not as sharply defined as in other Rego chernozemic profiles and tends to merge into a transitional AC horizon.

Calcareous Chernozemic Profile types: Ah, Bm̄j, Ck, C.

Soils with Ah or Aa horizons as defined in the Order and Great Groups underlain by a colour Bmj from which free carbonates are not completely removed. This colour Bmj horizon is usually weakly prismatic in macro-structure. A lighter coloured Ck horizon of carbonate accumulation is usually present above the C.

This profile type may be divided into a well-drained and a gleyed (imperfectly-drained) type. In the well-drained type the carbonates are present in the B through insufficient leaching; in the latter they are frequently an expression of upward movement of soluble carbonates. In profiles with grumic (self-mulching) characteristics, the separations between Ah, Bmj and Ck horizons tend to be diffuse and transitional.

Orthic Chernozemic Profile types: Ah, Bm, Ck, C or Ah, Bmt̄j, Ck, C.

Soils with Ah or Aa horizons as defined in the Order and Great Groups underlain by a colour Bm which is free of carbonates, or by a weakly textural Bmt̄j horizon. The B horizon is usually prismatic in macro-structure, breaking to blocky or coarse granular aggregates; this latter tendency increasing with clay content. A lighter coloured horizon of carbonate concentration, Ck, is usually present but is not an essential criterion. Profiles with gleyed (imperfectly drained) or saline horizons may be subdivided if desired.

Orthic profiles with grumic characteristics occur in soils of high clay content, and are characterized by granular to small angular blocky structure in the A and angular blocky to massive structure in the Bm horizons. The boundaries between A, Bm and Ck horizons are frequently sharper and less diffuse than in Rego and calcareous chernozemic profiles.

Eluviated Chernozemic Profile types: Ah, Ae, Bt, Ck, C or Ah, (Ahe), Ae, (AB), Bt, Ck, C.

This category includes soils previously referred to as "leached chernozemic and solodic profiles".

Soils with an Ah or Aa horizon as defined in the Order and Great Groups underlain by an Ae horizon lighter in colour, of slight to moderate acidic reaction, and with blocky structure or with a weakly macro prismatic outline breaking easily into blocky to platy micro strucutre. Ahe and AB horizons transitional to the Ah and B may occur. The Bt horizon is coloured and somewhat finer in texture than the Ae, with well developed macro-prismatic breaking to blocky micro structure. The development of coatings and stainings on the surface of the peds, if present, are less strongly expressed than those characteristic of solonetzic Bn horizons, and the cationic ratio of calcium to other ions usually remains relatively high. Bf horizons with obvious concentration of iron humates are excluded. The reaction of the upper B is usually neutral to weakly acidic, but lower B horizons are frequently calcareous.

Profiles with gleyed (imperfectly drained) or saline horizons may be subdivided if desired. Eluviated chernozemic profiles with grumic characteristics have not been recognized.

It should be recognized that under the Chernozemic Dark Grey Great Group no provision is made for an Eluviated Chernozemic Subgroup profile as such a profile is probably synonymous with the Dark Grey Wooded profile 3.22, as described under the Podzolic Order.

Gleyed and Saline Profiles

Salinized and gleyed, (imperfectly drained) horizons may occur with all profiles within the Great Groups. They are indicated in the classification as Saline or Gleyed Subgroup profiles, but are not used alone, but as intergrades to all other profiles.

For saline profiles, no limit of salinity is imposed but it should be sufficient to be suspected by eye and confirmable by simple field test.

Fleyed or imperfectly drained profiles may be recognized by weak development of mottling or other characteristics of wetness in any horizon. This development should not be sufficient to mask the main characteristics of the Subgroup profiles. Hydromorphic soils with horizons exhibiting permanent features of gleying should be classified within the Gleysolic Order.

CLASSIFICATION OF THE SOLONETZIC ORDER OF SOILS

Order 2:

Soils with solonetzic or disintegrating solonetzic B horizons which have an exchangeable base status in which the ratio of calcium to magnesium and sodium is usually 1 or less, or which have 15 percent exchangeable sodium, with saline sub-soils. Well to imperfectly drained soils developed under a vegetative cover of grasses, forbs, or trees.

The major profile types are:

Alkali Solonetz	-	Ah, Bn, Csk, C.
Solonetz	-	Ah, Bnt, Csk, C.
Solodized Solonetz	-	Ah, Ae, Bnt, Csk, C.
Solod	-	Ah, Ae, AB, Btn, Csk, C.

L-H horizons may occur in the Dark Grey and Grey sub-groups.

The criteria for sub-groups colours are similar to those for the Chernozemic and Grey Wooded soils. Gleyed (g) horizons may occur in all profile types. The gleyed sub-groups are not used alone but in conjunction with all other sub-group profiles.

e.g. 2.22/8 - Gleyed Dark Brown Solonetz.

Great Group

2.1 Alkali Solonetz

Profile type: Ah, Bn, Csk, C.
The solonetzic (Bn) horizon is strongly expressed, has an alkaline reaction and may contain free carbonates. The upper C is dominantly saline and usually calcareous.

- 2.11 Brown Alkali Solonetz
- 2.12 Dark Brown Alkali Solonetz
- 2.13 Black Alkali Solonetz
- 2.14 Dark Grey Alkali Solonetz (occurrence doubtful)
- 2.18 Gleyed Alkali Solonetz

2.2 Solonetz

Profile type: Ah, Bnt, Csk., C.
The textural solonetzic, Bnt, horizon has a neutral or slightly acidic reaction. The upper C is usually saline, calcareous and gypsiferous, Csk. A thin or weakly expressed Ahej and a thin Ae may be present.

- 2.21 Brown Solonetz
- 2.22 Dark Brown Solonetz
- 2.23 Black Solonetz
- 2.24 Dark Grey Solonetz
- 2.28 Gleyed Solonetz

2.3 Solodized Solonetz

Profile type: Ah, Ae, Bnt, Csk,, C.
The Ae is well developed and acidic in reaction and the textural, Bnt, horizon has a strongly expressed white capped columnar structure which may vary from acidic to alkaline reaction. The upper C is usually saline, calcareous and gypsiferous, Csk,.

2.31 Brown Solodized Solonetz
2.32 Dark Brown Solodized Solonetz
2.33 Black Solodized Solonetz
2.34 Dark Grey Solodized Solonetz
2.35 Grey Wooded Solodized Solonetz
2.38 Gleyed Solodized Solonetz

2.4 Solod

Profile type: Ah, Ae, AB, Btn, Cks, C.
The Ae is well developed and acidic in reaction, a transition AB horizon expressing disintegration of the upper part of the solonetzic B is characteristic, the Btn may only have weak prismatic structure breaking easily to blocky aggregates. The Btn may be relatively thin. The upper C horizon is usually calcareous and saline, Cks.

2.41 Brown Solod
2.42 Dark Brown Solod
2.43 Black Solod
2.44 Dark Grey Solod
2.45 Grey Wooded Solod
2.48 Gleyed Solod

Criteria and Definitions to be used with Order 2

Order 2 - Solonetzic

Definition

Soils with A horizons overlying solonetzic or disintegrating solonetzic Bn horizons with saline subhorizons or with subhorizons influenced by saline waters. These B horizons are characterized by a base status in which the ratio of calcium to magnesium and sodium cations is significantly less than in Chernozemic soils, usually in the order of 1 or less or in which the exchangeable sodium exceeds 15 percent.

Desalinization of these horizons result in an increase of alkali-peptised and deflocculated colloidal fractions which coat and partially infiltrate the peds in the B horizon with dispersed material. These horizons are characterized by coated columnar or prismatic macro- structures, and blocky micro-structures, with hard to very hard consistence when dry. This firm consistence of the coated peds of solonetzic Bn horizons tends to result in a characteristic concentration of root development along the cleavage planes rather than in uniform penetration of the peds.

Further leaching and removal of alkaline bases result in the formation of acidic Ae horizons with blocky to platy structures, and finally to the de-alkalinization and structural breakdown of the solonetzic B horizon. The major horizon features resulting from these processes are used as criteria for the separation of the Solonetzic soils at the Great Group level into four major profile types with the following horizon sequences: Ah, Bn, Csk, C; Ah, Bnt, Csk, C; Ah, Ae, Bnt, Csk, C; and Ah, Ae, AB, Btn, Csk, C.

At the Subgroup level these major profile types may be divided on the bases of significant differences in the darkness and colour of surface A and Aa horizons, similar to those defined for Chernozemic soils, but in addition including provision for a Grey Wooded Subgroup with L-H, Ae; L-H, Ahj thin, Ae or Aa, Ae; types corresponding to those defined for Podzolic soils. It should be noted that while general characteristics of the A horizons of the Solonetzic soils with respect to colour, organic matter content, and base saturation are very similar to those recognized for the Chernozemic soils and may be subdivided in the same way, the structures developed in the Aa horizons usually become a little more massive and hard on wetting and drying than is found in the Chernozemic soils.

Definitions for Separation at the Great Group Level

2.1 Alkali Solonetz Profile types: Ah, Bn, Csk, C.

A soil with an A horizon as defined in the Subgroup, but usually thin when compared to the B horizon. The Bn horizon has strong coatings and very dark stainings, has an alkaline to highly alkaline reaction, and may contain free carbonates. The Bn horizon may have a faint grey-coloured round-top to the columnar structure which has a very firm consistence when dry. The C horizon is dominantly saline and usually calcareous, Csk. Profiles with imperfectly drained or gleyed horizons may be separated if desired.

The occurrence of Dark Grey alkali solonetz profiles are considered doubtful, as it is unlikely that tree growth could be sustained on soils with such alkalinity and structure. Grey Wooded Subgroup profiles are impossible to have as no Ae horizon is allowed in the alkali solonetz Great Group profile.

2.2 Solonetz Profile type: Ah, Ahej, Bnt, Csk, C.

Soils with an Ah horizon as defined in the Sub-groups which may be underlain by a thin weakly expressed and slightly lighter coloured Ahej horizon. A thin Ae may be present in soils intergrading to the Solodized Solonetz (2.3)

The Solonetzic Bn is textural, Bnt, and well developed, but with somewhat less pronounced coatings and lighter coloured stainings than is found in the Bn of Alkali Solonetz profiles. The structure of the Bnt is columnar of prismatic with moderately hard consistence when dry. The reaction of the Bnt horizon varies from weakly acidic to slightly alkaline. The upper C horizon is usually slightly saline and calcareous, Csk. Profiles with gleyed or imperfectly drained horizons may be separated if desired.

Grey Wooded Sub-group profiles are not possible as no well developed Ae horizon is allowed in the Solonetz Great Group profiles.

2.3 Solodized Solonetz Profile type: Ah, Ae, Bnt, Csk, C.

A solodized solonetz profile usually has an Ah horizon as defined in Sub-groups, but may occur under natural conditions with avery thin or insignificant Ahj horizon overlying the lighter coloured Ae. In these latter profiles the Aa is generally lighter in colour than in other associated Solonetzic soils.

The Ae horizon is significantly lighter in colour than the B horizon and has a strongly developed platy structure. The reaction of the Ae varies from acidic to neutral. The Bnt horizon is solonetzic with a very hard, white-capped columnar macro-strucutre, the latter usually making a sharp interface between the friable Ae and hard Bnt horizons. The micro-structure of the Bnt is blocky with a hard consistence when dry. The surfaces of the aggregates are strongly coated and are usually darker in colour than the inside of the peds. The reaction of the B horizon varies from slightly acidic to moderately alkaline. The lower B and C horizons are normally alkaline and frequently saline.

The solodized solonetz soils may be divided at the Sub-group level into significantly differing soils on the basis of variations in the characteristics of the A horizon. Grey Wooded profiles may occur within this Great Group.

2.4 Solod Profile types: Ah, Ae, AB, Btn, Bnt Csk, C.

Soils with Ah horizons as defined in the Subgroups, but usually thin in comparison to the thickness of the lighter coloured Ae horizon. The Ae horizon is lighter in colour and usually thicker than the Btn. The Ae may frequently be divided into Ael and Ae2 layers on variation in colour and structure. The upper portion of the Ae (Ael) is usually prismatic in macro-structure and blocky to platy micro-structure, with moderate consistence. The lower portion of the Ae (Ae2) if present is lighter in colour and more acidic than the Ael, and has a stronger development of platy structure. There is no abrupt or sharp interface between the Ae and B horizon.

The B horizons are textural and may be considered as remnants of former thicker, Bn horizons. These remnant B horizons vary from slightly acidic to alkaline in reaction. The upper B horizon may frequently be separated as an AB horizon, characterized by a weak or fragmental prismatic strucutre breaking easily to blocky aggregates of moderate consistence. The peds of this AB horizon are usually coated with light-coloured siliceous material, and are acidic in reaction. The lower solonetzic portion of the Bn may be characterized by a weak prismatic structure breaking easily to blocky aggregates or may still exhibit characteristics similar to those occurring in the solodized solonetz soils having a macro-prismatic or columnar structure breaking to moderately compact blocky aggregates with very dark surface coatings and stainings, Bnt.

The C horizon is usually saline and calcareous, Csk. It is possible for Grey Wooded Solod profiles to occur in this Great Group.

REPORT ON THE CLASSIFICATION OF PODZOLIC SOILS

P. C. Stobbe,
Chairman, Subcommittee on Podzolic Soils

3. Podzolic Order

Well and imperfectly drained soils developed under forest or heath having light colored eluvial (Ae) horizons and illuvial (B) horizons with accumulations of sesquioxides, organic matter or clay; or any combination of these.

3.1 Grey Brown Podzolic Great Group

Soils with dark colored mull-type surface horizons (Ah), with lighter colored eluvial horizon(s) (Ae) and with illuviated horizons (Bt) in which clay is the main accumulation product. Developed on basic or calcareous parent materials. The solum generally has a medium to high degree of base saturation.

3.11 Orthic Grey Brown Podzolic Subgroup
Soils with well-developed Ah, Ae and Bt horizons. Ae horizon is light colored and lacks a definite, brown upper subhorizon. Solum generally deep (more than 18 inches).
Profile: (L-H), Ah or Aa, Ae, (AB), Bt, C.

3.12 Minimal Grey Brown Podzolic
Soils with well-developed Ah but with weakly expressed Ae and Bt horizons. Solum generally shallow (less than 18 inches).
Profile: (L-H), Ah or Aa, Aej, Btj, C.

3.13 Brunisolic Grey Brown Podzolic
Soils with well-developed Ah, Ae and Bt horizons. Upper Ae1 (Bmf) is brown to reddish brown in color (Chroma 3), and grades to lighter colored lower Ae2, over Bt horizon.
Profile: (L-H), Ah or Aa, Ae1 or Bmf, Ae2, (AB), Bt, C.

3.14 Bisequa Grey Brown Podzolic
Grey Brown Podzolic soils in which a podzol sequence of horizons has developed in Ae and overlying a continuous textural (Bt) horizon at depths of less than 30 inches from the surface. If the solum of the podzol sequence is well developed (orthic) it must be less than 18 inches thick.
Profile: L-H, Ah, Ae, Bf, C/Bt, C or L-H, Ah, Ae, Bf/Ae, Bt, C.

3.18 Gleyed Grey Brown Podzolic
Soils with the same type of profiles as any of the other subgroups but with mottling or other discolorations due to periodic wetness in the Ae and Bt horizons. Specific profile types may be indicated as follows: 3.11/8, 3.13/8, etc.
Profile: (L-H), Ah or Aa, Aeg, Btg, C.

3.19 Peaty Grey Brown Podzolic
The gleyed Grey Brown Podzolic soils may have a peaty surface layer 6" to 12" thick. They are designated as 3.18/9.

3.2 Grey Wooded Great Group

Soils with organic surface horizons(s) (L-H) with lighter colored eluvial horizon(s) (Ae) and with illuviated horizons (Bt) in which clay is the main accumulation product. Developed on basic parent materials. The solum generally has a medium to high degree of base saturation.

3.21 Orthic Grey Wooded
Soils with organic surface horizons (L-H), with a light colored Ae and a Bt. They may have thin Ah, (less than 2") slightly mottled lower Ae and a marked AB horizon.
Profile: L-H, (Ah) Ae, (AB) Bt, C.

3.22 Dark Grey Wooded
Soils with organic surface (L-H) and with Chernozemic Ah or Ahe (more than 2") over a light colored Ae, or soils with organic surface over a prominent dark grey Aeh horizon and underlain by Bt. The plowed layer of both subtypes is darker than that of the orthic subgroup.
Profiles: L-H, Ah or Ahe, Ae, (AB), Bt, C, or
L-H, (Ah), Aeh, Btj, C.

3.23 Brunisolic Grey Wooded
Soils with organic surface over brown or reddish brown upper Ae1 (Bmf1) which grades to lighter colored lower Ae2 (Bmf2 or C or Ae) over Bt horizon. The degree of base saturation is higher than that of the solum of Acid Brown Wooded soils.
Profile: L-H, Ae1 or Bmf1, Ae2 or Bmf2 or C, (AB), Bt, C.

3.24 Bisequa Grey Wooded
Grey Wooded soils in which a podzol sequence of horizons has developed in Ae and overlying a continuous textural (Bt) horizon at depths of less than 30 inches from the surface. If the solum of the podzol sequence is well developed (orthic) it must be less than 18 inches thick.
Profile: L-H, Ae, Bf, C/Bt, C or L-H, Ae, Bf1, (Bf2)/Ae, Bt, C.

3.28 Gleyed Grey Wooded
Soils with same type of profiles as any of the other subgroups but with mottling or other discolorations due to periodic wetness in the Ae and Bt horizons.
Specific profile types may be indicated as follows: 3.2 1/8, 3.23/8, etc.
Profile: L-H, Aeg, Btg, C.

3.29 Peaty Grey Wooded
The gleyed Grey Wooded soils may have a peaty surface layer 6" to 12" thick. They are designated as 3.28/9 or more specifically as 3.21/8/9, 3.22/8/9 etc.

3.3 Humic Podzol Great Group

Soils with thick organic surface horizons (L-H), with light colored eluvial horizon (Ae), and with illuvial horizon (Bh) in which organic matter is the main accumulation product. The Bh is at least 2" thick and contains 10% or more of organic matter; it generally has a color of 5YR 3/3 or darker. It may be underlain by a Bfh or Bf horizon. Degree of base saturation of solum is very low and cation exchange capacity of Bh is very high.

3.31 Orthic Humic Podzol

The Bh horizon contains free iron, as well as 10%, or more, of organic matter and is underlain by Bhf horizon containing less than 10% organic matter. Bh and Bhf horizons may be friable or cemented and may be underlain by thin, vitreous, dark reddish brown, impervious hardpan.
Profile: L, F, H, Ae, Bh, Bhf, C.

3.32 Humus Podzol

The Bh horizon is free of iron oxide or so low in iron oxide that it does not turn red on ignition.
Profile: L, F, H, Ae, Bh, C.

3.38 Gleyed Humic Podzol

Humic Podzols with same type of profiles as either of the other subgroups but mottled or splotched with iron and/or organic matter in Ae and B horizons due to periodic wetness.
Specific profile types may be indicated as 3.31/8 or 3.32/8.
Profiles: L, F, H, Aeg (ABg) Bhg, C,
L, F, H, Aeg, Bhg, Bhfg, C.

3.39 Peaty Humic Podzols

All of the subgroups may have a peaty surface 1' to 3' thick. The peaty layer consists essentially of thick L and F horizons which are underlain by well developed Ae and Bh horizons.

3.4 Podzol Great Group

The undisturbed soils have organic surface horizon(s) (L-H), a light colored eluvial horizon (Ae), and an illuvial B horizon (Bf or Bfh) in which organic matter and sesquioxides are the main accumulation products. The main B horizon contains less than 10% of organic matter but a thin (less than 2" thick) Bh horizon containing more than 10% organic matter may be present immediately under the Ae. The solum is generally moderately to strongly unsaturated.

3.41 Orthic Podzol

Soils with organic surface horizon(s) (L-H), a light colored eluvial horizon (Ae) more than 1" thick and a friable Bfh or Bf horizon of high chroma. A Bh sub-horizon containing more than 10% organic matter is lacking or less than 2" thick.
Profile: L-H, Ae, (Bh), Bfh or Bf, C.

3.42 Minimal Podzol

Soils with organic surface horizons (L-H), with thin (less than 1") light colored eluvial horizon (Ae), and with friable Bfh or Bf horizon or soils with Ae horizons more than 1" thick but with weakly expressed B horizons (less than 2units of chroma or value darker than Ae horizon).
Profile: L-H, Ae (Bfh), Bf, C or
L-H, Aej, Bfj, C.

3.43 Orstein Podzol

Similar to orthic subgroup but with cemented B horizon; may be continuous or interrupted. In practice, if more than 15% (horizontally) of the B is cemented the soil series shall be classified in this subgroup.
Profile: L-H, Ae, (Bfhc), Bfc, C.

3.44 Textural Podzol

Soils with an organic surface horizon (L-H), with light colored eluvial horizon (Ae) and with illuvial horizon (Btf) which contains accumulations of organic matter, sesquioxides and of clay. The clay content increases markedly from Ae to Btf and increases with depth to lower Bt2 or Bt3 and then decreases gradually and imperceptibly to the parent material. The solum is acid and unsaturated.
Profile: L-H, Ae, Btf1, Bt2, BC, C.
This subgroup may be considered as an intergrade between the Podzol and Grey Wooded groups as the B horizon has some characteristics of both groups. It differs from the Bisequa Podzols in which the podzolic B overlies the textural B and the two B horizons are generally separated by an Ae horizon.

3.45 Bisequa Podzol

Podzol sola, having organic surface (L-H), Ae and Bf horizons, that have developed in the Ae of Grey Brown Podzolic or Grey Wooded Soils, and are underlain by a textural (Bt) horizon. The Bf and Bt horizons are often separated by the lighter colored lower part of the Ae of the podzolic profiles which might be considered as the C horizon of the upper Podzol profile. If the solum of the podzol sequence is well developed (orthic) it must be more than 18 inches in thickness or if weakly developed (minimal) the depth to the continuous Bt must be more than 30 inches. If Bt is discontinuous or so weak that it does not interfere with the moisture regime, the Podzol profiles are classified with the other appropriate Podzol subgroups.
Profile: L-H, Ae, Bf, C/, Bt, C.

3.47 Podzol with Permafrost

Podzol soils with the solum characteristics of any of the above subgroups underlain by permafrost. Specific profile types may be indicated as follows: 3.41/7, 3.42/7, etc.
Profile: L-H, Aeg, Bfg, Cz.

3.48 Gleyed Podzols
Pdozol soils with the characteristics of any of above subgroups but with mottling or other discolorations due to periodic wetness in the Ae and Bf horizons. Specific profile types may be indicated as follows:
3.41/8, 3.42/8, etc.
Profile: L-H, (Ah), Aeg, Bfg, Cg.

3.49 Peaty Podzols
Gleyed and subarctic podzols with a peaty surface 6" to 12" thick. They may be designated as follows: 3.48/9 Peaty gleyed Podzol; or more specifically 3.41/8/9; 3.41/8/9, etc.

REPORT ON THE CLASSIFICATION OF BRUNISOLIC SOILS

A. Leahey,
Chairman, Subcommittee on Brunisolic Soils

CLASSIFICATION OF THE BRUNISOLIC ORDER OF SOILS

Order 4. Brunisolic Soils

Well to imperfectly drained soils developed under forest or mixed forest and grass vegetation with brownish colored sola without marked eluvial or illuvial horizons.

Great Groups	Sub-groups
4.1 Brown Forest Soils of high base saturation with a distinct Ah horizon.	4.11 Orthic Brown Forest Ah, Bm, C 4.12 Degraded Brown Forest Ah, Bm, Btj, C 4.18 Gleyed Brown Forest
4.2 Brown Wooded Soils of high base saturation without distinct Ah horizons.	4.21 Orthic Brown Wooded L-H, Bm, C, L-H, Bmf, Bm, C 4.22 Degraded Brown Wooded L-H, Aej, Btj, C 4.27 Brown Wooded with permafrost L-H, Bm, Cg, Cz 4.28 Gleyed Brown Wooded
4.3 Acid Brown Wooded Soils of low base saturation without distinct Ah horizons.	4.31 Orthic Acid Brown Wooded L-H, Bmf, Bm, C 4.37 Acid Brown Wooded with perma frost L-H, Bmf, Bm, C, Cz 4.38 Gleyed Acid Brown Wooded
4.4 Acid Brown Forest Soils of low base saturation with distinct Ah horizons	4.41 Orthic Acid Brown Forest Ah, Bmfj, C 4.48 Gleyed Acid Brown Forest
4.5 Concretionary Brown Soils containing numerous pedogenic magnetic ferruginous concretions and prominent iron coatings.	4.51 Orthic Concretionary Brown L-H, Bfcc, C 4.58 Gleyed Conretionary Brown

Definitions and Discussion of Brunisolic Great Groups and Sub-groups

4.1 Brown Forest

Soils of high base saturation with a distinct Ah horizon.

An L-H horizon may or may not be present. Usually it is destroyed through the actions of earthworms. The parent material is usually calcareous.

The Brown Forest soils occur almost entirely in the Great Lakes - St. Lawrence Lowland physiographic region. Here they have developed under similar climatic and biotic conditions as the Grey-Brown Podzolics and they appear to represent a stage of soil development between a Regosol and a Grey-Brown Podzolic soil. Their lack of distinct eluvial or illuvial horizons appear to be due to their age, high lime parent material or a combination of both.

Three sub-groups have been recognized. They are the Orthic, the degraded (an intergrade to the Grey-Brown Podzolic) and the gleyed (an intergrade to the Dark Grey Gleysolic). Their definitions are:

4.11 Orthic Brown Forest - Well drained Brown Forest soils with no apparent eluviated or illuviated horizons.

4.12 Degraded Brown Forest - Well drained Brown Forest soils with weakly developed illuvial horizons as judged by some clay accumulation.

4.18 Gleyed Brown Forest - Imperfectly drained Brown Forest soils with mottling and duller colors than the well drained Brown Forest soils.

2 Brown Wooded Soils

Soils of high base saturation without a distinct Ah horizon.

An L-H horizon is usually present. The parent material is usually calcareous. The thickness of the solum is rarely more than two feet.

The Brown Wooded soils occur in dry valleys in the Cordillera extending from the United States into the Yukon Territory. They are common on the intermediate terraces of the rivers in the forested region of the Great Plains. They are of rare occurrence on the uplands in the Great Plains. In the Cordillera they appear to be the zonal soils of the driest forest while elsewhere they are developing under similar climatic and biotic conditions as the Grey Wooded soils. The Brown Wooded soils appear to represent a stage of soil development between a Regosol and a Grey Wooded soil. Their lack of distinct eluvial or illuvial horizons appears to be due to climate, age, high-lime parent material or a combination of all these factors.

Four sub-groups have been recognized. They are the orthic, gleyed, the degraded, and with permafrost. Their definitions are:

4.21 Orthic Brown Wooded - Well drained Brown Wooded soils with no apparent eluviated or illuviated horizons. The upper part of the mineral solum may have a higher chroma than the lower part.

4.22 Degraded Brown Wooded - Well drained Brown Wooded soils which have weakly developed eluvial and illuvial horizons as shown by some clay accumulation.

4.27 Brown Wooded Soils with permafrost.

4.28 Gleyed Brown Wooded - Imperfectly drained Brown Wooded soils with mottling and duller colors than the well drained Brown Wooded soils.

4.3 Acid Brown Wooded Soils*

Soils with low base saturation without a distinct Ah horizon.

An L-H horizon is usually present. The parent material is usually of low base saturation.

The Acid Brown Wooded soils occur in all provinces but their major distribution is in the western part of the Appalachian region in Quebec and in the southern parts of the Canadian Shield in Ontario and Quebec. In these areas they may be considered as zonal soils. The Acid Brown Wooded soils appear to represent a stage of soil development between the Regosol and the Podzol. Their lack of distinct eluvial and illuvial horizons may in some instances be attributed to age or resistant mineral material. However, for the most part the reasons for their failure to develope into Podzols are unknown.

Three sub-groups have been recognized to date. These are the orthic, the gleyed and with permafrost.

4.31 Orthic Acid Brown Wooded - Well drained Acid Brown Wooded soils.

4.37 Acid Brown Wooded Soils with permafrost.

4.38 Gleyed Acid Brown Wooded - Imperfectly drained Acid Brown Wooded soils with mottling present throughout the solum.

4.4 Acid Brown Forest Soils

Soils of low base saturation with a distinct Ah horizon.

Soils classified into this group at present have parent materials of both low and high base status. A thin organic horizon may be present.

The only place where soils have been classified into this group is on the southeastern coastal plain of Vancouver Island. The distinct Ah horizon may be a relic from a time when these soils were under grass or a grass and oak vegetation. At present some of the virgin sites are covered by coniferous trees.

Two sub-groups have been recognized to date. These are:

4.41 Orthic Acid Brown Forest - Well drained Acid Brown Forest soils.

4.48 Gleyed Acid Brown Forest - Imperfectly drained Acid Brown Forest soils with mottling and duller colors than the orthic sub-groups.

4.5 Concretionary Brown Soils

Soils containing numerous pedogenic magnetic ferruginous concretions and prominent iron coatings.

The parent material is of either low or high base saturation.

* Formerly known as Brown Podzolic soils.

The Concretionary Browns occur entirely on the west coast of B.C. under a climate characterized by mild, wet winters and cool, dry summers. Forest cover on virgin sites is heavy. In general appearance they resemble Acid Brown Wooded soils but the presence of magnetic concretions distinguishes them. For reasons of climate or parent material they are unique to the west coast.

Two sub-groups have been recognized to date. These are:

4.51 Orthic Concretionary Brown - Well drained Concretionary Brown soils.

4.58 Gleyed Concretionary Brown - Imperfectly drained Concretionary Brown soils with prominent mottling in the lower part of the sola and with higher chroma than the Orthic Concretionary Brown in the upper part of the sola.

REPORT ON THE CLASSIFICATION OF REGOSOLIC SOILS

L. Farstad
Chairman, Sub-committee on Regosolic Soils

Order 5: Regosolic Soils

Well and imperfectly drained soils which lack discernible horizons or in which horizon development is limited to a non-chernozemic organic-mineral surface horizon (Ah) or to organic surface horizons (L-H) less than 12 inches thick.

Great Group: 5.1 - Regosol

Only one great group has been recognized to date. Therefore the great group definition is the same as for the order.

Sub-groups

5.11 Orthic Regosols: Soils lacking any horizon development or with thin or weak Ah horizons and without visible evidence of salts or gleying. (Weak Ah horizons are defined as Ah horizons that will not produce Aa horizons of 5 inches thickness one Munsell unit darker in value than the C horizons - dry colours.)

5.12 Mull Regosols: Soils which have a distinct non-chernozemic Ah horizon, little or no L-H, and without visible evidence of salts or gleying.

5.13 Mor Regosol: Soils which have organic horizons up to 12 inches in thickness, little or no Ah and without visible evidence of salts or gleying.

5.14 Organo-Regosol: Soils containing a relatively high content of organic matter in the profile. The organic matter may occur as layers or pockets separated by mineral materials without visible evidence of salts or gleying.
(This sub-group probably includes the well and imperfectly drained counterparts of the Rego-Gleysol.)

5.15 Saline Regosols

5.17 Regosols with Permafrost

5.18 Gleyed Regosol: Imperfectly drained Regosols

Note: The terms Saline, with Permafrost, and Gleyed are to be used in conjunction with other sub-groups. For example:

5.11/8 Gleyed Orthic Regosol

5.14/7 Organo Regosol with Permafrost

REPORT ON THE CLASSIFICATION OF GLEYSOLIC SOILS

W.A. Ehrlich
Chairman, Sub-committee on Gleysolic Soils

5	Gleysolic	6.1 Meadow	6.11 Orthic Meadow 6.12 Calcareous Meadow 6.13 Saline Meadow 6.14 Degraded Meadow 6.19 Peaty
		6.2 Dark Grey Gleysolic	6.21 Orthic Dark Grey Gleysolic 6.22 Saline Dark Grey Gleysolic 6.23 Degraded Dark Grey Gleysolic 6.29 Peaty
		6.3 Gleysol	6.31 Orthic Gleysol 6.32 Calcareous Gleysol 6.33 Saline Gleysol 6.34 Rego-Gleysol 6.39 Peaty
		6.4 Eluviated Gleysol	6.41 Humic Eluviated Gleysol 6.42 Low Humic Eluviated Gleysol 6.43 Ferralitic Eluviated Gleysol 6.49 Peaty

6 Gleysolic Order

Soils with organic horizons (12 inches thick), or with an Ah horizon or with both, or without these surface horizons but with some organic material dispersed throughout the mineral soil. The subsoils usually show gleying and are dull colored but may have brighter colored prominent mottles.

Soils associated with wetness. They have developed under various climatic and vegetative conditions and in the presence of a high or highly fluctuating water table.

6.1 Meadow Great Group

Soils with a dark colored Ah horizon more than 2 inches thick which grades into a dull colored horizon or horizons that may or may not show gleying. May have organic horizons not exceeding 12 inches in thickness.

These soils have developed under grasses, sedges and swamp-forests.

6.11 Orthic Meadow Sub-Group

Soils with a non-calcareous, Ah horizon which grades into a dull colored horizon or horizons. Underlying material are usually calcareous. May have organic horizons up to 3 inches thick.

6.12 Calcareous Meadow Sub-Group

Soils with a calcareous, Ah horizon which grades into a calcareous (not significantly saline), dull colored horizon or horizons. May have organic horizons up to 3 inches thick.

6.13 Saline Meadow Sub-Group

Soils with an Ah horizon which grades into a saline, usually calcareous horizon or horizons. May have organic horizons up to 3 inches thick.

Water soluble salts usually occur in the Ah horizon. Salinity of the soil is sufficiently high to affect plants with a low salt tolerance.

6.14 Degraded Meadow Sub-Group

Soils with an Ah horizon underlain by a mottled Btg horizon. May have organic horizons up to 3 inches thick.

6.19 Peaty

Any meadow soil with 3 to 12 inches of peat. These soils should be classed as 6.11/9 - Peaty Meadow; 6.12/9 - Peaty Calcareous Meadow; 6.13/9 - Peaty Saline Meadow; 6.14/9 - Peaty Degraded Meadow.

6.2 Dark Grey Gleysolic Great Group

Soils with a dark colored Ah horizon more than 2 inches thick abruptly underlain by a gleyed horizon or horizons. May have organic horizons not exceeding 12 inches in thickness.

Developed under swamp-forest vegetation.

The major features distinguishing the Dark Grey Gleysolic soils from the Meadow soils are: (1) lower organic matter content of the Ah horizon, (2) abrupt termination of the Ah horizon from the underlying horizon, and (3) strong gleying.

6.21 Orthic Dark Grey Gleysolic Sub-Group

Soils with an Ah horizon abruptly underlain by a gleyed horizon or horizons. May have organic horizons up to 3 inches thick.

6.22 Saline Dark Grey Gleysolic Sub-Group

Soils with an Ah horizon abruptly underlain by a gleyed saline horizon or horizons. May have organic horizons up to 3 inches thick.

6.23 Degraded Dark Grey Gleysolic Sub-Group

Soils with an Ah horizon abruptly underlain by a Bg horizon with an accumulation of clay and sesquioxides. May have organic horizons up

6.29 Peaty

Any Dark Grey Gleysolic soil with 3 to 12 inches of peat. These soils should be classed as: 6.21/9 - Peaty Dark Grey Gleysolic; 6.22/9 - Peaty Saline Dark Grey Gleysolic; 6.23/9 - Peaty Degraded Dark Grey Gleysolic.

6.3 Gleysol Great Group

Soils with organic horizons less than 12 inches thick or without these horizons and with a strongly gleyed mineral horizon or horizons. May have a thin Ah horizon up to 2 inches thick. No noticeable eluvial or illuvial horizons.

These soils developed under swamp-forest, heath or swamp vegetation.

6.31 Orthic Gleysol Sub-Group

Soils with organic horizons less than 6 inches thick, a thin (2 inches thick) or absent Ah horizon underlain by a strongly gleyed non-calcareous mineral horizon or horizons.

6.32 Calcareous Gleysol Sub-Group

Soils with organic horizons less than 6 inches thick, a thin (2 inches thick) or absent Ah horizon underlain by a strongly gleyed calcareous horizon or horizons. This Sub-Group includes the Gleysol soils with a marly horizon.

6.33 Saline Gleysol Sub-Group

Soils with organic horizons less than 6 inches thick, a thin (2 inches thick) or absent Ah horizon underlain by a strongly gleyed horizon or horizons with water soluble salts in sufficient quantities to affect plants with a low salt tolerance.

6.34 Rego-Gleysol Sub-Group

Soils with less than one inch of peat or muck on the surface and without an Ah horizon. Some organic material in the form of peat, muck, or organic mud may be dispersed through the mineral soil. Strongly gleyed mineral soil occurs at or near the surface.

6.39 Peaty

All Gleysol soils except Rego-Gleysol with 6 to 12 inches of peat. These soils should be classed as 6.31/9 - Peaty Gleysol, 6.32/9 - Peaty Calcareous Gleysol; 6.33/9 - Peaty Saline Gleysol.

6.4 Eluviated Gleysol Great Group

Soils with organic horizons (12 inches thick) or with an Ah horizon or with both but with a mottled Aeg horizon and a mottled Bg horizon. These soils have developed under grasses, sedges and swamp-forest.

6.41 Humic Eluviated Gleysol Sub-Group

Soils with an Ah horizon more than 2 inches thick, a mottled Aeg horizon and a mottled Btg horizon.

Soils developed under grasses and sedges in the grassland region but may have organic horizons up to 6 inches thick.

6.42 Low Humic Eluviated Gleysol Sub-Group

Soils with organic horizons up to 6 inches thick, a thin (2 inches thick) or absent Ah horizon underlain with a mottled Aeg horizon and a mottled Btg horizon.

6.43 Ferralitic Eluviated Gleysol Sub-Group

Soils with organic horizons up to 6 inches thick, a thin (2 inches thick) or absent Ah, a mottled strongly gleyed Aeg horizon and a mottled strongly gleyed Bfg horizon.

Soils developed under swamp-forest, heath or swamp-vegetation.

6.49 Peaty

Soils in this group with 6 to 12 inches of peat. These soils should be classed as: 6.41/9 - Peaty Humic Eluviated Gleysol; 6.42/9 - Peaty Low Humic Eluviated Gleysol; 6.43/9 - Peaty Ferralitic Eluviated Gleysol.

REPORT ON THE CLASSIFICATION OF ORGANIC SOILS

R. Wicklund
Chairman, Sub-committee on Organic Soils
(This report is submitted for study purposes only)

Organic soil - a soil that contains at least 20 percent organic matter, is 12 inches or more in depth, and has no horizon development in the mineral substratum other than gleying.

Classification. Modification of Dawson and Farnham

Order. (Cat. VI)

7. Organic soils.

Great Soil Group. (Cat. V)

7.1 Terrestrial organosol - soils lacking a (basal) layer of sedimentary peat, diatomaceous earth or marl and lacking permafrost.

7.2 Aquatic organosol - soils having a (basal) layer of sedimentary peat, diatomaceous earth or marl and lacking permafrost.

7.3 Permafrost organosol - soils with permafrost.

Sub-Group. (Cat. IV)

7.11 Sphagnum peat
7.12 Fibrous peat
7.13 Disintegrated peat
7.14 Muck

7.21 Sedimentary peat
7.22 Diatomaceous earth
7.23 Marl peat

7.31 ----------

Definition of Terms

Sphagnum peat - organic soil material consisting predominantly of sphagnum moss, leaves and stems.

Fibrous peat - organic soil material consisting predominantly of the partially decayed remains of marsh plants other than sphagnum.

Disintegrated peat - organic soil material consisting predominantly of finely divided, unidentifiable plant remains, that are not chemically decomposed.

Woody peat - organic soil material consisting predominantly of small fragments of the woody parts of plants.

Muck - organic soil material consisting predominantly of finely divided unidentifiable plant materials. Solubility in saturated sodium pyrophosphate solution is greater than three-quarters of one percent.

Sedimentary peat - organic soil material consisting predominantly of the fecal remains of small aquatic animals. Material is plastic and non-sticky.

Diatomaceous earth - an unconsolidated deposit of the remains of diatoms mixed with organic matter.

Marl - an impure unconsolidated deposit of carbonate of lime.

Characteristics to be used in examination of organic soil profiles.

Depth - to mineral layer or to the first impermeable layer.

Muck - 1. Less than 24" (Shallow)
2. 24"-48" (Deep)
3. 48" + (Very deep)

Peat - 1. Less than 36" (Shallow)
2. 36"-72" (Deep)
3. 72" + (Very deep)

Reaction - pH of individual layers examined.

Nature of underlying material

1. Shallow organic soil overlying sand.
2. Shallow organic soil overlying loam and silt loam.
3. Shallow organic soil overlying clay.
4. Shallow organic soil overlying marl.

Discussion on Classification of Organic Soils

Stobbe - The definition of the order is perhaps not suitable because it demands some adjustment of other orders. There are organics with horizons developed in mineral substratum other than by gleying, for example 2 feet of peat over well-developed Podzol or Grey Wooded.

Chancey - cannot agree with 12 inch limit for these reasons. We will have to increase the depth in the definition and I move that this limit be increased to eliminate these problems. Twenty-four inches would be better in view of the character of these soils in Newfoundland. Would 24 inches be agreeable?

Stobbe - There are peaty Podzols with 36 inches of peat and this doesn't offend me, but in another case there was a well-developed Podzol which became covered with peat, and in this case this relic Podzol shouldn't be classed with Podzols but rather with organics.

Hutcheon - We have 2 feet of peat over well-developed horizons in Saskatchewan. What shall we do with them?

Stobbe - We should classify peats of up to 3 or 4 feet of peat according to the character of the lower mineral profile, on deeper peats we should give more emphasis to the character of the peat and less to the mineral sequum.

Chancey - Two concepts are involved. The accepted peat is a basin or hill developed due to water saturation. The other peat is in a well-drained position. Also we should have the organic matter content much higher than 20 or 30 percent.

Stobbe - Suggests that in Humic Podzols the limit for peat should be increased to 2 or 3 feet. For Grey Wooded soils under peat they probably never developed under the peat and therefore should be classed as peat soils.

Mathews - Maybe we need another order for these shallow peat soils. I don't think we need to be concerned about what happens when they are cultivated.

Stobbe - But some of the Peaty Podzols would then fall in an order other than Podzolic. I would be pleased to change the definition in Podzolic order to permit more than 12 inches of peat, although this change should apply only to Podzols and Humic Podzols because in other great groups the profiles didn't develop under peat.

Millette - Do not like the sub-groups established here because most bogs are stratified or interlayered.

Odynsky - Impractical to classify basal layers if they occur at depths greater than 6 feet. Farnham's limit is at 6 feet. Are we going to go deeper than 6 feet?

Wicklund - This is a fundamental question: Dawson's system versus Farnhams's.

Stobbe - At depths to 6 feet that basal layer is more important to management.

Rowe - We might get a much better classification of peat from Sweden, other European countries or Russia who have classified these deposits in many ways.

Leahey - At present we shall have to continue ad hoc until more study is conducted. This report was prepared only for study purposes and to focus attention on the problems. In my opinion the sub-committee has done a good job in achieving these objectives. The sub-committee was thanked for their efforts.

REPORT OF THE SUB-COMMITTEE ON PUBLICATIONS

A. Leahey, Chairman

This sub-committee considered matters relating to publication of information approved by the National Committee. This report consists of the recommendations submitted by the sub-committee to the plenary session on February 27, the action that was taken on them and some of the relevant discussion.

Publication of the Classification System

The sub-committee made the following recommendations:

1. That the N.S.S.C. system of soil classification as approved by this 1960 meeting be published.

2. That all names defined in the publication be approved for use in other publications if used as defined.

3. That the publication mentioned under the first recommendation should consist only of the classification tables and an adequate description of each class in categories 4, 5 and 6. The classification tables should only include those characteristics that are differentiating at the particular level concerned. The adequate description of each class should be written separately and in addition to the soil characteristics should include a description of the environmental factors and location.

4. That the editorial committee for this proposed handbook on classification consist of the chairman of the national committee, the chairmen of the Order sub-committees at the 1960 meeting, the chairman of the sub-committee on Soil Horizons, and a bilingual member (French-English). The chairman of the national committee will be the chairman of the editorial committee.

After considerable discussion these recommendations were unanimously accepted by the national committee.

The discussion covered such topics as how the proposed publication would affect the usual Proceedings, when the soil classification system should come into force, the format of the publication on soil classification and revisions in the system.

(a) It was agreed that we should issue a Proceedings as well as the handbook on soil classification. The Proceedings would include the classification table, the major items of discussion on classification and other business matters. However, it would be shortened over previous proceedings by not including the full reports of the committees on the classification of mineral soils. The Proceedings should be issued as quickly as possible.

(b) The sub-committee expressed the view that the classification system should come into force when the handbook on classification was released. Dr. Stobbe thought we should try out the new proposals for a year. Dr. Hutcheon disagreed with the idea of a trial period and stated the 1960 proposals should go into effect as quickly as possible as we had to make a firm decision on this matter sometime and it was unlikely that we would be able to arrive at better proposals within the next few years. Dr. Hutcheon's views prevailed and the meeting agreed "that as soon as the classification table is released by the chairman of the N.S.S.C. it will be deemed to be in force."

This decision means that the classification system is now in force insofar as new publications are concerned. It may also be used for publications now in course of preparation at the discretion of the authors concerned.

(c) After some discussion the meeting decided that the handbook on soil classification should be first issued as a mimeographed publication in order to get the information into the hands of the Canadian pedologists as soon as possible. Later we should consider dressing up the publication and issuing it in printed form under some such title as "Canadian Soils and their Classification".

(d) The meeting agreed that classification system should remain in force until it is revised by a national meeting of the N.S.S. Committee.

Standing Committee on Soil Classification

All the mineral soils in Canada are not covered by the N.S.S.C. classification. Some of these soils which fall outside the present system will likely be described in reports before the classification system is revised. The sub-committee on publications felt there should be some control and some priority on the use of names for such soils until the classification system can be revised to take care of them. Hence the following two recommendations were submitted to the plenary session.

(1) That a standing committee on soil classification be established. Its duties will be to receive and study submissions regarding the establishment of new classes and to tentatively approve new classes of soils and their names for use until a revised classification system is published.

(2) That this standing committee on soil classification will consist of the chairman and the secretary of the national committee and any three other members whom they will appoint to consider each particular submission. These two recommendations were approved by the members.

Soil Survey Handbook

The sub-committee expressed concern over the fact that many previous reports of the N.S.S.C. which might be grouped under a general heading of soil survey methods and techniques, were being somewhat ignored and that the recommendations in these reports were not being followed. Yet a great deal of time and effort had gone into these reports. The sub-committee felt this situation probably arose from the fact that these reports are in a number of different proceedings and that we should bring them together in one publication. Therefore the following recommendations were submitted to the plenary session.

(1) That a soil survey handbook be prepared to include the definition of terms as proposed by the most recent committees on soil survey methods and nomenclature (not including soil classification) and as approved by the N.S.S.C.

(2) This handbook will represent the official view of the N.S.S.C. in regard to these definitions and the terms will be used in soil survey publications only as they are defined until such time as the handbook is revised.

Discussion on these recommendations showed that several provinces were not willing to accept in toto all the recommendations previously made by sub-committees on drainage, structure, topographic classes, etc. A suggestion that these sub-committee reports needed critical evaluation and revision before becoming official received strong support. The opinion was expressed that we had been so much concerned with soil classification matters since 1955 that we had neglected these other important aspects of our work. Generally the members of the N.S.S.C. accepted the principle expressed in the recommendations but they felt that the publication of such a handbook at this time would be premature. A motion by Dr. Stobbe, seconded by Mr. Clayton, that these recommendations be tabled was accepted by the meeting.

Membership of Sub-committees at Guelph Meeting

Chernozemic and Solonetzic Soils:	Clayton (Chairman), Bowser, Chapman, Ehrlich, Farstad
Podzolic Soils:	Stobbe (Chairman), Baril, Cann, Chancey, Ellis, Millette, Odynsky, Pratt, Wicklund
Brunisolic Soils:	Leahey (Chairman), Day, Hoffman, Mailloux, Sprout
Regosolic Soils:	Farstad (Chairman), Chapman, Day, Ellis, Pratt, Wicklund
Gleysolic Soils:	Ehrlich (Chairman), Cann, Chancey, DeLong, Mailloux, Mathews, Odynsky
Soil Horizons:	Bowser (Chairman), Baril, Clayton, Hoffman, Millette, Sprout, Stobbe
Organic Soils:	Wicklund (Chairman), Baril, Chancey, Day, Ellis, Hills, Mackenzie, Odynsky, Pratt, Sprout.
Co-ordination of Classification on Mineral Soils:	Stobbe (Chairman), Bowser, Cann, Clayton, Ehrlich, Farstad, Hoffman, Mailloux, Millette
Publications:	Leahey (Chairman), Chapman, Mathews

Attendance at Plenary Sessions

Atkinson, H.J.	C.D.A. Research Branch	Ottawa
Baril, R.	" " "	Ste. Anne de la Pocatiere
Bowser, W.E.	" " "	Edmonton
Cann, D.B.	" " "	Truro
Chancey, H.W.R.	" " "	St. John's
Chapman, L.	Ontario Research Foundation	Toronto
Clayton, J.S.	C.D.A. Research Branch	Saskatoon
Day, J.H.	" " "	Ottawa
DeLong, W.A.	Macdonald College	Quebec
Ehrlich, W.A.	C.D.A. Research Branch	Winnipeg
Ellis, J.G.	University of Saskatchewan	Saskatoon
Farstad, L.	C.D.A. Research Branch	Vancouver
Gillespie, J.E.	" " "	Guelph
Hedlin, R.A.	University of Manitoba	Winnipeg
Hills, G.A.	Ont. Dept. Lands and Forests	Maple
Hoffman, D.W.	C.D.A. Research Branch	Guelph
Hutcheon, W.L.	University of Saskatchewan	Saskatoon
Irving, R.M.	Ontario Agricultural College	Guelph
Johnson, W.E.	Saskatchewan Dept. of Agriculture	Regina
Leahey, A.	C.D.A. Research Branch	Ottawa
MacKenzie, A.F.	Ont. Agricultural College	Guelph
Mailloux, A.A.	Que. Dept. Agriculture	Ste. Anne de la Pocatiere
Mathews, B.C.	Ont. Agricultural College	Guelph
Millette, G.	C.D.A. Research Branch	Fredericton

Morwick, F.	Ont. Agricultural College	Guelph
Olding, A.B.	C.D.A. Research Branch	Guelph
Odynsky, W.	Alberta Research Council	Edmonton
Pratt, L.E.	C.D.A. Research Branch	Ottawa
Richards, N.R.	Ont. Agricultural College	Guelph
Ripley, P.O.	C.D.A. Research Branch	Ottawa
Rowe, J.S.	C.D.N.A.N.R. Forestry Branch	"
Rowles, C.	University of British Columbia	Vancouver
Sprout, N.	B.C. Dept. of Agriculture	Kelowna
Stobbe, P.C.	C.D.A. Research Branch	Ottawa
Toogood, J.	University of Alberta	Edmonton
Webster, G.R.	C.D.A. Research Branch	Saanichton
Wicklund, R.	" " "	Guelph
Whiteside, G.B.	" " "	Charlottetown