Programme & Excursion Guide

British Society for Soil Science

Autumn Meeting 1976

DUBLIN

BRITISH SOCIETY OF SOIL SCIENCE

AUTUMN CONFERENCE AT DUBLIN

September 13-19, 1976

PROGRAMME, SUMMARIES & EXCURSION GUIDES

Edited by Edward B. Culleton

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BRITISH SOCIETY OF SOIL SCIENCE

D U B L I N 1 9 7 6

Local Committee

Chairman: Michael Gardiner, The Agricultural Institute

James Brogan	The Agricultural Institute
Michael Bulfin	" " "
James Collins	University College Dublin
Michael Conry	The Agricultural Institute
Edward Culleton	" " "
Olive Daly	" " "
Sean Diamond	" " "
Thomas Finch	" " "
Robert Hammond	" " "
Michael Jelley	" " "
Austin Morgan	University College Dublin

PROGRAMME

Monday, September 13

15.00-20.00	Registration
19.00-19.30	Evening meal
	Council meeting
21.00	Welcoming reception

Tuesday, September 14

	Chairman: Mr. R. I. Davies, University of North Wales, Bangor
09.15	Formal Opening of Conference Dr. T. Walsh, Director, Agricultural Institute, Dublin
09.30-10.15*	Man's influence on the Irish landscape Professor G. F. Mitchell, F.R.S., Trinity College, Dublin
10.15-10.45	Coffee
10.45-11.30*	Land resource appraisal, an Irish experience Dr. M. J. Gardiner, Head, National Soil Survey of Ireland, Agricultural Institute
11.30-12.15*	The occurrence and significance of peatland in Ireland Mr. R. F. Hammond, National Soil Survey, Agricultural Institute, Lullymore, Co. Kildare
	*Includes 15 minutes discussion time
12.30	Lunch
13.30-18.00	*Alternative afternoon field excursions*
Excursion A	Agricultural Institute's Animal Production Research Centre at Grange, Co. Meath, on heavy limestone-shale soils. Also Newgrange Neolithic site
Excursion B**	Forestry, amenity, agricultural land use and reclamation in the Wicklow hill and mountain region; granite, mica schist and peat soils will be shown
Excursion C	Agricultural Institute's Peatland Experimental Station at Lullymore, Co. Kildare. Research on grassland, arable crops and nursery stocks on milled and cut-over peat; aspects of industrial utilisation of peat
19.00	Dinner
20.00	Meeting of the Council

Wednesday, September 15

09.00-18.00 — *Alternative full day excursions*

Excursion D — Two profiles on coarse and fine textured limestone soils in Co. Kildare. Visits to a typical farm and the Agricultural Institute's Crop Research Centre at Oakpark, Carlow

Excursion E** — Wicklow mountains; forestry, amenity and agricultural land use of soils on acid and basic igneous materials, and peat. Visit to the Forest and Wildlife Service's Forestry Training School at Avondale, with a range of mature forest species

Excursion F — Midland peat soils - reclamation, agriculture and fuel

As Tuesday afternoon Excursion C, together with amenity use of peatland and the Grand Canal system at Robertstown, Co. Kildare, also relict soils under peat

** The excursions to the Wicklow mountains (B) or (E) have high scenic content

19.00 — Dinner

20.00 — Annual General Meeting

Thursday, September 16

Chairman: Mr. P. H. Nye, Soil Science Laboratories, Oxford University

09.00-9.45 — Does a soil survey need a soil classification?
Mr. J. M. Ragg, Soil Survey, Edinburgh School of Agriculture

09.45-10.30 — Soil horizons and soil layers
Dr. E. A. FitzPatrick, Department of Soil Science, University of Aberdeen

10.30-11.15 — The root-soil interface
Professor P. B. H. Tinker, Department of Plant Sciences, University of Leeds

*Includes 15 minutes discussion time

11.15-11.45 — Coffee

11.45-12.45 — Soil ~~Science~~ Chemistry and the Search for ~~Unifying~~ Concepts a topic for Presidential Address
Presidential address: Professor P. W. Arnold, Department of Soil Science, The University, Newcastle-upon-Tyne

13.00 — Lunch

14.20	Research communications on the following themes (to run concurrently); a) Soils and the human factor b) Soil biology and plant nutrition c) Soil genesis, classification and land use d) Soil physics and engineering
15-40-16.10	Coffee
16.10	Research communications on themes (a), (b) and (c) continued
19.00	Depart for Conference Dinner, Trinity College, Dublin

POST-CONFERENCE EXCURSION TO WEST CORK, SEPTEMBER 17-19

Friday, September 17

07.45	Depart St. Patrick's College for Heuston Station
08.30	Depart by train for Mallow (arrive Mallow 11.40) Visit Agricultural Institute's farm at Coolnakilla to see hill land reclamation, associated soils and dairy research
	Overnight, Imperial Hotel, Cork

Saturday, September 18

09.00	Leave by coach for Bandon, Clonakilty, Skibbereen and Bantry seeing plaggen soils, high manganese soils, brown podzolic soils and associated farming
	Overnight, Westlodge Hotel, Bantry

Sunday, September 19

09.00	Leave by coach for Glengarriff, Kenmare and Mallow, seeing hill and mountain land-use
15.30	Depart Mallow for Dublin by train
18.30	Arrive Dublin

RESEARCH COMMUNICATIONS

Thursday, September 16

SOILS AND THE HUMAN FACTOR

Chairman: Dr. P. Ryan, The Agricultural Institute, Sandymount Avenue, Dublin

14.20-14.40*	The use of soil maps for corrosion prediction M. G. Jarvis and D. Mackney (Soil Survey England and Wales, A.R.C. Weed Research Organisation, Yarnton, Oxford)
14.40-15.00	Identification and classification of man-made soils B. W. Avery (Soil Survey England and Wales, Rothamsted, Herts.)
15.00-15.20*	Cadmium and lead-contaminated soils in Wales B. E. Davies and L. J. Roberts, (Geography Department, University College of Wales, Aberystwyth)
15.20-15.40*	Man-made soils in West Cornwall S. J. Staines (Soil Survey England and Wales, Austell, Cornwall)
15.40-16.00	Coffee
16.00-16.20*	Soil profile modification under the influence of peat debris E. Coyle and J. F. Collins (Soil Science Department, University College, Dublin)
16.20-16.40*	Properties and significance of a man-made iron-pan podzol near Castletownbere, Co. Cork M. J. Conry (The Agricultural Institute, Oakpark, Carlow)

* Includes 5 minutes discussion time

RESEARCH COMMUNICATIONS

SOIL GENESIS, CLASSIFICATION AND LAND USE

Chairman: Mr. B. Clayden, Soil Survey of England and Wales, University College of Swansea

14.20-14.40*	Amorphous constituents of podzolic B horizons P. J. Loveland (Soil Survey England and Wales, Rothamsted, Herts.)
14.40-15.00*	Some effect of the plantation of conifers on a freely drained lowland soil I. C. Grieve (Geography Department, University of Keele, Staffs.)
15.00-15.20*	Soil-land use relationships in Tigrai, Ethiopia K.J. Virgo and R.N. Munro (Hunting Technical Services Ltd., Boreham Wood, Herts.)
15.20-15.40	Coffee
15.40-16.00*	Applications of soil survey maps in the construction and maintenance of pipelines C. J. Argent (Engineering Research Station, British Gas Corporation, Newcastle)
16.00-16.20*	The usefulness of the physiographic survey in a soil productivity programme H. E. Cuanalo de la Cerda (Soil Science Department, Colegio de Postgraduados, Chapingo, Mexico)
16.20-16.40	Factors of soil formation: the computor looks at Jenny R. Webster (A.R.C. Weed Research Organisation, Yarnton, Oxford)
16.40-17.00*	The distribution and pastoral capability of major soil types in West Scotland J. S. Bibby, G. R. Bolton, M. J. S. Floate and G. Hudson (Macauley Institute for Soil Research and Hill Farming Research Organisation, Edinburgh)

*Includes 5 minutes discussion time

SOIL BIOLOGY AND PLANT NUTRITION

Chairman: Prof. D. M. McAleese, Department of Agricultural Chemistry and Soil Science, University College, Dublin

14.20-14.40*	The co-ordination chemistry of humic substances - the need for a critical approach P. MacCarthy (Department of Chemistry, University of Georgia, Athens, Ga., U.S.A.)
14.40-15.00	The fertility of termite mounds (*Macrotermes falciger*) and adjacent A1, and Ap horizons near Salisbury, Rhodesia J. P. Watson (Department of Agriculture, University of Rhodesia, Rhodesia)
15.00-15.20*	Incubation studies on transformations of nitrogen fertilisers in some Irish soils M. G. Connolly, P. O'Toole and M. A. Morgan (Soil Science Department, University College, Dublin)
15.20-15.40*	Uptake and assimilation of nitrogen by wheat seedlings exposed to ammonium nitrate and urea D. P. Bradley and M. A. Morgan (Soil Science Department, University College, Dublin)
15.40-16.00	Coffee
16.00-16.20*	A soil with high potassium-fixing properties in Co. Kildare J. C. Brogan, P. V. Kiely and M. J. Conry (The Agricultural Institute, Johnstown Castle, Wexford)
16.20-16.40*	Some observations on the treatment of restored gravel workings for tree planting D. F. Fourt and I. G. Carolan (Forestry Commission, Farnham, Surrey)
16.40-17.00*	Nutritional properties of a peat sub-stratum in glasshouse production P. A. Gallagher (The Agricultural Institute, Kinsealy, Dublin)

*Includes 5 minutes discussion time

RESEARCH COMMUNICATIONS

SOIL PHYSICS AND ENGINEERING

Chairman: Dr. R. M. Jelley, The Agricultural Institute, Kinsealy, Dublin

14.20-14.40	Measurement of dry bulk density with a neutron probe C. E. Mullins (Soil Science Department, University of Aberdeen)
14.40-15.00*	The effects of rotary cultivation of compact sub-soil on soil physical conditions and yield of sugar beet P. T. Gooderham and S. M. Wilkins (Wye College, Ashford, Kent)
15.00-15.20*	Assessment of seedbed tilths and their effects on tap rooted crops M. F. Harrod (A.D.A.S., Soil Science Department, Cambridge
15.20-15.40*	Simultaneous infiltration, redistribution and evaporation of water from soil D. A. Rose (Glasshouse Crops Research Institute, Little-hampton, Sussex)
15.40	Coffee

*Includes 5 minutes discussion time

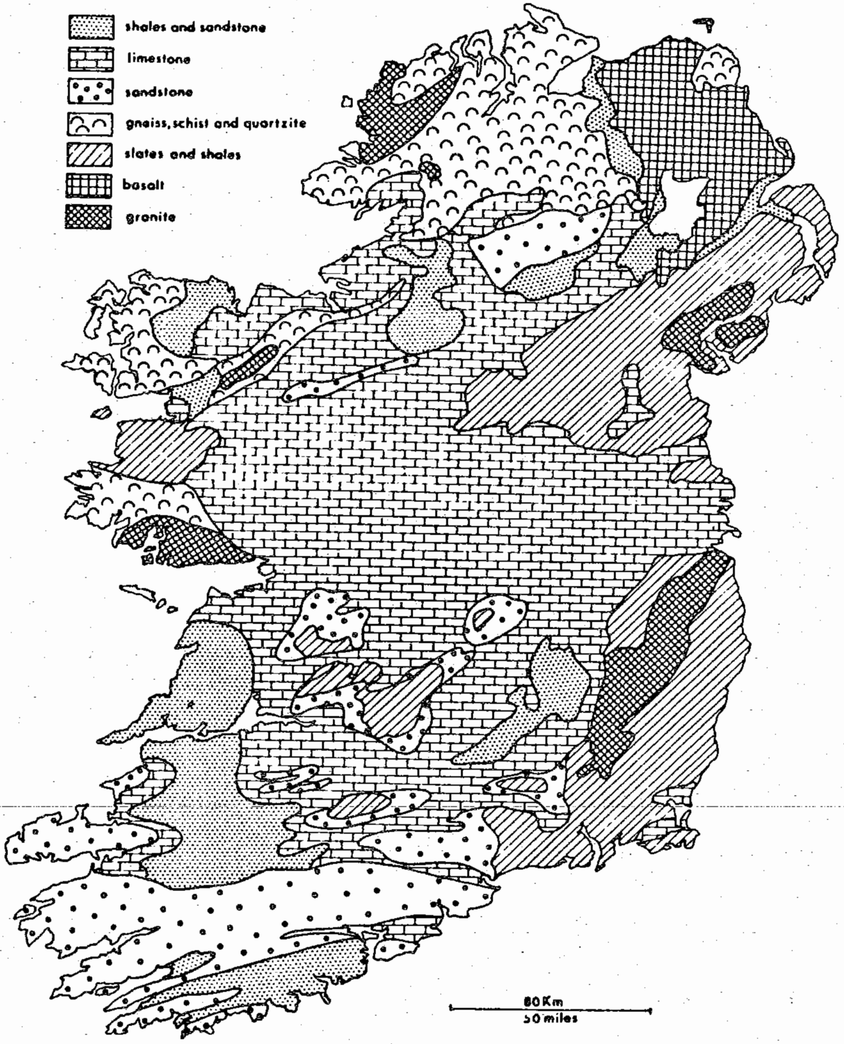


Fig. 1 : Principal rocks — Ireland
(Reproduced from "A Systematic Geography of Ireland" by Desmond Gillmor, published by Gill and Macmillan, 1971)

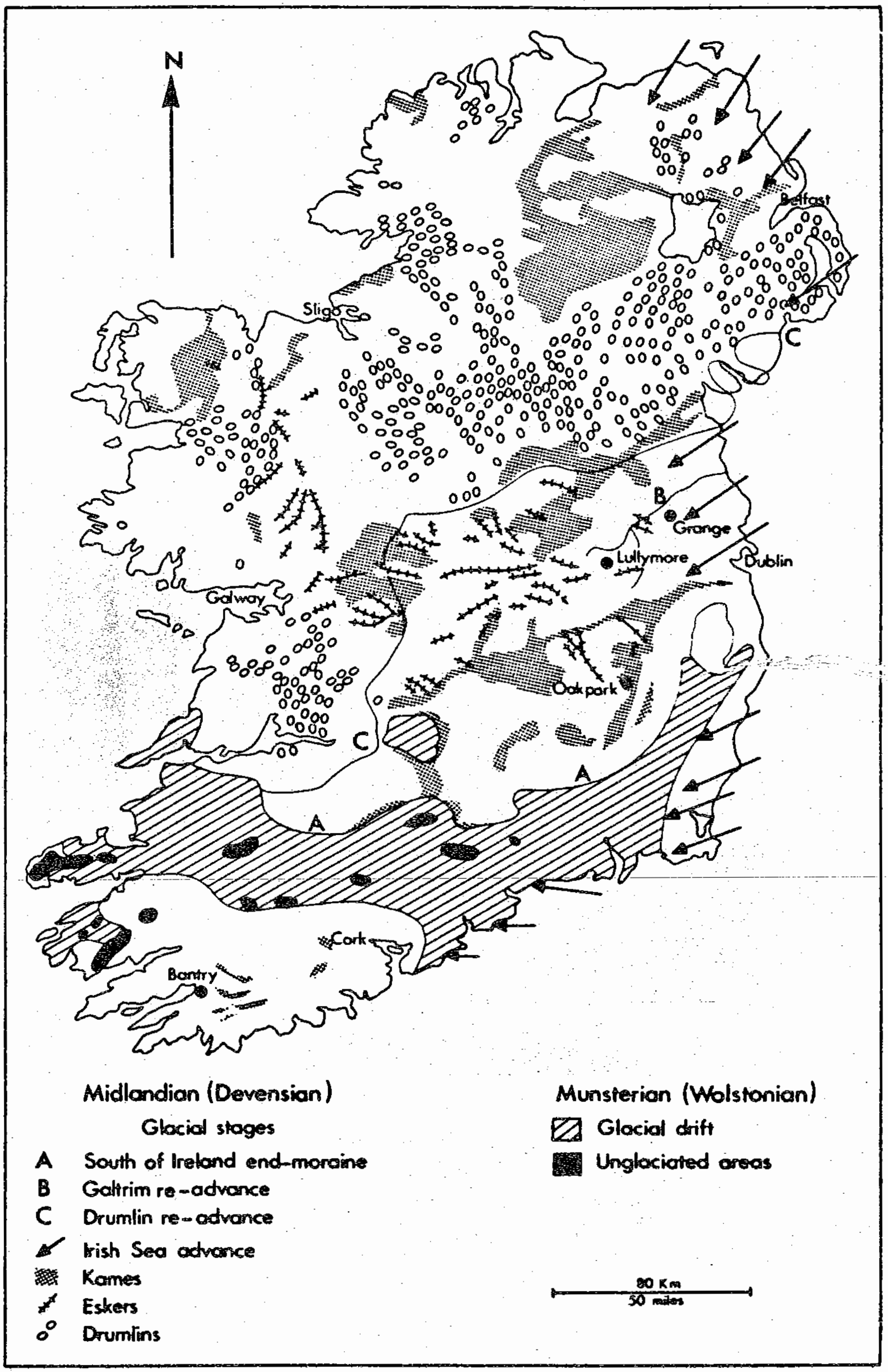


Fig. 2 : Glacial drift map — Ireland (from various sources)

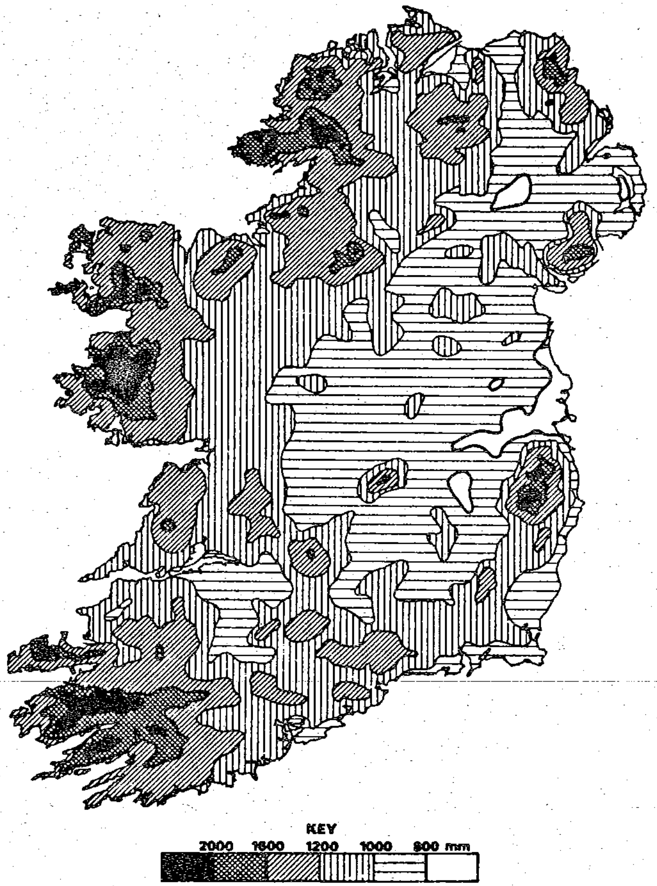


Fig. 3: Mean annual rainfall (mm) 1931–1960
(Reproduced from "The Climate of Ireland" by P.K. Rohan, 1975, with the permission of the Controller, Stationery Office, Dublin.

MAN'S INFLUENCE ON THE IRISH LANDSCAPE

G. F. Mitchell

About 10,000 years ago climatic amelioration at the end of the Ice Age enabled a stream of plants and trees to re-enter the country, and normal soil formation started. Over 5,000 years ago the country was covered by high deciduous forest, accompanied by corresponding soil development.

The first farmers arrived 5,500 years ago, and armed with axes and hoes of polished stone, they opened up transient clearances in the woods, and when the soil became exhausted, they moved on. Renewed tree-growth replenished soil fertility.

Though bronze replaced stone, this pattern probably continued till a few centuries before the birth of Christ when iron implements made woodland clearance easier, and the introduction of the plough-ard made shallow cultivation more effective. There was then marked loss of soil fertility and extensive podzolisation.

About 300 A.D. deeper ploughing with a coulter plough brought fresh material to the surface, while the woodlands went into uninterrupted decline. Natural soil replenishment was no longer possible.

In early Ireland wealth was counted in the head of stock, rather than in number of acres. The Anglo-Normans, who arrived in 1150, wanted good land for tillage, and they turned to the grey-brown podzolics. Any surviving woodlands disappeared in Tudor times, and every twig and bush had vanished by 1840. The population, nourished by the potato, had risen to 10,000,000, and almost every acre of Ireland was turned and re-turned with the spade to try to satisfy the need for food.

The farms of modern Ireland have risen from that ruined landscape.

LAND RESOURCE APPRAISAL - AN IRISH EXPERIENCE

M. J. Gardiner

A brief outline of basic soils appraisal and examples of qualitative and quantitative soil suitability will be presented. Related economic, demographic and sociological factors will be included and the applicability of the findings at farming, regional and overall development levels questioned.

Relationships between soil type, crop performance, farm size and income will be pointed out. Emphasis will be placed on land-use planning in marginal land areas where options are restricted, farm size is small and off-farm employment unavailable. The magnitude of farm restructuring problems will be discussed and the role of land resource appraisal in both the reform directives of the Common Agricultural Policy and in land valuation examined.

THE OCCURRENCE AND SIGNIFICANCE OF PEATLANDS IN IRELAND

R. F. Hammond

The significance of peatlands in Ireland is attributable to the fact that they cover 20 per cent of the land surface. Three different peatland categories are recognised, blanket bog, raised bog and fen. The most common use for the first two categories over the centuries has been for fuel. The third category is now mostly reclaimed and under permanent pasture.

Within the past four decades there has been a rapid expansion in the production of industrial peat fuels and horticultural peat moss from raised bogs. Utilisation of this organic resource has brought prosperity to many parts of the country hitherto unknown since the heyday of the canals.

The Agricultural Institute is examining factors of classification, land-use suitability and agricultural systems on organic soils. This research is looking to the present requirements of the farmer who now wishes to reclaim hand cutover peatland areas and to the projected requirements of the industrial producer when peat fuel production ceases.

DOES A SOIL SURVEY NEED A SOIL CLASSIFICATION?

J. M. Ragg

A soil taxonomy enables a soil surveyor to organise the soils he observes in the field for storage and display in the form of a conventional soil map, but the usefulness of the map depends mainly upon the efficacy of the taxonomy. Automated techniques of data collection, storage, processing and display now make it possible to withhold any form of classification until a particular *kind* of map is called for. Computer maps range in style from raster plots using line-printers, matrix-printers or computer typesetters to outputs from sophisticated line drawing devices. The author has produced thematic soil maps using the programme GRID CAMAP linked to a modified line printer. Examples of these maps will be exhibited and the question posed in the title will be discussed.

SOIL HORIZONS AND SOIL LAYERS

E. A. FitzPatrick

Geomorphological studies during the last two decades have emphasised the fact that denudation is largely synonymous with soil erosion and that as the landscape is fashioned by erosion and deposition, the soil is removed and redistributed either within the landscape or deposited at some distant position.

It would seem that in the majority of cases the soil surface is constantly moving downslope over the surface so that the up-slope position is losing material which is accumulating in the mid or lower slope positions giving stratified soils. The rate at which this process is taking place varies from one climatic region to the other. In tundra and desert areas the process is particularly rapid whereas in warm densely vegetated areas the process seems to be slower. Since climates are not constant but change dramatically from one to the other we find that slope deposits and stratification that developed in one climatic era are now present in a new and contrasted climate. In some cases there is evidence for only a single major climatic change such as we find in northern Europe where many of the present soils on slopes are developed in solifluction deposits of the last glaciation. Another good example occurs in Western Nigeria where the top 50-100 cm of the present soil is a pedisediment formed when conditions became drier for a short period but are now humid again.

In some situations the process is cyclic so that the soils show evidence of many different periods of erosion and deposition. Excellent examples of this type occur in Australia, particularly in the region around Canberra. Where the process has been cyclic, soils of different ages may now be exposed at the surface.

Stratification can also result from the addition of loess or other wind-blown material. In some parts of Europe the soils show a marked increase in clay with depth as a result of a thin cover of loess having been depositied during the Pleistocene period over clays derived from the weathering of limestone during the Tertiary period. Such processes cause great problems in establishing the genesis of the soil affected and even greater problems in their classification.

THE ROOT-SOIL INTERFACE

P. B. H. Tinker

The leaves and roots of plants provide the main transfer interfaces with the environment. Of these, the root has received least attention, since it is the least accessible and most complicated.

A variety of materials are transferred across the root surface - nutrient ions, water, organic exudates, carbon dioxide and oxygen. With some, transfer may occur in either direction, depending upon the conditions. The soil outside the root is strongly modified by these material transfers, and may be regarded as part of the interface, rather than of the bulk soil. The soil environment experienced by the plants roots may therefore be quite different to that of the original soil, with pH and the concentrations of P and K being most likely to vary.

The organic exudates from the root support a much increased micro-organic population, though the effect of this on the plant is still a subject of dispute. Symbiotic organisms such as the mycorrhizas inhabit this interface, and with the ectomycorrhizas may develop so strongly that they form a solid layer between root and soil.

Most theoretical work assumes good contact between root and soil, but this is uncertain. Root hairs may act as a guarantee of good contact, and also form a much more efficient absorbing organ than the root itself, but it is possible that the root itself is often in poor contact with the soil. This could reduce the efficiency of the root appreciably.

At present much of our knowledge of the interface is derived indirectly or from theory, or as averages over the whole root system. Much more detailed knowledge of the precise conditions around particular root zones and a clearer understanding of the effects of the chemical and biological soil components on the root properties are needed.

THE USE OF SOIL MAPS FOR CORROSION PREDICTION

M. G. Jarvis and D. Mackney

Corrosion of ferrous metals is often a costly hazard to the distribution and transport of commodities by buried pipeline. To minimise this risk it would be useful if the occurrence of corrosive environments were predictable so that they could be avoided or preventative measures taken.

A recent investigation of the variability of properties thought to determine the aggressiveness of soil to ferrous metals will be described. It has shown that, in parts of Oxfordshire, general purpose, medium scale soil maps can predict corrosion with sufficient confidence to make them a potentially useful tool for identifying and avoiding areas of high risk.

IDENTIFICATION AND CLASSIFICATION OF MAN-MADE SOILS

B. W. Avery

If the influence of man on vegetation is taken into account, there are few soils in the British Isles with properties entirely attributable to natural agencies. However, in classifying soils of England and Wales for survey purposes, man-made soils are restricted by the author to those having a 'thick man-made A horizon' or in which disturbed soil material is identifiable below the maximum normal depth of ploughing, taken for the purpose as 40cm. The characteristics and classification of these and related soils will be discussed with reference to divisions made in other classifications and to problems of identification.

CADMIUM AND LEAD CONTAMINATED SOILS IN WALES

B. E. Davies and L. J. Roberts

Base metal mining in Wales has left a legacy of soils contaminated by heavy metals, especially cadmium and lead. The worst affected areas are the valley soils of Ceredigion and the Halkyn Mountain area of Clwyd. A survey of surface soils has been made in Clywd and the extent of contamination assessed by computer-prepared contour maps and perspective blocks, examples of which will be shown. Radishes grown on the soil indicated a high uptake of the metals.

MAN-MADE SOILS IN WEST CORNWALL

S. J. Staines

Man-made or Plaggen soils are rare in England although more widespread in coastal districts of southern Ireland. The distribution of these soils in Cornwall, their mode of formation and agricultural properties will be discussed. Long term manuring with sea manures, beach sand, dune sand and town refuse has produced soils with thick, dark, coarse loamy or sandy topsoils. The improvements over the pre-existing brown earths and gley soils include ease of working and the ability to be trafficked during the winter to allow harvesting of broccoli and the planting of early potatoes with a minimum of structural damage. Some erosion has occurred on moderate slopes near Penzance.

SOIL PROFILE MODIFICATION UNDER THE INFLUENCE OF PEAT DEBRIS

E. Coyle and J. F. Collins

Studies are being carried out on soil profile modification underneath peat debris near a former peat storage area. The effects of different thicknesses of peat, ranging from 5cm to more than 25cm, on the properties of the original topsoil are under investigation. Physical and chemical data for a number of contrasting 'micro-profiles' show acidification of the original surface, soil structural alteration (from crumb to massive), iron reorganisation (mottles, concretions, 'placic horizon', complete removal) textural changes, etc., under different thicknesses of peat.

PROPERTIES AND SIGNIFICANCE OF A MAN-MADE IRONPAN PODZOL NEAR CASTLETOWNBERE, CO. CORK

M. J. Conry

The accumulation of an artificial layer of peat mould led to the development of an A2 horizon and a thin wavy ironpan in the Ap horizon of a brown-podzolic soil derived from fluvio-glacial gravels. X-ray diffraction shows pedogenetic evolutionary weathering. Micromorphological studies show that the plasmic fabric of the Ap is disintergrating in the A2 horizon.

THE DISTRIBUTION AND PASTORAL CAPABILITY OF MAJOR SOIL TYPES IN WEST SCOTLAND

J. S. Bibby, G. R. Bolton, M. J. S. Floate and G. Hudson

Soil surveys in various parts of Argyllshire have shown that the hill land is dominated by organic and peaty gley soils. Under rainfall ranging from 1250 to 3000 mm the distribution of soils is strongly dependent on slope, despite the presence of a wide variety of rock types ranging from gabbro to schist. As improvement practices need to be confined to areas of low or moderate slope (usually $< 15^o$) for technical and financial reasons the study of production from peats and peaty gleys is important.

Indigenous dry matter production on deep peat and peaty gley soils is about 1500 and 3000 kg/ha respectively but the nutritional quality for sheep is poor. Soil improvement and surface seeding results in improved quality herbage and significant yield increases to about 2000 and 5000 kg/ha respectively. Peaty podzols are of more limited occurrence, and are commonly associated with steeper slopes; important increments of improved herbage productions have been obtained on these soils.

AMORPHOUS CONSTITUENTS OF PODZOLIC B HORIZONS

P.J. Loveland

Fe, Al and in many cases Si, have been extracted from the <2 mm fraction of 37 podzolic B horizons, the B horizon of an Andosol and, for comparison, the B horizons of 3 brown earths, by: (i) 0.1 M K-pyrophosphate (ii) pH 3 oxalate and from the clay fractions of these horizons by (i) dithionite-citrate-bicarbonate (ii) boiling 0.5 M NaOH. The fluoride reactivity of the soils has also been measured.

The results are interpreted as showing that significant amounts of poorly-ordered almuino-silicates, analagous to the allophane - like material found in Andosols, can occur in podzolic B horizons. The amounts are related to the parent material of the soil.

The implications for soil classification are discussed.

SOME EFFECTS OF THE PLANTATION OF CONIFERS ON A FREELY DRAINED LOWLAND SOIL

I. C. Grieve

The paper examines the effects of the plantation of conifers on an acid brown soil in the Forest of Dean by comparing 3 soils under conifers for approximately 50 years with a control soil. Soil properties measured were profile morphology, iron movement, soil aggregation, porosity and infiltration capacity.

Soils under two conifers were found to be significantly podzolised after only 50 years, with an associated loss of aggregation and aggregate stability in the A horizon. There was decreased microporosity, but an increased volume of large ($>60\mu$) pores.

It was concluded that the conifer sites studied are showing a significant tendency towards podzolisation, but that the process is a very long-term one. The probable significance for forestry in economic terms is slight, but in terms of soil degradation the change is significant and disturbing. The plantation of conifers on this type of site must therefore be considered carefully in view of this.

SOIL-LAND USE RELATIONSHIPS IN TIGRAI: ETHIOPIA

K.J. Virgo and R.N. Munro

Reconnaisance soil surveys were carried out in Central Tigrai Province by Hunting Technical Services as part of a regional agricultural development study. The area comprises a series of rolling plateaux and steep-sided mountain ranges, lying at elevations of between 2000 and 4000 m. These high elevations result in a more temperate climate than normally associated with this geographical zone; the soils, vegetations and land-use are similar to those usually associated with higher latitudes.

The climate is semi-arid with a brief summer rainfall of very high erosivity. A wide range of geological formations has resulted in several distinct landforms, each characterised by a particular range of soils. Well drained Cambisols and Luvisols occur on the meta-sediments and sandstones, while Vertisols and Vertic Cambisols predominate on the basalts and calcareous sedimentaries.

Small-scale subsistence cereal farming has been practised for many centuries; all land that is physically capable of being cultivated is utilised. All remaining land is grazed. Distinct patterns of land-use are associated with individual landforms and the types of crop grown vary with elevation. Nucleated village patterns are typical of the Vertisol areas while dispersed settlement occurs in areas of well drained soils. A soil moisture deficit was found to occur throughout the year; excessive run-off reduced the amount of moisture available to crops, especially in the Vertisols. Soil and water conservation is the key to increased agricultural productivity.

APPLICATIONS OF SOIL SURVEY MAPS IN THE CONSTRUCTION AND MAINTENANCE OF PIPELINES

C. J. Argent

The soils in which both transmission and distribution pipes are laid can have an important effect on the subsequent performance of those pipes. Perhaps the single most important factor is the soil corrosivity which is usually assessed by measuring the soil resistivity. Other factors such as soil stoniness, clay content, soil water regime, etc., can be of value in selecting the most suitable pipe coating to apply in particular situations. Many of these properties can be read directly from soil maps. The remainder, including soil resistivity, have been successfully correlated with soil map units. These maps are therefore of particular value for rapid assessment of soil conditions along all types of pipelines in rural areas.

THE USEFULNESS OF THE PHYSIOGRAPHIC SURVEY IN A SOIL PRODUCTIVITY PROGRAMME

H. E. Cuanalo de la Cerda

Yield data from 93 maize experiments carried out over a period of five years were employed in an evaluation of the usefulness of the physiographic survey in locating experimental sites and in extending research findings to geographic areas.

Maize responses to several levels of nitrogen, phosphorus and population density were determined at each experimental site, and these data were related to the 17 facets using multiple linear regression. Two or more facets were grouped together when plant response at sites within the facets was similar.

The results indicate that facets behave like homogeneous units, and that optimum levels of fertilisation and population density are related to these units. By grouping facets in which plant response to treatments is similar, it is possible to define areas of a convenient size for making recommendations aimed at increasing agricultural productivity.

FACTORS OF SOIL FORMATION: THE COMPUTER LOOKS AT JENNY

R. Webster

It is 35 years since Jenny expressed the idea of soil as a function of its environmental and parent material in what seemed to be mathematical form. With the aid of computers, mathematical solutions can be found, and one technique, canonical correlation, is described briefly. Canonical correlation, an analytical technique whereby one set of multivariate data about a population can be related to another in terms of linear functions of the two sets, can be used to express quantitatively the relation between the soil and its environment, and to attempt prediction of the one from a knowledge of the other. The method will be illustrated by an example of its application in Australia where unexpected relations were revealed between the soil and its altitude and the area to which water can disperse from it. The canonical correlations were sufficiently strong to allow modest predictions of a few soil variates from knowledge of the environment or physiography, but most soil variates were poorly predicted.

THE COORDINATION CHEMISTRY OF HUMIC SUBSTANCES - THE NEED FOR A CRITICAL APPROACH

P. MacCarthy

The coordination reactions of humic substances are of importance from an agricultural, environmental and fundamental point of view. Humic substances are a complicated mixture of organic components which are extracted from soils and similar environments, and which have so far defied fractionation into discrete species. This greatly complicates the chemistry of these substances and in particular their complexation reactions. At present, these complexation reactions cannot be interpreted on a detailed micro scopic basis in a manner analogous to that of complexes formed with discrete ligands or even with well-defined polyelectrolytes. The purpose of this paper is to examine some of the limitations imposed on the microscopic interpretation of complexation data as a result of the indeterminate nature of the humic "ligands". The analysis is illustrated by various examples taken from the recent literature.

THE FERTILITY OF TERMITE MOUNDS (*MACROTERMES FALCIGER*) AND ADJACENT A1 AND Ap HORIZONS NEAR SALISBURY, RHODESIA

J. P. Watson

Twelve termite mounds (about 2 m high and 10 m basal diameter) and adjacent A1 (under savanna-woodland) and Ap (under annual crops) horizons were sampled in Tribal Trust Land where Africans practise subsistence agriculture on soils derived from granite. Termite mounds were higher than A1 and Ap horizons in extractable cations, C.E.C., total and mineral N, available P, pH values, silt and clay. The A1 horizons are higher in organic matter than the Ap horizons and termite mounds. The Ap horizons are lower in plant nutrients than the A1 horizon and termite mounds. A pot test using perennial ryegrass gave mean yields of 0·61, 1·02 and 6.76 g/pot for Ap horizons, A1 horizons and termite mounds respectively. An attempt was made to answer the question whether, in order to increase crop production, fertile termite mounds should be mixed with less fertile Ap horizons, or whether crops should be grown on termite mounds *in situ* and Ap horizons as is sometimes done today.

INCUBATION STUDIES ON TRANSFORMATIONS OF NITROGEN FERTILISERS IN SOME IRISH SOILS

M. G. Connolly, P. O'Toole and M. A. Morgan

Laboratory and glasshouse incubation studies were carried out to compare biological transformations of urea and ammonium nitrate in some Irish soils.

Hydrolysis of urea was influenced by rate of application, soil type and temperature. Rates of urea hydrolysis varied among soils over 24-hour incubation periods. With one exception, urea added to soil samples at 100 or 200 ppm nitrogen was completely hydrolyzed within 16-24 hours; at 1000 ppm nitrogen, however, the soils had decomposed only 45-75% of the added urea after 24 hours. Urea hydrolysis, generally, was accompanied by decreases in soil acidity of one pH unit.

Subsequent patterns of nitrification over a 54-day incubation period varied with soil type. In one soil (pH 6.8, 16% clay), nitrification of ammonium-nitrogen derived from urea (100 and 200 ppm nitrogen) or ammonium nitrate (100 ppm nitrogen) was completed by 18 days. In contrast, an acid soil (pH 5.6, 24% clay) nitrified only 30% (approx.) of added urea-nitrogen and apparently little of the added ammonium-nitrogen in ammonium nitrate. Soil pH values generally decreased during nitrification of the accumulated ammonium-nitrogen.

UPTAKE AND ASSIMILATION OF NITROGEN BY WHEAT SEEDLINGS EXPOSED TO AMMONIUM NITRATE AND UREA

D. P. Bradley and M. A. Morgan

Nutrient culture techniques were used to compare the absorption and assimilation of urea-nitrogen and ammonium nitrate-nitrogen by 22-day old intact wheat seedlings.

Cumulative nitrogen uptake from ammonium nitrate increased three-fold (approx.) when the ambient nitrogen concentration applied to either nitrogen-pretreated or nitrogen-starved seedlings was increased from 0.3-3.0 meq. nitrogen/litre. Under similar circumstances, total nitrogen uptake from urea was increased twofold in plants previously exposed to nitrogen and six-fold in plants previously deprived of nitrogen.

At 0.3 and 3.0 meq. nitrogen/litre, urea-nitrogen absorption was considerably less than total nitrogen uptake regardless of whether the seedlings had been pre-exposed to nitrogen or not. At the higher concentration of ambient urea, nitrogen uptake by nitrogen-starved plants was more than twice that of seedlings previously treated with nitrogen; there was no difference in uptake by each group of seedlings at the lower concentration of urea.

The above results will be discussed in relation to (a) the relative distribution of absorbed nitrogen in roots and shoots (b) the relative distribution of this nitrogen into ethanol-soluble and insoluble fractions and (c) the amino acid composition of the soluble and insoluble nitrogen pools.

A SOIL WITH HIGH POTASSIUM FIXING PROPERTIES IN CO. KILDARE

J. C. Brogan, P. V. Kiely, M. J. Conry

A small area of alluvial soil overlying calcareous marl in Co. Kildare showed extremely high potassium fixation. Although the area had been treated with high rates of potassium for 10 years and 100 kg K/ha had been added in February 1975, the exchangeable potassium values were very low - 0.3 me/100 g (Morgan's 8 ppm). When barley was sown in April 1975, without further potassium, the yield was 0.45 tonnes/ha (3.6 cwt/ac) but when 100 kg K/ha was drilled with the seed the yield was 4.5 tonnes/ha (36 cwt/ac). This is the highest response to potassium in cereals ever recorded in Ireland. Top dressing the control plots with potassium at the grass corn stage increased yields slightly to 0.625 tonnes/ha (5 cwt/ac). The vermiculite content of the soil was exceptionally high and the Q/I relationship also showed the strong adsorptive characteristics of the soil.

In an adjacent plot, grass showed a relatively small response but the potassium content of the herbage was very low - down to 1.0% K in the third cut.

SOME OBSERVATIONS ON THE TREATMENT OF RESTORED GRAVEL WORKINGS FOR TREE PLANTING

D. F. Fourt and I. G. Carolan

The plateau and valley gravel deposits of North East Hampshire have been worked for building and road materials for centuries. The older hand workings, and the "hill and dale" from dragline extraction were never a problem for tree growth, although topographically inconvenient. These sites soon revegetated to pine and birch, or were planted.

Modern methods of extraction utilise giant rubber-tyred scrapers, which remove topsoil to dumps nearby. Tracked or wheeled front-end loaders then work the economic part of the deposit.

Restoration consists of the burial of organic debris and stumps under a cover of subsoil and waste laid by multiple passes of the scrapers.

Those processes are carried out with moist or wet material and there is intense repacking of each successive layer. Before planting it is necessary to loosen and drain this metre-thick layer using more heavy machines and some of the methods employed are described and discussed.

NUTRITIONAL PROPERTIES OF A PEAT SUB-STRATUM IN GLASS-HOUSE PRODUCTION

P. A. Gallagher

Work on tomato growing at Kinsealy has shown that excellent yields can be obtained by using peat as a medium; two methods of production have been evaluated. Firstly, a permanent trough-type system is used in which 42 l of peat is allowed for each plant, and the peat, sterilised after each crop, is used for a number of years. In the second method only a small quantity of peat is used (14 l/plant) and for one year only. In this latter "throw away peat" method, various systems involving troughs, pots (one plant per pot) and modules (3 plants per module) have been tested and high yields obtained with each system.

Studies on volume of peat used have shown that 14 l peat per plant is the minimum amount to use. Although excellent yields have been obtained with only 6 l of peat per plant the use of such small quantities of peat presents problems in nutrition and watering. Studies have shown that potassium levels in small quantities of peat (14 l/plant) can be quickly depleted and that potassium levels in the irrigation water will have been increased to 350 or 450 ppm K. Phosphorus levels can also be quickly depleted though basic slag can be used as a base dressing to supplement super-phosphate as a soluble phosphorus source. Studies on nitrogen nutrition have shown that approximately 100 ppm nitrate-nitrogen is the optimum level, though good growth can be obtained over a wide range of nitrogen levels. These studies also showed the value of a slow-release nitrogen source in the base fertiliser formulation.

Watering is a major problem in crop production systems using small quantities of peat; overwatering reduces growth, causes root damage and induces iron deficiency; underwatering reduces growth, increases soil salinity problems and induces calcium deficiency. To overcome this a capillary watering system based on capillary matting has been tried. In this way, moisture tension in the peat is maintained at a constant level and uniform rate of growth is obtained.

MEASUREMENT OF DRY BULK DENSITY WITH A NEUTRON PROBE

C. F. Mullins

There are a number of situations in which dry bulk density figures are desirable for neutron probe sites. These can be obtained from the volumetric water content of the soil when saturated if the particle density of soil solids is known. Conversely, in field calibration of the neutron probe, an independent check on the measured value of dry bulk density can be made if neutron probe readings are available for a time in which the soil was saturated.

THE EFFECTS OF ROTARY CULTIVATION OF COMPACT SUB-SOIL ON SOIL PHYSICAL CONDITIONS AND YIELD OF SUGAR BEET

P. T. Gooderham and S. M. Wilkins

A new approach to sub-soil loosening is being developed involving the rotary cultivation of sub-soil. The design of the machine will be described and the new concept compared to conventional sub-soiling. Data collected in 1974 and 1975 will be presented to compare the effects of rotary cultivation of sub-soil, of fixed tine sub-soiling and of vibrating tine sub-soiling on soil physical conditions and the yield of sugar beet.

ASSESSMENT OF SEEDBED TILTHS AND THEIR EFFECTS ON THE GROWTH OF TAP-ROOTED CROPS

M. F. Harrod

Methods of assessing seedbed tilths are discussed in relation to cultivation experiments on the sugar beet and carrot crops in eastern England.

Physical methods to judge seedbed packing status have included visual structure scoring, bulk density, penetrometer resistence and the unconfined shear vane. Only the visual structure score and the unconfined shear vane have given consistently useful results.

Aggregate-size distribution as a result of seedbed cultivation is determined by sieving air-dried samples taken at crop drilling. Results indicate a useful separation of seedbed preparation techniques as well as a good relationship to sugar beet seedbed emergence.

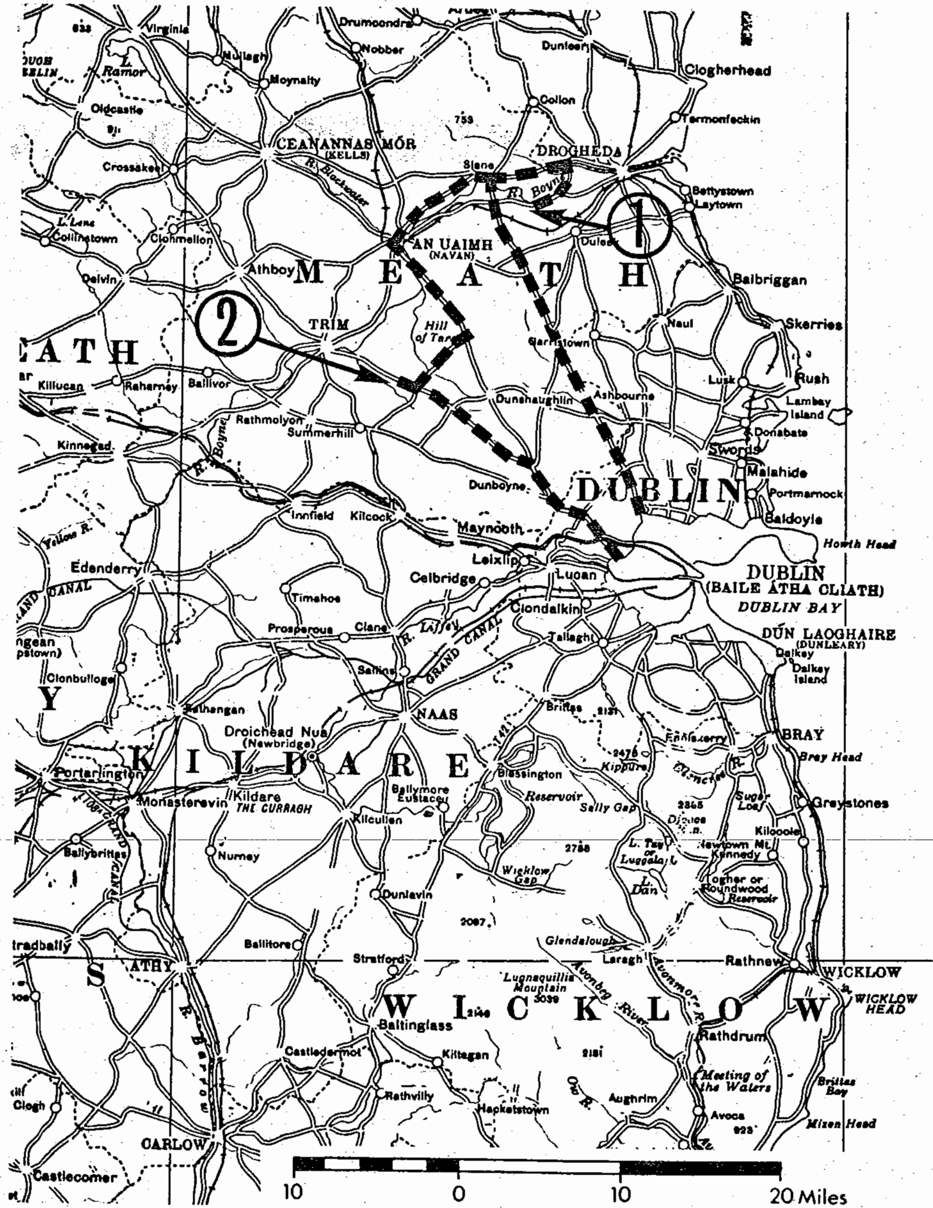
Biological methods of assessment are considered of equal value to the physical methods, especially as the aim of any seedbed preparation technique is to allow "drilling to stand" and to obtain high yield. Plant emergence, storage root length and crop yield are discussed in relation to physical methods of assessment and seasonal interactions.

SIMULTANEOUS INFILTRATION, REDISTRIBUTION AND EVAPORATION OF WATER FROM SOIL

D. A. Rose

The above process was studied when water was applied to soils dried to pF 6 and pF 4.2 as a single irrigation of 1.25, 2.5 or 5.0 cm. The process is described in detail, and the implications for seed germination in arid areas is discussed.

EXCURSION A



<u>ROUTE OF EXCURSION A</u>

EXCURSION A

Leader: T. F. Finch

Other participants: G. F. Mitchell (TCD), J. Harte, D. Collins, V. Flynn (Agric. Inst.)

Hrs	*Stop*	
13.30		Depart St. Patricks College
14.30	A1	Newgrange Neolithic passage grave
15.45	A2	Grange Animal Production Station
16.45		Depart for St. Patricks College

STOP A1 *NEWGRANGE*

This is one of the great series of Neolithic passage graves found in the Boyne valley. The monument consists of a mound about 90 m in diameter and 15 m high with a retaining wall of large decorated kerbstones. A ring of enormous pillarstones surrounds the mound. The 20 m-long passage leads into a high-roofed chamber containing large stone basins.

A roof-box above the entrance enables the sun to enter this chamber on Mid-Winter Day (Dec. 21). This was possibly a ritual method of marking the shortest day of the year. "The careful orientation of the tomb and passage presupposes that their builders must have had some knowledge of astronomy and the movements of the sun, and possibly of the moon" (Harbison, 1976). The construction indicates a high level of building expertise and probably of farming activity during the period around 4,500 B.P.

STOP A2 ANIMAL PRODUCTION RESEARCH STATION, GRANGE, CO. MEATH

The main emphasis in the research work is on cattle and beef production aimed at reducing animal production costs and increasing efficiency at farm level.

Calf production: An intensive continuing programme of calf rearing is in progress with particular emphasis on the factors which improve survival during the first 12 weeks of life - colostrum feeding, level of milk feeding and housing. Work is also in progress on multiple suckling and the importance of grass quality for young calves.

Grassland production and utilisation: Studies are in progress on fertiliser use for grass production, on stocking rates of different types of cattle at pasture and on silage conservation. Other work in progress includes studies on storage; fertiliser value, times and rates of application of cattle slurry, and on the suitability of different grass species for winter feed and yield.

Winter feeding and housing: Liveweight gain responses to silages with varying amount of supplements (e.g. barley, roots or protein meal), are being investigated as well as different housing systems - roofed and unroofed cubicles - with straw or soil-bedding, concrete floor and slats.

Cattle production systems: Systems of cattle production being studied and developed include, single suckling, mixed grazing (cattle and sheep), bull beef, two-year old beef, winter finishing and summer grazing.

Reproduction in cows: A number of experiments relating to heat synchronisation in cattle are in progress. Various hormone treatments are being studied aimed at obtaining a suitable procedure which will give a good heat response together with high fertility to A.I.

Sheep research: The sheep research programme is based on increasing reproductive efficiency and devising production systems to make the most of these advances. These include early fat lamb production, three lamb crops in two years and twice yearly lambing.

The soils: The soil parent materials on the Station are of very mixed composition as the drift from which they are derived was laid down in an area of junction between the Irish Sea ice and the Midland ice (Fig. 2). The soils to be examined originated on till of Irish Sea origin but contain a high proportion of shale. The predominant soil is moderately well drained and often shows grey brown podzolic characteristics. An imperfectly to poorly drained version of this soil will also be seen.

Moderately well drained soil
(Gardiner, 1962)

Horizon	*Depth (cm)*	*Description*
A11	0-20	Dark greyish-brown (10YR 4/2); clay loam; moderate, medium crumb structure; friable; very few, small, faint reddish-brown mottles; abundant, diffuse roots; boundary gradual to:
A12	20-40	Dark greyish-brown (10YR 4/2); loam to clay loam; moderate medium crumb structure; friable; abundant diffuse roots; boundary gradual to:
(B)	40-60	Dark greyish-brown (10YR 4/2); clay loam; weak, fine to medium sub-angular blocky structure; friable; plentiful diffuse roots; boundary gradual to:
(C)	60-80	Dark greyish-brown 10YR 4/2); clay loam; weak, fine to medium sub-angular blocky structure; friable; some roots

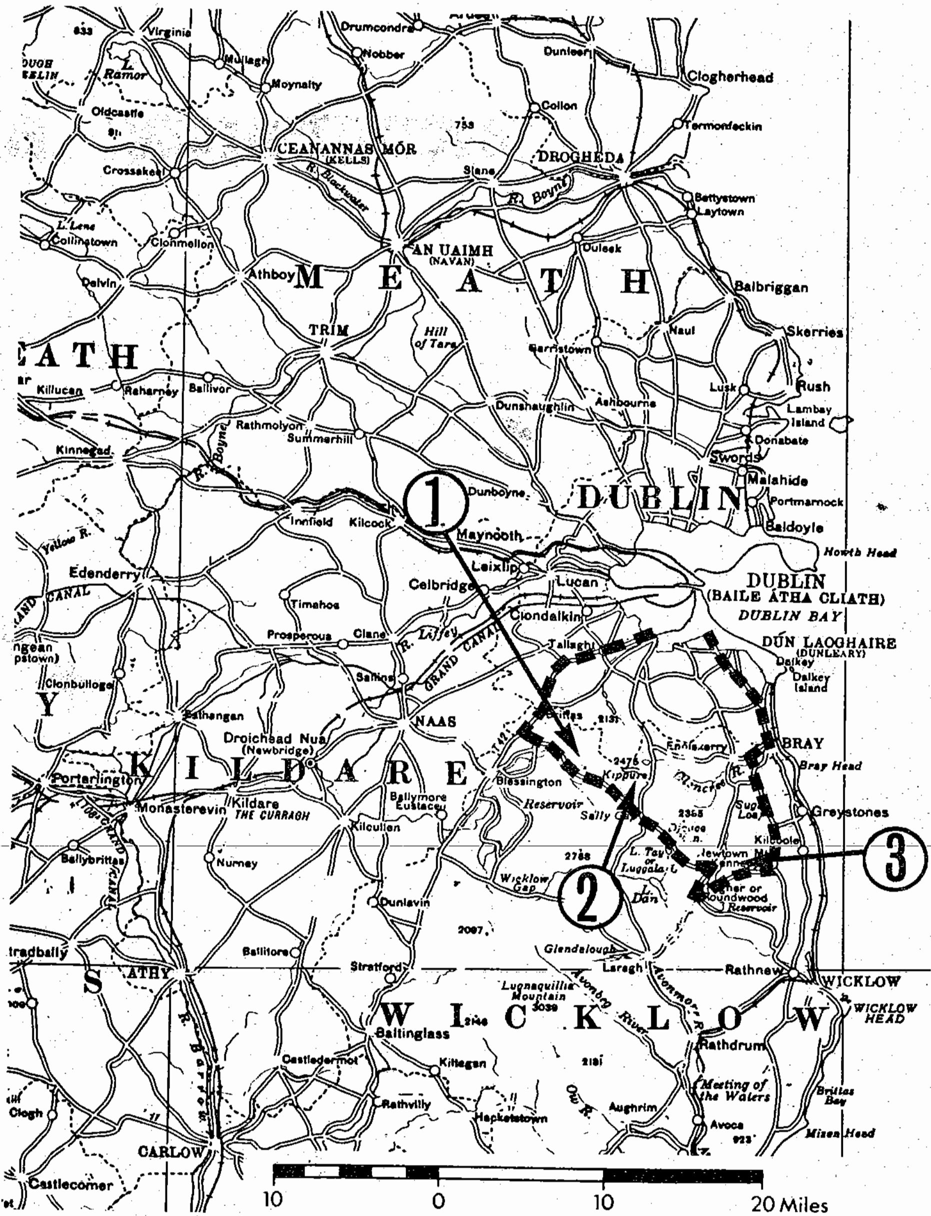
Horizon Particle-size analysis - (mineral fraction) %	A11	A12	(B)	(C)
Coarse sand (2-0.2 mm)	12	13	12	13
Fine sand (0.2-0.05 mm)	16	18	13	15
Silt (0.05-0.002 mm)	41	46	43	41
Clay (< 0.002 mm)	31	23	32	31
pH	6.4	6.5	6.6	6.8
C.E.C. m.e./100 g (NH_4OAC)	14.9	14.3	13.8	15.1
T.E.B. m.e./100 g	14.4	11.4	12.6	13.8
Base sat. %	96.7	70.0	91.0	91.0
C %	3.1	1.3	1.0	1.0
N %	0.32	0.13	0.12	0.05
C/N ratio	9.7	10.0	8.3	20
Free iron % (Dithion ext.)	1.9	2.1	2.7	2.4

Imperfectly to poorly drained soil
(Gardiner, 1962)

Horizon	*Depth (cm)*	*Description*
A11	0-20	Dark greyish-brown (2.5Y 4/2); clay loam; weak, medium crumb structure; friable; few medium, distinct reddish-brown (5YR 4/4) mottles; abundant diffuse roots; clear, smooth boundary to:
A12	20-35	Olive brown (2.5Y 4/4); clay loam; very weak, medium crumb structure; friable; many medium faint, light olive brown (2.5Y 5/4) mottles; plentiful diffuse roots; boundary gradual to:
A13G	35-50	Olive (5Y 5/3) clay loam to silty clay loam; massive structure; somewhat firm; many, medium distinct, light olive-brown (2.5Y 5/6) mottles; few roots; abrupt, smooth boundary to:
C11G	50-65	Grey (5Y 5/1); loam to clay loam; massive structure; many, medium prominent, olive-brown (2.5Y 4/4) mottles; no roots
C12G	65-80	Similar to above horizon; mottles more plentiful and coarser

Horizon	A11	A12	A13G	C11G	C12G
Particle-size analysis-(mineral fraction) %					
Coarse sand (2-0.2 mm)	10	9	7	7	7
Fine sand (0.2-0.05 mm)	14	17	13	19	21
Silt (0.05-0.002 mm)	42	41	47	46	45
Clay (<0.002 mm)	34	33	33	28	27
pH	6.2	7.0	8.1	8.3	8.3
C.E.C. m.e./100g(NH_4OAC)	23.9	14.9	10.2	7.4	7.9
T.E.B. m.e./100g	20.8	14.6	30.8	28.9	30.3
Base sat. %	87	97	sat.	sat.	sat.
C %	4.7	1.3	0.7	0.7	0.3
N%	0.47	0.13	0.08	0.05	0.00
C/N ratio	10.0	10.0	8.7	7.2	-
$CaCO_3$ %	0.0	0.0	nd	18.3	22.2

EXCURSION B



ROUTE OF EXCURSION B

TITHEWER - intensive ewes, overwintered on slats, silage + meal
300 ac.
Cu + Co deficiency
Cockfoot
High N
No fluke - Wicklow too acid.

EXCURSION B

CO. WICKLOW

Granite soil, hill-land reclamation, scenic route

Leader: M. Bulfin (Agric. Inst.)

Hrs	*Stop*	
13.30		Depart St. Patricks College
15.00	B1	Granite profile, Ballysmultan
16.00	B2	Reclamation plots
16.20		Scenic route via Sally Gap and Lough Tay
16.50	B3	Mr. Hamilton's farm, Tithewer
17.20		Depart for St. Patricks Collete

Peat erosion starting ± 50 yrs BP, at altitudes of 1800 ft +

Reclamat^n liming + reseeding
no cultivat^ns ("drops" + tumblers)
no drainage.
Slag gov. estate + money available.

CO. WICKLOW

Co. Wicklow lies to the south of Dublin city. It is dominated by a range of mountains which runs down the centre of the county, following the axis of the Caledonian folding. Most of the higher mountains were formed from a granite batholith which was injected into the already much-folded shales during Devonian times. Shales and schists surround the granite (Fig. 4). During the Pleistocene, large quantities of limestone drift were deposited over the shales both in the east and west of the county.

As the road comes over the gap at Saggart (see Route Map) it enters the end of a long, wide, flat valley bounded on the west by a low range of shale hills and on the east by the foothills of the granite mountains. This valley was the site of Glacial Lake Blessington, a very large lake which developed when ice moving eastwards impounded melt waters against the mountains. The valley is full of glacial lake deposits of mixed origin and the surrounding rim is gapped in many places by the meltwater channels. The current level of the lake is some 190 mO.D. but during glacial maxima in this area the level ranged up to 290 m.

On both sides of the road near Blessington huge deltaic deposits of limestone sands and gravels are seen. These were deposited from the stationery front of the glacier which towered over the low ridge to the right. The present gravel pits provide much of the building material for Dublin city.

At Blessington the route crosses the lake, which is, in fact, a man-made reservoir supplying Dublin. On the east shores the soils are derived from a variable mixture of limestone, schist/shale and granite materials. The first granite cutcrop can be seen on the right on the boulder-strewn Woodend Hill. Moving eastward from the junction at Oldcourt the proportion of limestone and shale decreases rapidly until almost pure granite soils are encountered on Ballynatona Hill. Coming downhill approaching Ballysmultan Bridge, the site of the first profile can be seen situated at about 275 m on the opposite hill-side (Stop B1)

The route then continues along the upper course of the Liffey to Sally Gap. The road is now bounded on both sides by the smooth convex slopes and rounded domes of the granite massiff typified by Kippure, 750 m, (with TV mast), on the left. The soils change from mineral brown podzolics and podzols to peaty gleys, peaty podzols and peats. A brief look at the effect of fertilisation and reseeding on blanket peat will be taken. (Stop B2)

The route continues over the Sally Gap, the highest road pass in the country; seen to the east is Djouce (725 m) a schist mountain with a ragged irregular shoulder stretching to the south; on the right is Lough Tay nestling in a glacially deepened valley. The overdeepening occurs where the ice crossed the geological boundary from the granite to the schist. Much of the most interesting scenery in Wicklow occurs at this granite/schist interface which is frequently accompanied by glacial deepening and spectacular waterfalls. Moving further eastwards the granite influence can be seen in the boulder strewn fields. While the rounded granite boulders are a major impediment to reclamation, the granite influence on the soils in the eastern area falls off quite rapidly once the shale boundary is crossed. The soils in the Roundwood area are mainly

STOP B1 *GRANITE SOIL PROFILE*

Location:	Ballysmultan, Co. Wicklow
Topography:	Strongly sloping to hilly
Slope:	7°
Altitude:	280 m O.D.
Drainage:	Well drained
Parent material:	Granite glacial till
Great soil group:	Brown podzolic

Horizon	*Depth (cm)*	*Description*
A11	0-15	Sandy loam to loam; very dark greyish-brown (10YR 3/2); weak, fine to medium granular structure; friable; abundant fine roots; arbitrary boundary to:
A12	15 - (30-35)	Sandy loam to loam; very dark greyish-brown (10YR 3/2); weak, fine to medium granular; friable; plentiful fine roots; faunal activity causing slight mixing of A and B material across boundary; clear wavy boundary to:
B2(ir)	(30-35)-50	Coarse sandy loam; yellowish-brown (10YR 5/8); very weak, fine to medium granular; very friable; few fine roots; clear wavy boundary to:
B3	50-60	Loamy sand; yellowish-brown (10YR 5/6); structureless; single grain, very friable; very few roots; clear wavy boundary to:
C	60+	Coarse sand; yellowish-brown (10YR 5/4) nearest

brown earths, brown podzolics and some weak podzols.

The route continues eastward from Roundwood to the farm of Mr. Hamilton at Tithewer, Newtownmountkennedy. This farm is situated on the Vartry Plateau, at altitudes from 275 to 335 m - approximately half the farm is over 275 m. It is underlain by Cambrian shales but glacial drift from the local mountain glaciation covers the solid rock so that there is an admixture of Ordovician shale to the Cambrian material. The soils are predominantly shallow brown podzolics with some brown earths, podzols, lithosols and gleys.

The farm was reclaimed from a heavy infestation of furze, bracken and poor agrostis-dominated pasture. Stone clearing, drainage, ploughing, fertilising and reseeding were carried out from 1972 onwards. Details of the reclamation work will be given at the farm. (Stop B3).

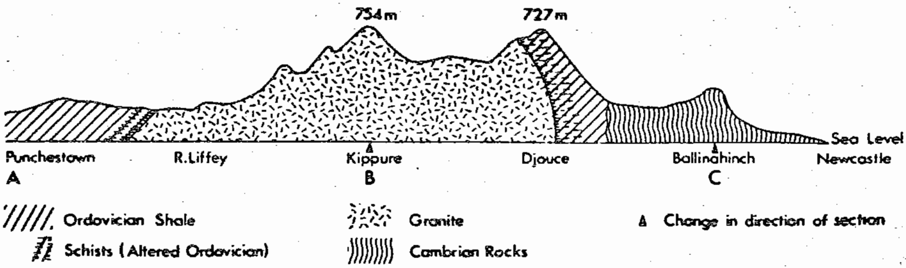
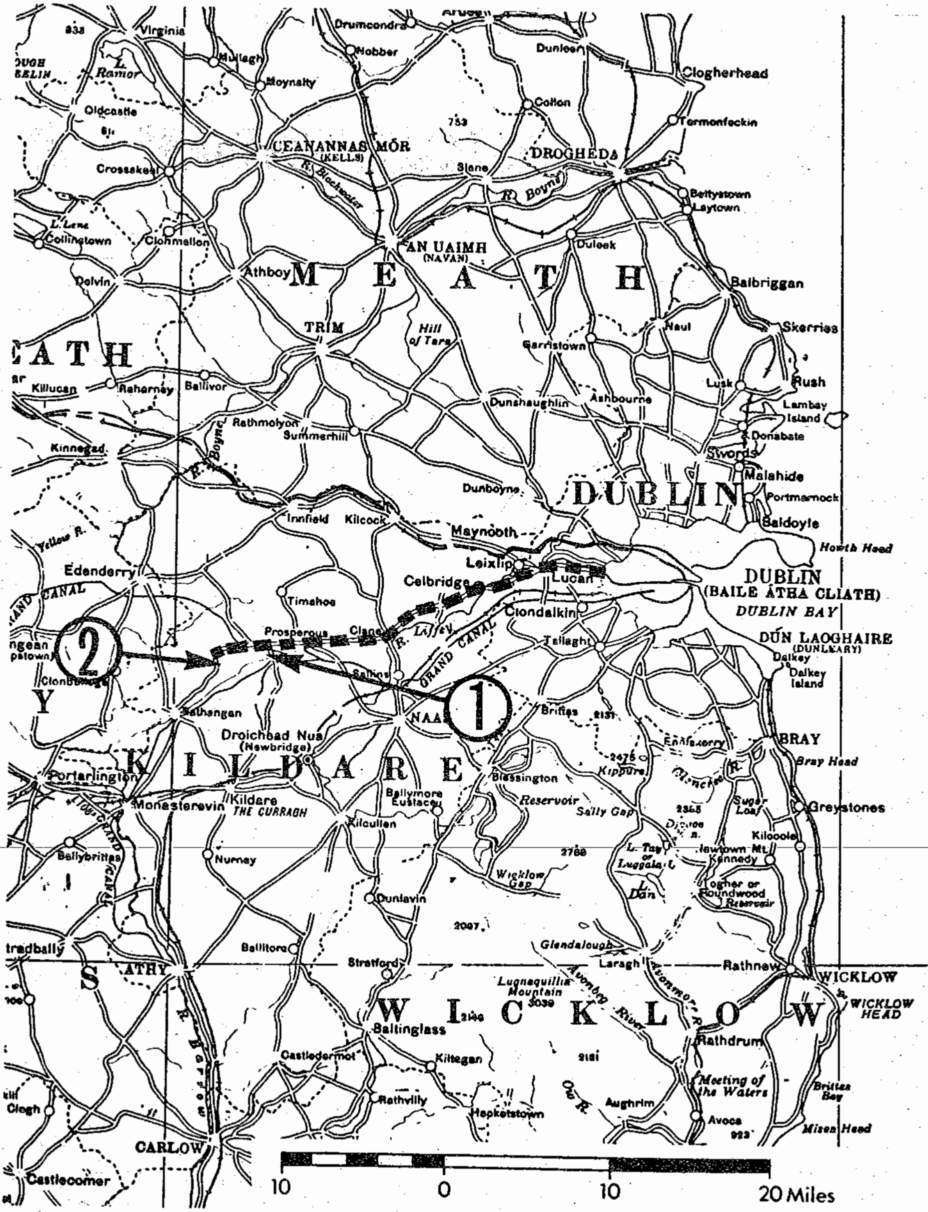


Fig. 4: Cross-section through County Wicklow in region of Sally Gap

EXCURSION C



ROUTE OF EXCURSION C

EXCURSION C

Raised bog stratigraphy and Lullymore Peatland Experimental Station

Leader: R. F. Hammond (Agric. Inst.)

Other participants: A. J. Cole, F. S. McNaeidhe (Agric. Inst.),
C. McCoy (B. na M.)

Hrs.	*Stop*	
13.30		Depart St. Patricks College
14.15	C1	Peat profile
14.45	C2	Lullymore Experimental Station
		Grassland
		Nursery stock development
		Arable crops on milled-over peatland
16.45		Depart for St. Patricks College

RAISED BOG STRATIGRAPHY AND LULLYMORE PEATLAND EXPERIMENTAL STATION, CO. KILDARE

The bedrock in the Lullymore-Clonsast area consists solely of Lower Carboniferous limestone. The composition of the glacial drift reflects the underlying rock strata with stone counts showing 50 to 80% Carboniferous limestone.

The disruption of drainage systems by deposition of glacial drift materials during the last glaciation, and periods of climatic deterioration in the post-glacial period, resulted in the accumulation of large peat deposits in the Central Plain of Ireland. These deposits, characteristically convex in shape, are called raised bogs.

Stop C1
Before utilisation for peat fuel, the original peat depth was 4 to 5 metres. Within this depth a profile sequence of different peat types was present. The basal tier (of variable thickness depending on topography of the bog floor) was comprised of the remains of herbaceous and woody plants which grew in eutrophic to mesotrophic environments. The peat at these levels was generally well humified (Profile 1, next page)

When the bottom tier had accumulated to a thickness which diluted the ground-water effect, acid-tolerant plants (*Calluna, Erica* sp.) and oxyphilous plants (*Sphagnum* sp., *Eriophorum* sp.) became the dominant peat formers. This acid tier may be sub-divided into two layers. The lower one is a humified peat with *Eriophorum, Calluna, Sphagnum* and some pine remains whilst the upper layer is comprised dominantly of unhumified *Sphagnum* mosses and gives the peat formation its characteristic raised appearance in the landscape.

These raised bogs have, for centuries past, provided a ready source of fuel. In the three decades since 1946 the larger raised bog complexes in the Midland plain have been exploited by Bord na Mona (Irish Peat Development Authority) for the industrial production of peat fuels.

It is estimated that ½ million acres of cutover raised bog are left as a result of hand harvesting of peat for fuel over the centuries. Over the next 25 years a further ⅓ million acres of peatland will become available when peat harvesting is completed. A comprehensive body of scientific information which is essential for the future productive use of this land, whether for arable crops, fruit, nursery stocks or animal production, is being gradually built-up from research work in each of these areas.

STOP C2 *Peatland Experimental Station*

The station at Lullymore, established in 1960 by An Foras Taluntais has concentrated on grassland, and horticultural and arable crop production.

Cattle production
Grazing trials on shallow cutover raised bog at Lullymore have shown that the optimum stocking rate is 4.3 store cattle per hectare where clover supplies most of the nitrogen requirements to the sward. At this stocking rate an overall seasonal liveweight gain of 0.8 kg/day was recorded over a 184-day grazing period. A lower stocking rate did not increase liveweight

RAISED BOG PROFILE

Depth (cm)	Description
0-160	Peat; dominantly *Sphagnum* with some *Calluna* and *Eriophorum* remains; dark reddish-brown (2.5YR 2/4); poorly humified; wet, non-greasy; clear, smooth boundary to:
160-260	Peat; humified matrix with *Calluna* and *Eriophorum* remains locally abundant; very dusky red (2.5YR 2/2); moderately well humified; non-greasy; clear, smooth boundary to:
260-330	Peat; heterogenous matrix comprising herbaceous plant remains with wood remains embedded, these can be locally abundant; colour darkens rapidly on exposure to air; (5YR 3/2 - 5YR 2/2); well humified; slightly greasy; strong smell of sulphides; abrupt, wavy boundary to:

Depth (cm)	0-160	160-260	260-330
Fibre %	85.3	80.8	78.0
Bulk density g/cc	0.07	0.12	0.11
Loss on ignition %	98.0	97.0	94.3
Moisture %	88.9	84.9	88.4
pH	4.7	4.6	5.0
C.E.C. me/100g (NH_4OAC)	96	96	94
T.E.B. me/100g	15	22	72
Base sat. %	15	23	77
Nitrogen %	0.7	1.0	1.7

gain per bullock or per hectare. Liveweight gain per bullock was significantly reduced at a higher stocking rate (5.6 store cattle per hectare) over the August/October period. In these trials supplementary copper slightly increased liveweight gain.

The tendency for better response to copper therapy at high stocking rate, especially in 1968, may be associated with higher levels of pasture nitrogen and molybdenum. Herbage molybdenum levels were far above desirable levels and in some samples values of over 40 ppm were recorded. Some of the herbage molybdenum probably came from the poorly drained calcareous sub-soils. Herbage molybdenum was more than double the level previously recorded on grass-only swards on shallow peats. These trials also showed that nitrogen increased the copper content of grass and lowered the molybdenum content.

Nursery stock on peatland
Species of *Juglans, Acer, Tilia, Liquidamber* and *Betula* grown at Lullymore were from 20 to 60% taller after one growing season than those grown on mineral soil; a range of *Thuja* and *Chamaecyparis* cultivars had a 10 to 20% differential in growth rate.

In the past two seasons emphasis has been laid on testing different genera for hardiness on open peatland. Of an extensive range of plants, only *Griselinia, Ilex* and *Magnolia* suffered any frost damage due to September frosts.

Arable cropping on milled-over peatland
The vegetable crops under experimentation are onions, early and late carrots, cabbage, cauliflower, lettuce and redbeet. The field crops grown are barley, potatoes and sugarbeet. Swedes are grown both as vegetables and as fodder for sheep.

Trials have shown that peatland is highly suitable for the production of vegetable crops. Good drainage and adequate shelter are essential to obtain good quality and yield. In the trials being conducted in arable crops the main emphasis is on the investigation of deep and thorough incorporation of lime and fertiliser and the effect of regular application of trace elements to crops. Weed control trials are also being carried out.

Soft fruits
The performance of strawberries, raspberries, blueberries and cranberries on peat soil is under investigation. Excellent results have been obtained with blueberries. Promising results have also been obtained with strawberries and raspberries but trials are being continued with a view to improving the quality of these crops on peatland.

Bulb crops
The trials which have been carried out over the past two seasons indicate that good quality tulip and narcissus bulbs can be produced on peat soil. The skin quality and colour, particularly of tulip bulbs, has been excellent.

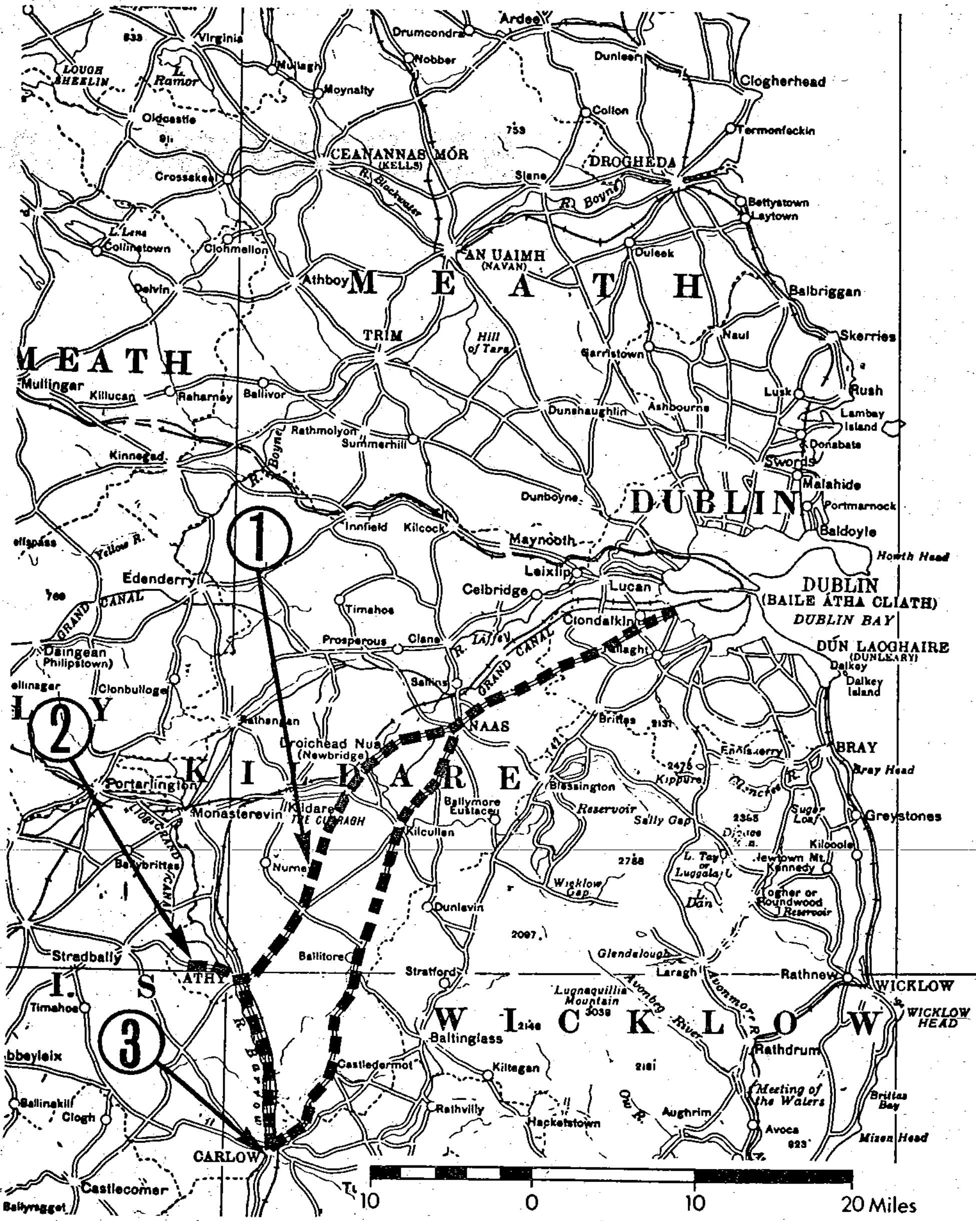
Peat profile 2 will be examined here.

PROFILE 2 *RAISED BOG PROFILE*

Horizon	Depth (cm)	Description
Ap	0-20	Peat; comminuted peat with abundant wood fragments and some recognisable herbaceous plant remains; black (5YR 2/1); moist friable; non-greasy; abrupt, smooth boundary to:
C	20-85	Peat; abundant wood remains, 20-40 cm level decreasing with depth; local concentration of *Phragmites communis* leaves and rhizomes at 70 cm; dark reddish-brown (5YR 2/2); moderately to well humified; slightly greasy; aeration mottles; abrupt irregular boundary to:
CG	85-100	As above with dark reddish-brown (5YR 3/4) rapidly changing on exposure to dark reddish-brown (5YR 2/2); sulphides present; abrupt, wavy boundary to:
	100+	Mineral substratum

Horizon	Ap	C	CG
Fibre %	69.4	76.7	78.1
Bulk density g/cc	-	0.11	0.11
Loss on ignition %	86.0	93.0	89.1
Moisture %	69.9	85.9	85.5
pH	5.4	4.7	4.7
C.E.C. me/100g (NH_4OAC)	218	233	192
T.E.B. me/100g	175	151	143
Base sat. %	80	65	74
Nitrogen %	1.9	2.1	2.3

EXCURSION D



ROUTE OF EXCURSION D

EXCURSION D

Soils on limestone drift, Co. Kildare, Oakpark Crop Research Centre

Leaders: J. F. Collins (UCD), M. J. Conry (Agric. Inst.)

Other participants: J. Fox (Farmer), T. M. Thomas, J. J. Diamond, V. Connolly, L. Dowley, M. Neenan, C. Cunningham and T. F. Leonard (Agric. Inst.)

Hrs.	*Stop*	
09.00		Depart St. Patricks College
10.15	D1	Fontstown Series - soil profile
11.30	D2	Mortarstown Series - soil profile and farm of Mr. Jim Fox
14.00	D3	Oakpark
16.00		Depart for St. Patricks College

The broad plains of Co. Kildare have been slowly evolved by atmospheric solution of the Carboniferous limestone. The few conspicuous hills are mostly of other resistant rock types. The Chair Hills are all of older rocks; Ordovician slates, with an andesite lava flow, make up Allen and Grange hills with "reef" limestone forming the Chair proper; Ordovician red shales occur in Dunmurray and Red Hills and also some green grits that may be Silurian. The ridges along the south-eastern margin of the county consist of tightly folded Silurian grits and slates. These are highly baked to the south where the main intrusion of the Leinster granite emerges.

A thick mantle of glacial tills and gravels covers the rock almost everywhere, thinning only as the rock emerges to form hills or where rivers have recently cut down.

The last great Irish ice-sheet built up in the west-central midlands, whence it flowed outwards (Fig. 2). North of the Slieve Bloom Mountains it rasped off great quantities of the Carboniferous limestone bedrock in its path. In north Kildare it coalesced with ice pushing south from the northern part of the country and the combined flow then pushed south-eastward to the foothills of the Leinster Mountain chain, just outside the county. Here it finally halted and terraces of till and outwash were piled against the mountain slopes. As melting set in, a broad belt of diverse tills and gravels was dumped across the centre of county Kildare, which in most places has an erratic cover of loamy till, deposited when the ice finally melted. Grey brown podzolic soils developed from these limestone deposits occupy 47% of the county.

Because of variation in till composition several soil series have been separated (Conry *et al* 1970), two of which will be examined i.e. Fontstown and Mortarstown. The Fontstown series, which has well-developed discontinuous A2 and B2t horizons and a rather shallow profile in places, is derived from highly calcareous (44%-60% $CaCO_3$) coarse-textured drift. The Mortarstown series is a deeper fine-textured soil developed in a fairly permeable material containing 30%-44% $CaCO_3$. Physical and chemical analyses of representative profiles for each series are presented, together with observations on the mineralogy and micromorphology of selected horizons within each soil. Environmental differences such as relief and rainfall are not thought to be important factors in the genesis of these soils. Morphological and compositional differences between the soils are best explained on the basis of the physical and chemical composition of their respective parent materials.

STOP D1

FONTSTOWN SERIES
(Conry *et al.* 1970)

Soil character: These soils occur mainly in the southern half of the county. Although the elevation varies from less than 60 to over 160 m, the flattish to undulating nature of the topography is a feature of this area. The soils occupy 17% (70,7000 acres or 28,600 hectares) of the county.

They are moderatley deep to shallow, well-drained, and of sandy loam to loam texture. Soil sections normally show a wide variation in depth; in extreme cases the profile varies from 20 to 75 cm but is generally 40-50 cm deep.

The section to be visited shows a brown to dark brown Ap horizon with a moderately strong structure and friable consistence. This A horizon is generally 25 cm deep but varies from 18 to 30 cm; it usually contains 16 to 18% clay and 35% silt but the clay percentage varies from 14 to 21% and generally tends to increase from west to east. Organic carbon content of the surface horizon varies from 1.2 to 2.3%. Beneath this horison a leached, sometimes indurated, pale brown A2 overlies a dark yellowish-brown B horizon which shows a strong textural increase. There is an abrupt transition from the textural B horizon to stony parent material. In the shallow parts of the profile the A2 and B horizons are absent and the Ap horizon rests directly on the parent material (C horizon).

These soils generally have a very high base status with free carbonates occurring throughout the profile. The free carbonates in the A horizon are probably due to the large scale use of the underlying "corn gravel" and burned lime as liming agents, particularly in the 19th century. However, some lime-deficient patches occur throughout this series. Small areas of the Athy Complex (gravels) occur within this series but they could not be separated from the Fontstown Series at the scale of mapping employed.

Soil suitability: These soils have a wide use range. Together with the soils of the Athy Complex, they are largely responsible for South Kildare's reputations as a tillage area. With their light to medium texture, good structure and friability they are easily tilled. Where properly manured especially with potash, excellent yields of malting barley, wheat, sugar beet, swedes and other root crops can be obtained. Boron deficiency in swedes is a common problem. Peas, French beans, carrots and cabbage are grown extensively for food processing. Raspberries and strawberries give good returns. Blackcurrants give good returns despite the fact that frost is a serious hazard and the soils are only considered moderately suitable for blackcurrants because they show a moisture deficit in dry periods.

Traditionally, these soils were not supposed to require lime but in most recent years, where lime-sensitive crops, such as swedes, sugar beet or peas are grown, irregular patches showing severe lime deficiency symptoms have been observed. As a direct result toxic levels of manganese generally reduce yields considerably and often result in complete crop failures.

These soils are highly suitable for grass production. With proper manuring, and particular attention to potash and nitrogen, a very high output can be attained especially on new leys. Due to the relatively light texture of the soil, free drainage and shallow depth a moisture deficit can severely limit production in dry seasons.

FONTSTOWN SERIES
(Collins *et al.* 1975)

Location: Suncroft, Co. Kildare
Topography: Flat to very gently undulating with slope 0-1°
elevation 90m O.D.
Vegetation: Pasture
Parent material: Calcareous, compact, stony till composed mainly of limestone
Classification: Grey brown podzolic

Horizon	*Description*
A1	0-20 cm; loam; dark greyish-brown (10YR 4/2); weak medium crumb structure; very friable both wet and dry; plentiful rooting with many stolons; clear smooth boundary to:
A21	20-43/51 cm; sandy loam; dark greyish-brown (10YR 4/4) to yellowish-brown (10YR 5/4); structureless to single grain; firm when moist; many large animal channels; very porous; very fine roots abundant; indistinct boundary to:
A22	43/51/58 cm; same as above but with horizontal bands or laminations of light yellowish-brown (10YR 6/4) materials and very dark greyish-brown (10YR 3/2) along animal burrows; distinct clear boundary to:
B2t	51/58-64/76 cm; loam; mixed dark greyish-brown (10YR 4/2) and brown to dark brown (10YR 4/3); weak medium sub-angular blocky structure; friable; very few roots; very little animal activity; some few distinct continuous clay skins; some black areas (10YR 2/1) which coincide with decalcifying limestone; very sharp wavy boundary to:
C	64/76 + cm; loam; yellowish-brown (10YR 5/4); massive structure; calcareous till which tends to be stony and compact.

Marked difference to B2t + that above — is this pure pedogenesis? (cf. Salop) — same origin for both A1 - A22 + B2t + C

FONTSTOWN SERIES

Physical and chemical analyses

Particle size analysis (mineral fraction) %	A1	A21	A22	B2t	C
Very coarse sand (2-1mm)	1.3	0.37	1.77	1.9	3.7
Coarse sand (1-0.5mm)	2.0	1.0	1.6	1.94	3.4
Med. sand (0.5-0.25mm)	5.3	6.6	6.0	4.5	4.5
Fine sand (0.25-0.10mm)	19.9	35.9	29.2	8.3	9.0
Very fine sand (0.10-0.05mm)	14.5	19.6	19.7	7.6	8.1
Sand (total)	47	63	59	33	29
Silt	33	20	24	41	45
Clay	20	17	17	26	26
Fine clay/coarse clay	0.32	0.15	0.14	0.39	0.32
Bulk density (g/cc)	1.15	1.53	-	1.54	1.82
pH	7.6	7.7	7.6	8.0	8.3
C.E.C. (NH4OAC) m.e./100 g)	14.1	8.3	7.8	12.8	14.7
C.E.C. ($BaCL_2$ m.e./100 g)	18.6	14.0	5.6	14.0	13.4
T.E.B. (m.e./100 g)	14.8	6.8	5.8	10.7	9.3
Base sat. %	79	49	sat.	sat.	sat.
C %	1.6	0.41	0.31	0.36	0.265
Total N %	.185	.078	.078	.081	.084
C/N	10.06	6.1	4.6	5.17	3.7
Free iron % (Dithion. ext.)	1.4	0.71	0.84	1.85	0.84
$CaCO_3$%	-	-	-	0.1	42.8

Sand mineralogy

Horizon	*Fraction*	*Minerals**
A1	Light	Quartz, K-feldspar, plagioclase K-feldspar,
	Heavy	Opaques, zircon, epidote, tourmaline
A21	Light	Quartz, K-feldspar, plagioclase feldspar, altered feldspar
	Heavy	Opaques, garnet, zircon, epidote, sphene, tourmaline, amphiboles
A22	Heavy	Opaques, tourmaline, hornblende, epidote, garnet, rutile, zircon
B2t	Light	Quartz, K-Feldspar, plagioclase K-feldspar, altered feldspar
	Heavy	Opaques, epidote, garnet, zircon, rutile, hornblende
C	Light	Calcite, quartz, K-feldspar, plagioclase feldspar, altered feldspar
	Heavy	Opaques, calcite, zircon, epidote, tourmaline, garnet

Micromorphological analysis

A22 43/51 - 51/59 cm; mixed argill and silasepic porphyroskellic fabric with large packing voids, irregular vughs and few channels; isolated patches of vosepic plasmic fabric. Small amount of clay but some few very distinct void and channel argillans occur showing very strong orientation. Occasional small areas of clay and silt concentrated to give close packing of the grains. Sesquioxide nodules rare. Organic matter rare.

B2t 51/59 - 64/76 cm; birefringence of the plasma high overall. Voinsepic agglomeroplasmic fabric with small, medium vughs and packing voids; areas of masepic plasmic fabric occur. Occasional distinct void and channel argillans (Plate 4.3). Many clustered sesquioxide domains or masses mainly associated with organic matter. Sand grains are mainly quartz with occasional feldspars and micas. Organic matter common.

C 64/76 + cm; argillasepic porphyroskellic fabric with many large irregular mammillated and smoothed vughs, vesicles (rare) and few irregular jointed planes. Cutans absent. Some sesquioxide nodules - particularly associated with carbonate grains.

STOP D2

MORTARSTOWN SERIES
(Conry *et al.* 1970)

Soil character: This soil occurs in isolated pockets mainly in the western part of the county. Topography is flattish and elevation varies from 50 to 100 m. The series occupies 2.80% (12,400 acres or 5,000 hectares) of the county.

These are deep, well-drained soils of loam to clay loam texture and of medium to high base status. Soil sections usually consist of a brown to dark brown surface Ap horizon, 20-30 cm deep, overlying a lighter coloured A12 horizon which in turn overlies a fine-textured B horizon. The surface horizon contains 20 to 24% clay and 35 to 40% of silt and has an organic carbon content which varies from 2.3 to 3.5 and is as low as 1.1% under almost continuous tillage. Occasionally the clay content may be up to 27%. The A12 (or A2) is thin or absent in places but in all cases the Bt horizon, which is usually 50 cm thick, normally contains 40 to 45% of both clay and silt. The B horizon has a very good structure and shows a very high proporation of both micro- and macropores as well as large vertical worm holes thus ensuring easy penetration of air and water. There is an abrupt transition from the textural B horizon to the parent material at a depth of 76 to 96 cm. Roots penetrate freely to a considerable depth and moisture holding capacity is high.

Some of the physical limitations of this soil are attributed to the moderately heavy, rather stone-free nature and relatively low $CaCO_3$ content of the glacial till from which the soil is derived. Many of these soils, particularly in the Churchtown area northwest of Athy, have been formerly used for brick-making, the surface horizons are often replaced after the thick, heavy carbonate-free B2t horizon has been removed for brick-making.

Soil suitability: These soils are suitable for the production of a wide range of farm, fruit and vegetable crops and are capable of supporting high-class grassland. Response to fertilisers, particularly potassium, is good~~. Due to the relatively fine texture and rather weak structure of~~ the surface soils, tilling and harvesting can be difficult in unfavourable seasons, resulting in reduced crop yields and poor quality. This is especially true when the soils are frequently tilled. For the same reason poaching by grazing stock in wet periods is a hazard. Wheat gives good returns but frequent cropping often causes reduced yields. Although heavy textured soils are considered unsuitable for malting barley, these soils are used extensively for this enterprise in the Churchtown area, near Athy. Swedes, sugar beet and other root crops grow satisfactorily. Peas, French beans, cabbage and carrots are successfully grown for the processing industry.

Mr. Jim Fox, on whose land the profile was opened, will discuss his system of intensive arable farming on both the light-textured (Fontstown Series) and heavy-textured (Mortarstown Series) soils.

huge lime requirements (3 ton/ac/yr.)
No animals → low OM applicat^ns → structure problems – future.

MORTARSTOWN SERIES
(Collins *et al*, 1975)

Location:	Coursetown, Athy, Co. Kildare
Topography:	Flat to gently undulating with slope 0-2^{0} Elevation to 70 m OD
Vegetation:	Tillage
Parent material:	Calcareous, stratified glacial drift composed mainly of limestone, resting on gravels
Classification:	Grey brown podzolic

Horizon	*Description*
Ap	0-25 cm; clay loam; brown to dark brown (10YR 4/3); strong, medium crumb structure; friable when dry, sticky when wet; some roots and stolons; clear smooth boundary to:
A12	25-41 cm; clay loam; dark yellowish-brown (10YR 4/4); weak, medium sub-angular blocky and crumb structure; friable; few roots; some few faint Mn mottles; indistinct boundary to:
B21t	41-61 cm; silty clay; dark yellowish-brown (10YR 4/4) with some ped faces covered by metallic black (5YR 2/1) mangans; angular blocky structure; firm *in situ*; few roots and abundant large worm channels lined with excreta; clay skins common but mainly on vertical faces; indistinct boundary to:
B22t	61-81 cm; clay; dominant colour is dark yellowish-brown (10YR 4/4) with specks of reddish yellow (5YR 6/8); otherwise similar to B21 but with clay skins more prominent and continuous; indistinct wavy boundary to:
B3	81-92 cm; silty clay; dark yellowish-brown matrix (10YR 5/4) with areas of light yellowish-brown (10YR 6/4); some few Mn mottles and specks of black (10YR 2/2) material, probably decalcifying limestone; massive structure; firm; very little if any rooting; clear wavy boundary to:
C	92 + cm; gravelly clay loam; greyish-brown matrix (10YR 5/2) with specks of black (10YR 2/1) material; massive structure; lenses of fine sand present; calcareous

High pore % in B21t, + generally v. good structure, but no subsoiling ('so far).

Physical analysis

Particle-size analysis (mineral fraction) %	Ap	A12	B21t	B22t	B3	C
Very coarse sand (2-1 mm)	1.0	1.1	1.2	1.4	1.3	1.8
Coarse sand (1-0.5 mm)	1.5	1.5	1.3	1.5	1.6	1.9
Med. sand (0.5-0.25 mm)	6.2	5.2	3.3	3.6	3.6	4.1
Fine sand (0.25-0.10 mm)	17.6	14.7	7.2	7.6	7.0	7.6
Very fine sand (0.10-0.05 mm)	8.8	6.9	5.2	5.2	4.8	5.4
Sand (total)	36	29	18	19	18	21
Silt	35	38	41	39	41	44
Clay	29	32	41	42	41	35
Fine clay/coarse clay	0.43	0.33	0.47	0.78	0.61	-
Bulk density g/cc	-	1.57	1.72	1.70	1.65	1.74
pH	6.7	6.9	7.0	7.0	7.1	7.9
C.E.C. (NH4OAC) m.e./100 g	15.3	13.4	14.4	14.6	13.6	11.8
C.E.C. ($BaCl_2$) m.e./100 g	19.6	15.8	16.0	16.6	17.2	18.6
T.E.B. m.e./100 g	12.6	9.2	10.4	11.0	11.6	14.1
Base sat. %	64	58	65	66	68	sat.
C %	1.25	0.58	0.29	0.28	0.24	0.23
N %	0.164	0.096	0.076	0.068	0.065	0.049
C/N	8.9	7.1	4.4	4.7	4.3	5.5
Free iron % (Dithion. ext.)	1.6	1.9	2.4	2.7	1.85	1.4
$CaCO_3$ %	-	-	-	-	-	12.8

Micromorphological analysis

A2 25-41 cm. Mixed asepic and vo-insepic perphyreskellic fabric with large irregular and interconnected vughs and packing voids. Channels rare. Occasional channel argillans and papules. Many randomly distributed areas of opaque sesquixide material often more opaque at surface of grains. Frequent discrete ferro-manganiferous concretions and nodules. Some organic matter.

B22t 61-81 cm. Argillasepic and in-vosepic porphyreskellic fabric with occasional planes and channels, with large irregular orthovughs and vesticles common. Large areas of complex channel and void argillans with orientation poor to good but with poor lamination. Associated with illuviated clay are dense areas (blotches) of manganese and iron; also clustered areas of ferr-manganiferous nodules some of which are associated with sand grains. Organic matter rare.

C 96 cm +. Mainly asepic porphyreskellic fabric with smoothed vesicles and isolated vughs, with small areas of insepic agglomeroplasmic fabric with normal packing voids. Some simple and craze planes. Very few thick discontinuous channel argillans. Small areas of sesquioxide material. Some coarse textured, light coloured areas with intertoxic fabric. Skeleton grains mainly quartz and calcite and associated with clay films. Organic matter occasional.

The Centre is primarily concerned with research on aspects of tillage and forage crops. A summary of the current research programme is given below:

Cereals: A major area of investigation has been to find the effects of intensive and continuous growing of barley and wheat on the incidence of fungal diseases such as "eyespot" and "take-all" and on the control of perennial weeds. Field experiments are in progress to test a range of systemic fungicides for the control of cereal diseases.

Particular attention is being devoted to the control of wild oat, scutch and corn marigold using new herbicides.

Various cultivation systems for cereals are being assessed, these include direct drilling and reduced cultivation systems using implement/ seeder combinations. The production of catch-crops such as rye, ryegrass, turnip, rape, etc., through direct drilling on stubbles is under investigation.

Methods of grain-stroage, using aeration and propionic acid treatment and the effects of delayed harvesting on grain loss are being examined.

Grasses and legumes: Research is directed towards breeding and evaluating new varieties of perennial ryegrass, Italian ryegrass, tall fescue and white clover. Two new varieties of perennial ryegrass, "Oak Park" and "Green Isle" (tetraploid) have been produced and will be on the market within the next few years.

Grasses and clovers from home and abroad are being evaluated to find the best varieties for cutting, grazing and as ensiled material. Species of grass such as fall fescue, timothy, reed canary-grass, triticale and legumes such as tetraploid red clover, lucerne, birdsfoot-trefoil are being checked for their forage productivity.

New forage harvesters and methods of hay and silage making are being tested.

Root and fodder crops: Fodder crops including swedes and turnips for both sheep and cattle as well as rye and beet tops are being investigated. A new harvester has been designed to facilitate the ensiling of beet tops. Methods of feeding and handling crops for cattle and sheep are being studied.

Potatoes: Research on potatoes is mainly aimed at breeding new varieties and evaluating existing varieties for yield, crisping, canning, etc. Four new varieties, Oak Park Amber, Avenger, Beauty and Bounty have been released, seedlings are currently being grown in Spain, Cyprus and Lebanon.

Trials on new fungicides and spraying regimes are being carried out with particular emphasis on the possibility of preventing losses from blight during storage.

Sugar-beet: Mechanisation of crop production to reduce labour input costs is receiving special attention through experiments on reduced cultivation, chemical weed control and breeding new monogerm varieties suitable for sowing to a stand. The control of insect pests at the seedling stage through the use of different insecticides to obtain the optimum plant stand is being studied.

New crops: New crops are being studied for possible use as food, feed and industrial raw material. The main effort is on maize, poppies for alkaloid production, oilseed rape beans for protein feed, and rye-ergot for drug manufacture.

Environment protection: Residue levels of pesticides, weed-killers, fungicides, insecticides and other agro-chemicals are determined in samples of cereals, potatoes, sugar beet, foodstuffs, animal feeds, silage, soil and water.

A light-textured soil derived from calcareous fluvioglacial gravels will be examined in relation to the potential of this and other soils for sugar-beet production (next page).

Large soil variety over field trial plots.

SOIL PROFILE - OAKPARK

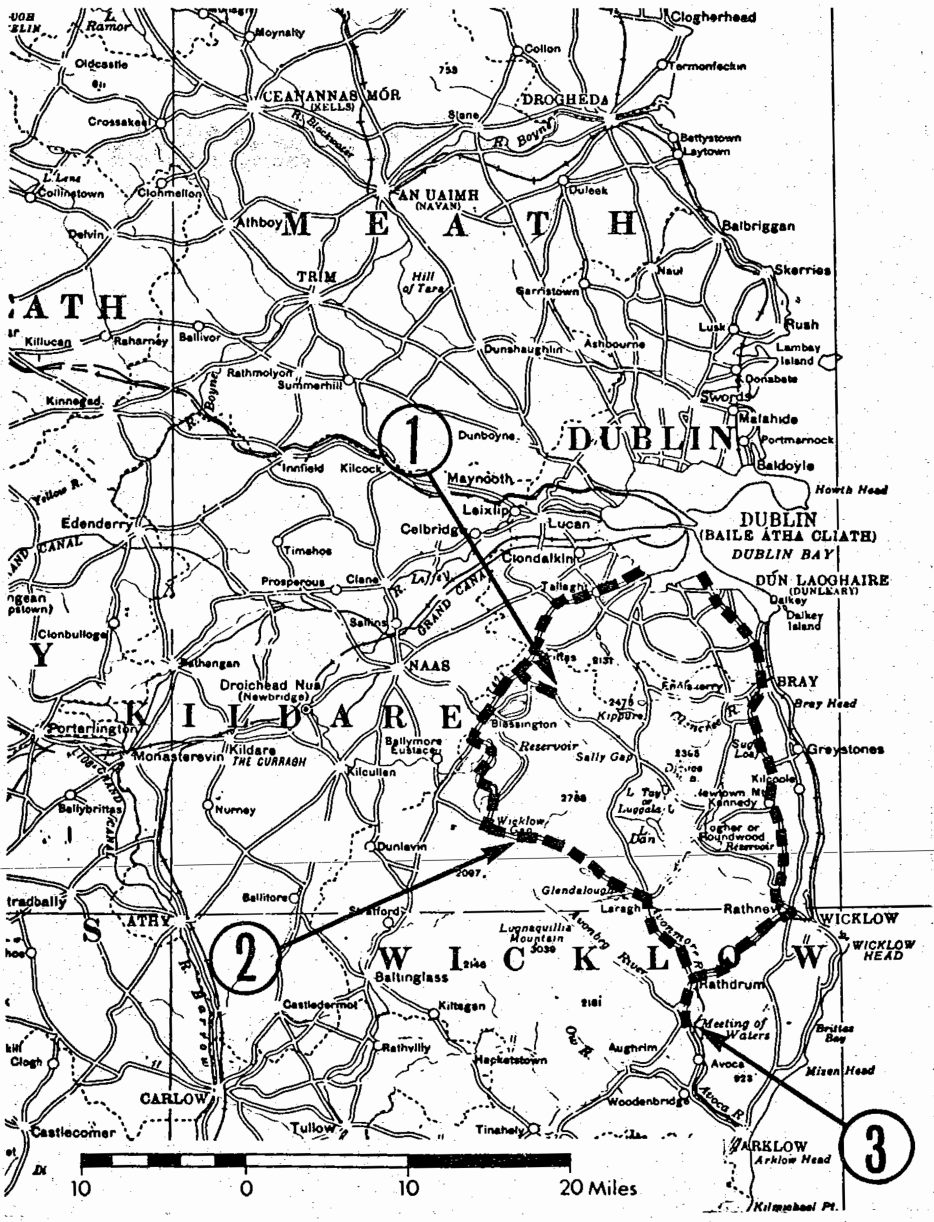
Elevation: 60 m O.D.
Topography: Flat, slope 0^{o}
Parent material: Compact, stony, calcareous till, composed mainly of limestone
Classification: Grey brown podzolic

Horizon	*Depth (cm)*	*Description*
A11) - Ap A12)	0-12.5 12.5-28	Fine sandy loam; dark brown (10YR 3/3); strong very fine to fine crumb structure; moist very friable; bleached quartz grains, abundant roots; clear boundary to:
A2	28-68	Sandy loam; dark yellowish-brown (10YR 4/4); strong very fine crumb structure; moist very friable; plentiful roots; clear tonguing boundary to:
B2t	68-75	Gravelly clay loam; brown to dark brown (10YR 4/3); moderate fine crumb structure; moist very friable; quartz grains not visible; plentiful roots; abrupt tonguing boundary to:
C	75+	Calcareous gravelly coarse sand; grey; structureless single grained; friable; plentiful roots in upper portion

Physical and chemical analysis

Particle-size analysis (mineral fraction) %	A11	A12	A2	B2t	C
Coarse sand (2-0.2 mm)	41	41	52	60	69
Fine sand (0.2-0.05 mm)	23	23	19	11	13
Silt (0.05-0.002 mm)	20	20	17	15	8
Clay (≤0.002 m)	16	16	12	14	9
pH	6.7	6.7	6.9	6.9	8.5
C.E.C. m.e./100 g ($BaCl_2$)	16.4	17.6	5.3	7.8	1.8
T.E.B. m.e./100 g	12.3	11.8	4.3	5.9	3.4
Base sat. %	75	67	81	76	sat.
C %	2.8	3.1	0.3	0.3	0.1
N %	0.25	0.26	0.05	0.06	0.02
C/N	11.2	11.9	6.0	5.0	5.0
Free iron %	1.4	1.7	1.0	1.3	0.3
$CaCO_3$ %	-	-	-	-	43.7

EXCURSION E



ROUTE OF EXCURSION E

EXCURSION E

CO. WICKLOW

Granite soil, Lough Nahanagan (eroding peat, power station, corrie moraines), scenic route, Avondale Forestry Training School

Leaders: M. Bulfin (Agric. Inst.), J. F. Collins (UCD)
Other participants: F. M. Synge, (Geol. Survey), T. Carroll (Dept. of Lands)

Hrs	*Stop*	
09.00		Depart St. Patricks College
10.35	E1	Granite soil profile, Ballysmultan
12.10	E2	Eroding peat, Turlough Hill
13.00		Laragh - lunch
14.30	E3	Avondale
16.30		Depart for St. Patricks College

For background information on the county and description of granite profile see p. 20 and also route map.

From the granite profile the bus returns to the main Dublin-Blessington road, passing the limestone gravel pits just outside Blessington village. The route continues south through limestone gravels until it swings left to cross the lake and travel by the lakeshore to Valleymount. The soils along this road are composed of varying mixtures of shale and limestone overlying granite bedrock. Moving uphill from the lake the eastern limit of the limestone is reached and soils derived from granite dominate. At least three local mountain glaciations are known for the Kings River Valley, these resulted in a ragged boulder-strewn microtopography which has kept agriculture at subsistence levels. The long delta deposits and alluvial flats at Loughstown in the valley-bottom stand out in sharp contrast as they are the only boulder-free soils in the valley.

Rainfall rates increase markedly towards Wicklow Gap and the soils change from peaty podzols to peaty gleys, peats and lithosols.

STOP E2

At Turlough Hill the Electricity Supply Board's hilltop storage reservoir (700 m) affords an extensive view of the high mountain area. Almost all of the 21,000 acres of deep peat on the mountain tops have now begun to erode and the gullying and sheet erosion is clearly visible in the surrounding areas. The corrie moraines in the lake have been radiocarbon-dated to 10,500 B.P.

The waterfall and glacial deepening at the granite/schist boundary may be observed as we descent Glendasan to Laragh. The route continues along the road which follows the Avonmore river to Rathdrum and Avondale. One of the few remaining native oak woodlands can be seen on both sides of the road soon after leaving Laragh. Much of the forestry along this stretch belongs to a private estate. The soils between Laragh and Rathdrum are mostly brown podzolics of mixed shale and granite.

STOP E3 AVONDALE FORESTRY TRAINING SCHOOL, RATHDRUM, CO. WICKLOW

Avondale was the birthplace and home of Charles Stewart Parnell (1846-91) the great Home Rule leader. Interesting features which will be examined are the Parnell Museum, the Professor Henry Memorial grove, the arboretum which contains a wide variety of trees many of them rare in Ireland, and experimental forest plots.

The major underlying formations are (1) volcanic rocks which include acid, felsic, crystal and lithic tuffs with some andesite flows, (2) ordovician slates and shales usually cleaved and locally phyllitic and (3) biotitic diorite, and dolerite.

The area was subjected to a number of glaciations mainly from the northwest and numerous large boulders of granite are conspicuous on the estate. Many of the parent materials of the soils are glacial tills derived from the local rock with little extraneous material apart from the boulders.

It has been estimated that 40-45% of the estate has soils derived from or developed in slaty parent materials which range from hard rock, through weathering debris (or rubble) to glacial till of fairly fine texture. A further 35-40% of the soils are developed in igneous rocks (cleaved and uncleaved tuffs, (Profile 1), coarse textured diorite (Profile 2), and iron-rich dolerite) and derived tills. The remaining 15-25% of the soils are derived from bouldery terrace gravels of differing age, and from channel-fill deposits of heterogeneous composition (Collins *et al.* in prep.).

PROFILE 1 - AVONDALE

Location:	In Eucalyptus grove near Memorial Garden. Compartment 4
Elevation:	140 m O.D.
Topography:	Level to gently sloping
Vegetation:	Eucalyptus
Parent material:	Cleaved tuff
Classification:	Acid brown earth

Horizon	*Depth (cm)*	*Description*
01	75-0	Very dark brown to very dark greyish-brown (10YR 2/2 - 3/2); poorly humified mat; clear smooth boundary to:
A1	0-18	Loam; dark brown to dark greyish-brown (10YR 3/2 - 3/4 with some brown areas 7.5YR 4/4); moderate medium crumb structure; some large roots; somewhat firm when moist but otherwise friable, clear smooth boundary to:
B21	18-42	Loam; yellowish-brown (10YR 5/6 - 5/6); very weak fine crumb structure; many large roots- with diffuse fine roots throughout; very friable; very stony; grades into;
B22	42-70	Loam; strong brown (7.5YR 5/6 - 5/8); moderate medium crumb to sub-angular blocky structure; (determined by stoniness); compact (dry) friable (moist); some roots; gradual smooth boundary to:
C	70+	Loam; brown to dark brown (7.5YR 4/4); tending towards dark yellowish-brown (10YR 4/4), shaly rubble

ANALYTICAL DATA

Horizon	01	A1	B21	B22	C
Particle-size analysis (mineral fraction) %					
Coarse sand (2-0.2 mm)	-	24	27	24	32
Fine sand (0.2-0.05 mm)	-	18	19	17	15
Silt (0.05-0.002 mm)	-	33	34	42	33
Clay (<0.002 mm)	-	25	24	17	19
pH	3.7	4.6	4.8	4.9	4.9
C.E.C.* m.e./100 g	36.9	23.1	22.0	16.2	12.7
T.E.B.* m.e./100 g	3.3	10.6	7.8	6.9	4.4
$EA_{(KCl)}$	3.4	5.0	3.3	1.2	0.6
C %	13.3	3.3	2.1	1.0	0.2
Free iron %					
Dithion ext.	-	2.2	3.1	3.3	2.1
Pyrophos. ext.	-	1.2	1.4	1.5	0.7

* Extracted with $N.NH_4O$ Ac at pH 7.0

PROFILE 2 - AVONDALE

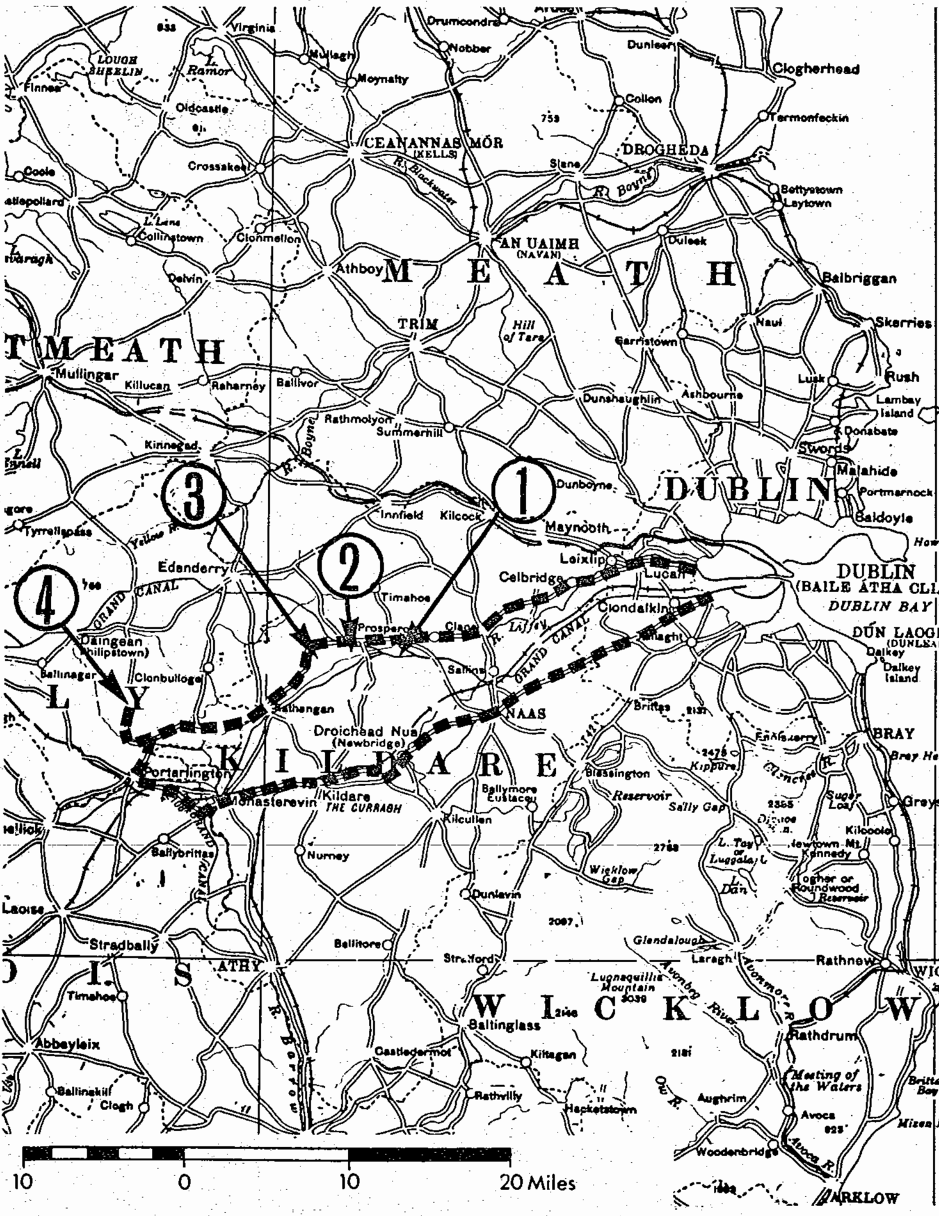
Location:	Avondale Forest, Compartment 12
Topography:	Level to gently sloping
Elevation:	120 m O.D.
Vegetation:	Larch
Parent material:	Weathered diorite rubble and till
Classification:	Brown earth

Horizon	*Depth (cm)*	*Description*
01	25-0	Thin layer of undecomposed leaves, twigs, bark, etc.
A11	0-10	Loam; dark brown to very dark greyish-brown (10YR 3/2 to 10YR 3/3); moderate to strong coarse and medium crumb structures; very friable; abundant roots, mostly fresh; no stones; diffuse smooth boundary to:
A12	10-30	Loam; brown to dark brown (10YR 4/3) moderate coarse and medium crumb structure, peds held together by diffuse roots; very friable; occasional stones, clear smooth boundary to:
(B)	30-45	Loam; dark yellowish-brown (10YR 3/4 - 4/6); moderate to fine medium crumb structure; few fine roots; occasional strong roots and rhizomes, few stones; clear smooth boundary to:
C	45+	Sandy loam; olive brown to light yellowish-brown (2.5YR 4/4 - 10YR 6/4) often dominated by the greenish colours of soft diorite stones; friable to firm; very few roots

Horizon	01	A11	A12	(B)	C
Particle-size analysis (mineral fraction) %					
Coarse sand (2-0.2 m)	-	20	35	37	50
Fine sand (0.2-0.5)	-	17	16	18	18
Silt (0.5-0.002)	-	40	29	31	21
Clay (<0.002 mm)	-	23	20	14	11
pH	3.7	5.3	5.5	5.8	6.1
C.E.C.* m.e./100 g	-	20.2	18.7	10.1	9.1
T.E.B* m.e./100 g	-	14.5	15.7	8.3	8.1
$EA_{(KCl)}$	-	3.2	1.8	1.7	0.6
C %	-	6.6	4.3	2.9	0.3
Free iron %					
Dithion ext.	-	1.0	1.5	1.7	0.9
Pyrophos ext.	-	0.9	0.6	0.5	0.2

* Extracted with N. NH_4O Ac at pH 7.0

EXCURSION F



ROUTE OF EXCURSION F

EXCURSION F

Raised bog stratigraphy, Lullymore Peatland Experimental Station, sub-peat mineral soils

Leader: R. F. Hammond (Agric. Inst.)

Other participants: A. J. Cole, F. S. McNaeidhe (Agric. Inst.), C. McCoy, G. Healy (B. na M.)

Hrs.	*Stop*	
09.00		Depart St. Patricks College
10.15	F1	Robertstown canal centre
11.00	F2	Peat profile
12.00	F3	Arrive Peatland Expt. Station
		a) grassland
		b) nursery stock
		c) arable crops
	F4	Clonsast
		a) grass and cattle production on peatland
		b) sub-peat mineral soils
16.30		Depart for St. Patricks College

Raised bog stratigraphy, Lullymore Peatland Experimental Station, sub-peat mineral soils

For general description of peat development in the post-glacial period and detailed peat profile descriptions see p.24-27.

The route from Dublin to Lullymore lies through undulating limestone country. There will be a short stop at Robertstown village, formerly a busy canal centre with a large hotel for passengers, and now a major recreational attraction.

Under Statute 25, Geo. II, c.10 (Ir.) 1751, the commissioners of Inland Navigation gave a great impetus to canal construction. Reasons given included one writer's prophetic comment that the Great Bog of Allen would disappear and be replaced by a "vast expanse of meadows bordered by towns and villages".

Lullymore Peatland Experimental Station (see p. 24)

Clonsast Sod-peat Bog

Commercial cattle raising on cut-away sod peat
Bord na Mona commenced the commercial development of sod-peat cutaway bog in 1972. The average depth of peat remaining after harvesting was 75 cm, consisting mainly of undisturbed fen with a shallow covering of *Sphagnum* strippings. The mineral substratum consisted entirely of stony, calcareous, glacial drift. For development as grassland it was decided to camber an area, giving a gradient of approximately 1% towards the main drain and not to use any intermediate tile or stone drains.

The pH of the cut-away peat varied from 3.5 to 7.5 - the higher figure being obtained where the subsoil has been incorporated. Quantities of lime varying from zero to 15 per ha were applied. Other nutrients added were:

76.3 kg N/ha., 76.3 kg P/ha., 152.7 kg K/ha
31 kg/ha copper sulphate, 2.25 kg/ha cobalt sulphate

The following mixture was sown:
18.25 kg/ha New Zealand Perennial Ryegrass, 13.63 kg/ha Sceempter (Spirit) Ryegrass, 4.54 kg/ha RNP Ryegrass (Italian), 1.70 kg/ha New Zealand White Clover

Grass establishment was excellent even on the areas where the sub-peat mineral subsoil was exposed. Clover growth was slow in the early stages but has since become well established in the pasture. It is now evident that clover establishment has been more successful and growth more vigorous in areas where the subsoil and peat were mixed than in the pure peat areas.

Rate of formation of grey brown podzolics in post-glacial period
Underneath Clonsast Bog relict soils showing marked pedogensis have developed on the calcareous limestone drift. Their relative maturity and distribution was determined by the length of time which elapsed before they were covered by the encroaching peat. This, in turn, was determined both by climatic changes and topographic effects.

Using pollen analytical and radiocarbon techniques such soil formation has been dated to 5,000 to 2,000 years B.P. (Hammond, 1968).

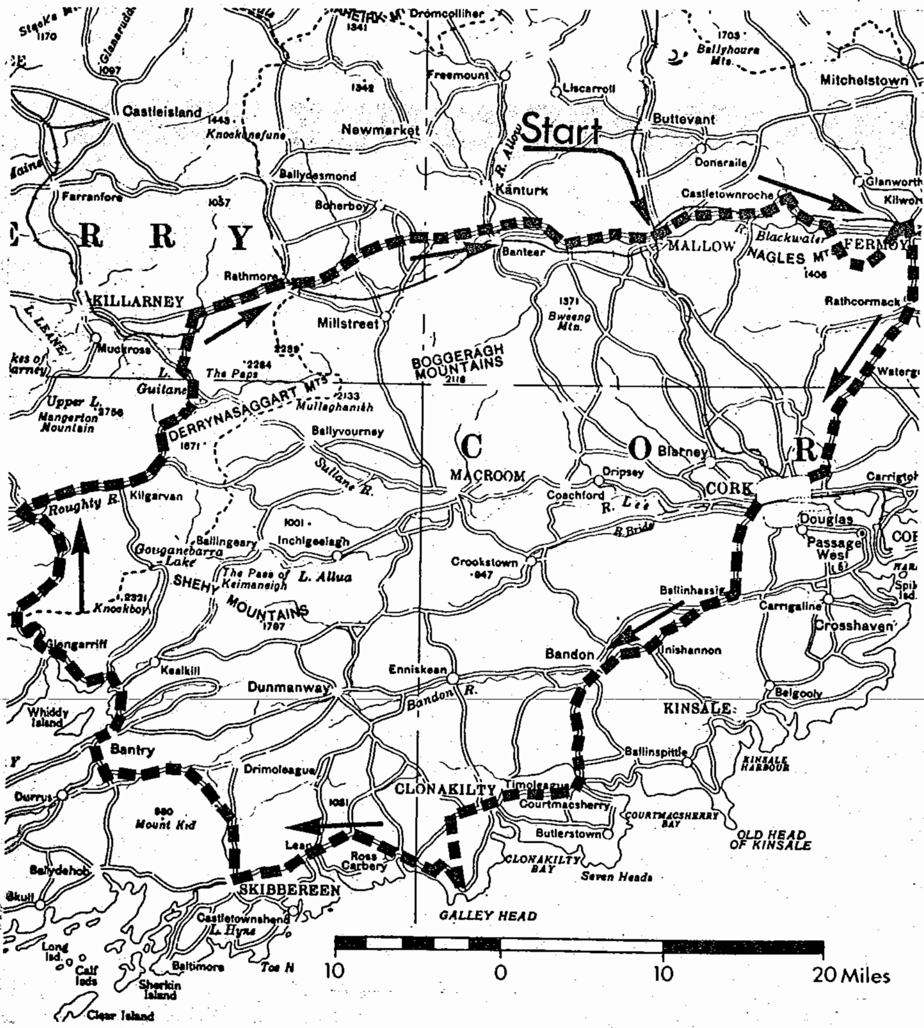
Profile description of well-developed relict soil

Horizon	*Thickness (cm)*	*Description*
A1	15	Dark grey (10YR 4/1; loam; very weakly developed structure; fossil roots; boundary clear, smooth to:
A2	5	Light grey 2.5Y 7/2); loam; massive structure; light olive brown (2.5Y 4/0) mottles; fossil roots; boundary clear, smooth to:
Bt	10	Olive (5Y 5/3); clay loam; slightly plastic; massive structure; boundary clear, smooth to:
Cca	-	Grey (5Y 5/1); loam; 5-10% stones; massive structure

Analytical data

Horizon	A1	A2	Bt	Cca
Particle size analysis (mineral fraction) %				
Coarse sand (2-0.2 mm)	18	24	18	20
Fine sand (0.2-0.05 mm)	30	29	17	23
Silt (0.05-0.002 mm)	42	39	35	39
Clay (<0.002 mm)	10	8	30	18
pH	5.8	6.6	7.3	8.1
C.E.C. m.e./100 g ($BaCl_2$)	24.9	6.0	15.6	3.2
T.E.B. m.e./100 g	14.5	5.1	13.0	5.2
Base sat. %	58	85	83	sat.
Free iron %				
Dithion ext.	0.13	0.11	1.10	0.14
$CaCO_3$ %	-	-	-	53.9

POST CONFERENCE TOUR



Post-Conference Tour

POST-CONFERENCE TOUR - WEST CORK

September 17–19

Leader: M. J. Conry (Agric. Inst.)

Friday, September 17

07.45	Depart St. Patricks College for Heuston Station
08.30	Depart by train for Mallow (arrive Mallow 11.40)
	Visit Agricultural Institute's farm at Coolnakilla to see hill land reclamation, associated soils and dairy research
	Overnight, Imperial Hotel, Cork

Saturday, September 18

09.00	Leave by coach for Bandon, Clonakilty, Skibbereen and Bantry seeing plaggen soils, high manganese soils, brown podzolic soils and associated farming
	Overnight, Westlodge Hotel, Bantry

Sunday, September 19

09.00	Leave by coach for Glengarriff, Kenmare and Mallow, seeing hill and mountain land-use
15.30	Depart Mallow for Dublin by train
18.30	Arrive Dublin

POST-CONFERENCE TOUR OF WEST CORK

General Description of Area

Geology: The geological pattern of the area is very complex. Not only are the solid formations complicated in terms of age, mode of formation, structure and composition, but the glacial drift deposits overlying the solid formations, and forming the parent materials of most of the arable soils in the area, are of very mixed origin and constitution.

The principal rock formations are Old Red Sandstone and Carboniferous shales and slates with some grits. The overlying drift deposits are derived mainly from the underlying solid formations and show great variation in physical constitution, and to a lesser extent in geological composition. Over much of the area, particularly at the higher elevations, drift cover is thin or non-existent leaving expansive stretches of bare rock. Alluvial materials occur along the river courses.

Topography and land forms: The physiographic features vary considerably within the area, providing rapid and significant changes in a complex landscape. The elevation varies strikingly, rising from sea level to 2,000 feet over short distances. The northern half, in particular, is very mountainous whilst the southern half is mainly steeply rolling to hilly. In the latter area the continuity of the land-form is constantly broken by patches of rock outcrops giving a very broken landscape. Along the Ilen and Bandon rivers, sizeable tracts of low flattish relief occur.

Climate: A considerable range of annual rainfall exists in the area, the average varies from 48 inches near the coast to 110 inches in the mountain regions. The area has an average annual temperature of 51°F, being about 2°F higher than the east coast.

Soils: The better soils occurring in the lowland areas belong to the Alluvial, Brown Earth and Brown Podzolic groups and mostly constitute the limited arable soils in the area. Of far more extensive occurrence are the poorer Podzols, Gleys, Peats and Skeletal soils, found mainly in the hill and mountain regions.

Hill Farm, Coolnakilla, Fermoy

Leader: J. Kiely (Agric. Inst.)

There are about 3½ million acres of hill and mountain land in Ireland. This land category includes a wide range of slopes, soils and vegetation. The present and future grazing potential is correspondingly variable. A 400-acre shallow peat hill farm at Coolnakilla near Fermoy is being used by the Agricultural Institute to compare different reclamation techniques, and the grazing potential of a 180-acre reclaimed section is being tested using a dairy herd. The results of this work will have relevance for the large amounts of shallow peat throughout the hill areas of the country.

The farm is situated at an elevation varying from 200-250 m O.D. The soil is shallow peat approximately 15 cm deep. The mineral subsoil is variable ranging from compact stony and dry to a stiff damp subsoil. The vegetation on the drier parts is heather and furze and moor grass is dominant on the wetter parts.

The aims of the experimental programme are:

i) to determine the grazing potential of reseeded heather land, especially its grazing capacity in the first 3 years after establishment;

ii) to cost the various reclamation methods currently available and to establish cheaper methods of development;

iii) to monitor the importance of micronutrients in improving general performance on animal health;

iv) to monitor the long-term effects of reclamation on soil and sward behaviour (Kiely *et al.* 1976).

Plaggen Soils
(Conry, 1971)

The deep man-made Plaggen soils in Ireland originated from the addition of large quantities of sea sand, either alone or in conjunction with stable manure or seaweed. It seems that sea sand has been applied to farm land from pre-Christian times; its use is authenticated from the thirteenth century on wards.

During part of the 18th century many coastal areas were centres of very high population and arable farming was essential to provide food for the dense population. To counteract soil acidity calcareous sea sand was used where available.

The solid particles in the sand, which consisted mainly of quartz grains and comminuted shells, gradually built up until the plaggen layer was up to 85 cm in depth.

The Irish Plaggen soils, like those of north-west Europe, are superior to their non-Plaggen counterparts in productivity. They are especially suitable for certain crops, like sugar beet, malting barley, onions and other vegetable crops. The formation of these soils leads to induced manganese, cobalt and boron deficiencies and a predisposition to eelworm infestation.

Profile description and analysis - Plaggen profile

Location:	Donroe, Ardfield, Clonakilty, Co. Cork
Topography:	Undulating
Slope:	0°
Altitude:	46 m O.D.
Precipitation:	1000-1250 mm
Vegetation:	Cultivated
Drainage class:	Well drained
Parent material:	a) Compact, non-tenaceous non-calcareous glacial till composed of sandstone, shaly sandstone, shale and slate, b) Calcareous sea sand
Classification:	Type Euplaggent (Brown Podzolic)

Horizon	*Depth (cm)*	*Description*
Ap11	0-15	Coarse sandy loam (to loamy sand); dark greyish-brown to brown (10YR 4/2-4/3) with abundant pale brown sand grains which gives it lighter colour; very fine granular structure (almost structureless); moist very friable to loose consistence; abundant roots; rounded beach stones common; strongly calcareous; gradual boundary to:
Ap12	15-30	Similar to above horizon but colour somewhat lighter
Ap13	30-58/61	Similar to Ap12 above; gradual boundary to:
Ap21b	58-66/84	(Coarse sandy) loam; otherwise similar to above horizon; it is mixture of sand plus original Ap horizon; clear wavy boundary to:
Ap22b	66-94/99	Loam; dark greyish-brown (10YR 4/2); moderate, fine and fine-medium granular structure; moist very friable sparse roots; non-calcareous; abrupt smooth boundary to:
B21irhb	94-135	Sandy loam; yellowish-brown (10YR 5/4-5/6); weak, very fine crumb structure; moist, very friable, sparse roots; non-calcareous; clear boundary to C:
B22irhb	107-135	Occurs in pocket in above horizon; coarse sandy loam; dark yellowish-brown (10YR 3/4- nearest) (reflects higher humus content), weak very fine structure; moist, very friable, non-calcareous:
Cb	135+	Gravelly sandy loam to loam; olive grey (5YR 5/2); structureless; moist firm *in situ* - upper few cm moist friable; no roots; non-calcareous:

Horizon	Ap11	Ap12	Ap13	Ap21b	Ap22b	B21irhb	B22irhb	Cb
Particle-size analysis (mineral fraction) %								
Coarse sand (2-0.2 mm)	68	67	59	40	33	40	59	35
Fine sand (0.2-0.05 mm)	8	8	11	17	14	16	9	18
Silt (0.05-0.002 mm)	13	19	18	38	34	35	13	39
Clay (<0.002 mm)	11	6	13	15	19	9	19	8
pH	7.6	7.9	8.2	8.3	8.1	8.2	8.1	7.3
C.E.C. m.e./100 g	10.4	6.0	3.9	4.1	8.6	4.8	8.6	2.2
T.E.B. m.e./100 g	55.9	60.9	61.6	57.6	15.4	11.8	11.8	3.0
Base sat. %	sat.	sat.	sat.	sat.	sat.	sat.	sat.	sat.
C %	2.9	1.9	1.0	1.8	2.4	1.6	2.3	0.3
N %	0.25	0.14	0.08	0.08	0.13	-	-	-
C/N	11.6	13.5	12.5	22.2	16.9			
$CaCO_3$ %	20.2	17.9	23.9	24.6	0.7	0	0	0
Free Fe_2O_3 % (Deb)	0.9	1.0	0.8	0.8	1.1	1.5	3.2	0.6
Extract. Co ppm	2.6	3.4	3.0	3.0	5.0	5.7	12	7.2
Total Mn ppm	140	250	150	220	750	130	1700	200
Extract. Mn ppm	7	-	-	-	-	-	-	-
Total cu ppm	20	40	15	18	15	10	15	15
Extract. Cu ppm	7.5	-	-	-	-	-	-	-
Extract. P ppm	104	75	12	8	1	1	1	1
Extract. K ppm	170	170	80	90	155	55	85	70
Extract. Mg ppm	860	940	1368	1672	215	100	135	60

Brown Podzolic Soils
(Conry *et al.* 1972)

These occur extensively in West Cork. They are derived from non-calcareous glacial till and gravels composed of a mixture of shale, shaly sandstone and sandstone. Those derived from till have been mapped as the Ross Carbery Series, those on gravels as the Drimoleague Series.

Physical Properties

Particle-size distribution: The Drimoleague gravel soils contain 14% clay and 20-30% silt while the Ross Carbery till soils contain 22% clay and 35-50% silt.

Macro and micromorphological: The Ap horizons have typical mull-like humus forms. The A2 horizons compared with other horizons have a low void count. They have a typical phyric related distribution pattern which is due primarily to the dense packing of the unequigranular skeletal material. Their firm to hand field consistence is directly related to this feature.

The B horizons have strong brown to yellowish red colours which are due to high concentrations of humus and sesquioxides. They have a very fine crumb structure with a very friable, fluffy field consistence with a very high percentage of inter-connected compound packing voids, typically the plasma (which consists of an intimate mixture of clay particles, humus and sesquioxides) occurs as loose and incomplete fillings between the skeleton grains. These plasma clusters have the appearance of rounded faecal-like pellets.

The plasma distribution varies with soil texture; in the heavier soils (RossCarbery Series) most of the plasma has an agglonereplasmic related distribution pattern, whereas in the lightest soils it occurs as cutanic material.

Chemical Properties

Organic matter: In these profiles which have remnants of A2 present the organic matter is very much lower in the A2 than in the Ap and B2 horizons. It is also, generally higher in the B horizons (2.5-4.5% C) than in the lower parts of the Ap (1.5-3% C).

Free iron: Maximum free iron is always found in the B horizons while in those profiles with an A2 horizon minimum values, apart from the C horizon, occur in the A2.

Pyrophosphate-dithionite extractable carbon, iron and aluminium: The Be horizon easily satisfy the USDA (1967) limits for spodic B horizons. Many of the B horizons contain more extractable C, Fe and Al than the strongly developed ironpan podzols. 63-75% of the carbon in the B horizons is extractible with pyrophosphate-dithionite.

Citrate-dithionite extractible Fe and Al and Si oxides: The data show that (i) the clay fractions of all horizons contain appreciable quantities of iron oxides, but by far the greatest quantities occur in the B2 horizons. Between 25 and 37% of the clay-sized fraction consists of extractible Fe_2O_3. (ii) there is pronounced accumulation of extractible Al_2O_3 in the B2 horizons.

Clay mineralogy: Despite the enormous quantities of iron in the B horizons only a very small proportion of this occurs as crystaline goethite. Pedogenetic evolutionary weathering apparently causes the destruction of chlorites and probably at the same time the formation of mixed-layered clay minerals or vemiculite in proceeding from the C to the A2 horizons.

Classification: These Brown Podzolic soils belong morphologically, chemically and genetically with the Podzol Great Soil Group. It seems more appropriate, however, to consider them as a separate subgroup within this Great Soil Group. It is proposed that a new subgroup, Ochric Haplorthods, should be created within the American System of classification to include those soils which have spodic B horizons and ochric Ap horizons.

Some Brown Podzolic profiles will be examined en route.

High Manganese Soils
(Conry and Ryan, 1963)

In West Cork, black indurated layers occur in the sub-surface depths of certain soils or within the underlying glacial deposits. These layers consist mainly of coarse sands and gravels cemented into a hard mass.

Description and analyses from typical gravels

	Free iron %	Total iron %	Total manganese %
Olive-grey (5Y 6/2); coarse sand and gravel loose, friable; immediately above the pan	0.64	5.05	0.03
Black (2.5YR 2.0); coarse sand and gravel; extremely indurated pan	1.90	3.10	6.6
Dark-red (2.5YR 3/6); coarse sand and gravel; firm *in situ* but friable *ex-situ*; immediately below indurated pan	4.41	20.55	0.10
Yellowish-red (5YR 5/8); coarse sand and very fine gravel; firm *in situ* but brittle *ex-situ*; underlying dark-red layer	4.53	9.78	0.07
Olive-grey (5Y 6/2); coarse sand and gravel; loose, friable similar to material above the indurated pan; underlying yellowish-red layer	1.70	5.10	0.07

The Mn layer varies in thickness from 30 to 150 cms. It is roughly horizontal about 3.0 m above the level of the water-table; its position appears to bear no relationship to surface ground topography, so depth from the surface is variable.

These manganese-rich layers occurring in gravel mounds on the higher ground in the area are apparently relicts from a period when the general water-table levels were higher than at present.

Very high levels of manganese are also a feature of certain soils in the area; the highest levels occurring in the alluvial soils, principally of the Ilen Series (Conry and Ryan, 1963). The most characteristic morphological feature of these soils is their very distinctive dark reddish-brown colours. The colours are included with the analytical figures for total iron and total manganese to show the close association between soil colour and the levels of total iron and manganese. It was possible to segregate alluvial soils in the field using the benzidine field test.

Total iron and total manganese in some West Cork soils

Soil	Depth cm	Colour	Total iron %	Total manganese %
Ilen I	0-30	Dark reddish-brown (5YR 3/2)	20.55	1.82
	30-60	Dark reddish-brown (5YR 2/2)	13.00	3.25
	60-75	Dark reddish-brown (2.5YR 3/4)	14.85	2.16
	75-100	Dark reddish-brown (2.5YR 3/4)	17.65	1.80
Ilen II	0-30	Dark reddish-brown (5YR 3/2-2/2)	13.55	2.60
	30-60	Dark reddish-brown (5YR 3/2-2/2)	13.35	2.84
	60-75	Dark reddish-brown (5YR 2/2)	10.37	4.00
Ilen III	0-30	Dark reddish-brown (5YR 3/2)	18.81	1.44
	30-60	Black to dark reddish-brown (5YR 2/1-2/2)	14.50	4.52
Ilen IV	0-30	Dark reddish-brown (5YR 3/2)	14.56	1.88
	30-100	Dark reddish-brown (5YR 2/2)	13.12	4.32

Herbage samples from these soils showed levels of 1,800 ppm of manganese which is greatly in excess of normal. The high levels in the alluvial soils constitute a fertility limitation; the majority of these soils have excellent physical properties, yet, even with adequate manuring and management, their productivity, especially for grass, is low.

Cereal and root crops failed to reach maturity on these soils, the cereals failing to produce grain but spectacular results were obtained with dressings of sodium molybdate and lime.

Farming reclaimed soils

The intensive dairying farm of Mr. Dan O'Mahony, Drimoleague, will be visited. The soils on the farm consist of reclaimed mountain peaty gleys and valley peats.

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STOP B1

British Soil Science Society

Autumn Meeting 1976 Dublin.

Excursion B and E. Wicklow

Analysis for granite profile at Ballysmuttan

Mechanical analyses

Horizon	A_{11}	A_{12}	B_2 (ir)	B_3	C
Depth cms	0-15	15-(30-35)	(30-35) -50	50-60	60^+
Coarse Sand	47	43	41	49	53
Fine Sand	20	21	25	29	30
Silt	23	25	28	16	15
Clay	10	11	6	6	2
pH	6.2	6.4	6.4	6.4	6.3
C%	3.0	2.3	1.1	0.7	0.3
N%	0.36	0.22	0.08		
C/N	8.3	10.5	13.8		
Free Fe_2O_3	0.6	0.2	0.8	0.4	0.2
~~Total~~	90	92	94	97	100

Provisional Classification Borris. Weakly podzolised variant.