THE SOILS ROUND KILMARNOCK

THE SOIL SURVEY OF SCOTLAND

The Macaulay Institute for Soil Research, Aberdeen

DEPARTMENT OF AGRICULTURE FOR SCOTLAND

MEMOIRS OF THE
SOIL SURVEY OF GREAT BRITAIN

SCOTLAND

THE SOILS OF THE COUNTRY ROUND KILMARNOCK

[SHEET 22 and part of SHEET 21]

BY

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PREFACE

THE SOILS of North Ayrshire were examined and surveyed by the late Professor Berry and other members of the staff of the West of Scotland Agricultural College in the years 1920-30. Chapter 26 of the Geological Survey Memoir for North Ayrshire is devoted to a study of the soils and agriculture of the region. This survey was principally concerned with the surface soils and a Soil Texture Map (scale 1 inch to 1 mile) was published. The concept of soil has changed since the original survey was made and present day soil surveys are based on the morphology of the soil profile. This involves the examination of horizons to a depth of approximately 4 feet and consideration is given to many more properties of soils than in the earlier survey.

The solid geology of this region is complex and in addition the glacial drifts upon which many of the soils are formed may be extremely complex, being derived from several rock types.

Mr. B. D. Mitchell commenced the survey in 1950 and completed the field work in 1954, he was assisted by Mr. D. T. Davies 1950 to 1951 and Mr. R. A. Jarvis 1952 to 1954. The memoir has been written by Mr. B. D. Mitchell and Mr. R. A. Jarvis.

Various members of the staff of the Macaulay Institute for Soil Research have contributed to this memoir; Dr. R. L. Mitchell wrote the section on Trace Elements, Dr. R. Hart the section on Minerals in the Fine Sand Fraction, and Dr. R. C. Mackenzie and Mr. W. A. Mitchell the section on Minerals in the Clay Fraction. During the summer of 1955 Mr. R. A. Robertson and Mr. E. L. Birse carried out a vegetation survey of the map area and wrote the Vegetation Chapter, Mr. S. E. Durno contributing the note on tree pollen analysis.

Dr. H. G. M. Hardie and the staff of the Soil Analysis Section of the Department of Pedology did the analyses of the soil profiles, except for the Exchangeable Calcium, Sodium and Potassium which were determined by Dr. R. L. Mitchell and the staff of the Department of Spectrochemistry. Miss A. M. B. Geddes and Dr. H. G. M. Hardie read the manuscript and, with Mr. J. W. Muir, offered many helpful suggestions. Professor H. Nicol and Dr. R. Laird of the West of Scotland Agricultural College have taken a considerable interest in the survey. A great deal of information on agriculture, agricultural history and land utilisation has been sought, and willingly given by Dr. Laird. Thanks are also due to the many farmers and landowners for their co-operation.

Copies of the field maps may be inspected in the Soil Survey Section of the Macaulay Institute.

The present memoir constitutes the first of the soil survey conducted in south-west Scotland. An overlay on the sheet 14 to the south was made by Mr. B. D. Mitchell and this work is continuing.

ROBERT GLENTWORTH
Head of the Soil Survey of Scotland

The Macaulay Institute for Soil Research,
Craigiebuckler, Aberdeen.
December, 1955.

CONTENTS

LIST OF COLOUR PLATES

LIST OF PLATES

LIST OF TABLES

APPENDICES

APPENDICES—*Continued*

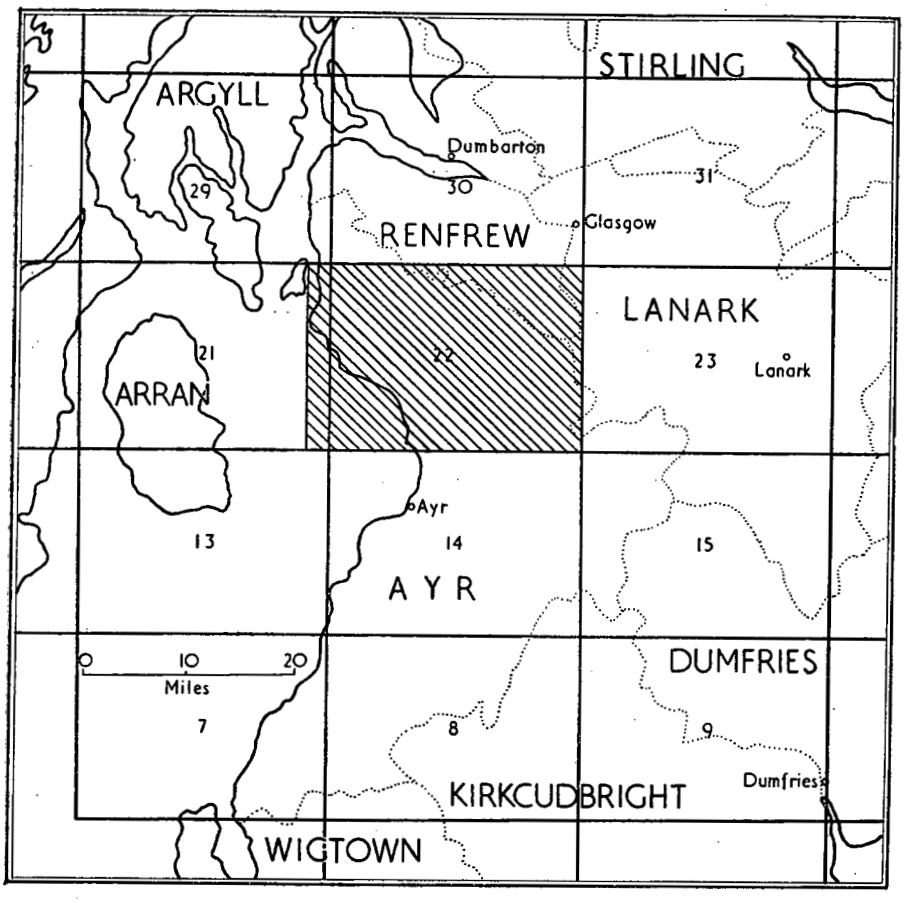


FIG. 1. Location of Area.

CHAPTER I

General Description of the Area

LOCATION AND EXTENT

THE district described in this memoir is situated in the south-west of Scotland, Fig. 1, and has an area of 408 square miles; 393 square miles are covered by the one-inch Third Edition Ordnance Survey Sheet 22, and 15 square miles (to the west) by Sheet 21.

The composite sheet embraces most of North Ayrshire and, in the north, parts of Renfrewshire and Lanarkshire, with the Ayrshire coast fringing the Firth of Clyde between Largs and Troon as the western margin. Civil parishes are shown in Fig. 2. The area is served by several towns, Kilmarnock being the most important and the principal market and industrial centre.

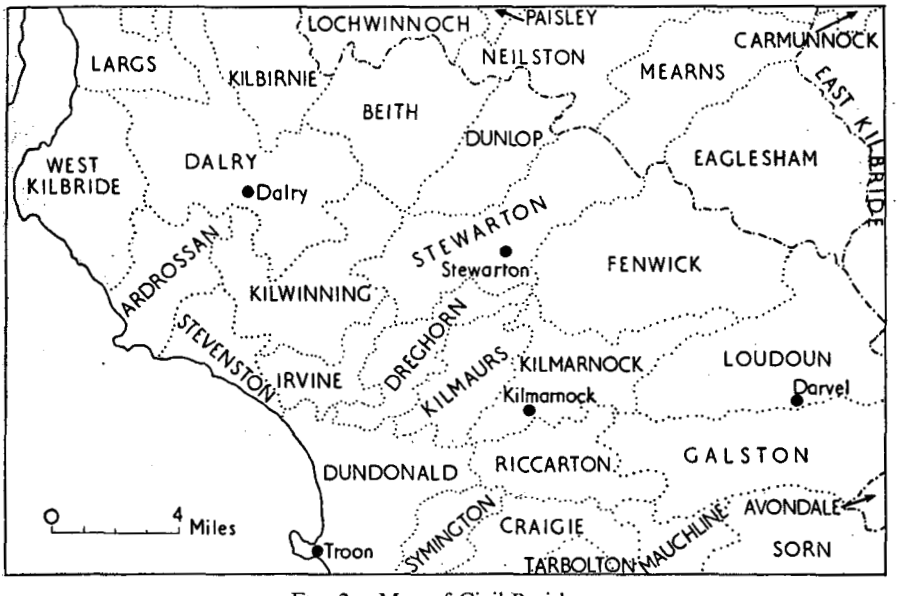


FIG. 2. Map of Civil Parishes.

PHYSICAL FEATURES

MAJOR STRUCTURAL DIVISIONS

Three major physical regions of the Scottish Central Lowland are represented in the area:

(1) The Ayrshire Plain
(2) The plateau tract dividing the Plain from the Clyde Lowland
(3) The Clyde Lowland

The Plain is a compact unit, the greater part being contained roughly by a line from Ardrossan through Kilbirnie, Lugton, Fenwick and Newmilns to Sorn. Narrow projections form the Irvine, Lochlibo, and Garnock Valleys, and the raised beach between the Renfrew Plateau and the sea.

The plateaux limit the Plain to the east and north, extending northwards from the Kyle Upland in the south-east to Ballagioch Hill, and from there westwards to the coast, which is bordered by the Renfrew Plateau from Ardrossan to Largs. Their continuity is broken only by the finger-like extensions of the Plain already mentioned.

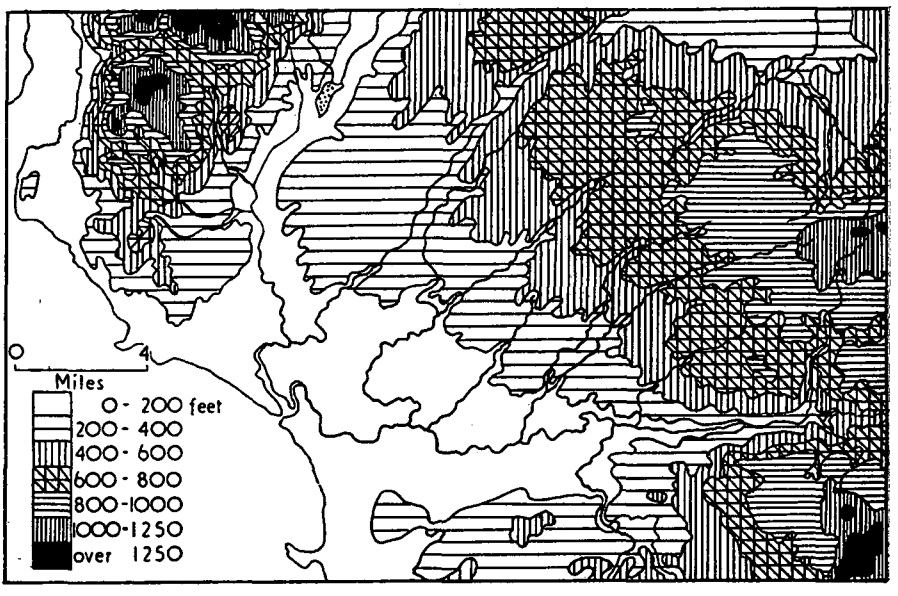


FIG. 3. Physical Map.

The boundary between the plateaux and the Plain is fairly sharp along the abrupt dip-slope of the Renfrew Plateau from Ardrossan to Kilbirnie and along part of the southern edge of the Beith Plateau between the Garnock and Lochlibo Valleys; elsewhere there is an imperceptible merging of the two regions.

In the north-east of the sheet area the Clyde Lowland is represented by the Neilston-Eaglesham Platform, the White Cart Valley, and a small portion of the lower Clyde Valley in the Giffnock district.

RIVER SYSTEM

The north-eastern corner of the area is drained northwards to the Clyde by the White Cart Water and its tributary, the Earn Water.

On the Ayrshire side of the watershed, from the Garnock Valley south-eastwards the drainage system reflects the smooth mature surface of the Plain, its saucer shape and its continuity with the plateaux, and an inward radial pattern of streams from the upland rim converges upon the coast at Irvine. Included in the system, from west to east, are the River Garnock, the Dusk, Lugton, Annick, Fenwick and Craufurdland Waters, the River Irvine and the Cessnock Water. This is the re-established pre-glacial consequent drainage system, the main streams having overcome the temporary obstructions of glacial debris and reverted towards their former alignment.

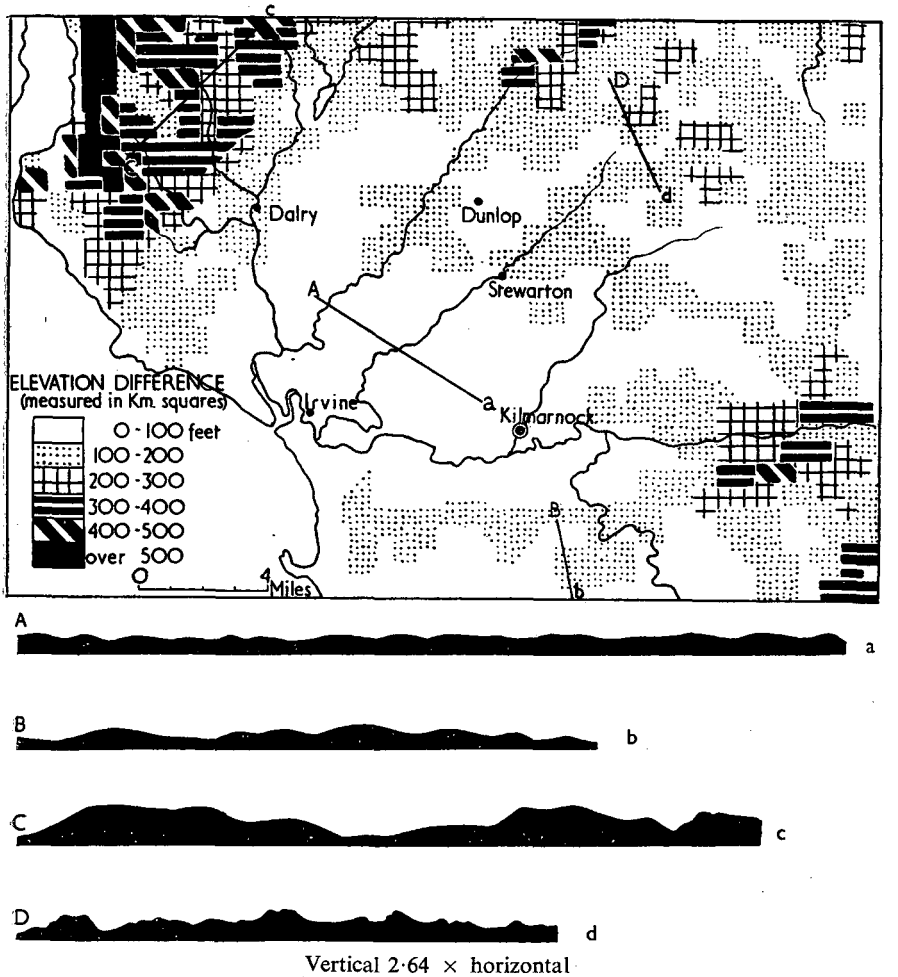
Very different is the pattern of tributary or subsequent streams which follow circuitous courses across the Plain through a network of shallow depressions in the glacial till. In the past the indeterminate character of the

subsequent drainage pattern was emphasised by a number of small lochs, most of which were drained towards the end of the eighteenth century.

To the west of the Garnock the drainage pattern is wholly governed by the structure of the Renfrew Plateau, the consequent valleys running south-east to the Garnock on the dip slope and west to the Firth of Clyde on the scarp.

LAND FORM REGIONS

Adequate representation of relief presents a considerable problem to the pedologist. Contour maps are useful in outlining the distribution of high land and low, Fig. 3, but give little or slight indication of the nature of the terrain. The relative relief map, Fig. 4, based upon the difference between the highest and lowest elevations within each kilometre square throughout the area, gives a general indication of the stage of dissection of the plateaux, but does not



Vertical 2·64 × horizontal

FIG. 4. Relative Relief Map.

show the intricate surface configuration which has such an overwhelming influence on the soil pattern where lithology and climate are constant.

The areas delineated in Fig. 5 have been constructed from field knowledge of their surface characteristics. Physiographic conditions favouring the pro-

duction of a particular slope form are usually rather widespread and thus the form is repeated frequently. Uniform lithology and physiographic history therefore, are characterised by the repeated occurrence of distinctive land forms, and any alteration in the physical factors leads to the disappearance of some of these forms and the introduction of new forms, thereby creating a regional boundary (Linton, 1951). The map of land form regions, Fig. 5, has been constructed upon this basis and is an attempted delimitation of regions characterised by distinct groups of land forms.

These units are listed below with a brief description of their features.

1. Lowland areas covered by deep glacial tills.
   (*a*) Cunningham Plain (50-400 feet). The pre-glacial surface is almost completely masked by a highly weathered till. An indeterminate subsequent drainage system has formed an intense reticulate pattern which is completely independent of the underlying relief. Low undulations, including many drumlins, grade into shallow depressions with only slight changes in elevation; the slopes rarely exceeding 3°.
   (*b*) Lowland Transition Zone (50-700 feet). The underlying structure governs the configuration of the surface and the topography may be undulating or rolling, often with a regular succession of ridges and troughs. Maximum slopes range from 3°-6°. There is no visible dividing line between the Zone and the Cunningham Plain.
2. Raised beach (0-50 feet)—almost level.
3. Garnock alluvium (100 feet)—level.
4. Neilston-Eaglesham Platform (400-600 feet).

A rolling surface with shallow stony till on the slopes which occasionally culminate in rocky knolls and grade down into wet hollows. The platform has apparently been eroded by moving ice for (apart from one or two hollows where deep till has lodged) it is almost completely without moderately fine textured highly weathered till of the type deposited on the Plain.

5. Eaglesham Moraine (500-800 feet).

Angular morainic debris forming a steep hummocky relief with wet hollows and some sand and gravel ridges. It rests on the Neilston-Eaglesham Platform and is contiguous with the northern edge of the Ballagioch Plateau.

6. Ballagioch Plateau (600-1000 feet)

This upland region appears to have been strongly scoured by ice flowing south-westwards. It is characterised by a series of small steep hills rising 100-200 feet from the base of the plateau, which possess little or no till and usually have bare rock exposed on the north-east, the iceward side. Each has a ridge of medium clay till tailing away on the lee side to the south-west.

A series of small lochs occupies rock-basins excavated in the floors of the valleys; elsewhere in the hollows there is a considerable depth of till. Basin peat has developed in places where natural drainage is obstructed.

7. Beith Plateau

To the north-west of the Ballagioch Plateau, across the Lochlibo Valley, lies the Beith Plateau. The western section has been named the Rowbank Plateau and the eastern section the Corkindale Plateau, with the Lochliboside Fault-line Scarp adjacent to it. The two sections are separated by a depression containing deep till and largely occupied by Hartfield Moss, which has been included in the Lowland Transition Zone.

(*a*) Rowbank Plateau (400-700 feet). The physiography of this sub-region is genetically similar to that of the Ballagioch Plateau but with more subdued relief. Glacial scour has been strong and the topography has taken on a crag-and-tail character oriented towards the south-west. Apart from one glacially-excavated rock basin occupied by reservoirs the hollows contain deep clay till.

(*b*) Corkindale Plateau (650-850 feet). An area of gentle slopes, rarely exceeding 5°, grading into shallow depressions. There is a thin cover of stony till with pockets of clay till in the hollows.

(*c*) Lochliboside Fault-line Scarp (400-700 feet). This falls away steeply along the south-eastern edge of the Corkindale Plateau at an angle of 12°-15° and is covered by a shallow till.

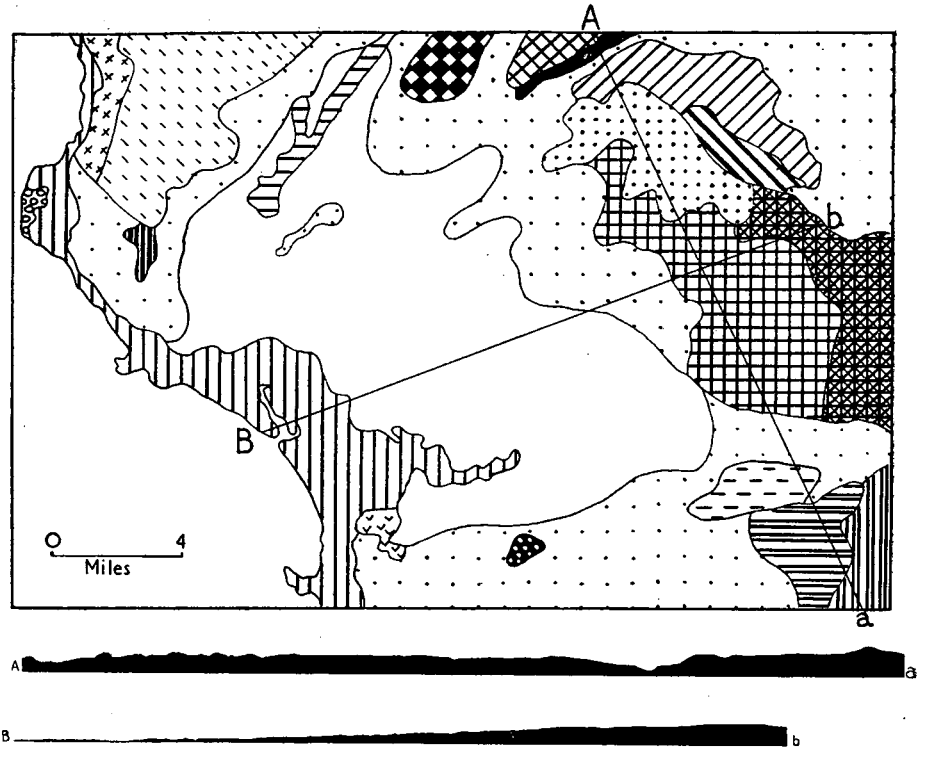


FIG. 5. Map of Land Form Regions

8. Cunningham Upland

South-eastward from the Ballagioch Plateau and in sharp contrast to its ruggedness a smooth, till-covered plateau extends to the Irvine Valley, Fig. 5,

A-a. It can be divided on the basis of relief into two main sections:

(*a*) Mathernock Moor (650-900 feet). The name is an old district name which has long been out of use (Dunlop, 1944). This western section of the Cunningham Upland borders the lowland along an indiscernible boundary. There is a deep cover of highly weathered till which completely obscures the configuration of the bed-rock, as on the Cunningham Plain, and gives the plateau an undulating relief broken only by the shallow valleys of one or two moorland streams. Slopes range from 0°-3°. The impermeability of the till, the subdued relief and the high rainfall have resulted in the surface being blanketed by a vast accumulation of peat.

(*b*) Ellrig Hills (800-1200 feet). These hills adjoin Mathernock Moor to the east and are bounded from the White Cart Valley section of the Lowland Transition Zone to the north by a well-marked break of slope extending from near Eaglesham to Cleughearn. The rolling surface (maximum slope 6°-8°) is considerably influenced by the underlying structure. The peat of Mathernock Moor continues eastwards to cover almost the whole area.

9. Kyle Upland

This can be considered as a continuation of the Cunningham Upland to the south of the Irvine Valley. There are two sub-regions with characteristics identical to those of 8(a) and 8(b) respectively:—

(a) Auchmannoch Moor (750-1000 feet)

(b) Distinkhorn Hills (1000-1400 feet).

The boundary between these units is sharper than that dividing 8(a) from 8(b) and the maximum slope in the Distinkhorn Hills is greater than in the Ellrig Hills, being approximately 20°, with the dominant slope 6-12°.

10. Lanfine Plateau

To the north, Auchmannoch Moor merges with the Lanfine Plateau, a rolling area (1°-10°) with a smooth surface of till. The western end of Gallows Hill shows evidence of glacial erosion rather than of deposition, being steeper than the rest of the hill and having only a shallow cover of stony till. To the west the plateau grades imperceptibly into the Lowland Transition Zone.

11. Renfrew Plateau (500-1400 feet)

(*a*) The plateau is divided into three blocks by through valleys following the line of dip south-eastwards. Four land-form types are dominant, as follows: (1) the rolling plateau surface generally tilted down to the south-east; (2) the steep-sided residual summits; (3) the steep sides of the through valleys; and (4) the undulating valley floors. There is a considerable depth of weathered till in the valleys and on slopes of up to approximately 6°, whereas the steeper slopes carry a thin stony till. Considerable areas of peat occur both in the valleys and at higher levels.

(*b*) Renfrew Plateau Scarp (50-1000 feet). The plateau falls away westward at a slope of 9-15° to the narrow raised beach beside the Firth of Clyde. The lower part bears a deep moderately fine textured till which gives way higher up to a shallow stony till.

(*c*) Knockewart Hills (500-750 feet). This southern outlier of the Renfrew Plateau has a similar physiography to the Rowbank Plateau: rugged on a small scale with a thin cover of stony till except in hollows where deeper deposits are found.

12. Three small but distinctive regions of fairly rugged surface occur within the lowland area:—

(a) Goldenberry Hill

(b) Dundonald Hills

(c) Craigie Hill

CLIMATE

The cool maritime cyclonic climate of western Britain is characterised by high rainfall evenly distributed throughout the year, a mild winter, cloudiness and a cool summer. North Ayrshire, sloping generally to the south-west, is especially subject to these oceanic influences. The same meteorological circulations operate over the whole area but their effect is greatly modified by

TABLE A. MEAN TEMPERATURE IN DEGREES FAHRENHEIT[1]

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Kilmarnock (70 ft.)													
Mean maximum ..	44·3	45·2	47·8	52·6	59·5	64·1	66·4	65·3	61·2	54·8	47·7	44·7	54·5
Mean minimum ..	34·3	34·4	34·6	37·2	42·7	47·1	51·0	50·5	46·2	41·9	35·9	35·1	40·9
Mean	39·3	39·8	41·2	44·9	51·1	55·6	58·7	57·9	53·7	48·3	41·8	39·9	47·7
Thorntonhall (450 ft.) (White Cart Valley)													
Mean maximum ..	42·2	42·8	45·5	50·4	57·0	62·1	64·8	63·4	59·4	52·8	45·5	42·8	52·4
Mean minimum ..	32·5	32·5	33·0	35·5	40·6	45·2	48·9	48·8	44·6	40·1	34·2	33·3	39·1
Mean	37·3	37·7	39·3	42·9	48·8	53·7	56·9	56·1	52·0	46·5	39·9	38·1	45·7

[1]Supplied by Meteorological Office, Edinburgh, 1955.

TABLE B. MEAN MONTHLY RAINFALL IN INCHES[1].

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Stevenston .. .. 186 ft. (coast)	3·8	3·3	3·1	2·4	2·6	2·6	3·3	4·2	3·4	3·9	4·3	4·7	41·6
Kilmarnock .. .. 70 ft. (Cunningham Plain)	3·9	3·3	3·1	2·3	2·4	2·5	3·3	4·3	3·3	3·9	4·2	4·7	41·2
Amlaird Filters .. near Fenwick 590 ft. (West margin Mathernock Moor)	4·1	3·5	3·5	2·4	2·5	2·5	3·4	4·4	3·5	4·0	4·4	5·1	43·3
Loch Goin .. 865 ft. .. (central Mathernock Moor)	4·9	4·0	3·9	2·7	2·9	2·8	4·0	5·0	3·9	4·5	4·9	5·9	49·4
Kaim Dam .. .. 616 ft. (Renfrew Plateau)	7·1	6·0	5·5	4·3	4·3	4·4	5·5	7·1	5·8	6·6	7·4	8·7	72·7
Springside .. .. 532 ft. (Beith Plateau) ..	5·3	4·5	4·1	3·2	3·2	3·3	4·1	5·3	4·4	5·0	5·5	6·5	54·4
Carmunnock .. 365 ft. (White Cart Valley)	4·0	3·3	3·1	2·2	2·4	2·4	3·1	3·9	3·0	3·6	4·0	4·8	39·8

[1]Supplied by Meteorological Office, Edingburgh, 1955.

altitude and distance from the sea: the climate becomes more inclement as one proceeds inland, ameliorating only when the Clyde Lowland is reached.

The records taken at Kilmarnock may be accepted as representative. The mean temperature for January is 39·3°F, for July 58·7°; the coolness of the summer is remarkable even by British standards, Table A. Night frost is frequent in winter but long spells of frost are rare.

The mean annual rainfall is 41·2 inches, with the minimum in April (2·3 inches), the maximum in December (4·7 inches) and a secondary peak in August (4·3 inches), Table B.

Cloud cover is an important feature. The annual average of bright sunshine is 1,255 hours, which is only 28% of the possible. The minimum is in December which has 28 hours, or 0·90 hours per day: 13% of the possible for the month. June receives an average of 187 hours, or 6·23 hours per day: 36% of the possible (Lebon, 1937).

No recordings of humidity have been made in the map area, the nearest station being Abbotsinch, Renfrewshire, for which relative humidity figures based on the period 1921-35 are available as follows: January average, 85%, July average, 71% (Meteorological Office, 1938).

Annual rainfall varies within the sheet area from about 32 inches along the coast between Gailes and Troon to over 70 inches on the Renfrew Plateau, Fig. 6. There is a greater increase in rainfall northward from the Plain than eastward, which is not entirely due to elevation; this difference at similar heights above sea-level is largely attributed to the unequal distances of the plateaux from the sea.

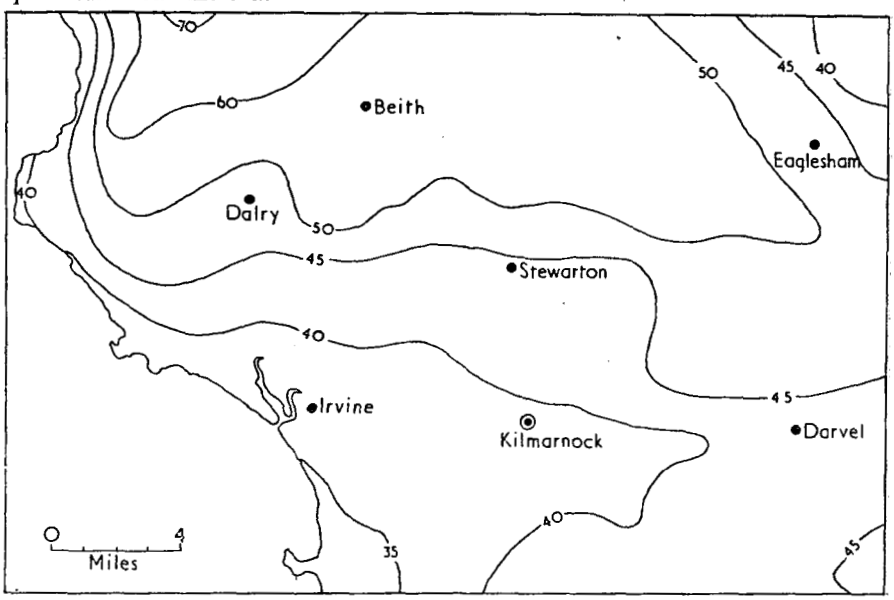


FIG. 6. Annual Average Rainfall (1881-1915), *inches*.

Few temperature data are available but it is probable that, although temperature is more evenly affected by changes in elevation than is rainfall, the spatial variation of temperature is less striking and has less influence upon farming. The frequent extensive cloud cover and the high annual rainfall reduce the temperature range.

To the North Ayrshire farmer wind is a more influential element of the climate than temperature. Its saucer-like relief lays the area open to the frequent strong winds that blow from the west and south-west and the surface configuration is such that very few farms can be said to have a sheltered position, however low-lying their situation. Only in the north-east of the area, beyond the plateau tract, is the wind effect of less importance.

Snow has little influence on soil formation, falling much less frequently and lying for a shorter time than in most other parts of southern Scotland.

CHAPTER II

Geology

SOLID GEOLOGY

GEOLOGICAL structure is closely associated with the broad features of relief, Fig. 7. The plateaux consist mainly of volcanic rocks of the Old Red and Calciferous Sandstone ages, with the sandstones of these formations occurring locally. These outcrops dip or are faulted down towards the plain which is developed on later Carboniferous and Permian sediments: mainly shales and sandstones—less resistant than the plateau formations. A brief account of the location and characteristics of the pre-Pleistocene formations of Sheet 22 is given below in chronological order (Richey *et al*, 1930).

SILURIAN

Downtonian Sandstone

East and south of Auchinlongford Hill, in the extreme south-east, reddish or purplish iron stained flaggy sandstones occur, often very quartoze but sometimes rather felspathic. Highly baked rocks in the south part of the Distinkhorn Hills are hard and splintery, usually greenish in colour, consisting of a fine grained sandstone with clay galls and subordinate bands of baked shale or mudstone.

OLD RED SANDSTONE

Lower Old Red Sandstone

This series is represented mainly by igneous rocks, but a sequence of felspathic sandstones is visible in stream cuttings south of Darvel. Lavas and interbedded ashes form the Lanfine Plateau and its western extension, Sornhill. Dykes and sills are exposed beside the Tulloch, Logan and Changue Burns, south of Darvel. The northern part of the Distinkhorn Hills provides a suite of rocks representative of Scottish igneous activity of Lower Old Red Sandstone times, including andesite, basalt and granodiorite; the plutonic complex occupies about three square miles. Except in stream cuttings the rocks are very poorly exposed, being mostly covered by peat and till.

Upper Old Red Sandstone

This formation is represented only by a sandstone, commonly red, often yellow or purple. Wind-rounded sand grains have not been recognised, whereas water-rounding of vein quartz pebbles is characteristic. Impure sandy limestone concretions with irregular form and vertical tendency are frequently encountered. In the north-west the sandstone occurs between Ardrossan and Largs, forming the Lowland Transition Zone around West Kilbride together with much of the Renfrew Plateau Scarp. South of Kilmarnock and Galston is a considerable area of soft red, yellowish or white quartzose sandstones varying from coarse to medium grain, with rusty spots and greenish clay galls. Gritty varieties are often felspathic and carry water-rounded pebbles of

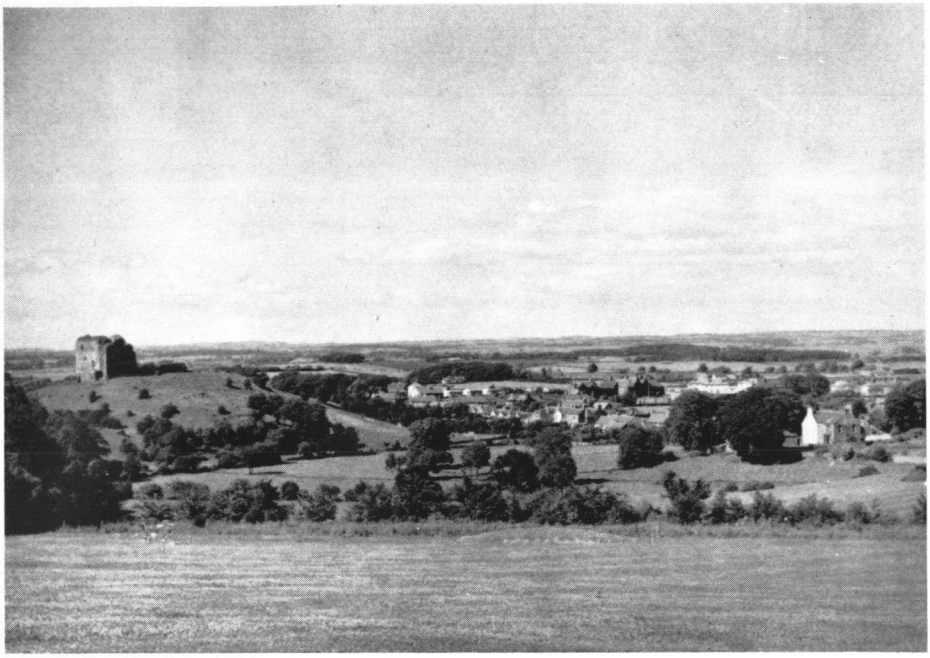


PLATE 1
The till plain, from Dundonald.

PLATE 2
The till plain, near Kilmarnock. Soils of the Kilmarnock association.

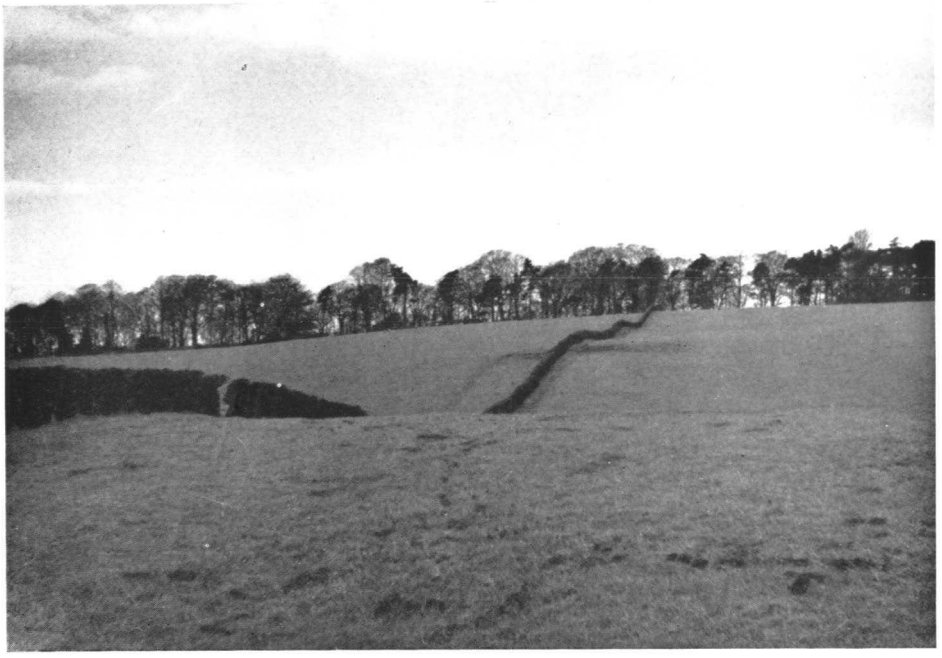


PLATE 3
The till plain: drumlin area immediately north of Kilmarnock. Kilmarnock series.

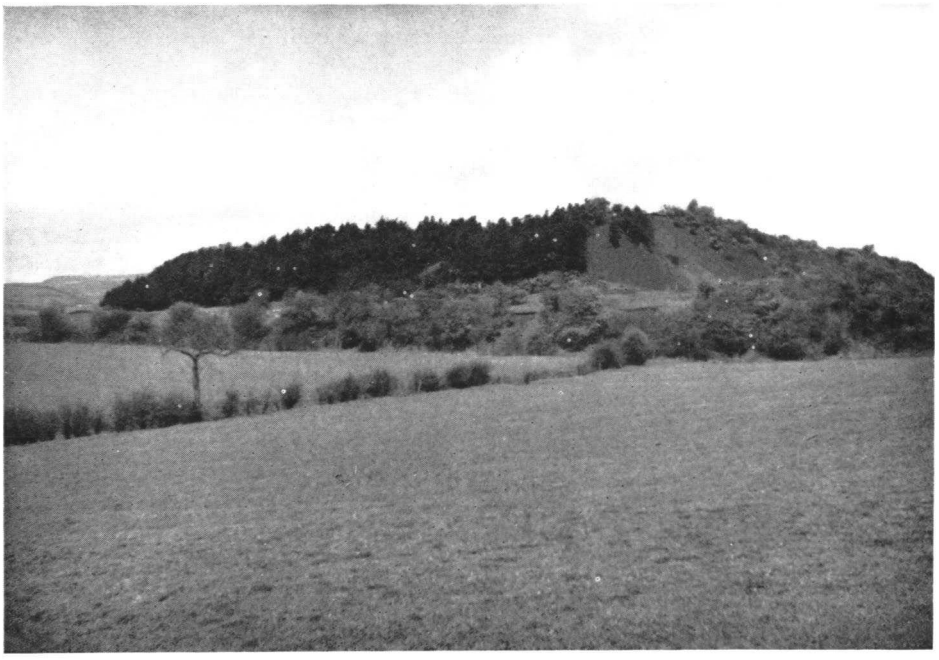


PLATE 4
Pine established on disused colliery tip in Ashgrove series area near Dalry.

quartz and quartzite. Interbedded with the sandstone are subordinate soft chocolate-red, purplish and pale green marly clays. Cornstones are well developed.

CARBONIFEROUS

All divisions of the Scottish Carboniferous, including contemporaneous lavas and ashes, are represented in North Ayrshire.

Calciferous Sandstone Series

This series has two very different developments separated by the Inchgotrick Fault which runs from Darvel to Inchgotrick Farm, 2 miles south of Riccarton, and thence south-west to Fullarton House, Troon. Apart from occasional minor volcanic horizons, only sediments occur south of the fault. These fall into two groups, the lower comprising the Ayrshire Cementstone Group which is mainly represented by bluish green to dark greenish grey marl or marly shale with many intercalated bands of yellow-weathering compact grey cementstone. Towards the base, red marl and ripple-marked red and yellowish sandstones (often micaceous) become prominent. The sandstone often carries green clay as laminae and galls. The cementstone is probably precipitated, due to a concentration of calcium and magnesium oxides in lagoonal waters: analysis shows them to be essentially muddy dolomites. The upper group of the Calciferous Sandstone sediments is represented only by a thin sandstone.

To the north of the Inchgotrick Fault the series is represented partly by sediments, including marine limestones, often with volcanic detritus, but chiefly by Clyde Plateau Lavas, tuffs and intrusions; these occur in extensive outcrops on the northern plateaux and the Cunningham Upland. The general sequence is:

(1) Upper group—microporphyritic basalts
(2) Lower group—macroporphyritic basalts

Mugearite flows are associated with both groups and trachytic lavas and ashes occur locally especially with the microporphyritic basalts. Trachyandesites and trachytes form a belt extending throughout the Ellrig Hills and over parts of the Ballagioch Plateau and the Neilston-Eaglesham Platform. Beds of volcanic detritus occur between lava flows.

On the Renfrew Plateau the succession is as follows:—

Upper Group: Microporphyritic basalts of Dalmeny type in the north; rhyolite in the south.

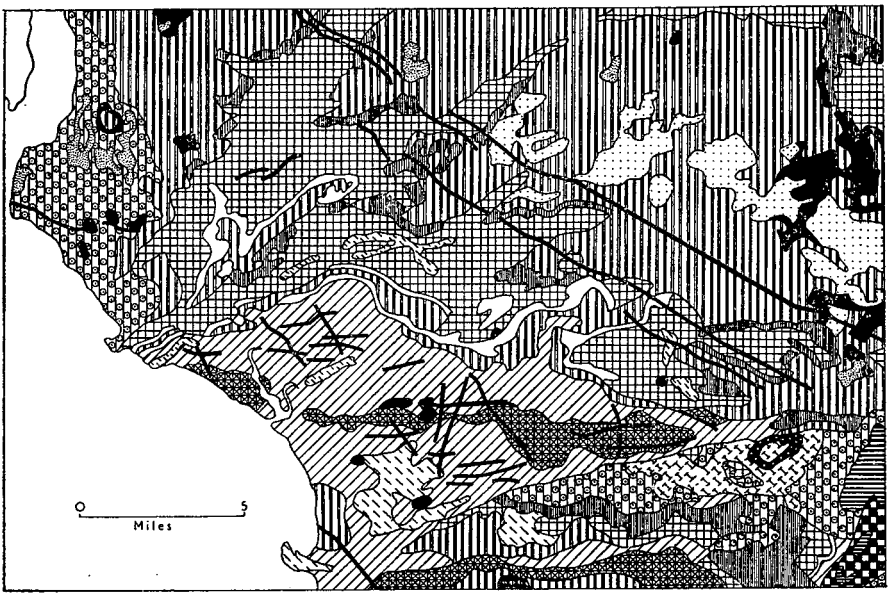
Lower Group: Macroporphyritic basalts, mainly Markle type with interbedded mugearites, and some Jedburgh type. Microporphyritic basalts, mainly Jedburgh, with subordinate flows of Dalmeny and Markle types. Basal sediments and ash resting on Upper Old Red Sandstone.

The Beith Plateau has a similar lithology.

Outcrops are numerous on the Ballagioch Plateau, the Neilston-Eaglesham Platform and the Cunningham Upland with the exception of Mathernock Moor which is covered by till and peat. Microporphyritic basalts are found in the eastern half of the Neilston-Eaglesham Platform, at the western end south-west of Neilston, and underlying the whole of Mathernock Moor. Macroporphyritic basalts occupy the central portion of the Neilston-Eaglesham Platform and part of the Ballagioch Plateau. Trachyandesites and trachytes

underlie the Ellrig Hills, part of the Ballagioch Plateau and an area immediately east of Neilston.

Red or chocolate marls, collectively termed "volcanic detritus", are associated with the Calciferous Sandstone and are quite common north of the Irvine on the fringes of the plateaux. Well-rounded pebbles in the agglomerates are almost invariably composed of acidic volcanic rocks, usually felsite, seldom trachyte. The red rocks are probably derived largely from rotted basalt which is often difficult to distinguish from detrital marl, though



- Permian Sandstone
- Barren Red Measures
- Productive Coal Measures
- Millstone Grit
- Carboniferous Limestone Series
- Calciferous Sandstone Series
- Old Red Sandstone
- Old Red Sandstone conglomerate
- Downtonian Sandstone
- Agglomerate in vents, and tuffs (trachytic and basaltic)
- Permian basalt
- Rhyolite, trachyte and trachyandesite lavas of Carboniferous age
- Basalt lavas of Carboniferous age
- Basalt and andesite of Old Red Sandstone age
- Plugs, sheets and dykes of Calciferous Sandstone age
- Sheets; basalt, dolerite, quartz-dolerite, teschenite, etc., of various ages
- Dykes of various ages
- Granite and granodiorite of Old Red Sandstone age

FIG. 7. Distribution of Solid Geological Formations.
(Sketch prepared from Geological Survey Sheet 14—¼ inch to 1 mile—with permission of the Director of the Geological Survey and Museum.)

the latter contains flakes of mica and grains of quartz. Fine volcanic mud from trachytic rocks may be coloured red because of the concentration of ferric iron, as is found south of Eaglesham where green trachytic ash is overlain by red marl. Dark red marls or mudstones interbedded with coarser material occur in the Darvel district; these may represent ash fallen in water.

The uppermost Calciferous Sandstone sediments merge into the Lower Limestone Group, limestone being the dominant member of both formations. There are three main areas, forming one broad depression:

(1) the central area, running from Beith down the Dusk Water to Ardrossan;
(2) the western limit, occurring around Dalry and along the western slopes of the Garnock Valley;
(3) the eastern limit, outcropping in the Lugton, Stewarton, Moscow and East Kilbride areas.

Carboniferous Limestone Series

The lower portion of the Limestone Coal Group contains ironstones, chiefly claybands with one or more black bands; the intervening beds are mainly shales with sandstone interbedded at intervals, whilst the upper portion is coal-bearing and contains relatively more sandstone. Coal seams usually rest on thin fireclay beds and are overlain by shales. Four main limestones occur in the Upper Limestone Group, the intervening strata consisting largely of sandstone. Cycles of sedimentation are clearly defined, proceeding from limestone through shale and sandstone to coal. Interbedded volcanic ash occurs south and west of Dalry. Between the Dusk Water and Inchgotrick Faults both groups are thinner but still recognisable. South of the Inchgotrick Fault thinning has been carried to extreme, and in places both groups consist almost entirely of sandstone or of mixtures of sandstones, shales and fireclays with thin coals.

Four combined Limestone Coal and Upper Limestone zones occur in Sheet 22:—

Zone 1 occurs north of the Neilston-Busby Fault which brings strata of Limestone Coal and Upper Limestone Groups against Clyde Plateau Lavas.

Zone 2 lies north-west of the Dusk Water Fault. The differences in thickness of strata on either side of this fault are very marked. The Limestone Coal Group contains a number of seams of coal and ironstones, and the latter is replaced by volcanic ashes south and south-west of Dalry.

Zone 3 outcrops between the Dusk Water and Inchgotrick Faults. The formations are much thinner than in Zone 2, coals in the Limestone Coal Group being fewer and the limestone in the Upper Limestone Group being less well developed. Some recovery occurs with increasing distance from the Dusk Water Fault.

Zone 4 forms a narrow belt running east from Inchgotrick Farm, south of the fault, to the north-east part of Mauchline parish and appears also on Weitshaw Moor and in the Burn Anne Valley.

Millstone Grit

This is restricted to beds between the Upper Limestone Group and Coal Measures. The top of the Millstone Grit in North Ayrshire is drawn just above the Ayrshire Bauxitic Clay and three divisions have been distinguished:

(1) Upper Sedimentary Group. The Ayrshire Bauxitic Clay is included in this section: a light grey, brittle, non-porous rock, occurring in very limited areas, between Saltcoats and Dalry, and at Sornhill in Galston parish.

(2) Volcanic Group. Practically the whole of the Coal Measures in Sheet 22 are underlain by these rocks, chiefly lavas rich in iron but containing too much alumina and silica to allow their use as iron ore. They outcrop to the north of the Dusk Water Fault, along the northern edge of the central coal field, bordering the Coldcothill coal belt south of the Inchgotrick Fault, and at Barassie.

(3) Lower Sedimentary Group. This occurs in a few scattered localities in the lower Garnock Valley and east of Kilmaurs.

Coal Measures

The Lower or Productive Group occurs as a light coloured sandstone intercalated with shales, fireclays, a few ironstones and frequent coal seams. The Upper Group or Barren Red Measures consists mainly of reddish sandstones and marls in which coals are thin or absent.

NEW RED SANDSTONE

Approximately $\frac{1}{2}$ square mile of the Mauchline Basin New Red Sandstone falls within Sheet 22, east of Barnweill Hill. Brick to orange-red, the sandstone shows very prevalent wind-rounding of its larger quartz grains. The quartzose sandstone is continuous, argillaceous material being absent. West and east of this area, forming Barnweill Hill and the Mossgiel ridge respectively, New Red Sandstone basic lavas occur, with ashes well represented.

SILLS, VENTS AND DYKES

Sills of post-Calciferous Sandstone age

A great variety of sills occurs, varying in thickness from thin sheets a foot or so across to intrusive masses traceable for miles and measuring over 100 feet where thickest. Five types have been distinguished as follows:—

1. Teschenite, camptonite, picrite.
2. Dolerite, alkali dolerite, essexite, theralite.
3. Coarse-grained basalt similar to Millstone Grit basaltic lavas of Dalmeny type.
4. Basic fine-grained olivine-basalt.
5. Rotten dolerite with quartz.

Volcanic vents of post-Calciferous Sandstone age

More than forty ash (tuff) necks, together with a few plugs, have been recorded by the Geological Survey. The material within the necks usually consists of unstratified basaltic ash, ranging to agglomerate, with embedded fragments of sandstone, shale, etc., derived from the walls of the vents. Ash found in vents may be green, red, yellowish green or dark grey.

Dykes of post-Carboniferous age

Dykes are very numerous in Sheet 22 and many are related to Mull and North of England dykes, They are especially numerous in the Irvine coal basin. Six types are recognised as follows:—

1. Andesite.
2. Border rocks between andesite and quartz-dolerite.
3. Quartz-dolerite.
4. Tholeiite and allied basalt and dolerite.
5. Analcite-bearing olivine-dolerite, camptonite, etc.
6. Unclassed decomposed olivine-basalt.

GLACIAL AND RECENT GEOLOGY

All parts of Sheet 22 have been affected in some way by the ice movements of the Pleistocene Epoch and in few places can the soil parent material be said to arise directly from the rock beneath. The ice which affected North Ayrshire flowed from the Scottish Highlands, over-riding the northern plateaux, Figs. 8 and 9. Mention is made by Richey (1930) of crag-and-tail features, the alignment of which is evidence of the southward direction of the ice flow. Another indication of southward flow is the scarcity of till on the Neilston-Eaglesham Platform and the northern part of the Beith Plateau which, together with the corresponding abundance of till to the leeward of this area on Mathernock Moor, may be regarded as a very large scale crag-and-tail formation. Strong local topographic control of ice-flow direction is apparent on the Renfrew and Ballagioch Plateaux where striations parallel to the valleys have been recorded (Richey *et al*, 1930). A till containing marine shells occurs in many parts of the plain and has also been noted in the higher ground between the Hareshawmuir and Glen Waters. This presents a problem which has given rise to much controversy among geologists. The most likely explanation is that the shells were carried by ice which must therefore have been flowing for a time eastwards into Cunningham from the Firth of Clyde.

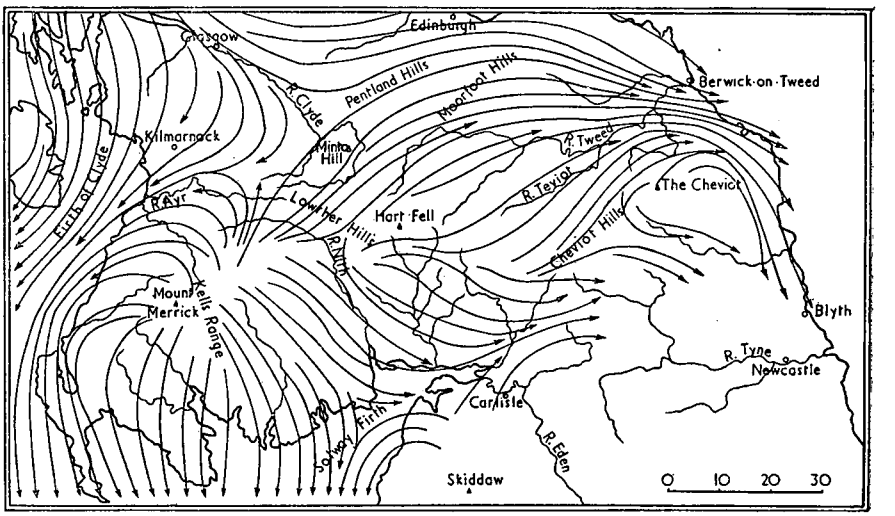


FIG. 8. Map showing direction of Ice Movement in the South of Scotland.
(Reproduced from British Regional Geology: The South of Scotland, 1948, by permission of the Director of the Geological Survey and Museum.)

Its proximity to the Scottish Highlands, which are known to have been the centre of origin of a massive ice sheet, means that the area was probably under moving ice of great thickness and was therefore under great pressure—equivalent to about 30 tons per square foot per 1000 feet of depth (Flint, 1947). Furthermore because of the low elevation of North Ayrshire relative to the Highlands the ice would have been moving at a considerable pace.

The combined effects of immense pressure and fairly rapid flow would cause strong erosion of the land surface during glacial advance, resulting in glacially sculptured landscapes together with such traces of glacial abrasion as striations and polished surfaces. Evidence of this exists in one or two places where minor features have not been masked by till or have been exposed for

quarrying purposes. At Hessilhead, 2 miles south-east of Beith, a 10 foot overmantle of till was cleared from half an acre in 1953 preparatory to an extension of quarrying. The till was found to be resting on a glaciated limestone platform with a highly-polished though slightly uneven surface. Evidence of strong glacial abrasion is also visible on steep north-facing sites in the northern plateaux, on Goldenberry Hill and in the Craigie and Dundonald Hills, and also on the *roches moutonnées* mentioned by Richey (1930) at Greenside, 2 miles north of Lugton. The Renfrew Plateau Scarp, the Lochliboside Fault-line Scarp and many of the valley sides in the northern plateaux bear signs of scraping and steepening, whilst most of the lochs which occur on the Rowbank and Ballagioch Plateaux appear to occupy rock basins excavated in the valley floors. At the site of Giffen Castle, $\frac{3}{4}$ miles south-east of Barrmill, a west-north-west dyke forms a scarp facing north-east about 100 feet high whereas to the south-west it does not project from the surface. It has been suggested that 100 feet of rock have been locally removed by the action of ice (Richey, 1930).

Most of the area is mantled in a thick sheet of till the configuration of which either reflects the form of the buried landscape or is independent of it as in the Cunningham Plain, where the till has been moulded into gentle undulations and drumlins. A drumlin field 10 or 12 square miles in area in the vicinity of Kilmarnock is described in The Geology of North Ayrshire (1930). Most of the drumlins are only 100-200 yards long and 50-100 yards wide, whereas drumlins in southern Scotland generally range from 300 yards to $\frac{1}{2}$ mile in length. In the northern part the orientation is south-west; closer to Kilmarnock it is only a little to the west of south; immediately south of the River Irvine the average direction is south; and 2 miles south-west of Kilmarnock

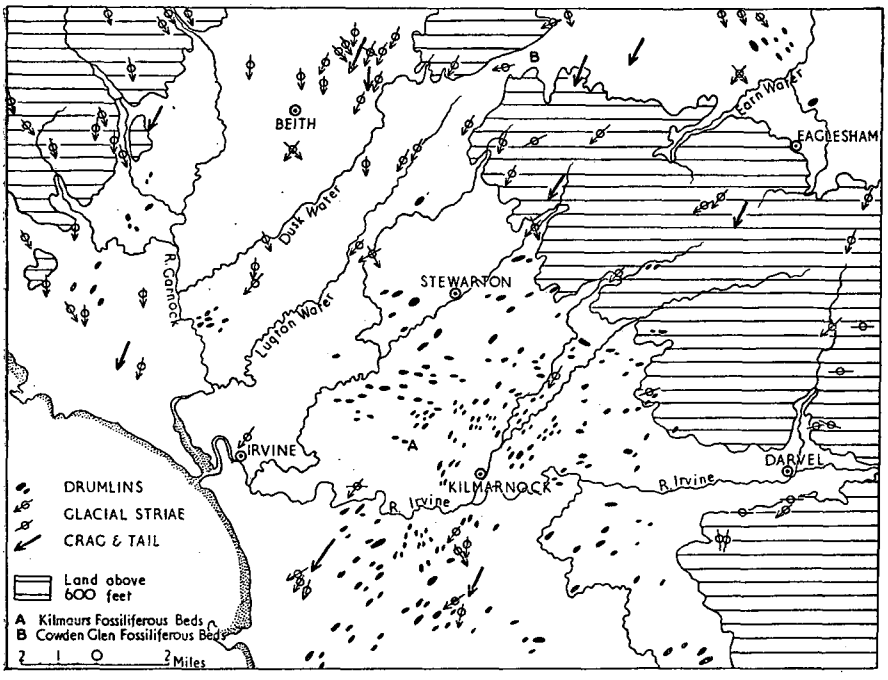


FIG. 9. Map of Drumlins and Striae.

(Reproduced from The Geology of North Ayrshire, Mem. Geol. Surv., 1930, by permission of the Director of the Geological Survey and Museum.)

there is a slight deflection to the east of south. This variation in alignment is an indication of differences in the direction of ice-flow. On the Rowbank and Ballagioch Plateaux till has been deposited as "tails" in the lee of rocky knolls which offered resistance to the ice, but on most steep slopes in the upland areas and also on the Neilston-Eaglesham Platform, where little deep till has lodged, there is a thin smear of stony till. Although stones from beyond the Highland Boundary Fault occur frequently in North Ayrshire the till is largely derived from the nearby bedrock. When the till at the base of a soil profile is examined and related to the district geology it will rarely be found to have moved more than a short distance.

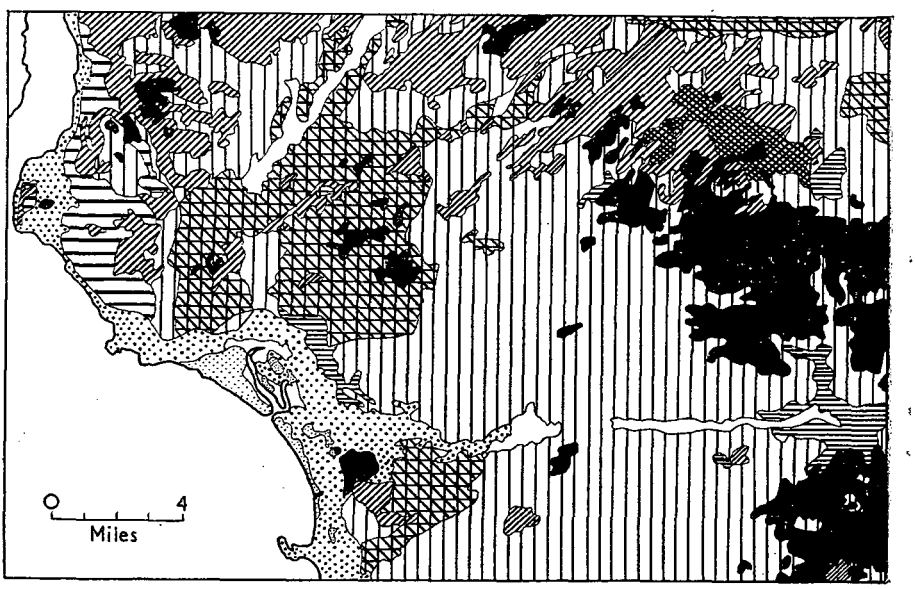
The till is clayey and shows no evidence of vigorous melt-water action. Under a great thickness of ice a pressure-melting temperature has been shown to exist at the base of the glacier (Holmes, 1941) and in sheltered situations where there was no scraping and scouring by ice it can be assumed that a constant deposition of the basal load took place. Thus till would accumulate by a "plastering-on" process. Once established, a till rich in clay and with few stones is very resistant to glacial erosion, partly because it is free of joints and partly because it is sticky when moist and causes stones in the basal ice to lodge in it rather than to erode it, thus hastening its own growth.

Despite the supposition that the till is never far from its place of origin, the North Ayrshire tills present a very complicated pattern due to the extreme diversity in the bedrock throughout the area and to the fact that the ice-sheet travelled in different directions at different periods. Excluding the shallow stony moderately coarse to medium textured till found on sites which experienced severe glacial abrasion, the deep till has been divided broadly into three classes according to texture: medium textured, moderately fine textured and fine textured, Fig. 10. The shallow stony till has been divided into five categories and the deep till divided into ten categories on a lithological basis. These categories represent the parent material of the soil series which are grouped according to their environment, particularly geology, into a larger cartographic unit, the soil association. As this consists of soil series developed on similar parent material it may frequently contain till of different textural classes, for example the Darleith association consists of shallow stony moderately coarse to medium textured till and deep moderately fine textured till. The distribution and geological composition of these various till categories are described under the appropriate soil association.

Under certain hydrologic conditions all these categories of till exhibit a high degree of weathering. Frequently a stone is seen which has been weathered completely into small fragments which yet remain together in the till matrix in the original shape of the stone. This phenomenon is common only in situations where the upper limit of water-logging fluctuates during the year and it is confined, moreover, to the stratum within which this rise and fall occurs. In permanently waterlogged soils and on freely and imperfectly drained sites weathering is always less advanced because no pedological condition appears to induce more rapid physical decomposition than the oxidation-reduction cycle caused by a fluctuating water-table.

In some places where the till has been exposed at depth by laterally-eroding streams there is a distinct line at 5-6 feet below which the till is duller and more subdued in colour—usually dark grey. There is no apparent difference in the lithological content nor in any physical characteristic, except that a roughly horizontal lamination occurs in the lower part which may be flow

structure induced in the plastic clay under great pressure of ice. This change occurs at about the same depth in moderately fine textured tills of varying origin. The division is considered to be the result of decomposition by atmospheric agencies, aided by sub-surface water, which began operating as soon as the till was exposed. If this is the case, then the change of colour indicates the depth to which oxidation has progressed, the dark grey of the lower section representing the unaltered till. Once within the zone of weathering the till would slowly assume a form characteristic of that found in similar material under the same pedogenic influences: for example in the Glen Burn near Fairlie the change is from ice-burdened flow-lamination through a looser platyness to the prismatic structure of the Largs series B horizon. Upward from the critical line to the soil parent material the till becomes more



Alluvium

Aeolian sand

Raised beach sand and gravel

Glacial-lake and fluvio-glacial sand and gravel

Moraine

Shallow stony till

Deep weathered till
Moderately coarse to medium texture

Moderately fine texture

Fine texture

Peat

FIG. 10. Map of Soil Parent Materials.

PLATE 5
The Ashgrove association north of Kilwinning. Note the *Juncus*- infested pastures. Glacial-lake flat in middle distance.

PLATE 6
The Lowland Transition Zone north of Dalry. Ashgrove association. Pronounced rigging and furrowing and the presence of *Juncus* spp. indicate poor drainage conditions.

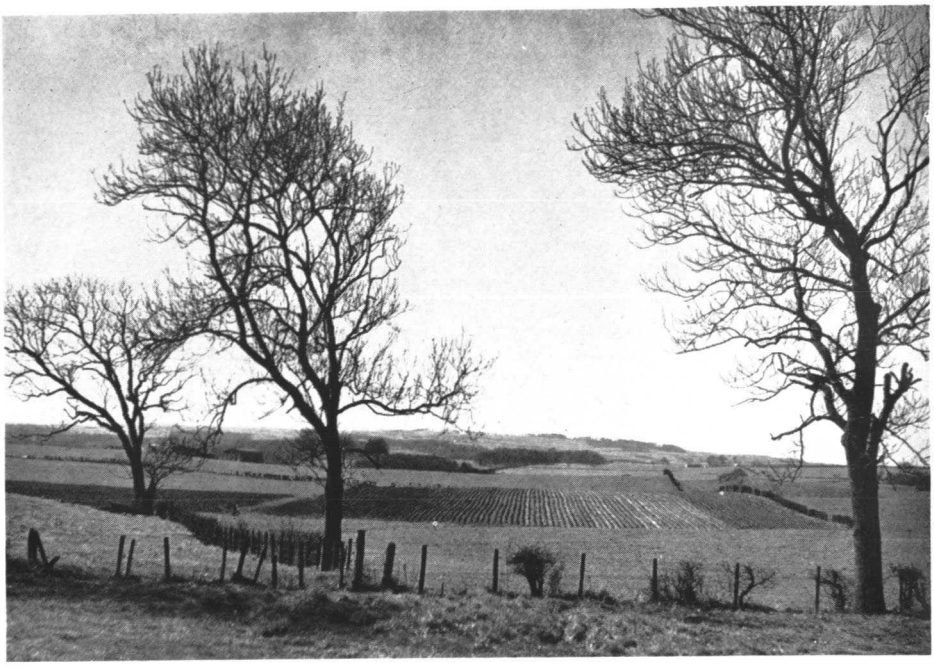


PLATE 7
The White Cart Valley.
(*By courtesy George Outram & Co. Ltd., Glasgow.*)

PLATE 8
Tile-draining on poorly drained site in Lowland Transition Zone near Sorn. Sorn association. Note rigging and furrowing in the background.

and more decomposed, the base of the solum consisting chiefly of alteration products and of the most resistant constituents of the original material.

In some exposures beside the Hareshawmuir Water and the Polbaith Burn on the western fringe of Mathernock Moor two separate tills can be seen. The lower is the till containing marine shells already mentioned as evidence of ice-flow from the west. The upper stratum in the Hareshawmuir depression consists of a moderately fine textured till derived almost entirely from basic and intermediate lavas; that near the Polbaith Burn is a mixed till derived from Carboniferous sediments and associated igneous formations.

Where uncultivated or rarely cultivated soils occur on moderately to steeply sloping accumulations of till in the uplands a stone layer between 12 to 18 inches from the surface has frequently been encountered. It consists mainly of sub-angular stones and there is a tendency for these to be oriented down the slope. In profile descriptions these are referred to as sub-angular stone pavements.

Morainic drift occupies a small proportion of the sheet area and is found only on the Neilston-Eaglesham Platform where a belt occurs adjacent to the northern side of the Ballagioch Plateau. The melting of the ice-sheet in Central Scotland often exposed the hill country first while stagnant ice covered the neighbouring lowlands, and the Eaglesham morainic belt is thought to be roughly parallel to the south-western margin of an ice lobe occupying the White Cart Valley. Most of it is in ridges or mounds consisting of angular fragments of local rock set in a loamy or sandy matrix. It has been suggested by Burnett and Richey (1930) that the material was subjected to periodic pushing due to minor fluctuations in the glacial retreat. Water must have been present in considerable quantity during this period for stratified drift in the form of a few mounds and ridges of sorted gravels and sand is to be found, chiefly in the valley of the Earn Water.

The exposure of plateau before plain at the end of the glaciation led to the formation of ice-dammed lakes in valleys containing stagnant ice in their lower reaches. Thus in the Enoch Valley near Eaglesham traces of five terraces of stratified glacial-lake sand and gravel have been mapped by the Geological Survey and related to successive halts of the receding ice-front (Richey, 1930). Similarly near Darvel there is a complexity of such terraces: the higher series was formed in a lake straddling the Irvine-Avon divide, both valleys being obstructed by ice downstream, and the lower series deposited after the Irvine blockage had shrunk below the level of the watershed. At Blacklaw, above Stewarton in the Annick Valley, a small area of sand and gravel is probably the result of the same agency, ice persisting in the valley after the plateau was clear and temporarily ponding the Annick.

A strip $\frac{1}{2}$ mile wide and 4 miles long of moundy stratified fluvio-glacial sand and gravel resting on till runs from Kilwinning to Dreghorn, while numerous dry channels and small accumulations of fluvio-glacial sand and gravel on the fringes of Auchmannoch Moor, along the southern slopes of the Irvine Valley and between the Enoch and Darvel glacial-lake deposits, indicate successive positions occupied by the ice-margin during retreat.

Raised beach deposits fringe the whole length of the coast. Northward from Saltcoats to West Kilbride they form a narrow strip bordering the rolling Old Red Sandstone section of the Lowland Transition Zone, widening considerably between this area and Goldenberry Hill and narrowing again from Hunterston to Largs at the foot of the steep Renfrew Plateau Scarp.

South of Saltcoats the deposits cover a broad territory following the Irvine upstream to Kilmarnock; they consist mostly of sand and gravel, but in the Caprington and Bankhead districts there are several pockets of brick clay of marine origin, some of which is used for brick and tile making.

Flat stretches of alluvium are found alongside every river and stream and in hollows on the till plain. The largest extends north-east from Dalry along the level floor of the Lochwinnoch depression into Sheet 30. Kilbirnie Loch and Barr Loch lie in this zone, which is generally 100 feet above sea-level, and although an attempt to drain the latter was made in the 19th century it is regularly inundated to its former extent during rainy spells. The remaining part of the valley floor consists of deep silt—very poorly drained.

Considerable amounts of aeolian sand have accumulated within 2 miles of the mouth of the Irvine. This has a characteristic topography, with unstable slopes periodically fixed by dune vegetation.

CHAPTER III

Methods and Definitions

FIELD METHODS

THE main objective of a soil survey is the identification and description of soils and the mapping of their distribution. In the field, soils are differentiated on the basis of their profile morphology. The features of the profile which are considered significant are colour, texture, consistence, organic matter, roots, wetness, stoniness, mottling and thickness of horizons. By studying these characters in small pits dug at frequent intervals it becomes apparent that whilst each profile has individual characteristics, some are so alike that they can be placed into one primary category. The primary category for mapping is the soil series which comprises soils with similar type and arrangement of horizons, developed on similar parent material.

A major problem in mapping soil series is the delineation of boundaries. Typical profiles of two soil series may differ widely but where the series are contiguous it is usual for them to merge, sometimes over a considerable distance. Consequently a line on the map very often implies a merging of soil series and not a sharp change in soil morphology. Frequently an appreciation of the relationship between soil profile characteristics and the topography and vegetation assists in the accurate delimitation of series.

CARTOGRAPHIC METHODS

The soil series, apart from being the primary mapping unit, is also the primary unit of classification, as dealt with in Chapter V. In order to relate series to their environment and particularly to geology they are grouped into a larger cartographic unit, the soil association. A soil association comprises series developed on similar parent material but varying in profile morphology due largely to differences in hydrologic conditions.

The Soil Survey of Scotland uses field maps with a scale of 1:25,000 (about $2\frac{1}{2}$ inches to 1 mile) which are reduced to a scale of 1:63,360 (1 inch to 1 mile) for publication. This reduction introduces certain difficulties. On a scale of 1:63,360 it is possible to delineate a minimum area of about 5 acres and so any uniformly-coloured area on the published map may contain enclaves, less than 5 acres in extent, of some other series. Wherever this happened repeatedly, however, a soil complex would be mapped with the component soil types listed in the text.

DESCRIPTION OF SOIL PROFILES

During the survey of an area, sites typical of each soil series are selected and profile pits dug. The depth of the pits varies, but commonly it is about 4 feet. Each profile is described in standard terms which are defined in this chapter.

A soil profile is described by first noting certain features of the site followed by the general characteristics of the profile. The profile is then subdivided

into its constituent horizons and these are described individually. It is usual to designate each horizon by a symbol, the same symbol being used for the corresponding horizon in any profile of a series or of a major soil group but it should be noted that the same symbol, when used in the description of profiles belonging to different major soil groups, may not have the same significance.

LABORATORY INVESTIGATIONS

A sample is taken from each soil horizon and subjected to a routine physico-chemical examination at the Macaulay Institute for Soil Research. The analyses carried out are shown in Appendix I.

Some profiles are selected and are further analysed by mineralogical, differential thermal, spectrochemical and X-ray methods.

STANDARD TERMS AND DEFINITIONS

The standard terms used to describe the site and the soil profile are listed and defined below. Of the characteristics which apply to the site, namely Relief and Slope Classes, Aspect, Altitude, and Vegetation, only the first is treated here, the others being self-explanatory.

Drainage Class and Horizon Nomenclature which involve the whole profile are considered next and finally the properties of the individual soil horizons: Colour, Texture, Structure, Consistence, Induration, Amount of Organic Matter, Stoniness, Mottling and Roots.

RELIEF AND SLOPE CLASSES

It is usual to give a description of the area in terms of land form units, as in Chapter I. In addition it is useful to relate soil series to slope and, to facilitate this, single slope classes are given below. They are the slope classes used by the U.S. Soil Survey (Soil Survey Staff, 1951).

Class A
Limits
Lower 0 per cent. Name:—level
Upper 1-3 per cent.

Class B
Limits
Lower 1-3 per cent. Name:—gentle
Upper 5-8 per cent.

Class C
Limits
Lower 5-8 per cent. Name:—moderate
Upper 10-16 per cent.

Class D
Limits
Lower 10-16 per cent. Name:—moderately steep
Upper 20-30 per cent.

Class E
Limits
Lower 20-30 per cent. Name:—steep
Upper 45-65 per cent.

Class F
Limits
Lower 45-65 per cent. Name:—very steep
Upper—None

HORIZON NOMENCLATURE OF SOIL PROFILES

Typical soil horizons can be readily compared and contrasted if a symbol is assigned to each one. The symbols normally used are L, F, H, A, B, C and D. General definitions of the layers or horizons to which these symbols are assigned are given first, followed by more precise definitions suitable for each major soil group formed in the area.

L, F and H layers are subdivisions of the organic matter lying on the surface of the solum and may be collectively termed the A_0 horizon.

L — a superficial layer of relatively undecomposed plant litter generally of the past year.
F — a superficial layer of partially decomposed litter with recognisable plant remains.
H — a superficial layer of decomposed organic matter with few or no recognisable plant remains.

The A horizon is the upper mineral part of the solum. It is the horizon of maximum biological activity and the horizon most subject to the direct influence of climate, plants and animals.

The S horizon is the surface horizon of a cultivated soil.

The B horizon is the lower part of the solum lying between the A and C horizons. It is characterised *either* by a relatively high content of sesquioxides or clay *or* by having a more or less blocky or prismatic structure. Quite often there are accessory characteristics such as a bright colour.

The C horizon—the weathering rock or other parent material from which the soil has developed.

The D horizon—a stratum unlike the material from which the solum has developed but which may influence profile development. The D_r horizon—consolidated parent rock like that from which the C horizon has developed or like that from which the parent material of the solum has developed if no C is present (Soil Survey Staff, 1951).

HORIZON NOMENCLATURE OF CERTAIN MAJOR SOIL GROUPS

Peaty Podzol with iron pan

L — Undecomposed plant litter.
F — Partially decomposed litter.
H — Decomposed organic matter—dark brown or black.
A_1— the uppermost mineral layer, dark coloured organic matter mixed with mineral matter relatively rich in silica.
A_2— a layer immediately below the A_1 which is low in organic matter, pale grey in colour and rich in silica. May show signs of gleying when it is designated either $A_2(g)$ when the gleying is slight or A_2g when the gleying is strong. A concentration of roots may be present at the bottom of this layer and they may be partially decomposed.
B_1— a thin iron pan about $\frac{1}{16}$ inch thick. Maximum enrichment of sesquioxides. May be continuous and impermeable to water and roots; there is then a strong tendency for gleying and for roots to concentrate immediately above in the A_2.
B_2— brighter than the A or C horizons. Relative enrichment of sesquioxides.
B_3— not so bright as B_2. Shows some relative enrichment of sesquioxides and a degree of induration.
C — the relatively unweathered parent material.

When a horizon has a slight or moderate amount of gleying its symbol is modified by adding (g), for example $A_2(g)$.

Brown Forest Soil (*low base status*)

These soils are roughly equivalent to the brown podzolic soils of the U.S.A.

L — undecomposed plant litter.
F — partially decomposed plant litter.
H — trace of decomposed organic matter—may be absent.
A — brown colour with medium organic matter, moder type; crumb structure. No differentiation into A_1 or A_2.
B_2— brighter brown colour than the A horizon. A relative enrichment of sesquioxides.
B_3— less bright than the B_2 horizon and nearer to the colour of the parent material. Some degree of induration.
C — relatively unweathered parent material.

When a horizon has a moderate amount of gleying, its symbol is modified by adding (g), for example $B_2(g)$.

Peaty Gley

L — undecomposed plant remains.
F — partially decomposed litter.
H — decomposed organic matter usually more than 2 inches thick and dark brown or black in colour.
A_1g — mixed organic and mineral layer. A little ochreous mottling associated with roots. Weak structure.
A_2g — pale coloured layer. There may be some ochreous mottling. Weak structure. Low content of organic matter.
B_2g — blocky or prismatic structure very apparent. Peds coated with grey but inside show ochreous and grey mottling.
B_3g — blocky or prismatic structure less apparent. Still grey coating to peds and inside, ochreous and grey mottling.
Cg — original colour of parent material more apparent. Structure more massive but peds still coated with grey and inside there is still ochreous mottling.

Surface-water Non-calcareous Gley

L — undecomposed plant litter.
F — partially decomposed litter.
H — trace of decomposed organic matter—often absent.
A_1g — mixed mineral and organic layer. Some ochreous mottling associated with roots. Weak structure.
A_2g — pale-coloured mineral layer, low in organic matter. Structure weak. May be some ochreous mottling.
B_2g — well-defined blocky or prismatic structure. Peds coated with grey and mottled inside with ochreous and grey.
B_3g — less well-defined blocky or prismatic structure. Peds coated with grey and mottled inside with ochreous and grey.
Cg — original colour of parent material more apparent. Structure more massive although peds may still have grey coatings and ochreous and grey mottling inside.

Ground-water Non-calcareous Gley

L — undecomposed plant litter.
F — partially decomposed litter.
H — trace of decomposed organic matter—normally absent.
Ag — uppermost mineral layer, organic matter content low to moderate, structure weak, ochreous mottling associated with roots.
Bg — weak prismatic structure. Faces of peds grey coloured and more or less strongly mottled with grey and ochreous colours internally.
Cg — massive structure. More or less strongly gleyed with grey colours much in evidence. Well-defined iron tubes around roots.

The inherent colours of the parent material are not developed in the lower horizons.

Surface-water Humic Gley

A — mixed organic and mineral layer; organic matter >20%. Frequently granular structure.
A_2g — greyish coloured layer. There may be some ochreous mottling. Prismatic to massive structure. Organic matter content low.
Bg — more massive structure developed. Faces of large cleavages coated with grey; internally ochreous and grey mottles. Well-defined iron tubes around many roots.
Cg — Original colour of the parent material more or less expressed. Structureless—massive. Large cleavages continue coated with grey and iron tubes persist around roots.

Ground-water Humic Gley

A — Mixed organic and mineral horizon: organic matter >20%. Structure weak.
Bg — Structure weak. Pale coloured; marked ochreous mottling may be present.
Cg — Structureless—massive. Strongly gleyed; grey and blue colours prominent. Iron tubes along many root channels.

The inherent colours of the parent material are not developed in the lower horizons.

DRAINAGE CLASSES

The term drainage has several meanings but here it refers strictly to the morphology of soil profiles. The terms used to describe the sequence of drainage classes are listed and defined below; precise descriptions of characteristics are possibly only with individual series.

Drainage:—excessive

The soil horizons are much shallower than usual. The B horizons are bright and uniform in colour. This type of profile is not common in North Ayrshire.

Drainage:—free

The B horizons are bright and uniformly coloured, although those with a small degree of dullness and some mottles are permitted within the class.

Drainage:—imperfect

The B horizons are not quite so bright as those of the freely drained soil and have appreciable mottling. They are designated $B_2(g)$, $B_3(g)$ etc. to indicate a moderate amount of gleying.

Drainage:—poor

The Bg horizons are dull and mottling is evident.

Drainage:—very poor

The Bg horizons are dull and mottling is very evident.

The imperfectly drained soil is intermediate between the free and poorly drained soil though in this area it is generally closer in character to the latter and usually requires to be tile-drained before it can be cultivated successfully

The poorly drained and the very poorly drained soils always require tile drainage before successful cultivation can be undertaken. Both may have an A_2g horizon which is often a dull grey colour but it is usually more evident in the very poorly drained soil. This horizon is the one of maximum gleying.

COLOUR

Pedologists attach great importance to the colour of soil horizons; it is one of the characteristics which indicate the drainage class of a soil. Individuals vary greatly in their ability to describe soil colour accurately and concisely and therefore use is made of colour charts. The Munsell Soil Colour Charts are used by the Soil Survey of Scotland.

According to the Munsell system each colour can be considered as the resultant of three variables, Hue, Value and Chroma, and each is designated in that order, for example (10YR6/3). The Hue is 10YR, the Value is 6 and the Chroma is 3. Moreover each colour is given a standard name, e.g. pale brown 10YR6/3.

Hue refers to the dominant spectral colour, e.g. whether red or yellow; Value refers to apparent lightness as compared to absolute white and is a function of the intensity of light; Chroma refers to the purity of hue, or, alternatively, the apparent departure from neutral greys or whites.

Several related subjects are considered under this heading. Soil texture refers to the relative proportions of the various size groups of primary particles in a mass of soil; it refers specifically to the proportion of sand, silt and clay in that part of a soil sample which passes through a 2 m.m. sieve. The presence of particles larger than 2 m.m. does not affect the texture of the soil directly, but it can be indicated by additional descriptive terms such as stony, pebbly etc. The texture of a soil horizon is one of its most important properties.

Soil separates are the arbitrarily selected size-groups of mineral particles which together make up the soil. Specifically they are the sand, silt and clay fractions into which the soil material is separated when subjected to mechanical analysis. The coarse sand separate consists of all those particles in a soil with effective diameters between 2000μ (or 2 m.m.) and 200μ; the fine sand fraction of particles with effective diameters between 200μ and 20μ; the silt fraction of particles with effective diameters between 20μ and 2μ; and the clay fraction of particles with effective diameters less than 2μ. Separates with these limits are defined by the International Scheme of Mechanical Analysis. The U.S. Department of Agriculture also has a scheme, the main difference between the two being in the size limits of the silt fraction. Both schemes are given below.

U.S. Dept. Agric. Scheme		*International Scheme*	
Name of Separate	Effective Diameter (range)μ	Name of Separate	Effective Diameter (range)μ
sand: very coarse sand	2000—1000	sand: coarse sand	2000—200
sand: coarse sand	1000— 500	sand: fine sand	200— 20
sand: medium sand	500— 250		
sand: fine sand	250— 100	silt	20— 2
sand: very fine sand	100— 50		
silt	50— 2	clay	<2
clay	<2		

The Soil Survey of Scotland until recently has used the International Scheme exclusively and all the mechanical analyses quoted in Appendix I are of this type.

Textural Class Names

In assigning textural class names to soils the Soil Survey of Scotland has combined all the sand separates into one with the general name—sand. The percentage of each separate is plotted on a triangular diagram and the area on the diagram into which the soil fits is ascertained. Each area has a Textural Class name and the soil is given the appropriate name. Fig. 11 is a triangular diagram showing the areas of the various textural class names. These areas have been defined after years of experience, especially in the United States. Strictly speaking, this diagram should be used only with the U.S. Dept. of Agriculture Scheme of Mechanical Analyses.

General Grouping of Soil Textural Classes

It is often convenient to distinguish broad groups of textural classes and although the terms "heavy" and "light" have been used for this purpose for

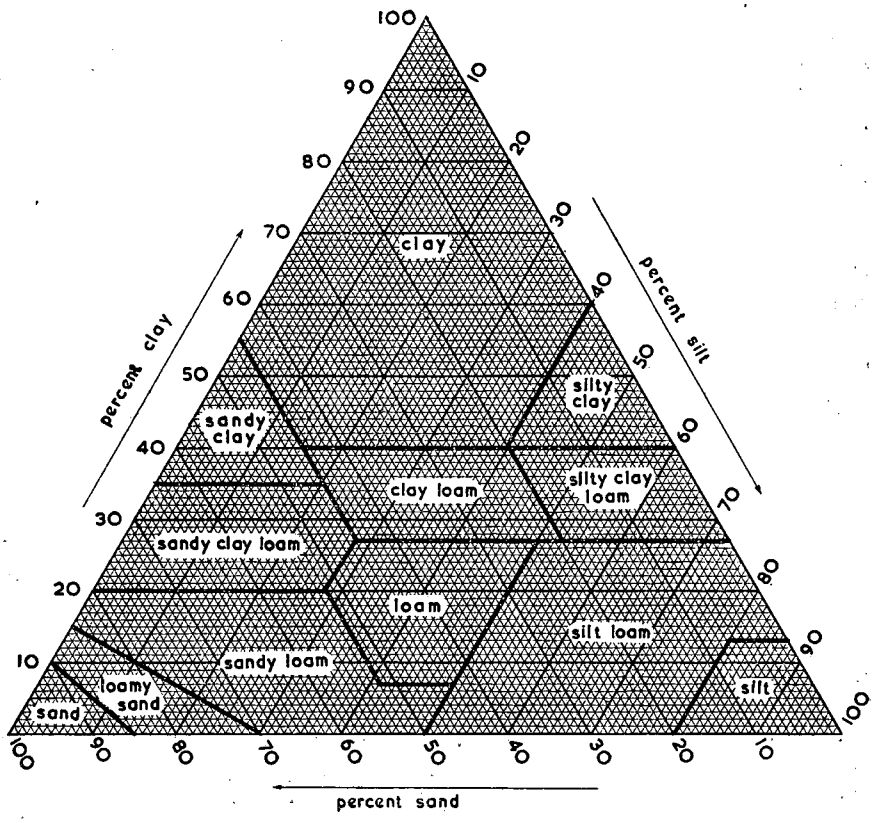


FIG. 11. The percentages of Clay (<2μ), Silt (2-50 μ) and Sand (50-2000 μ) in the basic soil textural classes.

many years they lead to confusion as they do not necessarily bear any relation to the actual weight of the soil; they refer in fact to the power required in ploughing.

Acceptable general terms are shown below with their relationship to the basic soil textural classes (Soil Survey Staff, 1951).

General terms		*Basic terms*
sandy soils	coarse textured soils	sand loamy sand
loamy soils	moderately coarse textured soils	sandy loam
	medium textured soils	loam silt loam silt
	moderately fine textured soils	clay loam sandy clay loam silty clay loam
clayey soils	fine textured soils	sandy clay silty clay clay

STRUCTURE

The structure of a soil is the aggregation of its primary soil particles into compound units. The compound units are largely independent of each other.

Structure is an important characteristic of soils. Soils with aggregates of spheroidal shape have a greater pore space between aggregates, a more rapid permeability and are more productive than soils of comparable fertility with massive or blocky structure.

Field descriptions of soil structure note (a) the shape and arrangement (b) the size and (c) the distinctness and durability of the structural units (peds). Each of these qualities is described by a separate set of terms. The shape and arrangement are designated as type of soil structure; size as class; and degree of distinctness as grade. The terms used are defined below (Soil Survey Staff, 1951).

Types. There are four primary types of structure.

1. Platy —with one dimension, the vertical greatly less than the other two.
2. Prism-like —with two dimensions (horizontal) greatly less than the vertical.
3. Block-like —with three dimensions of the same order of magnitude but having plane —or curved surfaces that are casts of the moulds formed by faces of the surrounding peds.
4. Spheroidal —with three dimensions of the same order of magnitude having plane or curved surfaces which have slight or no accommodation to the faces of surrounding peds.

Each of the last three types has two subtypes, namely prismatic (without rounded ends) and columnar (with rounded ends); angular blocky (with relatively sharp angles) and sub-angular blocky (with rounded faces); granular (relatively non-porous) and crumb (porous).

Class designates the size of the aggregates; five are recognised for each type. The terms used are very fine, fine, medium, coarse, very coarse. Table C shows the relationships of the various classes and types.

Grade of structure is the degree of aggregation and expresses the differential between cohesion within the aggregates and adhesion between the aggregates. In practice, grade of structure is determined mainly by noting the durability of the aggregates and the ratio of aggregated material to unaggregated when the aggregates are gently displaced or crushed.

Terms used for grading of structure are:—

1. Weak — aggregates barely observable *in situ*. When disturbed the soil material breaks into a mixture of a few unbroken and many broken units with much unaggregated material.
2. Moderate — well-formed units but not distinct in undisturbed soil. When disturbed there are many distinct units, some broken units and a little unaggregated material.
3. Strong — well-formed units, distinct in undisturbed soil; adhering only weakly to one another. When disturbed consist of entire units with few broken and very little unaggregated material.

When the soil horizon shows no structure it is termed structureless and can be either single-grain (if non-coherent) or massive (if coherent).

Terms describing each of these three qualities are combined to give the structural description, grade first, then class and finally type, e.g., strong, coarse, angular blocky.

CONSISTENCE

Soil consistence is a quality of soil material which is expressed by the degree of cohesion and adhesion. It is measured by the resistance of soil material to

TABLE C. TYPES AND CLASSES OF SOIL STRUCTURE

Type (Shape and arrangement of peds).

Class (size)	Platelike with one dimension (the vertical) limited and greatly less than the other two; arranged around a horizontal plane; faces mostly horizontal.	Prismlike with two dimensions (the horizontal) considerably less than the vertical; arranged around a vertical line; vertical faces well defined; vertices anguiar.		Blocklike: polyhedronlike, or spheroidal, with 3 dimensions of the same order of magnitude; arranged round a point.			
				Blocklike: blocks or polyhedrons having plane or curved surfaces that are casts of the moulds formed by the faces of the surrounding peds.		Spheroids or polyhedrons having plane or curved surfaces which have slight or no accommodation to the faces of surrounding peds.	
		Without rounded caps	With rounded caps	Faces flattened; most vertices sharply angular	Mixed rounded and flattened faces with many rounded vertices	Relatively non-porous peds	Porous peds
	Platy	Prismatic	Columnar	(Angular) Blocky	Subangular Blocky	Granular	Crumb
very fine	very fine platy <1 m.m.	very fine prismatic <10 m.m.	very fine columnar <10 m.m.	very fine angular blocky <5 m.m.	very fine sub-angular blocky <5 m.m.	very fine granular <1 m.m.	very fine crumb <1 m.m.
fine	fine platy 1-2 m.m.	fine prismatic 10-20 m.m.	fine columnar 10-20 m.m.	fine angular blocky 5-10 m.m.	fine subangular blocky 5-10 m.m.	fine granular 1-2 m.m.	fine crumb 1-2 m.m.
medium	medium platy 2-5 m.m.	medium prismatic 20-50 m.m.	medium columnar 20-50 m.m.	medium angular blocky 10-20 m.m.	medium subangular blocky 10-20 m.m.	medium granular 2-5 m.m.	medium crumb 2-5 m.m.
coarse	coarse platy 5-10 m.m.	coarse prismatic 50-100 m.m.	coarse columnar 50-100 m.m.	coarse angular blocky 20-50 m.m.	coarse subangular blocky 20-50 m.m.	coarse granular 5-10 m.m.	
very coarse	very coarse platy >10 m.m.	very coarse prismatic >100 m.m.	very coarse columnar >100 m.m.	very coarse angular blocky >50 m.m.	very coarse subangular blocky >50 m.m.	very coarse granular >10 m.m.	

deformation or rupture. Structure and consistence are interrelated, the former being the resultant of forces within the natural soil while the latter is concerned with the forces themselves.

As consistence is strongly influenced by the moisture condition of the soil it is necessary to have a set of terms for each significant moisture state (Soil Survey Staff, 1951).

Consistence when wet

To evaluate, roll the soil material between thumb and forefinger.

0. Non-plastic — no wire formable.
1. Slightly plastic — wire formable and soil mass easily deformed.
2. Plastic — wire formable and moderate pressure required to deform soil mass.
3. Very plastic — wire formable and much pressure required to deform soil mass.

Consistence when moist

To evaluate, attempt to crush in the hand a mass that appears moist.

0. Loose — non-coherent.
1. Friable — soil material crushes under very gentle pressure but coheres when pressed together.
2. Firm — soil material crushes under moderate pressure between thumb and forefinger but resistance distinctly noticeable.
3. Very firm — soil material crushes under strong pressure: sometimes not crushable between thumb and forefinger.

Consistence when dry

To evaluate, break an air-dry mass in the hand.

0. Loose — non-coherent.
1. Soft — breaks to powder or individual grains under very slight pressure.
2. Hard — can be broken easily in the hands but it is barely breakable between thumb and forefinger.
3. Very hard — can normally be broken in the hands but only with difficulty.

In Scotland soil horizons are usually either wet or moist.

INDURATION

Induration of a soil material refers to a handling property of the soil which appears not to be markedly affected by moisture content. Consistence, on the other hand, varies greatly with moisture. Three terms are used to describe this property and they are defined below

1. Weakly indurated — not usually detected when digging but presence shown by stabbing a knife into the profile face. Breaks easily in the hand.
2. Moderately indurated — detected when digging. Breaks in the hand by using moderate pressure.
3. Strongly indurated — detected when digging and in fact causes difficulty. Not readily broken in the hand.

ORGANIC MATTER

Organic matter in a soil may be described qualitatively and quantitatively. In profile descriptions it is usual to estimate the amount present in each horizon. If a horizon contains more than 20% organic matter it is considered an organic horizon; if less than 20% organic matter it is considered a mineral

horizon. The amount of organic matter in a mineral horizon may vary and it is usually indicated by standard terms which are listed and defined below:—

high	.. ..	13%-20%
moderate	.. ..	8%-13%
low	.. ..	<8%.

Organic horizons may often be subdivided into 3 layers—L, F, and H. The L layer is relatively fresh litter; the F layer is fermented litter with plant remains still recognisable; and the H layer is the well-decomposed humus with very few recognisable constituents. When the H layer is more than 12 inches thick the soil is considered a peat.

There are three types of humus in this area: mull, moder (silicate) and mor (Kubiëna, 1953). Mull is an intimate mixture of mineral and organic matter in the A horizon with the constituent parts not identifiable by means of a lens. Silicate moder has an appearance similar to mull but its constituent organic and mineral parts can be identified by a good lens. The third type, mor, is usually found where there are well-developed L, F and H layers. There is no intimate mixing of organic and mineral parts, the two remaining obviously distinct. The H layer itself has a very low mineral content.

The various major soil groups are associated with a certain humus type. The brown forest soils of low base status have typically silicate moder but occasionally may have mull. The peaty podzols and peaty gleys have a mor type of humus while the non-calcareous gleys have a form of silicate moder.

STONINESS

Stoniness is an important property of a soil. Stones dilute the finer material and normally increase the permeability of the soil; in addition they may adversely affect cultivation.

The terms in use for describing the stoniness of soil horizons are not precise; they are defined below:—

few stones	—	<15% by volume
stony	—	15-50% by volume
very stony	—	>50% by volume.

When the stone content reaches 80% or 90% by volume it is probable that the soil will be skeletal.

MOTTLING

To describe mottling accurately it is necessary to note colour and distribution. Colour may be noted by Munsell colour charts but in many of the early profile descriptions recorded in the memoir this has not been done; instead a general descriptive term "ochreous" has been used to denote different shades of brown. The distribution has been described by the following terms (Soil Survey Staff, 1951):—

(1)	Abundant	
	few	— mottles <2% of surface
	frequent	— mottles 2-20% of surface
	many	— mottles >20% of surface
(2)	Size	
	fine	— <5 m.m.
	medium	— 5-15 m.m.
	coarse	— >15 m.m.

(3) Contrast

faint	— hue and chroma of matrix closely related.
distinct	— matrix and mottles vary 1-2 hues and several units in chroma and value
prominent	— matrix and mottles vary several units in hue, value and chroma.

These terms are combined in the order in which they are given above, e.g. few, fine, distinct, ochreous mottles.

ROOTS

The terms used to describe the number of roots in a soil horizon are based purely on subjective estimations and are listed below:—

very abundant
abundant
frequent
occasional
rare

CHAPTER IV

Soil Classification and Formation

SOIL CLASSIFICATION

THE soil profile is the basic unit of the soil population but it is impractical to attempt to deal with such small units in any system of classification. The profile, however, is the unit which is studied in the field and upon which the differentiation of the larger soil categories depends. The criteria used to classify soils are those which can be observed or readily determined by simple techniques in the field. In this memoir the genetic classification used is that which has been adopted provisionally by the Soil Survey of England and Wales and the Soil Survey of Scotland. The soil categories are defined essentially in terms of morphological features. The smallest unit depicted on the map is the soil series, and certain of its morphological characteristics are selected to form the criteria of higher categories. Series with closely similar profiles are placed in sub-groups which are then arranged in major soil groups and these are finally assembled on a very broad basis into soil divisions. The arrangement of the soil series and the higher soil categories, which occur in the area is shown in Table D and a description of the sub-groups, major soil groups and divisions is given below.

TABLE D. CLASSIFICATION OF SERIES

Division	Major Soil Group	Sub-group	Series
Gley Soils ..	Surface-water Gleys	Non-calcareous Gleys	Amlaird, Ashgrove, Blairkip, Brocklie, Caaf, Cleuch, Fail, Giffnock, Kelburn, Kilmaurs, Pokelly, Rouken, Rowanhill, Sorn, Threepwood, Todrigs
		Peaty Gleys	Distinkhorn, Loudoun, Myres, Reoch, Reppoch, Weitshaw
		Humic Gleys	Corraith, Dalsangan, Giffen, Polbaith
	Ground-water Gleys	Non-calcareous Gleys	Ardoch, Hunterston
		Humic Gleys	Auchmannoch, Cawdron, Crosbie, Dunwan, Hapton, Hardhill, Kirktonmoor, Montgomery
Leached Soils	Podzols	Peaty Podzols (with iron pan)	Baidland, Glen Garr, Haupland, Knockendon, Moorhouse, Tulloch
	Normal Brown Earths	Brown Forest Soils (low base status)	Bargour, Caprington, Darleith, Darvel, Dreghorn, Dunlop, Faulds Highfield, Kilmarnock, Lanfine, Largs, Mauchline
Organic Soils	Climatic or Zonal Peat	Hill or Sub-Alpine	
	Local or Azonal Peat (Basin Peat)		

Division of Gleys

Gleys are soils which have developed under conditions of permanent or intermittent waterlogging. The mineral horizons of gleys are grey or bluish grey in colour and ochreous mottling is much in evidence. These colours which are secondary often conceal colours inherited from the parent material.

Major soil group: surface-water gley

Surface-water gleys are soils which commonly exhibit a strongly gleyed and seasonally waterlogged horizon (A_2g) immediately beneath the surface horizon. The intensity of gleying diminishes with depth, so that soil colour inherited from the parent material is better expressed in the B_2g and Cg horizons than in any of the others.

(a) *Sub-group*: *non-calcareous gley*

There is no free calcium in the upper mineral layers. The H layer is either absent or not more than 1 inch thick, and while the A_2g may be well defined this is not critical. Two drainage classes, poor and very poor, have been distinguished. In Ayrshire some of the soils in this sub-group conform to the American low-humic gley soils (Smith, 1952. Private communication).

(*b*) *Sub-group*: *peaty gley*

Peaty gleys have no free calcium in the upper mineral layers. The H layer is more than 2 inches thick and is usually well formed. A conspicuous A_2g is always present.

(*c*) *Sub-group*: *humic gley*

Humic gleys have no free calcium in the upper mineral layers. The peaty A_0 horizon is lacking, the profile consisting of dark coloured organo-mineral horizons, overlying mineral gley horizons.

Major soil group: ground-water gley

Ground-water gleys are soils which have developed under the influence of a high ground-water table. In these soils the effect of gleying shown increases with depth, and the colour inherited from the parent material is not readily apparent at depth.

(*a*) *Sub-group*: *non-calcareous gley*

No free calcium is found in the upper layers of this soil and the A horizons are seldom dark coloured. Grey colours become more pronounced with depth and waterlogging caused by the ground-water table is a feature of a large part of the solum.

(*b*) *Sub-group*: *humic gley*

No free calcium occurs in the upper mineral horizons. The surface horizon is highly organic and overlies an intensely gleyed mineral sub-stratum. A layer of peat may be noted between the humified top soil and the mineral horizons.

Division of Leached Soils

Leached soils are characterised by a uniformly coloured B horizon, absence of free lime in the upper horizons and an acid reaction.

MAJOR SOIL GROUP: PODZOL

Normal podzolic soils are characterised by a grey bleached A_2 horizon, usually with a weakly developed structure, a mor or peaty surface layer, and a strongly acid reaction. There is nearly always morphological or chemical evidence of the translocation of sesquioxides.

Sub-group: *peaty podzol with iron pan*

Peaty podzols have an H layer of mor humus. The definition of the A_2 may be very weak or marked, depending largely upon the acidity of the parent material. Gleying effects may also be noted in the A_2. The B_1 horizon is a thin, sometimes continuous iron pan, which may impede the vertical movement of water and the downward growth of roots. There is little evidence of gleying in the B_2 and B_3 horizons and the latter generally shows some degree of induration.

MAJOR SOIL GROUP: NORMAL BROWN EARTHS

A uniformly coloured B horizon is a characteristic feature of the normal brown earths. They have a mull or moder humus formation and a weakly to moderately acid reaction. There are no sharp horizon boundaries, and they do not show any pronounced translocation of sesquioxides.

Sub-group: *brown forest soils* (*low base status*).

Brown forest soils (low base status) have a moderately acid reaction and a moder humus formation. Each soil horizon merges into the one below. In North Ayrshire two drainage classes have been recognised within this sub-group. The internal soil-water relations of the Darleith, Dreghorn, Darvel and Faulds series come within the freely drained class, as gleying effects are absent throughout the profile. These soils are considered by some observers to be more akin to the American brown podzolic soils. Gleying effects are apparent in both the B and C horizons of the remaining series of this sub-group and they have been classified as imperfectly drained. Dr. Guy Smith (Private communication, 1952) considered the latter soils comparable with the American grey-brown podzolic soils, the increased clay content and the sub-angular blocky structure of the B horizon being the principal distinguishing features.

DIVISION OF ORGANIC SOILS

Organic soils are normally formed under water-logged conditions, and contain a minimum of 20% of organic matter, to a depth of more than 12 inches.

MAJOR SOIL GROUP: CLIMATIC OR ZONAL PEAT

Climatic or Zonal peat is an organic formation which develops zonally on various land forms under the influence of specific climatic conditions, e.g. high rainfall, low temperature and high humidity.

Sub-Group: *Hill or Sub-Alpine Peat*

Hill peat occurs at high elevations on level or slightly convex slopes, i.e. on high-lying plateaux.

MAJOR SOIL GROUP: LOCAL OR AZONAL PEAT (BASIN PEAT)

Local or Azonal peat develops initially under the influence of ground

water (soligenous) in areas where the relief is decidedly concave, i.e. it originates in lakes or badly drained basins in a free water medium.

In profile these deposits show vegetation sequences from free water sediments to the raised bog climax. The complete sequence is not always present but in this area the majority are considered to have reached the raised moss stage. These are typically dome shaped, developing from the low moor stage when the surface of the deposit rises above the influence of the ground water. The stages of development have not been delineated on the map.

SOIL FORMATION

Soil is essentially the mineral and organic material occurring at the surface of the earth which supports plant life. In its various and markedly diverse forms it constitutes a mantle over the earth. The characteristics of the soil at any one place are the result of the interaction of the five genetic factors, climate, parent material, relief, living matter and time (Jenny, 1941), and also the effects of man's use. Changes in the genetic factors are very often gradual and continuous and this continuous variation is reflected in the soil properties. However, in practice, one does not attempt to deal with the whole continuum; units are noted, and classification is necessary. The main purpose of the genetic groupings is to relate differences in soil properties to the causal environmental factors.

DISTRIBUTION OF MAJOR SOIL GROUPS

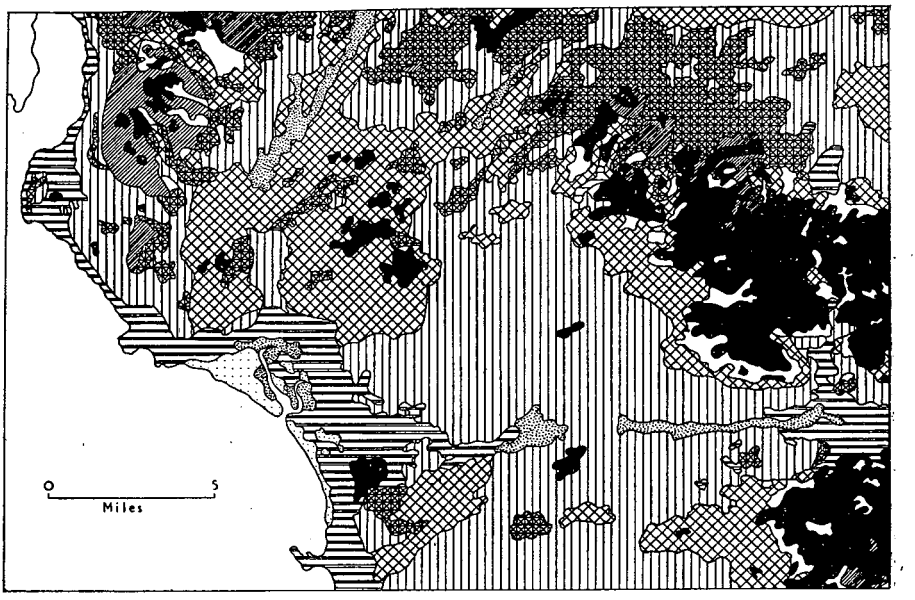
Fig. 12 shows the distribution of the major soil groups in Ayrshire. In general zonal peat, peaty podzols and peaty gleys occur on the high-lying ground, viz. the Renfrew Plateau, the Ballagioch Plateau and the Cunningham and Kyle Uplands. Brown forest soils are located at slightly lower altitudes, viz. the Lowland Transition Zone of the north-west, the Beith Plateau and the Neilston-Eaglesham Platform. Brown forest soils with gleyed B and C horizons and non-calcareous gleys dominate the lowland areas covered by deep glacial till, viz. the Cunningham Plain and the greater part of the Lowland Transition Zone.

FACTORS AFFECTING THE DISTRIBUTION OF MAJOR SOIL GROUPS

By correlation the pedologist is able to draw general conclusions concerning soil genesis and the effect of each soil factor. In a normal location, however, there are usually differences in more than one genetic factor and the influence of each is either diminished or enhanced by interaction with the others. The measurement of the effect of a soil forming factor is therefore seldom precise.

The Climatic Factor

The climatic factor influences soil genesis mainly through the moisture and energy it gives to an environment. Within limits the organic matter content of a soil increases as the precipitation increases and as the temperature falls. Of the two, rainfall is the more important in Ayrshire. From Fig. 6 it will be noted that the rainfall increases sharply in the Renfrew Plateau but only gradually over the Cunningham Plain to the broad moorland watershed lying between Beith, Darvel and the Kyle Upland. The high rainfall and slightly lower temperatures prevailing in these high-lying areas promote the accumulation of organic matter; zonal peat, peaty gleys and peaty podzols are widespread. On the very steep sloping ground in the regions



Brown forest soils of low base status

Shallow and intermediate

Deep

Brown forest soils of low base status with gleyed B and C horizons

Non-calcareous gleys

Peaty podzols

Peaty gleys

Peat

Soils developed on alluvium (unclassified)

Soils developed on aeolian sand(unclassified)

FIG. 12. Generalised Distribution of Major Soil Groups.

of high rainfall there is frequently no evidence of humus accumulation or of horizon differentiation in the mineral solum, erosion keeping pace with the soil forming processes. In the north-west the rapid increase in rainfall has a marked effect on soil genesis, the transition from brown forest soils on the low ground to peaty podzols and peaty gleys in the uplands being sharply defined. Soils developed upon tills derived from such diverse geological formations as Old Red Sandstone sediments and Calciferous Sandstone age lavas are present but the pronounced differences in rainfall in this region tend to outweigh the effects of variations in the base-richness of the parent material. Over the Cunningham Plain the gradual increase in rainfall is reflected principally in the internal drainage of the soils which slowly deteriorates on passing from west to east. Brown forest soils with gleyed B and C horizons predominate on the plain but gradually give way to non-calcar-

eous gleys and finally peaty gleys on approaching the uplands. Non-calcareous gleys and peaty gleys are to be found in the lower rainfall areas but such occurrences are due either to topographic or parent material effects.

The Parent Material Factor

The soil parent material consists of the geological deposits and formations, mineral and organic, upon which the soil forming processes act. Parent material exercises a considerable influence on the distribution of the major soil groups in this area, its most influential properties being texture and base-richness.

The texture of the parent material affects mainly the internal soil-water relations. In Ayrshire a soil developed on a fine textured till is invariably either a non-calcareous gley or a peaty gley and if developed on a moderately fine textured till it is a brown forest soil, commonly with gleyed B and C horizons. Small differences in texture within the range moderately fine to fine produce variations in drainage, and incidentally in the handling properties. In the coarser textured parent materials small variations in texture have little or no effect upon soil hydrology and the soils developed upon such deposits as raised beach and fluvio-glacial sand and gravel are either brown forest soils or peaty podzols. A comparison of Figs. 10 and 12 shows these trends. The most clayey parent materials are the mixed tills derived from sandstones and shales of the Carboniferous Limestone Series and the Productive Coal Measures and approximately 90% of the soils developed on these tills are gleys. Brown forest soils with gleyed B and C horizons account for 76% of the soils formed on moderately fine textured tills, while 74% of the soils developed on loamy textured tills, for example, the Largs association, come within the brown forest soil group and have either free or imperfect internal drainage. Of the soils developed on raised beach and fluvio-glacial sands and gravels, 93% are freely drained and consist of brown forest soils and peaty podzols.

The textural differences of the soil parent materials are related to the parent rock and also to glaciation. It has been noted that tills with a wide textural range are associated with many of the geological formations in the area, for example, the till parent material of the Darleith association varies from loam to clay and that of the Ashgrove association shows a similar range of texture. The distribution of the various textures within an association is allied to relief, the shallow loamy textured material is usually found on the steeper slopes and hill tops while the finer textured material is confined to the gently sloping ground and valley bottoms. A similar distribution of till has been observed in the north-east and south-east of Scotland by Glentworth (1954) and Muir (1956). The proportion of loamy to fine textured material varies for each till and is considered to be a parent rock effect. In the Darleith association the proportion of loamy till is relatively much larger than that found in the Ashgrove association; the till of the former is derived mainly from Calciferous Sandstone age lavas while that of the latter originates from Carboniferous sediments which are much softer rocks and therefore more susceptible to denudation and comminution.

The effect of the base-richness of the parent material on major soil group distribution is not readily assessed in this area. However, it has been observed that organo-mineral soils developed on intermediate or basic lava till only occur in areas of high rainfall whereas those developed on the more siliceous

and clayey tills from Carboniferous sediments have been mapped in areas with a moderate rainfall (40-45 inches), for example, at Auchentiber and Bloak Mosses. Under a moderate rainfall and on an intermediate or basic lava till the soil normally found is a brown forest soil with gleyed B and C horizons and in a few instances a non-calcareous gley. The relative distribution of peaty podzols and brown forest soils is also controlled to a slight degree by the base-richness of the parent material. Peaty podzols do not develop on base-rich materials in areas of moderate rainfall; like peaty gleys on similar parent materials they are confined to high rainfall regions but well-developed peaty podzols on acidic parent materials have been noted in areas where the annual rainfall is approximately 45 inches.

A striking effect of the base-richness of the parent material is observed in the peaty podzol group. Such soils have developed on loamy textured tills derived from numerous rock types, viz. Old Red Sandstone, Carboniferous Limestone Series sandstone, intermediate and basic lavas of Calciferous Sandstone and Old Red Sandstone ages and also on granodiorite. The peaty podzol, where developed on a till derived from the more siliceous rocks such as Old Red Sandstone and Carboniferous Limestone Series sandstone, has well-formed A_2 and B_2 horizons, but where developed on a till derived from intermediate lavas these horizons are poorly expressed. The A_2 and B_2 horizons, particularly the former, are discernible only with difficulty in peaty podzol profiles formed on a basic lava till.

The ferruginous content of the parent material does not affect the distribution of the major soil groups but it has a considerable influence on the profile morphology within a group. It has been observed in brown forest soils that structure and consistence improve with an increase in the ferruginous content of the parent material. A well-defined firm crumb structure is a feature of the shallow loamy textured, freely drained soil of the Darleith association (parent material high in ferruginous material) while the corresponding soil of the Ashgrove association (parent material lower in ferruginous material) exhibits a weak soft crumb structure. An example of a soil with a very high ferruginous material content occurs at Littlehill, near Symington. The parent material is an agglomerate rich in haematite. The soil has a pronounced crumb structure and a decidedly reddish brown cast, and is considered to belong to the sub-type *Ferritic Braunerde* (Kubiëna, 1953).

A further effect of the ferruginous content of the soil parent material is shown in the non-calcareous gley soils of the Darleith and Ashgrove associations; in the former the gley effects consist of a preponderance of ochreous mottles, while in the latter the grey mottles are dominant. It is also noteworthy that when the internal drainage is improved by artificial methods the ochreous mottles tend to persist but the grey mottles disappear allowing the inherent colour of the parent material to be expressed.

The Relief Factor

Relief involves principally degree, curvature, and length of slope. It is very often determined by the kind and age of the geological formations, climate, vegetation and other factors. Since its influence on the soil varies greatly in relation to the other soil forming factors it cannot always be regarded as an independent variable. Nevertheless several soil-relief correlations must be kept in mind when studying soils in the field. There are, for example, definite relationships between relief and thickness and organic matter content

of the A horizon, depth of solum, degree of horizon differentiation and the internal drainage of a soil.

Relief has a considerable influence upon the distribution of major soil groups in North Ayrshire. Zonal peat is always associated with the level or gentle slopes of the high lying ground, especially in the Renfrew Plateau and the Cunningham and Kyle Uplands. In these districts a change of slope from gentle to moderate is usually accompanied by a thinning of the peat and the development of a peaty gley. Freely drained soils are dominant on the steeper slopes where, as mentioned previously, the more loamy textured and shallower till occurs. The majority of the soils developed on the steeper slopes come within the peaty podzol group.

On the Cunningham Plain the texture of the parent material and the relief largely determine the drainage class of the soils and hence the distribution of the major soil groups. The most clayey soils in this region are those of the Ashgrove and Rowanhill associations. Throughout these associations the topography is mainly undulating and the general soil pattern is one of non-calcareous gleys with poor drainage on the slopes and crests of the undulations and non-calcareous gleys with very poor drainage in the troughs. On the few moderate to steep slopes brown forest soils with either free or imperfect drainage occur. Over the greater part of the Ayrshire till plain, however, moderately fine textured soils predominate, and while the lower clay content is reflected by the general improvement in the soil-water relations, major soil group distribution is largely controlled by the topography; brown forest soils with gleyed B and C horizons occur on the gentle to moderate slopes and non-calcareous gleys with poor drainage on the level or depressed sites.

The most extensive association within the plain is the Kilmarnock which receives a considerable variation in rainfall, from a little over 35 inches in the west to 50-60 inches in the Cunningham Upland. The climatic influence upon the distribution of soil categories is therefore observable within this association. In the areas of lower rainfall brown forest soils with gleyed B and C horizons occur on the gentle to moderate slopes and surface-water non-calcareous gleys occupy the depressions. The gradual increase in rainfall to the east results in a gradual deterioration in soil drainage and eventually surface-water non-calcareous gleys with poor drainage replace the brown forest soils with gleyed B and C horizons on the gentle to moderate slopes and humic gleys replace the non-calcareous gleys in the depressions. Before passing finally into the peat moorlands non-calcareous gleys give way to peaty gleys. Brown forest soils with gleyed B and C horizons only occur on steep slopes in these latter areas.

Generally, on the undulating till plain the distribution of the major soil groups is related to topography. In addition, within one climatic zone it is seldom that the soil-water relations involve more than two contiguous drainage classes, but this is due in part to the moderately fine to fine texture of the parent material. Shallow loamy textured till and steep slopes are prevalent in many parts of the volcanic uplands, for example, the Neilston-Eaglesham Platform. Within this land form unit only two soil groups, brown forest soils and humic gleys are found. In contrast to the soil drainage conditions on the till plain, the marked differences in relative relief and the loamy texture of the parent material on the Neilston-Eaglesham Platform have resulted in the development of only the end members of a hydrologic sequence, namely

the freely drained and the very poorly drained classes (Glentworth and Dion, 1949).

The Vegetation Factor

Several factors complicate the relationship between major soil group and vegetation. Changes in vegetation usually accompany alterations in climate, parent material and relief. Furthermore in areas such as Ayrshire which are largely cultivated it is rather difficult to determine the native vegetational type of a particular soil and it cannot therefore be stated with any degree of certainty what soil properties are influenced by vegetation. However, even allowing that vegetation is not an independent variable, once a type of vegetation becomes established it can influence soil development (Jenny, 1941).

In North Ayrshire the following general correlations between major soil group and vegetation have been made. Brown forest soils carry an acid grassland type of vegetation in which *Agrostis tenuis, Festuca ovina, Anthoxanthum odoratum, Poa pratensis* and *Galium hercynicum* predominate. Most of the brown forest soils with gleyed B and C horizons are cultivated; however, the following species are representative of the older pastures, *Poa trivialis, Lolium perenne, Cynosurus cristatus, Ranunculus repens, Ranunculus acris,* and *Trifolium repens.* The vegetation associated with the non-calcareous gley group usually consists of *Holcus lanatus, Alopecurus geniculatus, Ranunculus repens* and *Juncus effusus.* Either a *Nardetum* or *Callunetum* type occurs on the peaty podzols; the former is not widespread, being found in areas where the grazing tends to be more intensive. *Calluna vulgaris, Vaccinium myrtillus, Deschampsia flexuosa* and *Hypnum cupressiforme* are the dominant species in the *Callunetum* type. *Eriophorum vaginatum, Juncus effusus, Molinia caerulea, Sphagnum* spp. and *Polytrichum commune* are typical of the peaty gleys. The humic gleys support a marshy type of vegetation comprising *Juncus acutiflorus, Juncus effusus, Carex nigra, Anthoxanthum odoratum, Ranunculus repens* and *Ranunculus flammula.* The species on the hill and raised moss peats are very similar, consisting of *Eriophorum* or *Calluna,* the latter predominating on the drier habitat. Subsidiary species vary considerably in amount depending upon local conditions, but *Sphagnum* spp. are always present.

The Time Factor

The time factor is of little importance in the distribution of major soil groups in this region, the whole of it being freed from glaciation at virtually the same time. There are differences in the soils developed on the raised beach deposits, those close to the sea being lower in clay and organic matter than those further inland but it is very doubtful if the variations in these properties are solely attributable to the time factor.

Man's Influence

Man's activities in this area have modified to varying degrees the distribution of the major soil groups. Throughout an appreciable part of the hill ground the peat has been cut and the stripped land drained and cultivated. Peaty podzols have been cultivated and now the only remnant of the podzolic profile is the indurated B_3 horizon. Most of the brown forest soils with gleyed B and C horizons are artificially drained and unless the field drains are efficiently maintained the tendency is for the soil-water condition to deteriorate to those of the non-calcareous gley. Peaty gley and non-calcareous gley soils occupy many of the felled woodland areas on the lower lying ground.

Recently, however, some of these areas have been gyrotilled, drained and brought into normal cultivation. It is expected that in time a brown forest soil with gleyed B and C horizons will develop on these sites. The majority of the raised moss deposits on the lower ground are apparently no longer active. On many of these deposits where the drainage has been improved *Calluna vulgaris* has become dominant and near Auchentiber, Scots Pine has been planted. It is evident, however, that in the past raised mosses were more extensive but cutting and draining have enabled many of the sites to be cultivated.

Therefore, although climate, parent material, relief, vegetation and time are primarily responsible for soil development and major soil group distribution, the effects of man's use are also of considerable importance.

PLATE 9
The Lochlibo Valley. The Ashgrove association is in the foreground; the Darleith association on the hillside.
(*By courtesy of George Outram & Co. Ltd., Glasgow.*)

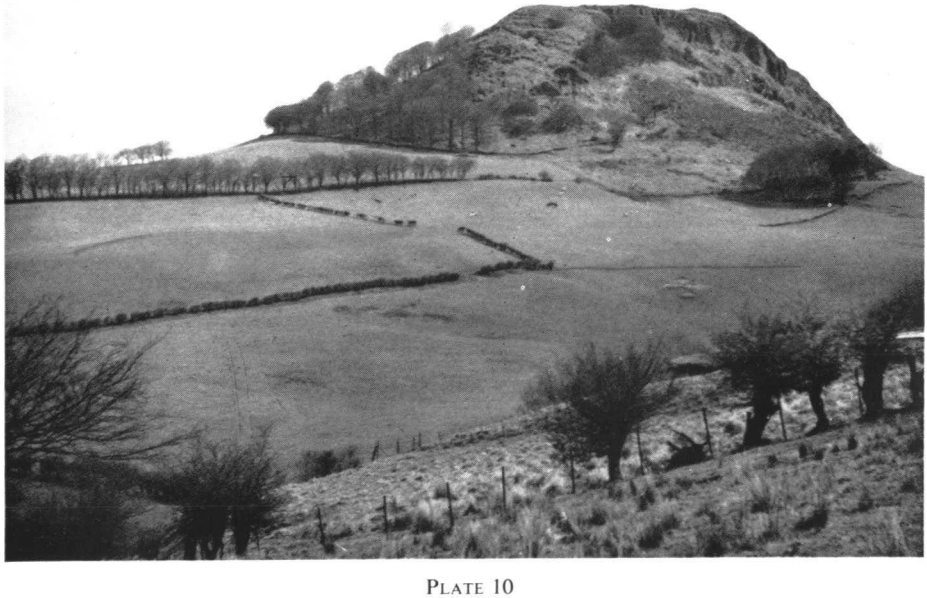


PLATE 10
Loudoun Hill, Darvel. A phonolitic trachyte plug. Dunlop series on the lower slopes.

PLATE 11
View north-west across the Lochwinnoch depression from the Rowbank Plateau towards the Renfrew Plateau.

PLATE 12
The Lochwinnoch depression. Note alluvial flat in the valley bottom, flanked by the poorly drained Ashgrove series. The Renfrew Plateau forms the background.

CHAPTER V

The Soils

As every division of the Scottish Carboniferous is represented in North Ayrshire, it is probable that the soil categories established in this area will be repeated throughout much of the Central Valley, although their relative distribution may be affected by the greater variation in climate and topography in this large area.

Fifty four soil series have been recognised within the composite sheet and they have been grouped into fourteen large cartographic units (soil associations) on the basis of the geological origin of the parent material. The series have been given geographic names and the associations usually those of their most characteristic series. Soil series can be further divided into types on a textural basis but this has not been done in this instance as a Soil Texture Map, Fig. 13, prepared by the West of Scotland Agricultural College is available for Sheet 22. They can also be differentiated into phases, depending on some characteristic which affects agricultural practice; differences in stone content, depth of surface soil and slope, for instance, are commonly separated at this categorical level. In North Ayrshire the top soil is generally 8-12 inches thick, i.e. intermediate; an exception is the Dreghorn series where deep surface horizons (>12 inches) have been observed. The stone content of the various soils has also been noted. These phase differences are recorded on the field maps but not on the published map.

The areas of the various soil categories are given in Table E which is arranged to show certain relationships between the soil series. Horizontally, series developed on parent material derived from the same rock types are grouped into associations; vertically, they are arranged according to drainage class and major soil group. The major soil group, a unit of classification, is the highest level of abstraction in the table. Five major soil groups have been recognised in this area; two of these contain two drainage classes—brown forest soils of low base status (freely and imperfectly drained) and non-calcareous gleys (poorly and very poorly drained). Only one association, the Darleith, has series representing the five major soil groups and all the drainage classes.

Brown forest soils occupy 51·5% of the map area while non-calcareous gleys cover 20%. It should be noted, however, that 64% of the brown forest soils are imperfectly drained and generally require some form of artificial drainage. Peaty podzols, with or without an iron pan, account for 3·7% of the map area, peaty gleys for 1·9%, and humic gleys for 3·5%. The remainder is made up of peat, both hill and basin—12·7%, aeolian sand—0·8%, and alluvium+mixed bottom land—5·9%; all of these have unique properties and are treated separately in the account of the soils which follows.

ASHGROVE ASSOCIATION

The soils of the Ashgrove association are confined to the country lying to the north of the River Irvine but are widely distributed throughout this area particularly in the north-western part of the Cunningham Plain. Characteristic of much of the boulder clay lowlands floored by Carboniferous Limestone Series sediments, they are amongst the finest textured soils in North Ayrshire, and can be compared to the clay and some of the heavy loam soils shown in the Soil Texture Map, Fig. 13.

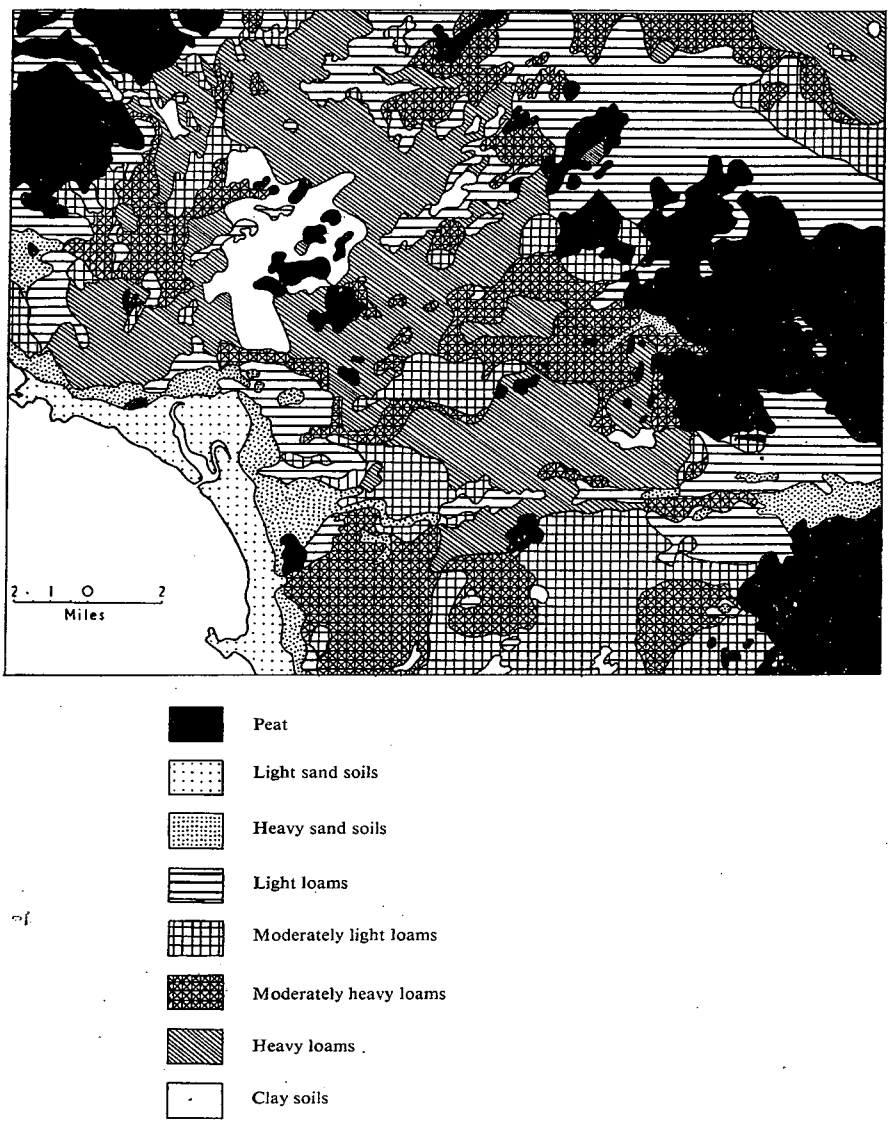


FIG. 13. Soil Texture Map.
(Sketch prepared from The Geology of North Ayrshire, Mem. Geol. Surv., 1930, with permission of the Director of the Geological Survey and Museum.)

TABLE E. AREA OF SOIL CATEGORIES (SQ. MILES)

Association	Series						
	Freely Drained	Imperfectly Drained	Poorly Drained	Very Poorly Drained	Freely Drained	Poorly Drained	Very Poorly Drained
Ashgrove 40·5		Highfield 2·1	Ashgrove 32·3	Caaf 4·6			Giffen 1·5
Bargour 14·7		Bargour 13·4	Brocklie 1·1				Dalsangan 0·2
Darleith 103·2	Darleith 40·1	Dunlop 28·2	Amlaird 10·1	Pokelly 0·6	Baidland 10·4	Myres 4·9	Dunwan 8·9
Darvel 11·6	Darvel 10·4		Ardoch 0·9		Tulloch 0·2		Hapton 0·1
Dreghorn 23·4	Dreghorn 21·9		Hunterston 1·4				Montgomery 0·1
Giffnock 3·1			Giffnock 2·7	Rouken 0·4			
Kilmarnock 88·0		Kilmarnock 73·9	Kilmaurs 12·1			Loudoun 1·5	Polbaith 0·5
Kirktonmoor 6·2	Faulds 3·9				Moorhouse 0·8		Kirktonmoor 1·5
Lanfine 9·7		Lanfine 6·2	Threepwood 0·9		Knockendon 1·6	Distinkhorn 0·3	Hardhill 0·7
Largs 11·0		Largs 6·7	Kelburn 1·6		Haupland 1·4	Reoch 0·6	Crosbie 0·7
Mauchline 0·5		Mauchline 0·4	Fail 0·1				
Reppoch 1·1			Cleuch 0·1		Glen Garr 0·8	Reppoch 0·1	Cawdron 0·1
Rowanhill 10·8		Caprington 3·1	Rowanhill 7·0	Todrigs 0·6			Corraith 0·1
Sorn 5·8			Sorn 4·8	Blairkip 0·4		Weitshaw 0·4	Auchmannoch 0·2
329·6 Major Soil Group	76·3	134·0	75·1	6·6	15·2	7·8	14·6
	Brown Forest Soils Low Base Status 210·3		Non-calcareous Gleys 81·7		Peaty Podzols 15·2	Peaty Gleys 7·8	Humic Gleys 14·6
Hill Peat 44·2, Basin Peat 7·4 } 51·6			Alluvium, Mixed Bottom Land } 23·9				Aeolian Sand 3·1

Distribution

The association covers 40·5 square miles, occurring in two units. The main area (38·1 square miles) occupies nearly all the north-western half of the Cunningham Plain and is contained roughly by a line Kilbirnie-Barrmill-Cunninghamhead-Stevenston-Munnoch Reservoir-Kilbirnie. Small patches of Darleith and Kilmarnock soils form a long narrow irregularly shaped strip in the centre of this area and there are also large accumulations of basin peat. The association projects north-eastwards at three points—from Kilbirnie and Glengarnock to the edge of Sheet 22, along the foot slopes of the Lochwinnoch valley bordering the Barr Loch alluvium, and from Barrmill via Lugton and Uplawmoor to Shillford in the Loch Libo Valley. A small outlier occurs to the north-west of Stewarton. The other division of the association (2½ square miles) lies east of the White Cart Water in the neighbourhood of Hairmyres Colony.

Parent Material

Carboniferous Limestone Series sandstones and shales in varying ratios form the major constituents of the glacial till parent material. The limestone contribution, as assessed from the stone composition, is seldom high and although an increase in the pH value from 5·5 in the surface to 7·5-8·0 in the C horizon is a feature of all the profiles analysed the soil cannot be classed as calcareous.

Distinctive properties of the till are clayey texture (45%+clay), plastic consistence, weathered stone content and considerable depth. In a few places the parent rocks come close to the surface and in some instances the till here is coarser textured—clay loam; stones are more frequent and less weathered. As stated previously, the ratio of sandstone to shale is very variable, but with the exception of small patches south of Ashgrove Loch, south of Sevenacres Quarry, immediately west of Highfield and south of Caldwell, the shale proportion is always the higher. Exceptionally high concentrations of shale occur in the till on the east side of the River Garnock between Dalry and Beith, in the neighbourhood of Uplawmoor and Lugton and in the north-eastern unit, east of Hairmyres colony.

Topography

The undulations of the main block develop into a rolling topography in the Lochwinnoch and Loch Libo extensions. A rolling landscape is associated with the eastern unit.

Climate

The main area lies between the 45 and 60 inch isohyets and the eastern area between the 35 and 45 inch isohyets.

Soils

Most of the soils of this association are developed on a deep clay till derived from shales and sandstones of the Carboniferous Limestone Series. They contain only a few stones, most of which are highly weathered, the shales especially being readily rubbed down between the fingers. This deep clay till is associated with a gently undulating topography and a less extensive, shallow clay loam textured stony till derived from the same parent rocks is found on the steeper sloping ground.

The association is made up of four series, the most extensive being the Ashgrove which has poor internal drainage and is found on the gentle slopes

and flattish crests of the undulations on the till plain. The influence of slope on soil development is greatly reduced by the high clay content of the soil profile (from 38% in the S horizon to 45%+ in the Cg). The imperfectly drained series, the Highfield, is developed on the shallow, more stony, clay loam textured till located on the steeper sloping ground, mostly of the Lowland Transition Zone, north-west of Dalry and south of Kilbirnie. A peaty podzol with iron pan occurs near Uplawmoor in an area too small to be recorded on the map. Two series, with very poor internal soil-water relations, the Caaf and the Giffen, occur in areas of level or depressed relief and are differentiated by the organic matter content of their surface horizons. The presence or absence of an organic top to these poorly drained soils is not, as in other associations, correlated with rainfall. Extensive artificial drainage systems (in recent times, 3 inch flat bottomed tiles) are common in all the series of this association.

Series

HIGHFIELD SERIES

The Highfield series is developed on a clay loam till and is confined to the moderately sloping ground of the association, the four principal locations being Highfield, Barrmill, Lochwinnoch, and Thirdpart Farm north-west of Dalry. Rock, either Carboniferous sandstone or shale, is usually encountered within two feet of the surface and it is the close proximity of rock to the surface rather than the occasional stoniness of the soil which sometimes makes cultivation difficult. Drainage is imperfect. This series is nearly always surrounded by the poorly drained Ashgrove series from which it is readily distinguished by the absence of *Juncus* spp. There is a considerable variation in rainfall over the scattered sites of the series (from 40-50 inches +) but the effect of these differences on the soil profile appears to be greatly modified by the moderately sloping relief and the loamy texture of the parent material.

GENERALISED PROFILE DESCRIPTION

SLOPE moderate
ASPECT south-west
ALTITUDE 550 feet
VEGETATION *Lolium perenne, Agrostis tenuis, Holcus lanatus, Lotus corniculatus*
DRAINAGE CLASS imperfect

Horizon	*Depth or Thickness*	
S	0-8″	Grey-brown (10YR5/2) loam, weak medium crumb, friable, organic matter moderate, roots frequent, few stones, no mottling. Sharp change into
B(g)	8-14″	Pinkish grey (7·5YR6/2) clay loam, fine sub-angular blocky, firm, organic matter low, roots occasional, few stones, few fine faint ochreous mottles, grey mottling negligible; merging into
B-C(g)	14-20″	Grey-brown (10YR5/2) clay loam, moderate fine platy, firm, moderately indurated—decreasing slightly below 20 inches, few fine faint ochreous mottles, grey mottling negligible.
D	20″	Rock: Carboniferous Limestone.

The texture of the surface horizon varies between loam and sandy clay loam and normally has only a few stones. There is little evidence of mottling except in some old pastures at Highfield where distinct rusty mottles were noted along the root channels. The B horizon has a clay loam (occasionally a clay) texture, the stone content is variable and ochreous mottlings are few, fine and faint. A sub-angular blocky structure is associated with the B

horizon and a moderate platy structure with the C horizon which always shows some degree of induration, particularly in the upper part. The rock (sandstone, shale or limestone) which occurs within about 2 ft. is normally in the form of a pavement, and this accounts for the infrequency of stony soils.

This series has been classified as a brown forest soil of low base status but in common with other North Ayrshire series allotted to this major soil group (e.g. the Kilmarnock and the Dunlop) it shows in the sub-angular blocky structured B(g) horizon evidence of the clay accumulation typical of the grey-brown podzolic soils.

NOTE ON AGRICULTURE. The Highfield series provides the best agricultural land of the association. Dairy farming is the main activity and rotations are similar to those on the northern and eastern Cunningham Plain where long leys are favoured. Land drainage, unlike that of the other series of the association, does not present a problem.

ASHGROVE SERIES

The proportion of shale and sandstone from which the till parent material is derived varies widely. On the east side of the Garnock Water between Dalry and Beith, at Caldwell and towards East Kilbride in the north-eastern section, the shale content of the sub-surface horizons is very high and is reflected in the loss on ignition figures which are of the order of 10%. Unlike the corresponding series of the Giffnock association, where the parent material contains a very high proportion of Carboniferous Limestone Series sandstone, there is a gradual increase in the pH value with depth, from 5·5-6·0 in the surface to 7·0-8·0 in the C horizon. The series is one of the finest textured in North Ayrshire, the clay content of the surface soil varying from 30-45% and that of the C horizon from 40-50%, the highest recorded (68%) being at Auchenmade Station, close to the Dusk Water. Over most of the series the topography is undulating, except at the small Loch Libo and Lochwinnoch extensions where it is rolling. Variations in rainfall from 35-50 inches are recorded but as in the case of the topography their influence on the soil profile is, in many instances, modified by the clay texture of the parent material.

GENERALISED PROFILE DESCRIPTION

SLOPE: moderate
ASPECT: north
ALTITUDE: 150 feet
VEGETATION: *Juncus effusus, Juncus conglomeratus , Agrostis tenuis, Anthoxanthum odoratum, Agrostis canina, Holcus lanatus.*
DRAINAGE CLASS: poor

Horizon	*Depth or Thickness*	
S	0-9″	Grey-brown (10YR5/2) clay loam, weak coarse crumb, slightly plastic, organic matter moderate, roots frequent, few stones, frequent fine distinct rusty mottles along root channels. Sharp change into
Bg	9-25″	Brown (10YR5/3) clay, fine to medium prismatic—tending to massive, slightly plastic, organic matter low, roots occasional, few stones, many small sandstone and shale fragments, many medium and coarse ochreous and grey mottles—the latter intense around stones and roots; merging into
Cg	25-40″	Dark brown (10YR4/2) clay, massive, slightly plastic, roots rare, few stones but many shale and sandstone fragments, few medium faint ochreous mottles, frequent medium distinct grey mottles.

The surface soil is commonly a clay loam, except in the Glengarnock-Auchentiber block where clay textures are the rule. It is generally grey-brown in colour and, in the older pastures at least, rusty mottles are always observed along the root channels. A clay texture and plastic consistence are amongst the principal features of the Bg horizon. Mottling, both ochreous and grey, is much in evidence. The structure of the Bg is either prismatic or massive while that of the clay textured Cg is invariably massive. In the latter grey and ochreous mottles are less numerous and less intense, indicating an improvement in the soil-water relations. Iron tubes are sometimes present, but they are not a general feature. They are, however, commonly found south of Beith in the Whitestanes area where it was also noted that the surface horizons have above-average organic matter contents.

The Ashgrove series is grouped with the non-calcareous gleys, and the decrease in gley effects with depth further differentiates it as a surface-water soil.

NOTE ON AGRICULTURE. Dairying is the main industry. The clay texture and plastic consistence of the subsoil render drainage difficult and the minimum of cultivation is done. In a few places, with careful working at the correct state of dryness, the soil yields a good tilth and green cropping can be carried out, but the crop is always precarious. In the clay land between Glengarnock and Auchentiber the ill-effects of the fine texture are intensified. Adequate drainage is the major problem of the series; systems of field drains are found throughout, and in the past ridges and water-furrows were widespread. Several years ago mole draining was tried with some success in a few areas, usually augmenting the existing tile drainage system; provided the slope is favourable, i.e., not too steep, and the subsoil is a stiff clay and free from boulders, this less expensive method of drainage could be effectively employed. As a result of the poor drainage conditions the soil is readily poached and prone to *Juncus* infestation.

CAAF SERIES

This series is widely distributed but rarely extensive, as it is restricted to drainage channels and areas of depressed relief. The sites are comparable to those of the Giffen series, but the soils are strikingly different in that whereas the Giffen is a humic gley, the organic matter content of this soil is generally less than 6%. It is developed on a dark grey plastic clay till containing many sandstone and shale fragments, but as it is frequently associated with lacustrine alluvium the upper horizons are occasionally derived from this latter material. The drainage class is very poor and many of the sites are liable to periodic flooding.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	150 feet
VEGETATION	*Juncus effusus, Carex nigra, Carex panicea, Anthoxanthum odoratum, Ranunculus repens.*
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-8″	Brown (10YR5/3) loam to silt loam, moderate to coarse crumb, slightly plastic, organic matter moderate, few stones, distinct rusty mottles along root channels, faces of peds slightly grey. Sharp change into
A_2g	8-17″	Pale yellow (2·5YR7/4) silt loam, massive, very plastic, organic matter low, roots occasional, no stones, frequent coarse distinct ochreous mottles, many coarse prominent grey mottles, faces of large cleavages completely grey in colour. Sharp change into
Bg	17-30″	Dark grey-brown (2·5Y4/2) silt loam, coarse prismatic to massive, plastic, roots rare, many small weathered sandstone and shale fragments, few medium distinct ochreous mottles, iron tubes along the root channels, many coarse prominent grey mottles on faces of peds; merging into
Cg	30-42″	Dark grey (10YR4/1) clay, massive, slightly plastic, many sandstone and shale fragments, few medium faint indistinct grey mottles, grey colours dominant around old roots and the few large stones.

The top soil has either a loam or silt loam texture and a slightly plastic consistence. Rusty mottles are prominent along the root channels. In the profile described the A_2g is derived from lacustrine alluvium, hence the silt loam texture. Irrespective of origin, the structure of the A_2g is massive, the consistence very plastic, and the horizon the most intensely gleyed of the profile. The Bg may be either a sticky plastic silt loam or a clay. Small stones are usually noted in this horizon. Gleying is still pronounced and iron tubes are present along root channels. A slightly plastic dark grey clay is characteristic of the Cg horizon. Gleying is reduced but the iron tubes continue along the roots. Though generally exhibiting a massive structure, this horizon has been observed with a weak platy structure. Large cleavages are a feature of the profile and the faces of these are always markedly grey in colour, even at depth.

The Caaf series has been included with the non-calcareous gley soils; it is also a surface-water soil.

NOTE ON AGRICULTURE. Most of the sites are low-lying and comparatively level, so that drainage improvement, either by tiles or by ditches, is feasible only if there is an adequate outlet. In addition to the very poor drainage, the soil is clayey textured and cultivation is a far from attractive proposition. The series is mainly in permanent grass which provides poor quality grazing for dairy herds.

GIFFEN SERIES

The Giffen series covers a very limited area; it is associated mainly with the level or gently sloping ground in and around the Mosses of Bankhead Cockinhead, Auchentiber, Bloak and Kennox, all lying between Glengarnock and Auchenharvie. These mosses consist essentially of basin peat which has developed in the troughs of the undulating ground and this series occurs where the peat thins on spilling over the crests of the undulations. It is also located in a number of isolated depressions, particularly on the east side of the Garnock Water between Dalry and Beith. The soil is characterised by a dark brown surface horizon, high in organic matter, with markedly gleyed sub-surface horizons. The drainage class is very poor.

PLATE 13
The Eaglesham Moraine south-west of Eaglesham. Note the hummocky relief.
(*By courtesy of George Outram & Co. Ltd., Glasgow.*)

PLATE 14
The Eaglesham Moraine near Brother Loch. Kirktonmoor association.

PLATE 15
The Ballagioch Plateau: western end. Darleith association. Basin peat in centre (Knockmade Moss).

PLATE 16
On the Ballagioch Plateau. Portion of Eaglesham Moraine in centre.

GENERALISED PROFILE DESCRIPTION

SLOPE	very gentle
ASPECT	south
ALTITUDE	300 feet
VEGETATION	*Juncus effusus, Deschampsia caespitosa, Ranunculus repens, Cardamine pratensis.*
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-7″	Dark brown (7·5YR5/3) humified silty clay loam, moderate medium to coarse granular, friable, organic matter high (25%+), roots abundant, no stones, frequent fine distinct rusty mottling along root channels. Sharp change into
A_2g	7-13″	Light brown-grey (11YR6/2) clay, coarse prismatic fading to massive, very plastic, organic matter low, roots frequent to occasional, few stones—mainly sandstones, frequent fine faint ochreous mottles, many coarse prominent grey mottles, faces of peds entirely coated in grey. Sharp change into
Bg	13-27″	Grey-brown (11YR5/2) clay, massive, very plastic and sticky, live roots rare, many small stones—sandstones and shales, well-defined iron tubes around root channels, many coarse prominent ochreous and grey mottles, faces of large cleavages completely grey; merging into
Cg	27-45″	Grey (7·5YR5/0) clay, massive, plastic, many small fragments of sandstone and shale, ochreous mottling negligible, few medium distinct mottles, faces of cleavages grey gleyed, iron tubes present.

The surface horizon is a silty clay loam containing upwards of 25% organic matter. A moderately well-developed granular structure is common and fine but distinct rusty mottles occur along the many root channels. The A_2g, always a shade of grey, is a clay with a weakly prismatic to massive structure. It is very plastic and the organic matter content is very low. This is the horizon of maximum gleying in the profile and grey mottles predominate. A massive, very plastic clay, containing many sandstone and shale fragments, comprises the Bg. Grey colours, though still marked, are less intense than in the Ag. Iron tubes are observable along the root channels. The Cg horizon is also a massive structured plastic clay, but here the grey mottling is sparser, less intense, and the parent material colour is revealed. As in the Caaf series, large cleavages occur through the sub-surface horizons, the sides of which are sticky and completely grey in colour.

This series has been placed with the humic gley soils.

NOTE ON AGRICULTURE. Most of the series is drained, either by tiles or by ditches. Some of it is cultivated but the greater part is in grass, providing rather poor quality grazing.

BARGOUR ASSOCIATION

The Bargour is the most extensive association south of the River Irvine and like the majority in this region is developed on a till derived largely from either Carboniferous or Old Red Sandstone sediments. With the Lanfine and Mauchline associations, which it resembles in several aspects, it corresponds in the main to the moderately light loam soils depicted in the Soil Texture Map, Fig. 13.

Distribution

The association covers a total area of 14·7 square miles, the main section being an irregularly shaped region in the south-east, centred near Crossroads. Projections extend northward as far as the River Irvine from Hurlford to beyond Galston, and southward to the southern edge of Sheet 22 from the Fail district east towards Sorn. In the south-west a 1½ square mile strip occurs south of Symington in the low-lying country west of Barnweill Hill.

Parent Material

The parent material is a clay loam to clay till originating from a variety of rock types, chiefly Old Red Sandstone and Barren Red Measures sandstone, with lavas and Carboniferous rocks contributing to a lesser degree. The red sandstone constituent of the till in the northern part of the larger area is derived mainly from Old Red Sandstone, whereas Barren Red Measures sediments predominate in the south. In the smaller western zone the red sandstone element originates almost entirely from Barren Red Measures. The till everywhere is a fairly deep deposit with a low stone content.

Topography

In the main region the Bargour soils are associated with rolling topography but the western unit is predominantly undulating.

Climate

The northern portion of the principal unit lies within the 35-40 inch rainfall zone and the southern within the 40-45 inch zone; most of the western unit also lies within the 35-40 inch zone but the western tip receives less than 35 inches per year.

Soils

The Bargour soils are developed on a red-brown till which is uniformly clay loam to clay in texture, the variation in rainfall is limited to 35-45 inches, and the ground is gently to moderately sloping. Because of the small variation in these factors the association contains only three series, the imperfectly drained, the Bargour, being the largest and the most important agriculturally. Soils with poor drainage, the Brocklie series, occur frequently in conjunction with the very poorly drained soils of the Dalsangan series in the drainage channels and areas of subsidence over coal workings. Soils of the Brocklie series have also been noted on the sites of numerous small woodlands and shelterbelts felled during the First World War.

Series

BARGOUR SERIES

The Bargour series is the principal series of the association. It is developed on a red-brown clay loam till which, judging from the absence of rock outcrops and the rolling to undulating topography, is a fairly deep deposit. The series has been classified as imperfectly drained but in the Auchmillan-Rottenrow belt and in the neighbourhood of Brocklie the $B_2(g)$ horizon often contains a higher percentage of clay than that of the modal profile, and drainage, though imperfect, verges on poor. Evidence of past marked rigging and furrowing to facilitate drainage is observed in these areas.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate
ASPECT	north
ALTITUDE	250-300 feet
VEGETATION	*Poa trivialis, Ranunculus repens, Ranunculus acris, Bellis perennis, Holcus lanatus, Lolium perenne, Trifolium repens.*
DRAINAGE CLASS	imperfect

Horizon	*Depth or Thickness*	
S	0-8″	Light brown (7·5YR6/4) sandy clay loam, fine sub-angular blocky, friable, organic matter low, few stones, roots abundant, dark red mottles along root channels. Sharp change into
B_2(g)	8-16″	Reddish yellow (7·5YR6/6) sandy clay loam, weak sub-angular blocky—arranged in 2-3 inch prisms, firm, organic matter low, stones few, roots occasional, frequent medium distinct yellow-orange and grey mottles, faces of units coated light grey. Moderately sharp change into
B_3(g)	16-23″	Yellow-red (5YR5/6) clay loam, well-defined coarse prismatic, very firm, roots rare, stony, variegated colours from decomposing stones, few medium distinct yellow orange mottles, grey gleying on faces of units and around stones. Sharp change into
C(g)	23-34″	Red-brown (5YR5/4) clay loam, prismatic to massive—very firm, stony—Barren Red Measures sandstone; basalts and shale, roots rare, few fine faint ochreous mottles, grey mottles on faces of units and along root channels, few pseudo-concretions of manganese.

The surface horizon is usually a light brown loam to sandy clay loam, friable and relatively stone free. Dark red rusty mottles are sometimes present in the root channels. The colour of the B_2(g) horizon varies between reddish brown and reddish yellow. A sandy clay loam to clay loam texture is associated with the horizon and also a sub-angular blocky structure, the peds often being arranged in prisms. Both yellow and grey mottles are readily observable and the faces of the peds are coated in grey colours. A similar colour range applies to the B_3(g) horizon. It textures to a clay loam (35% clay), is firm and has a good prismatic structure. Variegated colouring from decomposing stones is a feature of this horizon and although yellow and grey mottles are still distinct they are normally less than in the B_2(g). A red-brown colour, a clay loam texture, and a structure fading from prismatic to massive characterise the C(g) horizon. Mottling is always much less intense than in the B(g) horizons and pseudo-concretions of manganese are often present.

The series has been grouped with the brown forest soils of low base status with gleyed B and C horizons.

NOTE ON AGRICULTURE. Conditions are favourable for arable farming and although dairying is the most important activity a good deal of cropping is done. Hay and pasture, turnips and potatoes are grown successfully. Large areas of the series are effectively tile drained.

BROCKLIE SERIES

The Brocklie series is located in the smaller drainage channels and in depressions over coal workings; most of the larger areas of depressed relief are occupied by uniformly moderately fine to fine textured alluvium. This poorly drained series of the Bargour association has also developed on the sites of several woodlands felled between 1914 and 1918, and in recent years

some of those in the Crosshands district have been gyrotilled, tile drained and cultivated. The soil profile has been greatly disturbed in the process; the upper horizons of the old woodland soil are absent in some places and in others roughly mixed with the red-brown clay till, but in all probability an imperfectly drained soil similar to the Bargour series will in time develop.

GENERALISED PROFILE DESCRIPTION

SLOPE	gentle
ASPECT	south-east
ALTITUDE	200 feet
VEGETATION	*Juncus effusus, Agrostis tenuis, Trifolium repens, Ranunculus repens, Anthoxanthum odoratum, Holcus lanatus.*
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
S	0-8″	Very dark grey (10YR3/1) sandy clay loam, weak medium sub-angular blocky, friable, organic matter low, few stones, roots abundant, rusty mottles along roots. Sharp change into
A_2g	8-11″	Light grey (10YR7/1) clay loam, weak fine sub-angular blocky—arranged in prisms, slightly plastic, organic matter low, few stones, roots frequent, many fine prominent yellow mottles, faces of units grey. Sharp change into
B_2g	11-18″	Brown (7·5YR5/4) clay, medium to coarse prismatic, plastic, few stones, roots occasional, many prominent medium and fine yellow and grey mottles, faces of units grey. Sharp change into
B_3g	18-25″	Reddish brown (5YR5/4) gritty clay, tending to coarse prismatic, slightly plastic, many very small stones, roots rare, many prominent fine yellow and grey mottles; merging into
Cg	25-42″	Reddish brown (5YR5/4) clay loam, massive, slightly plastic, few stones, roots rare, few fine distinct yellow mottles on grey coloured cleavage faces.

A dark grey colouring and a sandy clay loam texture are common features of the surface horizon which is usually friable and comparatively stone free. Rusty mottles are always evident along the root channels. The A_2g is clearly distinguished by its light grey colour. It has a clay loam texture, with sub-angular blocky peds nearly always arranged in prisms, and a consistence tending to plastic. Yellow mottles are prominent and the peds are coated grey. The B_2g textures to a clay, the structure is coarse prismatic and the consistence plastic. Yellow and grey mottles are larger than those of the A_2g but the faces of the peds continue grey. A sharp change from brown to reddish brown and a grittiness in the clay mark the change to the B_3g. There is often an increase in stone content, most of the stones being highly weathered, whilst grey and yellow mottles decrease in size if not in number. A clay loam texture and massive structure are associated with the Cg horizon. Mottling is greatly reduced but the faces of the large cleavages are an intense grey.

The morphology of the series conforms to that of a surface-water non-calcareous gley.

NOTE ON AGRICULTURE. Poor drainage and the practical difficulties involved in attempting to improve it, especially in subsidence areas, give the series a low agricultural rating.

DALSANGAN SERIES

The Dalsangan series is characterised by a surface horizon rich in organic matter and by very poor drainage. It occupies a few areas of low relief and is usually in close association with alluvium.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	400 feet
VEGETATION	*Juncus effusus, Deschampsia caespitosa, Carex nigra, Anthoxanthum odoratum, Galium hercynicum, Agrostis tenuis, Polytrichum commune.*
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-10″	Dark brown (7·5YR3/2) humified sandy loam, no definite structure, no stones, roots abundant. Sharp change into
A_2g	10-20″	Grey (7·5YR5/1) sandy clay loam, massive, plastic, organic matter low, stones few—highly weathered, roots occasional, many distinct yellow-orange mottles, grey colours prominent throughout; merging into
B-Cg	20″+	Grey brown (2·5YR5/2) clay, massive, plastic, few stones, roots rare, iron tubes around roots, grey colours less prominent.

The surface horizon is a dark brown humified sandy loam, stone free and wet; it is underlain by a 10-12 inch A_2g which is strikingly grey in colour. The texture varies from sandy clay loam to clay but the consistence is always plastic and the structure massive. Yellow and grey mottles are prominent and iron tubes occur along the root channels. The A_2g merges into a massive plastic clay and though grey colours are again evident they are less prominent than those of the A_2g. Well-defined iron tubes occur along the roots.

The series has been grouped with the humic gley soils.

NOTE ON AGRICULTURE. A marsh vegetation, normally dominated with *Juncus* spp., is carried by this series and is indicative of its low agricultural value.

DARLEITH ASSOCIATION

The Darleith association covers 103·2 square miles and is the largest and most widespread association mapped in North Ayrshire. It also contains the greatest number of soil series, due to wide variations in topography and climate and the broad textural range of the parent material. For this reason the association best demonstrates the relative influence of these three soil forming factors.

DISTRIBUTION

It is mainly confined to the higher ground which can be conveniently divided into three areas.

Area I. This area occupies the well-defined high basalt plateau in the north-west; included in it are the Mistylaw Hills north-west of Kilbirnie and the distinct line of hills which runs 2-3 miles west of the Garnock Water ending rather abruptly at the Rowanside Hills above Ardrossan. The western margin is rather irregular, starting from the high ground immediately behind Largs, encircling the west slopes of Whatside and Green Hills and then following the course of Caaf Water to Knockendon Reservoir. Both north and south of the

Knockewart Hills the Largs association to the west makes deep inroads into the association. The southern boundary takes in Busbie Moor and the rock-studded ground about the farms of Craigiepark and Darleith, the latter giving its name to the association.

Area II. This is the most extensive area, with its western limits lying roughly along the Beith-Glasgow road from which it stretches in a broad crescent over the hills and wide moorland country to the vicinity of Darvel. The northern boundary is clearly outlined by the Neilston-Eaglesham Platform, but the southern boundary from Beith to Hareshawmuir Water is interrupted at Loch Libo and north of Stewarton by two faulted strips of Carboniferous sediments. Darleith soils also occur on the Cathkin Braes, the western tip of which encroaches on the north-east corner of the map.

Area III. South of the River Irvine the association is restricted to the prominent sills at Dundonald and Craigie, two small areas south of Galston in the neighbourhood of Sornhill, and Gallows and Changue Hills on Lanfine Estate. It also occurs on Barnweill and Helenton Hills near Symington.

Parent Material

The soils of this association are developed on a till derived mainly from Calciferous Sandstone age lavas of intermediate and basic composition.

Area I. The parent rock types here are mainly micro- and macro-porphyritic basalts and trachy-basalts of Calciferous Sandstone age but towards the west more acidic felsite sills occur. The till derived from these rocks is brown to red-brown in colour and varies greatly both in depth and texture. On the hill tops and steeper slopes it is comparatively shallow; in places the soils are practically residual, with a high stone content and textures ranging from loam to clay loam. On the gentler slopes and in the valley bottoms the till is much deeper, with a moderately fine to fine texture, and contains very few stones, suggesting very thorough grinding by ice action rather than excessive weathering. Occasionally well-rounded green mica schist pebbles have been noted in the deep till, particularly in the most northerly districts.

Area II. In this area the parent rock types are largely the same as those in Area I with the addition of trachyte and trachyandesite in the centre and east. Again the till has a wide textural range and depth. In the north it is loam to clay loam in texture and seldom more than 3 feet deep, whereas on the gentle and moderately sloping moorland ground to the south it is of considerable depth, with the texture of a medium clay.

Area III. In the southern part of the North Ayrshire till plain the parent material is derived from a variety of igneous rocks. At Dundonald and Craigie the soils are developed on a till derived from teschenite, olivine-dolerite and monchiquitic basalt, while those near Sornhill and Lanfine and Changue Hills are formed on till from basalt and basic andesite of Old Red Sandstone age. The red-brown till on Barnweill Hill is derived essentially from Permian age basalt, and the strikingly red till at Helenton and Littlehill is from agglomerate. In all these locations the till is fairly shallow, with a loam to clay loam texture and a variable stone content.

Topography

Extremes of slope occur throughout the areas occupied by the association.

Area I. In the north-west the conspicuous Renfrew Plateau, ranging from 500 feet at the Rowanside Hills in the south to 1364 feet at Greenside Hill in

the north, is deeply dissected. There are numerous rock outcrops and crag and tail phenomena.

Area II. On the ice-scoured plateau extending from the vicinity of the Garnock Water north of Beith to Eaglesham the topography is the same as that of the north-western plateau but on a lesser scale. The frequency of dissection is greater but the intensity is less than on the Renfrew Plateau. This plateau has a maximum elevation of 852 feet at Neilston Pad in the west and rises to over 800 feet south-west of Eaglesham. East of the Lugton Water in the neighbourhood of Dunlop the underlying rock, as in the north, greatly influences the relief and a sharply rolling topography results which gradually becomes undulating as the high level deep till plateau of Mathernock Moor is approached. Over this southern part the altitude increases gradually from 350 feet to 1000 feet.

Area III. South of the River Irvine the association occurs on hill tops and knolls and has a rugged hilly topography at Dundonald and Craigie. The heights at which it is located here are very variable: from 342 feet at Dundonald to 978 feet at Changue Hill south of Darvel.

Climate

The highest rainfall (approximately 70 inches) is in the extreme north-west and the range from Ardrossan to Mistylaw Hill is 38-66 inches+. Over the Beith-Darvel plateaux the rainfall varies between 48 and 55 inches and from Dundonald to the Mean Muir district there is a gradual increase from 36-50 inches+.

Unfortunately there are few temperature data available for the region but the variation of temperature with altitude has been estimated as no more than 3°F. (Lebon, 1937); furthermore, seasonal variations in mean temperature are not great. The effects of altitude on temperature, as already stated, are greatly modified by cloud cover and the influence of the sea.

Soils

The Darleith association was originally limited to the loam textured soils with free and imperfect drainage developed on a shallow stony till derived from intermediate and basic lavas of Calciferous Sandstone age. Poorly and very poorly drained soils developed on the deep medium clay till derived from similar rock types were grouped in the Amlaird association. It was later appreciated that tills with a wide textural range can be formed from all the parent rocks encountered. In addition, the loamy textured till is usually found on the hill tops and steeper slopes whilst a clay textured till is located in the valleys and on the smoother slopes. As the tills are contiguous the soil series of the Darleith and Amlaird associations were therefore grouped into one large cartographic unit, the Darleith association. Fig. 14 illustrates this relationship.

Seven series have been grouped into this association, the wide textural range of the parent material, from loam to medium clay, and the extremes of slope and climate producing marked differences in profile morphology. Variation in the drainage class is closely allied to differences in relative relief and in the texture of the parent material. On the North Ayrshire till plain where the topography is mainly undulating and the parent material is invariably clay textured, variations in internal soil-water relations with slope seldom involve more than two contiguous drainage classes. However, on the

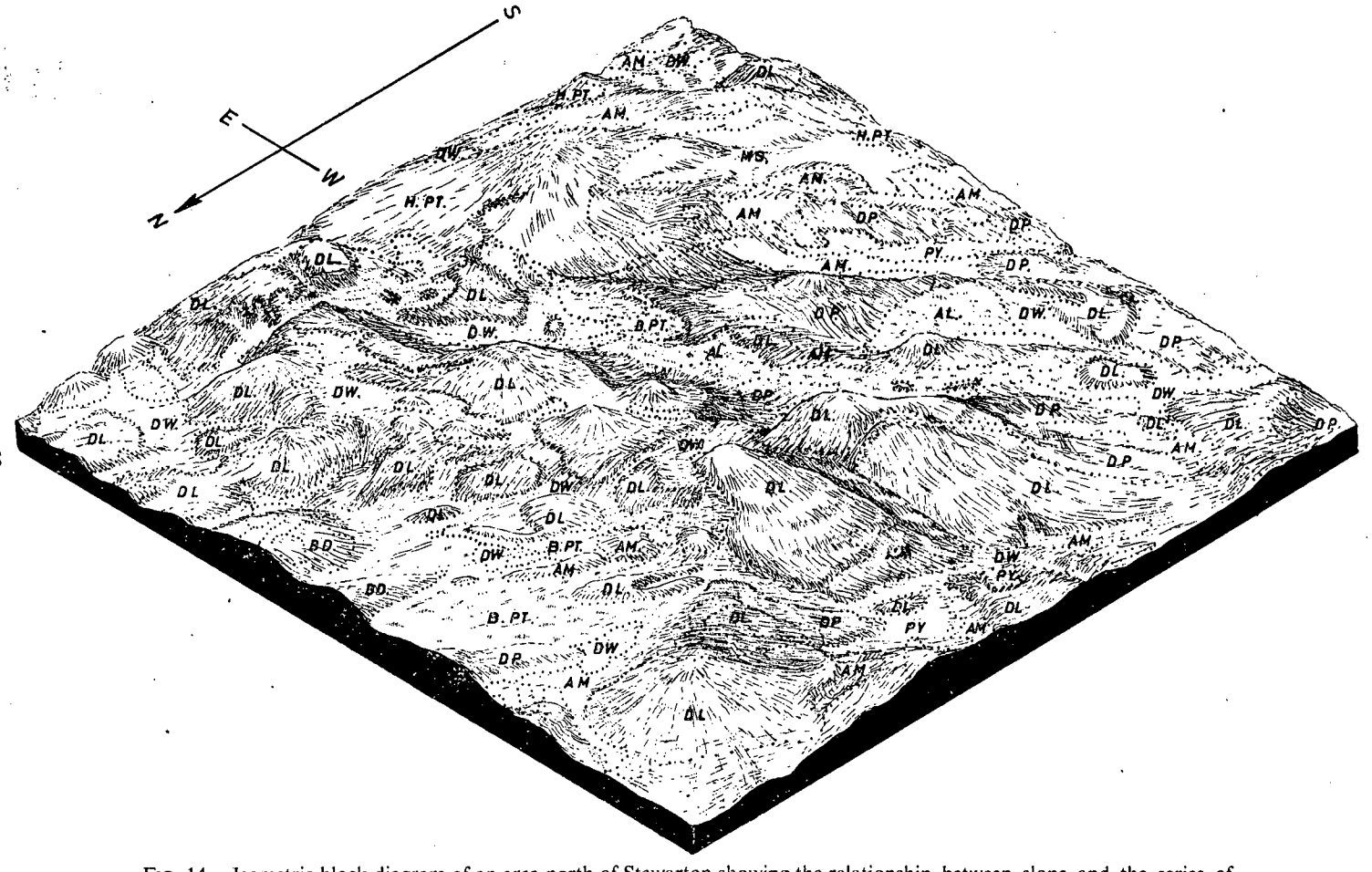


FIG. 14. Isometric block diagram of an area north of Stewarton showing the relationship between slope and the series of the Darleith association. Scales: horizontal 1:25,000 vertical 3·412 × horizontal.

Renfrew Plateau and the rugged volcanic uplands between Neilston and Eaglesham frequent and wide differences in relative relief result in a complex soil drainage pattern containing only the extremes of the drainage continuum.

Series

DARLEITH SERIES

The Darleith series is the most extensive of the association; it is located on the hill tops and steeper slopes, particularly on the lower hills of the Renfrew Plateau and throughout the Neilston-Eaglesham Platform. With the corresponding organo-mineral series, Baidland, it occupies roughly the areas depicted as free from boulder clay on the Drift Edition of Sheet 22. It is developed on a shallow, loam to clay loam till which is sometimes stony and it is invariably freely drained.

GENERALISED PROFILE DESCRIPTION

SLOPE	steep
ASPECT	north-west
ALTITUDE	550 feet
VEGETATION	*Agrostis tenuis, Festuca ovina, Anthoxanthum odoratum, Trifolium repens, Galium hercynicum.*
DRAINAGE CLASS	free

Horizon	*Depth or Thickness*	
S	0-7″	Brown (10YR5/3) loam, medium crumb, friable, organic matter moderate, few stones, roots plentiful, no mottling. Sharp change into
B_2	7-12″	Brown (7·5YR5/4) gritty loam, very fine to fine sub-angular blocky, loose, organic matter low, few stones, roots moderate, few fine faint mottles; merging into
B_3C	12-24″	Reddish brown (5YR5/4) loam, fine medium sub-angular blocky, firm, weakly indurated, stony, few fine faint mottles.
D_r	24″+	Rock : micro-porphyritic basalt.

The soils are shallow, being rarely more than 3 feet deep. They are often very stony, especially in the very shallow profiles, and rock outcrops are frequent. A striking feature is the well-developed crumb structure of the surface horizon which is probably related to the high content of ferruginous material in the till. Apart from structure and stone content there is little horizon differentiation. The colour and texture are fairly constant. Generally but not always there is weak induration at about 18 inches. Although the series is freely drained yellow mottles are occasionally noted in the B horizon but they are few and faint.

The series has been classified as a brown forest soil of low base status. At Littlehill, where it covers a very small area, the parent material is largely derived from an agglomerate rich in iron oxide which imparts a distinctive brown-red colour to the whole profile. The soil here is considered to be a *Ferritic Braunerde* (Kubiëna, 1953).

NOTE ON AGRICULTURE. The soils of the Darleith series are comparable to the light loam soils of the volcanic uplands described in the Geological Survey Memoir for Sheet 22. Although the series is generally shallow and often stony, a large proportion of it is in cultivation. Regarded as "hungry-land", it responds well to nitrogenous, phosphatic and potassic manures (Berry *et al*, 1930). Dairy farming is the main activity except in the north-west where sheep farming is general. As on most of the high ground in Ayrshire

where dairying is practised, many of the farms on the Darleith soil suffer from an inadequate water supply.

DUNLOP SERIES

The Dunlop series is developed on clay loam to clay till and is intermediate between the loamy textured Darleith series and the Amlaird series which is developed on a medium clay till, It occurs on the moderately sloping lower ground of the volcanic uplands and on the rolling land of the till plain, where the rainfall is between 40-50 inches. In the former areas the parent material is seldom finer textured than clay loam whereas on the till plain it is clay textured (45-50% clay), particularly on the crests; the drainage class is imperfect.

GENERALISED PROFILE DESCRIPTION

SLOPE moderate
ASPECT south-west
ALTITUDE 500 feet
VEGETATION *Poa trivialis, Lolium perenne, Cynosurus cristatus, Bellis perennis, Ranunculus repens, Ranunculus acris, Trifolium repens.*
DRAINAGE CLASS imperfect

Horizon	*Depth or Thickness*	
S	0-9″	Brown to dark brown (7·5YR4/2) loam, medium crumb, friable, organic matter moderate, few small stones, roots numerous, no mottling. Sharp change into
B_2(g)	9-17″	Brown to dark brown (7·5YR4/4) clay loam, fine sub-angular blocky, friable, organic matter low, few small stones, roots few—sometimes with iron staining along channels, frequent medium distinct ochreous mottles, faces of peds slightly grey. Sharp change into
B_3(g)	17-24″	Brown (7·5YR5/4) clay loam, medium prismatic, firm, a few weathering basaltic and trachytic stones, roots few, frequent fine to medium distinct ochreous mottles, faces of peds slightly grey coloured; merging into
C(g)	24-36″	Brown (7·5YR5/4) clay loam, coarse platy, firm, few small stones as above, few fine faint ochreous mottles, faces of peds slightly greyish in colour.

The surface horizon is seldom more than 9 inches except in the district to the north and east of Stewarton where patches of medium clay till occur. On this land in the past ridges and water furrows were commonly set out in order to improve drainage, and on the crests of the ridges the S horizon may be 18 inches in depth.

The B_2(g) horizon has a sub-angular blocky structure and normally the clay content is rather higher than in the horizon immediately below. Fairly distinct mottling is another feature of the B_2(g). The B_3(g) has a prismatic structure and there may be weak induration. Ochreous and grey mottles are always less than in the B_2(g). A platy structure is frequently associated with the C(g) horizon and gleying is very much reduced.

As the gley mottles decrease with depth, the internal soil-water relations of this series are those of a surface-water soil. It is classed as a brown forest soil of low base status with gleyed B and C horizons and is considered equivalent to the American grey-brown podzolic soil.

NOTE ON AGRICULTURE. This series probably provides the best agricultural land of the association. Dairy farming is the mainstay and rotations are

similar to those on the bulk of the Cunningham Plain with the accent on long leys. Drainage, though still a major consideration, is not such an acute problem as in other parts of North Ayrshire.

AMLAIRD SERIES

Although never extensive, the Amlaird series is widely distributed throughout the northern parts of the sheet area, being associated generally with the more gentle slopes and valley bottoms of the volcanic uplands. Clay textured sub-surface horizons are a notable feature of this soil and combined with the gently sloping topography and high rainfall result in poorly drained "*Juncus* meadow".

GENERALISED PROFILE DESCRIPTION

SLOPE very gentle
ASPECT south
ALTITUDE 600 feet
VEGETATION *Juncus effusus, Agrostis tenuis, Anthoxanthum odoratum, Ranunculus repens, Bellis perennis, Deschampsia caespitosa, Holcus lanatus.*
DRAINAGE CLASS poor

Horizon	*Depth or Thickness*	
S	0-10″	Very dark grey (10YR3/1) loam to clay loam, weak crumb, friable, organic matter moderate, roots numerous with many fine faint rusty mottles along the channels, very few small stones, generally dull appearance. Sharp change into
B_2g	10-15″	Brown (7·5YR5/4) clay, medium to coarse prismatic, sticky —plastic, organic matter low, roots plentiful, several highly weathered igneous stones, many fine to medium prominent mottles of yellow and grey, surface of peds grey, iron tubes along root channels; merging into
B_3g	15-25″	Brown (7·5YR5/4) clay, medium to coarse prismatic, plastic, few roots with well-formed iron tubes, many coarse prominent mottles of yellow and grey—the latter particularly intense around stones; merging into
Cg	25-36″+	Dark reddish (5YR4/2) clay, medium to coarse prismatic—fading with depth, slightly plastic, ochre and grey mottles as above but decreasing with depth.

The texture of the surface horizon varies between loam to clay loam, approximating to the moderately heavy loam to clay loam soils of the Soil Texture Map, Fig. 13. A pavement of angular stones sometimes lies between the surface and Bg horizons. The B_2g of this series shows the preponderance of yellow mottles over grey which appears to be characteristic of the B horizon of poorly drained soils developed on igneous parent materials. It is further characterised by a medium to coarse prismatic structure and a sticky plastic consistence. A similar structure occurs in the B_3g horizon but it is only slightly plastic and less sticky. The structure in the Cg, especially in the wet condition, tends to become massive.

The decrease in both yellow and grey mottling with depth and the consequent manifestation of the parent material colour is the criterion in placing this soil in the surface-water category. Genetically this soil is classed as a non-calcareous surface-water gley.

NOTE ON AGRICULTURE. Correlated with the finer texture of this series, there is a noticeable decrease in the area given over to cropping and a corresponding increase in pasture and hay. Some farms are devoted entirely to

grazing. The high rainfall together with the gently sloping ground and the relatively impervious nature of the subsoil make drainage an acute problem. In a wet season this series tends to poach very badly.

POKELLY SERIES

A minor component of the association, the Pokelly series is restricted to the depressions of the rolling Lowland Transition Zone in the Dunlop-Fenwick district. The clay texture of the parent material and the practically level slopes on which this is located are the significant factors in the development of this soil. Frequently the upper horizons of the profile consist of alluvial material but this does not justify placing the series in the alluvium category. The drainage class is very poor.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	550 feet
VEGETATION	*Juncus effusus, Carex nigra, Carex panicea, Anthoxanthum odoratum, Ranunculus repens.*
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-8″	Very dark grey (7·5YR3/1) silty clay loam, medium to coarse granular, friable, organic matter moderate, roots numerous, stones few, frequent fine distinct rusty mottles along root channels. Sharp change into
Ag	8-13″	Dark brown (7·5YR3/2) clay loam, sub-angular blocky, slightly plastic, organic matter moderate, roots frequent, stones few, many fine faint yellow and orange mottles, distinct grey gleying. Sharp change into
Bg	13-24″	Grey (7·5YR5/1) clay, prismatic—but not very distinct in wet condition, sticky—very plastic, roots few, stones very few, well-defined iron tubes along root channels, many medium prominent yellow-brown mottles, grey gleying intense; merging into
Cg	24-36″	Brown (7·5YR4/4) clay, massive, plastic, iron tubes around the few roots present, stones few, ochre and grey mottles decreasing rapidly.

The moderate organic matter content of the surface horizon is an important feature of the profile, serving to differentiate it from the peaty gley. An indistinct prismatic structure, a sticky plastic consistence, and intense gleying, especially with grey colours, are characteristics of the Bg horizon. In the Cg horizon the structure tends to be massive and the consistence plastic, but the outstanding feature is the rapid decrease in both grey and ochreous mottling and the resultant expression of the parent material colour. It is this latter condition which typifies the soil as a surface-water gley.

Low-humic gley, an American soil group, has been suggested as applicable to this series (G. D. Smith. Private communication).

NOTE ON AGRICULTURE. The series is of little agricultural importance. Most of it can be termed "*Juncus* meadow," clay texture and wetness being major obstacles to cultivation. In addition, as the very poor drainage is caused by the clayey subsoil and level topography, attempts at adequate artificial drainage involve many difficulties.

BAIDLAND SERIES

The Baidland series is developed on a shallow loamy till under topographic conditions comparable to those of the Darleith series but it occurs at higher altitudes where increased rainfall and lower temperatures promote the accumulation of humus. Two large tracts are to be found on the Renfrew Plateau north and south of Camphill Reservoir, and lesser areas are located on the Ballagioch Plateau and on the Ellrig Hills.

A thin iron pan is commonly present in the profile and may noticeably restrict the vertical movement of water. Characteristics of imperfect to poor drainage are frequently observed above the pan, whereas below it drainage is usually free.

GENERALISED PROFILE DESCRIPTION

SLOPE	gentle
ASPECT	south-west
ALTITUDE	750 feet
VEGETATION	*Calluna vulgaris, Erica tetralix, Nardus stricta, Deschampsia flexuosa, Hypnum cupressiforme**
DRAINAGE CLASS	free below the iron pan

Horizon	*Depth or Thickness*	
L	½″	Litter
F	½″	Partially decomposed litter
H	6″	Dark brown (7·5YR3/2) greasy humus
A_2	0-3″	Very dark brown (10YR2/2) sandy loam, fine sub-angular blocky, friable, organic matter high, roots abundant, bleaching slight. Sharp change into
B_1	at 3″	Thin iron pan
B_2	3-8″	Brown to dark brown (7·5YR4/4) loam, weak medium sub-angular blocky, friable, organic matter low, roots occasional few well-rounded stones, very few fine faint mottles; merging into
B_3	8-15″	Brown (7·5YR5/4) gritty loam, medium blocky, moderately indurated, roots rare, stony. Sharp change into
C	15-21″	Brown (7·5YR5/4) gritty loam, coarse platy, indurated, roots, stony. Sharp change into
D_r	21″	Shattered rock; trachyte.

The A_2 horizon is seldom less than 6 inches thick. Differentiation between the A_1 and A_2 horizons is usually difficult as bleaching of the latter is nearly always indefinite. The A_2 is frequently more easily discernible in an exposure which has been allowed to dry out, as it then acquires a slightly greyish appearance. The B_1 is sometimes not well defined and may even be absent. Depending on the permeability of the iron pan the lower part of the A_2 may occasionally be wet and show yellow and grey mottling, in which case the horizon is designated $A_2(g)$. A brighter brown colour (but not orange-brown) and a weak sub-angular blocky structure are always associated with the loamy B_2 horizon. There is a great reduction in the number of roots as they are unable to penetrate the B_1. Very slight mottling may be noted: insufficient to classify the soil as imperfectly drained. Moderate induration and a gritty loam texture are important features of the B_3 horizon; the structure is medium blocky and it is often stony. A shallow C horizon, gritty loam in texture, with a coarse platy structure and less indurated than the B_3 merges into rock (in this profile, trachyte).

*The Baidland series also carries a grass vegetation, e.g. *Nardus stricta, Anthoxanthum odoratum, Deschampsia flexuosa, Festuca ovina, Potentilla erecta, Rhytidiadelphus squarrosus.*

The series has been classified as a peaty podzol with iron pan, the basic to intermediate nature of the parent material being responsible for the poor development of the A_2 and B_2 podzolic features.

NOTE ON AGRICULTURE. Cultivation in this series is negligible; numerous rock outcrops, the often precipitous nature of the ground, high rainfall, and exposure greatly reduce the agricultural value. Sheep farming is the most important agricultural activity.

MYRES SERIES

The Myres series is developed on a medium clay till on the crests and slopes of an undulating topography and under conditions of high rainfall, a combination of factors conducive to poor drainage and humus formation. It forms an almost continuous fringe to the peat of the Cunningham Upland, whilst in the northern part of the Renfrew Plateau it is limited to the higher lying areas of deep till.

GENERALISED PROFILE DESCRIPTION

SLOPE: moderate
ASPECT: north-west
ALTITUDE: 1,100 feet
VEGETATION: *Eriophorum vaginatum, Molinia caerulea, Juncus effusus, Nardus stricta, Juncus squarrosus, Polytrichum commune, Sphagnum* spp.
DRAINAGE CLASS: poor

Horizon	*Depth or Thickness*	
L	1″	Litter
F	1½″	Partially decomposed litter.
H	7″	Black (7·5YR2/1) humus, greasy, roots abundant.
A_2g	0-2″	Dark grey-brown (10YR4/2) sandy clay loam, moderate sub-angular blocky, slightly plastic, organic matter low—confined to several stains, roots frequent, a few small highly weathered stones, many fine distinct yellow-orange mottles—often associated with roots, markedly grey gleyed throughout. Sharp change into
B_2g	2-10″	Brown (7·5YR5/2) clay, medium to coarse prismatic, sticky—plastic, organic matter low, roots occasional, several small igneous stones, many coarse prominent yellow-orange mottles, marked grey gleying on faces of peds and around stones; merging into
B_3g	10-17″	Brown (7·5YR5/2) clay, medium to coarse prismatic, plastic, roots occasional, several small stones—many green, many coarse prominent mottles, well-defined iron tubes along root channels, grey gleying on faces of peds less than in B_2. Sharp change into
B_3g	17-22″	Dark brown (7·5YR4/4) gritty clay, prismatic fading to massive, plastic, roots rare, several small green stones, few distinct yellow mottles, grey gleying persisting on faces of peds and around stones; merging into
Cg	22-30″+	Dark brown (7·5YR4/4) gritty clay, massive, firm, roots rare, several small green stones, faces of peds distinctly grey but gleying characteristics decreasing with depth.

Several inches of black organic matter with plant remains still visible form the normal surface soil of this series. A typical A_2g horizon has a sandy clay loam to clay loam texture, a moderate sub-angular blocky structure, a plastic consistence, and intense grey gleying. The B_2g is usually a wet clay with an ill-defined medium to coarse prismatic structure; it is sticky and plastic with both ochreous and grey mottling greatly in evidence. Normally the B_3g is

less sticky and plastic with a prismatic structure which fades to massive. Well-formed iron tubes surround the roots. The Cg consists of a gritty clay with massive structure; iron tubes persist around the few roots but mottling tends to decrease, the parent material colour becoming apparent. It is assumed that the green colour of the stones, occurring particularly in the B_3g and Cg horizons, is due to ferrous iron complexes which are indicative of the anaerobic conditions.

The series belongs to the surface-water group, and the presence of plant remains in the organic topsoil further characterises it as a peaty gley.

NOTE ON AGRICULTURE. Sheep farming is the mainstay supplemented on some farms by the summer grazing of cattle. The greater part of the series supports a wet moorland type of vegetation: high rainfall, clayey subsoils and poor drainage being deterrents to cultivation. Small areas of moorland ground have been cultivated in the past but these are now in permanent pasture. Systems of open ditches, some of very recent construction, are further evidence of attempts to improve the grazing.

DUNWAN SERIES

Widely distributed, but nearly always the minor component of any drainage sequence, this series is located in depressions and water courses throughout the volcanic uplands. It is developed on a clay till under high rainfall and it is sometimes water-sorted. The soil is distinguished by the high organic matter content of the surface horizon and very poor drainage.

GENERALISED PROFILE DESCRIPTION

SLOPE: very gentle
ASPECT: south
ALTITUDE: 750 feet
VEGETATION: *Juncus effusus, Deschampsia caespitosa, Carex nigra, Anthoxanthum odoratum, Galium hercynicum, Agrostis tenuis, Polytrichum commune.*
DRAINAGE CLASS: very poor

Horizon	*Depth or Thickness*	
S	0-11″	Dark brown (7·5YR3/2) humified loam, roots abundant, stones very few or absent, frequent fine distinct rusty mottling along root channels. Sharp change into
Ag	11-16″	Brown to dark brown (7·5YR4/2) silty loam, no distinct structure—difficult to determine under very wet conditions, sticky—slightly plastic, organic matter high, roots abundant, very few stones, few fine faint ochreous mottles, markedly gleyed throughout. Sharp change into
Bg	16-25″	Dark yellowish brown (10YR4/4) clay, massive, sticky—plastic, organic matter low, roots occasional, few stones—sometimes highly weathered and often green coloured, many coarse prominent mottles of ochre and grey, faces of large cleavages intensely grey, well-formed iron tubes along root channels; merging into
Cg	25-35″	Grey-brown (2·5YR5/2) loam, massive, slightly plastic, roots rare, few stones—as above, intense grey gleying throughout, ochre colours confined to iron tubes in root channels.

Generally there is no A_0 horizon, and plant remains are seldom visible to the naked eye. The surface horizon consists usually of an intimate mixture of organic and mineral matter, frequently greasy to the touch. The upper horizons are often affected by alluvial material which imparts to the Ag

horizon a recognisable silt content. As this horizon is always wet and has a sticky plastic consistence the structure is difficult to determine. It has a high organic matter content and yellow mottles are few and faint, though grey colours are prominent. The Bg is a sticky plastic clay usually with a massive structure, coarse prominent yellow-orange and grey mottles, and large grey-sided cleavages. Well-defined iron tubes are also a feature of this horizon. In the Cg horizon the structure continues massive and iron tubes persist around root channels, but ochreous mottling is replaced by grey. As in the Myres series small green coloured stones occur throughout the lower horizons.

The soil is considered a humic gley, a category embracing Half Bog and Wiesenboden soils (Thorp and Smith, 1949). In addition the Cg horizon has the appearance of being permanently waterlogged—an essential characteristic of a ground-water soil.

NOTE ON AGRICULTURE. The series, which is confined to river channels and waterlogged depressions, is of little agricultural importance. It is rarely cultivated, usually supporting a herbaceous marsh type of vegetation.

DARVEL ASSOCIATION

Soils of the Darvel association are formed on the widely scattered but rarely extensive deposits of glacial-lake and fluvio-glacial sand and gravel in Sheet 22. They are amongst the sandiest soils of North Ayrshire and are of considerable agricultural importance in the coastal belt, where the rainfall is less than 40 inches and the topography is undulating.

DISTRIBUTION

All glacial-lake and fluvio-glacial sand and gravel spreads are occupied by the Darvel association to the exclusion of other soils. There are four main locations with a total area of 11·6 square miles, the largest occurring on the complex system of glacial-lake deposits in the upper Irvine Valley and its tributary valley, Darvel Glen. Next in extent is the four mile belt of fluvio-glacial sand and gravel between Kilwinning and Dreghorn, whilst the remaining two sections are composed of the remnants of glacial-lake terraces south of Eaglesham in the Ardoch Valley and north-east of Stewarton in the upper Annick Valley. One or two patches of fluvio-glacial material on the Lanfine Plateau, on the south side of the Irvine Valley near Greenholm, and beside the Earn Water in Renfrewshire, complete the pattern of the association.

PARENT MATERIAL

The parent material consists of glacial-lake and fluvio-glacial inter-bedded sands and gravels, ranging in texture from sandy loam to coarse gravel with a loose sand matrix. Everywhere the character of the parent material is a reflection of the local rocks and tills, the contribution by extraneous material being usually low. Examination of the pebbles in the deposits at Eaglesham and Darvel showed them to be derived from the assortment of igneous rocks in the district. These deposits are very deep in parts, as can be judged from the exposures at the Loudoun Hill sand quarry and the Netherton sand pit south of Eaglesham; the shallower deposits are underlain by the till of the surrounding Darleith association which also underlies the narrow glacial-lake terrace in the Annick Valley north-east of Stewarton. Between Kilwinning and

Dreghorn the fluvio-glacial deposits are bounded to the east by the Kilmarnock association; this association is developed on a mixed till derived from igneous and sedimentary rocks; the mixed origin continues in the sands and gravels.

Topography

The glacial-lake deposits present level or undulating surfaces often dissected by gullies and frequently terminating in steep slopes which mark the position of former ice blockages; the fluvio-glacial sediments on the other hand, tend to occur in irregular moundy formations.

Climate

The association is found in several rainfall zones, the average annual figures being as follows:—

1. Kilwinning—Dreghorn, 35-40 inches.
2. Upper Irvine Valley, 40-45 inches.
3. Darvel Glen and Ardoch Burn, 45-50 inches.
4. The Earn Water and upper Annick Valley deposits both receive approximately 50 inches.

Soils

Four soil series are represented in this association. As a result of the undulating or irregular moundy topography and the sandy texture and loose consistence of the parent material the majority of the soils are freely drained, viz. the Darvel and Tulloch series. Occasionally, in the Eglinton and Glen Water districts, the sand and gravel deposits are shallow, overlying a loamy textured, impervious till which has an adverse effect on the internal drainage of the soil profile. In general, however, the series with poor and very poor drainage, the Ardoch and the Hapton, constitute the minor components of any hydrologic sequence, and indeed the Hapton occurs only in the higher rainfall regions, namely the upper Irvine and Annick Valleys. In these valleys, too, peaty surface horizons are common to the soils on the freely drained sites. These soils, which constitute the Tulloch series, are strongly podzolised and usually exhibit a well-developed iron pan. Remnants of the podzolic profile, the bright brown B_2 and indurated B_3 horizons, are frequently encountered in the freely drained mineral soils around Eglinton; the upper horizons have lost their identity in the plough layer.

Series

DARVEL SERIES

The Darvel is the largest series and is without exception the dominant one in the various and widespread sites of the association. It is developed under a rainfall of 35-40 inches on a brown to dark brown gravelly sand to loamy sand on either gently or moderately sloping ground. On the Annick and Glen Water terraces the deposit tends to be shallow and as the underlying water-modified till is frequently exposed towards the base of the solum the textures throughout the profile are less coarse than those of the modal soil. The drainage class is free.

GENERALISED PROFILE DESCRIPTION

SLOPE	gentle
ASPECT	south
ALTITUDE	700 feet
VEGETATION	*Poa trivialis, Ranunculus repens, Festuca rubra, Dactylis glomerata, Trifolium repens, Phleum pratense.*
DRAINAGE CLASS	free

Horizon	*Depth or Thickness*	
S	0-11″	Brown (7·5YR5/4) sandy loam, fine crumb, friable, organic matter moderate, few pebbles, roots abundant, no mottling; merging into
B_2	11-26″	Brown (7·5YR5/4) sandy loam, medium crumb, friable, organic matter low, stony, roots frequent, no mottles; merging into
B_3	26-34″	Brown to dark brown (7·5YR4/4) loamy sand, weak sub-angular blocky, slightly indurated, stony—large and small pebbles, roots occasional, sand grains slightly coated with iron oxides. Sharp change into
C	34″ +	Brown to dark brown (7·5YR4/4) gravelly sand, single grain, occasional bands of iron and manganese oxides.

The surface horizon is normally less than twelve inches deep but on occasions a moderate organic matter content has been noted to a depth of two feet, due no doubt to long cultivation. A high gravel content in the plough layer, though not normal, has been recorded. The texture is always sandy loam. A similar texture is associated with the B_2 horizon which has a medium crumb structure, a friable consistence and is usually stony. The B_3 is a loamy sand and usually shows signs of induration. Mottling is not evident in either of the B horizons, but the sand grains in the B_3 are often coated with iron oxides. A gravelly sand to loamy sand with little cohesion is characteristic of the C horizon. Bands of iron and manganese oxides are also a feature of the parent material. In the areas where the sand and gravel spreads are shallow a water-modified boulder clay sometimes constitutes a D horizon.

The series has been classed with the brown forest soils of low base status though in the virgin state it was in all probability a podzol.

NOTE ON AGRICULTURE. In agricultural value parts of the Darvel series rank amongst the highest in North Ayrshire. Farming practice is determined to a large extent by distance from the sea. Thus, around Eglinton, though dairy herds are kept, most of the farms grow early potatoes and a five or six year rotation is practised, e.g. potatoes, oats, potatoes, wheat or oats and rye grass. Further inland dairying is the mainstay and along the Irvine Valley, in the Darvel district, the land yields excellent crops of rye grass hay, roots and clover (Berry *et al*, 1930). The hilly ground to the south of Darvel and around the upper reaches of Glen Water is devoted to sheep grazing.

ARDOCH SERIES

Like the Darvel series, the Ardoch occurs in all the association locations, but it is a minor component, being restricted to drainage channels and a few depressions some of which are subsidences due to coal mining. The series is developed on a yellowish brown gravelly sandy loam and is poorly drained.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	50 feet
VEGETATION	*Juncus effusus, Agrostis tenuis, Holcus lanatus, Poa pratensis, Anthoxanthum odoratum.*
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
S	0-5″	Very dark grey-brown (10YR3/2) sandy loam, medium crumb, friable, organic matter moderate, few stones, roots abundant, fine rusty mottles along root channels. Sharp change into
Ag	5-12″	Very dark grey-brown (10YR3/2) gravelly sandy loam, structureless, organic matter moderate, stones few—mainly basalts, roots frequent with many mottles along the channels; merging into
Bg	12-18″	Brown to dark brown (7·5YR4/4) gravelly sandy loam, structureless, non-plastic, organic matter low, stones as in Ag, roots occasional, frequent medium distinct ochreous and grey mottles; merging into
Cg	18-28″	Yellowish brown (10YR5/4) gravelly sandy loam, structureless, non-plastic, roots rare, many medium distinct ochreous and grey mottles. Sharp change into
Dg	28-40″	Dark yellowish brown (10YR4/4) sandy clay loam, massive, slightly plastic, roots absent, few stones—sandstones and shale, few medium distinct grey mottles.

The usual features of the surface soil are sandy loam texture, friable consistence and few stones. Rusty mottles are always apparent along the root channels. The S horizon is often underlain by a gravelly sandy loam Ag horizon which is wet and shows rusty mottlings along the roots. The Bg horizon too is a wet gravelly sandy loam; it is structureless and both ochreous and grey mottles are distinct. A similar texture and structure are associated with the Cg but there is a decrease in ochreous mottles and an increase in grey mottles. In the profile described, a water-modified till derived from Productive Coal Measures forms the D horizon.

The series has been grouped with ground-water non-calcareous gleys.

NOTE ON AGRICULTURE. The series usually supports a *Juncus*-infested pasture, the poor drainage rendering it of little agricultural value.

TULLOCH SERIES

The Tulloch series is very small and is the only member of the association to support a semi-natural vegetation. The sites, which are freely drained, fringe the moorlands at Glenouther Moor, Overmuir (north of Darvel) and King's Moss. A loamy sand texture is one of the more important properties of the parent material.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate
ASPECT	south-east
ALTITUDE	800 feet
VEGETATION	*Calluna vulgaris, Erica tetralix, Nardus stricta, Deschampsia caespitosa.*
DRAINAGE CLASS	free below the iron pan

Horizon	*Depth or Thickness*	
L	½″	Litter.
F	½″	Partially decomposed litter.
H	4″	Very dark brown (10YR2/2) peaty organic matter.
A_1	0-2″	Very dark brown (10YR2/2) sandy loam, fine crumb, loose

Horizon	*Depth or Thickness*	
		to friable, organic matter high, roots abundant, few stones. Sharp change into
A_2	2-5″	Dark brown (10YR4/3) sandy loam, structureless, loose, organic matter high, few stones, roots frequent, few fine distinct rusty mottles along root channels.
B_1	at 5″	Thin iron pan.
B_2	5-14″	Brown (7·5YR5/4) loamy sand, structureless, loose, organic matter low, many pebbles, pockets of coarse sand, roots rare, no mottling; merging into
B_3	14-23″	Light reddish brown (5YR6/3) sandy loam, structureless, indurated, roots rare, many large and small pebbles, no mottling. Sharp change into
C	23-30″	Brown (7·5YR5/4) loamy sand, single grain, many pebbles, roots rare, no mottling.

A_0 horizons up to twelve inches thick are fairly normal. A thin A_1 horizon with a sandy loam texture is a common feature and the structure is usually recognisable as fine crumb with little cohesion. The A_2 is distinct and textures to a sandy loam, has a loose consistence and rusty mottling occurs around the roots. Beneath this is a thin continuous iron pan followed by a B_2 horizon of loamy sand texture, normally structureless and loose; ochreous mottling is rare. The B_3 is characterised by moderate induration and shows no recognisable structure and no secondary chemical weathering; it ranges in texture between loamy sand and sandy loam. The change from the B_3 to the C is accompanied by a rapid decrease in induration, but apart from this the features of the B_3 and C horizons are comparable.

The marked podzolic features of this soil are allied to the acidic nature and sandy texture of the parent material. It is classified as a peaty podzol with iron pan.

NOTE ON AGRICULTURE. Occupying, in the main, districts where sheep farming is extensively practised this series is utilised for rough grazing.

HAPTON SERIES

This series occupies sites similar to those of the Ardoch series but at higher altitudes, for example, Logan Burn and Overmuir in the upper Irvine Valley, where increased rainfall (50 inches) and lower temperatures are responsible for the high organic content of the surface layers. The locations usually have either a level or depressed relief with the water-table seldom far from the surface and consequently the drainage class is very poor.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	650 feet
VEGETATION	marsh
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-9″	Very dark brown (10YR2/2) humified sandy loam, weak sub-angular blocky, roots abundant. Sharp change into
Bg	9-20″	Grey (10YR5/1) sandy loam, structureless, non-plastic, organic matter low, roots frequent, stony, few fine distinct ochreous mottles, many coarse prominent grey mottles; merging into
Cg	20″+	Brown to dark brown (7·5YR4/4) sandy loam, structureless, non-plastic, many stones, roots rare, frequent distinct ochreous and grey mottles—the former following root channels.

The surface soil is characterised by a very dark brown colour due to the high percentage of organic matter. In contrast is the underlying Bg with its low organic matter content and preponderance of grey colours. It has a sandy loam texture, is structureless and non-plastic. Ochreous mottling is less intense below 20 inches, but there is no change in the intensity of grey colours or in texture, structure and consistence.

The series has been classed as a ground-water humic gley.

NOTE ON AGRICULTURE. Very poor drainage and the frequent inaccessibility of the sites make the series valueless for agricultural purposes. It carries a marsh type of vegetation.

DREGHORN ASSOCIATION

One of the larger associations of North Ayrshire is the Dreghorn which extends to 23·4 square miles. It is developed on the raised beach sand and gravel forming a continuous fringe to the Clyde coast. The soils are coarse textured and dominantly freely drained and consequently their cultivation is straightforward and not prolonged, unlike that of the majority of the soils of the region. What is regarded as the best early potato land of Ayrshire is largely made up of these soils.

DISTRIBUTION

This association is limited to the raised beach deposits adjoining the coast between Largs and Troon. These deposits reach a maximum height of 110 feet and a raised coastline traceable at this level north of Saltcoats is shown in the Drift Edition of Sheet 22. Between Kilwinning and Dundonald the beach, which elsewhere is ¾ mile wide, spreads from 2½ to 3 miles inland. From Kilwinning to the River Irvine the eastern boundary of this expanse is determined by the moundy glacial sands and gravels of the Darvel association, while southwards to Dundonald the boundary is most irregular, with the beach making numerous deep inroads into the till plain. The only other large area is near West Kilbride, where beach material forms a unit 2½ square miles in extent. Isolated portions occur in the Irvine Valley as far east as Kilmarnock.

PARENT MATERIAL

Raised beach deposits consisting of sand, gravel and brick clay form the parent material. The brick clay deposit is generally located in hollows in the till and is nearly always either partly or completely covered with sand and gravel. The area covered by soils developed on this material is negligible and they have not been mapped. Sand and gravel are the principal components of the soil parent material. Numerous exposures on the rivers Irvine and Annick and in sand pits, etc. show bedded layers of sand and gravel similar to those forming the present beach, extending downwards for many feet. This deposit, however, is not uniformly deep for the underlying till may be encountered within the depth of an ordinary profile inspection pit, especially in the hollows. Marine shells have been found in the sands or in the associated clays in a few localities south of Kilwinning. These shells have been recognised as partly arctic in character (Robertson, 1877). Although the coastal raised beach deposits have a maximum height of 110 feet, most of them are below the

40 feet level, and this 40 foot beach of North Ayrshire may belong to the Early Neolithic submersion.

Topography

The surface throughout is either level or faintly undulating but the association area is probably best described by the term, depressed micro-relief.

Climate

There is an increase in rainfall northwards along the coast from a little below 35 inches at Troon to nearly 45 inches at Largs. The lower Irvine Valley receives 35-40 inches. Despite proximity to the sea, late spring frosts occur in most of this low-lying area, with the exception of the strip north of Ardrossan. The rarity of late frosts in the Ardrossan-West Kilbride strip is of considerable importance as it enables the first early potato varieties to be grown.

Soils

The association is composed of three series of which the freely drained Dreghorn is the most extensive and the most important agriculturally. Soil with poor internal drainage, the Hunterston series, is restricted to isolated level or depressed sites, none of them covering an appreciable area. Only one small patch of the third series, the Montgomery, has been mapped. It is characterised by a humified surface horizon and very poor drainage. Many of the low-lying and level tracts are liable to flooding in times of spate, while subsidences over coal workings have added to the drainage difficulties and in some instances have caused serious deterioration in farm values.

Series

Dreghorn series

The Dreghorn is the dominant series of the association. It is developed on a yellowish brown loamy sand or sand, and though the gravel content in the parent material may sometimes be high it is rarely present in the upper horizons of the soil profile. The clay content of the soils increases very slightly the further they are from the sea, but the coarse sand fraction remains uniformly high. Consequently the soils are porous, have a low water-retaining capacity and a poor absorptive power for soluble manures. However, the regional water-table tends to be high, ensuring generally a good supply of underground water, and the rainfall is also relatively high, whilst organic matter, low in the soil close to the coast, increases with distance from the sea. In the soils termed *Early Potato Soils* (Berry *et al*, 1930) the organic matter content reaches a maximum of 9% and the dark brown colouration has been noted to 18 inches or more. This accumulation of organic matter increases the nutrient capacity of the soil. Hence, the adverse properties of this sandy textured and freely drained series which are manifest at the coast gradually diminish inland.

Generalised Profile Description

SLOPE	gentle
ASPECT	west
ALTITUDE	50 feet
VEGETATION	*Lolium perenne, Holcus lanatus, Trifolium repens.*
DRAINAGE CLASS	free

Horizon	*Depth or Thickness*	
S	0-10″	Dark brown (7·5YR4/2) sandy loam, moderate crumb, soft, organic matter low, roots abundant, few small pebbles, no mottling; merging into
B_2	10-23″	Brown to dark brown (10YR4/3) sandy loam, weak very fine sub-angular blocky, weakly indurated *in situ*, organic matter low, roots frequent, few pebbles, slight coating of iron oxide on some sand grains. Sharp change into
B_3	23-33″	Yellowish brown (10YR5/3) loamy sand, structureless, moderately indurated in parts, roots occasional, few pebbles, sand grains coated with iron oxides. Sharp change into
C	33″+	Yellowish brown (10YR5/3) gravelly loamy sand. Iron and manganese oxide bands noted at depth.

The surface horizon of these soils, except for those close to the coast, is dark brown and sandy loam in texture. A fairly well-developed crumb structure and a friable or soft consistence are also characteristic. There may be a few pebbles but this is not a common feature. Ochreous mottles have never been observed. The B_2 horizon has a similar texture but the brown colour is generally lighter than that of the S. The brown colouration due to organic matter commonly penetrates to 24-30 inches. A sub-angular blocky structure is a feature of this horizon but it is very poorly defined and the peds break up in the hand with very slight pressure. However, a slight induration *in situ* is noticeable throughout the horizon and a faint coating of iron oxides is usually to be seen on the sand grains. Transition to the B_3 is marked by a change in colour to yellowish brown, the texture becomes more sandy and structure disappears. Sometimes moderate induration *in situ* is noted but induration in this horizon is seldom uniform. The iron oxide coating on the sand grains is unmistakable. On passing into the C horizon the gravel content frequently increases; the texture remains loamy sand or sand but there are no signs of induration, though sand and gravel bands cemented by iron or manganese oxides or an admixture of both commonly occur at depth.

In the map legend this series is listed under brown forest soils of low base status, but in all probability it is a podzolic soil which has lost its characteristic morphology through cultivation.

NOTE ON AGRICULTURE. This is one of the few soil series of North Ayrshire where agricultural problems associated with the ready permeability of water are manifest. As mentioned previously, the organic matter and clay contents of the series increase with distance from the coast, and this is accompanied by a rise in agricultural value. On the coast the series is mainly utilised for golf courses and here it is actually described by Berry *et al* (1930) as *Golf Course Soil*. Good grazing for sheep can be maintained on these soils without manuring. A short distance inland early potato growing is one of the principal activities. Potato crops are taken from the same ground year after year, Italian rye grass or rape being sown after the harvest with the object of maintaining the organic matter level. These soils require heavy dressings of farm manure. Still further inland, where the risk of late spring frosts is greater, early potato growing gives place to dairy farming.

HUNTERSTON SERIES

The Hunterston series has developed on the level or depressed sites throughout the association. There are several large areas around Shewalton Moss, in

the vicinity of Gailes, close to the River Garnock alluvium at Stevenston, and within Hunterston Estate. The series has also developed in subsidences over coal workings. Frequently the raised beach deposits in these localities are shallow and the underlying clayey textured till may be exposed within the soil profile depth. The drainage class is poor as a result of the presence of a high water-table which in many instances is related to the existence of the clayey and impervious till within a few feet of the surface, although the low elevation, the proximity of higher ground and the comparatively high rainfall are also important contributory factors.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	50 feet
VEGETATION	*Juncus effusus, Agrostis tenuis, Holcus lanatus, Poa pratensis, Anthoxanthum odoratum.*
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
S	0-12″	Dark grey-brown (10YR4/2) sandy loam, weak crumb, friable, organic matter low, roots abundant, no stones, frequent distinct rusty mottlings along root channels. Sharp change into
Bg	12-25″	Brown (10YR5/3) sand, structureless, loose, organic matter low, roots occasional, few pebbles, frequent fine to medium distinct ochreous mottles, frequent fine faint grey mottles. Sharp change into
Cg	25-38″	Dark yellowish brown (10YR4/4) loamy sand, structureless, non-plastic, roots rare, few small pebbles, many fine distinct to prominent ochreous mottles. Sharp change into
Dg	38″+	Dark yellowish brown (10YR4/4) sandy clay loam, massive, plastic, roots rare, frequent medium distinct ochreous and grey mottles.

The dark grey-brown surface horizon has a sandy loam texture, a weak crumb structure and a soft to friable consistence. Pebbles are seldom present. Rusty mottles are very noticeable along the root channels. A loamy sand texture is common to the Bg which generally degrades to the structureless condition while the consistence decreases to loose. In the wet state the consistence is non-plastic. Ochreous and grey mottles are roughly comparable in number but the former are always more obvious. There is seldom any variation in texture, structure or consistence on passing into the Cg horizon, but the yellowish brown colour of the beach sand becomes apparent and the ochreous colours increase, generally in the proximity of the few roots. In the profile described, a Dg horizon consisting of water-modified Productive Coal Measures till was exposed. A sandy clay loam texture, massive structure and plastic consistence are typical of this horizon.

This series has been grouped with the ground-water non-calcareous gley soils.

NOTE ON AGRICULTURE. The agricultural rating of this series is much lower than that of the Dreghorn series because the low-lying level tracts which it occupies are difficult to drain efficiently whilst the subsidence areas present an even greater drainage problem. The drainage problems of this series are due to a high ground-water table and in this respect the soils differ markedly from the majority of Ayrshire soils which are classed as surface-

PLATE 17
The Rowbank Plateau. Ben Lomond at extreme right.

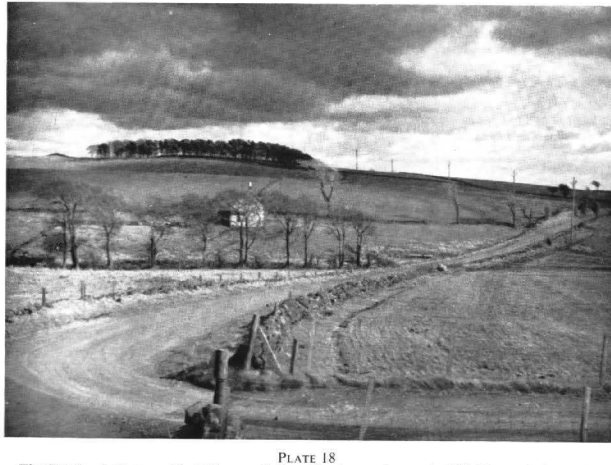


PLATE 18
The Rowbank Plateau. Darleith association: Dunlop series on the hillside; Amlaird series in the foreground.

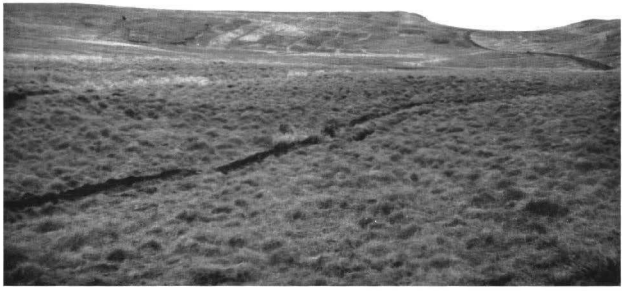


PLATE 19
Open drainage ditches, Queenseat and Ballagioch Hills. Darleith association, Myres series.

PLATE 20
Mathernock Moor: view south from Queenseat Hill. Note the deep peat covering and the gently undulating relief. Distinkhorn Hills and Lanfine Plateau in background (*left*).

water soils, the clayey textures of the latter being primarily responsible for their hydrologic condition.

MONTGOMERY SERIES

The Montgomery series is represented on the map by only one small area, although several patches were noted which were too small to be mapped. This series always occurs in conjunction with the poorly drained Hunterston. It is the only member of the association to have a highly humified top soil and the internal drainage is very poor.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	50 feet
VEGETATION	marsh
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-11″	Very dark brown (10YR2/2) humified sandy loam, no definite structure, non-plastic, organic matter high, roots abundant, no stones. Sharp change into
Bg	11-18″	Grey-brown (10YR5/1) loamy sand, structureless, non-plastic, organic matter low, roots frequent to occasional, no stones, few fine faint ochreous mottles, many medium prominent grey mottles; merging into
Cg	18-25″	Yellowish brown (10YR5/3) loamy sand, structureless, non-plastic, roots rare, few pebbles, frequent medium to coarse distinct ochreous and grey mottles. Sharp change into
Dg	25″+	Dark yellowish brown (10YR4/4) sandy clay loam, massive plastic, roots rare, few stones, frequent medium distinct grey mottles.

The surface soil consists of a structureless humified sandy loam, with a non-plastic consistence. The very dark brown colour of the horizon is in striking contrast to the grey-brown of the underlying Bg, the texture of which is more sandy, generally loamy sand. This horizon is structureless and ochreous and grey mottles are present, the latter predominating. A yellow-brown horizon designated Cg follows the Bg, with texture, structure and consistence similar to the latter. Apart from the basic colour the only noticeable difference is an increase in the number and intensity of the grey mottles. In the profile described a clayey till was exposed at about two feet. As in the Dg horizon of the Hunterston series, this clayey till is derived from sandstones and shales of the Productive Coal Measures.

The series has been classified as a ground-water humic gley.

NOTE ON AGRICULTURE. As the series is very poorly drained with the water-table seldom far from the surface throughout the year it is of no agricultural value.

GIFFNOCK ASSOCIATION

The Giffnock association is not extensive, covering 3·1 square miles and containing only two series, the Giffnock and the Rouken. Though developed on a till derived from the same rock types as the Ashgrove association, namely sandstone and shale of the Carboniferous Limestone Series, the proportion of the sandstone is much higher here than in the Ashgrove parent

material. Furthermore the increase in pH value with depth which occurs in the Ashgrove soils is not a feature of the Giffnock association.

Distribution

A large area of this association was encountered when mapping an overlap on Sheet 30. Only a strip less than $\frac{3}{4}$ mile wide and $6\frac{1}{2}$ miles long encroaches on the north-eastern edge of the Kilmarnock Sheet, occupying the lower ground between Neilston and Clarkston.

Parent Material

The parent material is a clay loam to sandy clay till derived from sandstone and shale of the Carboniferous Limestone Series. As judged from the absence of rock outcrops, the smooth well-rounded topography and from several deep exposures on Castlemilk Estate the till is usually of considerable depth. The stone content is low, at least in the top few feet, but large boulders were observed in deep excavations at various building sites between Thornliebank and Castlemilk; these were dominantly sandstone and it is assumed, therefore, that the till is little contaminated. The higher sandstone content of this till as compared with that of the Ashgrove association is reflected in the sand fraction which is 10-12% higher. The colour, too, is uniformly light brown whereas the Ashgrove till is usually either brown or grey-brown.

Topography

The association is located close to the boundary between the lower Clyde Valley and the White Cart Valley section of the Lowland Transition Zone; the relief varies from undulating to rolling.

Climate

Although the association covers only a small area on Sheet 22, there is a marked decrease in rainfall from west to east, with over 50 inches at Neilston and less than 40 inches at Clarkston.

Soils

The association is represented only by a poorly drained series, the Giffnock, and a very poorly drained series, the Rouken. Over the greater part of the association the clay content of the soil profile, excluding the surface horizon, lies between 35-40%, the maximum clay content recorded being 43·2%. This is the most important property of the parent material and results in the marked degree of uniformity in profile morphology, rather wide variations in slope having little influence on the internal soil-water relations. On the steep sloping ground south of Linn Park the soil is poorly drained and identical to that in the gently sloping fields close to Balgray Reservoir. Furthermore a difference of 10 inches in average annual rainfall is not reflected in the soil profile.

Series

GIFFNOCK SERIES

The Giffnock is by far the larger series, occupying both the crests and slopes of the undulations. It is developed on a light brown sandy clay to clay loam till, the stone content of which tends to be low and consists of sandstones and shales, with the former predominating. The stone composition shows little

evidence of contaminating rock types. The drainage class is poor but unlike some gley soils of North Ayrshire a markedly grey A_2g horizon is not always present.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate
ASPECT	south
ALTITUDE	300 feet
VEGETATION	*Cynosurus cristatus, Poa trivialis, Agrostis tenuis, Lolium perenne, Bellis perennis, Ranunculus repens, Ranunculus acris, Holcus lanatus, Juncus effusus.*
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
S	0-11″	Pale brown (10YR6/3) sandy clay loam, weak medium crumb, friable, organic matter low, roots abundant, few stones, frequent coarse prominent rusty mottles along root channels. Sharp change into
A_2g	11-17″	Very pale brown (10YR7/4) sandy clay, moderate fine to medium prismatic, slightly plastic, roots occasional, few stones—mainly sandstones, frequent coarse prominent ochreous mottles, many coarse distinct grey mottles. Sharp change into
Bg	17-30″	Light brown (7·5YR6/4) clay, massive, plastic, roots occasional, few stones—sandstone and occasional shale, also sandstone boulders, many medium distinct ochreous or grey mottles, faces of large cleavages coated in grey; merging into
Cg	30-40″	Light brown (7·5YR6/4) sandy clay, massive, plastic—slightly plastic towards base, roots rare, few stones—sandstone and shale, few medium fine to distinct ochreous and grey mottles, sides of cleavages coated grey.

The surface horizon is characterised by a pale brown sandy clay loam, relatively stone free, and exhibiting distinct rusty mottles along the root channels. A very pale brown colour is typical of the A_2g which varies in texture between sandy clay and clay loam. It has a moderately well-defined prismatic structure and shows some signs of plasticity. Both ochreous and grey mottles are numerous and striking. The Bg is frequently finer textured and the prismatic structure of the A_2g fades to massive, the plasticity is increased and mottles, though still striking, are reduced in number. This massive structure and plastic consistence continue in the Cg, but the texture is usually a sandy clay. There is a pronounced reduction in ochreous and grey mottles but the large cleavages which appear in the Bg persist, their sides sticky and coated in grey colours.

This series conforms to the non-calcareous gley soil group and is also a surface-water soil.

NOTE ON AGRICULTURE. Rouken Glen, Linn Park and numerous golf courses which serve the city of Glasgow are situated on this series. In addition a considerable area is being lost to agriculture by the city's building programme. The system of farming practised on the remaining land is similar to that on the moderately fine textured soils of North Ayrshire. As in the Ashgrove series the soil drainage is the limiting factor. The minimum of cultivation is done and the rotation places emphasis on long leys.

ROUKEN SERIES

The Rouken series, like most of the soils of the region with very poor

drainage, occupies the level ground which fringes most of the streams within the association. It has also been mapped in the larger depressions though frequently these contain glacial-lacustrine deposits. The parent material is a light brown, slightly plastic clay till, containing numerous highly weathered sandstone and shale fragments.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	300 feet
VEGETATION	*Juncus effusus, Carex nigra, Carex panicea, Anthoxanthum odoratum, Ranunculus repens.*
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-9″	Brown (10YR5/3) clay loam, weak medium crumb, slightly plastic, organic matter low, roots frequent, few stones, distinct rusty mottling along root channels. Sharp change into
A_2g	9-16″	Grey (10YR6/1) clay, massive, very plastic, organic matter low, roots occasional, few stones, few coarse distinct ochreous mottles, many coarse prominent grey mottles, large cleavages coated grey. Sharp change into
Bg	16-27″	Pinkish grey (7·5YR6/2) clay, massive, plastic, few stones, many coarse prominent ochreous and grey mottles, a few iron tubes along root channels, faces of cleavages and stone matrix interfaces coated grey; merging into
Cg	27-36″	Light brown (7·5YR6/4) sandy clay, massive, slightly plastic, roots rare, few stones—sandstone and shale, ochreous mottling negligible and few medium grey mottles, cleavage faces and areas around stones sticky and grey in colour.

The surface which is seldom more than 9 inches deep is a clay loam with a weak crumb structure. The low organic matter content of this horizon is an important differentiating feature. A striking colour change from brown to grey marks the transition to the A_2g which is a massive structured plastic clay. Grey mottles predominate and large cleavages with completely gleyed sides are readily discernible. The structure, texture and plasticity of the Bg are similar to those of the A_2g, but there is a slight reduction in mottling confirmed by the colour smear which is pinkish grey or brown-grey. In the Cg the inherent colour of the parent material, light brown, is expressed due to the marked reduction in gley effects. The large cleavages, first noted in the A_2g, descend to the Cg horizon and the sides continue completely grey gleyed.

The series is grouped with the non-calcareous gley soils, the soil-water relations conforming to those of the surface-water category.

NOTE ON AGRICULTURE. The series is located for the most part in fairly level-bottomed depressions where adequate artificial drainage would involve considerable practical difficulties and therefore it is commonly left to support rather a low-value permanent grazing.

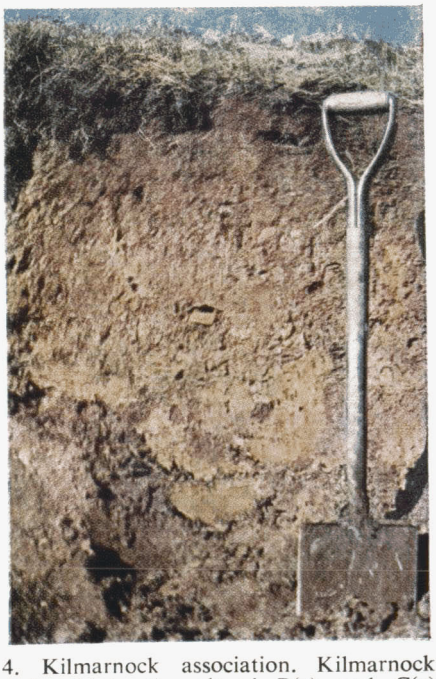
KILMARNOCK ASSOCIATION

The Kilmarnock association is one of the most extensive in North Ayrshire, occupying 21% of the map area. Though more widely distributed than any of the other associations on the till plain and the Lowland Transition Zone it is largely restricted to the country north of the River Irvine and in particular

1. Blown sand above podzol with iron pan. Note (i) the series of buried A_1 horizons; (ii) the fairly well-devoloped A_2 horizon; (iii) the iron pan; and (iv) the humus bands in the B_2 and B_3 horizons.

2. Kirktonmoor association, Faulds series. A shallow, freely drained soil with little horizon differentiation.

3. Till of the Kilmarnock association overlying an earlier till, Volga Burn, Moscow.



4. Kilmarnock association. Kilmarnock series. Note the gleyed B(g) and C(g) horizons.

5. Ashgrove association, Ashgrove series. Apart from the surface horizon ochreous and grey mottles are prominent throughout the profile. Note the massive structure in Bg and Cg horizons.

6. Bargour association, Brocklie series, developed in felled woodland. Note (i) the shallow H layer; (ii) the deep, heavily gleyed A_2g horizon; and (iii) the development of the parent material colour towards the base, typifying a surface-water soil.

7. Sorn association, Sorn Series. Note (i) the markedly gleyed A_2g horizon; and (ii) the development of the parent material colour towards the base.

8. Darleith association, Dunwan series. Note (i) the muck loam top; (ii) the intensely gleyed A_2g horizon; and (iii) the many green weathered stones, towards the base.

to the south-eastern part of the Cunningham Plain. The parent material is a mixed till of moderately fine to fine texture which is characteristic of much of the till-covered lowlands floored by Carboniferous sediments and contemporaneous lavas.

Distribution

The association covers 88·0 square miles and is grouped into seven areas:
Area I. This area of the association lies between the Knockewart Hills and the Cunningham Plain forming a strip ¾-1 mile wide and 3½ miles long which runs south from Munnoch Reservoir to the raised beach near Saltcoats.
Area II. Between the Renfrew Plateau and the Cunningham Plain a strip 1 mile wide and 5 miles long runs from Dalry northwards to above Kilbirnie.
Area III. On the rolling country below the western and southern margins of the Rowbank Plateau the association occurs as an L-shaped unit ½-1 mile wide and 5 miles long, with Beith situated at the angle.
Area IV. In the north-east corner of Sheet 22 a compact unit is situated between Thorntonhall and Carmunnock with two sinuous projections, one running 4 miles south-eastwards along the eastern slopes of the White Cart Valley, and the other extending 3 miles westwards from Busby, reappearing in small enclaves further along the northern edge of the Neilston-Eaglesham Platform as far as Neilston.
Area V. A strip 1-1½ miles wide and 2½ miles long is associated with a ridge of Millstone Grit age basalt projecting from the till plain 1½ miles south-east of Dalry.
Area VI. A narrowing belt extends 6 miles eastwards from Symington and south of Craigie Hill as far as Carnell, with a curved projection skirting the western and northern slopes of Craigie Hill. An isolated square mile near Loans may be regarded as an outlier of this area.

All these areas fall within the Lowland Transition Zone.
Area VII. The largest block of the association occupies the south-eastern half of the Cunningham Plain and adjacent areas of the Lowland Transition Zone. It comprises roughly the angle between the Annick Water and the River Irvine within a line joining Stewarton, Waterside and the upper Craufurdland Water to the edge of Mathernock Moor, and from there eastwards to Darvel Glen. Two triangular shaped areas project north-westwards across the Annick Water: one in Stewarton parish extending to Auchentiber, and a smaller unit near Girdle Toll. Two similarly shaped projections reach south-westwards across the River Irvine; one between Hurlford and Riccarton which is almost contiguous with Area VI at the northern foot of Craigie Hill, and a smaller unit between Gatehead and Dundonald. An isolated area, 1 square mile in extent, occurs 1½ miles north of Dunlop.

Parent Material

Throughout these areas the soil parent material is a mixed till of medium clay texture derived from Carboniferous sandstones, shales, and contemporaneous lavas. In Areas I, II, III, and IV, situated where lowland sedimentary rocks border the igneous uplands, the lava component is derived from the plateaux and the sediments from the plain. In Areas V, VI and VII, both are derived from the plain, the igneous material originating mostly from Millstone Grit age basalts which outcrop in close association with the sediments. On the Cunningham Plain in Area VII further igneous material has been added

to the till from the teschenite and olivine-dolerite intrusions of late Carboniferous age and also from a number of Tertiary basic dykes.

In depressions the till has normally been considerably modified by water action, and in the complex drumlin field immediately west of Kilmaurs there is some evidence of water-modification on the slopes which has resulted in a more loamy textured till. West of Stewarton, in the triangle formed by the Darleith association boundary and the Annick and Lugton Waters, the association is characterised by a finer textured parent material. Consequently the soil-water relations are less satisfactory and although the dominant soil has been classed as imperfectly drained it is inferior to the modal imperfectly drained soil of the association. The finer texture is the result of a higher proportion of Carboniferous sediments in the till. Within the Kilmarnock association area volcanic detritus contributes to the soil parent material in three localities which are too small for representation on the One-Inch map: (1) on Loudoun Mains Farm, 1 mile north of Newmilns, (2) at the hamlet of Dalgarvel, 2 miles south of Dalry, and (3) at the south end of Blair Estate, 2 miles south-east of Dalry. A strip, $\frac{1}{2}$-1 mile wide, of coarser textured Kilmarnock association soil is found between Dundonald and Kilwinning where the association adjoins the raised beach.

Topography

Except on the undulating Cunningham Plain, Kilmarnock soils are associated with a rolling relief.

Climate

The association is found under widely differing conditions of rainfall, from the 30-35 inches zone at Loans to 60 inches north of Kilbirnie.

Area IV, in the White Cart Valley, Area VI south of Craigie and most of Area VII, the largest unit, fall within the 35-45 inches zone.

Soils

A large proportion of the soils of this association can be identified with the moderate heavy and heavy loam soils of the Soil Texture Map, Fig. 13, and although these soils have a wider distribution than any other class they are mainly confined to the till-covered lowlands north of the River Irvine. The ratio of Carboniferous sediments to igneous material in the soil varies but the maximum clay content in the profile remains constant at 30-35%, except in the neighbourhood of Lugton and north of the Annick Water between Cunninghamhead Station and Stewarton where clay contents of 40-45% are prevalent. This increased clay content is correlated with the higher proportion of Carboniferous shales in the till. Small patches of more loamy textured Kilmarnock soils occur in the drumlin field west of Kilmaurs and on the steep sloping ground to the north of Newmilns and Darvel; in these areas the till has been water-modified and clay contents as low as 20% have been recorded.

The low relief, undulating to gently rolling, and the medium clay content of the parent material have imparted a marked degree of uniformity to the soils. Four soil series have been delineated within the association but it is only rarely that more than two are represented in a district. Generally, the series with imperfect drainage is dominant, the poorly drained series being confined to the land with level or depressed relief. Within the largest block of the association (Area VII), occupying the south-eastern section of the Cunning-

ham Plain and areas of the Lowland Transition Zone, there is a gradual increase in altitude from approximately 100 to 700 feet accompanied by a progressive increase in rainfall from 35 to 50 inches+ and a decrease in the mean annual temperature of the order of 3°F. This variation in the climatic factor is reflected in the soil profile and in the relative distribution of the series. Below approximately the 45 inch isohyet the series distribution conforms to the general pattern of the association with imperfectly drained soils occupying the crests and slopes of the undulations and those with poor drainage prevalent in the troughs. Under higher rainfall conditions however, the tendency is for the series with poor drainage to occur on sites comparable to those occupied by the imperfectly drained series in the lower rainfall areas, while the depressions contain soils classed as very poorly drained, usually with surface horizons rich in organic matter. Before passing finally into the peat moorlands which receive the highest rainfall within this zone there is a belt of varying width where peaty topped soils with poor internal soil-water relations predominate. On the less favourably sloping ground in this region humic gley soils with very poor drainage occur.

Series

KILMARNOCK SERIES

The Kilmarnock is the most extensive series of the association, except near Lugton in Area III and adjoining Mathernock Moor in Area VII. It is developed on a reddish brown to brown clay loam to clay till with variations in geological composition which have already been discussed. The stone content of the till tends to be low and large boulders are seldom encountered. From the infrequency of rock exposures, even in deeply cut river channels, it is assumed that the till is generally of a considerable depth. An undulating to gently rolling topography is characteristic of most of the association and the Kilmarnock series, which is classed as imperfectly drained, occurs on the gentle or moderate slopes wherever the rainfall is less than about 45 inches; under higher rainfall conditions the poorly drained Kilmaurs series is commonly found on such sites. Much of the series is artificially drained and various systems are in use, from old stone drains to 3 inch diameter flat bottomed tiles. In many districts there is evidence of old ridges and water furrows although the modern trend is to plough them out and lay 3-inch diameter tiles at a depth of 2 to 2½ feet at 27 foot intervals. North of the Annick Water, near Stewarton, the internal drainage is adversely affected by the noticeably higher clay content throughout the soil profile, but with pronounced rigging and furrowing and efficient subsoil drainage the tendency towards poorly drained conditions has been confined to the lower horizons. Man is therefore to a great extent responsible for the uniformity of the internal soil-water relations of this series.

Included within this series are three very small and ill-defined patches of soil derived from a parent material contaminated with volcanic detritus. They are located at Loudoun Mains Farm near Newmilns, and around Dalgarvel and Cockenzie Farm, south of Dalry. The profile differs from that of the normal soil only in the striking reddish brown colour of the sub-surface horizons. The chemical analyses of two profiles sited at Loudoun Mains Farm show them to be comparable to others of the Kilmarnock series, the only divergence being in the available phosphate figures of the basal horizons,

which are much lower than the normal. In all probability the high haematite content of the detritus accounts for this marked phosphate fixation.

GENERALISED PROFILE DESCRIPTION

SLOPE	gentle
ASPECT	east
ALTITUDE	150 feet
VEGETATION	*Poa trivialis, Lolium perenne, Ranunculus repens, Ranunculus acris, Cynosurus cristatus, Trifolium repens.*
DRAINAGE CLASS	imperfect

Horizon	*Depth or Thickness*	
S	0-10″	Brown (10YR5/3) loam to clay loam, medium crumb, friable, organic matter moderate, roots abundant, a few faint mottles along roots in upper 2 inches. Sharp change into
B_2(g)	10-22″	Brown (7·5YR5/11) clay loam, fine sub-angular blocky, firm, organic matter low, roots frequent—becoming occasional with depth, few stones, few fine faint yellow-orange mottles, few fine grey mottles on faces of peds; merging into
B_3(g)	22-28″	Brown (7·5YR5/4) clay loam, weak medium to coarse sub-angular blocky, few stones, roots occasional, grey mottles comparable with B_2(g), yellow mottling very slight; merging into
C(g)	28-40″	Brown (7·5YR5/4) clay loam, weakly laminated, slightly indurated, roots rare, grey mottles very few and faint.

The texture of the surface horizon varies between loam and clay loam. It has a medium crumb structure, is friable, and occasionally has rusty mottlings along the root channels. A firm sub-angular blocky structure is associated with the clay loam textured B_2(g) horizon, the clay content of which is often slightly higher than that of either the B_3(g) and C(g). Ochre and grey colours are normally restricted to a few fine mottles. The transition from the B_2(g) to the B_3(g) is rarely accompanied by a colour change, both being either brown or reddish brown. The structure of the B_3(g) is nearly always less well-defined, tending towards coarse sub-angular blocky, and though the intensity of grey mottles in the two horizons is similar, yellow mottles are less frequent in the B_3(g). Manganese staining, particularly on the faces of the peds, has been observed in both illuvial horizons. In the C(g) horizon the texture is clay loam to clay, a platy structure is typical and there may be slight induration. Ochreous mottling has never been noted and grey mottles are few and faint.

The series has been classified as a brown forest soil of low base status, but in the sub-angular blocky structure and apparent accumulation of clay in the B horizon it resembles the American grey-brown podzolic soil.

NOTE ON AGRICULTURE. Dairying is the main industry and its produce supplies the principal revenue. With careful working at the proper stage of dryness the soil yields a good tilth and green cropping can be practised, but the crop is precarious and a wet season can ruin it. Only a very small proportion of the series is in fact green cropped, this being determined mostly by local factors such as texture, depth of top soil, slope, aspect, etc. The commonest rotation is oats (lea), oats (stubble), followed by rye grass hay, and then pasture over perhaps six years (Berry *et al*, 1930).

KILMAURS SERIES

The Kilmaurs series has been classified as a poorly drained soil and throughout most of the association it is restricted to depressions and the less favour-

PLATE 21
Glenouther Moor (included in Mathernock Moor). Darleith association. Succession from Amlaird series (*foreground*) to Dunwan series and finally to deep peat.

PLATE 22
Deep peat on Glenouther Moor.

PLATE 23
Ice-scoured surface on Renfrew Plateau. Darleith series on lower slopes; Baidland series above.

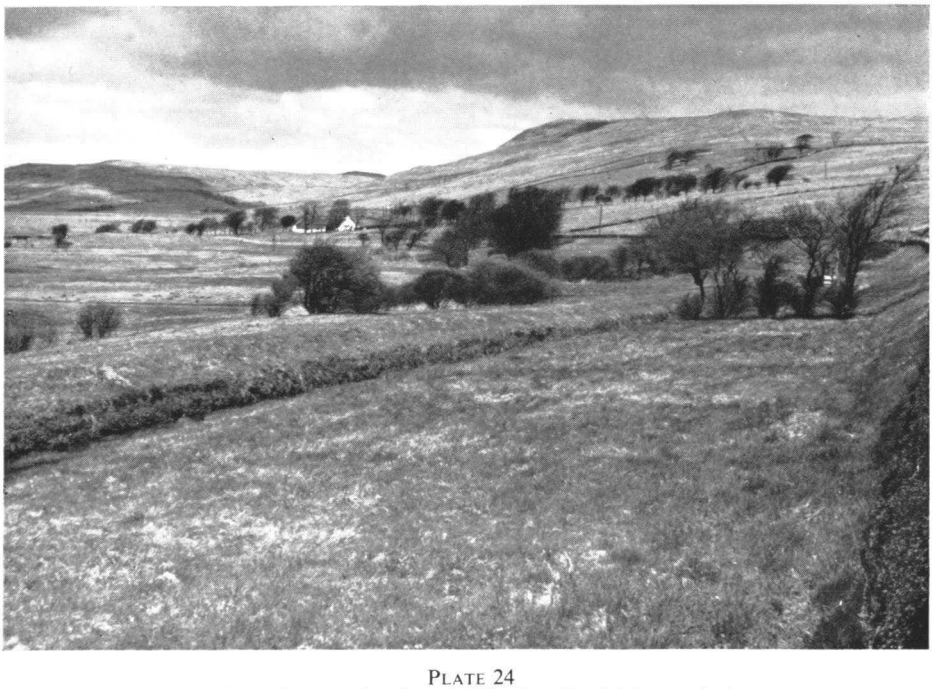


PLATE 24
Renfrew Plateau: the Camphill Valley. Darleith association.

ably sloping ground. West of Kilmarnock it has developed in local subsidences over coal workings, and in the extensive drumlim field to the north it forms an intricate pattern with the Kilmarnock series. Dark surface horizons are sometimes met with in these areas of depressed relief, and the sub-surface horizons may show evidence of water-modification. Occasionally there are six inches or more of plastic lacustrine clay immediately beneath the plough layer, followed by horizons developed from the mixed till of the Kilmarnock association. The presence of this shallow lacustrine layer is correlated with post-glacial lakes which are known to have occupied many of the depressions in the North Ayrshire till plain. The soil pattern of the Kilmarnock district is repeated in the other areas of the association with the exception of those near Lugton and Mathernock Moor. In these localities the parent material is finer textured (38-40% clay), the profile seldom shows signs of water sorting and the rainfall is higher, approaching 50 inches; allied with these differences is the predominance of the Kilmaurs series.

The Kilmaurs series in general is developed on a brown to dark brown slightly plastic clay loam to clay till. The stone content is varied, but irrespective of geological origin the stones are nearly always highly weathered.

Considerable areas of this series have been laid with field drains of some description, but these require fairly frequent attention and in the districts of high rainfall where *Juncus* spp. are prevalent it is doubtful if many are in an effective condition.

GENERALISED PROFILE DESCRIPTION

SLOPE	very gentle
ASPECT	south-west
ALTITUDE	250 feet
VEGETATION	*Agrostis tenuis, Trifolium repens, Ranunculus repens, Bellis perennis, Poa trivialis, Juncus effusus.*
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
S	0-9″	Brown to dark brown (10YR4/3) clay loam, medium sub-angular blocky, slightly plastic, organic matter moderate, few stones, roots frequent, rusty mottles along channels, faces of peds greyish. Moderately sharp change into
Ag	9-16″	Yellowish brown (10YR5/4) clay loam to clay, ill-defined prismatic, slightly plastic, organic matter low, few small stones, roots frequent, few fine faint ochreous and grey mottles. Sharp change into
A_2g	16-20″	Light yellowish brown (10YR6/4) clay loam to clay, weak prismatic, plastic, few stones, roots occasional, frequent fine distinct yellow mottles, many coarse distinct grey mottles, faces of peds completely grey in colour. Sharp change into
Bg	20-29″	Brown to dark brown (10YR4/3) clay loam to clay, fine medium prismatic, plastic, many small weathered stones —sandstones, shales and lavas, roots rare, many medium distinct ochreous and grey mottles, faces of peds completely grey gleyed, iron tubes along root channels; merging into
Cg	29-38″	Brown to dark brown (10YR4/3) clay loam to clay, coarse platy, slightly plastic, few large and small weathered stones, roots rare, few fine faint ochreous mottles, marked grey colours around stones, iron tubes along root channels.

The surface horizon consists of a brown to dark brown clay loam with a sub-angular blocky structure and usually a slightly plastic consistence. Rusty

mottles occur along the root channels and the faces of the peds may be greyish in colour. The Ag has a clay loam to clay texture, the structure is weakly prismatic, and again the consistence is slightly plastic. A few fine faint mottles are present. Below, the A_2g is lighter in colour and is the horizon of maximum gleying. The texture is clay loam to clay, the structure is weakly prismatic and the consistence plastic. Ochreous mottles are frequent, fine and distinct and there are many coarse distinct grey mottles, while the faces of the peds are completely grey. A brown to dark brown colour and a clay texture are associated with the Bg horizon. The structure is fine to medium prismatic and the consistence is plastic. Many small highly weathered stones are a feature of the Bg, Carboniferous sandstones, shales and lavas being represented. Generally, there are many distinct ochreous and grey mottles and the faces of the peds are markedly grey. Iron tubes occur along the root channels. The colour and texture of the Cg are similar to those of the Bg but the structure tends to be coarse platy and the consistence less plastic. A few large stones and several small ones are normally found in this horizon. Ochreous mottling is less intense but grey colours predominate around stones and on the faces of the peds; iron tubes persist along root channels.

The Kilmaurs series has been grouped with the non-calcareous gleys and the decrease in number and intensity of grey and ochreous mottles towards the base of the profile differentiates it as a surface-water soil.

NOTE ON AGRICULTURE. As the surface horizons tend to be loams or clay loams and the subsoil is frequently a stiff plastic clay loam to clay, drainage is difficult and there is little cultivation done. Drainage trouble is often aggravated by subsidence due to coal workings which lowers the value of the farm on which it occurs.

LOUDOUN SERIES

The Loudoun series forms a narrow but uninterrupted border to the peat moorlands in the northern part of the upper Irvine Valley. It is developed on a slightly plastic impervious clay loam to clay till on the crests and gentle slopes of an undulating terrain which is exposed and experiences a high rainfall (50 inches+). These conditions combine to produce a soil with a peaty surface and poor internal soil-water relations.

GENERALISED PROFILE DESCRIPTION

SLOPE moderate
ASPECT south-west
ALTITUDE 750 feet
VEGETATION *Juncus effusus, Juncus acutiflorus, Nardus stricta, Festuca ovina, Festuca rubra, Agrostis canina, Galium hercynicum.*
DRAINAGE CLASS poor

Horizon	*Depth or Thickness*	
L	1″	Litter.
H	4″	Black (7·5YR2/1) humus, greasy, roots abundant.
A_1	0-1″	Dark brown (10YR4/3) loam, weak subangular blocky, non-plastic, organic matter high, stones few, roots abundant, rusty mottles along root channels. Sharp change into
A_2g	1-7″	Brown (10YR5/3) sandy loam to sandy clay loam, weak sub-angular blocky, slightly plastic, organic matter moderate, stones few, roots abundant to frequent, many coarse distinct ochreous and grey mottles, faces of peds coloured with grey. Sharp change into

Horizon	*Depth or Thickness*	
Bg	7-20″	Brown (7·5YR5/4) clay loam to clay, massive, slightly plastic, organic matter low, stony—mainly Carboniferous age sediments and lavas, roots occasional, frequent fine medium distinct, ochreous mottles, many coarse distinct grey mottles, iron tubes on root channels and faces of large cleavages completely grey gleyed. Sharp change into
Cg	20-34″	Brown (7·5YR5/4) clay loam, massive, slightly plastic, stony, roots rare, few fine faint ochreous mottles, frequent distinct grey mottles on faces of peds, iron tubes around roots.

The surface soil is composed of up to 12 inches of black organic matter, rich in visible plant remains. This may be underlain by an A_1 consisting of a loam with a weak sub-angular blocky structure and non-plastic consistence; stones are few and there are many roots often surrounded with rusty coloured mottles. The A_2g varies in texture from a sandy loam to a sandy clay loam, the sub-angular blocky structure is poorly expressed, and the consistence is slightly plastic. Ochreous and grey mottles are many, coarse and distinct, while the faces of the peds are decidedly grey in colour. A massive structure and sticky plastic consistence characterise the Bg. The texture is clay loam to clay with the latter more common, and the content of weathered stones can be fairly high. Grey mottles, though distinct, are smaller and less numerous than in the horizon above. Iron tubes occur along the root channels and the faces of the large cleavages have a sticky grey coating. A massive structure which may tend to platy at depth is a feature of the clay loam to clay textured Cg horizon. There are commonly several highly weathered stones in this horizon, many of them green. Ochreous colours are generally restricted to the iron tubes which surround some of the roots and grey gleying is less than in the Bg horizon.

The series has been grouped with the surface-water peaty gleys.

NOTE ON AGRICULTURE. The clayey impervious subsoil of this series combined with the high rainfall does not encourage cultivation. Most of the series carries a wet moorland type of vegetation which provides grazing for sheep and, on some farms, summer grazing for cattle.

POLBAITH SERIES

The Polbaith is the smallest series of the association. It is located in depressions and water courses bordering the moorlands to the east of Moscow and to the north of Newmilns and Darvel. The parent material is a grey brown plastic clay till, occasionally bearing evidence of water-modification. A highly humified surface horizon and a subsoil displaying the properties of very poor drainage are the distinctive features of this series.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	650 feet
VEGETATION	marsh
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-8″	Brown (7·5YR7/2) humified loam, weakly defined sub-angular blocky, greasy, organic matter high, no stones, roots abundant, rusty mottles along the root channels. Sharp change into

Horizon	*Depth or Thickness*	
A_2g	8-19″	Light brown-grey (10YR6/2) clay loam, massive, plastic, organic matter moderate, few weathered stones, roots occasional, distinct ochreous mottles along root channels, many medium and coarse prominent grey mottles. Sharp change into
Bg	19-25″	Brown (10YR5/4) gritty clay loam to clay, massive, plastic, organic matter low, stony—small and mixed in origin, frequent distinct and prominent ochreous and grey mottles, faces of large cleavages completely grey, iron tubes with inner grey core along roots; merging into
Cg	25-38″	Grey-brown (10YR5/2) clay, massive, plastic, many small bluish green stones, many grey mottles, prominent ochreous colours confined to occasional root channels.

The S horizon is a humified loam (organic matter 30%+) with an ill-defined sub-angular blocky structure, usually very wet and greasy to touch. Roots are abundant and are surrounded with distinct rusty mottles. The light brown A_2g horizon is a clay loam, the structure is massive and it is also sticky and plastic. Distinct ochreous mottles are mainly confined to root channels, while many coarse prominent grey mottles occur throughout. A brown clay with massive structure and sticky plastic consistence represents the Bg. This horizon invariably contains numerous small stones. Both ochreous and grey mottles are much in evidence but do not, as in the A_2g, mask the basic soil colour. The faces of the large cleavages are coated with grey and iron tubes are obvious around the roots. The Cg horizon consists of a grey-brown plastic clay with a massive structure, which may tend to platy at depth. Many small bluish green stones can be seen and, while grey mottling is similar to that of the Bg, ochreous colouring is limited to a few root channels.

This soil is considered to be a surface-water humic gley.

NOTE ON AGRICULTURE. Situated as it is in depressions, with very poor drainage, this series is of little agricultural value.

KIRKTONMOOR ASSOCIATION

The Kirktonmoor association is developed on a morainic drift which imparts a moundy topography to the ground. As much of the surrounding country has a very thin mantle of till and numerous rock outcrops with an ice-scoured appearance, the boundaries of the association are fairly clearly defined in the landscape. The parent rock types of this association are represented in the Darleith association but the frequency of water-sorting of the morainic material, the characteristic topography and the practical implications of these factors warrant establishing a separate association.

DISTRIBUTION

The Eaglesham Moraine is covered exclusively by soils of the Kirktonmoor association which occupies 6·2 square miles. Extending from Eaglesham north-westwards in a belt one to two miles wide it ends in an abrupt descent to the floor of the Neilston-Eaglesham Platform at Faulds Farm, Newton Mearns. A southern limb projects for a short distance into the Brother Loch depression of the Ballagioch Plateau.

Parent Material

The deposits are shallow, resting directly on solid rock, and they consist mainly of angular fragments of the country rock, micro- and macro-porphyritic basalts, trachybasalts, trachyandesites and rhyolites set in a sandy loam to clay loam matrix (Burnett and Richey, 1930).

Topography

Steep hummocks or mounds with numerous wet hollows typify the relief and the altitude varies between 500 and 800 feet.

Climate

Rainfall in this region is approximately 50 inches in the year.

Soils

Three soil series have been delineated within this association. Numerous steep slopes and the unconsolidated nature of the parent material result in the dominance of freely drained soils; in most of these the surface horizons have only a moderate organic matter content, but the content is greater in the higher-lying districts, where increased rainfall and lower temperatures encourage humus formation. In the intricate pattern of hollows water movement is restricted by the lack of adequate natural outlets. The hollows are occupied by very poorly drained soils, invariably with humified surface horizons.

Series

FAULDS SERIES

This series is the largest of the association and is found on the steep sides and tops of the hummocks or mounds. It is developed on a shallow morainic drift, containing many large and small sub-angular and angular stones within a sandy loam matrix. Most of the series experiences less than 50 inches of rain annually. The internal drainage conditions conform to those of the freely drained class.

Generalised Profile Description

SLOPE steep
ASPECT south
ALTITUDE 650 feet
VEGETATION *Festuca ovina, Agrostis tenuis, Anthoxanthum odoratum, Trifolium repens, Veronica chamaedrys, Bellis perennis.*
DRAINAGE CLASS free

Horizon	*Depth or Thickness*	
A	0-14″	Dark brown (7·5YR4/2) sandy loam, medium granular, friable, organic matter moderate, many well-rounded few sub-angular stones—mainly Calciferous Sandstone age lavas, roots abundant, no mottling. Sharp change into
B	14-25″	Dark brown (2·5YR4/2) sandy loam, weak medium sub-angular blocky structure, organic matter moderate, friable, stone content as above, roots occasional, no mottling. Sharp change into
C	25-36″	Brown (7·5YR5/2) gritty sandy loam, structureless, loose, organic matter low, small sub-angular stones and several large angular basalts, roots occasional, no mottling. Sharp change into
D	36″+	Varying sizes of angular basaltic stones, relatively unweathered.

A medium granular structure is usually associated with the sandy loam textured surface horizon. The B horizon also textures to a sandy loam but the structure is seldom well-defined, the tendency being towards sub-angular blocky, Normally there is no ochreous mottling. The organic matter content particularly in the B horizon, is often higher than colour would indicate and this is a feature of the loamy soils on the volcanic uplands. A gritty sandy loam loose and structureless, typifies the C horizon. The stone content is very high with the proportion of angular stones higher than in either the A or the B horizon. Again there is seldom evidence of mottling. In the profile described the C horizon is underlain by angular basaltic stones, but frequently the D horizon consists of unfissured rock.

The morphology of the profile is similar to that of the brown forest soil of low base status.

NOTE ON AGRICULTURE. As drainage is free and exposure and steepness are not excessive, dairying is practised in preference to sheep farming. Cultivation is often limited by the stoniness and shallowness of the soil. The rotation commonly comprises oats, potatoes and turnips followed by pasture. Like the Darleith series it is regarded as "hungry land" and responds well to the application of nitrogen, phosphate and potash (Berry *et al*, 1930).

MOORHOUSE SERIES

The Moorhouse series occupies the well drained sites in the higher and more exposed parts of the association south of Brother Loch and to the north of Ballagioch Hill. As in the Faulds series, the morainic drift on which it is formed is nearly always shallow and very stony but textures are finer, sandy clay loams being frequently encountered. A peaty surface and free drainage, at least in the lower part of the solum, characterise this series.

GENERALISED PROFILE DESCRIPTION

SLOPE	gentle
ASPECT	west
ALTITUDE	800 feet
VEGETATION	*Nardus stricta, Anthoxanthum odoratum, Juncus squarrosus Agrostis tenuis, Festuca ovina, Galium hercynicum, Polytrichum* spp.
DRAINAGE CLASS	free below the iron pan

Horizon	*Depth or Thickness*	
L	½″	Litter.
F	½″	Partially decomposed litter.
H	3″	Very dark brown (10YR2/2) greasy peat.
A_1	0-2″	Dark brown (7·5YR3/2) sandy loam, medium crumb, friable, organic matter high, roots abundant, very few stones, distinct rusty mottlings along some root channels and also on some stones.
B_1	at 2″	Thin iron pan.
B_2	2-9″	Brown (7·5YR5/4) sandy clay loam, weak very fine sub-angular blocky, friable, organic matter moderate, roots frequent, stony—mostly angular Calciferous Sandstone age lavas, no mottling; merging into
B_3-C	9-16″	Reddish brown (5YR5/3) gritty sandy clay loam, structureless, slightly indurated, organic matter low, many large and small stones—origin as above, few fine faint ochreous mottles.
D_r	16″+	Weathered Dalmeny basalt.

The H layer, which may be as much as 12 inches thick, is always peaty, greasy to touch, and wet. An A_1 horizon consisting of a sandy loam, with a medium crumb structure and rusty mottlings along root channels, is always present. The occurrence of an A_2 is sporadic and the horizon is never well developed; it is usually wet and bears evidence of gleying. On the few occasions when the absence of a thin iron pan has been recorded, a stony indurated layer 1-2 inches thick, rich in ferruginous material, with a dense root mat above has been noted; in such cases the upper horizons are without exception very wet and the vegetation is dominated by *Eriophorum* spp. A sandy clay loam texture and numerous angular Calciferous Sandstone Series lavas characterise the B_2 horizon. The sandy clay loam texture persists in the B_3-C which is often gritty and slightly indurated and sometimes shows slight ochreous mottling. The stone content is similar to that of the B_2.

This series has been distinguished as a peaty podzol with iron pan.

NOTE ON AGRICULTURE. High rainfall and adverse exposure greatly reduce the agricultural value of this series, which is mainly utilised to provide rough grazing for sheep.

KIRKTONMOOR SERIES

The numerous hollows which occur throughout the association are occupied principally by the Kirktonmoor series. This series is developed on a very stony sandy clay loam parent material but the upper soil horizons, which are high in organic matter, are often affected by alluvial material. Very poor drainage prevails, rendering the series of little agricultural value.

GENERALISED PROFILE DESCRIPTION

SLOPE: level
ASPECT: nil
ALTITUDE: 800 feet
VEGETATION: *Juncus acutiflorus, Juncus effusus, Rumex acetosa, Glyceria fluitans, Agrostis canina, Cardamine pratensis, Brachythecium* spp., *Sphagnum* spp.
DRAINAGE CLASS: very poor

Horizon	*Depth or Thickness*	
S	0-10″	Dark brown (7·5YR3/2) humified loam, structureless, very wet, organic matter high, roots very abundant. Sharp change into
B_2g	10-16″	Light brown (7·5YR6/4) loam to sandy clay loam, weak medium prismatic, slightly plastic, organic matter low, roots frequent to occasional, few stones, many coarse prominent ochreous and grey mottles, faces of peds completely grey; merging into
B_3g	16-27″	Strong brown (7·5YR5/4) sandy clay loam, massive, plastic, roots occasional, stones few, many coarse prominent ochreous and grey mottles, faces of peds entirely grey, iron tubes along roots; merging into
Cg	27-40″	Reddish grey (5YR5/2) sandy loam, massive, slightly plastic, roots rare, many highly coloured weathered stones in a grey matrix, well-defined iron tubes around a few roots.

A humified loam comprises the surface horizon. The texture of the B_2g varies from loam to sandy clay loam, the structure is weakly prismatic and the consistence slightly plastic. Ochreous and grey mottles are very marked. In the B_2g the texture is sandy clay loam, the structure massive, and the

consistence plastic. Ochreous and grey colours are again very prevalent. The reddish cast which appears on the colour smear of the Cg horizon is derived from highly weathered reddish stones and not from the sandy clay loam matrix which is completely grey. Well-formed iron tubes occur around the roots in the B_3g and Cg horizons.

The series has been grouped with humic gley soils.

NOTE ON AGRICULTURE. Occupying sites where conditions are persistently wet and boggy, the series is of little agricultural importance.

LANFINE ASSOCIATION

The Lanfine association, which covers 9·7 square miles, is located in four distinct areas. Variations in the texture of the parent material, and particularly in rainfall and slope, occur throughout the association, but within any area these features are reasonably constant. Consequently, although the association consists of five soil series differing markedly in profile morphology and genesis, there are never more than three represented in any one location and one of these is invariably dominant.

DISTRIBUTION

The association occurs in four groups, one in the north-west of Sheet 22, two in the south-east and one on the southern edge. In the southern block of the Renfrew Plateau (i.e. the portion to the south of the Knockendon Valley) the deep till carries Lanfine soils. This area is bounded by a line drawn from Knockendon Reservoir via Kaim, Glentane, Caldron and Gill Hills back to the reservoir. Several hill summits are not covered by deep till and on these are found enclaves of the Darleith association. In the south-east the association occupies the Lanfine Plateau with the exception of the ice-steepened western side of Gallows Hill where the soil belongs to the Darleith association; it occurs also on the southern slopes of the Irvine Valley adjacent to Lanfine Hill, and in a small part of the Lowland Transition Zone at the western end of the plateau in the vicinity of Sornhill, which is itself an enclave of the Darleith association. In the northern part of the Distinkhorn Hills the Lanfine association is again represented, though only on the slopes of three hills where the deep blanket peat thins and gives way to a peaty gley soil, the Distinkhorn series. The southern group comprises two units, one occupying Barnweill Hill, apart from an enclave of the Darleith association on the north-east side, and the other a narrow strip adjoining the Mauchline association at Millburn. These cover 1 square mile and $\frac{1}{8}$ square mile respectively.

PARENT MATERIAL

The association is developed on a reddish brown sandy clay loam to clay loam till derived in the north-west from a mixture of felsite, Calciferous Sandstone age lavas and Upper Old Red Sandstone sediments. In the Lanfine Plateau area the till is derived from lavas of Lower Old Red Sandstone age with a varying admixture of Upper and Lower Old Red Sandstone sediments. Slightly finer textures are associated with poorly drained sites. On the Distinkhorn and neighbouring hills the soil is developed on a sandy loam to sandy clay loam till derived from granodiorite mixed with Lower Old Red Sandstone and Downtonian Sandstone. The southern units are developed on a reddish brown sandy loam to sandy clay loam till derived from New Red

and Barren Red Measures sediments together with basaltic lavas. Throughout all the locations the till, while generally more than 4 feet thick, is not as deep as on the Cunningham Plain. The stone content is variable; in three profiles on Lanfine Hill many red, green and brown, highly weathered stones were observed in the B and C horizons, whereas in the corresponding horizons of two profiles at Sornhill the stone content was described as few.

Topography

The north-western unit occupies much of the southernmost block of the Renfrew Plateau and is characterised by a rolling topography. The surface of the Lanfine Plateau unit is more complex, varying between undulating on the ridge tops and rolling in the Burn Anne Valley and on the south slopes of the Irvine Valley near Greenholm. The relief is rolling to hilly in the Distinkhorn Hills, rolling at Barnweill, and hilly at Millburn where there is a north-facing basalt scarp. Elevations range from 650 to 1,270 feet in the north-west, 200 to 1,050 feet in the Lanfine Plateau, 850 to 1,250 feet in the Distinkhorn Hills, and 200 to 500 feet in the Barnweill and Millburn districts.

Climate

There is a considerable difference in mean annual rainfall in the four areas of the Lanfine association, reflecting the variation in distance from the sea. The north-western unit falls mostly within the 50-60 inches zone, while the south-eastern and southern units are respectively at the higher and lower ends of the 40-45 inch range.

Soils

The Lanfine soils are developed on a reddish brown till, rarely stony, with a textural range of sandy loam to sandy clay loam, the latter being the more common. Of the four areas in which the soils occur, those in the Barnweill and Sornhill-Hardhill districts have a comparable rainfall—35-40 inches, a sandy loam parent material and a rolling topography, and dominantly imperfectly drained soils of good agricultural value are developed. On the Renfrew Plateau and in the area of the Distinkhorn, the higher rainfall 50-60 inches and somewhat lower temperature conditions favour the accumulation of humus, thus in these areas soils with organic surface horizons are common. Sandy loam textures and free to imperfectly drained sites are features of much of the Renfrew Plateau unit where peaty podzols with iron pan are widely developed and well expressed. In the Distinkhorn neighbourhood the more impervious nature of the sandy clay loam subsoil results in a dominance of peaty gley soils.

Series

LANFINE SERIES

The Lanfine series is the largest of the association and the most important agriculturally. It covers the greater part of the volcanic upland area immediately south of Galston and Darvel which includes the Lanfine Plateau and part of the Lowland Transition Zone near Sornhill. A second sizeable unit occupies the rolling ground in the vicinity of Barnweill, while a third and very narrow patch lies on the Mauchline-Tarbolton ridge. The series is developed on a reddish brown sandy loam to sandy clay loam till on moderately sloping ground and under a rainfall of approximately 40 inches. The

internal soil-water relations are those associated with the imperfectly drained class. On the north-facing moderate slopes of Lanfine Hill, however, numerous springs cause wet flushes which complicate the drainage pattern.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderately steep
ASPECT	north
ALTITUDE	800 feet
VEGETATION	*Poa trivialis, Trifolium repens, Cynosurus cristatus, Ranunculus repens, Senecio jacobaea, Bellis perennis.*
DRAINAGE CLASS	imperfect

Horizon	*Depth or Thickness*	
S	0-10″	Brown (10YR5/3) loam, weak medium crumb, friable, organic matter moderate, few stones, roots abundant, few fine faint rusty mottles along root channels. Sharp change into
B_2(g)	10-16″	Brown (7·5YR5/4) sandy loam, fine sub-angular blocky, firm, roots frequent, organic matter low, few stones—Old Red Sandstone sediments and basalts, few fine to medium faint ochreous mottles, particularly along root channels and on faces of peds, few medium faint grey mottles throughout. Sharp change into
B_3(g)	16-20″	Strong brown (7·5YR5/6) coarse sandy loam, poorly defined coarse platy, moderately indurated, roots occasional, stony —mainly small, few faint fine ochreous and grey mottles and pseudo-concretions of manganese. Sharp change into
C_1(g)	20-27″	Dark brown (7·5YR4/4) sandy clay loam, massive, firm, roots rare and mostly dead, many green weathered stones, distinct ochreous mottles around root channels; merging into
C_2(g)	27-36″	Reddish brown (5YR5/3) sandy clay loam to clay loam, massive, firm, roots rare, stones as above, ochreous mottles entirely replaced by grey along root channels.

The surface horizon consists of a brown loam, usually with a poorly developed crumb structure, and faint rusty mottlings along the root channels are frequent. A sandy loam texture and a firm sub-angular blocky structure are common features of the B_2(g) horizon. A few medium sized but faint ochreous mottles occur along the root channels and on the faces of the structural units. Similarly sized grey mottles are also evident. Generally a sandy loam with a poorly defined coarse platy structure and moderate induration characterises the B_3(g). This horizon is sometimes stony and pseudo-concretions of manganese are at times present, particularly on the faces of the peds. Ochreous and grey mottles are nearly always less in both number and intensity than in the B_2(g). The C(g) horizon varies in texture from a sandy loam to sandy clay loam, the latter being more common. As a rule the structure is massive and the consistence firm. Frequently distinct ochreous mottles are noted around root channels but grey colours are less evident. In the area which covers the uplands south of Galston and Darvel sand lenses are occasionally encountered within the solum; they are no doubt allied to the presence of fluvio-glacial sands and gravels in the neighbourhood.

The series has been classified as a brown forest soil of low base status with gley B and C horizons.

NOTE ON AGRICULTURE. Conditions throughout most of the series are favourable for arable farming. Dairy farming is the mainstay though a good deal of cropping is done. Wheat and timothy are grown and green crops, both

potatoes and turnips, are generally a success. On the Lanfine Plateau, however, adverse exposure and a higher rainfall restrict cropping.

THREEPWOOD SERIES

Slope is the most influential factor in the development of this series which occurs, very often in conjunction with the humic gley soils of the Hardhill series, in drainage channels and areas of low relief in the Barnweill and Sornhill-Hardhill districts. The only unit of any extent and consequence is that on the level to gently sloping ground around Cairnhill south of the Burn Anne. Here the series is developed directly on a brown sandy clay loam till in contrast to most of the depressed sites where the till is water-modified, and colluvial material, especially in the deeper valleys, frequently contributes to the upper horizons of the profile. Poor drainage is a characteristic of the series.

GENERALISED PROFILE DESCRIPTION

SLOPE moderately steep
ASPECT north
ALTITUDE 800 feet
VEGETATION *Juncus effusus, Agrostis tenuis, Trifolium repens, Ranunculus repens, Anthoxanthum odoratum, Holcus lanatus.*
DRAINAGE CLASS poor

Horizon	*Depth or Thickness*	
S	0-9″	Brown (10YR5/3) loam to sandy clay loam, weak fine sub-angular blocky, friable, organic matter moderate to high, roots abundant, few stones, marked rusty mottles along root channels, faces of peds very dull. Sharp change into
B_2g	9-18″	Brown (7·5YR5/4) coarse sandy clay loam, coarse prismatic, slightly plastic, organic matter low, roots frequent, many small stones—Old Red Sandstone basalts, sandstones and a few quartz pebbles, frequent medium prominent yellow, orange and grey mottles—the latter intense around stones and on faces of peds, iron tubes along root channels; merging into
B_3g	18-25″	Brown (7·5YR5/4) clay loam, coarse prismatic—fading to massive, plastic, sticky, roots occasional, stony—proportion of basalts higher than in horizon above, frequent medium distinct ochreous mottles, prominent grey mottles throughout, iron tubes along root channels; merging into
Cg	25-36″	Brown (7·5YR5/4) sandy clay loam, massive, firm, frequent dead roots—live roots rare, many highly weathered blue-green stones, very few fine faint ochreous mottles, grey mottles coarse and prominent around root channels; merging into
Cg	36-40″	Reddish brown (5YR5/3) sandy clay loam, massive, firm, roots rare, stones few, no ochreous mottles and grey mottles greatly reduced.

The surface soil is a loam to sandy clay loam with a weak sub-angular blocky structure. There are usually prominent rusty mottles along root channels and the faces of the peds are very dull. A coarse sandy clay loam texture, a coarse prismatic structure, and a slightly plastic consistence are characteristic of the B_2g. The stone content is fairly high and includes Old Red Sandstone age basalts and sediments and well-rounded quartz pebbles. Most of the stones are highly weathered, presenting a variety of colours including red, blue, green and strong brown. Frequent prominent mottles of ochre and

grey are observed, the latter especially around stones and on the faces of the peds. Well-defined iron tubes surround the root channels. The coarse prismatic structure continues in the B_3g and then fades to massive. This horizon is plastic and sticky with a stone content similar to the B_2g except that the proportion of igneous material is higher. Ochreous mottles are again much in evidence, as are iron tubes. A brown sandy loam and a massive structure are usual features of the Cg horizon. Many highly weathered, blue-green stones are present, but there is a marked reduction in the mottling associated with gley conditions.

This is a surface-water soil and conforms to the non-calcareous gley group.

NOTE ON AGRICULTURE. The only area of the series which is of any agricultural importance is that around Cairnhill, south of Galston. Because of the poor drainage *Juncus* spp. are a pest and, being difficult to control, they prevent successful cropping which is limited to a few acres of oats and roots. The greater part of this land is given over to long leys in grass.

KNOCKENDON SERIES

The Knockendon series is limited to the southern Renfrew Plateau block, occurring on the moderate slopes of Kaim, Glentane, Caldron and Gill Hills. It is developed on a reddish brown sandy loam till derived from a mixture of Old Red Sandstone sediments and Calciferous Sandstone age lavas and felsite. A high rainfall (60-70 inches) and the loamy textured parent material combine to produce well-leached soils with surface horizons rich in organic matter. In addition the acidic character of the parent material enhances the podzolic features of the soil profile.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate
ASPECT	north-east
ALTITUDE	750 feet
VEGETATION	*Calluna vulgaris, Vaccinium myrtillus, Carex nigra, Empetrum nigrum, Deschampsia flexuosa, Eriophorum vaginatum.*
DRAINAGE CLASS	free to imperfect below the iron pan

Horizon	*Depth or Thickness*	
L	½″	Litter.
F	1″	Partially decomposed litter.
H	9½″	Very dark brown (10YR2/2) wet greasy humus, roots very abundant in top 6-7 inches.
A_2	0-3″	Dark grey-brown (10YR4/2) sandy loam, weak fine sub-angular blocky, friable, organic matter high, frequent roots, few stones, few fine faint yellow and grey mottles.
B_1	at 3″	Thin iron pan.
B_2	3-9″	Brown (7·5YR5/4) gritty loamy sand, weak fine sub-angular blocky, loose, organic matter low, roots occasional, stony—mixture of felsite, andesite and Old Red Sandstone, few fine faint ochreous mottles. Sharp change into
B_3	9-21″	Brown (7·5YR5/4) loamy sand to sandy loam, coarse platy, indurated, roots rare, stony—similar to those in B_2, few fine faint ochreous mottles along root channels; merging into
C	21-30″+	Light brown (7·5YR6/4) loamy sand to sandy loam, coarse platy, less indurated than B_3, roots rare, stony, no mottling.

The depth of the A_0 horizon and the relative thickness of the F and H layers vary considerably, the latter layer consisting usually of a black greasy humus.

PLATE 25
Juncus-infested land on the Rowbank Plateau. Darleith association, Amlaird series.

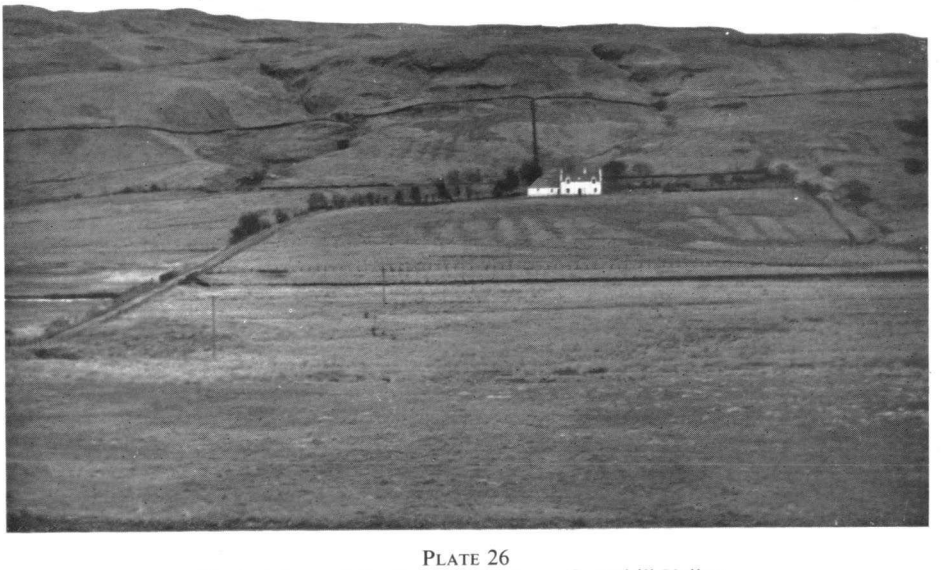


PLATE 26
Typical farm of the Renfrew Plateau. Camphill Valley.

PLATE 27
View north-west towards Goldenberry Hill from Tarbet Hill, West Kilbride. Largs association in foreground; Dreghorn association on raised beach. Little Cumbrae and Argyll mainland in background.

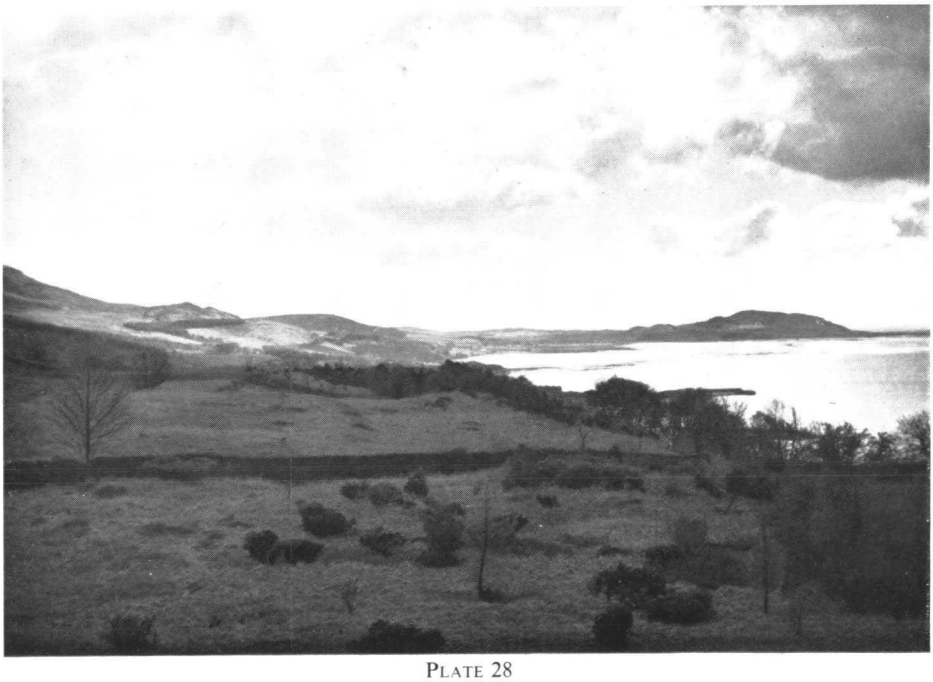


PLATE 28
View south towards Goldenberry Hill from above Largs. Darleith association on slopes of Renfrew Plateau Scarp (*left*) and Goldenberry Hill (*centre right*). The Largs and Dreghorn associations are found on the low-lying land.

A sandy loam A_1 horizon rich in organic matter is sometimes, but not always, present and the A_2, although well defined, is seldom more than 3 inches deep. It has a sandy loam texture and a poorly developed sub-angular blocky structure. A few fine yellow and grey mottles, indicating restricted drainage, are frequently observed where the underlying iron pan is well developed. The B_2 is commonly a loamy sand, again with a weak sub-angular blocky structure and loose consistence. A few faint ochreous mottles are usually noticeable. In the B_3 the texture is less coarse—sandy loam, the structure alters to coarse platy and it is invariably indurated. The C horizon has a structure and texture similar to that of the B_3 but is less indurated and nearly always lighter in colour.

The series has been placed in the peaty podzol with iron pan group.

NOTE ON AGRICULTURE. The high rainfall and hilly topography of the series area give rise to poor agricultural conditions. Rough grazing is provided on the hill slopes for sheep and a few cattle.

DISTINKHORN SERIES

In the hilly moorland country in the vicinity of the Distinkhorn, high rainfall (50-60 inches) and low temperatures combine with low relative relief to make the area a peat-forming region. It is in this area, on a few small scattered sites where a fairly rapid increase in slope causes thinning of the deep peat blanket, that the Distinkhorn series is recognised. A substantial peaty top and sub-surface horizons showing the effects of poor drainage are the principal features of the series.

GENERALISED PROFILE DESCRIPTION

SLOPE moderate
ASPECT east
ALTITUDE 1,200 feet
VEGETATION *Eriophorum vaginatum, Vaccinium myrtillus, Deschampsia flexuosa, Calluna vulgaris, Molinia caerulea, Polytrichum* sp., *Sphagnum*, spp.
DRAINAGE CLASS poor

Horizon	*Depth or Thickness*	
L	½″	Litter.
F	½″	Partially decomposed litter.
H	10″	Black (10YR2/1) very wet, greasy humus.
A_1	0-7″	A boulder pavement, consisting of both large and small sub-angular boulders—granodiorite and sandstone (Downtonian and Old Red Sandstone) in a matrix of a dark brown humified loam. Sharp change into
A_2g	7-15″	Light grey (10YR7/2) sandy clay loam, weak medium sub-angular blocky, wet, slightly plastic, organic matter low, roots occasional, few stones—granodiorite and sandstones, few fine faint ochreous mottles, grey gleying intense. Sharp change into
B-Cg	15-24″	Light brown (7·5YR6/4) sandy loam to sandy clay loam, platy, moist, firm, slightly indurated, many large and small granodiorite stones, roots occasional, few fine faint ochreous mottles, no grey mottles.

The H horizon is invariably a wet greasy peat beneath which there is an unusual A_1 consisting of large and small sub-angular boulders, the interstices filled with a dark brown sandy loam, rich in organic matter. The A_2g has a sandy clay loam texture, a weak sub-angular blocky structure and a slightly plastic

consistence. Ochreous mottling is normally slight but grey gleying is quite marked. In the B-Cg horizon the parent material colour is apparent. This horizon is a sandy clay loam, with a rather weakly developed platy structure and slight induration. Many granodiorite stones of varying size are usually noted. There may be a little ochreous mottling but grey colours are seldom seen.

The profile characteristics of this soil conform to those of a surface-water peaty gley.

NOTE ON AGRICULTURE. The proportion of this series under cultivation is negligible as it is confined almost entirely to wet moorland areas. These support an *Eriophorum*-dominant vegetation which provides an "early bite" for sheep.

HARDHILL SERIES

The Hardhill series is always a minor member of any drainage sequence. It is contained within a small area of depressed relief in the Renfrew and Lanfine Plateaux and the northern part of the Distinkhorn Hills. Resulting from its location the upper horizons of the profile are frequently colluvial in character and the parent material is very often water-modified; although the series occurs almost entirely in peat-forming regions it is probably the presence of a high permanent ground-water table which has most influence on its development. The drainage class is very poor.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	1,000 feet
VEGETATION	*Juncus acutiflorus, Juncus effusus, Agrostis tenuis, Agrostis canina, Trifolium repens, Holcus mollis.*
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-8″	Very dark brown (10YR2/2) humified loam, greasy to touch, no stones, roots abundant. Sharp change into
Bg	8-20″	Grey-brown (10YR5/2) sandy loam to sandy clay loam, massive, slightly plastic and sticky, organic matter low, few stones, roots occasional, few medium distinct mottles, generally gleyed throughout; merging into
Cg	20-28″	Grey (10YR5/1) sandy clay loam, massive, plastic and sticky, roots rare, stones few, intensely grey gleyed, well-defined iron tubes around root channels.

One of the principal differentiating features of this series is the humified loam surface horizon. The Bg has a texture ranging from sandy loam to sandy clay loam and a structure which tends to be prismatic but is generally poorly defined as it is wet and sticky. Grey colours are pronounced throughout the horizon. A sandy clay loam texture, a sticky massive structure and an intense development of grey colouring typify the Cg horizon.

The Hardhill series has been grouped with the humic gley soils.

NOTE ON AGRICULTURE. This series has little agricultural importance, being restricted to drainage channels and depressions which are almost permanently waterlogged.

LARGS ASSOCIATION

This association is relatively small, its total area being 11 sq. miles, but

wide variations in topography and climate occur throughout the limited area it occupies, and correlated with these variations are great differences in the characteristics and properties of the soils. Some series of this association form part of the best agricultural land of North Ayrshire, whilst others can be classed with the poorest.

Distribution

The association occurs in two distinct and widely separated parts of the map, the north-west and south-east. In the former area the eastern margin between Largs and Gill Hill, the southernmost height of the Crosbie Hills, coincides with the top of the Renfrew Plateau Scarp, apart from a long narrow strip which follows the course of the Caaf Water to the lower reservoir. Southwards from Gill Hill the association embraces the western side of the Knockewart Hills, Haupland Moor, and the low ground south of the Rowanside Hills to Ardrossan. The western boundary is determined by the coastal raised beach deposits, which isolate a very small area of the association around Goldenberry Hill near Portencross. On several hill tops in the West Kilbride district and on narrow ridges north of Glentane Hill soils of the Darleith association interrupt the continuity of this association. On the Kyle Upland it is confined largely to a belt about $\frac{1}{2}$-1 mile wide bordering Brown's Muir and Mean Muir.

Parent Material

The parent material in the Ardrossan-Largs area is a reddish brown till derived from Old Red Sandstone sediments. Its stone content is usually low but in the district to the north of Glen Burn quartz pebbles are very common, exposures of the parent rock hereabout providing evidence of their origin. Differences in the depth and texture of the till are closely allied to topography in that on the steep slopes in the hilly regions it is shallow with a sandy loam texture, in contrast to the areas of more subdued relief where it is normally deeper and textures to a sandy clay loam. In the Kyle Upland area the infrequency of rock exposures and the predominance of an undulating topography are indications of a deep till mantle. Shallow till only occurs on Tulloch Hill south-east of Darvel and as a border to several streams which cut deeply into the parent rock. The till in this area is derived from a mixture of Upper and Lower Old Red Sandstone; it is fairly stone free and usually has a sandy clay loam to clay loam texture.

Topography

Steep slopes are frequently encountered in the hilly region between Crosbie and Largs and south-eastwards from West Kilbride, whilst the topography of the remainder of the association is rolling and this area is regarded as being part of the Lowland Transition Zone. The altitude varies from approximately 100 feet in the coastal areas to 1100 feet at the saddle between Lairdside and Kaim Hills in the north and 600 feet at Haupland Moor in the south. On the Kyle Upland the topography is undulating and the altitude range is 800-900 feet.

Climate

In the north-west the proximity of the association to the sea and the rapid increase in altitude cause a wide variation in rainfall, from 35 inches on the

lower ground to 60 inches+ at the top of the Renfrew Plateau Scarp. In the south-east, however, on the gently sloping ground bordering Mean Muir and Brown's Muir, the rainfall, although fairly high, is within the narrow limits of 45-50 inches.

Soils

The Largs association was originally named Kirkland after the farm on which it was first recognised, but as the survey progressed similar soils were mapped at Largs and this name was considered more suitable. Five soil series have been recognised in this association, but only in the north-western area do they form a complete unit. In this area the ground rises steeply and there is an appreciable increase in rainfall with altitude (35-60 inches). This marked difference in rainfall has a considerable influence on the soil in that the lower ground is dominated by mineral soils whilst on the higher land there is a preponderance of organo-mineral soils. The boundary between these two broad divisions coincides roughly with the 45 inch isohyet. There are instances, however, when it is apparently determined by the maximum altitude of cultivation and the climatic factor cannot therefore be regarded as solely responsible for this "vertical zonality".

Within each of these areas the distribution of the soil series is allied to slope and to the texture of the parent material. On the lower ground the series with imperfect internal drainage predominates. In general, the poorly drained soils occupy the depressions and water channels but there are a few instances of excessively waterlogged sites caused by either the impervious nature of the subsoil or the high level of the permanent ground-water table, where very poorly drained soils with humified surface horizons have developed.

Peaty podzols with iron pan occur throughout the higher ground on the free to imperfectly drained steep slopes and hill tops where textures finer than sandy loam are seldom encountered. Peaty gleys are limited to the more moderate slopes where the till is deeper and usually has a sandy clay loam texture. In the wet flushes and drainage channels the organic material composing the surface horizons is nearly always highly humified and frequently amounts to an organic mud.

Around Mean Muir and Brown's Muir south-east of Darvel the parent material is uniformly sandy clay loam to clay loam and differences in relative relief are small. There is a very gradual increase in altitude towards the moorland area and consequently the rainfall, though high, varies very little. Under these conditions changes in soil characteristics are infrequent and are never sharply defined. Poorly drained gley soils dominate the area, with peaty gleys adjoining the extensive peat moorlands. Free to imperfectly drained soils occur on isolated patches of the coarse textured till which borders a few streams and covers Tulloch Hill. Generally a peaty podzol with iron pan is developed on these sites.

Series

LARGS SERIES

The Largs series is the most extensive of the association and is located on the lower slopes of the Renfrew Plateau Scarp and between West Kilbride and Ardrossan in the Lowland Transition Zone. The reddish brown till upon which it is developed has usually a sandy clay loam texture and is relatively stone free, except in the area north of Glen Burn, already referred to, where

quartz pebbles are prevalent. Most of the series is imperfectly drained but occasionally the parent rock comes close to the surface and the subsoil has a sandy loam texture, and on these sites, which however have not been delineated, drainage is free.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate
ASPECT	south-west
ALTITUDE	400 feet
VEGETATION	*Agrostis tenuis, Ranunculus repens, Trifolium repens, Poa trivialis, Anthoxanthum odoratum, Poa pratensis.*
DRAINAGE CLASS	imperfect

Horizon	*Depth or Thickness*	
S	0-10″	Reddish brown (5YR4/3) sandy loam, medium crumb, loose, organic matter moderate, few Old Red Sandstone pebbles, roots abundant, no mottling. Sharp change into
B_2(g)	10-16″	Light reddish brown (2·5YR6/4) sandy clay loam, medium sub-angular blocky, friable, organic matter low, few Old Red Sandstone pebbles, roots frequent, frequent fine faint mottles of yellow and orange. Sharp change into
B_3(g)	16-22″	Reddish brown (2·5YR4/4) sandy clay loam, fine sub-angular blocky, indurated, few Old Red Sandstone and quartz pebbles, roots occasional, few fine faint mottles of yellow and orange; merging into
C(g)	22-36″	Reddish brown (2·5YR4/4) sandy clay loam, medium to coarse platy, slightly indurated, stone content as above, roots rare, no grey mottles.

The surface horizon is without exception a sandy loam with a moderate crumb structure and a loose to friable consistence. A sandy clay loam texture and sub-angular blocky structure are associated with the B_2(g) together with moderate ochreous mottling; frequently black manganese stains occur on the faces of peds. Although the B_3(g) horizon has a sandy clay loam texture, the clay content is normally 1-2% lower than in the B_2(g). The horizon has a sub-angular blocky structure, with the degree of induration varying between slight and moderate. There is a decrease in both size and frequency of ochreous mottles as compared with the B_2(g) and grey colours are never pronounced. Again pseudo-concretions of manganese may be present. The C(g) horizon is a sandy clay loam with a coarse platy structure in which the gley characteristics are less evident.

The series is classified as a brown forest soil of low base status with gleyed B and C horizons.

NOTE ON AGRICULTURE. Throughout the series conditions are favourable for arable farming and though dairy farming is the rule, a good deal of cropping is done. Wheat and timothy hay are grown, and turnips and potatoes are generally a success. Indeed, early potatoes are the mainstay of the small holdings on Goldenberry Hill between Portencross and Hunterston House. After the potato crop Italian rye grass or rape is sown and later ploughed in to maintain the organic matter content, but on the larger farms this crop is grazed. Hay and pasture with good development of clover are successfully grown. Much of the ground is moderately sloping and drainage difficulties are seldom encountered.

KELBURN SERIES

In the north-west the Kelburn series is a minor component of the association, being limited to depressions and drainage channels, but in the Auchmannoch Moor area in the south-east it is the most widespread series. It is developed on a brown to red-brown sandy clay loam to clay loam till which is usually deep and contains a few stones, most of them highly weathered. When located in depressions or drainage channels the upper horizons of the profile are often influenced by alluvial material. Around Auchmannoch Moor the soil is poorly drained, the result, in this instance, of the combined influence of the gently undulating topography, the somewhat higher rainfall (40-45 inches), and the clayey nature of the subsoil; in other areas poor drainage is due mainly to low relief.

GENERALISED PROFILE DESCRIPTION

SLOPE	gentle
ASPECT	west
ALTITUDE	800 feet
VEGETATION	*Juncus effusus, Ranunculus repens, Alopecurus geniculatus, Cynosurus cristatus, Trifolium repens, Agrostis* spp., *Anthoxanthum odoratum, Poa pratensis.*

Horizon	*Depth or Thickness*	
S	0-10″	Grey-brown (10YR5/2) sandy clay loam, weak medium sub-angular blocky, friable, organic matter moderate, roots abundant, a few well-rounded Old Red Sandstone pebbles —some highly weathered, frequent fine distinct mottles along root channels. Sharp change into
B_2g	10-19″	Brown (7·5YR5/2) clay loam, medium prismatic, plastic, organic matter low, few stones—mainly Old Red Sandstones —nearly all highly weathered, roots occasional, many medium and prominent ochreous and grey mottles—the latter marked around stones and on faces of peds; merging into
B_3g	19-25″	Brown (7·5YR5/4) clay loam, massive, plastic, stone content as above, roots occasional, frequent medium prominent mottles of ochre and grey—the latter marked around stones and down large cracks, well-defined iron tubes along root channels; merging into
Cg	25-36″	Brown (7·5YR5/4) clay loam—more loamy than horizon above, massive, slightly plastic, few stones, roots rare, mottles greatly reduced but iron tubes around roots well-developed.

A sandy clay loam texture and a weak sub-angular blocky structure are usually associated with the surface horizon. Roots are abundant and there are nearly always rusty mottlings along the channels. An A_2g horizon is sometimes present which is rather heavily grey gleyed and frequently coarser textured than the horizon immediately below. The absence of this horizon in the profile described is probably due to cultivation. Features of the B_2g other than the clay loam texture are the coarse prismatic structure and plastic consistence. Ochreous and grey mottles are very evident. The B_3g differs from the B_2g by virtue of its massive structure and the presence of well-defined iron tubes around root channels. In the Cg horizon the texture and structure are comparable to those of the B_3g and iron tubes persist. Ochreous and grey mottles, characteristic of gley conditions, are greatly reduced.

The series is classed as a surface-water non-calcareous gley.

NOTE ON AGRICULTURE. Dairy farming is the chief agricultural activity. Apart from cultivation of a little oats and roots most of the series is devoted to long leys in grass which can best be described as "*Juncus* meadow". Improvement would be difficult as the level to very gentle slopes are a serious obstacle to adequate drainage.

HAUPLAND SERIES

The Haupland series occurs on the drier sites of the higher ground between Largs and Haupland Moor. It is developed on shallow, light reddish brown, sandy loam till, rarely containing many stones. High rainfall (50 inches) and the acidic nature of the parent material are responsible for a well-developed A_0 horizon. Though this series is located in areas where the till is either freely or imperfectly drained, the presence of an iron pan sometimes causes serious impedance in the surface horizon.

GENERALISED PROFILE DESCRIPTION

SLOPE moderately steep
ASPECT north
ALTITUDE 950 feet
VEGETATION *Calluna vulgaris, Carex nigra, Vaccinium myrtillus, Nardus stricta.*
DRAINAGE CLASS free beneath the iron pan

Horizon	*Depth or Thickness*	
L	1″	Litter.
F	½″	Fibrous organic matter.
H	8½″	Very dark grey-brown (10YR3/2) greasy organic matter.
A_1	0-3″	Very dark grey-brown (10YR3/2) humified sandy loam, weak crumb, roots abundant. Sharp change into
$A_2(g)$	3-5″	Dark brown (10YR3/3) loamy sand, structureless, organic matter moderate, very few stones, roots frequent, frequent fine distinct rusty mottles along root channels, few grey mottles.
B_1	at 5″	Thin iron pan
B_2	5-10″	Strong brown (7·5YR5/6) sandy loam, weak fine to medium prismatic, friable, organic matter low, roots occasional, few stones, few fine faint yellow and orange mottles, no grey mottles. Sharp change into
B_3	10-18″	Light reddish brown (5YR6/3) sandy loam, structureless, slightly indurated, few stones, roots rare, very few faint mottles of yellow and orange; merging into
C	18-25″+	Light reddish brown (5YR6/3) sandy loam—slightly finer than horizon above, faint signs of lamination, slightly indurated, few stones, roots rare, no mottling.

The A_0L layer varies greatly in thickness and has been observed as thin as 1 inch. It is always peaty, moist to wet and greasy to the touch. An A_1 is commonly present with a sandy loam texture and very weak crumb structure. The A_2 is very well defined and usually has a loamy sand texture. Where the iron pan is well formed and impervious the lower part of the A_2 bears evidence of gleying, usually in the form of yellow and orange mottles. A dense root mat may also be present immediately above the iron pan. Strong brown colours are a feature of the B_2 horizon. It has a sandy loam texture, a weak prismatic structure and a few faint ochreous mottles may be observed. The B_3 has a similar texture, but is structureless and light reddish brown in colour. Slight induration is normally found and also a few faint yellow and orange mottles. In the sandy loam C horizon weak lamination is discernible and there may also be a slight degree of induration.

This series has been identified as a peaty podzol with iron pan.

NOTE ON AGRICULTURE. The series occupies *Calluna* moorland areas, but in places there is evidence of past cultivation, for instance, on the western slopes of Haupland Moor where rudimentary peaty podzols, sometimes with iron pan, are to be found. These never occupy more than the top three to four inches of the profile and are underlain by twelve inches or more of uniformly brown sandy loam. This horizon, which has a moderate organic matter content, appears to be an old S horizon; beneath it there may be a second iron pan. As there is a reasonable depth of soil and drainage tends to be imperfect on much of the west-facing slopes of Haupland Moor, cultivation could probably be undertaken. Generally, however, sheep and cattle are grazed on the steep and rough hill slopes, the topography and shallowness of the soil combining to produce unsatisfactory agricultural conditions.

REOCH SERIES

The only area of the Reoch series which is of any consequence borders Auchmannoch Moor south-east of Darvel. Developed on a weak red sandy clay loam till, on gently sloping ground and under a rainfall approaching 45 inches, this soil is characterised by a peaty surface horizon. The series is actually transitional between the poorly drained gley soil, the Kelburn series, and the Auchmannoch Moor peat. The drainage is poor, tending to very poor in patches.

GENERALISED PROFILE DESCRIPTION

SLOPE	gentle
ASPECT	west
ALTITUDE	350 feet
VEGETATION	*Calluna vulgaris, Nardus stricta, Juncus squarrosus, Vaccinium myrtillus.**
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
L	$\frac{1}{2}''$	Litter.
H	3″	Dark brown (7·5YR3/2) greasy organic matter.
A_1g	0-8″	Brown (7·5YR5/2) loamy sand, weak crumb, friable, organic matter low—confined to numerous brown stains and blotches, stones absent, roots abundant, many distinct rusty mottles along root channels and many distinct grey mottles throughout. Sharp change into
A_2g	8-14″	Strong brown (7·5YR5/6) loamy sand, very weak sub-angular blocky, friable, organic matter low, few quartz pebbles, roots occasional, many coarse prominent yellow and orange and grey mottles. Sharp change into
Bg	14-25″	Light reddish brown (2·5YR6/4) sandy clay loam, medium prismatic, plastic, roots occasional, few highly weathered sandstones, many medium prominent mottles of ochre and grey—the latter heavy on faces of peds and around stones, well-formed iron tubes around root channels; merging into
Cg	25-36″	Weak red (10R5/4) sandy clay loam, medium prismatic—fading to massive, slightly plastic, roots rare, few stones, ochreous and grey mottles greatly reduced but grey gleying fairly intense around a few old roots and the few stones.

*Typical pasture on this series: *Juncus effusus, Trifolium repens, Agrostis tenuis, Poa pratensis, Ranunculus repens, Sagina procumbens.*

A brown loamy sand A_1g horizon underlies the peaty surface soil. It has a weak crumb structure and is always stained with humus. Distinct rusty mottlings surround the abundant root channels and grey mottles occur throughout. The A_2g is frequently strong brown in colour, texturing to a loamy sand, with a weak subangular blocky structure. Yellow, orange and grey mottles are prominent. A light reddish sandy clay loam, a medium prismatic structure and a plastic consistence are features of the Bg horizon. Grey colours predominate on the faces of the peds and are also found around the stones. Ochreous mottles are prominent and well-formed iron tubes are present around roots. The texture of the Cg horizon is similar to that of the Bg as is the initial structure which, however, rapidly fades to massive. The iron tubes continue in the Cg but both ochre and grey mottles are reduced, the latter being restricted to old root channels and surfaces in contact with stones.

The series is recognised as being a surface-water peaty gley.

NOTE ON AGRICULTURE. Poor drainage and adverse climatic conditions give this series a low agricultural rating. It supports a wet grass meadow type of vegetation, with *Juncus* spp. a perpetual pest.

CROSBIE SERIES

Occurring in drainage channels and depressions, mainly at the higher altitudes, the Crosbie series is practically always a minor member of any hydrologic sequence. As the parent material is frequently water-sorted, the texture is variable. The series is very poorly drained, and in parts is developed under virtually permanently waterlogged conditions.

GENERALISED PROFILE DESCRIPTION

SLOPE: level

ASPECT: nil

ALTITUDE: 350 feet

VEGETATION: *Juncus effusus, Juncus acutiflorus, Anthoxanthum odoratum, Agrostis canina, Luzula multiflora, Rumex acetosa, Carex nigra, Rhytidiadelphus squarrosus.*

DRAINAGE CLASS: very poor

Horizon	*Depth or Thickness*	
S	0-10″	Very dark brown (10YR2/2) humified sandy loam, greasy to touch, no stones, roots abundant. Sharp change into
Bg	10-18″	Light brown-grey (10YR0/2) loamy sandy to sandy loam, structureless, organic matter low—confined to a few humus stains, roots occasional, stones few, few medium distinct ochreous mottles, generally grey gleyed throughout; merging into
Cg	18-24″	Light brown-grey (10YR6/2) sandy clay loam, massive, plastic, very wet and sticky, roots rare, stones few, well-defined iron tubes round root channels, heavily grey gleyed throughout.

One of the most striking and recurring features is the highly humified sandy loam surface horizon. The Bg is usually a very wet sandy loam with a poorly defined structure. In the profile described, the Cg horizon consists of sandy clay loam with a massive structure and a sticky plastic consistence. Gleying is so intense in this horizon that the original parent material colour is obliterated.

This soil has been classed as a ground-water humic gley.

NOTE ON AGRICULTURE.The series carries a herbaceous marsh type of vegetation; being restricted to narrow channels and depressions it is of little agricultural importance.

MAUCHLINE ASSOCIATION

The Mauchline association was first distinguished when mapping, for reasons of continuity, a strip about one mile wide on the northern margin of Sheet 14. It is the smallest association within Sheet 22, occupying slightly less than $\frac{1}{2}$ a square mile and containing only two series, the Mauchline and the Fail. The former is classed as imperfectly drained and the latter as poorly drained.

DISTRIBUTION

The association falls almost entirely within Sheet 14 but a narrow strip overlaps the sheet boundary on the Mossgiel ridge near Millburn and there is a small patch to the north of Fail.

PARENT MATERIAL

Although the association is developed essentially on a sandy clay loam to clay loam till derived from New Red Sandstone deposits, igneous pebbles are fairly common. From the frequency of rock outcrops it is probable that the till mantle is not very deep.

TOPOGRAPHY

The surface configuration is undulating near Fail and rolling near Millburn.

CLIMATE

On Sheet 22 the Mauchline Association lies towards the lower end of the 40-45 inch rainfall range.

SOILS

The intermediate texture of the parent material, the moderate rainfall and favourable topography result in the predominance of imperfectly drained soils with a high agricultural rating. These soils fall into the category of moderately light loam soils developed on boulder clay over lavas and sediments of various ages described by Berry *et al* (1930). Poorly drained units within the association are confined to a few drainage channels and to the level ground south-west of Fail Loch.

Series

MAUCHLINE SERIES

This is the larger series in both the Fail and Millburn districts. As the series is formed on a reddish brown sandy clay loam till and occurs on either undulating or rolling ground, the internal soil-water relations are always within the range of the imperfectly drained class. A commonly occurring feature of the soil profile is a sharp change in texture from sandy loam to sandy clay loam between 12 and 18 inches. It is not clear, however, whether this phenomenon is of pedological or geological origin.

GENERALISED PROFILE DESCRIPTION

SLOPE	gentle to moderate
ASPECT	south
ALTITUDE	350 feet
VEGETATION	*Poa trivialis, Ranunculus repens, Ranunculus acris, Bellis perennis, Holcus lanatus, Lolium perenne Trifolium repens.*
DRAINAGE CLASS	imperfect

Horizon	*Depth or Thickness*	
S	0-10″	Light brown (7·5YR6/4) sandy loam, weak medium crumb, friable, organic matter moderate, roots frequent, few stones, no mottling. Sharp change into
B_2(g)	10-19″	Reddish yellow (5YR6/6) sandy loam, fine sub-angular blocky, friable, organic matter low, roots occasional, occasional igneous pebbles and few weathered sandstones, frequent fine distinct yellow-orange mottles and few fine faint grey mottles. Sharp change into
B_3(g)	19-28″	Light reddish brown (5YR6/4) sandy clay loam, tending to massive, weakly indurated, roots rare, stony—mainly weathered sandstones, frequent fine distinct yellow-orange mottles, very few fine faint grey mottles. Sharp change into
C(g)	28-36″	Reddish brown (5YR5/4) sandy clay loam, medium platy, slightly indurated, stony—small weathered sandstones and occasional igneous pebbles, few fine faint ochreous mottles, many pseudo-concretions of manganese.

The S horizon consists invariably of a friable sandy loam with a weak crumb structure. It is underlain by a B_2(g) horizon with a textural range from sandy loam to sandy clay loam, that of the modal profile being sandy loam. The structure is sub-angular blocky and the consistence friable. A few weathered sandstones are usually present and occasionally igneous pebbles. Ochreous colours are more distinct than grey. A sandy clay loam texture, a massive structure and slight induration are characteristics of the B_3(g). In the relative intensity of ochreous and grey mottles it resembles the B_2(g). The reddish brown colour of the parent material is apparent in the C(g) horizon which has a medium platy structure, is slightly indurated and usually stony. Ochreous mottling is slight and grey mottling is seldom in evidence. Pseudo-concretions of manganese which are associated in Ayrshire with the imperfectly drained class are a common feature of the C(g) horizon.

This soil has been grouped with the brown forest soils of low base status with gleyed B and C horizons.

NOTE ON AGRICULTURE. Although dairy farming is the principal activity, cropping is often carried out. Wheat and timothy are grown, and potatoes and turnips are normally successful crops. Good hay and pasture are also achieved on this land.

FAIL SERIES

This series is confined to localities with depressed relief, the largest lying immediately north of Fail on the southern boundary of the map. It is developed on a reddish brown sandy clay loam to sandy clay till and the drainage class is poor.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	300 feet
VEGETATION	*Agrostis tenuis, Trifolium repens, Ranunculus repens, Anthoxanthum odoratum, Juncus effusus.*
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
S	0-9″	Brown (10YR5/3) loam, weak fine to medium sub-angular blocky, friable, organic matter moderate, roots abundant, few stones, frequent fine distinct mottles along root channels, faces of peds generally dull. Sharp change into
B_2g	9-17″	Brown (10YR5/2) sandy clay loam, coarse prismatic, slightly plastic, organic matter low, roots frequent, few stones, many coarse prominent yellow-orange mottles and many medium distinct grey mottles, particularly on faces of peds and around stones; merging into
B_3g	17-25″	Reddish brown (5YR5/3) sandy clay loam to sandy clay, weakly coarse prismatic to massive, slightly plastic, roots occasional, few stones, frequent coarse prominent ochreous mottles, large cleavage faces completely grey, well-defined iron tubes along root channels; merging into
Cg	25-33″	Reddish brown (5YR5/3) sandy clay, massive, slightly plastic, few stones, roots rare, ochreous colour less evident, iron tubes persist around roots, cleavage faces intensely grey.

A loam texture, a structure which tends to be weak fine to medium sub-angular blocky, and distinct rusty mottles around the roots are typical features of the surface horizon. The B_2g is distinguished by a sandy clay loam texture, a coarse prismatic structure and numerous yellow-orange mottles. Grey colours cover the faces of the peds and the stone-matrix interfaces. The reddish cast of the parent material becomes obvious in the B_3g as the yellow-orange mottles decrease in number although not in intensity. Grey colours, however, completely mask the faces of the large cleavages and iron tubes occur around roots. This horizon has a sandy clay loam to sandy clay texture and weakly prismatic to massive structure. A massive structure is also a characteristic of the Cg horizon which normally textures to sandy clay or clay loam. Iron tubes are present and the faces of the large cleavages continue grey.

This series has been classified as a non-calcareous surface-water gley.

NOTE ON AGRICULTURE. Because of the poor drainage of the series the acreage devoted to cropping is very much less than on the Mauchline series. Long leys in grass are the general practice.

REPPOCH ASSOCIATION

The Reppoch association was encountered and characterised when mapping an overlap on Sheet 23 (Hamilton) for purposes of continuity and it does little more than encroach on Sheet 22, in the extreme south-eastern corner. The district in which it occurs is high-lying and exposed, and experiences a high rainfall; consequently the majority of the soils have peaty surfaces and the association is surrounded for the greater part by deep peat deposits.

DISTRIBUTION

The association is made up of several small blocks, involving Auchinlongford Hill, Glen Garr, and Blackside Hill which lie in the southern portion of the Distinkhorn Hills in the south-eastern corner of the map.

PARENT MATERIAL

The parent material is a brown to reddish brown till derived from Downtonian Sandstone, but although this till covers a fairly large area its function as a soil parent material is greatly restricted by the deep peat mantle which

dominates the Kyle Upland. Variations in the texture and especially in the depth of this till deposit are closely related to the topography. On the steep sloping ground of Auchinlongford Hill, Pepper Knowe, Wedder Hill and Glen Garr the till is very shallow, less than 18 inches, and textures are usually sandy loam. In these locations there are many exposures of the parent rock, while boulders (mainly of Downtonian Sandstone but occasionally of granodiorite) are commonly strewn over the surface. On the lower-lying and less steeply sloping ground above Auchinlongford, bordering the Cleuch Burn and between the farms of Blackside and Blacksidend, the till is a much deeper and more clayey deposit with sandy clay loam or sandy clay textures predominating.

Topography

Most of the area has a hilly relief and falls within the Distinkhorn Hills unit of the Kyle Upland. Only a small portion lies within the Auchmannoch Moor unit. The altitude ranges from 700 feet at the intersection of the Cleuch Burn with the southern boundary of the map, to 1403 feet at Glen Garr, the highest point in the Blackside Hills.

Climate

The high-lying area occupied by this association is exposed to rather severe weather, with an average annual rainfall in the 45-50 inch zone.

Soils

Although the association is contained within a comparatively small area, four component soil series have been recognised. The wide differences in slope, commonly accompanied by less pronounced but significant differences in the till texture, are primarily responsible for the marked changes in the soil profile morphology. The climatic conditions of the district promote the accumulation of organic matter, three of the four series mapped there having either peaty or humified surface horizons. On the steeper slopes and knolls of the higher ground where the till is shallow, sandy textured, and very often stony, the internal soil drainage is normally free. Peaty podzol soils, the Glen Garr series, are common on these sites and the profiles for the most part exhibit a thin well-developed iron pan. On the lower-lying and less steeply sloping land of the Blackside Hill mass where the deeper and more clayey till has accumulated, two soil series have been recognised. Both have poor internal drainage but are differentiated by the organic matter content of the surface horizon; the Cleuch series has a mineral top soil whereas that of the Reppoch series is peaty. The fourth series, the Cawdron is limited to several deep depressions and is classed as very poorly drained.

Series

CLEUCH SERIES

The Cleuch series is the only representative of the association which does not have a highly organic surface horizon. It almost entirely covers the cultivable land at Blacksidend Farm. A reddish brown sandy clay loam till (27-30% clay) containing only a few stones, mainly well weathered, comprises the parent material. The ground is gently to moderately sloping and the drainage class is poor.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate
ASPECT	south-west
ALTITUDE	850 feet
VEGETATION	*Juncus effusus, Agrostis tenuis, Trifolium repens, Ranunculus repens, Anthoxanthum odoratum, Holcus lanatus.*
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
S	0-9″	Grey-brown (10YR5/2) sandy clay loam, weak fine sub-angular blocky, friable, organic matter low, few stones, roots abundant, distinct to prominent rusty mottles along root channels. Sharp change into
A_2g	9-11″	Light brown-grey (10YR6/2) sandy clay loam, weak fine to medium sub-angular blocky, slightly plastic, organic matter low, roots frequent, few stones, frequent fine prominent ochreous mottles, many coarse faint to distinct grey mottles, faces of peds grey coloured. Sharp change into
Bg	11-26″	Yellowish brown (10YR5/6) sandy clay loam, massive, plastic, roots occasional, few highly weathered stones, frequent medium to coarse distinct ochreous mottles, many fine to medium distinct grey mottles, cleavage faces completely grey in colour; merging into
Cg	26-40″	Reddish brown (5YR5/4) sandy clay loam, massive, slightly plastic, roots rare, few stones, few fine faint ochreous mottles decreasing with depth, faces of cleavages intensely grey coloured.

The surface horizon has a sandy loam texture and a sub-angular blocky structure which is by no means clearly defined. The consistence is friable and distinct rusty mottling along the root channels is another typical feature. The A_2g is readily recognised by its greyish colour. The sub-angular blocky structure is poorly expressed as in the S horizon, and the texture is unaltered. Ochreous and grey mottles are always present, the latter being larger and more numerous. A yellowish brown colour is a feature of the Bg. The texture is generally sandy clay loam but sandy clays have been recorded. A massive structure and plastic consistence are other outstanding features. Stones are few and the majority are highly weathered. Both ochreous and grey mottling are very marked whilst the faces of the large cleavages which appear for the first time in this horizon are completely grey. The texture and structure of the Cg are similar to those of the Bg; the consistence, however, is less plastic. One of the more significant differences is the appearance in this horizon of the reddish brown colour of the parent material. This is largely due to an appreciable decrease in both ochreous and grey mottling, only the intensely grey gleyed faces of the large structural cracks remaining unaltered.

The Cleuch series is classified as a surface-water non-calcareous gley soil. NOTE ON AGRICULTURE. Hay and roots are grown to provide winter keep for the sheep which are the principal agricultural concern of this district, but in view of the poor drainage of the soil and the adverse climatic conditions even this limited cropping must prove hazardous in some seasons.

GLEN GARR SERIES

The Glen Garr is the largest series of the association and is located on the steep slopes and knolls of the hilly moorland ground. On these sites the soil parent material is a shallow reddish brown till, usually with a sandy loam

texture (19-20% clay) and frequently stony. A characteristic of the series is the development of a thick peaty A_0 horizon, a product of the climatic conditions of the region combined with the acidic nature of the parent material. In a few scattered patches the till is absent and this peaty horizon overlies the Downtonian Sandstone rock, which may be either unfissured or highly fissured; these very small areas of skeletal soil have not been delineated. As mentioned previously, boulders are common on many of the sites; these are mostly of Downtonian Sandstone origin but sometimes granodiorites and sandstones (Old Red Sandstone) are noted. An iron pan is a usual feature of the soil profile and the drainage class, below the iron pan at least, is always free.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate .
ASPECT	south
ALTITUDE	950 feet
VEGETATION	*Calluna vulgaris, Nardus stricta, Festuca ovina, Deschampsia flexuosa, Agrostis canina, Anthoxanthum odoratum, Pleurozium schreberi, Polytrichum commune, Rhytidiadelphus squarrosus.*
DRAINAGE CLASS	free below the iron pan

Horizon	*Depth or Thickness*	
L	1″	Litter.
F	1½″	Partially decomposed litter.
H	10½″	Black (5YR2/1) greasy humus.
A_2	0-4″	Brown (7·5YR5/2) sandy loam, weak very fine to fine sub-angular blocky, slightly plastic, organic matter moderate, abundant roots, few sandstones, few fine faint ochreous mottles towards base.
B_1	at 4″	Thin continuous iron pan.
B_2	4-8″	Strong brown (7·5YR5/6) sandy clay loam, weak fine to medium sub-angular blocky, friable, organic matter low, roots rare, few small pebbles, few fine faint ochreous mottles. Sharp change into
B_3	8-13″	Brown (7·5YR5/4) sandy clay loam, weak fine platy, friable, slightly indurated *in situ*, roots rare, few stones, negligible ochreous mottling; merging into
C	13-24″	Reddish brown (5YR5/3) sandy loam, moderate fine platy, friable, indurated *in situ*, few sandstones, no mottling.

An H layer is invariably present, varying in thickness from 2 to 12 inches with the latter end of the range the more common. The A_2 horizon may also vary somewhat; there may be abundant evidence of gleying in some profiles and very little in others. A sandy loam texture, a fine sub-angular blocky structure, and a friable or slightly plastic consistence are typical. A root mat is frequently present at the base of this horizon, the roots being unable to penetrate the iron pan forming the B_1 horizon. This iron pan is usually continuous but there are places, for example, immediately above Auchinlongford Farm, where it is not well developed, and the whole profile appears to be a rather rudimentary peaty podzol. If a stone lies across the A_2, B_1 and B_2 transitions then in all probability the iron pan will continue through the stone and that portion lying above the pan will have the typical bleached appearance of the A_2. The continuity of these A_2 and B_1 horizon features in stones is not limited to this series but is of widespread occurrence. The B_2 has usually a strong brown colour with a sandy loam to sandy clay loam texture and a poorly defined sub-angular blocky structure. Slight ochreous mottling is sometimes

present but is never sufficient to justify the classification of the drainage as imperfect. The transition to the B_3 is accompanied by a change in structure to fine platy and there are generally some signs of induration *in situ*. In the reddish brown coloured C horizon the texture is frequently coarser, sandy loam, but the platy structure persists and also the slight induration.

The series has been recognised as a peaty podzol with iron pan.

NOTE ON AGRICULTURE. The series occupies hilly areas mainly dominated by heather which provide useful grazing for sheep. In some parts the iron pan seriously impedes the vertical movement of water in the upper horizons; this could be improved by rupture of the pan.

REPPOCH SERIES

The Reppoch series consists of only one small unit located on Blacksidend Farm, bordering the upper reaches of the Cleuch Burn to the west and the Glen Garr series to the east. This series is developed on a deep sandy clay loam textured till, on gently to moderately sloping ground. It is characterised by a fairly deep peaty surface horizon and poor internal drainage. In the semi-natural condition it usually supports an *Eriophorum* type of vegetation.

GENERALISED PROFILE DESCRIPTION

SLOPE moderate
ASPECT south
ALTITUDE 1000 feet
VEGETATION *Eriophorum vaginatum, Vaccinium myrtillus, Deschampsia flexuosa, Calluna vulgaris, Molinia caerulea, Polytrichum commune, Sphagnum* spp.
DRAINAGE CLASS poor

Horizon	*Depth or Thickness*	
L	1″	Litter.
H	8″	Dark reddish brown (5YR2/2) greasy peat.
A_2g	0-9″	Light grey (10YR7/2) sandy clay loam, very weak medium sub-angular blocky, plastic, sticky, organic matter low, roots frequent, few quartz pebbles, many fine distinct to prominent ochreous mottles along root channels, matrix completely grey gleyed. Sharp change into
Bg	9-17″	Light yellowish brown (10YR6/4) sandy clay loam, massive, very plastic, frequent roots, few highly weathered sandstones, frequent medium prominent ochreous and grey mottles, iron tubes along root channels, interfaces between stones and matrix sticky and grey. Sharp change into
Cg	17-32″	Light grey (10YR7/2) sandy clay loam to sandy clay, massive, plastic, roots rare, few stones—all highly weathered and many green in colour, few fine faint ochreous mottles, occasional iron tubes, frequent fine to medium distinct grey mottles, faces of large cleavages completely grey.

The H layer is rarely less than six inches deep and is underlain by a striking light grey A_2g. This normally has a sandy clay loam texture and a plastic and sticky consistence which makes the structure difficult to discern. Grey colours caused by gleying are very intense and ochreous mottles are also very evident, particularly along root channels. The Bg has a sandy clay loam texture (occasionally sandy clay), but the structure is massive and the consistence more plastic than in the A_2g. A few highly weathered sandstones are always observed. Ochreous and grey mottles are equally conspicuous and well-

defined iron tubes surround the roots. There is no change in either texture or structure on passing to the Cg, but the consistence is less plastic and there are fewer ochreous mottles. Iron tubes persist around the few roots, and the sides of the large structural cracks, traceable to the top of the Bg, are grey and sticky.

The Reppoch series has been placed in the surface-water peaty gley soil group.

NOTE ON AGRICULTURE. The characteristic vegetation of this series makes only low quality grazing for sheep. Open ditches are necessary to remove the surface water. As with the other peaty topped, poorly drained marginal soils of Ayrshire, cropping is not an attractive proposition because a tile drainage system would have to be provided and a liberal fertiliser programme introduced to increase the fertility level and reduce the peaty top.

CAWDRON SERIES

The Cawdron is the smallest series of the association, being confined to a few small drainage channels and wet hollows. The brownish grey till parent material is frequently water-modified and consequently there is a considerable variation in texture. In addition as the series is situated close to streams, often at the foot of steep slopes, the upper horizons usually bear evidence of colluvial material. The principal differentiating features of this series are the highly humified surface and the very poor internal drainage.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	950 feet
VEGETATION	marsh
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-10″	Very dark brown (10YR2/2) humified sandy loam, structureless, roots abundant, no stones. Sharp change into
Bg	10-22″	Grey-brown (10YR5/2) sandy clay loam, massive, very plastic, sticky, organic matter low, roots occasional, few stones, few fine medium faint ochreous mottles, matrix intensely grey gleyed; merging into
Cg	22″+	Light brown-grey (10YR6/2) sandy clay loam, massive, very plastic, sticky, roots rare, few stones, well-defined iron tubes along root channels, matrix intensely grey gleyed.

A dark brown highly organic sandy loam is typical of the surface horizon, but occasionally this is no more than an organic mud. The underlying Bg very often extends beyond 20 inches in depth. It is grey-brown with textures varying between sandy loam and silty clay loam. The horizon is always wet and a massive structure is common. Grey mottles predominate and tend to obscure the few and faint ochreous mottles which are also present. Below the Bg there is a brownish grey wet sandy clay loam, usually very plastic and sticky. Grey colours are again intense and iron tubes are prominent along the root channels.

The series has been classified as a ground-water humic gley.

NOTE ON AGRICULTURE. This series is of no agricultural importance, being located in drainage channels and hollows which are virtually permanently waterlogged.

ROWANHILL ASSOCIATION

The Rowanhill association is confined to the land south of the River Irvine where it covers an appreciable area. Developed on a Carboniferous till derived essentially from shales and sandstones of the Productive Coal Measures, it is intermediate in texture between the till parent material of the two major associations of the Cunningham Plain, the Kilmarnock and the Ashgrove.

Distribution

Covering a total of 10·8 square miles, the association occurs in three localities, the largest extending for 6 miles from Riccarton to Fullarton House, Troon, with an average width of $1\frac{1}{2}$ miles. East and south-east of Craigie, at Muggerslandburn and Coldcothill, lie two smaller units similar in shape and almost equal in area (2 miles by $\frac{3}{4}$ of a mile) and divided only by a narrow strip of Kilmarnock association soils.

Parent Material

Productive Coal Measures sediments, chiefly shales and sandstones, form the basis of the till parent material, with a minor igneous fraction derived from the numerous basic dykes and doleritic sills in the district. The till is a comparatively deep mantle as evidenced by the fact that there are only five small exposures of parent rock throughout the association. Typical of the till is the presence of numerous small stones, principally shales and sandstones set in a brown clay loam to clay matrix; large stones and boulders are rarely observed.

Topography

The relief of the main location is mostly undulating, intensifying to rolling in the vicinities of Symington and Riccarton. At the Muggerslandburn site the surface is undulating, while at Coldcothill it is rolling.

Climate

The largest area falls within the 35-40 inches rainfall zone, with the exception of the south-western tip, near Loans, which experiences less than 35 inches. Both the smaller units receive rather more than 40 inches per year.

Soils

The clay content of the surface horizons of the Rowanhill soils varies between 32 and 38%, while the subsoil range is 36-42%. This is the highest clay content of any association in the southern region but it is less than that of the comparable Ashgrove soils to the north-west. As in the latter soils there is an increase in pH with depth, from 5·5-6·0 in the surface to 8·0 in the C horizon.

The association is composed of four soil series, of which the Rowanhill is the most extensive in the Riccarton-Loans and the Muggerslandburn locations. This series is poorly drained and its prevalence is partly due to the more clayey texture of the till and the higher incidence of gentle slopes in these districts. Imperfectly drained soils of the Caprington series are common to the more favourably sloping ground, while two series with very poor drainage, one exhibiting a surface horizon low in organic matter and the other very high in organic matter, the Todrigs and Corraith respectively, occur in

the numerous areas of depressed relief. As in other associations of the southern region, deposits of lacustrine alluvium occupy many of the depressions, thereby reducing the area of the very poorly drained components.

Series

CAPRINGTON SERIES

Though less extensive than the poorly drained Rowanhill series, the Caprington series constitutes the best agricultural land of the association. It is developed on a comparatively deep, brown clay loam till. The clay content is of the order of 38% and in this respect the series resembles the Kilmarnock series, which it commonly adjoins. A characteristic of the series is the low content of stones, these being principally Productive Coal Measures shales and sandstones with an occasional doleritic or basaltic pebble. The series occurs on the moderately sloping ground above Loans and south of Riccarton, it is prevalent west of Craigie and dominates the Coldcothill location. The internal soil drainage is classified as imperfect, but with reservation, as field drains ramify the series for the greater part. The term "improved poorly drained" (Glentworth, 1954) has been used to denote the drainage class, and it is obvious that unless the tile drainage system is efficiently maintained the soil-water relations in many parts will revert to the poorly drained condition. In Ayrshire this term "improved poorly drained" is applicable to many areas of the series classed as imperfectly drained, in particular, the Kilmarnock, Bargour and Dunlop series.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate
ASPECT	north-west
ALTITUDE	200 feet
VEGETATION	*Poa trivialis, Lolium perenne, Ranunculus acris, Trifolium repens, Ranunculus repens.*
DRAINAGE CLASS	imperfect

Horizon	*Depth or Thickness*	
S	0-8″	Brown (10YR5/3) clay loam, medium crumb, friable, organic matter low, roots abundant, few stones—coal and shale fragments, few fine faint rusty mottles along root channels. Sharp change into
B_2(g)	8-16″	Light yellowish brown (10YR6/4) clay, fine to medium prismatic, slightly plastic, organic matter low, roots occasional, many weathered shale and sandstone pebbles and fragments —occasional lava, frequent fine to medium distinct ochreous mottles, few fine distinct grey mottles, faces of peds slightly grey in colour. Moderately sharp change into
B_3(g)	16-26″	Brown (10YR5/3) clay loam, fine to medium prismatic, slightly plastic, roots rare, many coal and shale fragments, few fine faint ochreous mottles, frequent medium distinct grey mottles; merging into
C(g)	26-38″	Brown (10YR5/3) clay loam, medium platy, slightly plastic, roots rare, many shale and coal fragments, ochreous mottling negligible, few fine distinct grey mottles on faces of peds and along root channels.

The surface horizon is rarely more than nine inches deep, has a loam to clay loam texture and a friable consistence. The organic matter is low, usually around 6%. Rusty mottles are always apparent along the many root channels. A light yellowish brown colour is generally associated with the

B_2(g) horizon, which has a clay loam to clay texture and a reasonably well-developed prismatic structure, though sometimes it is plastic and sticky. Many small shale and sandstone fragments are to be noted. The frequency and distinctness of the ochreous mottles tend to obscure the equally significant grey mottles. The B_3(g) is characterised by a stronger brown colour and a coarser texture, clay loam; the prismatic structure and slightly plastic consistence continue. Unlike the B_2(g) grey mottles predominate. On passing to the C(g) horizon the main differences are the development of a platy structure and a marked reduction in both ochreous and grey mottles, the texture, consistence and stone content remaining reasonably constant.

The series has been classed with the brown forest soils of low base status with gleyed B and C horizons.

NOTE ON AGRICULTURE. The maintenance and improvement of field drainage systems have been mentioned previously. This series is classed as "moderately heavy loam" (Berry *et al*, 1930) and consequently it is devoted primarily to the development of good pasture and hay. Successful green cropping is possible, especially in favourable seasons, but the cost of working these clayey soils is high and probably this more than any other factor determines the amount of cropping undertaken.

ROWANHILL SERIES

The Rowanhill series is the most extensive and is present in all three areas of the association. In the tract of lower-lying ground between Riccarton and Loans it predominates on the gentle slopes and flattish tops of the undulations. At Muggerslandburn it occupies similar but much less extensive areas, whilst at Coldcothill it is restricted to a patch of lowland bordering a sizeable alluvial spread. The parent material is a brown, slightly plastic, clay loam to clay. At Coldcothill the soil profile bears evidence of water-sorting but this is not surprising as it is very low-lying and adjoins a post-glacial lacustrine deposit. The stone content tends to be low but there are a few patches, for example, at Peatland south of Gatehead, where the subsoil is noticeably darkened by the high shale content. Like most of the stones encountered in these soils, these shales are highly weathered and readily rubbed down between the fingers; consequently a high stone content in the subsoil is not repeated in the plough layer. The drainage class is poor but *Juncus* spp. are less prevalent than on other poorly drained series developed on comparable sites. This may be a result of the lower rainfall which, for the principal area, is less than 40 inches.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate
ASPECT	north-west
ALTITUDE	100 feet
VEGETATION	*Poa trivialis, Trifolium repens, Lolium perenne, Ranunculus repens, Alopecurus geniculatus, Holcus lanatus, Ranunculus acris, Agrostis tenuis.*
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
S	0-7″	Brown (10YR5/3) clay loam, medium to coarse crumb, slightly plastic, organic matter low, roots abundant, few stones—mainly coal and shale, distinct rusty mottles on root channels. Sharp change into

Horizon	*Depth or Thickness*	
A_2g	7-16″	Yellowish brown (10YR5/4) clay loam to clay, moderate fine prismatic, plastic, organic matter low, roots occasional, stony—sandstone and shale, frequent to many medium prominent ochreous and grey mottles, faces of peds and stone-matrix interfaces completely grey in colour; merging into
Bg	16-26″	Brown (10YR5/3) clay loam, weak prismatic to massive, plastic, roots occasional, many small highly weathered sandstone and shale fragments and occasional igneous pebbles, few medium faint ochreous mottles, frequent fine to medium distinct grey mottles, faces of peds and cleavages coated with grey; merging into
Cg	26-40″	Brown (10YR5/3) clay loam to clay, massive—tending to very weak platy at depth, slightly plastic, roots rare, stones as above, ochreous mottling negligible, few fine distinct grey mottles.

The surface horizon has a clay loam texture and a slightly plastic consistence. The organic matter content is invariably low—4-5%. Distinct rusty mottles are always present around the roots. The A_2g, which is the horizon of maximum gleying, is yellowish brown in colour; it has a clay loam to clay texture, a fairly well-developed prismatic structure, and a plastic consistence. Both ochreous and grey colours are much in evidence. The transition to the Bg is marked by the development of deeper brown colours caused by the reduction in ochreous mottling. The texture continues either clay loam or clay and the structure may remain prismatic but more commonly passes to massive. A similar textural range is characteristic of the Cg horizon as is also a massive structure which, however, may alter to weak platy at depth when it is accompanied by a change in consistence from plastic to slightly plastic. There is a further decrease in ochreous and grey mottling in this basal horizon.

As stated above the series of the Rowanhill association generally show a progressive increase in pH down the profile, from 5·5-6·0 in the surface to perhaps 8·0 in the Cg horizon, but the soils are not regarded as calcareous. The Rowanhill series has been placed in the non-calcareous gley group; it is in addition a surface-water soil.

NOTE ON AGRICULTURE. The dominant factor controlling agricultural practice on much of the land of North Ayrshire is the soil texture, and it has been found that on the finer textured soils even small differences in texture necessitate modifications in agricultural methods. The Rowanhill association provides evidence of this in that the slight increase in the clay content of the Rowanhill series as compared with the Caprington, admittedly accompanied by a deterioration in internal drainage, can be correlated with a marked decrease in the acreage given over to green cropping and a corresponding increase in hay and pasture. Many farms are largely devoted to grazing. Wheat and timothy can be successfully grown; fields of timothy of many years' duration are occasionally to be seen. To attain its best agricultural rating, however, this soil must be effectively tile drained.

TODRIGS SERIES

The Todrigs series occurs throughout the various areas of the association and is always the minor component of any hydrologic sequence. It occurs at the bottom of the numerous troughs in the undulating ground, though in some cases it is replaced by post-glacial lacustrine material. This soil has also

developed in several depressions caused by underground coal workings. The parent material is a brown, slightly plastic clay, usually containing many shale fragments and is derived from the Productive Coal Measures. The drainage class is very poor and as the necessary outfall for its improvement is generally difficult to attain it is of little agricultural value.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	100 feet
VEGETATION	*Juncus effusus, Carex nigra, Carex panicea, Anthoxanthum odoratum, Ranunculus repens.*
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-8″	Brown (10YR5/3) clay loam, medium to coarse crumb, slightly plastic, organic matter low, roots abundant, few sandstone and shale fragments, distinct rusty mottles along root channels; merging into
A_2g	8-15″	Yellowish brown (10YR5/4) sandy clay loam, weak fine prismatic, sticky and slightly plastic, organic matter low, roots occasional, few stones, distinct rusty mottles on root channels, many medium faint grey mottles. Sharp change into
B_2g	15-28″	Yellowish brown (10YR5/4) clay loam, massive, plastic, roots rare, stony—small sandstones and shales, frequent medium distinct ochreous mottles, many medium to coarse prominent grey mottles, large cleavages entirely grey; merging into
B_3g	28-40″	Grey-brown (10YR5/2) clay, massive, very plastic, many small roots, a few large sandstones and shales, few medium distinct ochreous mottles, frequent medium to coarse grey mottles; merging into
Cg	40-48″	Brown (10YR5/3) clay, massive—tending to weak fine platy at base, slightly plastic, many shale fragments, ochreous mottling negligible, few fine medium prominent grey mottles on faces of peds.

A clay loam (sometimes clay) texture and a slightly plastic consistence are features of the S horizon but the most important differentiating feature is the low organic matter content, 5% or less. In the profile described the yellowish brown Ag horizon has a sandy clay loam texture, which is fairly typical. The structure is prismatic but never well defined. It is noticeably sticky and the ochreous colours are always more distinct than the grey. The yellowish brown colour persists in the Bg but the texture alters to either clay loam or clay, while the structure becomes massive and the consistence more plastic. Ochreous and grey mottles are pronounced and large cleavages develop, the sides of which are completely grey. A grey-brown colour is associated with the B_3g, which textures to a clay, and the consistence is often very plastic. Mottling, both ochreous and grey, is normally less than in the B_2g. In the Cg horizon the inherent brown colour of the parent material is revealed by the marked reduction in grey mottles. The texture remains clay but the structure may change at depth from massive to weak platy.

The series is classified as a surface-water low-humic gley soil.

NOTE ON AGRICULTURE. The very poor drainage and the high clay content render this series of little agricultural importance. It commonly carries a low-quality permanent grazing.

CORRAITH SERIES

The Corraith series is the least extensive of the association. It occupies a long narrow strip separating the Caprington and Rowanhill series east of Loans and two small patches on the north side of the Dundonald sill at Harpercroft. The only other location joins the Inchgotrick Fault at Inchgotrick Farm, south of Riccarton; all these sites have depressed relief and the internal drainage of the soil is very poor. The parent material is a dark grey-brown sandy clay loam which frequently shows signs of water-modification. Apart from the very poor drainage features, the soil is differentiated by its humified surface horizon.

GENERALISED PROFILE DESCRIPTION

SLOPE	level
ASPECT	nil
ALTITUDE	100 feet
VEGETATION	marsh
DRAINAGE CLASS	very poor

Horizon	*Depth or Thickness*	
S	0-8″	Grey-brown (10YR5/2) clay loam, moderate medium to coarse granular, friable, organic matter high (19%), roots abundant, few stones, prominent rusty mottles along root channels. Sharp change into
A_2g	8-16″	Grey-brown (10YR5/2) clay, weak prismatic, plastic, organic matter low, roots occasional, few stones—mainly weathered sandstones and occasional shale, fine medium distinct ochreous mottles, many medium prominent grey mottles, faces of peds sticky and grey in colour, iron tubes not well-defined around roots; merging into
Bg	16-25″	Dark grey-brown (10YR4/2) clay, massive, very plastic, sticky, roots rare, stony—highly weathered shales and sandstones, frequent medium distinct to prominent ochreous and grey mottles, well-defined iron tubes along roots. Sharp change into
Cg	25-40″	Dark grey-brown (2·5YR4/2) sandy clay loam, massive, slightly plastic, roots rare, many sandstones and shales, iron tubes around roots, many medium to coarse distinct grey mottles.

The texture of the grey-brown surface horizon varies from clay loam to clay and the structure from medium to coarse granular. The organic matter content is usually 20% or more. The A_2g has a clay texture, a weakly defined prismatic structure and a plastic consistence. In contrast to the S horizon the organic matter is less than 4%. Grey mottles predominate, the faces of the peds are completely grey, and prominent iron tubes surround the roots. A dark grey-brown clay with a massive structure and very plastic consistence is typical of the Bg. Ochreous and grey mottles are equally numerous and prominent. There is not usually any colour change on passing to the Cg but in many instances the texture changes to sandy clay loam or clay loam. The structure remains massive, but the plasticity decreases and once more grey mottles predominate, ochreous colours being confined to the iron tubes which are continuous from the A_2g.

The Corraith series has been placed in the humic gley soil group.

NOTE ON AGRICULTURE. The series is of little agricultural importance. It occupies very small areas and any attempt to improve the drainage would be costly and greatly out of proportion to its worth.

SORN ASSOCIATION

The Sorn association forms a comparatively small but not inappreciable unit situated towards the south-east corner of Sheet 22. The extreme eastern part of the district is rather sparsely populated and the formerly cultivated, now *Juncus*-ridden, undulating ground adds to the impression of isolation. Carboniferous sediments of various ages, but principally of the Calciferous Sandstone Series, are recognised in the moderately fine textured till parent material. One of the striking features of the association is the prevalence of poorly drained soils.

Distribution

The association covers a crescent-shaped portion of the Lowland Transition Zone to the west of the Kyle Upland. Occupying 5·8 square miles, it extends from Rodinghead, one mile north of Crosshands, to the southern edge of the map at Knowhead in the parish of Sorn.

Parent Material

The parent material is a moderately fine textured till derived very largely from sediments of the Calciferous Sandstone Series, with the addition of Old Red Sandstone in the east. In the south-west the Old Red Sandstone is replaced by Barren Red Measures material, whilst in the vicinity of Killoch and Rodinghead the frequent occurrence of black shales, especially at the base of the profile, suggests an influence from the Carboniferous Limestone Series and the Productive Coal Measures sediments which underlie these localities. That the till is a deep deposit is revealed by exposures in the courses of the rivers which flow through the area; 15-20 feet of this red-brown till overlying various sediments of the Calciferous Sandstone Series were noted on the River Cessnock $\frac{3}{4}$ mile east of the Galston-Sorn road.

Topography

On passing from west to east there is a gradual increase in altitude from 400 feet at Crosshands to 750 feet on Auchmannoch Moor. The topography is undulating throughout.

Climate

The mean annual rainfall is between 40-45 inches. This seems somewhat low compared with that of other areas at similar heights but, as stated earlier, the lower rainfall on the eastern plateaux as compared with that of the northern districts is attributable to greater distance from the sea.

Soils

The predominance of moderately fine textures in the parent material, the prevalence of gentle slopes and the small variation in rainfall impart a high degree of uniformity to the morphology of the soils. Although four series have been mapped, the Sorn, which is poorly drained, is unquestionably the most widespread, except on the approaches to the more exposed moorlands in the east where it is superseded by the Weitshaw, also poorly drained but with a deep well-developed peaty top. The remaining two series, the Blairkip and the Auchmannoch, are very minor components; both are classed as very poorly drained but the former is a low-humic gley and the latter a humic gley.

The occurrence of a peaty top in the soils with poor drainage is closely related to climate, in particular to the increased rainfall on the higher ground. The incidence of an organic top in soils with very poor drainage tends to follow a similar pattern but the influence of climate is not so decisive, and there are instances where factors other than climate must be involved. Soils with imperfect drainage were noted on a few short steep slopes but they occupied areas too small to be mapped.

Series

SORN SERIES

The Sorn series is the most extensive of the association. In general it is developed on a brown to red-brown sandy clay loam till. Stones vary in number from few to moderate and consist principally of Carboniferous and Old Red Sandstone pebbles, except in the Killoch and Rodinghead areas already referred to where there is, in addition, a proportion of shales. Fine textured soils are also associated with these shale-contaminated areas, sandy clay and clay textures being common to the Cg horizon. Except for the troughs the series occupies all the undulating ground between Rodinghead House, Crosshands and Knowhead Farm on the south-eastern edge of the map. The drainage class is poor, which is rather surprising in view of the moderately fine texture of the till and the fairly moderate rainfall of the region. A great many ridges and water furrows are evidence of past efforts to improve the drainage. *Juncus* spp. are quickly established on this land, for example in the older pasture on the east side of the Galston-Sorn road the growth becomes progressively ranker as the moorlands are approached.

GENERALISED PROFILE DESCRIPTION

SLOPE	moderate
ASPECT	south
ALTITUDE	640 feet
VEGETATION	*Cynosurus cristatus, Agrostis tenuis, Alopecurus geniculatus, Ranunculus repens, Poa trivialis, Lolium perenne, Trifolium repens, Juncus effusus.*
DRAINAGE CLASS	poor

Horizon	*Depth or Thickness*	
S	0-10″	Grey-brown (10YR5/2) sandy clay loam, moderate medium to coarse crumb, friable, organic matter low, roots abundant, few well-rounded sandstones—some highly weathered, many fine faint rusty mottles along root channels. Sharp change into
B_2g	10-19″	Brown (7·5YR5/4) sandy clay loam, medium to coarse prismatic, slightly plastic, roots occasional, stony—weathered sandstones, frequent medium distinct ochreous and grey mottles, faces of large cleavages and stone matrix interfaces sticky and coated with grey; merging into
B_3g	19-25″	Brown (7·5YR5/4) sandy clay loam, weak medium prismatic, slightly plastic, roots occasional, few large sandstone pebbles, few medium faint ochreous mottles, frequent medium distinct grey mottles; merging into
Cg	25-37″	Brown (7·5YR5/4) sandy clay loam, weak platy, slightly plastic, roots rare, stony—small sandstone pebbles, few fine faint ochreous mottles, few to frequent fine grey mottles, grey colours prominent in root channels and around stones.

The surface horizon is grey-brown and has a sandy clay loam texture; there is normally very little variation in texture throughout the profile, and the organic matter is low. There are always many rusty mottles along the root channels. An A_2g horizon may or may not be present beneath the plough layer. Where it occurs, the A_2g is decidedly grey, wet, and slightly plastic; usually there is little change in texture. The brown B_2g is similar in texture to the S and has a prismatic structure. Ochreous and grey mottles are numerous and striking whilst the faces of the large cracks are coated in light grey. The main difference in the B_3g is the development of a weak prismatic structure and a decrease in the number of ochreous mottles; grey mottling is still extensive. In the Cg horizon a platy structure is common, the texture is again sandy clay loam (or perhaps sandy clay) and grey colours are less noticeable except in the inner cores of the root channels and around stones.

The series has been grouped with the surface-water non-calcareous gley soils.

NOTE ON AGRICULTURE. Dairy farming is the mainstay and little green cropping is practised on this series. In Ayrshire clayey textures are generally the principal obstacle to green cropping but in this case the major deterrent is the naturally poor drainage, which, however, could in many cases be improved by tile draining. Hay and pasture are successfully grown, though *Juncus* spp. eventually become a pest in the latter.

BLAIRKIP SERIES

The Blairkip series is of minor extent and importance. It is developed on a brown clay loam to clay till and occurs on the very gently sloping ground bordering several small rivers, where it commonly adjoins alluvium. The internal drainage of the soil is very poor.

GENERALISED PROFILE DESCRIPTION

SLOPE: gentle

ASPECT: nil

ALTITUDE: 600 feet

VEGETATION: *Poa trivialis, Alopecurus geniculatus, Poa pratensis, Holcus lanatus, Trifolium repens, Juncus effusus.*

DRAINAGE CLASS: very poor

Horizon	*Depth or Thickness*	
S	0-11″	Grey-brown (10Y5/2) sandy loam. weak medium to coarse granular, friable, organic matter low, roots abundant to frequent, no stones, distinct—prominent rusty mottles along root channels. Sharp change into
A_2g	11-18″	Light brown-grey (10YR6/2) sandy clay loam, weak. fine prismatic, slightly plastic, organic matter low, roots frequent, few stones—Calciferous and Old Red Sandstone, many medium distinct ocherous mottles, inherent soil colours masked by grey; merging into
Bg	18-31″	Brown (7·5YR5/4) sandy clay loam, massive, slightly plastic, sticky, roots occasional to rare, stone content as above, few medium distinct ochreous mottles, frequent fine to medium distinct grey mottles, cleavages coated with grey, well-formed iron tubes around roots; merging into
Cg	31-37″	Brown (7·5YR5/4) clay loam, massive, slightly plastic, roots rare, few stones—less weathered than in horizons above, many green coloured micaceous sandstones, few medium faint grey mottles, iron tubes along root channels.

The surface horizon is grey-brown with a low organic matter content. The texture is sandy clay loam, stones are either few or absent, and rusty mottles figure prominently along the root channels. Grey colours resulting from gleying dominate the A_2g which has a sandy clay loam texture and an indistinct prismatic structure. Prominent ochreous mottles are always present. In the Bg the prismatic structure changes to massive and a stickiness becomes noticeable. There is a decrease in ochreous mottles and a marked decrease in grey mottles. Iron tubes occur around the root channels. The main difference between the Bg and Cg horizons is that the latter has a higher clay content, being normally a clay loam to clay. There is also a further decrease in ochreous and grey mottles in the Cg horizon, but iron tubes are still present round the few root channels.

The series is grouped with the surface-water non-calcareous gley soils.

NOTE ON AGRICULTURE. The series is of little agricultural importance. The very poor drainage is a major obstacle to successful cultivation and in many instances this could be improved by artificial methods, but any such efforts could be more fruitfully directed to the adjacent Sorn series.

WEITSHAW SERIES

This series occupies the slopes and crests of the undulating ground bordering Weitshaw and Auchmannoch Moors in the extreme south-eastern section of the map. It is developed on a light brown sandy clay loam to clay loam till under climatic conditions which promote the formation of peat. The series is characterised by a peaty top and poor internal drainage.

GENERALISED PROFILE DESCRIPTION

SLOPE gentle
ASPECT west
ALTITUDE 700 feet
VEGETATION *Juncus effusus, Trifolium repens, Agrostis tenuis, Poa pratensis, Ranunculus repens.*
DRAINAGE CLASS poor

Horizon	*Depth or Thickness*	
L	1″	Litter.
H	7″	Dark brown (10YR4/3) greasy peat, roots abundant. Sharp change into
A_2g	0-4″	Pale brown (10YR6/3) sandy clay loam, structureless, non-plastic, organic matter low, roots frequent, no stones, few fine to medium distinct ochreous mottles, many coarse prominent grey mottles. Sharp change into
Bg	4-22″	Reddish brown (5YR5/3) sandy clay loam, massive, slightly plastic, organic matter low, roots frequent to occasional, few stones—mainly sandstones, frequent fine to medium distinct ochreous and grey mottles, faces of cleavages coated with grey; merging into
Cg	22-35″	Light brown (7·5YR6/4) sandy clay loam to clay loam, massive, slightly plastic, roots rare, stony—mainly highly weathered sandstones, few fine faint ochreous mottles, few medium distinct grey mottles, faces of cleavages and stone matrix interfaces coated with grey.

A thin litter layer very often overlies the dark brown peaty H horizon. The A_2g is pale brown to grey-brown and normally has a sandy clay loam texture, though sandy loam textures have been recorded. The structure is not clearly defined and, in marked contrast to the H horizon, the organic

matter content is low. Grey mottles are very evident and ochreous mottles few but distinct. In the Bg the parent material colour develops, the texture remains sandy clay loam (occasionally clay), and the structure is usually massive. Ochreous and grey mottles are equally numerous and distinct. The structure and texture in the Cg horizon are similar to the Bg, but ochreous and grey mottlings are greatly reduced, only the faces of the large cleavages remaining completely grey.

The series is recognised as conforming to the surface-water peaty gley group.

NOTE ON AGRICULTURE. Poor drainage and adverse climatic conditions are responsible for the low agricultural rating of this series. Where cultivated it supports a wet grass meadow vegetation, invariably infested with *Juncus* spp. In the semi-natural state *Eriophorum* spp. are the dominant vegetative type and provide an "early bite" for the sheep which tend to replace dairy herds on this land.

AUCHMANNOCH SERIES

Occurring in drainage channels and depressions, mainly in the higher lying ground of the district, this series is always a minor component of a hydrologic sequence. As the parent material is often water-sorted the texture of the soil is very variable. The series is characterised chiefly by a highly humified organic surface horizon, in which the contributing plant remains are difficult to discern, and by very poor internal drainage conditions.

GENERALISED PROFILE DESCRIPTION

SLOPE level
ASPECT nil
ALTITUDE 600 feet
VEGETATION marsh
DRAINAGE CLASS very poor

Horizon	*Depth or Thickness*	
A_1g	0-11″	Dark brown (10YR2/2) humified loam, roots abundant, no stones. Sharp change into
Bg	11-20″	Light brown-grey (10YR6/2) clay, massive, sticky and plastic, organic matter low, roots frequent—occasional at depth, stones few, few fine distinct ochreous mottles, many medium and coarse prominent grey mottles; merging into
Cg	20″+	Light brown (7·5YR6/4) sandy clay loam, massive, plastic, roots rare, many small highly weathered stones, ochreous mottling negligible, many distinct grey mottles.

The surface horizon is a dark brown humified stone-free loam, in striking contrast to the Bg which is predominantly greyish in colour and has a low organic matter content. The Bg has also a clay texture and is sticky and plastic; sandy clay loam textures have been recorded. Ochreous mottling, unlike grey, is seldom marked. Greyish colours are also associated with the Cg horizon which usually has a sandy clay loam texture.

The series has been classified as a ground-water humic gley.

NOTE ON AGRICULTURE. A herbaceous marsh type of vegetation is a common feature of this series. The location and very poor drainage render it of little agricultural value.

PEAT

Within the area covered by the map two types of peat deposit may be recognised, namely hill peat and basin peat.

Basin peat deposits originate in many of the poorly drained hollows of the North Ayrshire till plain and hence tend to be more local in distribution than the hill peat deposits which develop regionally under ombrogenous conditions, forming a mantle over the high ground. The former extends to 7·4 square miles and the latter to 44·2 square miles.

BASIN PEAT

Most of the basin peat deposits have reached the raised moss stage of development and carry an oligotrophic vegetation dominated by *Eriophorum vaginatum*, *Sphagnum* spp., and *Calluna vulgaris*, for example, Auchentiber, Bloak, Cockinhead and Hartfield Mosses. In many places the characteristic dome shape of such deposits is well displayed. On the other hand many of these mosses have been greatly affected by human interference and have either been cut over or extensively drained, for example, Shewalton and Riccarton Mosses. These activities are strongly reflected in the character of the surface vegetation and it is doubtful if any of these deposits are active peat formers at the present time.

The bulk of the peat is dark to light brown, fibrous and shows little shrinkage on drying. It is composed chiefly of the remains of *Sphagna* and some *Eriophorum vaginatum*. The base of the deposit is often characterised by the presence of a light brown sedge-grass peat which represents the low moor stage of development. Within the profile, bands of a more humified peat occur in which the remains of *Calluna vulgaris* are prominent. These represent periods when drier climatic conditions prevailed.

These deposits, therefore, not only provide a stratigraphical record of the vegetational changes which have taken place from the original eutrophic low moor stage to the oligotrophic raised moss stage but also give a good indication of past climatic conditions.

HILL PEAT

In contrast to the basin peat deposits which develop locally under soligenous conditions, extensive deposits of hill peat occur on the Renfrew and Ballagioch Plateaux and on the Cunningham and Kyle Uplands, where specific climatic conditions such as high rainfall, high humidity and low temperature are operative. No semi-aquatic vegetation need proceed the formation of these deposits. The vegetation is dominated by *Eriophorum vaginatum*, *Sphagna* and *Calluna vulgaris* abundant. Other species include *Trichophorum caespitosum*, *Narthecium ossifragum*, *Erica tetralix* and *Deschampsia flexuosa*.

The depth of the peat is very variable, being greatly influenced by the underlying topography. This is indicated by the greater depths which occur in saddles or on level terraces and the tendency for the deposit to thin on the steeper slopes.

Hill peat shows a uniformity in composition which is consistent with its mode of formation. The peat is dark brown and fibrous in character and the partially decayed plants are easily recognisable, These consist chiefly of *Eriophorum vaginatum*, *Sphagna* and *Calluna*. The uniformity of these deposits may be interrupted locally by horizons containing Birch remains or a preponderance of *Calluna vulgaris*.

Over most of the area it is evident that the hill peat is being subjected to denudation due primarily to headward erosion by streams; the action of wind and rain on the exposed hags tends to accelerate the denudation process.

Large areas of the hill peat have been cut over in the past but the adverse climatic conditions prevailing at these higher elevations limit reclamation attempts to the lower more accessible slopes where the peat is thinner and improvements in the drainage of the subsoil are practicable.

ALLUVIUM

Flat spreads of alluvium are found along every stream and in many of the depressions of the irregular surface remaining after glaciation, particularly in the till plain, their total area being 23·9 square miles. The texture of this recent superficial deposit ranges from sand to clay and the drainage of the soil developed on it varies from imperfect to very poor.

Alluvium is divided broadly into two major types, fresh water and marine, but only the former is represented in North Ayrshire; fresh water alluvium may be further differentiated into river and lacustrine but this has not been attempted. The material laid down by rivers is normally found in the vicinity of existing streams and river courses, whilst lacustrine accumulations occur in numerous hollows, originally the sites of post-glacial lakes.

Distribution

River alluvium is widely distributed throughout the map area, extensive and scenically important spreads being associated with the River Irvine and the Kilbirnie hollow which stretches from Dalry north-eastwards through the Barr Loch to the northern margin of the sheet. It has been suggested that in 100 foot beach times a shallow and in places very restricted tidal strait extended up the Garnock Valley and through the Kilbirnie Loch hollow, but it is also thought that the waters were brackish or even fresh (Bailey, 1930). This hollow is really a long, very open trough (in places more than $\frac{1}{2}$ mile wide) eroded in Carboniferous sediments and flanked by uplands formed from contemporaneous igneous rocks. At the present day the floor of the valley is being gradually raised with alluvium carried down by the lateral streams, whilst the lake basins of the Kilbirnie and Barr Lochs are retained by deltas (Bailey, 1930). The alluvial terraces of subsidiary drainage channels especially those of the Lugton, Annick, Carmel, Fenwick, Craufurdland, White Cart and Glen Waters in the north and the Cessnock in the south, are considerably narrower than those associated with the two principal rivers, but nevertheless they involve an appreciable area.

The post-glacial lacustrine deposits, though found throughout the map area, are allied more particularly to the numerous depressions in the till plain. Lacustrine material has also been recognised in conjunction with alluvium of the river type on the broad flats which border some of the rivers draining the plain, notably those of the Lugton Water lying between Uplawmoor and Lugton, and north of Auchentiber. The large alluvial tract of the Cessnock Water south-west of Hurlford also consists of a mixture of river and lacustrine material.

Parent Material

The parent material is a water-sorted deposit laid down at the close of the glacial period or by later streams. Deposition is, in fact, still taking place

in many localities. Normally river alluvium bears evidence of the geological formations through which the river and its tributaries have cut, and as the geological formations in this region are complex, the alluvium is consequently heterogeneous. In the volcanic uplands the gravel which is usually found at depth in river alluvium is derived largely from basaltic rocks, whereas on the till plain it consists of a variable mixture of igneous and sedimentary rock types. Although the geological origin of the alluvial material can be readily established in a few areas—for example, a small patch located in the Killoch Water approximately 1½ miles east of Busby is clearly derived from red and green volcanic detritus, the local rock—a straightforward relationship is exceptional in this region.

Generally, the river alluvium is coarse to moderately coarse textured, and while the upper 2 or 3 feet of the profile are virtually stone free, gravel usually occurs below this. An exception is the semi-coastal alluvium around the lower reaches of the Irvine and the Garnock; this is derived from raised beach material and gravel has not been encountered at depth.

By comparison the lacustrine type is more homogeneous and in most instances is derived from the local rock or till, the latter being the more common source. Lacustrine alluvium is a much more clayey deposit, with silty clay loam and silty clay textures the rule. Stones are seldom observed and, unlike river alluvium, it is not underlain by gravel, certainly not within the depth of an ordinary profile pit.

The large alluvial flats connected with stretches of the Lugton and Cessnock Waters which are a mixture of the river and lacustrine types, have a textural range from loamy sand to silty clay loam, with the moderately fine textured material the most prevalent.

In some of the hollows in the till plain there is only a very thin layer of loamy or clayey textured lacustrine alluvium and this is underlain by till, frequently water-modified. Soils developed in areas of this type are not classed as alluvium but are grouped, depending on the geological origin of the underlying till, within the appropriate association, invariably the adjoining one.

Topography

The alluvial sites are usually clearly distinguishable in the landscape as they generally consist of level, or at the most, very gently undulating ground, as distinct from the surrounding land which is moderately sloping or even steep. Their location can also frequently be determined from Ordnance Survey maps by the arrangement of field boundaries.

Soils

As most alluvial soils are liable to flooding and therefore subject to continual erosion and deposition, they are regarded as immature and show little or no definite profile development. They can, however, be differentiated on a basis of texture and drainage class, but in this region these criteria vary very rapidly, presenting a complex soil pattern, and the soils are therefore undifferentiated.

Although no profile can be cited as typical, certain generalisations based on the broad river and lacustrine division may be made. Soils developed on the former are mostly moderately coarse textured and the most common drainage class is the imperfect. Podzol profiles with iron pan have been

observed in river alluvium, but in this parent material such a marked profile development is exceptional. Normally, the surface horizon consists of a brown sandy loam and the subsoil a lighter brown sandy loam, whilst gravel occurs between 2 and 3 feet. Estuarine alluvium around the Irvine and Garnock gives rise to very sandy soils, while in places higher up these rivers the soils are more loamy but still noticeably coarser textured than the soils of the surrounding areas. Along certain reaches of the Irvine near Kilmarnock, Galston and Darvel, and in the Kilbirnie hollow north of Dalry, the predominant soil of the "holm lands" is moderately coarse to medium textured and though liable to flooding provides good pasturage at most seasons of the year (Berry *et al*, 1930). Similar soils are located on the alluvium of the subsidiary drainage channels. Small areas of more clayey soil with either poor or very poor internal drainage also occur on river alluvium. Peaty surface horizons or buried peaty horizons are a feature of the latter drainage class which is fairly widespread, occurring south of the Barr Loch, on the River Irvine east of Hurlford, and on the broad flats associated with the Lugton and Cessnock Waters. A common profile shows nine or ten inches of dark brown silty clay loam overlying peat in which *Phragmites* grass is often recognisable amongst the plant remains. Basin peat has developed on the Cessnock alluvium south of Riccarton and Hurlford.

The soils formed on the lacustrine alluvium show a greater degree of uniformity in that they are invariably either moderately fine or fine textured and the internal soil-water relations are limited to the poor and very poor drainage classes. Profiles are frequently encountered with a greyish brown clay loam surface horizon overlying a grey silty clay loam subsoil; clay contents of 74% have, however, been recorded for sub-surface horizons. Prominent ochreous and grey mottles are characteristic of the subsoil and the drainage is very poor. In the very poorly drained areas a deep peaty top is usually observed, and the material beneath nearly always has a noticeable silt content and is markedly grey gleyed. The mineral surface horizon underlain by a peaty horizon, which was noted in some soil profiles developed on river alluvium, is a common feature of post-glacial lake deposits, especially those located within the Ballagioch Plateau. Although not prevalent on the till plain sites, buried peaty horizons have been noted in the alluvial soils at Dalsangan and Bruntonwood Mains, near Crosshands.

NOTE ON AGRICULTURE. The imperfectly drained soil developed on sandy and loam textured river alluvium is easily managed and fertile, but its liability to flooding in times of spate greatly restricts agricultural practice and for that reason it is normally left to provide good pasture. Along certain stretches of the River Irvine levees have been constructed to afford some protection from flooding. In the alluvium of the Irvine and the Garnock there are large areas of depressed relief where the drainage ranges from poor to very poor, and because of their proximity to higher ground and the high rainfall, the water-table is close to the surface throughout most of the year. Adequate drainage of these sites is hindered by the lack of a suitable outfall.

Lacustrine alluvium is always found in hollows and the internal drainage of the soil is either poor or very poor. Difficulty is again experienced in finding a suitable outfall for artificial drainage systems, and this in conjunction with the predominance of moderately fine to fine textures makes the soils unsatisfactory for cultivation. The majority support rather a low quality pasture.

MIXED BOTTOM LAND

In essence mixed bottom land is a cartographic unit, and taxonomically a soil complex. The term is applied to stream channels, usually narrow, containing a heterogeneous mixture of soils, of which the component types are too small to be mapped on a scale of 1 inch to 1 mile. Included within the unit are soils on the sloping (very often steep) sides of the channel and the assortment of alluvial deposits in the vicinity of the stream. Marked differences in the age, drainage class, and texture of the soils are observable.

AEOLIAN SAND

Amongst the recent superficial geological deposits aeolian sand, though not agriculturally important, covers 3·1 square miles. Blown sand persists along the shores of Irvine Bay and a particularly large area occurs south-east of Stevenston, extending inland for 1½ miles and diverting the River Garnock for a distance of 2 miles. Isolated patches are located throughout the sandy coastal strip in the Stevenston-Troon region; in the vicinity of Fullarton House, Troon, and fringing the River Irvine immediately south of Irvine, they cover an appreciable area.

Where vegetation has been able to establish itself, the slopes of the sand dunes remain unchanged for a considerable time, but where the sand has not been stabilised by vegetation the mounds are continually being modified by wind action. The mobile nature of this deposit is evident from the records, a conspicuous line of dunes forming part of the Misk Knowes having shifted 200-300 yards eastwards since the 50 foot Ordnance contour line of 1856 was drawn (Richey, 1930).

The sandy coastal belt greatly influences the soils of the North Ayrshire till plain adjoining it, principally those of the Kilmarnock, Rowanhill and Largs associations. For some distance inland the upper horizons of these soils, which are developed on clayey till parent materials, contain a high proportion of sand. This sand has been carried by wind but not in sufficiently great amounts to warrant mapping as aeolian sand.

In some of the mobile dunes evidence of soil development may be completpletely lacking whilst in others a succession of buried A_1 horizons separated by layers of sand may be observed. The drainage class is normally excessive and the soils come within the skeletal soil group. A feature of the blown sand deposits immediately south of Fullarton is a buried podzol with iron pan profile; for the podzolic profile to reach such a marked degree of development the dunes in this district must in the past have been stabilised over a lengthy period. An A_1 horizon buried in the overlying blown sand is further evidence of periodic stabilisation and mobilisation, which is characteristic of the formation. A description of this particular soil is given below.

GENERALISED PROFILE DESCRIPTION

SLOPE moderate
ASPECT north-east
ALTITUDE 30 feet
VEGETATION *Ulex europaeus, Festuca rubra, Salix repens, Elymus arenarius, Sarothamnus scoparius, Poa pratensis.*
DRAINAGE CLASS excessive

Horizon	*Depth or Thickness*	
C	0-6″	Brown (10YR5/3) sand, structureless, loose, organic matter very low, roots abundant. Sharp change into

Horizon	*Depth or Thickness*	
A_1	6-11″	Brown (10YR4/2) sand, structureless, loose, organic matter low, roots abundant. Sharp change into
C	11-15″	Brown (10YR4/3) sand, structureless, loose, organic matter very low, roots abundant. Sharp change into
A_1	15-21″	Very dark grey (10YR3/1) fine sand, structureless, loose, organic matter moderate, roots frequent; merging into
A_2	21-27″	Dark brown (7·5YR3/2) fine sand, structureless, loose, roots frequent, distinct rusty mottles along root channels.
B_1	at 27″	Thin continuous iron pan
B_2	27-36″	Dark brown (7·5YR4/4) fine sand, structureless, loose roots occasional to rare, few fine distinct ochreous mottles, humus staining forming an intricate network; merging into
C	36″+	Brown (10YR5/3) sand, structureless, loose, roots rare, no mottling.

There is no evidence of soil profile development in the surface layer which is simply the unaltered parent material texturing to a sand, structureless and with a loose consistence. On the dunes with an established vegetation the colour is often a light brown-grey and the texture sandy loam. The buried A_1—which in this case is actually a series of very narrow A_1 horizons separated by equally narrow layers of sand—differs from the C horizon principally in colour; it is a slightly darker brown. Beneath the A_1 the C horizon is repeated and this is followed by the very dark grey A_1 horizon of the buried podzol profile which usually has a fine sand texture. The profile is structureless throughout and the consistence loose. The transition to the A_2 is marked by a colour change to dark brown and distinct rusty mottles are sometimes noted along the channels of the frequent roots. In this horizon there is slight gleying caused by impedance of vertical drainage by the underlying iron pan. This iron pan is thin, well developed and continuous. A rich dark brown colour is typical of the B_2 horizon, in which there is a very noticeable decrease in the number of roots, only a few being able to penetrate the B_1. Ochreous mottles are few but readily discernible. Humus staining forming a continuous and intricate network is very pronounced in this horizon but gradually fades in the underlying parent material.

NOTE ON AGRICULTURE. The very sandy texture, excessive internal drainage and very low organic matter content of these aeolian sand soils render them of little agricultural value; only one small area, at Ardeer Mains Farm, east of Stevenston, is cultivated.

CHAPTER VI

Vegetation

THE vegetation of North Ayrshire presents a wide range, from the pioneer communities of coastal dunes to the mature forest and moorland communities inland. Little of the vegetation is unaffected by man's activities and that on land not actively under the plough is best described as semi-natural.

True natural vegetation is to be found in the early stages of dune formation, and on a few of the cotton-grass mosses. The aquatic and semi-aquatic communities around small lochs and along watercourses and the vegetation of sea cliffs and certain steep valley gorges, may be termed natural. These, however, were not investigated since their extent is generally too limited to come within the compass of soil-mapping on the scale of 2½ inches to 1 mile.

FACTORS

The zonal influence of climate is still clearly evident in the vegetation, although the natural woodland and moss have been largely converted to arable land and pasture. Within the regional limits set by climate and the local effects of soil and topography, man has adapted the major part of the landscape to his use.

Comparative analysis of the natural and semi-natural vegetation gives a measure of the relative influence of the three factors, climate, soil and man.

CLIMATE

The cool moist maritime climate has a strong influence on the vegetation, especially when compared with drier eastern areas. Prior to man's intensive cultural practices peat formation must have been widespread on the gentler slopes; it is still active on the cotton-grass mosses at higher elevations.

Heath vegetation is confined mainly to the lava hills near the coast. The rainfall is high there but the steeper slopes may militate against the establishment of cotton-grass moss.

The grassland at lower altitudes has often species indicative of wet conditions, even where the soil is freely drained. This applies equally to woodland and instances can be quoted where *Deschampsia caespitosa* is locally dominant of the floor vegetation in deciduous woodland which is growing on freely drained soil.

The cloud cover and low summer temperatures combined with the moderately high rainfall are mainly responsible for the wet character of the vegetation.

The land is exposed to the prevailing winds off the Firth of Clyde and this has a marked effect on the growth of trees for a considerable distance inland. Trees on the windward side of Loudoun Hill near Darvel have their crowns pruned to the shape of the slope.

EDAPHIC AND TOPOGRAPHIC

Many of the soil series are on tills of fine texture—a fact which accentuates the effect of the climate. The influence of texture on the development of soil is described in Chapter IV but its concomitant effect on the vegetation is often obscured by practices such as drainage or neglect of drainage. The extremes of texture stand out clearly as instanced by permanent pasture on the Dreghorn series and on the Caaf series. On the former series *Agrostis-Festuca* grassland is developed, and on the stiff clay of the latter there is a marshy pasture dominated by *Juncus effusus*, *Carex nigra* and *C. panicea*. The vegetation on the wide range of intermediate soils is with difficulty correlated with texture; the interplay of climate and topography is often of greater importance.

The influence of the base status of the soils and their ferruginous content is also difficult to estimate. The vegetation on soils derived from intermediate and basic lavas is drier and less acid in character than that on similarly textured soils developed on siliceous sediments. The effect on structure of a high proportion of ferric iron in the lava soils rather than enhanced base status is probably the operative factor.

Degree and form of slope also influence the type of vegetation developed. Reference has already been made to the heath established on the steeper hills near the coast as compared with the tendency to cotton-grass moss on the flatter hills.

Extensive raised mosses have developed on large areas of level topography in the past. These mosses are no longer active and much of their peat has been stripped off and the land reclaimed. The vegetation on the mineral soil thus brought into use has a more marked 'marsh' character than that on moderate slopes where the soil texture is similar.

BIOTIC

The modifying influence of man's activities is strongly stamped on the vegetational communities to be found in North Ayrshire. It is most evident in the arable areas but even in areas of hill pasture the cutting of open drains, the removal of peat and the heavy stocking with grazing animals have considerably altered the vegetation.

It is difficult to estimate the former extent of woodland since drainage and removal of peat have made a larger area of land potentially favourable to tree growth. No trees of great age are encountered and it can be safely said that all primitive forest has been removed from the area. Mature deciduous forest, which may differ little in character from natural woodland, grows round mansion houses and on steep slopes along watercourses. The trees are generally of even age and probably many were planted, although natural regeneration may account for a certain proportion.

In addition to these broad-leaved woods there are numerous shelterbelts of coniferous trees or a mixture of coniferous and broad-leaved trees. Many of these and some small plantations have been felled or have fallen into neglect. Some are now rough grazing or poor quality Birch and Willow scrub.

The raised mosses which still remain have been cut over and drained and the dominant plant is now commonly *Calluna vulgaris*. At Shewalton where a considerable amount of peat has been removed *Molinia caerulea* is dominant.

Removal of peat has also taken place in the area of hill peat. Cotton-grass moss has then been replaced by *Nardus* grassland or a rather mixed wet heath community with *Juncus effusus* common. Drainage of the peat has tended

to impart a drier character to the vegetation and *Calluna vulgaris* may be dominant.

The factors of burning and grazing also affect hill peat communities and it is difficult to assess the relative importance of these. On the coastal hills with heath vegetation a more strict rotation of burning is maintained so that a useful sward of *Calluna* is available for grazing.

Sheep and cattle are run on the hills and rough grazing while the long ley pastures are utilised for dairy cattle with some sheep and fattening cattle. The effect of selective grazing on the long ley pastures is seen in the abundance of *Ranunculus acris*, and on the poorly drained soils, of *Juncus effusus*.

Drainage is of paramount importance on the moderately fine to fine textured soils if they are to be maintained in a condition fit to carry a long ley pasture. A clear instance of this can be seen on the Ashgrove association where badly managed land carries a marsh vegetation of negligible grazing value whereas nearby drained land carries useful pasture.

TYPES OF VEGETATION

It is not intended to deal with the full range of vegetation communities but only with those whose extent and relationship with the major soil groups warrant their description. During the survey plant lists were drawn up for over 100 localities giving the subjective frequency of each species. Typical lists for definite soil series were selected to show the range of vegetation on each major soil group (Appendix III, Tables 16-22). Comparison of these tables also indicates the variation in specific composition which occurs in vegetation of similar status.

DUNE VEGETATION

The only primitive or pioneer plant community recorded was that on coastal dunes. Plant species of the two main stages, the building and the fixed dunes, were listed.

The mobile sand of the building phase is most commonly fixed by *Ammophila arenaria*, but in the earlier stages *Agropyron junceiforme* is important, and *Elymus arenarius* sometimes replaces *Ammophila* as the chief agent in fixing.

Ammophila is superseded by other species as the deposition of sand becomes negligible on the landward side of the dunes. A wealth of species enters—weed species and species of acid grassland and eventually of heath. In the area examined near Troon, *Festuca rubra* var. *arenaria* is the commonest grass and *Festuca ovina* is locally frequent. *Hypochaeris radicata* is abundant and *Anthyllis vulneraria*, *Plantago lanceolata* and *Luzula campestris* are common. Of the mosses, *Rhytidiadelphus squarrosus* is frequent and *Pseudoscleropodium purum* occasional.

DECIDUOUS WOODLAND

Knowledge of the extent and composition of post-glacial deciduous woodland is rather limited. A pollen diagram, Fig. 15, from an Ayrshire raised moss shows that before the Boreal Atlantic Transition (*ca.* 5000-6000 years B.C.), *Betula* was the dominant tree species with subsidiary *Pinus* and *Ulmus*. *Alnus* is represented only sporadically. The climate in Boreal time was cold and dry but this changed to much wetter conditions in the Atlantic period. The effect of this climatic change on the tree species is seen in the diagram at 4.6 metres

depth where there is a marked decrease in *Betula* with a corresponding increase in *Alnus*. For a considerable period *Alnus* pollen continues to be the most frequent with substantial amounts of *Betula* which tends gradually to increase. *Pinus* is negligible and *Quercus* and *Ulmus* remain low. In the upper part of the profile from 1·9 metres, *Alnus*, although still highly represented, becomes progressively lower in contrast to the rising proportion of *Betula*. The top metre of the diagram, which is comparatively recent, shows evidence

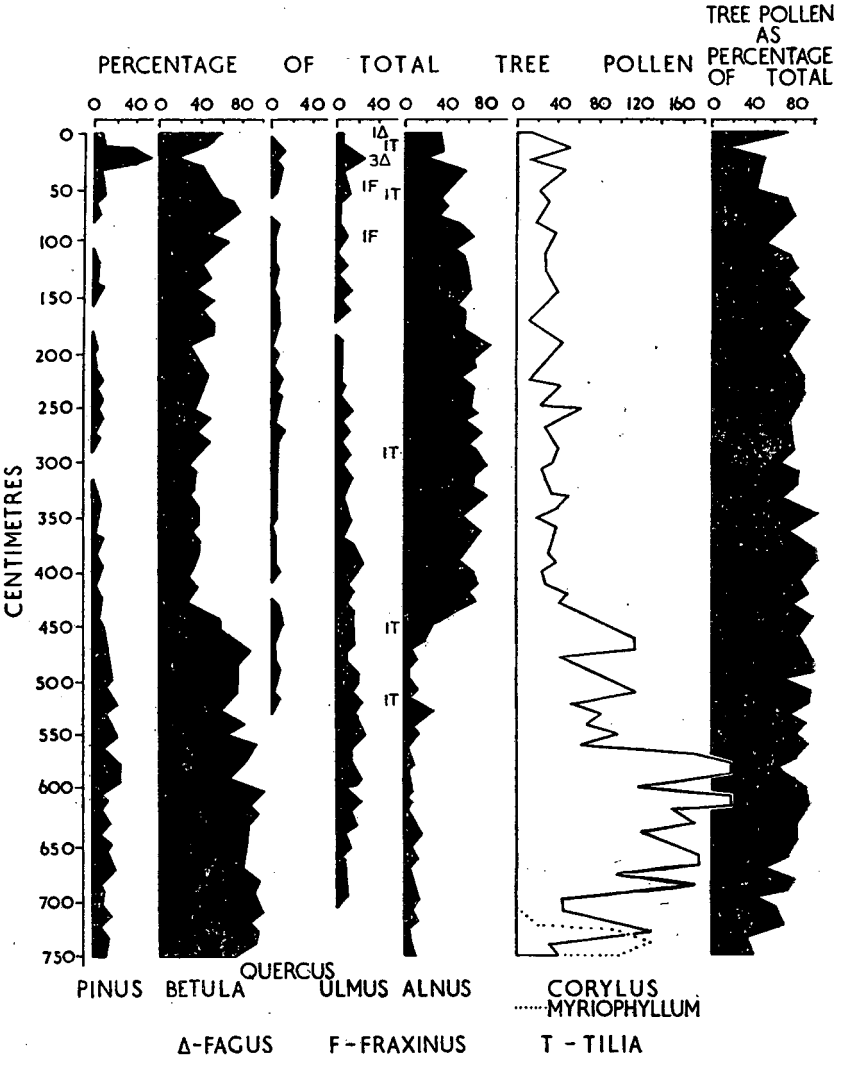


FIG. 15. Pollen Analysis of an Ayrshire Peat Deposit.

of a more mixed type of deciduous woodland. *Fagus* and *Fraxinus* are recorded for the first time and *Tilia* which occurs very infrequently at lower levels is again recorded; *Quercus* and *Ulmus* also show small increases. The *Pinus* peak at 30 cms. depth is probably accounted for by modern planting.

The overall picture therefore is one of dominance for long periods by *Betula* or *Alnus* with other tree species playing a minor part in the general woodland composition.

In present day woodlands planted *Fagus sylvatica* is often dominant or there may be a mixed dominance of such species as *Ulmus glabra*, *Quercus* spp., *Fraxinus excelsior*, *Acer pseudoplatanus* and *Betula* spp. These woodlands are usually along watercourses and in the vicinity of mansion houses.

A shrub layer is sometimes present, depending on the intensity of the tree cover and the status of the wood. The shrubs include young specimens of the dominant trees and such species as *Sorbus aucuparia*, *Corylus avellana*, *Crataegus monogyna* and *Ilex aquifolium*. Below this layer there are often local patches of low shrubby species, *Rubus fruticosus* agg., *Rubus idaeus*, *Lonicera periclymenum* and occasionally, *Hedera helix*.

The soils under these woods are usually fertile and damp and certain herbaceous species of the forest floor are reliable indicators of the moisture and base status. Tussock grass (*Deschampsia caespitosa*) is a local dominant, and abundant or locally abundant species are *Geum urbanum*, *Sanicula europaea*, *Melandrium rubrum* and *Epilobium montanum*. In addition to these indicator plants abundant species are *Poa trivialis*, *Holcus mollis*, *Pteridium aquilinum*, *Oxalis acetosella*, *Anthoxanthum odoratum*, *Endymion nonscriptus*, and *Viola riviniana*. The fern species, *Dryopteris austriaca*, *Dryopteris filix-mas* and *Athyrium filix-femina* form a large proportion of the ground vegetation, especially where the tree cover is continuous and fairly heavy. *Mnium hornum* and *Eurhynchium praelongum* are the most common mosses.

The presence of *Urtica dioica* and *Moehringia trinervia* often indicates an enhanced nitrate status of the soil.

Where the vegetation has been recently disturbed, as by felling, the rose-bay willow herb (*Chamaenerion angustifolium*) may rapidly colonise the area.

These woods are frequently repositories of all manner of rubbish and the presence of certain species is associated with this practice. *Galium aparine* and *Urtica dioica* together with wood species such as *Rumex obtusifolius*, *Stellaria media* and *Galeopsis tetrahit* are characteristic of these sites. Abundance of species such as *Holcus lanatus*, *Ranunculus repens* and *Poa trivialis* may be, but is not always, evidence of grazing by cattle.

Broadleaved woodland at higher elevation is generally dominated by *Betula* and species of Sallow are abundant. A large part of it is in an immature and disturbed state, due to recent felling.

Both species of Birch, *Betula pubescens* and *B. verrucosa* with intermediate forms are present, but in the wet soil conditions of Ayrshire *B. pubescens* is often the more abundant. By far the commonest Sallow is *Salix atrocinerea* and this also may be related to the soil-water conditions. The other species of Sallow, *Salix caprea* and *S. aurita* are locally common.

None of the birchwoods examined can really be considered as mature, and examples can be cited where *Quercus* occupies a minor position relative to *Betula*, and *Corylus avellana* is present in the shrub layer. In these cases the climax vegetation in former times was undoubtedly oakwood.

Alnus glutinosa may also occur as a constituent in the birchwoods. The abundance of its pollen laid down in peat would indicate that alderwood was the most widespread type of woodland up to recent times. Drainage and forest clearance of the till soils together with repeated felling of remaining woodlands have reduced it to minor importance.

The ground vegetation of the birchwood is more acid in character and may contain species showing more severe soil water-logging than the other types of deciduous woodland. Abundant species indicative of the more acid conditions are *Potentilla erecta*, *Luzula multiflora*, and *Deschampsia flexuosa*. 'Wet' species which are often very abundant are *Juncus effusus*, *Agrostis canina*, var. *canina*, *Deschampsia caespitosa*, *Juncus acutiflorus*, and *Carex nigra*. At higher elevation on peaty gley soils *Sphagnum* spp. and *Polytrichum commune* are abundant under rather poorly growing Birch. In one instance *Eriophorum vaginatum* was recorded under Birch. Other prevalent species are *Holcus mollis*, *Agrostis tenuis* and *Succisa pratensis*.

CONIFEROUS WOODLAND

Prior to the planting of conifers in recent times woodland of this type was probably very limited in the area. Conditions on the coastal hills may have formerly been suitable for Pine but it would have had to compete unfavourably with Oak.

The planted conifers are Scots Pine (*Pinus sylvestris*) and Norway Spruce (*Picea abies*) and the plantations are generally shelterbelts. European Larch, (*Larix decidua*) has also been planted and occurs occasionally, together with the other two species in the deciduous woodland.

Under *Picea abies* the ground vegetation is sparse or absent. In one plantation examined at an altitude of 900 ft. *Deschampsia flexuosa* and *Vaccinium myrtillus* are the only flowering plants, growing sparsely under dense shade. One moss, *Plagiothecium undulatum*, is also present. Where the canopy is more open *D. flexuosa* and *V. myrtillus* are still the most abundant species but *Calluna vulgaris*, *Galium hercynicum* and *Dryopteris austriaca* are occasionally found. Mosses are then more abundant and *Polytrichum commune* dominates the ground vegetation. Other mosses are *Sphagnum* spp., *Rhytidiadelphus loreus*, *Plagiothecium undulatum*, *Dicranum scoparium* and *Pleurozium schreberi*.

Under the more open canopy of *Pinus sylvestris* a greater abundance of vegetation is evident. Two plantations, one of Scots Pine and one of Norway Spruce, were recorded on raised moss peat and they demonstrate the differential effects of the tree species on the ground vegetation. The ground under the Norway Spruce is devoid of vegetation except below 'windows' in the canopy where occasional plants of *Dryopteris austriaca* and *Athyrium filix-femina* occur. In the Scots Pine plantation *Betula* spp. and *Sorbus aucuparia* of shrub stature occasionally occur. The ground vegetation, although poor in species, shows a luxuriant growth of *Dryopteris austriaca* and bramble (*Rubus fruticosus* agg.) is locally abundant. Other species present are *Vaccinium myrtillus*, *Anthoxanthum odoratum* and *Eriophorum vaginatum*. The last is a relict of the active phase of the raised moss.

A Scots Pine plantation on a mineral soil at an altitude of 400 ft. has a floor vegetation dominated by *Dryopteris austriaca* with *Oxalis acetosella*, *Holcus lanatus* and *Anthoxanthum odoratum* as locally abundant species. There are occasional trees of *Acer pseudoplatanus* and the seedlings of this tree are frequent. Part of the plantation has been felled over a period of years and the most marked effect of the felling is the suppression of *Dryopteris austriaca*. Grass species *Holcus lanatus*, *Holcus mollis*, *Agrostis tenuis* and *Anthoxanthum odoratum* initially form a rather open vegetation into which weed species from neighbouring agricultural land enter freely; *Spergula*

arvensis, *Stellaria media* and *Cerastium vulgatum* are representative of such conditions. As the grasses become dominant, however, these weed species are ousted.

LONG LEY PASTURE

This pasture is the least natural of the vegetation types recorded. However, since it is often laid down for periods of at least ten years, at the end of which time it may approximate to permanent pasture, it is worthy of description along with the more natural vegetation.

The soils are usually either imperfectly or poorly drained and since the efficiency of individual farmers differs there is considerable variation in the quality of this pasture.

In its general relationship with other vegetation it ranges from the Neutral Grassland to the Marsh Formation. On the drier sites the dominant grasses are *Poa trivialis*, *Lolium perenne*, *Agrostis tenuis*, *Poa pratensis*, *Holcus lanatus*, *Cynosurus cristatus* and *Dactylis glomerata*, and as the pasture ages *Agrostis tenuis* tends to become the sole dominant. In the absence of rejuvenation it would become *Agrostis-Festuca* pasture of the Acidic Grassland Formation. Where the soils are imperfectly to poorly drained the dominant grasses are similar to the above but indicators of wet conditions increase. The grass, *Alopecurus geniculatus*, is very abundant on wet sites and *Juncus effusus* dominates the poorly drained or the badly farmed land of better drainage.

The two species of buttercup, *Ranunculus repens* and *R. acris* are very abundant in these pastures and the increase of *R. acris* with continued grazing must considerably reduce the value of the herbage. *Trifolium repens* is abundant throughout this grassland and where grazing is heavy it may be the dominant species. The common daisy, *Bellis perennis*, occurs widely but is not invariably present. Weed species present in varying amounts are *Rumex crispus*, *R. obtusifolius*, *Sagina procumbens*, *Plantago major*, *Senecio jacobaea*, *Cerastium vulgatum*, *Cirsium arvense* and, on the wetter soils, *Cirsium palustre* and *Rumex acetosa*.

On some of the very poorly drained humic gley soils a form of pasture is maintained but the grasses are seldom dominant. *Juncus effusus* and *J. articulatus* are the most widespread dominants. Abundant grass species are *Agrostis canina* var. *canina*, *Holcus lanatus*, *Agrostis tenuis*, *Anthoxanthum odoratum*, *Deschampsia caespitosa* and *Poa pratensis*. Species of *Carex*, such as *C. panicea* and *C. nigra*, are often common. Frequent herbaceous species other than the above monocotyledonous plants are *Trifolium repens*, *Ranunculus repens*, *Rumex acetosa*, *Cardamine pratensis*, *Galium palustre*, *Cirsium palustre*, *Potentilla erecta* and *Viola palustris*.

PERMANENT PASTURE

(a) *Agrostis-Festuca* Grassland. Much of the permanent pasture on the free draining brown forest soils can be included in the *Agrostis-Festuca* grassland. Practices such as liming or soil of reasonable base status lend a rather more Neutral Grassland aspect to the vegetation. *Agrostis tenuis* and *Festuca ovina* are the dominants and *Anthoxanthum odoratum* is abundant. *Holcus lanatus*, *H. mollis*, *Festuca rubra* and *Agrostis canina* may be present in varying amounts. The heath bedstraw (*Galium hercynicum*) is a constant and abundant member of the community.

The abundance of such species as *Trifolium repens*, *Ranunculus repens* and *Poa pratensis* indicates a sward of better value than the usual *Agrostis-Festuca* pasture. The most frequent mosses are *Rhytidiadelphus squarrosus*, *Hypnum cupressiforme* and *Polytrichum* spp., but the occurrence of *Eurhynchium praelongum* confirms the less 'acid' nature of the vegetation.

Development of pasture after the felling of a Scots Pine plantation on the Lochliboside Hills shows acidic grassland with tendency to heath. *Deschampsia flexuosa* is the main dominant but *Agrostis tenuis* and *Festuca ovina* are locally dominant. *Galium hercynicum* is very abundant and *Potentilla erecta*, *Luzula campestris*, and *Anthoxanthum odoratum* are frequent to abundant. *Juncus squarrosus* is locally frequent and its presence along with *Carex binervis* and the infrequent occurrence of *Calluna vulgaris* demonstrate the affinity with heath.

(b) *Nardus* Grassland. On the freely drained organo-mineral soils *Nardus* grassland is often developed at the higher elevations. This community stands intermediate between the *Agrostis-Festuca* grassland and the communities on deep peat. It has affinities with heath as well and in Ayrshire is probably dependent on the biotic factor of grazing for its establishment.

Nardus stricta is the dominant species but wavy hair grass (*Deschampsia flexuosa*) is usually associated with it as an abundant species and may be locally dominant. The grasses, *Festuca ovina*, *Agrostis tenuis*, *Anthoxanthum odoratum* and *Agrostis canina* var. *arida* are frequent to abundant constituents of the community. The heath rush (*Juncus squarrosus*) and the heath bedstraw (*Galium hercynicum*) are constant and often abundant species.

Heath undershrubs which occur occasionally in this grassland but are not normally found are *Calluna vulgaris*, *Erica tetralix* and *Vaccinium myrtillus*. These species are all present in the vegetation on hill peat but *Nardus* grassland does abut on *Calluna* heath on the Renfrew Plateau and these two communities are alternatives, one displacing the other with a change in one factor such as rainfall, slope or grazing.

Eriophorum vaginatum and *Trichophorum caespitosum* sometimes occur with *Nardus* as dominant, giving clear indication of the affinity with hill peat vegetation.

The mosses present are *Polytrichum commune*, *Rhytidiadelphus squarrosus*, *Pleurozium schreberi*, *Hypnum cupressiforme* var. *ericetorum*, *Dicranum scoparium* and *Pseudoscleropodium purum*.

HEATH

Heath is mainly confined to mineral soils on the coastal hills and to certain areas of drier peat on other hills. It is also the vegetation on part of the drained and cut-over raised mosses.

Dry heath with no indicators of wet conditions is recorded from a small knoll on Caldron Hill. *Calluna vulgaris* is overwhelmingly dominant and grows in a low even sward. Sparse occurrence of *Vaccinium myrtillus*, *Deschampsia flexuosa*, *Festuca ovina* and *Erica cinerea* is noted. Mosses are also rare and the species observed are *Dicranum scoparium* and *Hypnum cupressiforme*.

The major area of heath does contain species lending a wetter character to the vegetation; such species are *Erica tetralix*, *Empetrum nigrum*, *Carex nigra*, *Eriophorum vaginatum*, *Trichophorum caespitosum* and *Juncus squarrosus*. Frequent species, in addition to those already noted in the dry heath,

are *Potentilla erecta, Galium hercynicum, Carex binervis, Nardus stricta, Festuca ovina, Anthoxanthum odoratum* and *Luzula multiflora.*

The heath mosses, *Hypnum cupressiforme* var. *ericetorum, Pleurozium schreberi,* and *Dicranum scoparium* are present in varying degrees of abundance. Areas of a wetter nature are characterised by the presence of *Polytrichum commune* and *Sphagnum* spp.

Burning of the heath may cause temporary dominance of *Vaccinium myrtillus* or *Deschampsia flexuosa.*

COTTON-GRASS MOSS

Vegetation dominated by *Calluna* in which *Eriophorum vaginatum* is a subsidiary species has been described under 'Heath', although that on the deeper peat might be more accurately described as 'Moor' or 'Moss'. Where *Eriophorum vaginatum* is dominant or co-dominant with *Calluna* the vegetation has been ascribed to the Cotton-grass Moss Association. This community is typically developed on hill peat but a similar community is present on raised moss at lower altitudes. The relationship between the two requires more detailed investigation, as it is felt that in North Ayrshire there is a sequence from the typical form of the one to the typical form of the other.

Eriophorum vaginatum is the dominant flowering plant, although *Calluna vulgaris* may be co-dominant in hagged areas or where slope and grazing practice have favoured it. Equally important as the cotton grass are species of *Sphagnum,* and examination of the peat shows it to be composed mainly of the remains of these species.

Other species, whose abundance varies but which are almost constant members of the community, are *Deschampsia flexuosa, Trichophorum caespitosum* and *Eriophorum angustifolium.* Less constant species but perhaps indicators of the status of the vegetation are *Narthecium ossifragum, Oxycoccus palustris* and *Molinia caerulea.* Tendency towards heath vegetation is demonstrated by the presence and increasing abundance of such species as *Potentilla erecta, Galium hercynicum* and *Vaccinium myrtillus.*

Polytrichum commune is generally an abundant species and locally dominates the vegetation. *Aulacomnium palustre* is also present but is rather erratic in its occurrence. The other mosses are those occurring typically on heath.

VEGETATION IN RELATION TO MAJOR SOIL GROUPS

The pattern of vegetation in relation to the major soil groups is largely upset by man's activities but the broad outline may be discerned through the intricacies and distortion imposed on it. The main difference arises from the water regime in the soils, although temperature also is undoubtedly operative in the division between humus-accumulating and non-humus-accumulating soils. The exceptions are the humic gley soils and the raised moss deposits which are developed independently of temperature.

BROWN FOREST SOILS

The soils in this group are divided into freely drained soils and those with gleyed B and C horizons. This division is reflected in the character of the vegetation, yet not invariably, as a soil on a moderate slope with a moist but concolorous freely drained B horizon may bear vegetation with *Deschampsia caespitosa* locally dominant under deciduous trees. Climate also influences

the occurrence of species so that vegetation at higher altitude on the freely drained soils may be more acid and more moist in character than that on imperfectly drained soils at low altitude.

(a) FREELY DRAINED (Table 16). Deciduous woodland on a freely drained brown forest soil has been recorded for a site at an altitude of 600 ft. The dominant trees are *Acer pseudoplatanus*, *Fagus sylvatica*, *Fraxinus excelsior* and *Quercus* spp. Dominants of the field layer are *Holcus mollis*, *Dryopteris austriaca*, *Agrostis tenuis* and *Deschampsia caespitosa*. *Oxalis acetosella* is abundant throughout the wood and the other less frequent species do not indicate conditions of high base status.

The upper portion of this wood has been felled and grazed for a number of years. *Agrostis-Festuca* pasture is established with a tendency to heath, indicated by the local dominance of heavily grazed *Calluna*. Natural regeneration of *Acer pseudoplatanus* is taking place but cessation of animal grazing would probably be necessary for the development of woodland. Absence of grazing in the first place would give rise to heath and eventually to the re-establishment of the forest.

Well-maintained permanent pasture on these soils is *Agrostis-Festuca* grassland with a stronger Neutral Grassland element. On the more neglected pastures heath species are common.

Above an altitude of about 700 ft. the brown forest soils are displaced by the peaty podzol group. Near this limit plants of *Nardus* grassland or heath are prominent in the sward.

(b) IMPERFECTLY DRAINED (Table 17). A large proportion of the lowland soils is included in this category and before the present era woodland on these soils was probably dominated by *Quercus* and *Ulmus*. *Ulmus glabra* and to a lesser extent *Quercus* spp. still occur frequently as the dominants in these woods but the introduced species *Fagus sylvatica*, *Acer pseudoplatanus* and *Fraxinus excelsior* are often more characteristic, forming a mixed stand. Dominance by one tree species is only to be found in certain beechwoods.

The ground vegetation is not much wetter in character than that on the freely drained soils but a better base status is indicated by the occurrence of certain species, for example, *Sanicula europaea*, *Melandrium rubrum* and *Geum urbanum*. Not all woods show evidence of this higher base status and rough grazing on a felled woodland near Crosshands shows an abundance of heath and *Nardus* grassland species.

The shelterbelts of coniferous woodland do not differ from the general description of these given in Chapter VIII.

Permanent pasture is limited on soils of this group and where it occurs *Juncus effusus* is commonly present. In other characters it is similar to the vegetation on freely drained soils but more akin to Neutral Grassland.

The long ley pastures, which are maintained on a large area of these soils, are dominated by sown-out grasses *Poa trivialis*, *Lolium perenne* and, to a lesser extent, by *Phleum pratense* and *Dactylis glomerata*. As the pasture gets older these species give way to 'natural' grasses. *Agrostis tenuis* is often dominant in the older pastures and *Poa trivialis* remains an abundant species. *Lolium perenne* persists to some extent but *Phleum pratense* and *Dactylis glomerata* disappear. Other frequent natural species in the later stages are *Anthoxanthum odoratum*, *Holcus lanatus*, *Cynosurus cristatus* and *Poa pratensis*, while *Alopecurus geniculatus* occurs locally as indicative of the wet conditions.

The change in the quality of the pasture as described will depend largely on management as well as time.

The leguminous plant associated with the grasses is *Trifolium repens*, but on the older pastures where *Agrostis* is the dominant, *Lotus corniculatus* and *Lathyrus pratensis* may be more abundant.

Ranunculus repens and *R. acris* are by far the most abundant weeds. *Bellis perennis* is also frequent and *Cerastium vulgatum*, *Rumex obtusifolius*, *Prunella vulgaris* and *Sagina procumbens* are constant although not abundant species.

NON-CALCAREOUS GLEYS

The major area of these soils is classed as poorly drained except for local very poorly drained sites. Low relief or increase in clay content causes the change in drainage and this difference is reflected in the wetter character of the vegetation.

(a) POORLY DRAINED (Table 18). On the poorly drained soils mature woodland with a mixed dominance of deciduous trees differs little from that on the imperfectly drained soils. The improvement of drainage by the action of the trees is evident.

The former maximum development of alderwood may have been on these non-calcareous gleys, although it probably extended on to the brown forest soils with gleyed B and C horizons and also the organo-mineral soils at higher altitude. *Alnus* now occurs occasionally in the birch-willow scrub.

The scrub woodland shows marked wet characteristics. The dominant is *Betula pubescens* with a lesser proportion of *B. verrucosa*. The Sallows, *Salix atrocinerea*, and *S. aurita* are abundant or locally dominant. The floor vegetation shows a wealth of species of occasional occurrence and no development of clearly defined societies. This indicates the unstable and temporary status of the vegetation. Abundant wet indicator species are *Juncus effusus*, *Deschampsia caespitosa*, *Juncus conglomeratus* and *Agrostis canina* var. *canina*. Other marsh and damp woodland species of less frequent occurrence are *Cirsium palustre*, *Equisetum sylvaticum* and *Angelica sylvestris*.

Differences in the base status of these poorly drained soils are evident from the floristic composition of some of the communities of scrub woodland, although the disturbed nature of the vegetation makes it difficult to draw firm conclusions. The presence of naturally regenerating *Fraxinus excelsior* with a ground vegetation dominated by *Deschampsia caespitosa* and *Melandrium rubrum* as a locally abundant species is strongly indicative of a more fertile soil than is found where *Betula* and *Salix* alone are present and *Calluna vulgaris* locally dominant of the field layer. The more fertile soil is probably the site of former alderwood with *Ulmus* and *Quercus*, while alderwood with *Betula* grew on the poorer site.

Permanent pasture on the poorly drained soils is limited, although felled woodland is often adopted as rough grazing. *Juncus effusus* increasingly dominates the vegetation and other common wet species are *Juncus conglomeratus*, *Deschampsia caespitosa* and species of *Carex*. Between the tussocks of *Juncus*, *Agrostis tenuis* is usually the most abundant species. *Anthoxanthum odoratum*, *Holcus lanatus* and *Agrostis canina* are locally abundant and the meadow grasses, *Poa trivialis* and *Poa pratensis* are frequent.

Long ley pasture is more difficult to maintain in a satisfactory condition than on the better drained soils. This is especially true at higher altitudes

where precipitation is greater. There is a strong tendency for *Juncus effusus* to become established and eventually to dominate the vegetation.

The grasses sown out and the sward established are similar to those on the imperfectly drained soils. In a like manner the natural grasses come in, *Trifolium repens* becomes less abundant and *Lotus* and *Lathyrus pratensis* increase. At the same time there is a greater abundance of grasses of damp meadows such as *Cynosurus cristatus* and *Alopecurus geniculatus*, and *Glyceria fluitans* is occasionally present. The moss, *Acrocladium cuspidatum*, is present as an occasional species and is further indication of the moisture status of the soil.

At higher altitude these soils pass into peaty gleys and deep peat. More acid species are present in the vegetation near this limit. Examples of these are *Carex ovalis*, *C. nigra* and the rare occurrence of *Juncus squarrosus*.

(b) VERY POORLY DRAINED (Table 19). The relatively small area of very poorly drained soils was not thoroughly investigated. On these soils the marsh character of the vegetation is more strongly accentuated; *Juncus effusus* is the dominant at the sites examined and other prevalent species are *Agrostis canina* var. *canina*, *Deschampsia caespitosa*, *Carex nigra*, *Carex panicea* and *Anthoxanthum odoratum*.

PEATY PODZOLS

The characteristic feature of these soils is a freely drained B_2 horizon under a peaty topsoil. Under the podzolising conditions prevailing a distinctly leached A_2 horizon may or may not be present, and an impervious iron pan may also be formed above the B_2 layer. With this variation in the upper horizons of the soil there is a concomitant variation in the vegetation (Table 20).

In the absence of an iron pan *Calluna* heath or *Nardus* grassland is established. The heath is generally associated with the drier conditions of the steeper slopes, although this is not invariable; the nature of the humus and the intensity of grazing may also be operative. Intergrades between the two communities do occur, but they are usually distinct and there is a tendency for them to be regionally distributed.

Where there is a well-developed iron pan under the A_2 horizon heath or *Nardus* grassland may still be maintained, with an increase in wet bog species such as *Eriophorum vaginatum*, *Trichophorum caespitosum* and *Sphagnum* spp. A stage is reached where raw peat rather than humus is laid down and under these conditions cotton-grass moss is established. The shallowness of such peat is confirmed by the abundance of *Juncus squarrosus* and the occurrence of such species as *Anthoxanthum odoratum* and *Festuca ovina*.

PEATY GLEYS

These soils are intermediate between the mineral gleys and peat. Their area has been considerably increased by the removal of peat and the vegetation has a rather mixed character containing elements of heath, *Nardus* grassland, marsh and cotton-grass moss (Table 21).

Long ley pasture is established over a fairly wide area on peaty gley soils, but in the past has been difficult to maintain as good grazing. The insidious encroachment of *Juncus effusus* can be halted by the recent practice of spraying hormone weedkiller and there may now be considerable appreciation in the value of these grazings. The early stages in the establishment of sown-out

pasture are similar to those on the mineral gleys. *Juncus effusus* gradually exerts its dominance on the vegetation, and, as distinct from the typical mineral gley, acid plants of wet conditions become more abundant. In a late stage of the degeneration of these pastures none of the sown-out grasses or their associated weeds are present. The dominants are *Juncus effusus* and *J. acutiflorus* and locally abundant grasses are *Nardus stricta, Festuca ovina, F. rubra, Deschampsia flexuosa* and *Agrostis canina.* Dicotyledonous herbs present include *Galium hercynicum, Potentilla erecta* and *Rumex acetosa.*

In the vicinity of hill peat, where the cutting of drains and removal of peat have considerably disturbed the natural vegetation, dominant and abundant species are *Juncus squarrosus, Deschampsia flexuosa, Calluna vulgaris, Vaccinium myrtillus, Eriophorum vaginatum, Molinia caerulea* and *Nardus stricta.* The most abundant moss is *Polytrichum commune* and *Sphagnum* spp. are locally abundant. The vegetation is very similar in character to that developed on a peaty podzol with serious drainage impedance above the iron pan. *Juncus effusus* is locally abundant beside open drains.

Scrub woodland of *Betula pubescens/B. verrucosa* is common on these soils. It is probably derived from primitive birchwood and modified by repeated felling and grazing. On exposed sites the growth of the Birch is poor, and one instance was seen where the shrubs were maintained at a low stature by browsing cattle. *Deschampsia flexuosa* is the most common grass of the floor vegetation and *Juncus effusus* is locally dominant. *Carex nigra* is also a prevalent species and *Polytrichum commune* and *Sphagnum* spp. occur abundantly in these woodlands.

Alnus glutinosa may also occur along with Birch and Willow on these soils. The sites are normally less exposed and the presence of such species as *Deschampsia caespitosa* and *Eurhynchium praelongum* indicates more fertile conditions.

HUMIC GLEYS

The only sites examined on the humic gleys, apart from one limited area of woodland, fall within long ley or permanent pasture. The typical vegetation is described under 'Long Ley Pasture'.

In the woodland site recorded, the trees are growing on the drier soil surrounding the area of humic gley. *Salix* spp. of shrub to small tree stature grow on the actual gley soil and the ground vegetation is dominated by *Athyrium filix-femina* and locally by *Juncus effusus.* Abundant species are *Dryopteris austriaca, Agrostis canina,* and *Ranunculus repens. Oxalis acetosella* is concentrated round the bases of the fern tussocks, and the most common mosses are *Brachythecium* sp. and *Eurhynchium praelongum* (Table 22).

HILL PEAT

The major vegetation community on the hill peat is cotton-grass moss. At the lower altitudes *Calluna* occurs as co-dominant with *Eriophorum vaginatum,* and a lower intensity of grazing and burning may favour the mixed dominance of these two species. Where drying out of the peat has taken place, either by drainage or the headward erosion of streams, there is often a tendency for *Calluna vulgaris* to be established as the dominant species.

Owing to flat topography and impervious till, peat formation can be active at almost any altitude. There is thus a range from the raised mosses through the peat at intermediate levels to the typical sub-alpine peat. Most of the peat

at intermediate levels has been removed to expose the underlying mineral material. One remaining example at Uplawmoor at an altitude of 500 ft. was examined. Here the peat is no longer actively forming and Birch woodland is established. Most of the Birch is of shrub stature and there is evidence of periodic selective felling. The surface of the peat is uneven and large hummocks of *Vaccinium myrtillus* occur, between which *Deschampsia flexuosa* is often dominant. *Sphagnum* spp. are locally abundant but not sufficient to cause peat formation.

Peat on Mean Muir south of Galston had been planted with a shelterbelt of Norway Spruce. One area is a mass of tangled trunks where the trees have suffered windblow due to the unstable rooting medium, or where the trees have become moribund and fallen even in moderate winds. The ground vegetation is dominated by *Juncus effusus* and *Sphagnum* spp., and *Agrostis canina* is locally abundant. The dominance of *Juncus effusus* is in striking contrast to the vegetation of unplanted peat where *Calluna vulgaris* and *Eriophorum vaginatum* are co-dominant. On the other side of the shelterbelt long ley pasture has been established on the peat; *Juncus effusus* is overwhelmingly dominant and the pasture is of little value.

RAISED MOSS

The raised mosses are much cut over and drained so that humification is likely to outweigh any fresh build-up of the peat. The vegetation is very similar to that on the hill peat and the main difference is in the greater abundance of *Calluna vulgaris*. The heather has not the typical small stunted growth of that on areas of active peat formation but is more vigorous and tussocky in habit.

Where a great deal of peat has been removed, as on Shewalton Moss, *Molinia caerulea* may become dominant.

Drainage of the mosses and planting with Scots Pine have also been carried out, but growth of the trees is often poor. *Sorbus aucuparia* and *Betula* spp. are occasional or locally frequent species in these plantations. As in Scots Pine plantations on mineral soils *Dryopteris austriaca* is dominant or locally dominant of the floor vegetation. *Rubus fruticosus* agg. is occasional to locally abundant and *Sphagnum* spp. are abundant.

LIST OF SPECIES RECORDED FROM PRINCIPAL SOIL CATEGORIES

TREES AND SHRUBS

Acer pseudoplatanus
Aesculus hippocastanum
Alnus glutinosa
Betula pubescens
B. verrucosa
Corylus avellana
Crataegus monogyna
Fagus sylvatica
Fraxinus excelsior
Ilex aquifolium
Larix decidua
Picea abies
Pinus sylvestris
Quercus petraea
Q. robur
Salix atrocinerea
S. aurita
S. caprea
S. purpurea
Sorbus aucuparia
Tilia sp.
Ulmus glabra

Achillea millefolium
A. ptarmica
Adoxa moschatellina
Aegopodium podagraria
Agropyron junceiforme
A. repens
Agrostis canina var. *canina*
A. canina var. *arida*
A. stolonifera
A. tenuis
Aira praecox
Ajuga reptans
Alchemilla glabra
Allium ursinum
Alopecurus geniculatus
A. pratensis
Ammophila arenaria
Anemone nemorosa
Angelica sylvestris
Antennaria dioica
Anthemis cotula
Anthoxanthum odoratum
Anthriscus sylvestris
Anthyllis vulneraria
Aphanes arvensis
Apium graveolens
Arenaria serpyllifolia
Armeria maritima
Arrhenatherum elatius
Athyrium filix-femina
Atriplex sp.

Bellis perennis
Blechnum spicant
Botrychium lunaria
Brachypodium sylvaticum
Bromus mollis

Callitriche stagnalis
Calluna vulgaris
Caltha palustris
Campanula rotundifolia
Cardamine amara
C. flexuosa
C. pratensis
Carex acuta
C. acutiformis
C. arenaria
C. binervis
C. curta
C. demissa
C. echinata
C. flacca
C. hirta
C. hostiana
C. lepidocarpa
C. nigra
C. ovalis
C. panicea
C. pilulifera
C. pulicaris
C. remota
C. rostrata
C. vesicaria
Carum verticillatum
Centaurea nigra
Cerastium vulgatum
Chamaenerion angustifolium
Chrysanthemum leucanthemum
Chrysosplenium alternifolium
C. oppositifolium
Circaea lutetiana
Cirsium arvense
C. palustre
C. vulgare
Claytonia alsinoides
Cochlearia officinalis
Conium maculatum
Conopodium majus
Crepis capillaris
C. paludosa
Cynosurus cristatus

Dactylis glomerata
Deschampsia caespitosa
D. flexuosa
Digitalis purpurea
Drosera rotundifolia
Dryopteris austriaca
D. borreri
D. filix-mas

Echium vulgare
Eleocharis palustris
Elymus arenarius
Empetrum nigrum
Endymion nonscriptus
Epilobium montanum
E. palustre
Epipactis helleborine
Equisetum arvense
E. fluviatile
E. sylvaticum
E. telmateia
Erica cinerea
E. tetralix
Eriophorum angustifolium
E. vaginatum
Euphrasia sp.

Festuca gigantea
F. ovina
F. pratensis
F. rubra
F. rubra var. *arenaria*
Filipendula ulmaria
Fragaria vesca
Galanthus nivalis
Galeopsis tetrahit
Galium aparine
G. hercynicum
G. palustre
G. verum
Genista anglica
Geranium dissectum
G. molle
G pratense
G. robertianum
G. sanguineum
Geum intermedium
G. rivale
G. urbanum
Glaux maritima
Glechoma hederacea
Glyceria fluitans

Hedera helix
Helictotrichon pubescens
Heracleum sphondylium
Hieracium pilosella
Hippophae rhamnoides
Hippuris vulgaris
Holcus lanatus
H. mollis
Honkenya peploides
Hydrocotyle vulgaris
Hypericum pulchrum
H. tetrapterum
Hypochaeris radicata

Iris pseudacorus

Jasione montana
Juncus acutiflorus
J. articulatus
J. bufonius
J. bulbosus
J. conglomeratus
J. effusus
J. kochii
J. squarrosus

Koeleria gracilis

Lapsana communis
Lathyrus pratensis
Leontodon autumnalis
Linum catharticum
Listera ovata
Lolium perenne
Lonicera periclymenum
Lotus corniculatus

Lotus uliginosus
Luzula campestris
L. multiflora
L. pilosa
L. sylvatica
Lychnis flos-cuculi
Lycopodium clavatum
Lysimachia nemorum

Malus sylvestris
Matricaria matricarioides
M. maritima ssp. *inodora*
M. maritima ssp. *maritima*
Meconopsis cambrica
Melampyrum sylvaticum
Melandrium rubrum
Melica uniflora
Mentha sp.
Menyanthes trifoliata
Mercurialis perennis
Milium effusum
Mimulus luteus
Moehringia trinervia
Molinia caerulea
Montia lamprosperma
Myosotis arvensis
M. caespitosus
M. discolor
M. secunda
Myrica gale

Nardus stricta
Narthecium ossifragum
Neottia nidus-avis
Nuphar lutea

Orchis ericetorum
O. fuchsii
Ornithopus perpusillus
Oxalis acetosella
Oxycoccus palustris

Pedicularis sylvatica
Phalaris arundinacea
Phleum pratense
Phragmites communis
Pinguicula vulgaris
Plantago coronopus
P. lanceolata
P. major
P. maritima
P. media
Platanthera bifolia
P. chlorantha
Poa annua
P. pratensis ssp. *pratensis*
P. pratensis ssp. *subcaerulea*
P. trivialis
Polygala serpyllifolia
Polygonum amphibium
P. aviculare
P. persicaria
Polypodium vulgare
Polystichum setiferum
Potamogeton sp.
Potentilla anserina
P. erecta
Primula vulgaris
Prunella vulgaris
Pteridium aquilinum

Ranunculus acris
R. bulbosus
R. ficaria
R. flammula
R. lenormandi
R. lingua
R. repens
Raphanus raphanistrum
Rhinanthus minor
Rhododendron ponticum
Rhynchosinapis monensis
Ribes rubrum
R. uva-crispa
Rosa coriifolia
R. tomentosa
Rubus chamaemorus
R. fruticosus agg.
R. idaeus
Rumex acetosa
R. acetosella
R. crispus
R. obtusifolius
R. sanguineus var. *viridis*

Sagina procumbens
Salix repens
Sambucus nigra
Sanicula europaea
Sarothamnus scoparius
Saxifraga spathularis x *umbrosa*
Scrophularia nodosa
Sedum anglicum
Senecio jacobaea
S. vulgaris
Sieglingia decumbens
Silene maritima
Sinapis arvensis
Sisymbrium officinale
Solanum dulcamara
Sonchus arvensis
S. asper
Spergula arvensis
Stachys palustris
S. sylvatica
Stellaria alsine
S. graminea
S. media
S. nemorum
Succisa pratensis
Symphytum perigrinum
S. tuberosum

Taraxacum officinale agg.
Teucrium scorodonia
Thelypteris oreopteris
Thymus drucei
T. serpyllum
Trichophorum caespitosum
Trientalis europaea
Trifolium campestre
T. dubium
T. medium
T. pratense
T. repens
Tussilago farfara
Typha latifolia

Ulex europaeus
Urtica dioica
U. urens

Vaccinium myrtillus
Valeriana officinale
Veronica beccabunga
V. chamaedrys
V. officinalis
Veronica serpyllifolia
Viburnum opulus
Vicia angustifolia
V. cracca
V. lathyroides
V. sepium
Viola canina
V. lutea
V. palustris
V. riviniana
V. tricolor

Zerna ramosa

Acrocladium cuspidatum
Atrichum undulatum
Aulacomnium palustre

Brachythecium albicans
B. rutabulum
Bryum sp.

Campylopus sp.
Ceratodon purpureus
Conocephalum conicum

Dicranella heteromalla
Dicranum majus
D. scoparium

Eurhynchium praelongum

Fontinalis antipyretica

Hylocomium splendens
Hypnum cupressiforme
H. cupressiforme var. *ericetorum*
H. cupressiforme var. *filiforme*

Leucobryum glaucum
Lophocolea bidentata

Mnium hornum
M. undulatum

Pellia sp.
Philonotis fontana
Plagiochila asplenioides
Plagiothecium undulatum
Pleurozium schreberi
Pohlia nutans
Polytrichum commune
P. juniperinum
Pseudoscleropodium purum

Rhytidiadelphus loreus
R. squarrosus
R. triquetrus

Sphagnum spp.

Thuidium tamariscinum

CHAPTER VII

Agriculture

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The West of Scotland Agricultural College

THIS area, included in the former sheet 22, comprises North Ayrshire and small parts of the adjoining counties of Renfrew and Lanark. The rainfall varies from under 35 inches on the coast to around 70 inches on the hills above Largs and Kilbirnie. The soils range from blown sands through loams to clays and peats. The very light sands near the coast are of little value agriculturally and are occupied by the I.C.I. factory, the War Department and the golf courses. The heavier sands and lighter loams are devoted to early potato growing while the heavier loams are under dairy farming and the more upland soils are devoted to sheep farming, Fig. 16.

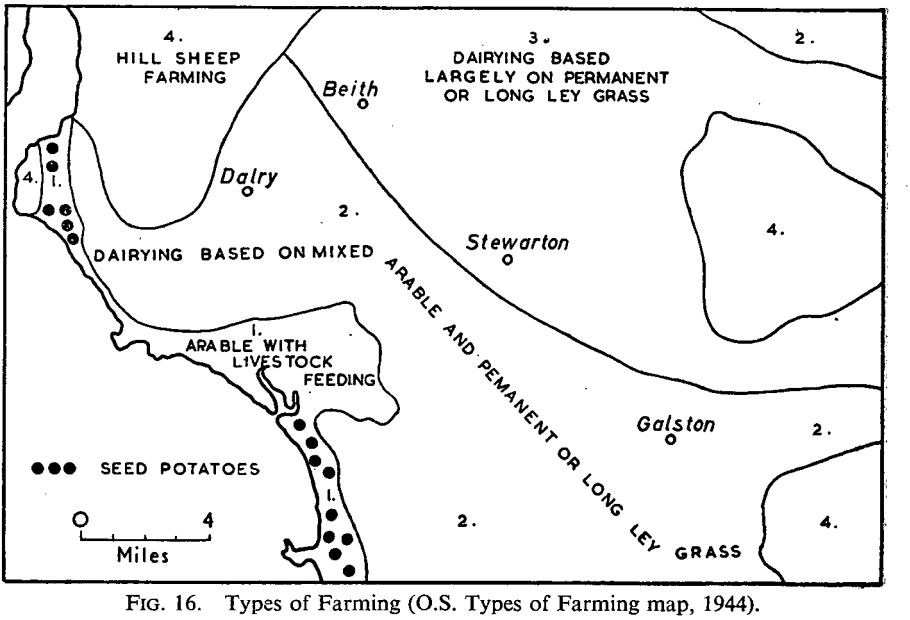

FIG. 16. Types of Farming (O.S. Types of Farming map, 1944).

HISTORICAL

The Ayrshire breed of cattle originated in this area, being known first of all as Dunlop cattle and later as the Cunningham Breed, Cunningham being the most northerly of the three sections into which Ayrshire was formerly divided. The village of Dunlop also has given its name to a type of cheese formerly made on many North Ayrshire farms till the establishment of the farmers' co-operative creameries at the beginning of the present century; and on Central and South Ayrshire farms till after the formation of the Milk Marketing Board.

Great development commenced in the enclosure and improvement of lands towards the end of the eighteenth century and continued throughout the nineteenth century. To facilitate the drying of the land, much of it had been set up in high ridges with water furrows, and the tile draining was introduced about 1830 by the Duke of Portland. Towards the middle of the nineteenth century Alexander Jack of Maybole introduced a reaping machine and McCartney of Cumnock an improved threshing mill. The growing of early potatoes on the coastal farms dates from 1860. In 1877 the Ayrshire Cattle Herd Book Society was formed and about 1907 Milk Recording was introduced in the Fenwick area after a deputation had visited Denmark to study the system there. In addition to Ayrshire cattle there are a number of Friesian herds which were mostly established in the early part of the present century. A pilot scheme for the reduction of tuberculosis was commenced in the area between Mauchline and Galston in the early thirties, and the favourable results quickly achieved gave a great impetus to the eradication of tuberculosis by the farmers of the county. Rapid progress was made in that connection and the dairy cattle have for several years been free of tuberculosis.

In the years between the wars much of the land had been laid down to grass owing to the low prices obtainable for crops and the low cost of imported feeding stuffs. The 1938 agricultural returns showed that two-thirds of the land was under pasture, one sixth under hay and only one sixth under arable crops. During the recent war, however, the acreage under arable crops was more than doubled, but has again shrunk in the past few years.

CLIMATE

The average annual rainfall on the coastal fringe is rather less than 35 inches and the grain cropping area figure lies between 35 and 40 inches. Most of the dairy farms have a rainfall of between 40 and 50 inches though the figure tends to be somewhat higher near the Kilbirnie hills. On the sheep farms near the Ayrshire county boundary the figure may rise to over 70 inches. The driest period is generally the three months March to May when the monthly average seldom exceeds 2 inches. On the other hand 5 inches can be exceeded in any or all of the late autumn months. As a general rule September has a lower rainfall than either August or October and is the best harvest month. Seldom do grass or crops suffer from drought except on the very lightest soils. Snow only lies for a very short time in most seasons near the coast but may persist for weeks on the high ground. The mean January temperature is around 39 degrees Fahrenheit and the July mean is about twenty degrees higher.

SIZE OF FARMS

While most farms are included in the range 50-150 acres, there are several schemes of Department of Agriculture small holdings and other small units of less than 50 acres. On the other hand there are a few large cropping and stock farms of 300 acres or over as well as a number of sheep farms where 1,000 acres is exceeded. There are comparatively few dairy farms of over 200 acres on the low ground though some of those in the higher lying districts may have an extensive additional area devoted to hill sheep and cattle rearing. The great majority of dairy farms have between 30 and 50 cows, and in addition to rearing their herd replacements, may have surplus stock for sale.

The number of owner/occupiers has greatly increased since 1918, the Lainshaw and Eglinton estates having been broken up shortly after the 1914-18 war, and farms of other estates have been sold at times, often to meet the requirements of death duties. There are still a considerable number of farms let to tenants on the Kilmarnock, Rowallan, Lanfine, and Southannan estates. Year to year tenancies are the rule, though there are a number of 14 year leases in force. Many of the rents show only slight increases over those prevailing at the beginning of the present century, being still under £2 per acre in many cases. Some recent rents, however, have been arranged at a much higher figure but very few farms are being let, the great majority being sold as they become vacant. It is becoming increasingly difficult, therefore, for young men to take up farming on their own account without a large amount of borrowed money to enable them to provide the capital now necessary to purchase and equip a farm. A vacant farm generally makes twice as much as a farm sold with a sitting tenant. Where farms are still standing at a low rental figure the proprietor cannot undertake extensive repairs and in many cases the tenants are carrying these out at their own expense, under an agreement whereby they are compensated if the farm is given up within a stated number of years. Where dairy byres and other premises had to be altered on rented farms to meet the requirements of the county sanitary inspector, such an arrangement enabled many occupiers to take full advantage of the premiums obtainable in respect of graded milk.

SOIL FERTILITY

When the Soils Department at the West of Scotland Agricultural College was developed during the late twenties, the first survey and intensive sampling was done in Central Ayrshire and more information was available at an earlier date regarding the soil condition of that county than of any others in west and south-west Scotland. Even in the late twenties and early thirties when agriculture was in a depressed condition, many farmers were endeavouring to improve their soils with dressings of ground phosphate, basic slag and lime. From the end of the nineteenth century North Ayrshire dairy farmers had been using large quantities of imported feeding stuffs, and soil fertility was thereby increased as in many cases little was being sold off the farm except milk or its products. The advent of the milk marketing scheme in 1933 ensured an economic return to the dairy farmer though crop prices remained low for a further period.

The introduction of the land fertility scheme in 1937 encouraged further lime and basic slag applications with considerable benefit, especially to the grasslands of the county. Keeping the land down under good grass for considerable periods raised the fertility level so that at the outbreak of war, even on secondary land, high crop yields were obtained. With continued cropping the soil structure of much of the heavy land deteriorated to the detriment of crop yields in the later war years. The loss of fertilising constituents, however, was comparatively small as, though the use of phosphate on grassland was banned for a number of the war years, a considerable amount of phosphate found its way on to the grazings either with or without the necessary permits for phosphate-deficient land. In recent years the amount of cropping especially on the heavier soils, has been greatly reduced, and lime is being liberally applied especially on grassland during the summer

months when the higher rate of subsidy prevails. The dressings of slow acting phosphate applied are generally lighter than immediately before the war due to the higher present-day cost and also to the fact that phosphate deficiencies on the low ground soils are not nearly so serious as 20-30 years ago. The soil pH figures generally range between 5·7 and 6·2 as compared with a figure of 5·0-5·6 a quarter of a century ago. Boron deficiency as evidenced by the occurrence of raan (Brown Heart) in the turnip crop is becoming more common, being possibly induced by the improvement in the lime status. This trouble is, however, less widespread than in the southern half of the county. On a number of farms, especially on the lighter soils, manganese deficiency symptoms have also appeared.

SYSTEM OF FARMING

On the coastal fringe early potato growing is practised combined with dairying or cattle farming. The potatoes are planted towards the end of February or during March when the weather is suitable, having been sprouted in boxes during the winter, and are given a liberal dressing of artificial manure up to 1 ton per acre. In addition either dung or seaweed is applied in the autumn and ploughed in during the winter. The variety planted as a rule, except on a few farms scheduled for wart disease, is Epicure. None of the newer immune varieties can withstand the winds or recover from the late frosts and produce a reasonable crop after a severe check. The crop is generally lifted during the second half of June or early July with the farmers' own labour or more commonly is sold by the acre to a merchant who supplies the labour for lifting and markets the crop.

ROTATIONS AND CROPS

The most common rotation in the county is an oat crop after lea followed by a root crop, then another cereal crop, hay and a varying number of years of pasture. The duration of the pasture is increased on the poorer soils and in the wetter districts. On a few farms where too great fertility results through the land lying under pasture, a root crop or potatoes may follow the lea. This is often done in potato growing districts enabling the dung dressing to be omitted in such cases. On the typical early potato growing soils a second potato crop given dung may follow the first after lea, or a cereal crop may be interposed. Except on the very earliest fields a year's pasture is occasionally included in order to increase the humus content and check eelworm development. The chief cereal grown is oats and this will account for about 98% of the cereal acreage, the balance being devoted to wheat which generally occupies only a portion of the redland break on the cropping farms. On the richer soils, yields of 2 tons per acre of oats are readily obtained in a favourable season and even on the soils less suited for intensive cropping, yields of 30 cwts. per acre are common after a period of years under pasture. A crop of 17 cwts per acre which is the crop reporters' average attribution to Ayrshire is regarded by most people as a partial failure. Wheat yields also normally range from 25 to 40 cwts. per acre. Where turnips are grown satisfactorily they considerably exceed the 17 tons per acre given as the county average in the Department of Agriculture's returns, being more commonly between 25 and 30 tons per acre. The Department average of 8 tons per acre for potatoes is generally exceeded except on those shore fields lifted before the middle of June to meet the demand for new season potatoes, when lifting may commence before 4 tons is reached.

First year's grass is normally cut for hay but on a number of farms it may be made into silage, though in the majority of farms it is second year's grass which is used for this purpose. On a number of dairy farms hay may also be cut in the second year but the greater number rely upon timothy meadows to provide the additional hay required on heavily stocked dairy farms. The taking of ryegrass seed from the first year's crop used to be a very common practice in the North Ayrshire parishes but only a few farmers now seed this crop. The green cut hay naturally is preferred for milk production. Most of the North Ayrshire dairy farms carry at least one cow and one follower per three acres. This necessitates the purchase of a large amount of feeding stuffs during the winter and the grazing away during the summer of part of the young stock. The Ayrshire breed is the one most commonly kept and includes many well known pedigree herds. There are also a number of Friesian herds and in some cases the common Ayrshire type of herd is being inseminated from Friesian bulls at the Southbar Centre.

The pig population fell considerably after the beginning of the century when farm buttermaking and cheesemaking largely ceased. It fell further during the war when feeding stuffs were scarce, but has risen considerably in recent years and is again static. The present figure averages around five pigs per holding but many farms do not have even one pig.

The number of horses has fallen greatly in the past 20 years. Many people purchased a tractor after the outbreak of war when additional cropping was called for. In recent years there has been a great development of mechanisation on the farm with a great extension of mounted equipment as well as the purchase of green crop loaders and pick-up balers. There are very few combine harvesters in the area, the wet climate and soft condition of the soil in the autumn being against the use of this heavy equipment. The rapidity with which field operations can be carried through enables greater use to be made of good weather for ploughing and cultivation work, but unfortunately a number of farmers often injure the soil through neglecting to wait till the land is in order.

LABOUR SUPPLY

In spite of the great development of mechanisation including the introduction of labour-saving machinery, the supply of labour is barely sufficient to meet the needs of agriculture. Regular workers cannot be obtained by all the farmers desiring them, and it is impossible for many farmers to get a supply of casual labour. At one time this was largely supplied by women from mining and other villages. The housing policy in recent times has done away with such villages and moved these people into the town where water and other services were more convenient. Such people in towns look to the town rather than to the country for part-time or full-time employment. The provision of milking machines on the great majority of dairy farms and the modernising of the farm kitchen has lessened the need for girls in the farmhouse and dairy, and it is very difficult to obtain the few required. There is very strong competition from industry, even in respect of the girls resident in the country, who through the development of public road transport can travel daily to the towns except from the more remote parts. The drift to the towns has also been encouraged by the scarcity of farm cottages. The County Council has provided a few farm cottages at some rural centres, mostly convenient to transport, but it is difficult to keep these houses occupied by *bona fide* agri-

cultural workers as many of the tenants, after a short period in agriculture, are enticed away to other employment. The introduction of the milking machine and the intensive treatment of grassland has enabled dairy herds to be increased on many farms to a figure which would never have been contemplated had it been necessary to continue hand milking. As has already been mentioned, all the dairy herds in the county have for some years been free from tuberculosis.

Owing to the reduction in the number of horses, very few country blacksmiths remain and many farmers are experiencing difficulty in having horses shod through the lack of skilled smiths. As however, there is very little road transport by horses, less shoeing is now necessary, because the few horses which remain are only employed on field operations.

SOCIAL

Most farmers in the county are members of the National Farmers' Union and there is strong development of the Women's Rural Institutes and the Young Farmers' Clubs. There are also a few agricultural discussion societies. Most of the parishes have their local farmers' society which holds a show of stock annually, mostly in April or May, but many are having difficulty owing to there often being two or more per week, in attracting sufficient entries and an adequate attendance in order to make the individual shows pay. As week after week the same exhibitors and the same attendance are being relied on for these events, there would appear to be a case for two or more parishes combining in a joint display.

Farm cottages have been mostly modernised during the past quarter century and many new ones have been built on the farms, as well as a few by the County Council. Farm houses have also been greatly improved, additions made and equipped with modern conveniences, including electric cookers, washing machines and in most cases television.

CHAPTER VIII

Forestry

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Forestry Commission (Scotland)

THE River Irvine which runs through the area covered by this survey, forms here the boundary between the West and South Conservancies of the Forestry Commission and the woodlands of the two sections are for this reason described separately.

SECTION I

The area north of the River Irvine is relatively poorly wooded. None of the woodlands in this section are owned by the Forestry Commission. Discounting small detached woods of less than five acres, the woodland area amounts to 5,242 acres. At present approximately one half of this area is productive i.e., is timber covered or has young tree crops which will produce timber. Conifer and broad-leaved tree crops are present in almost equal proportions. Most of the conifer crops are under 60 years of age and the main species are Scots Pine, Sitka Spruce, Norway Spruce, Japanese Larch and European Larch. The broad-leaved tree crops are generally of greater age—between 60 and 120 years—and the most common species are Sycamore, Beech and Oak.

The unproductive woodland areas include clear-felled areas which have not as yet been replanted, "devastated" areas from which all timber, except scattered, worthless stems, has been removed and scrub areas having low grade growth such as poor Birch and other scrub.

Some of the felled areas are in use temporarily for grazing. At Eglinton Castle where good quality soils were formerly under tree crops, reclamation of woodland for agriculture has proceeded on an extensive scale.

As might be expected, the broad-leaved tree crops have been planted on the more fertile sites, often around and near mansion houses and no doubt enhancement of amenity was one of the reasons for the planting of broad-leaved species. The quality of the hardwood crops is very variable but good quality Beech and Sycamore and, less frequently, good Oak can be seen.

The conifer crops have been planted on a wide range of sites and soil types and there is likewise a wide range of quality of crop. Growth has in general been satisfactory or good on the moderately good forest soils but an example of unsatisfactory development of Scots Pine on poor peat is to be seen near Auchentiber.

As regards sizes of woodland estates and woodland blocks, the majority of estates have less than 50 acres of woodland, often made up of a number of small blocks. The number of estates between 50 and 150 acres and the number having over 150 acres are both small in comparison. No estate has over 500 acres of woodland.

The section north of the River Irvine has never been regarded as a forest region, forestry being usually subsidiary to agriculture. Nevertheless, several important forestry estates exist where carefully planned forest management is practised. On two estates the woodlands have been Dedicated and an Approved Woodlands Plan operates on a third estate. Small Planting Programmes are in existence at a number of other estates but a good deal remains to be done towards the re-stocking of the unproductive woodlands where these are suitable for economic management.

There is not much of special importance to record regarding current forestry practice in this section. Normal technique is followed in establishment of plantations. Little is done in the way of ground cultivation prior to planting and drainage is usually by manual labour rather than by draining plough. As regards choice of species for planting, current practice appears to favour fast growing species such as Sitka Spruce and Japanese Larch where soil conditions are suitable but Norway Spruce and Scots Pine are still in use and *Pinus contorta* has been used on poor quality sites. Not much planting of broad-leaved species is being done but Beech and Sycamore are occasionally used.

SECTION II

The area lying to the south of the River Irvine forms part of the Forestry Commission South Conservancy. The land is mainly of high agricultural value and is poorly wooded. Planting has been done mainly for shelter and also for amenity in policy woodlands round mansion houses. The Forestry Commission has no land in the area. The total woodland area amounts to 1,570 acres of which only 800 acres are productive, the remainder being felled woodland or scrub. An area of about 135 acres has been lost to forestry due to building developments and reclamation to agriculture.

The largest woodland property in the area is in Lanfine Estate with a total of 697 acres. The Plan of Operations for management of the woods has been approved by the Forestry Commission under their Dedication Scheme. Only three other estates have over 100 acres of woodland and a further three estates have between 50 and 100 acres. Small Woods Planting Grants have to date been paid on 21 acres apart from which little systematic management is being carried out in the area.

The land is generally of high quality for timber production and excellent crops of hardwood species, including Oak, Sycamore, Beech and Ash occur on lower ground and more sheltered sites, where they have been mainly planted for amenity. On the higher and more exposed sites and especially where belts have been established for shelter the main species are Sitka and Norway Spruce and Scots Pine. These species have made good growth but have suffered considerably from wind damage in the past due to delay in carrying out thinning operations.

In this highly agricultural area forestry is likely to remain of secondary importance. Progress in restocking the felled woodland areas has been relatively slow but owners are being encouraged to replant.

CHAPTER IX

Discussion of Analytical Data

IN the course of surveying an area, soil profiles characteristic of the various soil series encountered are described in detail and sampled. Routine analytical determinations, which include loss on ignition, soil separates, exchangeable cations, percentage saturation, pH, carbon, nitrogen and total and acetic soluble phosphorus, are carried out on each sample. Furthermore the samples from a limited number of profiles are normally subjected to more detailed investigations involving specialised techniques. Clay samples from selected profiles in this area have been analysed for total silica, iron and aluminium. The clay mineral composition of certain profiles has been determined by X-ray and differential thermal analysis methods, the mineral components of the sand fraction by gravity technique and the trace elements by spectrochemical methods.

ROUTINE ANALYSIS

The routine analysis data of ninety soil profiles from North Ayrshire are given in Appendix I and for ease of reference in this chapter each profile has been allotted a number. Many of the variations in the values of the constituents result from inherent differences in the lithological composition of the parent material. However, the correlation and comparison of the values of each constituent frequently indicate that particular trends are common to the components of a major soil group and others to the components, especially drainage categories, of an association. Those trends are discussed in this Chapter in relation to the nine routine determinations listed above.

LOSS ON IGNITION

The loss on ignition values for the organo-mineral soils of this area—peaty podzol profiles (Nos. 70-77), peaty gley profiles (Nos. 78-83), and humic gley profiles (Nos. 84-89)—exhibit a marked decrease with depth. However, in the A_2 or $A_2(g)$ horizons of the peaty podzols with iron pan the organic matter content is often quite high due to a dense root mat immediately above the B_1, e.g. profiles No. 70, 71, 73, 74 and 77. A decrease in the loss on ignition with depth to 4% or less is also a feature of the mineral soils (Nos. 1-69) but the profiles of the Ashgrove association, e.g. Nos. 38-45, are exceptional in that the values show little change throughout. This constancy results from the high content of shale fragments in the sub-surface horizons of these soils. The influence of a high shale content on loss on ignition is also observed in the D horizon of profile No. 16, Darvel association, and in the C horizons of profiles No. 65 and 66, Rowanhill association.

SOIL SEPARATES

Soil separates, namely sand, silt and clay, are determined by mechanical analysis. The size limits are those determined by the International Scheme of Mechanical Analysis, sand 20μ-2000μ, silt 2μ-20μ and clay$<$2μ.

Relationships exist between the percentage of the three soil separates and the members of both associations and major soil groups. As mentioned in Chapter II many of the tills identified in North Ayrshire have a wide texture range and some can be divided into as many as four groups—moderately coarse, medium, moderately fine and fine texture. Generally, there is a relationship between the internal drainage of the soil and the textural group of the till upon which it is developed. This relationship is well marked in the mineral soils of the Darleith association. The freely drained Darleith series has a clay content in the till ranging from 15-25% (profiles No. 6, 7, 9 and 10), while that of the Dunlop series (Nos. 12-15), which is imperfectly drained, varies between 24 and 38%, and the Amlaird series (Nos. 47-52) with poor drainage, has a clay content of the order of 35-40%+. The distribution of the organo-mineral soils in the Darleith association can also be correlated with the textural group of the till parent material. Peaty podzols of the Baidland series (profiles No. 70 and 71) occur on moderately coarse to medium textured till, 15-25% clay, with the peaty gleys and humic gleys of the Myres and Dunwan series (profiles No. 78, 87 and 88), limited to the moderately fine to fine textured till, 30-45% clay. The series of the Ashgrove association, in particular the Highfield and the Ashgrove, show a similar relationship between drainage class and the texture group of the parent material. The Highfield series (profiles No. 1 and 2) which is imperfectly drained, is developed on a till with a clay content in the region of 40%, whereas the clay content of the Ashgrove series (profiles No. 38-44) varies between 40% and 60% and the soil is poorly drained. This tendency for the soil-water relations of series of an association to be allied to the texture of the parent material is not merely confined to associations developed on tills having a very wide textural range or to those varying between moderately fine and fine texture; similar trends occur in soils developed on tills limited to the coarser textured groups. For example in the Largs association the maximum clay content in the C horizon of the imperfectly drained Largs series (profiles No. 34 and 35) is 19%, whilst that of the Kelburn series (profile No. 64), poorly drained, is at least 10% higher. A similar difference in the percentage clay is noted between the Haupland series, peaty podzol (profiles No. 75 and 76), and the Reoch series, peaty gley (profile No. 81).

In the brown forest soil group the most striking trend in the percentage of soil separates occurs in profiles with gleyed B and C horizons. All the imperfectly drained mineral soils of the area have been placed in this group though they are in many respects comparable with the American grey-brown podzolic soils. A maximal clay content in the B horizon is one of the characteristics of the grey-brown podzolic soils and the majority of the imperfectly drained soils of this area exhibit this feature. In the Dunlop series, e.g. profiles No. 11 and 15, the clay content of the B horizon is 5-20% higher than that of the S and C horizons. The $B_2(g)$ horizon of the Caprington series (profile No. 37) has a clay content 4-6% higher than those of the horizons above and below, while the Kilmarnock series (profiles No. 24, 25, 26, 27 and 29) show a minimum increase of 3% clay in the illuvial horizon. The imperfectly drained series of other associations also show this *clay B* horizon, even the moderately coarse to medium textured Largs series (profile No. 34).

Water-sorting which is often noted in gleys occupying depressions is reflected in the mechanical analysis, e.g. profiles No. 53, 59, 63, 85 and 87. A high silt content is indicative of the alluvial nature of the S and A_2g horizons

of many of the gley soils with very poor internal drainage, encountered in post-glacial lacustrine flats, e.g. profile No. 45.

The clay content of the coarse textured soils of the Darvel and Dreghorn associations shows, with the exception of profiles No. 16 and 54, a decrease with depth, irrespective of the major soil group. The increased clay content of the lower horizons of profiles No. 16 and 54 is due to their being developed on a clay till derived from Productive Coal Measures, while the uppermost horizons are developed on fluvio-glacial sand and gravel.

EXCHANGEABLE CATIONS

Exchangeable Calcium

The values for exchangeable calcium vary with major soil group, parent material and drainage class. In brown forest soils with free internal drainage (Darleith, Darvel, Dreghorn and Faulds series) when the values of exchangeable calcium are high or moderate there is usually either a minimum in the B, e.g. profiles No. 6 and 30, or a regular decrease with depth, e.g. profiles No. 9 and 21, and when low there is generally a decrease with depth (profiles No. 17 and 22). A minimum value for exchangeable calcium is often noted in the B horizon of brown forest soils with imperfect drainage if large amounts are present in the profile, e.g. profiles No. 2, 15 and 26, but if the amounts are low or moderate then there is normally an increase in value with depth, e.g. profiles No. 33 and 35. The values recorded for this constituent in soils of the non-calcareous gley group tend to be high and show an increase down the profile; frequently the increase is considerable in the Cg, e.g. profiles No. 39 and 41. Both maximum, e.g. profile No. 48, and minimum, e.g. profile No. 62, values have however been recorded for the Bg horizon. In peaty podzols with iron pan the values for exchangeable calcium are invariably low, i.e. $<3{\cdot}0$ m.e./100 gms., and the maximum concentration is in the H layer, e.g. profile No. 77. Apart from the H layer, which varies between low and high, the values for exchangeable calcium in peaty gleys are low to moderate with that of the A_2g a minimum, e.g. profile No. 79. In humic gleys there is frequently a decrease in the value of this constituent with depth, e.g. profile No. 87.

Exchangeable Magnesium

The values for exchangeable magnesium when moderate to low are generally a tenth to a fifth of the exchangeable calcium. The brown forest soils with free internal drainage (Darleith, Darvel, Dreghorn and Faulds series) in this area usually contain moderate amounts of exchangeable magnesium, 0·3-5·0 m.e./100 gms., and often show a minimum value in the B horizon, e.g. profiles No. 6, 18 and 30. Frequently the concentration in the B horizon is about 50% of the S horizon, e.g. profiles No. 7, 10, 16-19, 21 and 31. In the brown forest soils classed as imperfectly drained the concentration of exchangeable magnesium increases down the profile, e.g. profiles No. 2 and 5, or shows a minimum value in the B(g) horizon, e.g. profiles No. 13 and 26. The increase in value may be very sharp in the C horizon, especially where the soil is developed on a basic igneous parent material, e.g. profiles No. 11 and 13-15. The values of this constituent in non-calcareous gleys, poor and very poorly drained, are moderate and show the same tendencies as those of the associated imperfectly drained brown forest soils, e.g. increase

with depth (profiles No. 43 and 47) and B minimum (profiles No. 40 and 51). Minimum values have also been observed in the A_2g horizon, e.g. profiles No. 54 and 60. In the peaty podzol group the exchangeable magnesium values, apart from the H layer, are generally low and two trends are apparent: either there is a regular decrease, e.g. profiles No. 75 and 77, or there is a minimum concentration in the B_2 or B_3 horizons, e.g. profiles No. 71 and 76. Peaty gleys contain moderate to low amounts of this cation which may either increase directly with depth, e.g. profiles No. 81 and 83, or show a minimum in the A_2g or Bg horizons, e.g. profiles No. 79 and 82. In the humic gley group the magnesium content is higher than in the peaty gley group and the A_2g horizon nearly always shows a minimum concentration, e.g. profiles No. 84 and 89.

Exchangeable Potassium

The values of this cation in the freely drained brown forest soils show a decrease with depth in the Dreghorn association, e.g. profiles No. 20-22, and a minimum value in the B horizon of the Darvel association, e.g. profiles No. 16, 18 and 19. These trends are apparently not related to parent materials as both occur in the freely drained series of the Kirktonmoor association (profile No. 30) and the Darleith association (profiles No. 6, 7 and 9). The values for exchangeable potassium are much more consistent in the brown forest soils with imperfect internal drainage, the majority having a minimum value in the B(g), e.g. profiles No. 4 and 32, and a similar trend occurs in the non-calcareous gley group, e.g. profiles No. 50 and 62. Peaty podzols usually show a minimum value for the potassium ion in the A_2 or B_2 horizons, e.g. profiles No. 71 and 72. Minimum values for this cation are observed in the A_2g, e.g. profile No. 79, and Bg horizons, e.g. profile No. 78, of peaty gleys. The majority of humic gley soils have a minimum concentration of exchangeable potassium in the Ag horizon, e.g. profiles No. 84 and 88.

Exchangeable Sodium

In the brown forest soils the lowest values for exchangeable sodium occur in those developed on coarse textured parent material (Darvel and Dreghorn series), several of which only contain this cation in the upper horizons, e.g. profiles No. 16 and 18. There are no significant trends in the freely drained soils developed on other parent materials. The amounts of exchangeable sodium in the brown forest soils with gleyed B and C horizons show considerable variation, with maximum, e.g. profile No. 12, and minimum, e.g. profile No. 14, concentrations of the cation in the B(g) horizon being observed in profiles from the same association. It is noteworthy that no exchangeable sodium was detected in the two profiles of the Largs series (profiles No. 34 and 35). In non-calcareous gley soils developed on coarse textured parent materials, Dreghorn and Darvel associations (profiles No. 54 and 55), the maximum concentration of exchangeable sodium is in the Cg horizon; otherwise this cation shows no significant trends in this soil group. Values for exchangeable sodium show no definite trends in any of the organo-mineral major soil groups. In the peaty gley group no sodium occurs in the profile of the Reoch series, Largs association (profile No. 81).

Exchangeable Hydrogen

The values for exchangeable hydrogen decrease with depth for all major soil groups, and if the organic matter content of the surface horizons is

high there is a pronounced decrease in the hydrogen ion value on passing into the B horizon, e.g. profiles No. 70 and 74.

PERCENTAGE BASE SATURATION AND pH

When the percentage base saturation in the freely drained brown forest soils is high there is normally an increase with depth, e.g. profiles No. 20 and 21, but when low or moderate the tendency is for the B horizon to be a minimum, e.g. profiles No. 18 and 22. However, in the imperfectly drained brown forest soils the percentage base saturation is generally higher and commonly increases with depth, e.g. profiles No. 1 and 3. The values for non-calcareous gleys, poor and very poorly drained, are high irrespective of parent material (except profile No. 64) and nearly all increase down the profile. Peaty podzols have low values throughout and commonly that of the A_2 horizon is a minimum, e.g. profiles No. 71 and 74. The percentage base saturation in peaty gleys tends to be low to moderate, with a minimum in the Ag horizon, e.g. profiles No. 79 and 82. In humic gleys the values for base saturation are usually high, and with the exception of profile No. 86 exhibit a minimum in the surface horizon.

The pH values of brown forest soils, freely drained, increase with depth, e.g. profiles No. 6 and 9, except in those developed on coarse textured parent materials when no definite trends are observable, e.g. profiles No. 16 and 21. In brown forest soils with imperfect drainage the pH value normally increases down the profile, the highest values being noted in the Caprington series (profile No. 37), range 6·0-7·7. The majority of non-calcareous surface-water gleys with poor drainage show an increase in pH with depth but there are a few instances of a decrease in the Cg horizon, e.g. profiles No. 50 and 56. The highest values recorded are in the Ashgrove series where the basal horizons attain a pH of 8·0+ (profiles No. 39 and 41). Very poorly drained surface-water gleys and all ground-water gleys show an increase in pH value with depth. The peaty podzols are the most acidic group (range within the profile, 3·4-5·5) and like the peaty gleys the value increases down the profile. Humic gleys on the other hand frequently have a minimum value in the Bg, e.g. profiles No. 84 and 89.

CARBON AND NITROGEN

The percentage of carbon and the percentage of nitrogen decrease down the profile of all major soil groups, with the exception of the peaty gley profile, No. 78.

PHOSPHORUS

Total Phosphorus

In the freely drained class of brown forest soils the amounts of total phosphorus vary between moderate and high and either show a regular decrease with depth, e.g. profiles No. 6 and 9, or a minimum in the B horizon, e.g. profiles No. 19 and 22. The percentage of total phosphorus in brown forest soils with gleyed B and C horizons varies considerably, but there is a definite tendency towards a minimum value in the B horizon, e.g. profiles No. 2, 4, 13 and 24. The majority of non-calcareous gleys have low to moderate percentages of this constituent, but irrespective of the percentage there is usually a minimum value in the Bg horizon, e.g. profiles No. 38, 39, 49 and 51. Values are usually moderate in the peaty podzol group but no consistent trends are

observable. Peaty gleys generally contain moderate to low amounts of total phosphorus and tend to have a minimum value in the Bg horizon, e.g. profiles No. 79 and 81, while humic gleys usually have moderate amounts and the tendency is for the Ag to be a minimal, e.g. profiles No. 84 and 89.

Acetic or Readily Soluble Phosphorus

Brown forest soils with free internal drainage have widely variable values for acetic soluble phosphorus which tend either to increase with depth, e.g. profiles No. 9 and 30, or to a minimum in the B horizon, e.g. profiles No. 20 and 21. Irrespective of the amount of readily soluble phosphorus present there is nearly always a minimum in the B horizon of imperfectly drained brown forest soils, e.g. profiles No. 4 and 34, with frequently a sharp increase in the C(g) horizon, e.g. profiles No. 29 and 37. Widely varying values are also a feature of the non-calcareous gley soils, the majority of which show a minimum in the Bg horizon, e.g. profiles No. 46 and 52. A marked increase in the Cg horizon has also been noted in many of these soils, e.g. profiles No. 39 and 59. In the peaty podzol with iron pan group the amount of this constituent is generally low and no definite trends are recognised. They are again low in the peaty gley soils, with minimum concentrations in either the Ag or Bg horizons, e.g. profiles No. 78 and 79. Though the amounts of acetic soluble phosphorus vary considerably between soils of the humic gley group, the values for individual profiles share common trends. There is nearly always a minimal in either the Ag or Bg horizons, e.g. profiles No. 87 and 85 respectively, and sometimes a marked increase in the Cg horizon, e.g. profile No. 84.

SILICA-SESQUIOXIDE RATIOS OF THE CLAY FRACTION

Silica, iron and aluminium determinations were carried out on the clay fraction ($<1{\cdot}4\mu$) of several typical profiles. The procedures followed are listed in the summary of analytical methods at the end of the chapter. The percentages of silica, iron oxide and aluminium oxide, and the following molecular ratios, SiO_2/R_2O_3. SiO_2/Fe_2O_3, SiO_2/Al_2O_3 and Al_2O_3/Fe_2O_3, are given in Appendix II, Tables 7-13. Silica-sesquioxide ratios indicate the relative leaching and differential movement of iron and aluminium oxides compared with silica and thus enable a comparison to be made between soils of various major soil groups.

Brown forest soils with free internal drainage, Table 7, exhibit little or no leaching of sesquioxides. The two profiles quoted show no great variations in the silica/iron oxide ratio, and there are no significant trends in the aluminium oxide figures. This lack of differentiation of sesquioxides in freely drained brown forest soils is in accordance with the definition of this major soil group and is similar to the results obtained by Muir and Fraser (1940) and Glentworth (1944). The ratios for the Darvel series profile are surprising as, developed on relatively acidic fluvio-glacial sand and gravel and under a high rainfall, it was expected that, although the profile bore little horizon differentiation, movement of sesquioxides would be apparent from the chemical analysis and the soil accordingly classed as a "concealed podzol" (Muir and Fraser, 1940). Slight induration *in situ* was recorded for the B_3 horizon of the Darvel series profiles and it is noteworthy that the SiO_2/Al_2O_3

ratio for the B_3 horizon of the profile examined is lower than those of the B_2 and C horizons. Glentworth (1954) obtained a similar correlation between the indurated layer and the SiO_2/Al_2O_3 ratio.

The percentage of silica in brown forest soils with imperfect drainage, Table 8, generally increases slightly down the profile. There is, however, a marked increase in the silica content with depth in the Dunlop series profile. This soil is developed on a till derived from basic and intermediate lavas of Calciferous Sandstone age, whilst either Old Red Sandstone or Carboniferous sediments are components of the parent materials of the other soils quoted in Table 8. Maximum concentrations of iron oxide in the B(g) horizon are noted in some of the profiles examined, but variations in the silica-sesquioxide ratios are small and translocation of iron oxide from the surface is therefore slight.

There is obvious leaching of iron oxide from the upper horizons of most of the poorly drained non-calcareous gleys, Table 9; the zone of accumulation is either the B_3g or Cg. In the profile of the one very poorly drained non-calcareous gley analysed, Table 10, movement of iron oxide from the S, A_2g and Bg horizons is most marked, the iron oxide content of the S horizon being a little more than half that of the basal horizon. All the non-calcareous gleys examined are surface-water soils, the vertical movement of water in the profile being impeded and in fact largely restricted to the top two feet of the profile by the moderately fine or fine texture of the soil. This surface-water feature doubtless explains the accumulation of iron oxide in the basal horizons.

The most striking differential movement of silica and sesquioxides occurs in the peaty podzol with iron pan group, Table 11. Soils within this group show decided leaching of iron oxide from the A_1 and A_2 horizons, this constituent accumulating in the B_2 horizon. The translocation of aluminium oxide is less distinct. In the Glen Garr and Baidland series profiles, pronounced induration was encountered in the B_3 horizon and it is noteworthy that the concentration of aluminium oxide is a maximum in the B_3 horizon of these profiles.

Of the peaty gley profiles examined the results for the Reppoch series, Table 12, provide positive evidence of translocation of iron oxide from the A_2g horizon with the Bg horizon the zone of accumulation. The results for the Myres series profile show only slight leaching of sesquioxides from the upper horizons and this can be correlated with the poorly developed H and A_2g horizons.

The movement of iron oxide from the surface and A_2g horizons of humic gley soils, Table 13, is most apparent and this constituent generally accumulates in the Bg horizon.

MINERALOGICAL ANALYSIS OF THE FINE SAND FRACTION

Fine sand fractions (20-200μ) of samples selected from North Ayrshire soil profiles have been separated according to specific gravity into three groups; characterised by orthoclase felspar, quartz and ferromagnesian silicate minerals. The separation technique has been described previously by Hart (1929). The results are given in Appendix II, Table 14.

Samples from the fourteen soil associations of North Ayrshire were examined. These associations can be grouped broadly on a parent material basis into three categories; those on till derived from basic and intermediate

igneous rocks, on till from sedimentary rocks (Carboniferous and Old Red Sandstone), and on drifts from admixtures of both the igneous and sedimentary rocks. Unlike the Roxburghshire soils (Muir, 1956) there are no distinct variations in the heavy mineral content within the individual associations. There is, however, a distinct correlation between the three parent material categories mentioned above and their content of ferromagnesian minerals. These minerals are most abundant in soils on basic and intermediate igneous tills, and least in soils developed on the various sedimentary tills within which there are no significant differences. The figures for the soils of the Kilmarnock and Lanfine associations, as would be expected, occupy an intermediate position.

MINERALOGICAL ANALYSIS OF THE CLAY FRACTION

The separation of clay for mineralogical analysis was carried out by standard sedimentation methods (Mackenzie, 1956) and the $<1{\cdot}4\mu$ fraction was used both for examination by X-ray diffraction and differential thermal analysis. Quantitative estimations were based on the results from both methods and Appendix II, Table 15, shows the composition of the soil clay from a number of typical profiles.

Till derived from Carboniferous rocks, both sedimentary and igneous, forms the parent material of over 75% of the soils on the sheet, and the clay fractions are predominantly composed of their weathering products. The igneous rocks are mostly basic and intermediate lavas of Calciferous Sandstone age, and they weather to give soil clays with considerable amounts of illite in the lower layers of the profiles, replaced to a certain extent by vermiculite towards the surface. These lavas are the parent rocks of the Darleith association, which is the most extensive on the sheet. The soils of this association can be divided into two groups, the first essentially of mineral soils—brown forest soils with free drainage and non-calcareous gleys with poor drainage; and a second group of soils with an organic surface—peaty podzols with free drainage and peaty gleys with poor internal drainage. The results for typical examples of these four soils are given in Table 15. It was found that the decrease in the vermiculite content with depth was more pronounced in poorly drained than in freely drained soils. The kaolin group is probably represented by "fireclay mineral" but the percentage is too small for certain identification. The distribution of the iron minerals is readily explained in terms of pedological processes; the haematite has disappeared from the A horizon of the podzol, and goethite and lepidocrocite are present in the Bg horizon of the gley.

The Carboniferous sedimentary rocks are, interbedded sandstone and shales of the Carboniferous Limestone Series which are the parent rocks of the Ashgrove association, and red sandstones and marls of the Barren Red Measures on which the soils of the Bargour association occur. The clay fraction of the Ashgrove soils has a high kaolin content—higher than in any other Scottish association examined, and the mineral present is well-crystallised kaolinite. Dioctahedral illite and vermiculite are also present. The dominant clay mineral of the Bargour soils is illite, the kaolin content is about 20-30% and about 5% of haematite is present. This amount of haematite is invariably found in soils derived from red parent rocks which originated under desert conditions, e.g. Triassic, Permian and Old Red Sandstone.

The Kilmarnock association, which is almost as extensive as the Darleith, is formed on mixed Carboniferous till containing lavas, sandstones and shales. This as would be expected gives soil clays intermediate in composition between the Darleith and the Ashgrove associations. One of the Kilmarnock profiles contains a little montmorillonite in the lower layers, but this mineral which is usually common in soils on basic rocks is seldom found in this area.

The Giffnock association on till derived from sandstone of the Carboniferous Limestone Series and the Rowanhill on Productive Coal Measures have a mineralogical composition similar to the Ashgrove soils, and the Mauchline association on New Red Sandstone is similar to Bargour, but also contains some chlorite. The clay fractions of the Largs association derived from till of Old Red Sandstone material are predominantly illitic. The illite in these soils, although dioctahedral, differs in its thermal characteristics from the normal type, but it is common to all soils derived from Old Red Sandstone so far examined (Mackenzie, 1954). They have a variable kaolin content and usually contain some vermiculite and haematite.

Cold precipitated iron oxide gel (Mackenzie, 1949) is not common in the soils of the area but was found in some of the soil clays on igneous rocks. The bottom layer of an imperfectly drained profile of the Lanfine association had about 5%, the parent material being mostly basalt of Old Red Sandstone age. It has been found for Scottish soils in general that the formation of ferric oxide gel is usually associated with the weathering of primary ferromagnesian rock minerals which are common in basic igneous rocks but rarer in sediments.

TRACE ELEMENTS

From the trace element point of view, the geological nature of the soil parent material is the most important characterisation. If this is accurately known, it is possible to assess with a reasonable degree of certainty the probable trace element status of any soil, in so far as its total contents are concerned. The pedological factors which have operated subsequently determine the solubility or availability of these trace elements in certain instances, but the total content is of considerably greater significance with trace constituents than with the major plant nutrients.

The associations from which typical profiles have been selected for trace element investigation are Darleith, Ashgrove, Kilmarnock, Largs and Dreghorn, covering such divergent parent materials as basic and intermediate lavas, shales, sandstones and raised beach sands and gravels.

Five different series of the Darleith association have been examined. Samples of the dominant freely drained series from Muirshiels (similar to profile No. 9) and Faulds Farm are similar in trace element contents with about 20 p.p.m. cobalt and copper, 20-40 p.p.m. nickel, 1000 p.p.m. manganese, 10 p.p.m. lead, 1 p.p.m. molybdenum, 100-200 p.p.m. chromium and vanadium, 200 p.p.m. strontium and 500-1000 p.p.m. barium, although the former is reported to have at least three times as much clay; the exchange capacities are similar. The other profiles from this association with one exception have similar total trace element contents, which are of the order which might be expected from a basic to intermediate lava; in that from South Drumboy (profile No. 88) the total contents of cobalt and nickel suggest a rather more basic origin.

In the freely drained profiles the amounts of 2·5% acetic acid extractable

trace elements are quite normal, indicating no likelihood of excess or deficiency, the figures for cobalt for instance falling from around 1 p.p.m. (a very adequate content) in the surface to one tenth of this in the lower layers.

Two other profiles from Faulds Farm, Amlaird and Pokelly series, are poorly and very poorly drained respectively, and in the latter in particular, a low-humic gley, we note the increased solubility of such elements as cobalt, nickel, vanadium (up to 4 p.p.m.) and zinc in the lower horizons, but there is no indication of surface accumulation sufficient to cause toxicities.

The amounts extracted from the peaty podzol at South Drumboy (profile No. 71), Baidland series, are generally similar to those from the Darleith series, while the humic gley from this farm, Dunwan series (profile No. 88), which has been mentioned has quite high contents of extractable nickel, in line with its more basic character, although it does not approach the toxic level. The contents in this association are such that, *a priori*, no complications concerned with metallic trace elements should arise. The amounts of cobalt and copper are adequate, and none of the potentially toxic elements, particularly nickel and molybdenum, are present in amounts liable to cause difficulties except under exceedingly abnormal conditions. The possibility of nickel toxicity in poorly and very poorly drained soils derived from basic rocks must always be kept in mind. No determinations of boron have been made.

The soils of the Kilmarnock association are derived from similar rocks to those of the Darleith soils, in admixture with sandstones and shales of Carboniferous age, and their total trace element contents are similar to those already quoted. Two profiles from Craufurdland Castle (Nos. 24 and 58), and one from Blackshill (No. 89), have been examined for extractable trace elements. The Kilmarnock series soil (brown forest soil with gleyed B and C horizons) and the Kilmaurs (non-calcareous gley) show rather higher extractable cobalt contents than corresponding soils from the Darleith association, but generally the values are of the same order. The main difference between the humic gleys from the two associations is the lower extractable vanadium in the Blackshill (Polbaith series) soil. The latter has some extractable lead in the lower horizons, probably derived from the sedimentary fraction of its parent material.

Generally the remarks regarding the status of the Darleith soils apply also to the Kilmarnock association.

Shales and sandstones of the Carboniferous Limestone Series provide the parent material of the Ashgrove association. These soils have up to 50% clay, suggesting a predominantly argillaceous origin. The typical series, from Barneyhill (profile No. 38), has total and extractable contents not far different from the associations previously discussed, apart from higher lead contents. The Giffen series, exemplified by the humic gley from Girthill (profile No. 84), once again shows the effect of very poor drainage in mobilising extractable cobalt, nickel, lead, vanadium and zinc, as well as iron, in the lower layers, but the levels do not approach those at which toxic effects are to be expected. The trace element levels in the soils of the Largs association are generally rather lower, as would be anticipated from the nature of the parent material, which has been derived mainly from arenaceous Old Red Sandstone sediments. These soils generally have clay contents below 20%. The total contents, based on profiles from Haupland (one similar to No. 34, and Nos. 75 and 81) are cobalt 3-8, nickel 8-20, copper <5, manganese 100-500, lead 10-20, chromium 25, vanadium 60, strontium 40, and barium 1000 p.p.m. The extractable

cobalt in the Haupland series is quite low, being less than 0·2 p.p.m., in the other series it is probably only the somewhat restricted drainage which prevents equally low values in the surface soils and there would appear to be a possibility of cobalt deficiency in ruminants grazing on the soils of this association. The copper status would also appear to be rather low.

The soils of the Dreghorn association on raised beach sand and gravel are considerably richer in the biologically important trace elements than are those of the Largs association. The lower layers of these profiles have less than 10% clay, but the content is greater in the surface, and the total contents of such elements as cobalt (15-20 p.p.m.), nickel (60 p.p.m.), copper (15 p.p.m.), vanadium (150 p.p.m.) and chromium (80 p.p.m.) suggest an argillaceous or igneous origin for the sedimentary material. These soils contain rather more molybdenum (2-3 p.p.m.) than normal.

The acetic acid soluble trace elements are generally quite high. The brown forest soil from Warrix (profile No. 21), has over 1 p.p.m. extractable cobalt and nickel in the surface and quite appreciable contents in all layers while in the non-calcareous gley (profile No. 55) the levels are above 2 p.p.m. in the lower layers. No trace element problems would be anticipated on these soils.

One or two other points of interest may be noted. As almost invariably found in Scottish soils, the total lead contents of the surface layers of all profiles examined are considerably higher than those of underlying horizons, typical values being 40-150 p.p.m. in the surface compared with 10-30 p.p.m. lower down the profiles. Among the elements not so far discussed may be mentioned lithium, with contents of 40-100 p.p.m. except in the Largs and Dreghorn associations when they are 8 and 20 p.p.m. respectively, and tin which was below 5 p.p.m. throughout. As far as is known at present, no significance need be attached to these elements at the levels occurring here.

SUMMARY OF ANALYTICAL METHODS

1. Soil separates (sand, silt and clay) were determined by a modification of the hydrometer method (Bouyoucos, 1927a, 1927b).
2. The exchangeable cations were determined in a neutral normal ammonium acetate leachate, calcium, sodium and potassium being determined by flame photometry (Ure, 1954) and magnesium colorimetrically (Hunter, 1950).
3. Exchangeable hydrogen was determined by electrometric titration of a neutral normal barium acetate leachate (Parker, 1929). pH was determined in aqueous suspension by means of the glass electrode.
4. Total carbon was determined by a wet combustion method using standard potassium dichromate solution (Walkley and Black, 1934).
5. Total nitrogen was determined by a semi-micro-Kjeldahl method (Markham, 1942).
6. Total phosphate was determined by a colorimetric method using hydrazine sulphate, after fusing the soil with sodium carbonate (Muir, 1952).
7. Acetic soluble phosphate was determined colorimetrically in a 2·5 per cent acetic acid extract (Williams and Stewart, 1941).
8. Silica-sesquioxide determinations of the clay fraction:—approximately 0·5 gm. of ignited clay was fused with sodium carbonate (Robinson, 1939), and the silica determined after a double evaporation with hydrochloric acid. Aluminium (Robertson, 1950) and iron (Scott, 1941) were determined colorimetrically in aliquots of the filtrate from the silica.

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APPENDIX I
Routine Analysis

TABLE 1. ROUTINE ANALYSIS OF BROWN FOREST SOILS.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
1.	ASHGROVE ASSOCIATION; Highfield Series. Highfield, 92042-92044																
S	1-4	10·70	50·7	16·1	28·0	1·25	0·40	0·13	0·15	12·70	13·2	4·94	3·61	0·282	0·188	1·1	Low exchangeable Ca in S. Low acetic soluble P_2O_5 throughout.
B(g)	6-10	9·30	44·4	16·8	34·2	2·94	0·52	0·18	0·11	9·21	28·9	5·39	2·45	0·253	0·181	0·7	
C(g)	12-15	9·65	26·4	24·3	44·5	7·83	1·20	0·18	0·11	6·18	60·1	6·03			0·167	1·0	
2.	ASHGROVE ASSOCIATION; Highfield Series. Thirdpart, 103605-103607																
S	2-6	17·80	35·2	26·2	25·3	14·90	1·02	0·26	0·34	11·45	59·2	5·95	6·16	0·581	0·607	11·7	High exchangeable Ca and total P_2O_5 throughout. High acetic soluble P_2O_5 in S and Bg, very high in C(g).
B(g)	9-13	7·30	36·5	19·7	40·2	12·21	1·58	0·26	0·22	6·56	68·3	5·78	0·57	0·068	0·460	16·7	
C(g)	16-20	6·88	33·1	23·7	39·8	18·50	2·94	0·26	0·37	4·25	84·8	5·90			0·503	103·8	
3.	BARGOUR ASSOCIATION; Bargour Series. Brocklie, 90810-90814																
S	2-6	7·78	54·7	14·7	26·8	3·80	0·22	0·11	0·18	5·78	42·7	5·55	2·68	0·229	0·175	1·5	High exchangeable Ca in C(g). Low exchangeable Mg in S, A_2(g) and B_2(g). Low total P_2O_5 in B_2(g) and B_3(g). High acetic soluble P_2O_5 in C(g), otherwise low.
A_2(g)	8½-10	5·61	50·1	14·9	32·2	3·51	0·26	0·08	0·11	2·91	57·6	5·69	1·09	0·098	0·114	0·6	
B_2(g)	11-13	4·48	52·7	14·1	31·0	3·49	0·24	0·10	0·08	1·21	76·4	5·85			0·078	0·6	
B_3(g)	15-21	4·63	42·2	18·4	37·1	6·78	0·62	0·14	0·10	0·73	91·3	6·19			0·061	0·6	
C(g)	36-40	5·84	38·5	21·5	37·1	8·85	1·56	0·11	0·14	Nil	100·0	7·75			0·146	31·2	

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
4.			BARGOUR ASSOCIATION; Bargour Series. Easter Hillhouse, 86202-86206														
S	1-6	9·62	49·6	14·2	31·4	9·78	0·86	0·09	0·11	11·15	90·5	6·23	2·60	0·250	0·182	3·0	High exchangeable Ca.
B_2(g)	8-12	6·00	51·3	14·5	31·3	7·64	0·80	0·08	0·06	Nil	100·0	6·52	0·93	0·103	0·096	0·9	High % saturation.
B_2(g)	14-19	5·25	48·3	13·0	36·1	10·30	0·82	0·12	0·12	Nil	100·0	6·61			0·070	0·8	Low total P_2O_5 except in S.
B_3(g)	24-32	4·44	50·3	12·3	35·2	9·80	1·20	0·11	0·17	Nil	100·0	6·76			0·074	0·9	Low acetic soluble P_2O_5 in
C(g)	36-42	3·98	53·3	10·0	32·5	9·15	1·48	0·09	0·17	Nil	100·0	6·88			0·081	3·8	B_2(g) and B_3(g).
5.			BARGOUR ASSOCIATION; Bargour Series. Langlands, 86227-86231														
S	1-6	6·98	31·5	22·0	43·0	11·15	1·30	0·13	0·17	3·12	80·3	5·67	2·81	0·263	0·144	2·4	High exchangeable Ca.
B_2(g)	8-15	5·43	46·0	15·7	35·6	15·95	2·28	0·11	0·17	4·00	82·3	6·67	0·50	0·065	0·071	0·8	High exchangeable Mg in C(g).
B_3(g)	18-22	5·45	35·9	16·0	45·4	14·81	2·74	0·10	0·19	Nil	100·0	7·06			0·132	13·0	High % saturation.
C(g)	25-30	4·97	40·6	21·8	35·1	14·85	4·18	0·12	0·21	Nil	100·0	7·19			0·156	31·8	Low total P_2O_5 in B_2(g).
C(g)	36-42	4·72	40·3	20·7	36·6	13·08	5·56	0·16	0·28	Nil	100·0	7·33			0·183	65·5	Low acetic soluble P_2O_5 in S and B_2(g), high in B_3(g) and C(g).
6.			DARLEITH ASSOCIATION; Darleith Series. Bowfield, 90839-90841														
S	2-5	21·30	50·0	15·9	18·1	8·15	0·70	0·28	0·28	15·95	37·1	5·21	8·20	0·630	0·356	0·9	High exchangeable Ca in S
B	7½-9	10·68	51·9	18·3	24·5	4·08	0·40	0·18	0·10	8·80	35·1	5·75	2·05	0·190	0·224	1·0	and C.
C	14-20	7·17	49·6	20·9	25·9	11·50	1·52	0·18	0·12	4·07	77·0	5·83			0·185	0·7	High total P_2O_5 in S. Low acetic soluble P_2O_5 throughout.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
7.			DARLEITH ASSOCIATION; Darleith Series. Craig, 90824-90827														
A	2-6	12·05	59·5	16·7	17·8	1·57	0·38	0·25	0·42	17·70	12·4	5·08	4·85	0·405	0·605	4·6	Low exchangeable Ca except in C.
B_2	10-14	9·75	52·5	16·5	26·1	0·78	0·18	0·18	0·24	12·88	10·3	5·08	2·43	0·190	0·545	5·7	
B_3	18-23	4·26	64·2	18·9	14·8	0·77	0·10	0·25	0·31	4·86	22·7	5·01			0·126	7·4	Low exchangeable Mg in B_2 and B_3.
C	27-30	4·68	52·5	20·9	24·3	4·60	3·38	0·44	0·64	4·65	66·0	5·42			0·143	0·5	High total P_2O_5 in A and B_2. Low acetic soluble P_2O_5 in C.
8.			DARLEITH ASSOCIATION; Darleith Series. Littlehill, 100340-100341														
A	1-3	15·60	49·6	15·1	27·5	13·30	6·16	0·37	0·40	13·70	58·0	5·30	6·04	0·502	0·296	3·1	Clay content above average for Darleith series. High exchangeable bases throughout.
C	6-10	8·98	46·4	19·8	29·4	15·20	6·30	0·30	0·18	8·88	71·2	5·95	2·32	0·232	0·255	4·9	
9.			DARLEITH ASSOCIATION; Darleith Series. Muirshiels, 85801-85803														
S	3-7	24·10	58·4	23·2	14·7	8·27	0·30	0·09	0·27	29·90	23·0	5·99	8·35	0·643	0·477	1·2	High exchangeable Ca and total P_2O_5 in S.
B	9-12	10·53	47·8	30·4	16·5	5·92	0·44	0·04	0·08	17·76	26·8	6·28	2·89	0·211	0·278	1·6	
C	12-16	4·01	65·1	18·3	12·6	3·46	0·90	Nil	0·04	10·72	29·1	6·40			0·216	10·3	High acetic soluble P_2O_5 in C, otherwise low.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
10.						DARLEITH ASSOCIATION; Darleith Series. Rogerton, 98542-98544											
S	2-5	25·10	N.D.	N.D.	N.D.	4·48	0·64	0·22	0·31	28·70	16·9	5·35	10·70	0·759	0·348	0·6	Low exchangeable Ca and Mg in B and C. High total P_2O_5 in S. Low acetic soluble P_2O_5 throughout.
B	9-14	9·75	56·5	18·0	20·6	1·28	0·12	0·14	0·07	7·97	16·8	5·53	2·23	0·168	0·231	0·4	
C	17-21	9·54	53·5	16·5	25·2	1·43	0·12	0·15	0·07	7·93	18·2	5·83			0·245	0·6	
11.						DARLEITH ASSOCIATION; Dunlop Series. Auchans, 86191-86195											
S	2-7	11·15	38·0	21·6	34·8	15·80	0·86	0·19	0·22	2·11	89·0	6·48	3·40	0·332	0·232	2·3	High exchangeable Ca except in D_r. High exchangeable Mg in C(g). High % saturation. Low total P_2O_5 in B_2(g) and B_3(g). High acetic soluble P_2O_5 in D_r, otherwise low.
B_2(g)	11-15	7·45	35·5	17·8	43·0	14·45	3·42	0·19	0·22	Nil	100·0	6·75	0·85	0·079	0·067	0·7	
B_3(g)	19-25	4·74	51·6	12·0	34·0	10·40	3·36	0·21	0·18	Nil	100·0	7·14			0·050	0·8	
C(g)	26-30	6·06	39·4	19·2	38·4	10·18	10·12	0·31	0·23	Nil	100·0	6·70			0·146	1·3	
D_r	32-36	4·05	77·6	6·8	11·6	6·78	2·94	0·41	0·14	Nil	100·0	7·11			0·122	10·4	
12.						DARLEITH ASSOCIATION; Dunlop Series. Girdle Hill, 92082-92085											
A	4-8	15·90	47·1	21·4	23·6	1·44	0·30	0·30	0·37	16·12	13·0	4·60	6·40	0·504	0·422	1·7	Low exchangeable Ca in A and A-B, high in B(g) and C(g). High total P_2O_5 in A and A-B. Low acetic soluble P_2O_5 in A and B(g), high in C(g).
A-B	12-16	11·02	44·1	25·1	25·3	1·88	0·30	0·29	0·14	8·37	23·8	4·80	3·92	0·306	0·345	4·0	
B(g)	20-24	4·03	43·8	19·9	32·4	8·25	2·06	0·31	0·19	3·44	76·0	6·01			0·124	2·4	
C(g)	31-34	4·51	42·8	21·3	33·7	8·50	2·28	0·29	0·27	1·44	88·7	6·20			0·253	36·0	

Horizon	Depth in	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
13.						DARLEITH ASSOCIATION; Dunlop Series. Muirshiels, 85787-85791											
S	1-7	36·89	N.D.	N.D.	N.D.	6·64	0·64	0·07	0·92	22·18	27·1	5·35	12·01	0·830	0·332	1·5	High exchangeable Ca in B_3(g) and C(g).
B_2(g)	11-15	7·75	47·3	22·9	25·9	5·20	0·30	0·02	0·25	11·80	32·8	6·43	1·34	0·097	0·279	3·5	
B_3(g)	18-22	6·48	49·7	22·4	24·7	14·55	2·30	0·12	0·17	5·25	76·8	6·33			0·153	0·8	High total P_2O_5 in S and C(g).
C(g)	26-32	3·58	50·8	22·6	24·8	12·17	3·60	0·11	0·21	4·25	79·0	6·27			0·254	26·4	Low acetic soluble P_2O_5 in S
C(g)	36-42	3·98	48·2	22·5	27·3	13·00	4·68	0·16	0·21	4·78	78·9	6·33			0·307	43·7	and B_3(g), high in C(g).
14.						DARLEITH ASSOCIATION; Dunlop Series. South Drumboy, 85814-85819											
S	2-6	12·80	52·5	16·1	25·1	7·75	0·26	0·08	0·21	23·10	26·4	5·43	6·00	0·493	0·346	2·1	High exchangeable Ca in B_3(g) and C(g).
A-B	9-11	6·47	49·7	20·1	27·0	4·10	0·74	0·04	0·17	14·90	25·6	5·70	0·97	0·083	0·222	2·9	
B_2(g)	14-18	6·74	40·8	22·7	33·1	6·20	1·42	0·03	0·21	14·60	34·9	5·63	0·79	0·021	0·221	2·3	High exchangeable Mg in C(g).
B_3(g)	21-26	5·00	39·3	28·4	29·8	14·14	3·18	0·18	0·29	6·54	72·4	5·58			0·238	2·6	
C(g)	30-33	7·19	37·0	26·0	33·5	17·00	2·08	0·34	0·40	5·75	77·6	5·49			0·278	7·0	High total P_2O_5 in S.
C(g)	36-41	4·24	38·1	24·4	35·4	13·04	10·06	0·10	0·32	4·85	83·0	5·70			0·298	10·8	Low acetic soluble P_2O_5 except in C(g).
15.						DARLEITH ASSOCIATION; Dunlop Series. Stonebyres, 92033-92036											
S	2-6	17·65	40·3	22·5	24·0	16·75	0·30	0·20	0·34	9·03	66·2	5·98	6·68	0·556	0·381	2·8	High exchangeable Ca throughout.
B_2(g)	9-13	8·42	35·8	22·0	38·0	9·55	0·68	0·16	0·23	7·01	60·2	5·80	1·15	0·108	0·246	1·8	
B_3(g)	17-23	6·14	57·7	19·0	20·2	15·40	1·18	0·26	0·16	6·06	73·7	6·28			0·427	22·4	High total P_2O_5 except in B_2(g).
C(g)	30-34	5·57	62·6	17·2	17·4	19·25	4·84	0·35	0·20	3·52	87·6	6·59			0·510	77·5	Low acetic soluble P_2O_5 in S and B_2(g), high in B_3(g) and C(g).

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
16.			DARVEL ASSOCIATION; Darvel Series. Eglinton Mains, 85850-85854														
S	½-2⅔	17·19	66·5	7·4	13·3	6·48	0·72	0·07	0·69	17·58	31·2	5·58	9·28	0·492	0·665	2·0	Low exchangeable Ca in A, B and C, high in D.
A	5-11	12·15	62·0	11·1	20·8	0·99	0·36	Nil	0·14	12·48	10·7	5·24	3·27	0·209	0·281	1·8	
B	16-23	8·60	71·6	10·0	14·2	0·21	0·40	Nil	0·07	9·15	6·9	5·31			0·242	1·6	High total P_2O_5 in S.
C	27-33	7·74	76·3	6·9	13·1	0·05	0·36	Nil	0·09	7·68	6·1	5·17			0·301	1·7	Low acetic soluble P_2O_5 except in D.
D	36-42	8·61	53·0	18·1	24·7	9·45	3·94	0·07	0·20	3·68	78·8	6·01			0·130	3·8	
17.			DARVEL ASSOCIATION; Darvel Series. Loudounhill Sand Quarry, 92138-92141														
S	3-8	9·30	72·8	10·2	12·4	3·29	0·32	0·21	0·13	8·27	32·5	5·73	3·94	0·274	0·258	1·5	Low exchangeable Ca in B_3 and C.
B_2	15-21	7·93	76·6	8·4	11·0	3·57	0·18	0·16	0·03	6·10	39·2	6·17	3·24	0·182	0·227	0·6	Low exchangeable Mg except in S.
B_3	28-31	5·20	81·2	8·4	7·8	2·01	0·08	0·12	0·03	5·55	28·8	6·11			0·200	0·7	
C	36-40	2·41	91·3	4·7	1·6	1·06	0·02	0·07	0·02	1·98	37·2	6·35			0·127	5·2	Low acetic soluble P_2O_5 except in C.
18.			DARVEL ASSOCIATION; Darvel Series. Lowtown of Blacklaw, 85900-85903														
S	1-5	13·65	66·9	13·6	12·7	6·80	0·36	0·04	0·37	8·63	46·7	5·81	6·49	0·513	0·403	4·4	Low exchangeable Ca in B_2 and B_3.
B_2	8-13	5·52	79·3	6·7	11·2	0·98	0·16	Nil	0·07	4·17	22·5	5·83	0·86	0·093	0·281	6·3	
B_3	16-25	3·36	74·1	14·1	8·4	2·35	0·34	Nil	0·07	3·86	41·7	6·10			0·280	11·5	Low exchangeable Mg in B_2.
C	30-35	3·64	63·7	19·4	13·4	4·52	1·12	Nil	0·10	4·50	56·0	6·01			0·287	19·3	High total P_2O_5 in S. High acetic soluble P_2O_5 in B_3 and C.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
19.						DARVEL ASSOCIATION; Darvel Series. Netherton, 92101-92104											
S	3-5	17·40	66·3	10·5	10·2	2·60	0·38	0·19	0·36	18·08	16·3	5·38	6·94	0·540	0·449	1·9	Low exchangeable Ca in S and B_2, high in C. Low exchangeable Mg in B_2. High total P_2O_5 except in B_3. Low acetic soluble P_2O_5 in S, high in B_3 and C.
B_2	9-18	5·03	82·9	7·3	7·3	1·41	0·18	0·11	0·10	3·96	31·3	5·87	0·74	0·072	0·500	5·2	
B_3	24-28	4·64	66·4	18·4	12·9	7·60	0·90	0·22	0·22	3·40	72·3	6·19			0·286	14·8	
C	36-40	4·44	93·4	2·1	2·3	9·25	1·04	0·18	0·24	0·98	91·8	6·20			0·428	39·0	
20.						DREGHORN ASSOCIATION; Dreghorn Series. Broomlands, 90842-90844											
S	2-8	9·10	68·3	10·1	17·2	2·18	0·32	0·16	0·77	9·90	25·7	4·96	3·57	0·289	0·374	4·3	Low exchangeable Ca except in B_2. Low exchangeable Mg except in S. High total P_2O_5 in S. Low acetic soluble P_2O_5 except in S.
B_2	12-20	6·70	73·5	8·0	15·3	4·03	0·28	0·13	0·29	2·96	62·6	4·85	1·96	0·180	0·298	0·9	
B_3-C	25-30	2·83	88·2	2·9	6·1	1·69	0·22	0·12	0·05	0·48	81·3	6·01			0·209	1·2	
21.						DREGHORN ASSOCIATION; Dreghorn Series. Warrix, 82161-82164											
S	2-6	11·50	60·3	16·1	18·0	10·39	0·67	Nil	0·08	1·80	81·2	6·58	2·48	0·206	0·335	17·1	High exchangeable Ca in S. Low exchangeable Na and K throughout. High total P_2O_5 in S. High acetic soluble P_2O_5 in S and C.
B_2	10-18	3·00	81·9	3·7	11·4	5·05	0·31	Nil	0·05	0·59	90·2	6·49	0·82	0·071	0·161	3·7	
B_3	22-31	2·55	88·3	1·5	7·6	4·92	0·31	Nil	0·05	Nil	100·0	6·85			0·122	5·6	
C	36-42	2·16	88·3	2·2	7·3	4·16	0·38	Nil	0·02	Nil	100·0	6·54			0·112	12·1	

Horizon	Depth in	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
22.			DREGHORN ASSOCIATION; Dreghorn Series. Yonderfield, 97500-97502														
S	3-9	8·02	78·7	7·3	10·0	3·22	0·48	0·09	0·21	7·15	35·9	5·85	2·62	0·220	0·303	17·7	Low exchangeable Ca except in S.
B	14-18	5·42	84·7	4·2	8·4	0·77	0·42	0·05	0·08	6·13	17·7	4·58	1·55	0·134	0·148	1·2	Low exchangeable Mg in C.
C	30-37	4·04	91·9	3·5	2·6	0·61	0·14	0·07	0·06	4·05	17·9	5·18			0·163	1·2	High total P_2O_5 in S.
																	High acetic soluble P_2O_5 in S, otherwise low.
23.			KILMARNOCK ASSOCIATION; Kilmarnock Series. Castle Hill, 82114-82118														
S	4-8	10·10	47·3	20·1	27·2	7·33	1·15	0·06	0·11	9·28	48·2	5·81	2·56	0·269	0·297	1·4	Low clay content in B_3(g).
B_2(g)	14-19	6·11	66·1	10·9	20·0	8·82	1·01	0·08	0·08	2·79	78·1	6·35	0·23	0·062	0·191	1·3	High exchangeable Ca throughout.
B_3(g)	24-28	3·32	75·4	11·2	10·2	8·00	1·30	0·02	0·06	4·37	68·2	6·55			0·176	15·1	
C(g)	36-40	4·83	54·5	16·5	26·6	11·15	3·75	0·02	0·17	3·58	80·7	6·84			0·237	60·5	Low acetic soluble P_2O_5 in S and B_2(g), high in B_3(g) and very high in C(g).
C(g)	42-48	5·31	56·4	14·4	26·6	12·70	4·38	0·06	0·24	Nil	100·0	7·62			0·252	98·3	
24.			KILMARNOCK ASSOCIATION; Kilmarnock Series. Craufurdland Castle, 82031-82035														
S	2-8	12·34	44·6	18·9	30·3	7·97	1·02	0·12	0·22	11·38	45·0	5·60	2·96	0·383	0·227	1·0	High exchangeable Ca throughout.
B_2(g)	12-15	7·07	26·5	31·7	38·3	12·28	1·08	0·06	0·18	7·33	65·0	5·96	0·40	0·062	0·135	0·8	
B_3(g)	19-22	5·96	35·8	23·2	38·1	13·84	1·18	0·07	0·21	3·22	82·7	6·26	0·23	0·031	0·133	1·0	High acetic soluble P_2O_5 in C(g), otherwise low.
C(g)	28-31	6·05	43·4	20·5	33·1	16·40	2·88	0·13	0·24	Nil	100·0	6·41			0·221	1·2	
C(g)	36-42	5·86	40·1	23·0	34·0	14·87	5·04	0·10	0·25	0·68	96·8	6·55			0·265	13·9	

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
25.			KILMARNOCK ASSOCIATION; Kilmarnock Series. Drummuir, 82199-82202														
S	2-6	9·54	45·1	18·4	31·7	8·95	1·26	0·04	0·15	4·74	68·8	5·72	2·18	0·226	0·178	1·7	High exchangeable Ca throughout.
B_2(g)	11-17	6·84	33·9	21·0	42·8	20·20	3·93	0·03	0·17	4·06	85·5	6·11	0·46	0·062	0·141	0·9	High exchangeable Mg in B_3(g) and C(g).
B_3(g)	24-32	7·57	41·0	18·0	37·3	17·85	6·73	0·05	0·18	Nil	100·0	6·89	0·46	0·074	0·286	20·8	High total P_2O_5 in C(g).
C(g)	38-45	4·65	45·2	16·1	36·4	15·23	7·80	0·05	0·20	0·62	97·5	6·68	0·40	0·041	0·322	66·8	Low acetic soluble P_2O_5 in S and B_2(g), high in B_3(g) and C(g).
26.			KILMARNOCK ASSOCIATION; Kilmarnock Series. Jocksthorn. 87394-87397														
S	1-6	12·48	41·4	22·0	30·4	17·75	2·50	0·10	0·13	4·56	81·8	6·60	4·48	0·402	0·263	2·9	High exchangeable Ca throughout.
B_2(g)	9-13	6·57	42·2	19·3	35·2	12·58	1·14	0·14	0·12	3·36	80·7	6·58	1·12	0·107	0·162	0·9	High exchangeable Mg in C(g).
B_3(g)	18-25	5·76	43·4	21·2	32·5	15·55	1·66	0·19	0·16	2·48	87·6	6·62			0·165	0·7	Low acetic soluble P_2O_5 throughout.
C(g)	38-44	5·33	55·6	13·3	28·5	14·10	6·98	0·23	0·15	2·12	91·2	6·90			0·224	2·0	
27.			KILMARNOCK ASSOCIATION; Kilmarnock Series. Loudoun Mains, 82110-82113														
S	2-6	13·15	44·3	16·1	33·0	15·57	1·65	0·06	0·35	5·04	77·8	6·64	2·61	0·345	0·364	3·1	High clay content in B_2(g).
B_2(g)	12-17	8·35	26·3	17·7	51·8	12·67	1·31	0·02	0·11	3·22	81·4	6·31	0·75	0·094	0·251	1·1	High exchangeable Ca throughout.
C(g)	26-31	7·83	44·9	16·3	34·8	10·87	3·23	0·02	0·11	0·20	98·8	6·50	0·41	0·052	0·210	1·2	High total P_2O_5 in S.
C(g)	38-42	6·17	44·3	18·1	34·5	13·21	4·02	0·02	0·15	Nil	100·0	6·65	0·42	0·042	0·263	11·9	High acetic soluble P_2O_5 in C(g), otherwise low.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
28.			KILMARNOCK ASSOCIATION; Kilmarnock Series. Tayburn, 83374-83379														
A	2-6	20·70	55·3	8·1	21·1	4·17	0·52	0·37	0·27	26·20	16·9	4·85	8·33	0·623	0·225	1·3	Low exchangeable Ca except in A and C(g).
A-B	7-11	10·80	60·0	9·8	24·8	1·31	0·34	Nil	0·04	18·87	8·2	5·08	2·18	0·178	0·178	0·6	
B_2(g)	12-15	7·60	58·9	10·0	27·3	1·14	0·40	Nil	0·04	13·59	10·4	5·20	1·16	0·083	0·178	0·6	Low % saturation except in C(g).
B_3(g)	16-20	7·90	40·2	17·2	38·8	1·85	0·50	Nil	0·04	11·64	17·0	5·26			0·169	0·6	
C(g)	24-30	6·84	38·4	16·7	41·5	2·87	0·88	0·09	0·10	10·88	26·6	5·31			0·180	0·4	Low acetic soluble P_2O_5 throughout.
C(g)	34-39	6·63	40·4	18·0	38·3	5·70	1·60	0·06	0·16	8·15	48·0	5·31			0·205	1·0	
29.			KILMARNOCK ASSOCIATION; Kilmarnock Series. Warwickhill, 82085-82088														
S	3-6	8·96	35·8	26·8	33·0	10·42	0·78	0·07	0·18	9·30	55·2	5·49	2·56	0·248	0·239	1·9	High exchangeable Ca throughout.
B_2(g)	10-14	6·43	40·4	16·5	39·9	16·35	3·16	0·06	0·17	5·93	77·0	6·13	0·68	0·083	0·148	1·0	
B_3(g)	24-30	5·35	43·9	26·0	27·4	15·79	5·32	0·08	0·24	1·25	94·5	6·54	0·46	0·031	0·248	25·6	High exchangeable Mg in B_3(g).
C(g)	39-44	4·87	41·3	20·6	35·4	13·23	4·48	0·12	0·26	0·40	97·9	6·72	0·41	0·031	0·305	111·8	Low acetic soluble P_2O_5 in S and B_2(g), high in B_3(g) and very high in C(g).
30.			KIRKTONMOOR ASSOCIATION; Faulds Series. North Moorhouse, 86722-86725														
A	1-7	15·20	49·9	21·9	16·7	11·38	0·88	0·14	0·17	6·16	67·2	5·86	4·57	0·460	0·414	4·2	High exchangeable Ca except in B.
B	14-22	6·87	72·6	12·1	11·9	4·03	0·72	0·08	0·07	3·26	60·0	6·08	0·39	0·059	0·300	13·6	
C	28-33	5·15	46·0	35·2	16·2	8·30	2·22	0·10	0·18	6·77	61·5	5·67			0·235	47·8	High total P_2O_5 in A.
C	38-43	5·44	41·9	37·1	18·6	7·80	3·70	0·12	0·19	6·23	65·5	5·76			0·297	64·5	High acetic soluble P_2O_5 except in A.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
31.						KIRKTONMOOR ASSOCIATION; Faulds Series. North Revock, 92030-92032											
A	5-11	15·15	60·8	13·7	17·9	0·65	0·30	0·20	0·28	20·93	6·4	5·06	5·07	0·440	0·537	1·5	Low exchangeable Ca, Mg and % saturation throughout.
A-B	17-22	14·70	60·9	14·2	17·6	0·66	0·14	0·17	0·30	19·70	6·1	5·06	5·06	0·443	0·528	4·1	
C	26-30	7·02	74·0	10·9	11·6	0·48	0·10	0·15	0·30	9·95	9·4	5·06			0·435	8·9	High total P_2O_5 throughout. Low acetic soluble P_2O_5 in A.
32.						LANFINE ASSOCIATION; Lanfine Series. Lanfine, 92110-92114											
S	3-7	11·40	57·7	15·9	20·7	8·71	0·84	0·22	0·24	8·85	53·7	5·67	4·19	0·364	0·247	3·2	High exchangeable Ca throughout.
$B_2(g)$	11-14	5·70	68·9	13·1	15·2	8·81	0·84	0·25	0·10	5·15	66·1	5·86	1·61	0·132	0·150	2·7	
$B_3(g)$	17-19	4·39	76·5	10·2	11·1	12·05	2·34	0·45	0·11	3·30	81·9	6·17	0·67	0·056	0·138	2·5	High exchangeable Mg, % saturation and acetic soluble P_2O_5 in C(g).
C(g)	24-28	3·78	58·6	16·5	21·1	17·35	8·54	1·12	0·20	Nil	100·0	7·35			0·117	10·1	
C(g)	33-37	3·37	55·2	11·8	29·6	9·95	5·24	0·94	0·21	Nil	100·0	7·65			0·153	22·4	
33.						LANFINE ASSOCIATION; Lanfine Series. Lanfine, 92121-92125											
A	2-6	12·51	59·4	14·7	19·7	2·68	0·50	0·31	0·21	16·28	18·5	4·92	4·90	0·415	0·231	1·3	Low total P_2O_5 in C(g).
B(g)	11-18	9·48	54·9	18·0	22·4	3·61	0·64	0·27	0·14	11·30	29·2	5·28	3·09	0·265	0·193	1·3	Low acetic soluble P_2O_5 throughout.
B(g)	23-27	8·69	65·6	13·2	16·9	3·24	0·56	0·25	0·08	9·20	31·0	5·69			0·123	1·2	
C(g)	32-36	3·34	61·5	11·6	23·6	4·92	1·10	0·21	0·11	2·46	72·0	5·80			0·055	1·2	
C(g)	40-44	4·21	52·4	12·4	33·1	4·33	1·10	0·25	0·16	5·95	49·5	5·29			0·060	0·5	

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
34.			LARGS ASSOCIATION; Largs Series. Haupland, 82174-82177														
S	3-7	6·12	70·9	6·8	19·2	1·89	0·26	Nil	0·14	10·00	18·7	5·23	2·44	0·214	0·220	4·8	Low exchangeable Ca throughout. High % saturation except in S.
B_2(g)	12-17	2·49	67·2	6·1	24·2	2·34	0·61	Nil	0·28	Nil	100·0	5·56	0·22	0·051	0·114	4·0	
B_3(g)	23-26	2·22	70·1	5·0	23·7	2·33	0·49	Nil	0·27	Nil	100·0	5·55			0·092	4·6	
C(g)	32-36	1·94	73·6	5·2	19·2	2·03	0·46	Nil	0·18	Nil	100·0	5·81			0·096	7·2	
35.			LARGS ASSOCIATION; Largs Series. Haupland, 82186-82189														
A	4-7	4·27	74·6	6·0	17·4	0·20	0·12	Nil	0·10	5·37	7·3	4·51	1·17	0·123	0·128	3·3	Low exchangeable bases throughout. Low total P_2O_5 in C(g). Low acetic soluble P_2O_5 except in A.
B_2(g)	12-17	2·80	75·2	5·7	16·3	0·20	0·19	Nil	0·03	3·23	11·5	5·02	0·35	0·071	0·105	1·6	
C(g)	25-34	2·72	79·2	6·0	12·1	0·96	0·18	Nil	0·03	3·53	24·8	5·94			0·121	1·9	
C(g)	41-45	4·00	73·3	4·5	18·2	1·27	0·25	Nil	0·06	4·62	25·5	5·97			0·068	2·4	
36.			MAUCHLINE ASSOCIATION; Mauchline Series. Barmuirhill, 92813-92816														
S	3-7	5·85	58·9	19·0	19·2	3·23	0·48	0·11	0·18	6·56	37·9	5·14	2·11	0·185	0·152	1·0	Low total P_2O_5 in B_2(g) and B_3(g). Very low acetic soluble P_2O_5 throughout.
B_2(g)	12-16	3·36	53·0	11·5	32·1	6·14	0·68	0·14	0·10	2·00	78·0	5·94	0·33	0·042	0·065	0·1	
B_3(g)	22-26	2·14	71·1	10·2	16·6	4·71	0·60	0·16	0·07	1·98	73·5	5·80			0·083	0·5	
C(g)	32-36	2·75	55·3	11·4	30·5	5·52	3·06	0·11	0·10	1·52	85·0	6·44			0·124	0·5	

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
37.			ROWANHILL ASSOCIATION; Caprington Series. Craiksland, 86181-86185														
S	1-6	10·71	33·2	27·9	33·6	13·90	1·26	0·21	0·19	3·08	83·5	6·06	3·64	0·293	0·168	3·4	High exchangeable bases and % saturation throughout.
B_2(g)	9-14	6·93	33·1	23·4	40·0	13·10	4·02	0·25	0·21	0·74	95·9	6·75	0·79	0·065	0·054	0·6	
B_3(g)	18-24	6·36	35·9	24·7	36·2	14·60	6·12	0·27	0·18	Nil	100·0	7·27			0·045	0·6	Low total P_2O_5 in B_2(g) and B_3(g).
C(g)	28-32	5·66	39·5	24·7	33·0	12·70	8·00	0·23	0·21	Nil	100·0	7·63			0·135	47·1	
C(g)	34-38	6·01	42·4	16·8	37·8	12·20	6·64	0·24	0·22	Nil	100·0	7·73			0·155	57·8	Low acetic soluble P_2O_5 in B_2(g) and B_3(g), high in C(g).

TABLE 2. ROUTINE ANALYSIS OF NON-CALCAREOUS GLEYS

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
38.	ASHGROVE ASSOCIATION; Ashgrove Series. Barneyhill Plantation, 83345-83348																
S	2-8	10·60	32·2	18·3	44·3	7·05	0·74	0·06	0·22	7·45	51·9	5·20	2·63	0·342	0·151	0·5	High exchangeable Ca except in S.
Bg	12-20	9·20	26·3	14·2	55·0	12·90	1·14	0·08	0·18	3·31	81·2	6·18	0·93	0·093	0·090	0·5	
Cg	23-29	9·60	25·2	24·2	45·8	15·70	2·94	0·08	0·16	1·87	90·9	6·54			0·115	2·2	Very high acetic soluble P_2O_5 in Cg, otherwise low.
Cg	36-41	9·45	28·3	20·9	46·1	14·95	2·66	0·05	0·18	0·92	95·1	6·99			0·215	85·0	
39.	ASHGROVE ASSOCIATION; Ashgrove Series. Diddup, 82165-82168																
S	3-7	12·90	38·1	20·8	34·7	11·40	1·29	0·13	0·40	6·33	67·8	5·71	3·77	0·321	0·212	1·6	High exchangeable Ca throughout.
Bg	10-12	9·38	35·6	17·7	42·1	12·27	1·29	0·12	0·14	1·85	88·3	6·35	1·91	0·166	0·132	1·0	
Cg	18-30	9·15	29·7	19·7	47·1	19·15	3·31	0·11	0·18	Nil	100·0	6·90			0·240	74·5	Very high acetic soluble P_2O_5 in Cg, otherwise low.
Cg	40-46	9·45	28·3	23·3	43·3	29·00	3·06	0·12	0·24	Nil	100·0	8·25			0·267	99·5	
40.	ASHGROVE ASSOCIATION; Ashgrove Series. East Kilbride, 98545-98548																
S	2-6	13·49	32·7	21·6	39·0	15·95	1·18	0·16	0·24	5·15	77·3	6·50	4·18	0·348	0·395	2·0	High clay content in Cg.
Bg	10-15	9·35	32·8	20·9	41·6	12·38	1·06	0·17	0·37	3·91	78·3	6·69	2·07	0·175	0·319	0·4	High exchangeable Ca throughout.
Cg	22-30	10·18	2·7	25·1	67·1	18·53	1·94	0·17	0·56	2·27	90·3	6·80			0·184	0·5	
Cg	40-50	11·01	6·7	27·2	60·6	14·52	3·34	0·18	0·27	3·05	86·0	6·95			0·231	0·6	High total P_2O_5 in S and Bg. Low to very low acetic soluble P_2O_5 throughout.

Horizon	Depth in	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
41.						ASHGROVE ASSOCIATION; Ashgrove Series. Girthill, 82208-82212											
S	1-3	10·63	45·7	21·0	28·0	9·28	0·78	0·12	0·20	3·39	75·4	5·94	3·68	0·278	0·076	2·1	High to very high exchangeable Ca throughout.
A_2g	6-9	8·62	27·7	21·6	46·4	13·29	3·20	0·08	0·16	2·49	87·2	5·93	1·24	0·083	0·143	0·7	
Bg	14-19	8·07	33·3	21·3	42·4	17·35	4·74	0·23	0·16	1·88	92·4	6·28	1·34	0·094	0·103	1·5	Low total P_2O_5 in S.
Cg	23-28	8·48	28·7	23·3	43·8	17·78	3·83	0·04	0·16	Nil	100·0	6·85			0·177	39·4	High acetic soluble P_2O_5 in Cg, otherwise low.
Cg	36-42	10·03	29·7	27·7	37·6	48·60	3·47	0·02	0·24	Nil	100·0	8·37			0·178	11·8	
42.						ASHGROVE ASSOCIATION; Ashgrove Series. Holms, 92086-92089											
S	2-6	12·40	31·3	24·5	38·0	13·65	0·82	0·25	0·32	5·88	72·0	5·99	3·91	0·322	0·242	3·2	High exchangeable Ca throughout.
Bg	9-13	9·07	26·5	22·0	47·0	12·58	0·84	0·17	0·10	3·98	77·5	6·16	2·03	0·170	0·174	0·7	
Bg	17-22	8·07	23·9	22·2	49·9	19·80	1·08	0·23	0·25	2·96	88·0	6·26			0·165	0·6	Low acetic soluble P_2O_5 in Bg.
Cg	30-34	7·80	27·6	23·2	45·3	20·45	3·56	0·19	0·21	2·54	90·7	6·30			0·263	8·0	
43.						ASHGROVE ASSOCIATION; Ashgrove Series. Knowes, 90815-90819											
S	3-7	13·38	32·6	25·0	35·7	13·35	0·90	0·27	0·24	5·92	71·3	5·98	4·20	0·299	0·276	2·7	High exchangeable Ca throughout.
Bg	13-17	10·30	10·9	23·4	60·6	17·05	1·24	0·18	0·20	3·50	84·3	6·18	1·76	0·109	0·180	0·5	
Bg	21-24	10·30	16·4	21·5	57·0	18·55	2·60	0·14	0·20	3·26	86·9	6·75			0·204	0·4	High exchangeable Mg in Cg.
Cg	27-30	10·50	20·1	20·2	54·5	16·80	4·56	0·13	0·20	2·74	88·8	6·88			0·219	0·5	
Cg	34-40	10·20	23·1	20·0	51·8	16·38	5·66	0·17	0·23	2·48	90·2	6·80			0·214	20·8	High acetic soluble P_2O_5 in Cg, otherwise low.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
44.						ASHGROVE ASSOCIATION; Ashgrove Series. Old Mains, 83349-83352											
S	2-6	10·60	50·2	16·6	27·9	6·40	0·56	Nil	0·16	8·78	44·7	5·61	3·12	0·362	0·186	0·7	High exchangeable Ca in B(g) and Cg.
Bg	9-15	6·97	48·5	16·9	31·1	8·50	1·00	Nil	0·09	4·10	70·0	5·92	1·54	0·205	0·113	0·5	
Bg	19-28	8·00	31·0	23·6	41·4	14·53	4·12	0·02	0·16	2·49	88·4	6·57			0·135	5·2	High acetic soluble P_2O_5 in Cg, otherwise low.
Cg	36-40	7·60	36·7	19·5	40·0	12·91	4·92	0·04	0·21	Nil	100·0	7·33			0·180	63·8	
45.						ASHGROVE ASSOCIATION; Caaf Series. Barneyhill Plantation, 83340-83343											
S	2-6	10·40	39·0	40·0	15·9	8·06	0·60	0·13	0·22	5·14	63·6	5·50	3·07	0·308	0·132	0·6	High silt content except in C(g).
A_2g	10-15	8·90	24·6	55·0	16·0	10·70	0·86	0·05	0·10	2·98	79·9	6·18	1·19	0·154	0·074	0·5	
Bg	20-27	9·92	22·0	49·8	23·3	13·38	2·12	0·02	0·16	2·48	86·9	6·68			0·123	0·6	High exchangeable Ca throughout.
Cg	37-42	9·96	29·4	20·2	45·4	11·87	3·38	0·04	0·18	1·13	93·1	6·80			0·200	48·0	Low total P_2O_5 in A_2g. High acetic soluble P_2O_5 in Cg, otherwise low.
46.						BARGOUR ASSOCIATION; Brocklie Series. Easter Hillhouse, 86212-86216											
S	1-7	7·72	47·1	17·0	32·0	9·18	0·76	0·16	0·11	3·70	73·5	5·77	2·29	0·207	0·146	2·5	High exchangeable Ca throughout.
Bg	9-13	6·20	35·8	21·2	40·0	9·82	0·78	0·09	0·07	1·78	85·8	6·30	0·95	0·101	0·086	0·9	
Bg	15-19	7·38	28·2	19·8	48·3	14·19	1·30	0·10	0·17	1·50	91·3	6·49			0·143	0·7	High acetic soluble P_2O_5 in Cg, otherwise low.
Cg	23-30	4·98	48·0	12·1	37·4	13·21	2·76	0·10	0·22	1·04	93·8	6·85			0·124	1·7	
Cg	33-39	4·60	50·2	13·0	34·5	9·83	4·42	0·12	0·17	0·99	93·8	6·82			0·074	15·7	

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
47.			DARLEITH ASSOCIATION; Amlaird Series. Auchans, 86196-86199														
S	2-7	12·62	36·8	22·9	34·0	13·49	2·00	0·21	0·50	2·53	86·5	6·27	4·41	0·353	0·238	2·2	High exchangeable Ca throughout.
B_2g	10-14	7·95	36·2	19·7	40·1	7·75	4·28	0·23	0·23	1·95	86·5	6·05	0·86	0·098	0·160	1·4	
B_3g	17-23	7·05	35·1	19·2	42·2	8·82	6·42	0·33	0·23	0·86	94·8	6·35			0·120	0·7	High exchangeable Mg in B_3g and Cg.
Cg	33-37	5·84	40·1	19·1	37·9	10·05	10·96	0·38	0·25	0·54	97·8	6·82			0·163	5·0	Low acetic soluble P_2O_5 except in Cg.
48.			DARLEITH ASSOCIATION; Amlaird Series. Bowfield, 90834-90838														
S	2-5	14·65	35·7	23·9	33·1	11·00	0·90	0·22	0·35	10·18	55·0	5·14	5·58	0·470	0·251	1·0	High clay content in B_2g.
A_2g	7½-9	10·20	27·3	26·9	40·8	16·00	1·22	0·18	0·34	5·04	78·0	5·84	2·90	0·222	0·175	0·8	High exchangeable Ca throughout.
B_2g	11-13	8·15	14·1	22·0	59·8	20·55	1·76	0·22	0·28	2·24	91·0	6·05			0·072	0·4	
B_3g	16-19	4·93	44·1	27·5	26·1	15·35	1·48	0·16	0·18	2·05	89·4	6·33			0·127	1·3	Low total P_2O_5 in B_2g.
Cg	31-36	6·10	36·0	18·1	42·9	15·05	4·20	0·22	0·21	3·40	85·3	6·30			0·254	4·7	Low acetic soluble P_2O_5 except in Cg.
49.			DARLEITH ASSOCIATION; Amlaird Series. Brown Hill, 97512-97515														
A	2-5	18·80	39·7	24·1	26·8	8·10	2·24	0·44	0·25	15·30	42·0	5·60	7·25	0·614	0·485	9·1	High exchangeable Ca throughout.
A-Bg	9-14	16·30	40·1	24·6	27·2	11·75	2·12	0·35	0·12	12·78	53·0	5·75	6·23	0·440	0·423	14·8	
Cg	20-28	6·05	37·5	16·8	42·7	21·95	3·68	0·25	0·19	3·50	88·3	5·97			0·488	133·7	High total P_2O_5 throughout.
Cg	36-42	5·59	40·6	15·9	40·7	20·25	2·66	0·22	0·19	3·06	88·5	5·95			0·528	60·8	High to very high acetic soluble P_2O_5 throughout.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
50.						DARLEITH ASSOCIATION; Amlaird Series. Girdle Hill, 92078-92081											
Ag	3-8	15·40	43·3	21·0	28·0	2·24	0·56	0·37	0·21	16·03	17·4	5·28	6·28	0·486	0·308	1·9	Low exchangeable Ca in Ag, high in B_3g and Cg.
B_2g	12-16	5·36	38·3	23·5	35·5	6·70	1·48	0·27	0·16	6·34	57·6	5·47	0·65	0·072	0·090	0·9	
B_3g	17-23	4·01	36·5	24·4	35·1	8·10	1·88	0·25	0·19	4·88	68·2	5·85			0·162	1·1	High total P_2O_5 in Ag and Cg.
Cg	33·37	3·49	29·5	19·9	47·2	9·35	2·98	0·31	0·36	3·95	76·8	5·56			0·304	55·8	High acetic soluble P_2O_5 in Cg, otherwise low.
51.						DARLEITH ASSOCIATION; Amlaird Series. Mosside, 92094-92097											
S	3-7	17·70	33·1	21·8	31·8	14·32	2·88	0·36	0·33	8·78	67·1	6·26	8·14	0·562	0·412	2·0	High exchangeable Ca throughout.
B_2g	14-19	9·36	28·8	18·9	47·6	11·18	0·80	0·23	0·10	3·98	75·6	5·74	1·51	0·098	0·158	0·8	
B_3g	23-27	8·18	29·3	18·0	48·6	14·05	1·38	0·17	0·12	2·52	86·2	6·10			0·193	0·8	High total P_2O_5 in S.
Cg	30-34	7·35	32·2	20·5	43·6	13·18	2·16	0·18	0·12	2·50	86·3	6·15			0·228	1·5	Low acetic soluble P_2O_5 throughout.
52.						DARLEITH ASSOCIATION; Amlaird Series. Stonebyres, 72037-72041											
S	2-6	11·75	31·1	30·4	32·6	10·40	0·72	0·18	0·24	8·40	58·0	5·55	4·08	0·361	0·320	3·7	High exchangeable Ca throughout.
B_2g	9-13	6·48	34·3	23·8	38·7	10·88	1·30	0·19	0·14	3·98	75·9	5·39	1·13	0·106	0·235	3·7	
B_3g	18-22	5·17	37·3	21·3	39·9	13·40	2·48	0·18	0·19	2·91	84·9	6·04			0·188	2·9	High total P_2O_5 in S and Cg.
Cg	25-28	4·06	52·0	18·6	27·4	12·55	2·94	0·17	0·16	1·98	88·9	6·22			0·294	29·1	High acetic soluble P_2O_5 in Cg.
Cg	31-35	5·05	45·2	16·8	35·5	16·20	3·34	0·22	0·25	2·01	91·0	6·40			0·359	33·2	

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
53.			DARLEITH ASSOCIATION; Pokelly Series. Faulds Farm, 85846-85849														
S	1-6	19·30	35·3	21·7	28·6	12·45	1·02	0·07	1·18	15·59	48·7	5·45	8·68	0·555	0·314	2·3	Low clay content in Cg.
Ag	8-13	5·18	44·9	28·1	24·5	12·30	1·36	0·08	0·21	8·08	63·4	5·60	0·77	0·072	0·211	21·3	High exchangeable Ca throughout.
Bg	18-25	4·21	54·1	18·2	25·6	17·90	1·88	0·06	0·21	4·30	82·4	5·96			0·252	43·8	
Cg	34-40	3·53	62·6	19·6	14·3	14·05	1·26	0·02	0·17	3·02	83·8	6·12			0·242	67·9	High total P_2O_5 in S. Low acetic soluble P_2O_5 in S, otherwise high.
54.			DARVEL ASSOCIATION; Ardoch Series. Eglinton Mains, 85860-85864														
S	1-4	12·08	76·0	4·3	13·7	18·60	1·26	0·08	0·44	3·18	86·3	6·59	6·20	0·395	0·214	0·9	High exchangeable Ca in S and Dg.
A_2g	6-11	5·74	76·2	5·0	16·0	3·19	0·28	Nil	0·10	3·03	54·1	6·10	2·06	0·102	0·164	0·8	
Bg	13-17	5·84	74·1	7·4	15·6	3·43	0·78	0·03	0·11	2·20	66·4	6·38			0·193	0·9	High acetic soluble P_2O_5 in Dg, otherwise low.
Cg	21-26	5·45	70·2	11·4	15·7	4·82	1·56	0·09	0·11	2·14	75·5	6·40			0·155	0·9	
Dg	32-40	5·35	56·8	13·1	27·4	9·31	3·64	0·11	0·08	Nil	100·0	7·33			0·126	14·4	
55.			DREGHORN ASSOCIATION; Hunterston Series. Warrix, 82155-82157														
S	1-9	6·45	67·4	11·8	17·6	3·24	0·25	Nil	0·08	9·72	26·8	5·71	1·98	0·132	0·221	6·7	High acetic soluble P_2O_5 in Bg and Cg.
Bg	14-20	2·70	90·3	1·6	5·4	2·77	0·31	Nil	0·03	1·21	71·9	6·18	0·17	0·022	0·112	20·6	
Cg	25-31	3·14	88·0	1·8	7·1	5·07	0·94	0·02	0·05	0·60	91·0	6·35			0·211	32·4	

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
56.			GIFFNOCK ASSOCIATION; Giffnock Series. Castlemilk, 98549-98552														
S	3-8	8·87	55·2	10·7	29·7	6·93	0·28	0·08	0·10	5·02	59·6	5·96	2·67	0·184	0·139	1·1	High exchangeable Ca in B_2g.
A_2g	12-16	5·54	46·7	15·3	35·2	6·89	0·26	0·05	0·05	2·00	78·5	6·55	0·74	0·051	0·062	0·4	Decrease in pH in Cg.
B_2g	21-28	6·20	40·8	12·3	43·8	10·55	0·70	0·15	0·10	2·02	85·1	6·73			0·073	0·4	Low total P_2O_5 except in S.
Cg	36-40	6·21	46·2	15·1	35·6	6·03	2·08	0·13	0·07	5·06	62·2	5·50			0·090	0·4	Low to very low acetic soluble P_2O_5 throughout.
57.			KILMARNOCK ASSOCIATION; Kilmaurs Series. Castle Hill, 82119-82123														
S	3-7	10·87	47·2	19·7	27·7	8·83	1·46	0·02	0·14	8·12	56·3	5·84	2·96	0·276	0·198	1·3	Low clay content in Cg.
A_2g	12-16	5·58	35·6	20·4	41·2	10·75	1·35	0·02	0·08	3·54	77·5	6·45	0·30	0·062	0·211	1·2	High exchangeable Ca
Bg	23-27	4·28	48·9	18·3	20·7	10·73	1·80	0·02	0·11	1·23	91·1	6·57			0·240	5·6	throughout.
Cg	30-34	3·59	67·0	14·1	15·4	9·24	1·67	0·02	0·08	0·60	94·8	6·76			0·266	42·7	Low acetic soluble P_2O_5 in
Cg	35-50	2·74	80·1	8·8	8·5	10·54	0·97	0·02	0·08	0·52	95·8	6·84			0·236	50·8	S and A_2g, high in Cg.
58.			KILMARNOCK ASSOCIATION; Kilmaurs Series. Craufurdland Castle, 82036-82040														
S	2-5	15·84	26·3	25·9	39·9	12·42	0·88	0·11	0·35	11·49	54·5	5·51	4·35	0·459	0·304	1·4	High clay content in A_2g
A_2g	8-12	9·68	24·3	21·8	49·2	13·19	0·67	0·05	0·17	6·34	69·0	5·84	1·89	0·208	0·213	0·6	and Bg.
Bg	18-23	7·14	28·5	11·3	56·6	17·32	2·35	0·07	0·28	2·30	89·9	6·19	0·56	0·083	0·140	0·5	High exchangeable Ca
Cg	28-32	6·58	41·3	17·6	37·8	16·40	4·12	0·06	0·27	3·03	87·4	6·47			0·274	3·4	throughout.
Cg	38-42	6·44	39·8	16·3	40·7	13·29	4·50	0·04	0·25	2·80	86·7	6·82			0·276	62·4	High acetic soluble P_2O_5 in Cg, otherwise low.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
59.			KILMARNOCK ASSOCIATION; Kilmaurs Series. Drummuir, 82194-82198														
S	2-6	11·94	42·0	19·0	33·0	10·20	1·09	0·05	0·32	9·33	55·0	5·60	2·95	0·349	0·232	1·6	High exchangeable Ca throughout. High exchangeable Mg in Cg. Low acetic soluble P_2O_5 in S and Bg, high to very high in Cg.
Bg	9-12	8·58	37·6	19·0	38·1	14·02	0·90	0·04	0·26	3·78	80·0	6·01	1·13	0·133	0·113	1·2	
Bg	15-18	7·38	36·9	18·0	41·4	20·24	1·95	Nil	0·17	2·36	90·5	6·44	0·78	0·082	0·103	0·7	
Cg	26-30	6·47	46·5	10·6	39·7	17·35	3·68	Nil	0·13	Nil	100·0	7·12	0·44	0·021	0·264	62·0	
Cg	38-44	5·76	49·8	17·9	29·5	15·30	5·78	Nil	0·15	Nil	100·0	7·46	0·56	0·041	0·305	119·0	
60.			KILMARNOCK ASSOCIATION; Kilmaurs Series. Jocksthorn, 87398-87402														
S	2-7	10·10	38·6	23·3	33·1	14·00	2·66	0·14	0·15	2·87	85·5	6-68	3·77	0·348	0·223	1·9	High exchangeable Ca throughout. High exchangeable Mg in Cg. High acetic soluble P_2O_5 in Cg, otherwise low.
A_2g	10-15	6·45	37·8	19·8	39·2	12·62	1·02	0·09	0·07	2·53	84·5	6·46	1·71	0·162	0·123	0·6	
A_2g	17-19	4·85	45·2	15·1	37·3	10·65	0·98	0·11	0·07	2·35	83·5	6·35			0·097	0·9	
Bg	22-28	5·47	38·5	22·6	36·2	16·35	2·68	0·10	0·13	2·19	89·7	6·44			0·159	0·6	
Cg	37-43	5·25	41·2	17·1	39·1	12·52	5·08	0·09	0·14	Nil	100·0	7·00			0·188	40·5	
61.			KILMARNOCK ASSOCIATION; Kilmaurs Series. Loudoun Mains, 82106-82109														
S	2-6	14·00	36·3	24·0	32·8	13·49	1·60	0·05	0·51	11·18	58·3	5·95	3·90	0·337	0·365	1·5	High clay content in Bg. High exchangeable Ca except in Cg. High exchangeable Mg in Cg. High total P_2O_5 in S and A_2g. Low acetic soluble P_2O_5 throughout.
A_2g	9-11	10·85	39·1	19·2	36·3	9·03	1·87	0·02	0·42	7·66	59·8	5·95	2·28	0·231	0·311	1·0	
Bg	18-24	9·58	17·7	17·9	59·7	15·25	3·31	0·06	0·26	3·68	83·3	6·02	0·58	0·074	0·178	0·9	
Cg	30-36	10·44	27·1	34·9	32·8	4·04	9·25	0·24	0·40	6·22	69·3	6·53	0·67	0·100	0·183	1·2	

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
62.						LANFINE ASSOCIATION; Threepwood Series. Lanfine, 92116-92120											
S	2-7	11·22	56·4	16·7	21·3	9·13	1·32	0·27	0·19	8·92	55·0	5·86	5·07	0·418	0·249	2·3	High exchangeable Ca except in B_2g.
B_2g	11-16	4·75	56·7	14·8	26·1	6·98	1·34	0·27	0·07	1·96	81·5	6·31	0·59	0·054	0·067	1·0	
B_3g	20-24	4·51	49·7	15·7	32·3	9·72	5·64	0·43	0·15	1·46	91·7	6·65			0·062	0·9	High exchangeable Mg in B_3g and Cg.
Cg	29-33	3·67	56·6	13·8	25·9	9·74	5·72	0·68	0·15	1·99	89·2	6·72			0·100	6·8	
Cg	36-40	3·49	58·4	12·6	25·5	11·01	5·64	0·89	0·18	1·99	90·0	6·66			0·126	11·2	Low total P_2O_5 in B_2g and B_3g. Low acetic soluble P_2O_5 except in Cg.
63.						LANFINE ASSOCIATION; Threepwood Series. Sornhill, 87358-87361											
S	4-8	6·21	51·1	16·9	29·0	9·44	0·56	0·21	0·14	3·33	75·8	5·85	2·03	0·195	0·112	1·6	High clay content in B_3g.
B_2g	12-18	4·01	50·1	13·3	32·5	11·30	0·92	0·14	0·13	1·43	90·4	6·55	0·48	0·051	0·044	0·8	High exchangeable Ca throughout.
B_3g	25-32	7·55	27·9	13·9	54·5	18·05	5·22	0·11	0·21	1·77	93·0	6·29			0·067	9·6	
Cg	36-42	3·83	58·6	12·5	25·1	12·62	3·96	0·15	0·15	1·23	93·2	6·56			0·113	22·0	High exchangeable Mg in B_3g. Low total P_2O_5 in B_2g and B_3g. Low acetic soluble P_2O_5 in S and B_2g, high in Cg.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
64.	LARGS ASSOCIATION; Kelburn Series. Glen Burn, 97485-97490																
A	2-8	15·10	75·7	8·6	8·2	0·32	0·26	0·19	0·16	22·72	3·9	4·60	7·26	0·545	0·262	0·7	Low exchangeable Ca in A, A_2g and B_2g, high in Cg. Low exchangeable Mg in A and A_2g, high in B_3g. High pH in Cg. Low total P_2O_5 in B_2g and B_3g, high in Cg. Low acetic soluble P_2O_5 in A, A_2g and B_3g, high to very high in Cg.
A_2g	11-13	9·30	58·1	14·4	22·9	1·25	0·14	0·16	0·06	15·15	9·6	4·69	3·26	0·260	0·143	0·6	
B_2g	16-20	4·94	58·2	12·6	26·7	0·47	0·36	0·12	0·05	8·87	11·1	5·31	0·94	0·077	0·074	7·8	
B_3g	27-33	3·72	50·3	12·6	33·4	5·15	6·30	0·23	0·15	4·17	74·1	6·03			0·073	1·5	
Cg	43-47	2·84	59·5	9·1	28·6	6·05	2·92	0·18	0·14	1·55	85·7	6·21			0·153	51·2	
Cg	72-80	2·90	51·5	12·5	33·1	9·45	3·62	0·21	0·24	Nil	100·0	8·00			0·315	183·7	
65.	ROWANHILL ASSOCIATION; Rowanhill Series. Craiksland, 86186-86190																
S	1-6	9·38	39·0	20·6	35·7	9·43	0·90	0·12	0·15	3·15	77·2	6·76	2·86	0·273	0·134	1·3	High exchangeable Ca throughout. High exchangeable Mg in Cg. Low total P_2O_5 in Bg and Cg. High acetic soluble P_2O_5 in Cg, otherwise low.
Bg	8-14	7·28	43·3	17·6	35·5	9·45	1·56	0·15	0·10	1·17	90·6	6·60	1·16	0·122	0·070	0·8	
Bg	16-18	8·10	27·4	21·0	47·7	17·13	4·32	0·24	0·18	Nil	100·0	6·85			0·046	0·8	
Cg	24-30	6·26	43·5	18·3	35·1	15·22	7·54	0·20	0·18	Nil	100·0	7·32			0·065	1·0	
Cg	36-40	5·56	42·1	18·8	36·4	12·97	8·04	0·19	0·21	Nil	100·0	7·66			0·118	25·8	
66.	ROWANHILL ASSOCIATION; Rowanhill Series. Peatland, 86217-86221																
S	1-8	11·40	33·8	22·5	38·0	13·26	1·96	0·28	0·22	3·92	80·1	5·75	3·10	0·251	0·127	1·6	High exchangeable Ca throughout. High exchangeable Mg in B_3g and Cg. Low acetic soluble P_2O_5 in S and B_2g, otherwise high.
B_2g	10-16	5·98	34·0	24·3	38·7	19·25	1·92	0·20	0·16	1·44	93·8	6·69	0·72	0·067	0·090	1·0	
B_3g	19-24	5·72	32·3	23·8	41·0	15·75	5·84	0·20	0·16	Nil	100·0	7·08			0·131	18·3	
Cg	26-32	5·94	32·5	23·7	40·9	13·50	6·76	0·18	0·12	Nil	100·0	7·33			0·162	55·2	
Cg	38-44	5·47	37·8	16·9	42·6	12·28	6·82	0·20	0·16	Nil	100·0	7·45			0·170	65·5	

Horizon	Depth in	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
67.						ROWANHILL ASSOCIATION; Todrigs Series. Peatland, 86222-86226											
S	2-6	8·40	41·3	22·4	32·1	12·35	1·30	0·16	0·14	2·74	83·7	6·19	3·03	0·219	0·124	5·6	High exchangeable Ca throughout.
A_2g	10-14	5·45	45·4	19·9	32·0	12·33	1·60	0·13	0·11	Nil	100·0	7·29	1·60	0·105	0·091	10·4	
Bg	17-25	5·75	40·9	22·7	33·6	15·30	3·92	0·18	0·20	Nil	100·0	7·90			0·151	22·0	High acetic soluble P_2O_5 except in S.
Bg	31-38	5·95	32·4	21·8	42·9	13·11	4·88	0·18	0·22	Nil	100·0	7·96			0·175	55·8	
Cg	42-47	5·40	32·3	23·4	41·6	10·22	4·94	0·18	0·21	Nil	100·0	7·98			0·180	64·4	
68.						SORN ASSOCIATION; Sorn Series. Knowhead, 92805-92808											
S	3-7	6·85	56·8	16·0	23·8	8·34	0·32	0·11	0·14	5·55	61·6	6·28	3·49	0·254	0·191	1·5	High exchangeable Ca in S and B_3g.
B_2g	12-17	4·42	50·3	13·2	34·3	7·40	0·52	0·12	0·10	4·01	67·0	6·24	0·35	0·048	0·072	0·2	
B_3g	21-24	3·98	50·9	11·0	34·1	8·20	0·42	0·12	0·14	2·47	78·2	6·30			0·110	0·2	Low total P_2O_5 in B_2g.
Cg	30-36	3·49	52·4	11·5	32·6	7·40	2·92	0·10	0·14	2·98	78·0	6·19			0·132	0·2	Low acetic soluble P_2O_5 throughout.
69.						SORN ASSOCIATION; Sorn Series. Knowhead, 92809-92812											
S	3-8	12·60	58·3	15·8	19·6	5·59	0·44	0·10	0·16	7·78	44·6	5·40	5·85	0·416	0·178	1·5	Low total P_2O_5 in B_2g and B_3g.
B_2g	12-16	4·28	56·8	13·9	27·2	5·53	0·64	0·08	0·10	2·45	72·2	6·17	0·70	0·053	0·066	0·7	
B_3g	21-27	4·04	60·6	10·6	26·8	7·36	1·24	0·07	0·11	0·96	90·2	6·64			0·084	6·0	Low acetic soluble P_2O_5 in S and B_2g, high in Cg.
Cg	32-36	4·23	51·4	10·4	36·1	7·71	2·04	0·07	0·15	Nil	100·0	6·85			0·132	23·0	

TABLE 3. ROUTINE ANALYSIS OF PEATY PODZOLS WITH IRON PAN.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
70.			DARLEITH ASSOCIATION; Baidland Series. Shieldhill, 100316-100320														
H	6-2	72·20	N.D.	N.D.	N.D.	1·02	1·34	0·50	0·67	72·20	4·7	4·14	32·66	2·150	0·353	0·7	Low exchangeable bases.
A_2	½-1½	25·40	N.D.	N.D.	N.D.	0·16	0·16	0·10	0·07	53·70	0·9	4·54	11·00	0·638	0·284	1·2	High total P_2O_5 except in A_2
B_2	4-7	11·10	66·7	19·3	8·5	0·16	0·10	0·07	0·02	17·40	2·0	5·06			0·244	1·6	and B_2.
B_3	11-16	6·60	68·5	15·6	12·6	0·16	0·06	0·06	0·02	9·62	3·0	5·20			0·379	8·7	Low acetic soluble P_2O_5 in
C	26-30	6·69	62·3	18·9	15·5	0·16	0·10	0·11	0·04	13·78	2·9	5·24			0·339	12·3	H, A_2 and B_2, high in C.
71.			DARLEITH ASSOCIATION; Baidland Series. South Drumboy, 85832-85837														
A_1	1-4	40·50	N.D.	N.D.	N.D.	0·71	0·50	0·05	0·41	70·90	3·7	4·77	22·70	1·183	0·320	0·9	Low exchangeable bases ex-
A_2	5-7	23·50	43·3	21·3	17·8	Nil	0·20	Nil	0·04	51·50	0·5	4·83	7·15	0·483	0·235	0·8	cept in C.
B_2	8-11	11·00	60·4	14·6	19·5	Nil	0·14	Nil	0·34	23·25	2·0	4·87	2·08	0·180	0·278	2·0	High total P_2O_5 in A_1.
B_3	13-17	6·19	61·4	16·4	19·1	Nil	0·08	Nil	0·33	15·85	2·5	4·81			0·272	4·9	Low acetic soluble P_2O_5 in
C	21-27	5·40	63·2	17·1	17·0	Nil	0·20	Nil	0·66	13·80	5·9	4·92			0·270	13·0	A_1, A_2 and B_2, high in C.
C	32-37	4·66	57·9	14·8	25·0	2·25	1·38	0·02	1·42	15·90	24·2	5·49			0·284	21·4	
72.			KIRKTONMOOR ASSOCIATION; Moorhouse Series. Longwood, 87370-87372														
A_1	½-3	30·90	N.D.	N.D.	N.D.	1·34	0·62	0·27	0·87	27·50	10·1	4·66	15·40	0·846	0·329	1·7	Low exchangeable Ca throughout.
B_2	5-9	12·10	56·9	16·5	20·6	0·16	0·10	0·26	0·18	12·25	5·4	5·02	3·90	0·223	0·211	1·8	Low exchangeable Mg in B_2
B_3-C	12-17	6·45	53·4	13·9	29·5	0·32	0·28	0·17	0·23	10·52	8·7	4·99			0·195	6·1	and B_3-C.
																	High total P_2O_5 in A_1.
																	Low acetic soluble P_2O_5 in
																	A_1 and B_1.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
73.						LANFINE ASSOCIATION; Knockendon Series. Glenton, 97516-97521											
H	1½-0	36·70	N.D.	N.D.	N.D.	1·31	1·08	0·57	1·00	45·90	7·9	4·06	21·00	0·789	0·200	2·6	Low clay content in A_1, A_2 and B_2.
A_1	½-2	15·45	82·2	7·4	2·7	0·31	0·28	0·23	0·38	23·10	5·2	4·09	8·44	0·392	0·146	0·8	
A_2	3-5	12·40	79·0	10·2	4·6	Nil	0·26	0·19	0·24	23·00	2·9	4·30	6·30	0·304	0·132	1·4	Low exchangeable bases except in H.
B_2	8-12	4·54	83·4	7·3	7·0	Nil	0·06	0·08	0·03	8·23	2·0	4·92			0·101	1·4	
B_3	17-25	2·97	71·4	9·2	16·4	Nil	0·06	0·07	0·05	4·60	3·8	4·92			0·111	5·9	Low acetic soluble P_2O_5 except in B_3 and C.
C	32-36	2·92	64·0	11·3	21·8	Nil	0·10	0·10	0·10	6·17	4·6	5·02			0·116	6·2	
74.						LANFINE ASSOCIATION; Knockendon Series. Knockendon, 97491-97495											
H	8-2	81·90	N.D.	N.D.	N.D.	1·72	1·24	0·69	0·62	80·40	5·2	3·94	38·00	2·780	0·322	0·7	Low clay content throughout.
$A_2(g)$	½-2	11·40	77·4	7·1	9·8	0·31	0·12	0·13	0·03	21·43	2·7	4·50	5·89	0·305	0·146	1·8	
B_2	4-7	8·35	86·2	5·6	4·0	0·32	0·12	0·15	0·03	13·28	4·5	4·91			0·302	1·1	Low exchangeable bases except in H.
B_3	12-18	4·23	82·5	7·4	8·0	0·15	0·04	0·06	0·03	5·13	5·2	4·91			0·155	2·4	
C	27-29	2·68	82·7	6·9	7·7	0·15	0·04	0·06	0·03	2·54	9·9	4·94			0·141	2·7	High total P_2O_5 in H and B_2. Low acetic soluble P_2O_5 throughout.
75.						LARGS ASSOCIATION; Haupland Series. Haupland, 100327-100330											
A	0-1	10·40	81·3	5·7	7·8	0·31	0·28	0·25	0·27	13·15	7·8	4·00	5·15	0·206	0·068	1·4	Low clay content in A.
B_2	4-13	5·46	75·7	7·8	13·8	0·15	0·10	0·09	0·07	6·52	5·9	4·44	1·93	0·132	0·058	0·6	Low exchangeable bases throughout.
B_3	21-26	1·91	81·4	4·0	13·7	Nil	0·04	0·05	Nil	0·49	15·5	4·96			0·036	1·0	
C	34-39	2·14	78·0	7·2	12·7	Nil	0·02	0·06	Nil	Nil	100·0	5·20			0·026	0·6	Low total and acetic soluble P_2O_5 throughout.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
76.						**LARGS ASSOCIATION; Haupland Series. Logan Burn, 92053-92058**											
H	7-3	85·00	N.D.	N.D.	N.D.	0·70	0·30	0·70	0·63	98·90	2·3	3·80	39·10	2·480	0·296	7·3	Low clay content in A_1 and A_2.
A_1	½-2½	20-23	72·3	4·0	9·6	0·16	0·10	0·15	0·02	38·70	1·1	4·09	11·50	0·378	0·123	1·5	
A_2	3½-4½	9·09	82·8	7·4	5·3	Nil	0·08	0·11	0·02	17·98	1·2	4·28	3·68	0·198	0·080	1·6	Low exchangeable bases throughout.
B_2	6-9	7·10	69·4	8·7	18·4	Nil	Nil	0·06	0·02	6·33	1·2	4·79			0·086	1·5	
B_3	13-17	2·81	74·5	8·8	13·9	0·15	0·02	0·11	0·05	2·44	11·9	4·69			0·061	1·7	Low total P_2O_5 except in H and A_1.
C	22-26	2·62	73·6	6·2	17·7	0·15	0·04	0·07	0·04	2·85	9·5	5·05			0·058	3·1	Low acetic soluble P_2O_5 except in H and C.
77.						**REPPOCH ASSOCIATION; Glen Garr Series. Auchinlongford, 92068-92072**											
H	9-3	87·40	N.D.	N.D.	N.D.	2·48	1·64	0·78	0·97	91·20	6·0	3·44	37·90	2·470	0·437	3·2	Low exchangeable bases except in H.
A_2	½-2½	13·70	74·0	4·4	14·8	0·16	0·14	0·11	0·04	22·48	2·0	4·45	6·60	0·420	0·138	0·9	
B_2	4-7	7·68	64·1	10·2	21·9	1·08	0·08	0·15	0·07	10·37	11·7	5·14			0·176	0·8	High total P_2O_5 in H.
B_3	9-12	7·33	58·4	10·8	27·1	0·16	0·04	0·14	0·07	7·40	5·3	5·22			0·159	1·4	Low acetic soluble P_2O_5 except in H.
C	18-22	5·18	65·0	12·6	19·9	0·15	0·04	0·10	0·07	2·87	11·1	5·42			0·144	2·4	

TABLE 4. ROUTINE ANALYSIS OF PEATY GLEYS

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
78.						DARLEITH ASSOCIATION; Myres Series. Girdle Hill, 92073-92077											
H	3-1	90·80	N.D.	N.D.	N.D.	1·06	1·48	1·22	0·90	101·80	4·4	3·63	33·50	1·625	0·293	1·7	Low exchangeable Ca throughout.
A_1	4-9	86·30	N.D.	N.D.	N.D.	0·35	0·72	0·90	0·23	78·60	2·7	3·66	43·80	2·375	0·225	1·4	
A_2g	12½-14	18·40	48·5	15·7	22·0	0·32	0·36	0·35	0·09	28·35	3·8	4·73			0·210	0·7	High total P_2O_5 in Bg.
Bg	17-21	15·40	58·1	14·1	20·1	0·33	0·32	0·29	0·08	22·65	4·5	5·16			0·351	1·1	Low acetic soluble P_2O_5 throughout.
Cg	29-34	4·87	32·4	20·0	45·2	2·98	0·96	0·36	0·25	7·84	36·7	5·20			0·202	1·3	
79.						KILMARNOCK ASSOCIATION; Loudoun Series. Tayburn, 83366-83369											
H	4-1	65·00	N.D.	N.D.	N.D.	11·49	0·56	0·14	0·90	79·80	14·1	4·61	30·40	2·100	0·454	1·5	High exchangeable Ca in H, low in A_2g and Bg.
A_2g	2-8	9·90	49·1	13·6	32·4	0·99	0·32	0·06	0·07	20·70	6·5	4·96	3·44	0·177	0·109	0·7	
Bg	10-18	6·53	36·5	18·6	41·7	2·72	1·22	0·08	0·13	13·36	23·7	5·11			0·088	0·5	High total P_2O_5 in H, low in Bg.
Cg	24-29	6·47	41·5	17·2	38·1	3·62	1·60	0·07	0·13	10·56	34·0	4·95			8·291	3·8	Low acetic soluble P_2O_5, except in Cg.
80.						LANFINE ASSOCIATION; Distinkhorn Series. Distinkhorn, 92098-92100											
H	8-2	63·80	N.D.	N.D.	N.D.	1·72	0·70	0·45	0·41	86·30	3·7	4·00	33·60	1·345	0·230	1·9	Low exchangeable bases except in H.
A_2g	8-13	4·68	61·1	13·9	22·7	0·15	0·02	0·11	0·04	5·32	5·7	4·91	1·12	0·077	0·091	2·6	
B-Cg	17-21	3·07	65·5	14·1	17·3	0·15	0·04	0·10	0·02	3·36	8·5	5·13			0·103	2·7	Low acetic soluble P_2O_5 throughout.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
81.						LARGS ASSOCIATION; Reoch Series. Haupland, 82182-82185											
Ag	1-6	4·88	82·9	4·5	10·2	1·26	0·29	Nil	0·13	6·95	19·5	5·23	2·13	0·172	0·065	2·4	Low exchangeable Ca and Mg in Ag and A_2g. Low total P_2O_5 throughout. Low acetic soluble P_2O_5, except in Cg.
A_2g	9-12	2·16	82·5	4·1	11·2	1·56	0·29	Nil	0·03	3·93	32·4	6·12	0·10	0·051	0·044	2·3	
Bg	16-22	1·86	73·9	5·0	19·3	3·67	0·33	Nil	0·10	Nil	100·0	6·53			0·040	2·7	
Cg	31-36	2·58	59·8	11·6	26·0	6·30	1·17	Nil	0·18	Nil	100·0	6·52			0·083	4·4	
82.						REPPOCH ASSOCIATION; Reppoch Series. Auchinlongford, 92063-92067											
H	7-1	87·50	N.D.	N.D.	N.D.	0·70	0·66	1·17	1·23	93·60	3·8	3·89	45·50	2·440	0·337	2·5	Low exchangeable Ca throughout. Low exchangeable Mg in A_2g and Bg. High total P_2O_5 in H, low in Bg and Cg. Low acetic soluble P_2O_5 throughout.
A_2g	2-7	5·83	50·9	12·2	34·0	0·15	0·10	0·13	0·04	13·55	3·0	4·21	2·12	0·172	0·101	0·9	
Bg	11-15	3·62	52·3	11·9	32·2	0·15	0·10	0·10	0·04	7·24	5·1	4·38			0·052	0·8	
Cg	19-23	3·44	47·6	11·9	37·1	0·31	0·56	0·11	0·08	6·25	14·5	4·78			0·051	0·8	
Cg	27-31	3·05	59·3	10·5	27·2	0·61	0·48	0·12	0·08	5·29	19·6	4·85			0·071	0·8	
83.						SORN ASSOCIATION; Weitshaw Series. North Blairkip, 100312-100315											
H	9-2	72·10	N.D.	N.D.	N.D.	32·40	0·60	0·34	0·64	41·60	45·0	5·42	45·80	1·840	0·364	1·1	High exchangeable Ca in H and A_2g. High total P_2O_5 in H, low in A_2g and Bg. Low acetic soluble P_2O_5 throughout.
A_2g	2-6	8·99	32·6	19·3	43·6	8·50	0·88	0·18	0·10	7·62	56·0	5·63	3·37	0·134	0·074	0·5	
Bg	11-16	5·11	42·1	15·7	39·7	5·83	1·32	0·17	0·10	2·00	78·8	5·54			0·054	0·4	
Cg	21-26	5·02	48·4	15·3	33·8	4·91	1·18	0·11	0·10	2·97	68·0	5·55			0·104	0·7	

TABLE 5. ROUTINE ANALYSIS OF HUMIC GLEYS

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
84.						ASHGROVE ASSOCIATION; Giffen Series. Girthill, 82203-82207											
S	1-6	34·70	N.D.	N.D.	N.D.	38·70	4·45	0·10	0·36	13·45	76·5	5·98	15·30	0·935	0·323	3·6	High clay content throughout.
A_2g	8-12	9·90	18·4	24·3	52·4	16·85	0·99	Nil	0·14	3·82	82·5	6·21	2·40	0·124	0·092	8·2	High exchangeable Ca throughout.
Bg	17-24	9·62	23·2	16·3	55·8	13·20	3·78	Nil	0·16	4·02	81·2	5·79	1·42	0·082	0·191	1·8	High total P_2O_5 in S, low in A_2g.
Cg	30-36	9·58	21·7	17·9	55·6	10·95	3·72	0·64	0·25	2·68	85·4	6·18			0·152	26·6	
Cg	40-45	9·97	29·2	18·8	47·0	13·70	3·75	Nil	0·28	Nil	100·0	7·50			0·168	60·5	Low acetic soluble P_2O_5 in Bg, high in Cg.
85.						ASHGROVE ASSOCIATION; Giffen Series. Old Mains, 83358-83361											
H	10-4	35·20	N.D.	N.D.	N.D.	36·80	4·38	0·15	0·31	22·80	64·8	5·80	18·25	1·170	0·166	1·1	High clay content in Bg.
A_2g	2-8	6·47	37·0	14·7	45·2	9·05	1·68	0·02	0·11	5·37	66·9	6·01	0·85	0·165	0·074	1·2	High exchangeable Ca throughout.
Bg	10-15	7·85	24·3	22·1	49·8	10·52	3·04	0·05	0·19	4·79	74·3	5·76			0·082	0·8	Low total P_2O_5 in A_2g and Bg.
Cg	23-28	8·35	40·1	16·1	39·7	7·35	2·78	0·08	0·25	4·34	70·7	6·32			0·161	24·0	High acetic soluble P_2O_5 in Cg, otherwise low.
86.						ASHGROVE ASSOCIATION; Giffen Series. Uplawmoor, 100336-100339											
H	6-2	77·10	N.D.	N.D.	N.D.	9·85	2·64	0·63	0·32	45·70	22·7	3·91	43·30	2·075	0·243	3·4	High exchangeable Ca in H, otherwise low.
A_2g	1-3	9·84	50·9	19·6	24·6	0·16	0·18	0·09	0·07	20·30	2·4	4·44	3·76	0·114	0·060	1·0	Low exchangeable Mg in A_2g.
Bg	8-14	7·36	36·7	16·6	43·0	0·15	0·48	0·09	0·10	11·60	6·6	4·60			0·047	0·6	Low % saturation in A_2g and Bg.
Cg	24-28	6·81	36·2	17·7	42·7	1·08	1·74	0·12	0·11	9·58	23·1	5·01			0·057	0·6	Low total and acetic soluble P_2O_5, except in H.

Horizon	Depth in.	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
87.						DARLEITH ASSOCIATION; Dunwan Series. Mosside, 92090-92093											
S	4-10	47·25	N.D.	N.D.	N.D.	31·40	1·44	0·25	0·42	41·30	44·8	5·25	22·30	1·675	0·334	1·4	High clay content in Bg. High exchangeable Ca throughout. High total P_2O_5 in S. Low acetic soluble P_2O_5 in S and Ag.
Ag	13½-15	35·45	N.D.	N.D.	N.D.	27·90	1·20	0·33	0·23	32·00	48·1	5·34	20·18	1·405	0·231	0·8	
Bg	19-23	10·41	13·1	22·5	59·2	10·20	1·12	0·23	0·13	7·33	61·4	5·44			0·176	3·9	
Cg	36-40	8·95	45·5	18·1	31·9	8·45	0·46	0·09	0·07	1·43	86·3	6·14			0·258	7·3	
88.						DARLEITH ASSOCIATION; Dunwan Series. South Drumboy, 85826-85831											
H	5-1	50·00	N.D.	N.D.	N.D.	5·25	1·08	0·16	0·76	69·50	9·4	4·69	27·45	1·520	0·430	1·3	High clay content in Bg. High exchangeable Ca except in H. High exchangeable Mg except in H and Ag. High total P_2O_5 in H, low in Ag. Low acetic soluble P_2O_5 in H and Ag, otherwise high.
Ag	2-6	15·70	27·3	23·1	41·9	9·82	3·02	0·06	0·15	31·40	29·4	5·50	6·25	0·223	0·083	0·7	
Bg	9-13	7·45	21·6	24·6	50·2	15·58	10·04	0·06	0·22	12·08	68·2	5·99	1·08	0·107	0·125	11·8	
Bg	15-20	5·66	32·7	26·6	37·9	15·48	6·36	0·06	0·24	11·98	65·0	6·04			0·226	60·4	
Cg	23-29	5·39	33·5	28·1	35·6	12·02	10·34	0·05	0·24	12·08	65·3	5·70			0·267	32·1	
Cg	33-37	5·28	40·0	20·3	37·1	11·70	6·28	0·05	0·24	11·59	61·5	5·52			0·265	28·1	
89.						KILMARNOCK ASSOCIATION; Polbaith Series. Blackshill, 90830-90833											
S	2-6	34·10	N.D.	N.D.	N.D.	9·15	1·30	0·16	0·10	22·40	32·4	5·31	18·60	0·902	0·265	0·9	High exchangeable Ca in S and Ag. Low acetic soluble P_2O_5 throughout.
Ag	10-16	10·02	36·2	26·9	32·2	16·95	0·60	0·31	0·37	6·50	73·8	5·75	3·33	0·133	0·136	0·5	
Bg	20-23	5·80	43·4	15·0	38·7	4·39	0·80	0·13	0·11	6·98	43·7	5·11			0·159	0·5	
Cg	33-37	6·18	44·6	13·9	38·4	4·97	1·30	0·11	0·18	6·93	48·6	5·20			0·240	0·6	

TABLE 6. ROUTINE ANALYSIS OF PROFILE DEVELOPED UPON AEOLIAN SAND

Horizon	Depth in	% Loss on Ignition	Mechanical Analysis			Exchangeable Cations m.e./100g.					% Saturation	pH	% Carbon	% Nitrogen	% P_2O_5	mg./100g. Read. Sol. P_2O_5	Remarks
			% Sand Inter.	% Silt Inter.	% Clay	Ca	Mg	Na	K	H							
90.								AEOLIAN SAND. Fullarton, 90849-90856									
C	1-5	0·81	94·4	1·1	3·8	0·45	0·08	0·03	0·06	0·98	38·8	3·83	0·20	0·029	0·069	4·9	Low exchangeable bases and low total P_2O_5 throughout. Low acetic soluble P_2O_5 except in top horizon.
A_1	7-10	4·58	91·6	1·1	4·9	0·30	0·16	0·08	0·06	1·98	23·3	5·00	1·42	0·102	0·078	2·4	
C	12-14	1·26	94·7	0·7	3·4	0·15	0·06	0·04	0·05	0·99	23·2	5·23	0·38	0·036	0·068	2·8	
A_1	17-25	4·94	83·9	8·1	5·5	0·15	0·06	0·07	0·05	4·95	6·2	4·80			0·067	0·6	
A_2	27½-29½	4·45	90·2	2·9	4·7	0·31	0·06	0·06	Nil	5·82	6·9	5·05			0·073	0·9	
B_1	@ 30	5·91	85·2	4·7	7·1	0·16	0·08	0·06	Nil	6·45	4·4	4·81			0·072	0·5	
B_2	32-34	2·31	90·6	2·0	5·1	0·15	0·04	0·04	Nil	1·45	13·7	5·10			0·071	1·2	
C	36-40	1·23	93·3	1·6	3·9	0·15	0·02	0·04	Nil	1·48	12·4	5·21			0·068	2·4	

APPENDIX II

Silica-sesquioxide Ratios of the Clay Fraction

TABLE 7.—SILICA-SESQUIOXIDE RATIOS: BROWN FOREST SOILS—Freely drained.

Association	Series	Profile No.	Soil No.	Horizon	Percentages			Ratios			
					SiO_2	Fe_2O_3	Al_2O_3	SiO_2/R_2O_3	SiO_2/Fe_2O_3	SiO_2/Al_2O_3	Al_2O_3/Fe_2O_3
DARLEITH	Darleith	6	90839	S	41·7	14·3	33·3	1·67	7·74	2·13	3·64
			90840	B	43·0	13·8	35·6	1·65	8·26	2·05	4·02
			90841	C	48·5	13·2	29·6	2·16	9·76	2·78	3·51
DARVEL	Darvel	17	92138	S	36·4	20·0	32·7	0·80	2·85	1·11	2·56
			92139	B_2	35·9	20·0	34·7	1·26	4·77	1·75	2·72
			92140	B_3	34·0	18·5	37·9	1·17	4·88	1·53	3·20
			92141	C	37·9	16·2	36·8	1·37	6·24	1·75	3·56

TABLE 8.—SILICA-SESQUIOXIDE RATIOS: BROWN FOREST SOILS—Imperfectly drained

Association	Series	Profile No.	Soil No.	Horizon	Percentages			Ratios			
					SiO_2	Fe_2O_3	Al_2O_3	SiO_2/R_2O_3	SiO_2/Fe_2O_3	SiO_2/Al_2O_3	Al_2O_3/Fe_2O_3
ASHGROVE	Highfield	1	92042	S	48·0	12·1	34·2	1·94	11·56	2·38	4·41
			92043	B(g)	49·1	11·6	34·5	1·99	11·24	2·41	4·67
			92044	C(g)	50·1	9·3	35·3	2·06	14·28	2·40	5·94
BARGOUR	Bargour	4	86202	S	48·7	12·5	30·0	2·18	10·33	2·75	3·76
			86203	B_2(g)	48·1	13·6	31·5	2·04	9·44	2·60	3·64
			86204	B_2(g)	50·0	12·4	30·2	2·21	10·72	2·81	3·82
			86205	B_3(g)	51·8	12·3	28·1	2·44	11·18	3·12	3·58
			86206	C(g)	51·7	12·6	27·8	2·45	10·92	3·16	3·46
DARLEITH	Dunlop	13	85787	S	33·8	12·1	39·5	1·21	7·40	1·45	5·11
			85788	B_2(g)	39·9	13·8	36·5	1·49	7·69	1·85	4·16
			85789	B_3(g)	49·1	12·6	31·5	2·10	10·31	2·64	3·90
			85790	C(g)	49·8	12·3	27·0	2·42	10·73	3·13	3·43
			85791	C(g)	50·5	13·6	27·1	2·38	9·82	3·14	3·12

Association	Series	Profile No.	Soil No.	Horizon	Percentages			Ratios			
					SiO_2	Fe_2O_3	Al_2O_3	SiO_2/R_2O_3	SiO_2/Fe_2O_3	SiO_2/Al_2O_3	Al_2O_3/Fe_2O_3
KILMARNOCK	Kilmarnock	24	82031	S	49·1	13·3	30·9	2·12	9·81	2·69	3·64
			82032	B_2(g)	50·0	12·9	31·7	2·12	10·25	2·68	3·84
			82033	B_3(g)	50·7	12·7	30·9	2·20	10·56	2·78	3·79
			82034	C(g)	51·2	12·6	30·1	2·28	10·78	2·88	3·74
			82035	C(g)	50·7	13·7	28·2	2·33	9·84	3·05	3·23
LANFINE	Lanfine	—	87353	S	49·2	11·2	30·5	2·22	11·70	2·74	4·26
			87354	B_2(g)	43·2	12·2	34·0	1·76	9·43	2·16	4·37
			87355	B_3(g)	47·4	11·5	32·2	2·03	10·96	2·50	4·39
			87356	C(g)	49·6	11·6	30·9	2·19	11·32	2·72	4·16
			87357	C(g)	51·0	11·9	28·6	2·38	11·35	3·02	3·76
LARGS	Largs	34	82174	S	48·8	11·9	28·2	2·31	10·81	2·93	3·69
			82175	B_2(g)	49·9	10·5	29·9	2·30	12·60	2·82	4·47
			82176	B_3(g)	50·6	11·4	28·9	2·37	11·75	2·96	3·96
			82177	C(g)	51·5	10·0	29·4	2·44	13·72	2·97	4·62
MAUCHLINE	Mauchline	36	92813	S	49·2	12·3	29·6	2·22	10·62	2·81	3·78
			92814	B_2(g)	49·3	12·4	29·7	2·22	10·52	2·81	3·74
			92815	B_3(g)	48·8	14·8	28·9	2·16	8·74	2·86	3·05
			92816	C(g)	49·3	15·1	26·8	2·30	8·68	3·12	2·78
ROWANHILL	Caprington	37	86181	S	48·0	11·7	32·7	2·03	10·91	2·49	4·38
			86182	B_2(g)	50·0	11·1	32·7	2·13	11·94	2·60	4·61
			86183	B_3(g)	50·2	11·7	30·3	2·26	11·34	2·81	4·04
			86184	C(g)	49·9	12·5	38·3	1·83	10·58	2·21	4·79
			86185	C(g)	49·7	13·2	38·9	1·78	10·01	2·16	4·63

TABLE 9.—SILICA-SESQUIOXIDE RATIOS: NON-CALCAREOUS GLEYS—Poorly drained

Association	Series	Profile No.	Soil No.	Horizon	Percentages			Ratios			
					SiO_2	Fe_2O_3	Al_2O_3	SiO_2/R_2O_3	SiO_2/Fe_2O_3	SiO_2/Al_2O_3	Al_2O_3/Fe_2O_3
ASHGROVE	Ashgrove	38	83345	S	50·3	11·7	34·2	2·04	11·38	2·49	4·57
			83346	Bg	49·9	11·0	33·3	2·09	12·05	2·54	4·75
			83347	Cg	51·3	10·4	32·6	2·23	13·14	2·68	4·91
			83348	Cg	50·4	10·8	30·8	2·27	12·41	2·78	4·48
BARGOUR	Brocklie	46	86212	S	48·7	13·1	31·3	2·08	9·88	2·64	3·74
			86213	Bg	48·9	13·5	31·1	2·09	9·63	2·66	3·62
			86214	Bg	50·5	12·3	28·9	2·32	10·88	2·96	3·68
			86215	Cg	52·6	12·3	26·1	2·63	11·38	3·42	3·32
			86216	Cg	51·6	10·6	27·1	2·58	12·92	3·22	4·01
DARLEITH	Amlaird	48	90834	S	50·0	12·4	29·3	2·28	10·71	2·88	3·71
			90835	Ag	49·7	14·1	31·8	2·06	9·37	2·65	3·54
			90836	B_2g	45·5	21·1	26·0	1·95	5·69	2·96	1·92
			90837	B_3g	49·6	15·4	28·6	2·19	8·54	2·94	2·91
			90838	Cg	49·2	16·6	26·5	2·24	7·86	3·14	2·50
GIFFNOCK	Giffnock	56	98549	S	49·0	11·9	33·2	2·03	10·90	2·50	4·36
			98550	A_2g	46·9	15·2	32·3	1·89	8·19	2·46	3·34
			98551	B_2g	49·9	12·2	31·9	2·13	10·87	2·65	4·10
			98552	Cg	51·4	11·1	32·3	2·21	12·26	2·70	4·55
KILMARNOCK	Kilmarnock	58	82036	S	51·7	10·2	32·2	2·27	13·51	2·72	4·96
			82037	A_2g	51·8	10·2	33·5	2·19	13·53	2·62	5·17
			82038	Bg	49·5	14·8	30·0	2·12	8·89	2·79	3·18
			82039	Cg	44·3	16·3	27·0	2·23	8·01	3·10	2·58
			82040	Cg	50·4	14·0	28·2	2·30	9·53	3·02	3·15
ROWANHILL	Rowanhill	65	86186	S	48·4	12·0	32·7	2·03	10·66	2·50	4·26
			86187	Bg	47·5	13·4	31·8	1·99	9·43	2·53	3·72
			86188	Bg	46·9	15·9	30·9	1·94	7·80	2·58	3·03
			86189	Cg	50·7	11·5	30·6	2·25	11·72	2·80	4·18
			86190	Cg	50·5	11·5	29·9	2·30	11·63	2·86	4·06
SORN	Sorn	69	92809	S	50·4	9·7	28·3	2·48	13·80	3·02	4·57
			92810	B_2g	41·9	22·2	26·1	1·76	5·01	2·71	1·85
			92811	B_3g	45·3	19·5	27·2	1·94	6·17	2·83	2·18
			92812	Cg	49·2	14·7	26·9	2·30	8·91	3·10	2·87

TABLE 10.—SILICA-SESQUIOXIDE RATIOS: NON-CALCAREOUS GLEYS—Very poorly drained

Association	Series	Profile No.	Soil No.	Horizon	Percentages			Ratios			
					SiO_2	Fe_2O_3	Al_2O_3	SiO_2/R_2O_3	SiO_2/Fe_2O_3	SiO_2/Al_2O_3	Al_2O_3/Fe_2O_3
ASHGROVE	Caaf	45	83340	S	53·0	6·7	35·4	2·26	21·06	2·54	8·30
			83341	A_2g	51·4	7·6	34·5	2·21	17·82	2·52	7·07
			83342	Bg	52·1	7·5	35·2	2·21	18·52	2·51	7·37
			83343	Cg	50·0	11·5	30·9	2·22	11·56	2·75	4·21

TABLE 11.—SILICA-SESQUIOXIDE RATIOS: PEATY PODZOLS WITH IRON PAN

Association	Series	Profile No.	Soil No.	Horizon	Percentages			Ratios			
					SiO_2	Fe_2O_3	Al_2O_3	SiO_2/R_2O_3	SiO_2/Fe_2O_3	SiO_2/Al_2O_3	Al_2O_3/Fe_2O_3
DARLEITH	Baidland	71	85832	A_1	44·6	17·1	25·2	2·09	6·94	3·01	2·30
			85833	A_2	51·5	9·4	29·1	2·49	14·54	3·01	4·82
			85834	B_2	41·2	16·3	33·5	1·59	6·71	2·08	3·22
			85835	B_3	41·3	12·5	37·2	1·55	8·76	1·88	4·64
			85836	C	48·0	11·4	31·0	1·72	11·13	2·03	5·48
			85837	C	49·8	11·7	29·1	2·31	11·25	2·91	3·87
LARGS	Haupland	76	92054	A_1	52·3	3·2	36·2	2·32	42·70	2·45	17·50
			92055	A_2	51·5	4·7	34·4	2·34	29·15	2·54	11·48
			92056	B_2	42·1	17·6	31·8	1·67	6·34	2·24	2·82
			92057	B_3	46·2	12·3	31·5	1·99	9·94	2·48	3·99
			92058	C	49·1	10·3	30·2	2·26	12·65	2·76	4·58
REPPOCH	Glen Garr	77	92068	H	45·1	24·0	11·2	2·88	5·01	6·83	0·74
			92069	A_2	53·3	4·3	34·7	13·07	33·01	2·60	12·67
			92070	B_2	43·1	16·4	34·0	5·27	6·99	2·14	3·26
			92071	B_3	44·3	12·6	35·4	1·73	9·35	2·12	4·40
			92072	C	45·1	13·7	34·3	1·78	8·75	2·22	3·93

TABLE 12.—SILICA-SESQUIOXIDE RATIOS: PEATY GLEYS

Association	Series	Profile No.	Soil No.	Horizon	Percentages			Ratios			
					SiO_2	Fe_2O_3	Al_2O_3	SiO_2/R_2O_3	SiO_2/Fe_2O_3	SiO_2/Al_2O_3	Al_2O_3/Fe_2O_3
DARLEITH	Myres	—	92126	A_2g	49·3	12·8	32·4	2·06	10·22	2·57	3·96
			92127	Bg	49·9	12·5	33·1	2·06	10·61	2·55	4·15
			92128	Cg	50·1	13·4	30·8	2·16	9·92	2·76	3·59
REPPOCH	Reppoch	82	92064	A_2g	54·8	4·0	35·5	2·45	36·50	2·62	13·92
			92065	Bg	46·8	15·6	29·7	2·00	7·96	2·67	2·97
			92066	Cg	50·3	11·1	32·1	2·17	12·02	2·65	4·53
			92067	Cg	51·0	8·9	31·8	2·31	15·24	2·72	5·60

TABLE 13.—SILICA-SESQUIOXIDE RATIOS: HUMIC GLEYS

Association	Series	Profile No.	Soil No.	Horizon	Percentages			Ratios			
					SiO_2	Fe_2O_3	Al_2O_3	SiO_2/R_2O_3	SiO_2/Fe_2O_3	SiO_2/Al_2O_3	Al_2O_3/Fe_2O_3
ASHGROVE	Giffen	84	82203	S	52·9	6·5	34·3	2·34	21·64	2·16	8·25
			82204	A_2g	55·0	5·0	35·9	2·38	29·23	2·59	11·24
			82205	Bg	53·1	8·5	33·4	2·33	16·61	2·70	6·14
			82206	Cg	53·9	7·9	32·9	2·42	18·17	2·79	6·51
			82207	Gg	53·7	7·3	34·0	2·34	18·81	2·68	7·01
KILMARNOCK	Polbaith	89	90830	S	49·8	10·0	32·0	2·20	13·19	2·64	5·00
			90831	Ag	53·8	5·9	36·3	2·28	24·25	2·51	9·65
			90832	Bg	50·1	12·5	32·3	2·11	10·63	2·63	4·04
			90833	Cg	52·0	12·2	30·0	2·34	11·30	2·95	3·83

APPENDIX II (continued)—Mineralogical Analysis of the Fine Sand Fraction

TABLE 14.—PERCENTAGE MINERAL GROUPS IN THE FINE SAND FRACTION (20—200μ)

Association	Series	Major Soil Group	Profile No.	Horizon	Soil No.	%age Mineral (Specific Gravity) Groups		
						Orthoclase Sp. Gr. <2·6	Quartz Sp. Gr. 2·6-2·9	Ferro-silicate Sp. Gr. >2·9
Ashgrove	Highfield	Brown forest soil, gleyed B and C horizons	1	S	92042	2·0	96·1	1·9
				B-C(g)	92044	2·1	95·3	2·6
	Ashgrove	Non-calcareous gley poorly drained	38	S	83345	1·9	95·8	2·3
				Cg	83348	2·1	95·0	2·9
	Caaf	Non-calcareous gley very poorly drained	45	S	83340	2·4	95·5	2·1
				Cg	83343	2·9	93·9	3·2
	Giffen	Humic gley	84	S	82203	2·1	96·4	1·5
				Cg	82207	3·2	93·9	2·9
Bargour	Bargour	Brown forest soil, gleyed B and C horizons	4	S	86202	2·1	95·1	2·8
				C(g)	86206	2·5	94·5	3·0
	Brocklie	Non-calcareous gley poorly drained	46	S	86212	1·9	95·5	2·2
				Cg	86216	2·9	93·9	3·2
Darleith	Darleith	Brown forest soil	6	S	90839	6·4	85·8	7·8
				C	90841	6·7	85·2	8·1
	Dunlop	Brown forest soil, gleyed B and C horizons	13	S	85787	7·1	85·1	7·8
				C(g)	85791	7·8	83·3	8·9

TABLE 14—continued

Association	Series	Major Soil Group	Profile No.	Horizon	Soil No.	%age Mineral (Specific Gravity) Groups. Orthoclase Sp. Gr.<2·6	Quartz Sp. Gr. 2·6-2·9	Ferro-silicate Sp. Gr.>2·9
Darleith (*contd.*)	Dunlop	Brown forest soil, gleyed B and C horizons	—	S	90857	5·9	87·6	6·5
				C(g)	90862	6·1	86·6	7·3
	Dunlop	Brown forest soil, gleyed B and C horizons	15	S	92033	4·5	89·8	5·7
				C(g)	92036	4·9	89·0	6·1
	Amlaird	Non-calcareous gley poorly drained	—	S	85842	1·9	91·3	6·8
				Cg	85845	2·1	89·9	8·0
	Amlaird	Non-calcareous gley poorly drained	48	S	90834	4·5	90·8	4·7
				Cg	90838	6·3	85·9	7·8
	Amlaird	Non-calcareous gley poorly drained	50	Ag	92078	4·7	92·5	2·8
				Cg	92081	5·8	87·3	6·9
	Pokelly	Non-calcareous gley very poorly drained	53	S	85546	1·5	93·2	5·3
				Cg	85549	1·9	91·2	6·9
	Baidland	Peaty podzol with iron pan	71	A_1	85832	4·1	92·0	3·9
				C	85837	6·1	86·7	7·2
	Myres	Peaty gley	—	A_2g	92126	3·0	93·1	3·9
				Cg	92128	5·7	87·7	6·6
Darvel	Darvel	Brown forest soil	16	S	85850	2·1	94·3	3·6
				D	85854	2·6	93·5	3·9
	Darvel	Brown forest soil	17	S	92138	1·8	95·3	2·9
				C	92141	2·5	93·9	3·6

TABLE 14—continued

Association	Series	Major Soil Group	Profile No.	Horizon	Soil No.	%age Mineral (Specific Gravity) Groups. Orthoclase Sp. Gr. <2·6	Quartz Sp. Gr. 2·6-2·9	Ferro-silicate Sp. Gr. >2·9
DREGHORN	Dreghorn	Brown forest soil	—	S	82158	1·5	96·9	1·6
				C	82160	1·8	96·3	1·9
	Dreghorn	Brown forest soil	21	S	82161	2·3	94·9	2·8
				C	82164	2·1	94·8	3·1
GIFFNOCK	Giffnock	Non-calcareous gley poorly drained	56	S	98549	2·2	96·9	0·9
				Cg	98552	2·6	95·7	1·7
KILMARNOCK	Kilmarnock	Brown forest soil, gleyed B and C horizons	24	S	82031	2·6	94·9	2·5
				C(g)	82035	3·5	93·4	3·1
	Kilmarnock	Brown forest soil, gleyed B and C horizons	25	S	82199	2·2	93·7	4·1
				B_3(g)	82201	2·9	93·5	3·6
	Kilmarnock	Brown forest soil, gleyed B and C horizons	28	A	83374	3·8	90·3	5·9
				C(g)	83378	4·5	89·5	6·0
	Kilmaurs	Non-calcareous gley poorly drained	58	S	82036	3·5	93·4	3·1
				Cg	82040	4·0	92·1	3·9
	Loudoun	Peaty gley	—	H	83370	5·1	88·0	6·9
				Cg	83373	5·6	87·3	7·1
	Polbaith	Humic gley	89	S	90830	0·9	97·8	1·3
				Cg	90833	3·8	92·1	4·1
KIRKTONMOOR	Moorhouse	Peaty podzol	72	A_1	87370	4·9	89·4	5·7
				B_3-C	87372	5·5	87·8	6·7

TABLE 14—continued

Association	Series	Major Soil Group	Profile No.	Horizon	Soil No.	%age Mineral (Specific Gravity) Groups. Orthoclase Sp. Gr. < 2·6	Quartz Sp. Gr. 2·6-2·9	Ferro-silicate Sp. Gr. > 2·9
LANFINE	Lanfine	Brown forest soil, gleyed B and C horizons	—	S	87353	2·5	93·9	3·6
				C(g)	87357	3·1	92·4	4·5
LARGS	Largs	Brown forest soil, gleyed B and C horizons	—	S	82178	2·4	95·7	1·9
				C(g)	82181	3·1	94·2	2·7
	Haupland	Peaty podzol with iron pan	76	A_1	92054	2·8	95·1	2·1
				C	92058	2·9	94·6	2·5
	Reoch	Peaty gley	81	Ag	82182	2·1	96·4	1·5
				Cg	82185	2·9	94·0	3·1
MAUCHLINE	Mauchline	Brown forest soil, gleyed B and C horizons	36	S	92813	1·9	96·1	2·0
				C(g)	92816	2·6	94·9	2·5
REPPOCH	Glen Garr	Peaty podzol with iron pan	77	H	92068	2·5	96·4	1·1
				C	92072	5·1	92·0	2·9
	Reppoch	Peaty gley	82	A_2g	92064	2·7	95·2	2·1
				Cg	92067	3·9	92·5	3·6
ROWANHILL	Caprington	Brown forest soil, gleyed B and C horizons	37	S	86181	3·2	94·2	2·6
				C(g)	86185	4·2	92·9	2·9
	Rowanhill	Non-calcareous gley poorly drained	65	S	86186	2·9	94·6	2·5
				Cg	86190	3·9	92·8	3·3
SORN	Sorn	Non-calcareous gley poorly drained	69	S	92809	2·8	94·8	2·4
				Cg	92812	2·9	93·9	3·2

APPENDIX II (continued)—Mineralogical Analysis of the Clay Fraction

TABLE 15.—PERCENTAGE MINERALS IN THE CLAY FRACTION (<1·4μ)

Association	Series	Major Soil Group	Profile No.	Horizon	Soil No.	Kaolin	Illite	Vermiculite	Montmorillonite	Chlorite	Mixed-layer Mineral (10-14 Å)	Quartz	Haematite	Lepidocrocite	Goethite	Fe_2O_3 gel
	Darleith	Brown forest soil	6	S	90839	20	20	35	0	10	0	5	0	0	0	0
				B	90840	20	20	35	0	10	0	5	0	0	0	0
				C	90841	20	20	35	0	10	0	5	0	0	0	0
	Amlaird	Non-calcareous gley	48	S	90834	15	25	60	0	0	0	0	0	0	0	0
				A_2g	90835	15	25	60	0	0	0	0	0	0	0	0
				B_2g	90836	10	20	25	0	0	40	0	0	5	<5	0
				B_3g	90837	10	35	10	0	0	40	0	0	5	0	0
				Cg	90838	10	50	0	0	0	40	0	0	0	0	0
DARLEITH	Baidland	Peaty podzol with iron pan	71	A_1	85832	10	25	40	0	0	25	<5	0	0	0	0
				A_2	85833	10	20	40	0	0	25	5	0	0	0	0
				B_2	85834	15	20	30	0	0	30	5	<5	0	0	0
				B_3	85835	15	20	30	0	0	30	5	5	0	0	0
				C	85836	15	30	35	0	0	10	5	5	0	0	0
				C	85837	15	40	25	0	0	10	5	5	0	0	0
	Myres	Peaty gley	—	A_2g	92126	30	45	20	0	0	0	<5	0	0	0	0
				Bg	92127	30	50	10	0	0	0	<5	0	0	0	0
				Cg	92128	30	60	5	0	0	0	<5	0	0	0	0
	Highfield	Brown forest soil with gleyed B and C horizons	1	S	92042	50	10	35	0	0	0	<5	0	0	0	0
				B(g)	92043	45	15	35	0	0	0	<5	0	0	0	0
ASHGROVE				B-C(g)	92044	45	20	30	0	0	0	5	0	0	0	0
	Giffen	Humic gley	84	A_2g	82204	60	5	30	0	0	0	5	0	0	0	0
				Bg	82205	55	15	25	0	0	0	5	0	0	0	0
				Cg	82206	55	30	15	0	0	0	5	0	0	0	0
				Cg	82207	50	30	15	0	0	0	5	0	0	0	0

TABLE 15—continued

Association	Series	Major Soil Group	Profile No.	Horizon	Soil No.	Kaolin	Illite	Vermiculite	Montmorillonite	Chlorite	Mixed-layer Mineral (10-14 Å)	Quartz	Haematite	Lepidocrocite	Goethite	Fe_2O_3 gel.
KILMARNOCK	Kilmarnock	Brown forest soil with gleyed B and C horizons	24	S	82031	30	10	50	0	0	0	5	5	0	0	0
				$B_2(g)$	82032	30	30	30	0	0	0	5	5	0	0	trace
				$B_3(g)$	82033	30	25	25	0	0	10	5	5	0	0	<5
				C(g)	82034	30	35	0	15	0	10	5	5	0	0	<5
				C(g)	82035	25	45	0	15	0	5	5	5	0	0	trace
	Kilmaurs	Non-calcareous gley	58	S	82036	50	5	40	0	0	5	0	0	0	0	0
				A_2g	82037	45	5	35	0	0	10	5	0	0	0	0
				Bg	82038	35	25	10	0	0	20	5	<5	<5	0	0
				Cg	82039	25	50	0	0	0	20	5	<5	0	0	0
				Cg	82040	20	50	0	0	0	20	5	5	0	0	0

APPENDIX III
Vegetation of Soil Categories

The following subjective frequency symbols have been used in the tables:—d—dominant, cd—co-dominant, va—very abundant, a—abundant, f—frequent, o—occasional, r—rare, l—local or locally.

TABLE 16.—THE VEGETATION OF BROWN FOREST SOILS

Freely drained

Species	Status and Series				
	Young Ley	Old Ley	Permanent Pasture	Deciduous Woodland	Coniferous Woodland
	Darvel	Darleith	Darleith	Darleith	Darleith
Acer pseudoplatanus				d	
Achillea millefolium	o		f		
Agrostis canina					f-a
A. tenuis	a-f	d	d	f-ld	
Anthoxanthum odoratum	o		a-va		l
Athyrium filix-femina				f	
Bellis perennis		la	o-f		
Betula spp.					o
Blechnum spicant					o
Cerastium vulgatum	o	o	f		
Cirsium arvense	o				
C. vulgare	r				
Cynosurus cristatus	f	f-a			
Dactylis glomerata	f-a	f			
Deschampsia caespitosa			o	l	
D. flexuosa					f-ld
Dryopteris austriaca				va-ld	o
D. filix-mas				f	
Euphrasia sp.			o		
Fagus sylvatica				d	
Festuca ovina			va-cd		
F. rubra	a	f-a	o-f		
Fraxinus excelsior				d	
Galium hercynicum			f-a	o	
Holcus lanatus	f	o-f	f-la		
H. mollis	l	o		a-d	f-ld
Juncus effusus					l
Lathyrus pratensis	r				
Leontodon autumnalis		o	f		
Lolium perenne	f	f			
Lotus corniculatus			f		
Luzula campestris			o-f		
Myosotis arvensis	o				
Oxalis acetosella				a	
Phleum pratense	f-a	f			
Pinus sylvestris					d
Plantago lanceolata	o	o-r	o		
Poa annua	r-o				
P. pratensis	o-f	f	f-la		
P. trivialis	va	f-la	r		
Potentilla erecta		r	o		
Quercus spp.				d	
Ranunculus acris		o-f			
R. repens	va	o-f	f		
Rhinanthus sp.			r		
Rubus idaeus				o	
Rumex acetosa	o-f	f	o-f	r	o
R. acetosella	o				o
R. obtusifolius	r				
Sagina procumbens		o			
Salix sp.					r
Senecio jacobaea		a			
Trifolium repens	a-f	a	f-a		
Vaccinium myrtillus					o
Veronica chamaedrys		o-r	f	o-r	
V. serpyllifolia	o-r				
Viola riviniana				o-r	

TABLE 16—continued

Species	Status and Series				
	Young Ley	Old Ley	Permanent Pasture	Deciduous Woodland	Coniferous Woodland
	Darvel	Darleith	Darleith	Darleith	Darleith
Mosses and Liverworts					
Brachythecium rutabulum		o			
Catharinea undulata		f			
Dicranum scoparium				r	
Eurhynchium praelongum		o			
Hypnum cupressiforme var. *filiforme*				o	
Lophocolea sp.		o			
Mnium hornum				f	r
Plagiothecium undulatum					o
Polytrichum commune					l-f
P. sp.			o		
Rhytidiadelphus squarrosus			o	f-a	o-f
Sphagnum sp.					o

TABLE 17.—THE VEGETATION OF BROWN FOREST SOILS

Imperfectly drained

Species	Status and Series				
	Young Ley	Old Ley	Permanent Pasture	Deciduous Woodland	Coniferous Woodland
	Kilmarnock	Largs	Largs	Kilmarnock	Bargour
Achillea millefolium	r		o		
Aesculus hippocastanum				r	
Agrostis canina			f-a		
A. stolonifera				a	
A. tenuis	f-ld	d	d	o	f-o
Alchemilla glabra	o				
Anthoxanthum odoratum	o	f-a	f-a	va	
Bellis perennis	f-a				
Carex ovalis		f			
Cerastium vulgatum	o-f				
Chamaenerion angustifolium				o-f	o
Conopodium majus				o	
Crataegus monogyna	o			f	
Cynosurus cristatus	o	f			
Dactylis glomerata	o-f			o-f	
Deschampsia caespitosa				o-f	
Dryopteris austriaca					a
D. filix-mas				o	
Epilobium montanum				o	

TABLE 17—continued

Species	Status and Series				
	Young Ley	Old Ley	Permanent Pasture	Deciduous Woodland	Coniferous Woodland
	Kilmarnock	Largs	Largs	Kilmarnock	Bargour
Epipactis helleborine				r	
Fagus sylvatica				d	
Festuca gigantea				o	
F. ovina		o			
F. rubra		o-f	f	la	
Fraxinus excelsior				r	
Galium aparine					r
G. hercynicum			a		
Geum urbanum				r	
Hedera helix				la	
Heracleum sphondylium				o	
Holcus lanatus	f	f		o	a-va
Ilex aquifolium				o	
Juncus effusus		ld-f	l		
Lolium perenne	cd	o-f			
Lonicera periclymenum				ld	
Lotus corniculatus			o		
Luzula campestris			o-f		
Moehringia trinervia					r
Neottia nidus-avis				r	
Oxalis acetosella					a
Phleum pratense	o				
Pinus sylvestris					d
Poa annua	f-la	o			
P. pratensis	o	f-la		o	o-r
P. trivialis	cd	la		la	
Polygonum aviculare	r				
P. persicaria	r				
P. sp.		l			
Potentilla erecta			f-la		
Quercus spp.				r	
Ranunculus ficaria				o	
R. repens	a	a		o	
Rosa sp.				o	
Rubus fruticosus				ld	o-lf
Rumex acetosa		o	f		
R. crispus	o				
R. obtusifolius	o-r	o		o-f	
Sagina procumbens		f			
Stellaria media	r-o				
Taraxacum sp.				r	
Trifolium repens	a	a	lf		
Ulex europaeus			f-a		
Ulmus sp.				o-r	
Urtica dioica	l				r
Veronica chamaedrys			r		
V. officinalis			r		
Viola riviniana				o	
V. sp.					r
Mosses and Liverworts					
Eurhynchium praelongum			o	r	
Hypnum cupressiforme			o	o	
Mnium hornum				f-va	
Polytrichum commune			f-a		

TABLE 18.—THE VEGETATION OF NON-CALCAREOUS GLEYS

Poorly drained

Species	Status and Series			
	Young Ley	Old Ley	Permanent Pasture	Deciduous Woodland
	Rowanhill	Ashgrove	Threepwood	Ashgrove
Acer pseudoplatanus				d
Agrostis canina		la	f-la	
A. tenuis		a-ld	a-d	
Alopecurus geniculatus	f		o	
Anthoxanthum odoratum	o	a	f-a	a
Athyrium filix-femina				o
Bellis perennis	f		o-f	
Cardamine pratensis			o	
Carex demissa		o	o	
C. flacca			o	
C. hostiana			o	
C. nigra		o-f	o	
C. ovalis		f	o	
Centaurea nigra		f		
Cerastium vulgatum	r-o		r	
Cirsium palustre			r-o	
Cynosurus cristatus		o	f-la	
Dactylis glomerata	o			
Deschampsia flexuosa				f
D. caespitosa		o-f	o-f	la
Dryopteris austriaca				f-a
D. filix-mas				f
Endymion non-scriptus				o-r
Equisetum sylvaticum				f
Fagus sylvatica				d
Festuca rubra	o			
Fraxinus excelsior				d
Galium hercynicum			r	
G. palustre			r	
Geum rivale				o
Glyceria fluitans	r	r		
Hedera helix				o
Holcus lanatus		f-a	f-a	
H. mollis			f	
Hypochaeris radicata	r			
Ilex aquifolium				o
Juncus acutiflorus		r		
J. conglomeratus		la-lcd		
J. effusus		d	a-d	
J. squarrosus			o	
Lathyrus pratensis	r			
Leontodon autumnalis	o-l			
Lolium perenne	f-a			
Lonicera periclymenum				f
Lotus corniculatus		f-a		
L. uliginosus		l		
Luzula multiflora		o	o	
Lychnis flos-cuculi			r	
Melampyrum sylvaticum				o
Myosotis secunda			r	
Oxalis acetosella				f-la
Pedicularis sylvatica			o	
Phleum pratense	f			
Pinus sylvestris				d
Plantago lanceolata	o			
P. major	f			
Poa annua	o			
P. pratensis	o	o	la	
P. trivialis	a	f		

TABLE 18—continued

Species	Status and Series			
	Young Ley	Old Ley	Permanent Pasture	Deciduous Woodland
	Rowanhill	Ashgrove	Threepwood	Ashgrove
Potentilla anserina	r			
Prunella vulgaris	f			
Quercus spp.				d
Ranunculus acris	f	f	f	
R. flammula		r	o	
R. repens	f-a	f	a	
Rubus fruticosus				o
Rumex acetosa		f-la	r-o	
R. crispus	r			
R. obtusifolius			r	
Sagina procumbens	f-a			
Sanicula europaea				r
Scrophularia nodosa			r	
Senecio sp.			r	
Sorbus aucuparia				d
Stellaria alsine			o	
Succisa pratensis				o
Trifolium repens	d	f	a	
Ulex europaeus			r-o	
Veronica chamaedrys			r	
V. officinalis			r	
V. serpyllifolia	r		r	
Vicia sp.	r			
Mosses and Liverworts				
Acrocladium cuspidatum	o		la	
Brachythecium rutabulum	f-la			
Eurhynchium praelongum	f			
Hypnum cupressiforme				o
Lophocolea sp.				r-o
Mnium hornum				f
Plagiothecium undulatum				o
Rhytidiadelphus squarrosus			o-la	

TABLE 19.—THE VEGETATION OF NON-CALCAREOUS GLEYS

Very poorly drained

Species	Status and Series		
	Improved Pasture	Marsh	Marsh
	Blairkip	Caaf	Caaf
Achillea ptarmica	r		
Agrostis canina	o	a-ld	
Alopecurus geniculatus	a		
Anthoxanthum odoratum		f-a	la
Bellis perennis	o-f		o
Betula sp.		f	
Cardamine pratensis		o	
Carex demissa			o
C. echinata		o	
C. nigra			cd
C. ovalis	o	o	o
C. panicea			va
C. sp.	r		
Centaurea nigra			r
Cerastium vulgatum	o		
Cirsium palustre		r	o
Dactylis glomerata	o		
Deschampsia caespitosa		f-a	
Equisetum sylvaticum		f	
Festuca pratensis	f		
F. rubra	o		
Glyceria fluitans	o	l	
Holcus lanatus	f-a	o	o
H. mollis		lf	
Lolium perenne	o-f		
Lotus uliginosus		r	
Luzula multiflora		o-f	
Juncus effusus	la	d	d
Phleum pratense	o		
Poa pratensis	f-la		
P. trivialis	d-a	o	
Potentilla erecta		o	
Ranunculus acris	o-f		o
R. flammula		l	o
R. repens			a
Rumex acetosa	o-f		
Sagina procumbens			o
Salix sp.		o	
Senecio jacobaea			o
Stellaria alsine		o-r	
Succisa pratensis		r	
Trifolium repens	f-la		o
Valeriana officinalis		r	
Mosses and Liverworts			
Acrocladium cuspidatum			o
Eurhynchium praelongum			o
Polytrichum sp.		la	
Sphagnum sp.		o-lf	

TABLE 20.—THE VEGETATION OF PEATY PODZOLS WITH IRON PAN

Freely to imperfectly drained below the pan

Series	Status and Series			
	Heath	Wet Heath	Wet Heath	Grass Heath
	Baidland	Baidland	Knockendon	Glen Garr
Agrostis canina				la
Anthoxanthum odoratum				f-a
Calluna vulgaris	d	d	d	
Carex binervis		o		
C. nigra			f-la	f
Deschampsia flexuosa	r	f	f	a
Empetrum nigrum		r	f	
Erica cinerea	r	r		
E. tetralix		f	o	
Eriophorum angustifolium			o-lf	
E. vaginatum ..			o-f	
Festuca ovina	r	o-f		a
Galium hercynicum				f
Juncus squarrosus		o		f
Luzula sp.				f
Nardus stricta		f		a-d
Potentilla erecta		o-f	o	o
Trichophorum caespitosum		r-o		
Vaccinium myrtillus	r	r	f-a	o
Mosses and Liverworts				
Dicranum scoparium	r	o	o	
Hypnum cupressiforme	r		f	
H. cupressiforme var. *ericetorum*		f-a		f
Plagiothecium undulatum		r	o-f	
Pleurozium schreberi			o	a
Polytrichum commune				la
P. sp.		o-r	f	
Rhytidiadelphus squarrosus				f-a
Sphagnum sp.		o-lf	f-a	l

TABLE 21.—THE VEGETATION OF PEATY GLEYS

Poorly drained

Species	Status and Series						
	Old Pasture	Marsh	Nardus Grassland	Wet Heath	"Moor"	Coniferous Woodland	Birch Wood
	Reoch	Loudoun	Myres	Distink-horn	Myres	Reoch	Loudoun
Achillea ptarmica	r						
Agrostis canina		f-a	f				
A. stolonifera		o					f-a
A. tenuis	a-ld						
Alopecurus geniculatus	f-a						
Anthoxanthum odoratum	f-a	f	f		o-f		
Bellis perennis	f						
Betula pubescens/ verrucosa							d
Calluna vulgaris				a-ld		o-r	
Cardamine flexuosa	o-r						
C. pratensis	r						
Carex nigra	o	lf		f	o-lf		
C. ovalis	o						
C. sp.			f				
Cerastium vulgatum	o-r						
Cirsium arvense	r						
C. palustre	o-f						
Cynosurus cristatus	f						
Deschampsia caespitosa		f					
D. flexuosa		f-a	f-a	a	a	o	la-d
Dryopteris austriaca		o				o-r	f
Empetrum nigrum				o			
Erica tetralix				o-f			
Eriophorum angustifolium					o		
E. vaginatum				f-a	a-d		
Festuca ovina		la	f-a		o-f		o
F. rubra		la	o-f				
Galium hercynicum		f-a	o-f	r	o	o-r	f
Holcus lanatus	f						
Juncus acutiflorus		a-cd					
J. effusus	d	d	l	l	f-ld		f
J. squarrosus	o-r	f	f		f-la		
Larix decidua						d	
Lotus uliginosus		r					
Luzula campestris	o	o					
L. multiflora		o			f		o
L. sylvatica			f				
Molinia caerulea		lf	o		f-cd		
Nardus stricta		la	d		f-la		
Picea abies						d	
Poa pratensis ssp. subcaerulea	a	o-f					
P. trivialis	f						
Potentilla erecta		o	o	o	o		
Prunella vulgaris	f						
Ranunculus acris	o-f						
R. repens	a-f						
Rumex acetosa	f	o-f					
R. acetosella	o						
Sagina procumbens	a						
Salix sp.							o
Senecio sp.	r						
Sorbus aucuparia							o

TABLE 21—continued

Species	Status and Series						
	Old Pasture	Marsh	Nardus Grassland	Wet Heath	"Moor"	Coniferous Woodland	Birch Wood
	Reoch	Loudoun	Myres	Distinkhorn	Myres	Reoch	Loudoun
Succisa pratensis							o
Trichophorum caespitosum			o-r				
Trifolium repens	a-ld						
Vaccinium myrtillus				a-ld	o-f	o	
Veronica serpyllifolia	o						
Mosses and Liverworts							
Acrocladium cuspidatum	o-lf						
Aulacomnium palustre					l		
Brachythecium sp.	o-lf						
Dicranum scoparium						o	f
Hypnum cupressiforme							o-f
Lophocolea bidentata					f		
Mnium hornum							o
Plagiothecium undulatum				o	o-lf	o	f
Pleurozium schreberi			f-a	o		o	
Polytrichum commune					o-la	d	a-ld
P. sp.	o	o-f	f-a	o			
Pseudoscleropodium purum		o					
Rhytidiadelphus loreus						a	
R. squarrosus		la					
Sphagnum spp.			o-lf	a	f-la	l	f-a

TABLE 22.—THE VEGETATION OF HUMIC GLEYS

Very poorly drained

Species	Status and Series		
	Old Pasture	Marsh	Deciduous Woodland
	Hardhill	Kirktonmoor	Dunwan
Acer pseudoplatanus			d
Agrostis canina	a		la
A. tenuis	a		
Angelica sylvestris			o
Anthoxanthum odoratum	f	f	
Athyrium filix-femina			d
Cardamine flexuosa			o-f
C. pratensis		o	o-lf
Carex nigra		o	
C. ovalis	o		
C. rostrata		f	

TABLE 22—continued

Species	Status and Series		
	Old Pasture	Marsh	Deciduous Woodland
	Hardhill	Kirktonmoor	Dunwan
Cerastium vulgatum	o		
Chrysosplenium oppositifolium			o-f
Cirsium palustre	f	o	o
Cynosurus cristatus	o		
Dryopteris austriaca			va
Epilobium palustre		o-r	r-lf
Equisetum arvense			r
E. sylvaticum			r
Fagus sylvatica			d
Festuca rubra	f	o-f	
Fraxinus excelsior			d
Galium hercynicum		f	
G. palustre	o-f	a	r
Holcus lanatus	f	o	
H. mollis	f-la	o-f	
Juncus acutiflorus	d	d	
J. effusus	a	d	f-ld
Lonicera periclymenum			r
Lotus corniculatus	o		
Lychnis flos-cuculi		o	
Menyanthes trifoliata		o	
Myosotis secunda		o	
M. sp.			r
Nardus stricta	o		
Oxalis acetosella			f-la
Poa pratensis	f-o		
P. trivialis		f	
P. sp.			o
Potentilla erecta	o		
P. palustris		f-a	
Ranunculus acris		o	
R. flammula		o	
R. repens	f		a
Rubus idaeus			r
Rumex acetosa	o	o-f	o
Salix caprea			d
S. sp.			d
Scrophularia nodosa			r
Stellaria alsine			r
Trifolium repens	f-a	a	
Urtica dioica			o-f
Viola palustris		o-f	
Mosses and Liverworts			
Acrocladium cuspidatum	o	o-f	
Brachythecium albicans	o-f		
B. sp.		a	f-a
Eurhynchium praelongum			f-a
Hypnum cupressiforme var. *filiforme*			l
Mnium undulatum	o		l
Polytrichum commune		o-f	
P. sp.	o		
Rhytidiadelphus squarrosus	f		
Sphagnum spp.		la	o
Thuidium tamariscinum			l

INDEX

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