ROTHAMSTED RESEARCH

Rothamsted Experimental Station Report for 1983

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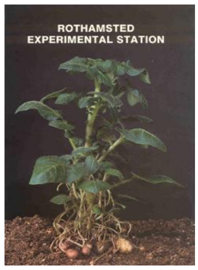

Soil Survey of England and Wales

D. Mackney

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SOIL SURVEY OF ENGLAND AND WALES

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Introduction

A programme is underway to complete a general purpose map of England and Wales at a scale of 1:50 000 and to meet local objectives to survey in more detail for specific purposes.

The 1:50 000 scale map will provide information at farm level for advisory work, and be a basis for improved agriculture land classification maps. It builds on the 1:250 000 scale soil map by improving prediction of soil distribution and reducing map unit variability. Mapping priorities for 1983–86 have been identified in consultation with ADAS, and fieldwork completed for some 700 km^2. In addition work has progressed on three 1:25 000 scale projects where more detailed investigation was appropriate; a special survey has also started on the North Kent Marshes where problems involving structural collapse and the blocking of drainage pipes by clay have attended an extension of arable cropping on difficult soils.

National inventories of peat deposits have been and are currently carried out in many countries, in some of which peat is very extensive, and a major resource of economic value. Although deposits in England and Wales are not extensive (lowlands *ca.* 1% and uplands *ca.* 2%) they have become important in recent years as a processed commodity, a significant proportion being utilized directly by food producing industries. Part of the remaining deposits, especially in the south and east, can be drained to give high quality land suited to cash crops. The rest, mostly in the north and west, is utilized at lower intensity in grassland enterprises, including rough grazing or as nature reserves. In these locations strong representations have been made to protect the remaining peatland from further wastage so that important wetlands and their flora and fauna can be conserved. While much is already known about individual bogs no organization has so far assembled this information in a form suitable for framing a national policy for peatland utilization. The National Lowland Peat Inventory programme (referred to later) is intended to provide new information to aid this process.

The publication of the National Soil Map has increased opportunities to exhibit the work of The Survey. Thus staff have prepared exhibits for the Royal Show and regional agricultural shows, 'Wheat '83', *Farmers Weekly* Drainage Event, the British Grassland Society, The British Cartographic Society and a number of other miscellaneous events.

The British Cartographic Society has recognized the technical quality of the maps by presenting The Survey with the 1983 John Bartholomew Award for 'Excellence in small scale thematic cartography'. The Award is a fine silver salver and a certificate of merit.

Throughout 1983 work has proceeded on a major exhibition aimed at increasing the general public's awareness and knowledge of the nation's soil resources. The exhibition is a joint enterprise of the Survey and Leicestershire Museums and will describe and illustrate the importance of soils in the context of farming, forestry, soil and nature conservation, engineering, land planning, land restoration and archaeology. Entitled 'Down to Earth' the exhibition will open on 12 March 1984 and will travel around Leicestershire Museums, before going to the Royal Show in July, and thereafter to the Geological Museum South Kensington, the National Museum of Wales, and several other venues at least until the spring of 1986. Publication of a new booklet 'Introducing The Soil Survey' will give the general public suitable background information in a clear and illustrative style and will complement other literature to accompany the 'Down to Earth' exhibition.

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Collaboration, consultation and tuition (as appropriate) has continued at levels in line with priority tasks with ADAS, the AFRC Institutes, universities, colleges, local authorities, water authorities, schools and commercial firms.

1:250 000 Scale, National Soil Map

In April the 1:250 000 map was published on schedule and is available to the public in three forms: as individual paper flat sheets; as a boxed library set of six sheets for the whole of England and Wales; and as folded cased maps. A brief explanatory legend booklet is supplied with each map sheet or library set. There has been much interest and sales have been very encouraging.

The six regional bulletins to explain the regional map sheets are now complete and ready for the printer. They will be published in 1984. During the past year regional officers and other senior staff have compiled and edited draft manuscripts together amounting to approximately 2 000 000 words: 380 diagrams and 200 plates have been prepared for publication.

The complex coordination of the texts has been facilitated by the use of word processors installed in April 1981. The ability and enthusiasm of our clerical staff has enabled us to use these machines to their limits with full effect. Considerable savings have been made in staff costs and will be made in printing costs, since both camera-ready copy and word-processed text on disk for direct typesetting have been prepared by Survey staff.

The bulletins cover the six Ministry of Agriculture regions: Northern England, which includes Humberside; Midland and Western England, which includes Lancashire; Eastern England, including Lincolnshire, Northamptonshire and Hertfordshire; South East England including Oxfordshire and Buckinghamshire; South West England; and Wales.

Each bulletin includes a full regional account of the soils in relation to climate, relief, geology and land use. Computer storage of extensive national sets of soil, climatic and other data as well as the use of the word processors has enabled available information to be coordinated in a way not previously possible, for all extensive soils in their environmental context. Each bulletin also includes practical interpretations for land management such as assessments of soil water regimes, of workability periods and drought risks in different climatic zones. These assessments, standardized according to national criteria, are used systematically to evaluate cropping potential and land drainage requirements. Suitability for forestry is also discussed in Wales, Northern England and the South West where this land use is most important. The six bulletins provide a comprehensive review of land resources in England and Wales–the first based on modern soil survey techniques. Although close central coordination has ensured that descriptive data and their interpretations are on a uniform basis, there has been ample scope to outline regional variations descriptively as well as interpretatively wherever necessary. (Hodgson, Thomasson, Regional Officers and their staffs)

1:50 000 Scale mapping

Sheet 81 (Alnwick and Rothbury). Approximately 100 km^2 have been mapped in the Rothbury district. Sheet 81 covers a large part of east Northumberland, from the coast between Craster and Blyth westwards to the Cheviot Hills and Great Bavington. Much is covered by till, derived from Carboniferous rocks, on which stagnogleyic soils predominate. The principal till-free areas are on the Cheviot andesite and the Lower Carboniferous Fell Sandstone near Alnwick and Rothbury. Mapping has been

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concentrated on the Fell Sandstone moorlands which have not been investigated in detail by the Survey before.

The Fell Sandstone is a hard rock giving a distinctive scarp and dipslope topography and the highest land in the district; it is generally under heather moorland. Podzolic soils are widespread, with stagnohumic gley soils and smaller areas of peat and lithomorphic soils. Humo-ferric podzols, although not extensive, mostly occur on the steeper slopes. However, soils on the larger scarp slopes, where soil patterns can be complex, often have ironpan. Podzolic soils on the dipslopes almost always have Bh horizons. On the higher till-free areas sandy humus-ironpan stagnopodzols occur in lithoskeletal drift. These soils often have affinities with the humo-ferric podzols in that the ironpan may overlie a well drained Bs horizon, with little evidence of gleying above the pan. Stagnogley-podzols are widespread on the middle and lower slopes where sandy wash overlies fine loamy till. Humus-ironpan stagnopodzols also occur, with the pan resting directly on gleyed till. Typical gley-podzols have been found in deep sandy drift at the base of slopes but are not extensive. Ironpan stagnopodzols have also been noted.

The Cementstone outcrop also has been investigated near Rothbury. The Cementstones are a sequence of mudstones, sandstones and limestones at the base of the Lower Carboniferous series which has given gently rolling country adjacent to hills formed of the harder Fell Sandstone or andesite. However, the bedrock is mostly covered by deep fine loamy drift on which stagnogleyic brown earths and cambic stagnogley soils occur. Small areas of typical brown earths over sandstone have been noted. Calcareous soils are very infrequent, despite the presence of limestone. (Kilgour and Payton)

Sheet 98 (Wensleydale and Wharfedale). About 110 km^2 have been completed around Grassington, Malham, Clapham and on the Lythe Fells. The soils are mainly over Carboniferous limestone or in till derived from sandstone and shales of the same system. Blanket bog covers much of the land above 300 m OD. The most common series include Wetton, Malham, Brickfield, Wilcocks and Winter Hill. Gravel spreads found unexpectedly near the village of Clapham are dominated by the Hall series (typical brown earths) but with related podzolic and gley soils on adjacent common land. (Carroll)

Sheet 106 (Market Weighton). This mapping commenced in the spring and 60 km^2 were surveyed on the Wolds around Middleton and in the Vale of York near Pocklington and Drax. On the Wolds a thin silty drift covers much of the chalk plateau, giving freely drained brown calcareous earths and brown rendzinas of the Panholes and Andover series respectively. Local areas of decalcified drift, usually identifiable by a very flinty surface layer, have Garston series (argillic brown earths) where chalk is at less than 80 cm and Charity series (argillic brown earths) on deeper drift. Valley sides under cultivation are dominated by the Andover series whereas permanent grassland mostly has grey and humic rendzinas of the Upton and Icknield series. On the lower Wolds dipslope the chalk is overlain by the western edge of the Holderness till sheet. Here fine loamy argillic brown earths of the Ludford and reddish Hunstanton series occur where chalk is relatively near the surface, with stagnogleyic argillic brown earths of the Burlingham series on deeper deposits.

In the vale of York between Market Weighton and Pocklington fine sandy soils predominate. Investigation of these suggests that the sands, mapped largely as the Everingham series (sandy gley soils), are not as thick as previously thought. In many places chalky and flinty gravel, occasionally with peat, is below sand little more than

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80 cm thick, whilst near Holme-on-Spalding-Moor the sand is less than 80 cm thick over Keuper Marl. Here, unnamed sandy over clayey cambic stagnogley soils have been mapped. Romney and Blacktoft soils occur in marine alluvium beside the river Ouse. The main map units elsewhere are Foggathorpe, in glacio-lacustrine clay, and Blackwood–Formby–Everingham, in sandy deposits. In the latter, the distribution of the component soil series depends on the size of the sand fraction and the presence or absence of stones. This flat, featureless land is all under arable cultivation. (Furness, Bradley and King)

Sheet 108 (Liverpool). Some 30 km^2 were surveyed on the Wirral where Clifton and Salop series are common. These typical stagnogley soils are mainly under grass and were often found poached by livestock during the wet spring; compaction due to silage-cutting machinery was also noted with grass regrowth sometimes sparse.(Lea)

Sheet 119 (Buxton, Matlock and Dove Dale). Fieldwork is now complete on Sheet SK06 and has commenced on SK16. The main soils over the Carboniferous Limestone (Malham, Nordrach, Crwbin and Wetton series) have been well studied previously and their pattern of occurrence is predictable. Local areas of soils in Head or deep loess over limestone, however, are less well understood and have required detailed sampling. Malham-Lonsdale intergrades are found, usually over cherty facies of the limestones.

The soil pattern on sandstones and mudstones west of the Dove valley is complex and the fieldwork has been slow due to the large numbers of small (10–20 ha) farms in some parishes. The Bardsey association of the 1:250 000 map has been divided mainly into Bardsey and Brickfield series with small delineations of Heapey soils on moderately steep slopes. The distinction between Bardsey and the similar Dunkeswick series in drift is complicated by the presence in clay subsoils of stones from thin bands of sandstone within mudstone sequences. Land mapped as Rivington association on the 1:250 000 map has mainly Rivington series with Newtondale series on steep slopes.

Above 300 m OD, podzoliation and humose and peaty topsoils are dominant soil features with stagnohumic gley soils developed over mudstones and Head and podzolic soils over sandstones. On the convex and level upper slopes of the Morridge, there is little drift over the mudstones; Ipstones and Onecote series are dominant with small patches of Winter Hill or Hepste series in hill peat. On lower and middle valley sides, thin Head has accumulated and Wilcock or Wenallt series are dominant. Many of the sandstones carry Belmont or Revidge series but the locally reddish Rough Rock, Roaches Grit and Chatsworth Grit have given a suite of podzols which includes Lydcott, Burcombe and Anglezarke series with humose variants of Withnell and Winskill soils. (Reeve and George)

Sheet 131 (Boston and Spalding). Fieldwork commenced on this sheet and about 30 km^2 has been completed near Boston on 1:25 000 sheets TF24, 33, 34 and 44.

There are old, small reclamations near and to the east of Boston, where Rockcliffe, Snargate and Tanvats series, commonly with unnamed silty and silty over clayey gleyic brown alluvial soils, occur in complex patterns with calcareous Romney, Wisbech and Agney soils and silty over clayey gleyic brown calcareous alluvial soils. To the west of Boston, Wallasea and Pepperthorpe soils are more common and clayey over coarse silty pelo-alluvial gley soils have also been noted.

A recent reclamation running northwards from Boston Haven is dominated by calcareous soils, mostly of the Agney series but with some Newchurch, Wisbech and

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Wallasea soils. Parts have been agricultural land for less than five years and here the topsoils have retained depositional laminations; the most recently reclaimed soils are still saline at depth. Recent reclamations along this part of the Lincolnshire coast mostly have soils in this 'medium silt' type rather than the 'light silt' of earlier enclosures. (Heaven)

Sheet 136 (Newtown). Beginning in September about 100 km^2 were map Sheet SO07, north-west of Rhayader in central Wales. This is an upland area of sheep farming and forestry, with some cattle rearing on lower ground.

Manod soils are dominant over Silurian siltstones, with Powys on some ridges and knolls. Parc profiles are common on hilltops above about 450 m, whilst only the highest hills—above 520 m—have stagnopodzols, mainly Hafren series, usually under *Nardus* grassland or heather moor.

Much of the gently to moderately sloping land below about 300 m has Brickfield, Cegin and Greyland soils developed in till. These cambic stagnogley soils are under permanent or ley grassland which is liable to poach in winter. Relatively level parts of the broad Marteg Valley near Bwlch-y-sarnau, along with several other valleys, contain stagnohumic gley soils, mainly Kielder and Mynydd series. The effects of improvement are broadly manifest on these soils, those under *Molinia* grassland or rushy pastures contrasting with others now drained and reseeded and bearing productive ley or permanent pasture. These improvements significantly increase the structural stability and bearing strength of the peaty or humose top soils. (Hartnup)

Sheet 150 (Worcester and the Malverns). Two survey teams commencing work in June have now completed some 200 km^2 on 1:25 000 sheets SP15, SO76 and SO96. The soil pattern on Triassic mudstones, often covered by thin drift deposits, is relatively simple. Fine loamy over clayey Whimple soils are widespread, with Brockhurst soils mainly in receiving sites. Worcester soils have been mapped on drift-free land.

The soil series on fine-grained Triassic sandstones south and east of Great Witley (SO755660) and around Martley (SO756598) have proved difficult to delineate due to the rapid variations in depth to sandstone and the incidence of thin, discontinuous mudstone bands within the succession. Complex patterns of fine loamy soils have also been encountered on terrace deposits north-east of Droitwich. These, and soils developed in reddish tills south of Bromsgrove, have been delineated as compound map units which include Salop, Clifton, Rufford and Flint series.

Near Martley, Palaeozoic siltstones, limestones and shales form a narrow north–south trending ridge linking the Malvern and Abberley Hills of which Rodge and Penny Hills are part. The limestones have shallow soils, either fine loamy Aberford series or fine silty Gatley series. Barton and Yeld series are formed on the siltstones and silty shales, respectively, and the heavier clay shales are dominated by Stanway and Martock series.

Evesham, Haselor and Denchworth soils are extensive on Lower Lias rocks to the west of Stratford-upon-Avon and in the southern parts of sheet SO96. Wickham series has been mapped on thin drift over Lower Lias clays. (Beard, Jones, Palmer, Smith and Whitfield)

Sheet 185 (Winchester and Basingstoke). Most of this land is on the Hampshire chalk and 19 km^2 have been mapped south of Basingstoke and near Winchester. Clay-with-flints mantles the high broad ridges near Overton and Preston Andover and paleo-argillic brown earths are widespread. The fine silty over clayey Carstens series is most common but elsewhere Porton soils with chalk at moderate depth and clayey

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Winchester and Givindale soils are also frequent, especially near Winchester. Seasonally waterlogged Batcombe soils are found locally, for example on high ground near Nerton.

Most of the lower ground has a thin cover of brown silty drift over chalk. Andover soils are dominant on slopes and fine silty brown calcareous earths, Panholes series, and typical argillic brown earths, Garston series, over chalk at moderate depth are also common. Shallow chalky Upton soils occur on steep slopes associated in places with Icknield soils under permanent grass. Deep Charity and Rowton soils cover the floors of most dry valleys. (Moffat and Staines)

1:25 000 Scale mapping

Sheet TL14 and 15 (Biggleswade and St Neots). This is an area with much high grade land and 20 km^2 of Sheets TL14 and 15 have been mapped. The solid rocks are Gault, Lower Greensand and Oxford Clay, covered over much of their outcrop by chalky till. In the Ivel and Ouse valleys there are extensive glaciofluvial and river terrace deposits. The farming pattern is of cereals on the clay soils and market gardening on the lighter land.

Fieldwork was concentrated on the Oxford Clay and chalky till in the west of the district, the former dominated by Evesham series and with a variety of similar soils with clayey drift in the upper 80 cm. Soils on chalky till are mainly Hanslope series, associated with the better drained Stretham series, fitting a pattern recorded by Sturdy and Allen in an earlier unpublished survey of the Shuttleworth Agricultural College farm. Between the Evesham and Hanslope series the St Lawrence series is often found, developed in fine loamy drift over Oxford Clay. (Wright)

Sheet ST01 (Sampford Peverell). This country lies east of Tiverton on Carboniferous sandstones, shales and limestone, and Permo-Triassic breccias, sandstones and mudstones, overlain in places by terrace gravels and alluvium. Mapping of 32 km^2 confirms patterns established in fieldwork for the 1:250 000 survey. Red fine silty soils on Carboniferous sandstone and siltstones are classed as typical brown earths on steep slopes but as stagnogleyic brown earths or stagnogleys elsewhere; a similar range extends over patches of Carboniferous limestone. Brown earths of the Crediton and Newbiggin series are found on Permian breccias, and lighter Bromsgrove and Cuckney soils on Triassic sandstones, with similar but stony soils on the Pebble Beds. Red marls have Whimple and Brockhurst soils and on terraces there are loamy (probably argillic) gley soils like the former Willand series. Dipwells have been installed to monitor water regimes, especially in red soils. (Hogan)

Sheets ST41/51 (South Petherton/Yeovil). Some 25 km^2 of land has been mapped, mainly on the Pennard Sands and Lower Lias silts and clays together with adjacent drifts and alluvium.

The Pennard Sands are dominated by fine silty profiles of the Yeld series, a stagnogleyic argillic brown earth. Associated soils are similar but have a clayey subsoil (Lambrook series), are more strongly gleyed (Stanway series—typical stagnogley soil) or share both features (Martock series—typical stagnogley soil). Winter cereals are common, with commercial apple orchards and some bush fruits in the Lambrook area.

The same suite of soils occurs over the Lower Lias silts and clays but here the wetter members, particularly Stanway series, are more prominent. Dipwells monitored over the winter of 1982/83 and continuing, place Yeld and Lambrook soils in Wetness Class II and Martock series in Wetness Class III. Drifts are both calcareous and siliceous,

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the former derived locally from the Junction Bed Limestone, the latter originating from more distant Greensand Chert Beds at the source of streams draining the area. Bishampton and Ludford series (fine loamy argillic brown earths) characterize the cherty drifts on low terraces. Alluvium is mostly Fladbury series, pelo-alluvial gley soils, in clay locally derived from the Lias. (Colborne and Staines)

National Peat Inventory

The survey of lowland peat soils and deposits continued in East Anglia following the methods described in *Rothamsted Report for 1982*, Part 1, 238. Twenty per cent of the project has now been completed.

Fenland. In the south-eastern Fenland, mainly between Stoke Ferry, Norfolk and Stretham, Cambridgeshire, a further 80 km^2 were covered by 305 auger borings to an average depth of two metres. Some 1800 double samples were taken and on average eight sites on an 0·5 km grid were described and sampled per day.

The pH determinations on fresh peat from the 1982 fieldwork have been plotted for each sampling depth, giving a series of maps clearly indicating the localities and depths at which strongly acid (sulphuric) horizons occur. Also, the paired pH values (for fresh and aerated samples) have been compared and show, that because of oxidation of sulphides, large falls in pH will occur in many layers of peat, marine clay (Fen Clay) and basal sands, upon lowering the watertable, whether to compensate for peat wastage or to improve arterial drainage. This potentially sulphuric material is also being spread over the surface of fields as spoil from drain maintenance, adding to the lime requirement for most crops. The largest individual increase in acidity was from pH 7·1 to 2·2 for basal sand from two metres depth. A total of 61 samples (7%) from 33 profiles (20%) had pH values less than 3, the lowest being 1·7. It is likely, however, that these pH values are 1 to 2 units lower than those of peat *in situ* that has oxidized following field drainage (Bloomfield & Coulter 1973, p. 316). A number of samples from the upper metre of drained profiles had initial pH values around 4 but acidity subsequently increased to values of 2 to 3.

Resurvey of peat areas mapped around Cambridge and Ely between 1950 and 1970 indicated that because of peat wastage, and increased awareness of acid sulphate conditions through pH monitoring, as well as changes in soil classification, the fen districts of these maps could be revised usefully at the present sampling intensity. Revision by desk study was undertaken for the National Soil Map using assumed wastage rates. Actual rates are not easy to judge as the Peat Inventory sampling points rarely coincided with earlier ones and the undulations of the substratum make comparisons unreliable. However, the general trend towards diminishing peat thickness and extent is clear.

High watertable management is commonly practiced now on some large farms to augment the water available to crops during the summer months. It also reduces the rate of peat wastage and slows down pyrite oxidation, thereby reducing the intensity of the acidity but prolonging its period. (Burton and Corbett, with assistants Grose, Heathwaite and Turton).

East Suffolk. In late 1982 and the summer of 1983 the peat survey covered river floodplains and coastal marshland in East Suffolk from Felixstowe to the River Waveney. The floodplains include those of the Deben, Butley, Alde, Minsmere, Blyth, Hundred and Waveney rivers.

The sampling method was changed in 1983 from the 0·5 km grid used on the southern sheets to a system of transects. The original grid was suited to the broad

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stretches of coastal marshland but inland, on narrow twisting valley floors, it gave few sample points and these occurred at varying intervals along the valley floor and in varying positions between the river channel and the upland. To pick up changes in stratigraphy across and along floodplains a new system of grouped sampling points was introduced, the borings 150 m apart at right angles to the river channel with transects spaced at 1·5 km intervals along the valley floor on alternate sides of the channel. This assumes some stratigraphic symmetry on the opposing sides of the floodplain but halves the working time required to gain permission and access.

In the two work periods, using these methods, almost 200 sites were described and 1400 samples collected, the working rate being four to five sites per day.

The deposits vary in thickness from less than 1 m to more than 8 m. Sixty-two per cent of the sites have peat less than 2 m thick; 16% more than 4 m; 3% more than 8 m. On river floodplains this represents a narrow central channel with peat more than 4 m thick flanked by gently graded platforms having less than 2 m. The thickest deposits are on estuarine marshland and, inland, at the confluences of the tributaries.

The nature of the peat varies with the locality but at most sites the deposit can be interpreted relative to the stratigraphic sequence evident in deep peat along the upper Waveney valley. There, with the sandy base at depths up to 6 m, a distinct layer of woody peat is sandwiched between upper and lower layers of sedge peat. Towards floodplain peripheries the bottom of this sequence is progressively truncated and, in the lower sections of river valleys, the top has been eroded and replaced by mineral alluvium. In the middle reaches, near the river channel, the sequence is buried under riverine alluvium up to 1 m thick.

The pH determinations on fresh peat show that at present about 15% of the soils are sulphuric, i.e with a pH less than 4·0 within 80 cm, whilst measurements on aerated peat show 43% of the soils to be sulphuric or potentially sulphuric. Sulphuric soils are distributed in small fairly discrete patches but the potentially sulphuric soils (43%) are ubiquitous and randomly distributed. The present distribution, therefore, probably reflects only local hydrology and land drainage.

When results from peat sampled below 80 cm depth are also accounted, 80% of the sites examined have pH values of less than 4·0, after aeration. This may apply to individual horizons or throughout the profile and pH values between 1 and 2 are common. (Burton and Corbett, with assistants Grose, Heathwaite and Turton)

Cumbria. The lowland peat survey started this year with about 170 deep borings from more than 40 km^2 of moss land along the Solway coast. The results will be of interest to farmers, nature conservationists, peat extraction companies and planning authorities. The farming community is interested in the potential of peat land for improvement and in managing improved land; one management problem is the low permeability of ripened surface horizons which causes surface ponding of rain and, after poaching by livestock, reduces grazing potential. The value of the mosses for nature conservation is recognized and some sites are protected as national Nature Reserves, Sites of Special Scientific Interest or local nature reserves managed by the Cumbria Trust for Nature Conservation. Three mosses are worked commercially for peat moss litter and owners are interested in the reserves of extractable peat and, since this bears on land restoration, in the nature of the mineral subsoil. The planning authority requires an inventory of such deposits to aid long-term land use planning. (Bendelow)

Somerset Moors. From 78 sites (about 35 km^2) sampled in the Upper Brue basin there is confirmation that thin, cotton grass peat extends eastwards from the cut-over peats

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of Westhay and Meare Heaths. North of Meare it is replaced by detrital woody peat occupying the former site of Meare Pool, where it is overlain by calcareous silts and clays. Reed peat occurs in places over the detrital woody peat around Glastonbury, North Moor and Queen's Sedge Moor, while the central part of Queen's Sedge Moor consists largely of sedge peat excepting a low rise south of Harter's Hill with fen moss and cotton grass peat. North of Godney, calcareous silty clays (Romano-British marine transgression) are covered by thin reed and detrital woody peats.

The range in pH values for these peats is somewhat wider than those from the Cary and Parrett basins in the 1981 survey. Most are higher than pH 4·0, with mean values around pH 5·0. (Cope)

Hampshire. Peat in south-east England is most extensive in the large valleys of the Hampshire and Berkshire chalkland. This year, the peat deposits in the Test valley have been investigated by sampling at 100 m intervals along transects 3 km apart. There is wide variation in the distribution and depth of peat and associated deposits, which everywhere are over flint gravels. The peat is 0·1–4·0 m thick, dark coloured and well humified, usually calcareous and incorporates sedge and reed remains and wood fragments. Intercalations of pale-coloured calcareous shelly marl and concretionary tufa are also common and in some places form sinuous ridges slightly above the general level of the valley floor. Where peat is at the surface, earthy eutro-amorphous peat soils, Adventurers' series, are common with earthy sulphuric peat soils, Mendham series, in places. Silty topsoils are widespread and silty over peaty or deep silty calcareous alluvial gley soils, Brissington and Wittering series, are common. Gleyic rendzina-like alluvial soils, Colthrop series, are found over thick tufa. (Allen & Brewer)

Basic and applied research

Mineralogy. The greenish colouration of the B and BC horizons of a Nercwys profile near Bridekirk, Cumbria, has been investigated. The colour is due to the presence of a mineral with a bulk composition close to that of an aluminous-glauconite, which is derived from the underlying basalt. Detailed investigation showed the mineral to be a mixture of celadonite, another mica (probably illite), and a small amount of smectite. This is the first recorded occurrence of celadonite in England. The findings suggest that other reports of aluminous-glauconites may be of similar mixtures. (Loveland and Bendelow)

Bs horizons of coarse loamy brown podzolic soils developed in granite and andesite in the Cheviot, Northumbria, contain unusually large amounts of oxalate-extractable Al. Similar soils in Scotland contain significant amounts of proto imogolite-allophane. We have shown that the English soils contain insufficient oxalate-extractable Si to allocate all the Al to such minerals. Further work is in progress to identify the source and nature of the 'excess' Al. (Loveland and Payton with Dr V. C. Palmer, Macaulay Institute)

Deposits of crystalline gypsum are found discontinuously in the surface clay layer of peat soils in West Sedge Moor, Somerset. The mineral is concentrated at the base of the clay at about 10–25 cm depth and in the peat just below, mainly in old root channels. In the peat, the crystals are fewer but occur in larger clusters along laminations or structure faces and fissures. Some are possibly in voids created by earthworms, but the most recent burrows appear to be clear. The deposits extend in decreasing amounts down to the permanent water-table at about 75–90 cm depth.

Samples from two sites, at Hambridge Drove and near Huntham Farm in West

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Sedge Moor, were examined in the laboratory. Gypsum was confirmed in both profiles by measuring the amount of acid soluble sulphate and by determining the refractive index with immersion liquids. Contents range from 8–19% and, on optical analysis, the white sugary deposits appear as translucent crystals with refractive index about equal to chloro-benzene (1·5245); the refractive index of gypsum lies between 1·520 and 1·530.

The gypsum is probably derived from the adjacent Keuper Marl, but the conditions which have allowed solution and redeposition in this particular locality are still not known; to date these deposits have not been found elsewhere in the Moors.

Sulphur has been reported in the drainage waters of West Sedge Moor at intervals since field drainage was improved by installing pumps about 1973. The white deposits appear at the pipe outlets of field drains and as a scum on the water surface or the sides of ditches. They have been identified as colloidal sulphur using a 'spot-test' (ADAS, Bristol) and similar material found in plastic drainage pipes removed from the peat was confirmed to be sulphur by X-ray methods. (G. Brown, Rothamsted)

The large amount of colloidal sulphur in West Sedge Moor is probably due to the occurrence there of gypsum deposits but its occasional appearance elsewhere in the peat moors suggests that sulphur can also be derived by biochemical decomposition of other peat constituents. (Cope, L. M. Heath and Findlay)

Salt-affected soils. Increasingly large areas of salt-affected soils in marshland in north Kent now under cultivation for winter cereals are showing signs of drain blockage and structural collapse followed by crop failure. The soils belong mostly to the Wallasea series (Sturdy 1976) and, in common with Dutch knip soils and German knickboden, have low subsoil permeability, a large exchangeable sodium percentage and a calcium:magnesium ratio of less than 3. In the Netherlands, the last two properties are regarded as relict features, but confer on knip soils such unfavourable physical properties that grassland is the preferred use. Analysis of laboratory data from preliminary surveys in North Kent suggests that the dispersion ratio (MAFF 1982) as a measure of instability, increases in these soils as exchangeable sodium increases and as organic matter content decreases. Conductivity measurements have shown that salinity commonly increases with depth, with nearly all the soils in the slight (conductivity >2–<4 mS cm^{-1}) and moderate (conductivity >4–<8 mS cm^{-1}) salinity classes (USDA 1954). Further field and laboratory work in progress is designed to relate these findings to the soil pattern on the ground, both under arable farming and traditional grassland, and to devise a suitable risk assessment for the problem. (Loveland, Sturdy, Hazelden, with Mr M. Marks, ADAS)

Air-water properties of soils. Air-water properties of soils are of major importance in assessing soil constraints to the use of land for a variety of purposes. A project has been started to determine the extent to which sufficiently accurate estimates of these properties can be made in the field from careful observation of soil profiles. The project has been conducted in three stages. Stage 1 involved the detailed description of an Evesham soil (calcareous pelosol) from Silsoe, Bedfordshire with special reference to structure, porosity, consistency and rooting depth. The profile was described at three different moisture contents, care being taken to select wet and dry extremes and an intermediate condition. Following these detailed descriptions, estimates were made of packing density, air porosity, available water capacity and saturated hydraulic conductivity (Ksat) from the morphological properties described.

In Stage 2 a number of field and laboratory measurements of air-water properties were made. These included Ksat by the auger-hole method, water regimes in dipwells,

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soil strength by hand penetrometer, moisture retention and bulk density measurements on triplicate cores, shrink-swell potential by the saran-coated clod method and pore space by image analysis.

Finally, estimates based on field morphology were compared with the field and laboratory measurements. For the two properties that have been completed—Ksat and available water capacity—there is a good correspondence between the two approaches; other measurements have yet to be completed. Other soils need to be similarly investigated and the work is continuing but, for clayey soils in particular, it appears that good estimates of air-water properties can be derived from field descriptions of soil morphology. (Bullock and Dr J. A. McKeague, Land Resource Research Institute, Ottawa, Canada)

Quantification of soil structure. This research aims to develop methods of measuring parameters for describing soil structure seen in 2-D sections of impregnated soil blocks.

Two systems have been developed using the Quantimet 720 image analyser to measure images of pore space taken by fluorescent photography. The first system, ANOPOR, classifies the outlines of individual pores into the most likely pore class using Bayesian statistics. The pore classes—planes, channels and vughs—were chosen because they have very different 3-D shapes resulting from their different origins and functions, for example with respect to water movement. These shape differences also give very different 2-D images and, using the mathematical tools of stereology, measurements of these can be interpreted as 3-D parameters describing structure. The system can be used to estimate the porosity and surface area associated with each pore class in a soil. Measuring the size distribution of each class is a further development and the ultimate aim is to establish a model to describe pore space in soil.

The second system, ANOSOL, measures the intercept length distribution. This cannot classify pore space morphologically like ANOPOR but can analyse much more complex structures, such as compound packing. The shapes of the distribution can be modelled using the Maximum Likelihood Program to provide parameters describing the structure.

These systems are currently being used in three projects:

1. To classify a wide range of soil structures, using parameters from ANOPOR;
2. To measure seasonal changes in soil structure in a heavy clay soil of the Denchworth series;
3. To investigate differences in the structure of the same soil under different land uses and to find the level of replication necessary to quantitatively measure the structure in a given soil. (Ringrose-Voase and Bullock)

Soil water regimes. Eight sites, where exploitation of soil available water by grassland has been studied using neutron probes, were sampled finally and closed down. Interim results for the Staffordshire sites have already been published, but the data set is now being analysed as a whole. It is clear that different soils affect rooting differently. In the Dale series, a surface-water gley soil, root extension in spring keeps pace with the falling water-table and its capillary fringe. Consequently, soil available water as conventionally defined is used only during sustained dry periods. On the site with Wick series, a stony coarse loamy soil without a water-table, grass growth begins earlier due to warmer soil temperatures and the available water is rapidly exploited to 1·2 m, though most efficiently in the top 50 cm of the profile. Summer growth is sustained only by temporary re-wetting of this upper zone by rainfall.

The remaining four neutron probe sites on Dale, Hodnet, Worcester and Salop

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series form part of an expanded programme of neutron probe investigations under a range of crops. (Reeve, Carter and Royston)

A reinvestigation of field capacity matric suction was made in the light of recent research indicating that sandy soils drain to an equilibrium suction of about 0·1 bar, rather than the 0·05 bar used by Soil Survey to define the upper limit of available water. Tensiometers installed on eleven soils (Rivington, Newport, Elmton, Nocton, Downholland, Fyfield, Wisbech, Cuckney, Wick, Alun and Sellack series) were used to record tensions 2–3 days after heavy rainfall. There was no evidence that the sandy soils drained to a consistently higher suction than the other freely draining soils. A mean value for all soils monitored was between 0·03 and 0·05 bar. No single suction can be correct for a range of soil types but the investigation supports the use of 0·05 bar which presently defines the upper limit of available water. (Carter, with others)

Soil potassium. Clay ($<2\,\mu$m) contents, estimates of potassic mica and expansible mineral (mainly smectite) contents of the clay fractions and K extractable by (i) a Ca-resin, and (ii) 20% HCl, have been tested against the K content of crops at harvest to see if these measurements accurately assess soil K and its availability to crops. Only K extractable by Ca-resin correlated significantly with the K content of the crops. However, K extracted by 20% (v/v) HCl correlated closely ($P<0{\cdot}001$) with a combination of clay and potassic mica contents of the soils. Thus, HCl extraction seems to estimate total available K reserves in the soil, but these reserves do not appear to directly determine K supply to crops. The latter must be estimated by a separate Ca-resin procedure. Further work is in progress to establish the nature of the K extracted by HCl and to devise a method of relating soil mineralogy to soil K parameters. (Loveland with Goulding, Soils and Plant Nutrition Department)

Soil erosion. Air photographs of 16 localities widely spread throughout England and Wales were taken by the MAFF Aerial Photography Unit; an area around Lewes was included this year following significant erosion in Sussex in the winter of 1982–83. Because of poor weather in spring most of the flights were delayed until June and July. Eroded fields, identified on the photographs and then visited, proved to be more frequent than last year. In only two localities, mainly under winter cereals in Bedfordshire/Cambridgeshire and Herefordshire, were eroded fields similar in number or fewer than last year. On average about twice as many fields within the sample localities were eroded in 1983 as in 1982; in Norfolk the factor was 8, in Nottinghamshire 6 and in Hampshire, Dorset, Somerset and Staffordshire 3. In Sussex, Dorset, Somerset and Norfolk there were more days with more than 10 mm rainfall, sufficient to cause erosion, in November and December 1982 than in 1981. In Norfolk, Staffordshire, Nottinghamshire and Shropshire there were more potentially eroding rainfalls this spring than last and this gave correspondingly more erosion in spring sown crops, especially sugar beet. In most localities erosion under winter cereals amounted to only about 60% of total erosion, but in Herefordshire, Cambridgeshire and Bedfordshire it accounted for about 80%. (Evans)

From September 1982 to June 1983, 40 fields chosen at random on Sheets ST41/51 were visited each month and erosion measured on fixed traverses. The high rainfall of this winter provided an excellent opportunity to monitor erosion rates under a variety of crops. Most erosion was encountered under winter cereals whereas fields with spring cereals, sugar beet, potatoes and maize suffered little erosion, principally because of the dry early summer. Of the 20 winter cereal fields examined 14 lost more than 1 $m^3\ ha^{-1}$ of soil, two fields more than 10 $m^3\ ha^{-1}$ and one more than 20 $m^3\ ha^{-1}$. Most erosion occurred during January although much was initiated during November.

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Much erosion appears to start in wheelings which often run downslope. Simple statistical analysis relating amount of erosion to slope, wheeling density, clay content and organic carbon provided few good linear relationships. However, grouping fields with greater than, and less than, 4 m^3 soil loss ha^{-1} showed that the more eroded fields are on average slightly steeper and have a lower organic carbon content than less eroded fields. The work has shown that the light textured soils, principally South Petherton and Bridport series in the Yeovil and South Petherton district, are very prone to erosion at times when heavy rain falls on fields with little or no crop cover, particularly if the soils have returned to field capacity after winter cereals have been sown. (Staines and Colborne)

Remote sensing—The SAR 580 Project. The sampling programme to collect data on soil moisture, surface roughness and crop cover, and the preliminary visual interpretations of the synthetic aperture radar images obtained over Eastern England in two flights of 16 and 30 June 1981 were described briefly in the *Rothamsted Report for 1981* and *1982*. In spring 1983 the digital tapes of the x and c band images, prepared by the Royal Aircraft Establishment, were sampled for radar signal strength and these values were related to the data derived from the field sampling programme. The x band radar correlates better than does c band radar with surface roughness, a measure of both soil roughness and plant height, and with soil moisture content of the top 5 cm of soil. For the flight of 16 June surface roughness correlates better with the radar signal than does soil moisture content; correlation coefficients of x band radar to roughness were in the range 0·81–0·85, and for soil moisture 0·73–0·78, whereas for c band radar the ranges were respectively 0·66–0·85 and 0·43–0·47. It is difficult to relate results from the flight of 30 June to those of 16 June. The later flight gave less consistent results and generally poorer correlations between surface properties and the radar signal which may be attributed to a number of causes: fewer and perhaps insufficient fields were sampled compared to the 16 June flight; only one soil type was sampled and at a time when neither soil moisture nor surface roughness showed much variation; and the strength of the radar signal returned to the aircraft varied markedly across the width of the image swath. The fields were in two clusters, one near the centre of the swath and one near the edge. From these results it seems unlikely that radar will be immediately useful for mapping soils or soil properties. (Evans)

Methodological research

Soil classification. A draft for the Technical Monograph 'Criteria for Differentiating Soil Series' was completed. An introductory chapter gives the general historical background to the soil series concept in England and Wales and establishes the present aim of defining soil series as the lowest taxonomic unit in our classification system. Central chapters detail the methods and criteria used to define soil series and a concluding chapter contains the revised definitions of all rationalized soil series recognized in England and Wales up to 1982. To help users identify changes to previously established series, the historical development and present status of all soil series mentioned in Survey publications is listed alphabetically in an Appendix. (Hollis)

Mapping methodology. The soil series is now firmly established as the lowest *taxonomic unit* within a precisely defined classification system. Nationally, for general purpose soil surveys, the soil series also remains the best basis for characterizing *map units*. To achieve consistency here map units need to be defined in terms of the

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proportions of their component series and for this purpose, the concept of *simple* and *compound* map units is being developed.

It is proposed that definitions of both simple and compound map units should include the concept of *similar soils*. Two soils are *similar* when they have no more than three different diagnostic properties, i.e. no more than three diagnostic properties are unique to one or other of the soils, and the range of their definitive properties is not significantly different. A table giving the range of definitive properties allowed within similar soils is being developed and tested.

Using the similar soils concept, two types of map unit are proposed:

(a) Simple map units are those in which most of the component soils are similar and have a range of properties as small or smaller than the range allowed within a single taxonomic unit. Simple map units are named from their predominant soil series;
(b) Compound map units are those in which a significant proportion of the component soils are dissimilar. They are named from their two or three most common dissimilar series.

Definitions of simple and compound map units based on the proportions of similar soils and the presence or absence of limiting inclusions within each map delineation are being tested.

It is proposed that during the present 1:50 000 and 1:25 000 mapping programmes, map units be assessed either from a minimum of ten borings per map delineation or from the surveyor's expert estimation of the proportions and extent of similar and dissimilar soils within a delineation. Such estimations will use relevant information from previous detailed mapping. (Hollis)

Podzolic soils. The differentiation of Bs from Bw horizons in brown podzolic soils and brown earths (Avery, 1980) has been assessed for 278 horizons in terms of:

(i) soil colour (Munsell value and chroma);
(ii) pyrophosphate-extractable Fe and Al in relation to measured clay content;
(iii) soil structure.

It has been shown that:

(a) soil colour alone is an unreliable differentiator;
(b) Bs horizons tend to have a finer, weaker and more granular structure than Bw horizons, but the class boundary is diffuse;
(c) combinations of soil colour with pyrophosphate data show no natural clustering.

In practice the only systematic differentiator between Bs and Bw horizons is the pyrophosphate data, which do not relate particularly well to field criteria.

Work is in progress to obtain an improved assessment of the structure of these horizons as a further aid to their differentiation. (Loveland and Williams)

Laboratory automation. Microprocessor controllable instruments have been built for the determination of soil pH and organic carbon content. An automatic fraction collector for use in particle-size analysis is nearing completion. (Loveland with Summerfield, Computing Unit, and Edwards, Instrument Workshops)

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Data management. Progress on the establishment of the Soil Survey Information System has been maintained. Work on this system can be regarded under three headings: Stage 1, data validation, conversion, error correction and updating; Stage 2, database management; Stage 3, interface of the systems with other software.

In Stage 1, approximately 90 000 purposive records from the 1:250 000 survey have now been secured on to magnetic tape. The system for validation of field records is now operational and 5000 National Soil Inventory and 7000 purposive records have been processed. All the programming and parameter coding for data validation and conversion of 1900 comprehensive profile descriptions, together with associated laboratory records, has been written and proven. The processing of this data will be undertaken on the new VAX 11/750 machine either late in 1983 or early 1984. The method of recording data in our laboratories at Rothamsted has been redesigned to give greater flexibility in recording and retrieving. Changes to Stage 1 software for the VAX 11/750 have been made and operational processing on the new machine has just been implemented.

Some of the validated data referred to above has been transferred to the VAX 11/750 for Stage 2 trials with the database management system Datatrieve. So far, these trials have been encouraging, but work on the design of the relational structure of the many databases now held must be completed before further data manipulation is undertaken. At a high level this structure is likely to be:

1. Point data	field; laboratory; altitude.
2. Raster data	National map units; profile available water; agro-climate; administrative areas.
3. Other data	National map legend; National map unit areas; Soil Survey publications; National catalogue of soil series (NATCAT).

The system to handle soil moisture analyses currently running on System 4, has been redesigned and a systems specification written for execution on the Midas micro-computer at Shardlow. As an interim measure, until this new system has been written and implemented, soil physical data for approximately 3000 soil horizons has been duplicated on the Midas with updates being made approximately twice a year from System 4. A suite of user friendly dBASE II programs have been written to manipulate this database quickly and easily. Several other dBASE II programs have also been written to manipulate a catalogue of 660 rationalized soil series definitions, the National and Regional map legends and the areas of every National map unit on a county, regional or national basis.

Software for the Microfin terminal has been written and a small field trial carried out. The data collected was successfully transmitted from Penrith over the public telephone to an Apple computer at Rothamsted using acoustic couplers. A number of software changes are needed before further field trials can be made.

As a by-product of cartographic work carried out by Institut Geographique Nationale, Paris, map units for the 1:25 000 sheets SP27/37 (Coventry South) are now held in raster format on the Prime 550 computer. There are three files, the initial rasterfile of 3×3 m cells, 25×25 m cells and 50×50 m cells. A number of thematic maps have been produced from this database using the AREAS package.

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Progress has been made towards resolving the temperature, moisture deficit and field capacity datasets to a 5 × 5 km grid but, with transfer of all agro-climatic data to the VAX 11/750 imminent, the work may not be completed by the end of the year. A 5 km matrix of annual average rainfall, 1941–70, has already been transferred from magnetic tape to the new machine. It is hoped that Datatrieve and other DBMS packages will greatly improve access to the agro-climatic data and allow interfacing with other files in the soil information system.

A few *ad hoc* programs have been written, mainly to retrieve information from databases on System 4 and to experiment with the creation and manipulation of soil data derived from farm surveys and held at present on the Midas microcomputer.

Discussions have commenced with the Computing Unit on the use of microprocessors in the Shardlow and Rothamsted laboratories. (Proctor, Jones, Ragg and Bailey)

The multifield alphanumeric catalogues of soil information built up in dBASE II on the Midas microcomputer at Shardlow have been expanded to include:

1. Profile available water, AP (Thomasson 1979), for about 370 soil series;
2. Workability assessments (Thomasson 1982) for approximately 400 soil series;
3. Wetness class (Hodgson 1976) with drainage for approximately 500 soil series.

All these soil series belong to the list rationalized by Clayden and Hollis (1984) which contains about 690 entries. Separate files listing depth to an impermeable horizon and the retained water capacity of surface soil are being developed and work is continually in hand to update and expand the lists described above. (Jones)

Supporting work

Soil water retention and soil engineering. Soil water retention properties have been measured on nearly 800 samples from over 70 profiles during the last year. Many were samples from profiles dug to characterize map units on the National Soil Map. The coefficient of linear extensibility (COLE) was determined for selected samples using the clod method. Atterberg and linear shrinkage tests were made on soil from the proposed Bleak House opencast site.

Work has been in progress to increase the capacity of the Shardlow laboratory. Additional pressure membrane cells and tension tables have increased laboratory capacity by 50%, and improved pressure regulation to the cells has shortened equilibration time. Processing of laboratory data will be speeded by using the Midas computer on site. Soil physical data for approximately 3000 soil horizons from a wide range of soils is now held on the Midas and can be manipulated and retrieved using any combination or level of the stored parameters; these include soil series and soil subgroup; horizon type; particle-size class and stone content; organic carbon content; bulk, packing and particle densities; water retained at 0·05, 0·1, 0·4, 2 and 15 bar; available water; and air capacity. (Reeve, Carter and Royston)

Soil water regimes. Dipwells were installed in two undrained sites of the Denchworth and Evesham series at Shuttleworth Agricultural College, Bedfordshire, and read weekly from November to June. Water levels in the Evesham series remained above 40 cm for the whole period, while levels in the Denchworth were consistently about 10 cm lower, falling below 40 cm for several weeks. (Wright)

At Skipwith Common, hydraulic conductivity measurements were made on selected profiles and water level monitoring continued. (Furness)

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Monitoring of dipwells near Selborne and Petersfield has been completed and the relationship between rainfall and water level is being modelled. Four soil profiles have been fully described and sampled for analysis. (A. J. Moffatt and M. G. Jarvis).

Some 110 sites (184 site years) with dipwell water level data for drained and undrained fields on the same soil series were verified for the Field Drainage Experimental Unit. The data will be analysed statistically by FDEU staff to determine changes in the incidence and duration of waterlogging after drainage. (Robson)

National Soil Inventory (NSI) pilot study. A computer mapping program was written to display grid sample points correctly classified on the National Map. The results confirm pictorially, previous estimates of map unit purity. (Rudeforth)

Soil micromorphology. Some 550 thin sections were made, partly to provide micromorphological data for profiles representative of units on the 1:250 000 National Map and partly for research purposes.

Images of pore space are now taken by photographing flat faces of impregnated blocks in UV light rather than from thin sections. This obviates the need for as many thin sections and more attention can be given to more representative sampling of soils for pore space measurement. (Bullock, Murphy and Fullstone)

Special and contract surveys

Work for ADAS. Maps of land capability for agricultural assessment and drainage need within the Yorkshire Dales National Park were produced at 1:100 000 scale. These maps were based on information collected during the National Soil Map programme, earlier reconnaissance soil mapping and the Survey's agro-climatic data. (Carroll)

A report was prepared for the Rural Planning Research Trust on the soils of the Eden District Study Area. The report included detailed soil surveys of nine farms covering a total area of 17 km^2. For each soil series identified, an assessment was made of drainage need, trafficability, poaching risk, grassland suitability, relative grazing value, ease of cultivation and limitations to forestry. (Bendelow)

A paper on soil type and the distribution of the snail host of the liver fluke has been written and accepted for publication. This study with P. W. Swire (ADAS) is concluded. (Wright)

Soil maps were prepared for the 'Barley '84' demonstration site at Great Smeaton, and a proposed experimental site at Nun Monkton, North Yorkshire. (Bradley)

Soil reports were constructed for winter sown cereal trials, and drainage trial sites. (Bradley, Fordham, Furness, Payton and King)

Information was supplied to the Land and Water Service for a public enquiry into a proposed gas main at Sunk Island, Humberside. (King)

A new detailed soil survey of Bridgets Experimental Husbandry Farm is being prepared. (Moffat)

The soils at experimental sites in Buckinghamshire, Hampshire and Berkshire were identified. (Moffat and Jarvis)

A description and map, based on National Map Units, of the soils of the Vale of Evesham was prepared for a booklet entitled 'Horticulture in the Vale of Evesham' to be published by ADAS, Evesham Area Office. (Smith)

Cereal irrigation plots at Gleadthorpe EHF were examined in detail for soil variability and sampled for moisture retention determinations. (Reeve)

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Other work. Soil maps and reports were provided for the following opencast coal sites: South Wales—Nant Helen (300 ha), Staffordshire—Bleak House (800 ha). (Palmer, Smith, Hartnup and Rudeforth)

Six National Trust farms totalling 9 km^2, five in Borrowdale and one in Keskadale were surveyed. A land evaluation is in preparation for estate management use in an area where amenity, as well as productivity, is important. (Bendelow)

A detailed survey was made of the Ingleborough Estate, North Yorkshire (*ca.* 12 km^2) with less detailed survey of the surrounding common land. (Carroll)

A 1:2500 soil map of Harlow Car Gardens, Harrogate, was made for the Northern Horticultural Society. (Bradley)

A detailed soil map was made of the Norfolk Agricultural Station at Morley St Botolph to correlate the soils with the Soil Map of Norfolk and the National Soil Map. The Station is underlain by chalky till with a lighter flinty drift cover, giving sandy loam and sandy clay loam topsoils. Ashley and Burlingham series predominate with some Beccles and Maplestead series, the latter associated with polygonal crop patterns evident on air photographs. (Wright)

The relationship between plant communities and soils on heathland and in valley mires in the New Forest is being investigated by grid sampling. (R. H. Allen with Mr M. Clarke, Southampton University)

Data on the water retention and density characteristics of 20 of the principal soils of England and Wales were provided for ICI. Similar information on lowland peats was supplied to Aberdeen University. (Carter)

At the request of the Anglian Water Authority soils within a 16 km radius of Luton were assessed for their suitability for the application of sewage sludge by injection. (Wright)

A range of soils were selected for the National Radiological Protection Board so that the uptake by plants of radioactive material could be investigated. (Hazelden and Moffat)

Some 60 ha of land were mapped near Lenham, Kent to assist drainage design and management for winter cereals. (Sturdy)

The available water in soils near Deal for various crops was assessed at the request of Kent Salads Ltd. (Hazelden)

The soils under fenland vegetation in Oxfordshire have been identified as part of a Nature Conservancy Council survey. (Allen)

A report on the soils of five wetland sites was made at the request of the National College of Agricultural Engineering. (Hodge and Wright)

A soils and vegetation field exercise was organized on the North Lees Estate, Derbyshire, for secondary school teachers attending a practical field geography course held annually at the Peak National Park Study Centre. (Reeve)

The soil of the Rothamsted Little Knott shelter experiment was fully described and sampled. (Reeve)

The Institute of Hydrology has been assisted in its development of a hydrological classification of soils for the European Flood Study. Winter rainfall acceptance potential (WRAP) assessments have been checked for soils in Belgium, The Netherlands, Denmark, Federal Republic of Germany and France north of latitude 45°N and national tables were produced of the European Community soil association units and the appropriate WRAP class using the 1:1 000 000 soil map of Europe, information from national soil scientists and data from gauged catchments throughout Europe. (Robson and Heaven)

The soils at two experimental sites were described for the Letcombe Laboratory. Assessments were also made of two proposed sites. (M. G. Jarvis and Moffat)

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Farm surveys under contract amounting to some 2000 hectares, have been completed. For one survey, data files listing soil properties, workability and droughtiness for individual fields were assembled on a Midas microcomputer, to demonstrate how such data can contribute to a farm management computer system. (Ragg, Jones, Smith, Whitfield, Wright, Staines and Fordham)

Soil and drainage design maps were provided under contract to Lawrence Gould Associates for 82 ha near Eardisley, Herefordshire. (Palmer and Smith)

A large bulk peat sample (1·25 m × 0·5 m × 0·5 m) was taken from the Morridge near Leek for Marconi Electronics, with the aid of a local contractor. A short report on the methods used has been written. (Jones and Hodgson)

Part of the RASE autumn cultivation site was resurveyed at the request of the Soil and Water Management Association. Soil compaction and the effects of various subsoiling treatments were demonstrated to visiting farmers. (Beard and Whitfield)

Staff

Staff changes in 1983 were few. Ruth Murphy retired after 13 years service, nearly ten of which were as Personal Secretary to the Head of Survey, and Amanda Frith has been appointed. Other retirements were Sheila Talbot from the Cartography Section and Rosemary Haggerty from the Laboratory. Jenny O'Donnell resigned and the vacancy in Publications has been filled by Christine Lapwood.

C. Smith was appointed and posted to the Wolverhampton sub-centre. J. M. Hodgson transferred to Rothamsted to take responsibility for Field Surveys, and H. George from Lincoln to the Derby centre.

Helen Page returned to Lanchester Polytechnic on completion of her year as a sandwich student and was replaced by T. Brewer.

D. Mackney and Mary Proctor attended the International Society of Soil Science Working Group on Soil Information Systems at Bolkesjo, Norway. D. Mackney also attended the EEC Programme Committee Meetings on Land Use and Rural Resources in Thessaloniki (Greece) in May, and Brussels in November. A. J. Thomasson and D. Mackney joined an EEC Seminar on Soil Survey and Land Evaluation in Wageningen, Netherlands in September.

A. J. Thomasson visited Dijon, France to examine field experiments on land drainage and tillage and also Yugoslavia to discuss drainage problems with staff of the Institute of Agroecology at the University of Zagreb. J. M. Hollis attended the 3rd Meeting of an International Reference Base for Soil Classification held in Bulgaria. The aim of the Reference Base is to produce an internationally agreed classification system through which the different national or organizational classification systems can be correlated and harmonized. P. J. Loveland attended the 5th Meeting of the European Clay Groups in Prague, Czechoslovakia and gave a paper. He and R. G. Sturdy also visited the Soil Survey Institute of the Netherlands to discuss the identification, classification and mapping of salt-affected soils. This was to aid the planning of our own special survey of saline soils of North Kent, which is now underway.

M. G. Jarvis continued to represent Soil Survey on the council and technical committee of the Soil and Water Management Association and the Public Agencies Committee of the Ordnance Survey. R. G. O. Burton attended meetings of the Fenland Research Committee.

Two further issues of the Staff Newsletter were produced by T. R. E. Thompson.

Visiting Workers. Dr. J. A. McKeague, visiting scientist from the Land Resource Research Institute, Ottawa, returned to Canada after a year with the Survey working on soil micromorphology and measurement of soil structure.

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