ROTHAMSTED RESEARCH

Rothamsted Experimental Station Report for 1984

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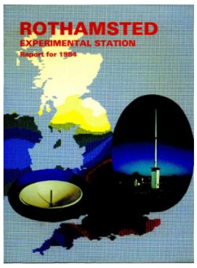

Soil Survey of England and Wales

D. Mackney

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SOIL SURVEY OF ENGLAND AND WALES

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Introduction

During the year the return to detailed mapping continued as further staff were released from writing and editing the regional bulletins. Surveys for publication at a scale of 1:50000 are now well underway in five regions and 3580 km^2 were completed at this scale. In Eastern Region much of the effort has been concentrated on the National Lowland Peat Inventory during which mapping and sampling covered 280 km^2 nationally. Surveys at a scale of 1:10000 for publication at 1:25000 continued in Bedfordshire, Somerset and Devon. In total 320 km^2 were covered and Sheets ST01 and ST41/51 are now completed and about to be written up.

The network of National Soil Inventory observations was almost completed during the year with the sampling of over 600 outstanding points, mainly in districts with old detailed mapping. The samples are currently being analysed by the Survey and the Soils Division at Rothamsted and by ADAS.

1:50000 Scale mapping

Sheet 81 (Alnwick and Rothbury). A further 290 km^2 have been mapped, on the coastal plain, the Fell Sandstone moorlands, the Cheviot Hills and in Harwood Forest. Although stagnogley soils predominate on the gently undulating lowlands near the coast, significant areas of coarse loamy and sandy glaciofluvial drift with brown earths, brown sands and sandy gley soils have also been mapped. These soils are more extensive than was first thought and form some of the best land in the district. Mapping on the Fell Sandstone has shown that humus-ironpan stagnopodzols and stagnogley podzols are extensive, whereas humo-ferric podzols are uncommon.

Mapping began this year on the Cheviot Hills. At lower altitudes, brown podzolic soils are widespread on moderately steep slopes. Their Bs horizons are particularly well developed and show several features of soils on volcanic rocks; such as very low packing density, fluffy and slippery consistence, large water-holding capacity and relatively high levels of oxalate-extractable iron and aluminium. With increasing altitude, organic matter levels in surface horizons increase to give humose and then peaty topsoils, this effect being accentuated on north-facing slopes. Soils grade progressively into stagnopodzols and finally into raw peat soils at the highest altitudes, where slopes flatten into gently sloping convex summits. Ferric stagnopodzols are as common as ironpan stagnopodzols, which suggests an intermediate stage of soil development between humic brown podzolic soils and ironpan stagnopodzols. The soils are mainly moderately to very stony and loamy over lithoskeletal basic igneous rock. Some stagnopodzols have developed over granitic parent materials.

Harwood Forest and its surrounds are mostly covered by till with cambic stagnohumic gley soils and cambic stagnogley soils. However on steeper slopes and hillocks ironpans invariably develop, but with no Bh horizon above the pan as on the higher Fell Sandstone land. The presence of a Bh horizon is usually related to the sandy nature of the upper soil horizons. Where these are loamy, as at Harwood Forest, this horizon is absent and ironpan stangopodzols are mapped. These are of two main types, one being in loamy drift over lithoskeletal sandstone (Belmont series) and the other (unnamed) in deep loamy drift. (Kilgour and Payton)

Sheet 98 (Wensleydale and Wharfedale). Fieldwork has continued mainly in the western part of the sheet, from the Howgill Fells in the north to the Bowland hills in the south. About 400 km^2 have been surveyed, mostly in the Yorkshire Dales National Park. The ground to the west of the Dent fault is underlain by Lower Palaeozoic sedimentary rocks. In the Rawthey valley, the soils under permanent pasture are brown earths with some stagnogley

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soils. Locally severe erosion has been noted here. Under bracken and heather on higher slopes there are brown podzolic soils, Manod series, or stagnopodzols, Hiraethog or Hafren series. The rounded summits have humic rankers (Skiddaw series) or raw peat soils (Crowdy series).

Several Sites of Special Scientific Interest and National Nature Reserves have been mapped and this district also contains some of the best examples of limestone pavement in Britain. Although short-range variation is a marked feature of such sites, the overall pattern of soil distribution is simple and predictable. Many pavements consist of bare expanses of rock and the steeper slopes are craggy and mantled by scree. The commonest soils belong to Wetton series, humic rankers, although there are in places extensive areas of the equally shallow, but less humose, Crwbin series. Rendzinas are sometimes found on scree slopes where the content of bases in the soil is being continually replenished. Brown earths and stagnopodzols are confined to pockets of drift overlying the limestone; this is most often loamy till but at Malham and Grassington the soils contain significant amounts of silty aeolian material. The higher ground is dominated by stagnohumic gley soils mainly in till, but some profiles are principally developed in clay-shales. Deep raw peat soils, Winter Hill series, cover much of the highest land, including the summits of Simon Fell, Whernside, and Widdale, Baugh and Great Shunner Fells. The steep slopes of the larger hills are characterized by rankers and stagnopodzols.

The drumlins of the lowlands to the south of the Craven fault are mostly in permanent pasture and have stagnogley soils, predominantly of Brickfield and Greyland series; the corresponding stagnohumic gley soils are found on common land and unenclosed land. There are a variety of soils in the glaciolacustrine, alluvial or peat deposits between the drumlins, but these level areas are often too small to distinguish at 1:50000 scale. The till is thinner towards the fault-line and sandstones and shales are sometimes exposed, with soils such as Revidge and Withnell, or Bardsey and Dale series, respectively. Raw peat soils predominate at altitudes over 300 m as the land rises towards the Bowland hills. (Carroll and Bendelow)

Sheet 106 (Market Weighton). Approximately 500 km^2 were surveyed on the Wolds, in the eastern Vale of York and on the warplands of the river Ouse between Goole and Selby. In addition, 60 km^2 of earlier mapping was revised in adjoining districts. A preliminary check on the 1:25000 published Sheet SE65 (York East) showed that the mapped soil boundaries can be used in preparing the 1:50000 map units.

On the Wolds, soils in widespread thin silty calcareous drift are mapped as Andover or Panholes series, depending on the thickness of the drift. Local areas of decalcified drift can usually be recognized by their flinty topsoils: the Garston series has chalk at less than 80 cm, the Charity series is in thicker drift and the Porton series becomes clayey at depth, overlies chalk within 80 cm and displays paleo-argillic features. Valley sides, and the western escarpment, are dominated by the Andover series where cultivated, but by grey and humic rendzinas of the Upton and Icknield series under permanent grass. Near Market Weighton, however, the escarpment is covered by blown sand, giving soils of the Newmarket, Swaffham Prior and Methwold series. On the lower Wolds dipslope, around Middleton-on-the-Wolds, the chalk is overlain by a drift representing the western limit of the Holderness till. Here, freely drained fine loamy soils of the Ludford and reddish Hunstanton series on the higher ground pass downslope into seasonally waterlogged soils.

In the Vale of York between Pocklington, Market Weighton and Gilberdyke, fine sandy soils predominate with small areas of peat (Adventurers' series) in depressions and along river courses, especially around Hotham Carrs. In areas mapped largely as Everingham series the sand is not as thick as previously thought. In many localities chalk and flint gravel occurs at little more than 80 cm depth, whilst near Holme-upon-Spalding-Moor, Mercia

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Mudstone (Keuper Marl) occurs under the sand at less than 80 cm. A radiocarbon age of 11 540 years BP, obtained from a buried peat sample collected near Holme-upon-Spalding-Moor, suggests that glacial Lake Humber had disappeared from there earlier than previously supposed.

Between Selby and Goole, the soils occur on four main parent materials: marine alluvium (warp), lacustrine sand, lacustrine clay and glaciofluvial sand and gravel. The soils in marine alluvium or warp have been mapped where the land lies within the natural tidal limits of the Ouse and Aire. Here, soil textures within individual fields vary from coarse and fine silty to clayey, according to the mode of sedimentation. The clayey soils, Wallasea series around Balkholme, and Newchurch and Dowels series bordering the Ouse and Aire, are mostly natural whereas the more extensive Blacktoft and Romney series are mainly man-made. The thickness of alluvium varies from 30 cm to 3 m or more. Slight hollows in some fields, particularly those under grass, mark the positions of old warping drains. The underlying material is mainly sand south of the Ouse, with an intervening peat layer in many places. North of the river the warp often overlies lacustrine clay. The lacustrine sands form long strips of slightly elevated ground, as from Rawcliffe through Goole Fields and from Barmby on the Marsh through Asselby, Kilpin and Laxton to Yokefleet. Soil series include Lund, Formby, Kexby and Everingham, depending on whether the sand is dominantly fine or medium in grade. Soils on the glaciolacustrine clay north of Howden are nearly exclusively of Foggathorpe series. Some very small areas of Portington series occur on Howden Common. West of Snaith and around Camblesforth, Newport soils are associated with glaciofluvial sand and gravel. (Furness, Bradley and King)

Sheet 108 (Liverpool). A further 132 km^2 were surveyed. Much of the land between Ormskirk and St Helens has Shirdley Hill Sand underlain by slowly permeable reddish fine loamy till which often causes waterlogging in the soils. Typical gley-podzols (Sollom series) and stagnogley podzols occupy relatively level land, with humus podzols on low ridges.

Although the climate is moist, iron-deficient Eag horizons can restrict rooting and produce severe drought symptoms in arable crops, as observed this summer in the patterned growth of cereals; such patterns were absent on many farms where the horizon had been removed for glass sand. Topsoils are strongly compacted by winter harvesting of carrots and brassicas and by ill-timed cultivations. Soils in this condition are easily eroded by rain.

Nine profiles were analysed from these sandy soils. Organic carbon in the very dark topsoils can be as low as 1.5% and the colour appears to be enhanced by the abundance of coal, charcoal and cinder fragments—presumably from nightsoiling. The colour of Bh horizons in the podzols is evidently due to organic matter as there is very little iron present.

On the southern banks of the Mersey, east of Runcorn, there are calcareous alluvial gley soils (Agney series), typical alluvial gley soils (Tanvats series) and pelo-alluvial gley soils (Wallasea series). Dredged sand close to Warrington has calcareous disturbed soils and much now forms arable land. The Wick series of typical brown earths is common near Daresbury along the line of Keckwick Hill, while the Clifton series of typical stagnogley soils is widespread further east. Clifton soils also dominate ground between Burtonwood and St Helens. (Lea and Thompson)

Sheet 119 (Buxton, Matlock and Dove Dale). Sheets SK15 and 16 have been completed, existing detailed mapping on SK17 has been reviewed and work on Sheets SK07 and SK14 has been started (220 km^2). Surveying has been concentrated on the soils over Carboniferous Limestone where there is a strong relationship between soil depth and slope angle and shape. Argillic and paleo-argillic brown earths (Nordrach series) are largely confined to level and gently sloping ground; brown earths (Malham series) are extensive on steeper or convex land. Related, markedly cherty soils are droughty, and their stoniness also prohibits

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the growing of cash crops such as seed potatoes and hinders cultivations for pasture re-seeding or periodic barley cropping. (Reeve and George)

Sheet 131 (Boston and Spalding). Some 240 km^2 were mapped on 1:25000 Sheets TF22, 23, 24, 32, 33, 34, 41, 42, 43 and 44. For large areas here, notably the reclaimed alluvium, it was already known that intensive survey would yield little more information about the soil pattern than that obtained during earlier small scale surveys. Consequently, the main effort has been concentrated where soil patterns are complex, while areas where soils are likely to be uniform were located mainly by the 2 km systematic sampling programme and then checked by a small number of purposive observations. Detailed work on very recent reclamations has confirmed that fine silty Agney soils are dominant, which contrasts with the coarse silty Wisbech series characteristic of older reclamations. A Wallasea-Wisbech unit is typical of low-lying areas inland of the main settlements, passing to silty over clayey Stockwith soils on slightly higher ground at the peripheries and with Romney soils on the highest ground. The soils on some high mounds in Bicker Haven, associated with former salt-making sites, lack mottling and are similar to typical brown calcareous earths, though local inclusions of charcoal and ash in the subsoil show that much of the silty material has been disturbed. (Heaven and Robson)

Sheet 136 (Newtown). A further 600 km^2 were mapped to complete the eastern half of the sheet, which includes the previously published sheet SO09 (Lea 1975). Soil patterns described for the sheet in the *Rothamsted Report for 1983* also occur on Silurian rocks and till in the newly mapped areas. The rocks exposed in cuttings and quarries around Newtown are often slightly calcareous, although the soils are decalcified. Glaciofluvial gravels are of minor extent, but relatively common in the Mule valley east of Newtown, where Rheidol soils have been mapped. Some 15 km^2 of Devonian sandstones and associated drift east of the English border support reddish soils, mainly Milford series.

Soil patterns shown on the National Soil Map have been confirmed and the larger scale of mapping has allowed inclusions of Powys and Rheidol soils to be shown separately. Small drier inclusions in the stagnogley units, and stagnohumic gley soils forming a significant proportion of National Map unit 713e, have also been mapped. This greater detail is very useful at district and farm level, for it increases confidence in predicting the potential or limitations of the land. (Hartnup)

Sheet 150 (Worcester and the Malverns). Some 900 km^2 have been mapped in detail with surveyors working from both Woodthorne and Wellesbourne. The parent materials range widely from hard Precambrian igneous rocks to glaciofluvial sand and gravel, giving a provisional legend of more than 100 soil series.

The survey includes the district mapped by Osmond *et al.* (1949) in the Vale of Evesham, and has shown that soils along the foot of the Cotswolds scarp in calcareous clayey drift (Head) over Jurassic clay are much more extensive than previously reported. Where the drift is less than 80 cm thick, wide spreads of Drayton series have been mapped. Between the Cotswolds scarp, Bretforton and the Littletons, patches of deeper drift, incorporating many oolitic limestone fragments from the crest of the Cotswolds, give rise to Lodgegrove series. These are well structured calcareous clayey soils, suffering only slight seasonal surface wetness.

On the Cotswold dipslope and the summit of Bredon Hill, the soils are mostly shallow brown rendzinas of the Elmton series with patches of deep calcareous brown earths of the Aberford series. Landslips on the Cotswold scarp, and the slopes of outliers such as Bredon and Dumbleton Hills, give very complex soil patterns. Locally on these steep slopes it has been possible to delineate patches of silty Atrim, South Petherton and Oxpasture soils.

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In the early survey of the Vale of Evesham the soils of the Avon terraces were mapped as the Pershore series, a broad concept which included soils developed in variable thicknesses of loamy and occasionally clayey drift overlying Lias clay. Topsoils are usually loamy but subsoil texture, stoniness and porosity vary greatly from place to place, giving marked differences in agricultural potential. These soils are used for market garden crops, potatoes and cereals; very little is grassland.

The deep, porous, well drained sandy loam and loamy sand Wick and Newport series, respectively, are extensive on wide terraces near Charlton, Fladbury, Wick and Burlingham. Occasionally, gravel substrates occur within 80 cm depth, giving Hall series. Arrow series occurs in hollows, where winter water-tables fluctuate in the porous subsoils. The deposits of the higher Avon terraces, generally heavier in texture than those on lower terraces, have fine loamy soils, often with dense, slowly permeable subsoils. The Bishampton series and its stagnogley counterpart, the Pinder series, are extensive. On sloping ground around the edges of the terraces, and elsewhere where drift deposits are thin, Oxpasture and Wickham series have been mapped.

The Avon alluvium is mainly clayey in texture and wet soils of the Fladbury series predominate, although there are some similar but calcareous Thames profiles. Slightly elevated ground adjacent to the river is dominated by the Wyre and Uffington series, both only slightly mottled; they are well structured soils, the latter being calcareous to the surface.

The Whimple series predominates in the Mercia Mudstone lowland to the east of the Malvern–Abberley ridge. These reddish clay loam over clayey soils are used mainly for cereals and grassland although topfruit is locally important. Areas of low relief, mostly under woodland, have similarly textured but wetter Brockhurst soils. The terraces of the Teme between Leigh and Lulsley are dominated by the Rushwick series, sandy loam soils with non-calcareous gravel within 80 cm depth, accompanied by reddish clay loam soils of the Salwick series with slight seasonal surface wetness.

The map is being compiled from field sheets and the remaining 150–200 km^2 will be completed in early 1985. (Whitfield, Beard, Jones, Palmer and Smith)

Sheet 163 (Cheltenham and Cirencester). Some 145 km^2 have been mapped on the Cotswolds north and east of Cheltenham. The Jurassic limestone is dominated by brown rendzinas, chiefly fine loamy Elmton series, often having a large silt content, and smaller areas of clayey Sherborne soils, but the boundaries between these textural differences are ill-defined. On level hilltops, some capped by limestones of distinctive lithology, there are deeper, stoneless, slightly acid brown soils. These include argillic brown earths of the fine silty over clayey Ston Easton or fine loamy over clayey Tetbury series, and brown earths of the fine loamy Waltham series. Where the limestones contain thin interbedded clays, brown calcareous earths of the deeper, clayey Moreton series are found. On the Fuller's Earth Clay however, pelo-stagnogley soils of the Denchworth series often replace the calcareous pelosols of the Evesham and Haselor series which are present further south. Dry valley floors contain brown calcareous earths in stony Head and colluvium, including the clayey Moreton and fine loamy Aberford series, as well as Didmarton soils in deep stoneless, clayey colluvium.

The Cotswold scarp is extensively landslipped. In the wider valleys south of Winchcombe, where limestone has been let down as rotational slips and wider camber flaps, even the valley bottoms have Elmton and Aberford soils in places. Where the Upper Lias is exposed, clayey Denchworth and Martock soils are developed. On steep and strongly sloping ground over Middle Lias silty shales and siltstones there are Yeld and Curtisden soils, accompanied by unnamed fine silty stagnogleyic brown earths. Denchworth and Evesham soils are found where the Lower Lias Clay lacks a cover of drift deposits. Along the foot of the scarp and in places extending widely upslope, the Drayton series occurs in thin clayey drift with occasio-

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nal limestone fragments. Relatively silty drift, containing much Middle Lias material, gives Oxpasture and Wickham soils and there are some clayey Holdenby soils. Terrace-like flats on either side of the river Isbourne north of Winchcombe have extensive spreads of little-sorted limestone gravel with brown calcareous earths (Badsey series) and there are similar unnamed clayey soils. Around Bishops Cleeve, where these materials are covered by loamy or clayey Head and influenced by groundwater, there are fine loamy over gravelly gleyic brown calcareous earths (Ickford series) and similar, deeper clayey soils. (Cope)

Sheet 164 (Oxford). Preliminary fieldwork has commenced and about 4 km^2 have been mapped near Benson. The soils encountered include Wantage and Gore series over Lower Chalk, coarse loamy over gravelly Sonning series on the Wallingford Fan Gravels, fine loamy over clayey Marlow series on gently sloping plateaux margins and, in the associated valleys, Soham and Weasenham series. Silty calcareous Coombe soils have been mapped in valleys elsewhere and Ickford and Kelmscot soils occur on terraces adjacent to the Thames. (Fordham)

Sheet 185 (Winchester and Basingstoke). About 102 km^2 have been mapped north of Alton and around Stockbridge. Carstens soils are dominant on the ridges in the east and extend down gently sloping valley sides. Batcombe series occurs sporadically but appears to be most common near outcrops of *Uintacrinus socialis* and *Marsupites testudinarius* zones of the Chalk. Some large areas of Charity series have also been delineated on the plateaux. Silty colluvial soils are widespread in the valleys with the calcareous Millington series present where Andover and Panholes soils occur on valley sides, and non-calcareous Notley series near the heads of valleys surrounded by Plateau Drift.

Around Stockbridge, shallow Andover and Panholes soils are extensive on gentle slopes with the chalky Upton series in places on steeper slopes. Porton and Carstens series are confined to small patches of Plateau Drift on hilltops. In the Test valley, Adventurers' soils have been mapped in fen peat associated with Colthrop series in calcareous tufa. Soils on nearby river terrace deposits are mainly very flinty, well drained typical argillic and paleo-argillic brown earths. (Allen and Moffat)

Sheet 201 (Plymouth and Launceston). About 60 km^2 have been surveyed on Bodmin Moor, much of it covered by soliflucted granite detritus of loamy or sandy texture containing stones of many sizes; in places the matrix is predominantly silty. Hilltops and valley side shoulders are often crowned by tors or boulder fields, while basins and valley floors contain peat deposits.

Stagnopodzols of the Hexworthy and Rough Tor series (Staines 1976) dominate the Moor. The peaty surface horizon can be up to 30 cm thick on relatively level ground of the higher moorland, but this thins and often gives way to a humose topsoil on drier, more sloping ground and in enclosed land. This change in the surface horizon is often paralleled by decreasing intensity of gleying in the subsurface Eag horizon.

On interfluves above about 300 m OD the podzolic B horizons characteristic of Hexworthy and Rough Tor series give place to gleyed subsoils of the Princetown series (Harrod *et al.* 1976), a stagnohumic gley soil. Here peaty topsoils are widespread but peat soils, with blanket peat thicker than 40 cm, are rare. Peat is largely confined to the basins and valley floors, where it can be more than two metres thick in places. Both fibrous and amorphous peat soils are present, of the Winter Hill (Jarvis, R. A. *et al.* 1984) and Crowdy series respectively (Staines 1976).

Steep slopes along the valley sides and around the margins of the granite are freely drained and carry brown podzolic soils of the Moretonhampstead series (Clayden 1964) and Moor

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Gate series (Harrod *et al.* 1976), with some podzols developed especially on bouldery ground.

Modification of the soils by man's activity has been widespread on Bodmin Moor. There is a long history of mineral extraction, both from deep mines and as tin streaming along alluvial tracts. Rights of turbary have been widely exercised, partly by the paring of peaty topsoils from stagnohumic gley soils and stagnopodzols and partly by the excavation of thicker peat in basins. It is uncertain how far the humose topsoils of Rough Tor and Hexworthy soils on enclosed land are a product of paring and burning of peat during reclamation.

Piezometers have been installed at eight sites on Dartmoor to help assess the water relationships in E and B horizons of Hexworthy, Rough Tor and Princetown series. (Harrod)

1:25000 Scale mapping

North Kent marshes. Following preliminary investigations of the salt-affected soils in these marshes *(Rothamsted Annual Report for 1983)*, about 70 km^2 of marshland have been mapped at the request of MAFF. Soil patterns were explored first in detail in four 1×1 km blocks of land where observations were made on a grid at a density of 50 km^{-2} and samples taken for analysis at 0–15, 35–50 and 70–85 cm depth. The survey was subsequently extended by grid observations at 250 m intervals. At these points electrical conductivity was measured at three depths using an Eijkelkamp probe to estimate salinity. Samples were also taken (density 2 km^{-2}) for the assessment of dispersion ratio. The data obtained are being analysed and a 1:25000 soil map, derivative maps and a report are being prepared. (Hazelden and Sturdy)

Sheet STO1 (Sampford Peverell). The remaining 62 km^2 have been mapped, and 17 pits were described and sampled. The completed map legend includes soils additional to those reported in the *Rothamsted Annual Report for 1983*. Terraces along the river Culm have reddish fine loamy gleyic brown earths while similar argillic soils of the Taunton series (Findlay *et al.* 1984) occur along the river Lowman. Over Triassic sandstones a few patches of unreclaimed heath and adjacent reclaimed land carry a variety of gley-podzols with humic-sandy gley soils, Isleham series (Hodge *et al.* 1984), in valley bottoms. Thick drift mantles some of the sandstone outcrop giving reddish fine loamy stagnogleyic brown earths of the Llangendeirne series (Rudeforth *et al.* 1984). Small patches of coarse loamy over clayey paleo-argillic stagnogley soils of the Essendon series (Jarvis, M.G. *et al.* 1984) were found on the narrow ridge crest of Gaddon Down.

The monitoring of dipwells in drained land during the winter of 1983/84 has shown stagnogleyic brown earths to be in wetness classes II and III, stagnogleys in classes III and IV and humic gleys in class IV. (Hogan)

Sheets ST41/51 (Yeovil). More than 150 km^2 have been mapped, almost completing the sheets. Many of the soils derived from coarse silty and very fine sandy sediments of the Upper Lias, particularly on sheet ST41 have a long history of erosion and associated colluviation in arable use. Deep coarse silty soils of the Bridport series (typical argillic brown earths) and fine silty Yeld soils (stagnogleyic argillic brown earths) are most extensive, but profiles truncated by erosion—brown rankers with little-altered, soft sediment close to the surface—are very common on slopes. Most valleys and the bottoms of many sloping fields contain colluvial deposits. In the dry valleys there are coarse silty colluvial brown earths and typical argillic brown earths, whilst wetter ground has gleyed coarse and fine silty alluvium (typical alluvial gley soils). Peat, organic-rich layers and charcoal found below and within the colluvium have been sampled to date the beginning of soil erosion; evidence based on pot sherds suggests that some colluvium may be of Bronze Age.

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The mapping has also revealed extensive deposits of thick (often >2 m thick) stoneless silty drift over old river terraces; both coarse and fine silty gleyic argillic brown earths have been identified.

Around Yeovil, where there is currently little intensive arable farming, erosion, though present, seems not to have altered the landscape as much as further west, and coarse silty South Petherton soils (typical brown earths) are more common.

Southern districts are underlain by Fullers Earth, Forest Marble, Oxford Clays and Cornbrash limestones. Calcareous clayey Evesham soils (calcareous pelosols) dominate the clay formations whilst remnant drift gives similar but flinty and cherty Drayton soils (calcareous pelosols). Mixed clays and limestones of the Forest Marble give clayey Haselor soils (calcareous pelosols) together with St Lawrence series (stagnogleyic brown calcareous earths). Where the limestone lacks a cover of drift, shallow brashy Sherborne and Elmton soils (brown rendzinas) predominate. Parts of the Cornbrash limestone carry a range of rather deeper soils of which the Tetbury series (typical argillic brown earths) is characteristic.

On lower-lying ground, flinty and cherty loamy drift mantling the clay gives well drained loamy Ludford soils (typical argillic brown earths) and also Bishampton series (stagnogleyic argillic brown earths).

Between Crewkerne and Chillington, complex soil patterns are associated with the Upper Greensand scarp and small areas of Lower Chalk and Plateau Drift. (Colborne and Staines)

TL14 and 15 (Biggleswade and St Neots). A further 37 km^2 were mapped, bringing the total area covered to 57 km^2. Work has been concentrated on the horticulturally important light land of the Ivel valley and the Lower Greensand outcrop. In the Ivel valley the highest terrace gives droughty, gravelly, coarse loamy paleo-argillic brown earths of the Sonning and Maxted series. More productive soils found on the lower terraces are less stony, gleyic brown earths and calcareous brown earths, chiefly Ickford series over gravel and the deeper Waterstock series. On the Greensand outcrop, brown sands (Cottenham series) predominate, while the more loamy Bearsted series is common at the margins. On Chalky till adjacent to the Greensand, many soils have a lighter topsoil than the clayey Hanslope series and these are distinguished as Ashley and Eyeworth series. (Wright)

National Peat Inventory

Yorkshire and Lancashire. About 70 deep borings were made over an area of about 33 km^2 in the raised mosses of Hatfield Moors and Thorne Waste, South Yorkshire. The peat was generally 1–3 m thick, although in some places it has been almost completely stripped. The upper *Sphagnum*-rich layers have now been mostly extracted and soil forming in moss peat was recorded at only four sites. The cut-over peat on the greater part of Hatfield Moors and much of Thorne Waste is dominated by the remains of cotton-grass, replaced by reed peat towards the base of the organic soil at Hatfield Moor. At Thorne Waste, however, the lower part commonly consists of a botanically complex mixture of grass and sedge remains, usually with a woody layer immediately above the mineral soil. The eastern margin of Hatfield Moors is under cultivation; the soils have an earthy surface horizon and are mapped as Altcar series. The mineral substrate is mainly coarse or fine loamy and often stoneless, while sandy or clayey horizons are uncommon and a silty substrate was recorded at only one site. The borings were matched with information from outside the mosses so that a map of the underlying drift geology could be prepared. (Carroll)

About 50 km^2 of the peat inland from Formby and Southport have been sampled at 0.5 km intervals on east–west transects 1 km apart. These peats were also surveyed in the 1950s following extensive saline flooding. The present survey is measuring wastage, and the acidity

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of the peat and sub-peat materials. Fresh and three-month aerated samples are being analysed at ADAS laboratories, Leeds, to identify any sulphuric peats. (Lea and Thompson)

Fenland. A further 108 km^2 were mapped and sampled, largely between Yaxley, Pondersbridge, and Thorney in Cambridgeshire (sheets TL19, 29, TF20), and in the fens east of Hilgay, Norfolk (TL69, 79), of which 76 km^2 were in areas without previous detailed soil information. Some 3250 paired samples have been taken for pH determination.

Thick peats have been examined in three localities:

a. At Holme Fen in and around the raised bog remnant, where peat is 2–3 m thick (TL19, 29).

b. In Methwold Severals (TL69) fibrous sedge peats over reed and woody peats are together between 1 and 2.5 m thick. Where a wedge of marine clay (Fen Clay) occurs at about 1.5 m depth, the measured pH values show that acid sulphate soils will form if drainage and wastage of the peat continues, with ochre being released into drains. Altcar soils upon wastage will develop into Mendham soils and eventually into Prickwillow and unnamed sulphuric humic-alluvial gley soils.

c. Deep borings were made along a 6 km transect through the western part of the Nene washes and along a 22 km transect through the central part of the Ouse washes. Here peats formed in historical times have not suffered severe wastage as the water-table has remained high. The peats are covered by up to 40 cm of calcareous riverine alluvium resulting from annual flooding, in the case of the Ouse washes since the construction of the drainage works in the mid-seventeenth century. The maximum thickness of peat is about 3 m, but between 1–2.5 m is more usual. Sedge peats overlie woody peats and the peat is separated into upper and lower layers by a wedge of Fen Clay which thickens northwards. The washes are mostly under permanent pasture and rough grazing, with a large part managed as a bird and wildfowl sanctuary.

Acid sulphate soils occur on about 20 km^2 of land south and west of Whittlesey in up to a metre of humified peat over Fen Clay (Mendham series), and where the peat is covered by riverine alluvium (soils related to Wensum and Midelney series). Soils investigated south of Thorney have the physical signs of strong acidity—jarosite mottles and thin intercalations of peat and marine clay—but pH determinations show that these soils are no longer extremely acid within 80 cm depth. However, a new zone of acidity is developing at depths below a metre as deeper drainage is followed by further oxidation of pyrites. (Burton)

Norfolk and Suffolk. Some 90 km^2 were surveyed and from 300 sites located on a 0.5 km grid about 3000 paired samples were taken from the Waveney valley below Harleston, and from the floodplains of the Bure, Ant, and Thurne. Between Harleston and Beccles the peat is usually less than 2 m thick. It is thicker—up to 6 m—below Beccles, although land near the river channel has up to 4 m of clay alluvium with sedge remains above two layers of peat separated by a bed of alluvial clay containing wood fragments.

In the Waveney valley woody peat is generally sandwiched between upper and lower layers of sedge peats, the uppermost commonly about 2 m thick and the lower one occurring below 5 or 6 m depth; this lower layer is absent near the uplands where the peat is thinner. To the north and east of Barnby Broad, east of Beccles, reed peat occurs at 1–3 m depth above a fairly extensive area of Hypnum moss peat at 3–5 m depth.

Beneath the present reed and sedge vegetation in the valleys of the Bure, Ant, and Thurne there is up to 1 m of sedge or reed peat lying on mineral alluvium.

About a quarter of the lower Waveney peats are acid sulphate soils, nearly half in the reclaimed area of Beccles Marshes with the remainder mostly to the east. In the Thurne floodplain about half the grassland and arable soils are sulphuric. (Corbett)

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Hampshire. The investigation of peat and associated deposits along the Test and Itchen valleys has been completed. Earthy eutro-amorphous peat soils (Adventurers' series) are dominant in the Test valley, but in the Itchen valley calcareous alluvial gley soils are extensive. The alluvial deposits vary in thickness, averaging 2.4 m in the Itchen valley and 1.6 m in the Test valley, and stratigraphy is also varied—calcareous tufa is intercalated within the peat, silty alluvium is often present at the surface and there is clayey alluvium at the junction of the peat and flint gravel below. (Allen and Brewer)

Basic, methodological and applied research

Soil classification. Technical Monograph No. 17 *Criteria for differentiating soil series* was completed and prepared for publication. It consists of three chapters, the first describing the historical background and development of the soil series concept in England and Wales, the second giving details of the present criteria used to differentiate soil series within subgroups and the third explaining how the criteria are used to define soil series and giving a key to all the rationalized series recognized in England and Wales up to 1984. An appendix provides an alphabetical index to all 1113 soil series mentioned in Soil Survey publications up to 1984. It lists the publication in which each series was first described, gives its present subgroup classification, the publication in which that subgroup was first used and, where necessary, names the rationalized soil series that has now replaced it. (Hollis)

Work was started on the rationalization and validation of previously described profiles with accompanying analytical data, to ensure that all are correctly classified according to the current system. To date, approximately 900 profiles have been checked, including most of

TABLE 1

Data available for the 24 most extensive soil series

Soil series	Area (km²) covered by Soil Association	Type of data available (minimum nos. of profiles with data): Particle size and organic carbon	Clay miner-alogy	pH	Water retention properties; bulk and packing density	Linear shrinkage; liquid and plastic limits	Pyroph. ext. Fe, Al and C
Denbigh	5704	24		24	3	3	16
Brickfield	5615	24	3	24	7	3	2
Manod	5354	13		13	7	3	10
Wickham	4746	15		15	7	3	
Wilcocks	4477	25		25	8	3	
Hanslope	3634	27	3	27	8		
Denchworth	3278	52	25	52	17		
Andover	3258	10		10	4	3	
Wick	2967	43	1	43	9	3	11
Evesham	2851	47	23	47	8	3	
Dunkeswick	2676	11		11	3	3	
Salop	2580	27	4	27	9	3	6
Beccles	2268	20	1	20	3	4	1
Clifton	2165	11		11	1	3	2
Newport	2008	33	1	33	6	3	8
Elmton	1884	18		18	3	3	
Whimple	1823	29	2	29	10	3	
Rivington	1745	14		14	5	3	4
Wallasea	1710	15	2	15	4	3	2
Cegin	1622	10		10	2	3	
Fladbury	1588						
Curtisden	1528	2		2	2		
Neath	1526	6		6	1		3

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those available for the 24 most extensive soil series in the country, as estimated from the 1:250000 soil map of England and Wales. Table 1 shows the amount of data available for these 24 series, the numbers in each column indicating the numbers of profiles available with the specified data. (Hollis)

Soil Survey Field Handbook. The existing handbook (Hodgson 1976) is being revised to produce an edition for use in England, Wales and Scotland. A draft being prepared for circulation to various staff has a format similar to the present handbook, consisting of five main sections: 1. General Information; 2. Site Description; 3. Profile Description; 4. Horizon Notation; 5. General Site and Profile Characteristics. (Bown, Soil Survey of Scotland, and Hollis)

Mineralogy. The mineralogy of the <2 μm fractions of some 700 profiles, representing the main soil series in England and Wales, has been reviewed. The findings confirm those of Avery and Bullock (1977) that soils developed in, or derived from, pre-Rhaetic sediments are dominated by mica with lesser amounts of chlorite and kaolin. Exceptions are soils developed in calcareous Coal Measure shales which have significant smectite contents, and freely drained soils in Mercia Mudstone which contain swelling chlorite, sepiolite and palygorskite. Soils developed in post-Triassic sediments are dominated generally by expansible minerals, except those developed in Lower Lias and Estuarine Series rocks (Jurassic) which are dominated by mica and kaolin respectively. The presence of loess in soils is associated with the occurrence of a complex interstratified mineral with X-ray diffraction properties akin to vermiculite. Weathering of soil clays is most marked in the wetter uplands, but over most of lowland England is detectable only by slight changes in non-exchangeable potassium content and cation exchange capacity towards the soil surface. Preliminary attempts were made to assign the major soil series in south-east England to mineralogical classes differentiated in terms of the relative abundances of particular minerals within the <2 μm fraction. A mineralogical province map of this area at a scale of 1:250000 has been produced using these data. (Loveland)

Podzolization. Podzols under sessile oak at Yarner Wood National Nature Reserve (Devon) have extraordinarily hard and compact bluish grey sub-surface (Ea) horizons. The parent material is Head derived from sandstones and mudstones of the Culm Measures (Lower Carboniferous) into which loess has been incorporated. The evidence shows that induration rather than cementation is responsible for the compaction—possibly brought about by cyclic wetting and drying. (Mr B. Clayden, New Zealand Soil Bureau and Loveland)

Soil erosion. Because of poor weather, aerial photographs of the 17 localities were taken late in the growing season, often in late July, and this may have reduced the likelihood this year of identifying eroded fields. However, the much lower number identified, one-third the total of 1983 and two-thirds of 1982, is probably related to the low winter and spring rainfall. In areas largely sown to winter cereals, as monitored in Cambridgeshire/Bedfordshire, Dorset, Gwent, Hereford and Sussex, there was much less erosion this year. For example only one eroded field was located along the Cambridgeshire/Bedfordshire flight line, compared to 16 and 18 fields in the previous two years.

In many localities erosion was mostly in crops sown in late spring or summer, especially sugar beet, potatoes and market garden crops; this was particularly so of sandy soils in Shropshire and Nottinghamshire, and of coarse loamy soils in Norfolk. In these localities erosion in cereals accounted respectively for only 20, 14 and 23% of all erosion. It seems

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likely that some of this erosion was attributable to irrigation, which was widespread in the dry summer.

This year, about 20% of the eroded fields located were not identified on the aerial photographs; these were either small scale erosional events which became obscured by later cereal growth, or the erosion happened after the aerial photographs were taken.

In the third year of this project, therefore, the pattern of erosion has been very different to previous years. Indeed, the three years have been markedly different in their patterns of erosion. In 1982 most erosion was in winter cereals; in 1983 there was widespread erosion in both winter and late spring, whereas this year erosion occurred most often in late spring and summer. It is also becoming apparent that reseeded leys, sown from June onward are often susceptible to erosion. (Evans)

Work is continuing over the winter of 1984/5 in south Somerset, and also in Dorset between Weymouth and Bridport on a coastal strip where erosion of clayey soils under winter cereals has been noted over several years. These investigations allow comparison of the nature and degree of erosion on heavy and light soils. (Staines and Colborne)

Poaching of grassland. Surface bearing strengths were measured by penetrometer at 32 grassland sites on contrasting soils in Dorset and Devon, visited regularly during the autumn, winter and spring of 1983/4. Dipwells were installed to monitor moisture regime and soils sampled for mechanical analyses and measurement of plastic limit. The results will contribute information to the Grassland Suitability Model and help to quantify the concept of 'safe grazing days'. (Staines)

Data management. As a source reference for answering enquiries concerning soils and land at given localities, an inventory was compiled of all Soil Survey field projects completed in Northern England, based upon 436 National Grid 100 km^2 squares. An appendix to the inventory allocates over 1500 soil profile descriptions to soil series or subgroups, in accordance with present-day classification, and indicates their appearance in Soil Survey publications. As a temporary measure pending digitization, a catalogue was compiled indicating the location of soil associations in Northern England in terms of National Grid 100 km^2 squares. (R. A. Jarvis)

Soil Information System. Progress on the establishment of the Soil Information System on the VAX 11/750 has continued. All data and appropriate software have been transferred from the System 4 successfully.

Data validation, conversion and error correction (Stage 1) is fully operational for all field records (i.e. detailed profile descriptions, National Soil Inventory and purposive auger boring records), the Rothamsted laboratory analyses and altitude measurements.

The relational database management system (Stage 2) has been set up, together with procedures for updating the database and auditing changes to the database, for all the data from Stage 1. These data can be retrieved, related to one another with a common key, and manipulated or displayed graphically, using the command language Datatrieve.

An approximate guide to the amount of information processed by Stage 1 and in easily manipulatable form (Stage 2) is shown in the following table:

	Stage 1	Stage 2
Detailed profile descriptions	2035	1050
National Soil Inventory records	5700	1700
Purposive auger boring records	110000	7000
Laboratory analyses	1465	1400[1]
Altitude records (on a 5 km grid)	6954	6954

[1]66000 analyses from 5900 samples for 1400 sites.

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These data can be retrieved, related to other data with a common key and manipulated using the command language Datatrieve. The database is continually being updated from Stage 1 and work is being carried out to include the following information already in computer form.

Soil series definitions
National map legend

Soil water/air relationships Profile available water Workability assessments Wetness class	by selected soil series
Field capacity Moisture deficits Rainfall Accumulated temperature Growing season Grazing season	at 5 km intervals

Some of these sets of data already exist as databases and are available on the VAX and the Midas microcomputer at the Shardlow centre. They are available using Datatrieve and dBase II commands, or by user-friendly procedures written in these languages.

Map digitization is being carried out using different agencies. Digitized versions of the 1:250000 National Soil Map of England and Wales should be available by the end of 1984 from Laser-Scan Laboratories Ltd and the 1:25000 sheet TF45 (Friskney) by early 1985 from the Ordnance Survey. Both will be available in raster and vector forms.

The software package AREAS is being converted for use on the VAX by the Rothamsted Computing Unit and coloured thematic maps of SP25/35 (Coventry South) have been generated on a SIGMA colour graphics device using parts of this package. (Ragg and Proctor)

Agroclimatic databank. A technical monograph describing the machine-readable moisture deficit, field capacity, accumulated temperature and rainfall datasets has been written for publication early in 1985. The monograph will contain microfiche of the 10 km grid data and be accompanied by four 1:1000000 scale maps. There will be an additional option to purchase the full climatic databank on disc for computer handling. (Jones and Thomasson)

The working datasets held on System 4 were successfully transferred to the VAX 11/750 in early February, and, in addition, 60–70 megabytes of raw and semi-processed data have been secured on magnetic tape. New datasets of accumulated temperature (above 0°C Jan to June, above 5.6°C all year, above 10°C all year) and growing season (start and end dates, length) have been prepared on a 5 km grid. Many datasets have now been set up as domains within Datatrieve and some simple manipulations undertaken. It is hoped to develop this facility in conjunction with soil data from the National Map to calculate machinery workdays, droughtiness and crop suitabilities for specific locations. (Jones)

Land evaluation. The Survey has continued to co-operate with MAFF in the development of an improved system of land classification (ALC) for control of urban development and mineral extraction in England and Wales. The chief topics currently under discussion are climatic criteria and their interaction with soil properties to form land qualities or limitations which control land grade. Progress to a more scientific system capable of spatial expression is particularly important in the context of EEC policies, and the interest in suitability of land for specific crops and non-agricultural uses. (Jones and Thomasson)

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Laboratory automation. An automatic fraction collector for use in particle-size analysis has been brought into regular use. The precision of the analyses for the silt (63–2 μm) and clay (<2 μm) content of standard samples is at least as good as that obtained by conventional pipette methods. Further development of this machine using microprocessor control is underway.

Software is currently being written to link various laboratory instruments as part of the development of an automated soil analysis laboratory. (Loveland with Edwards, Instrument Workshops, and Summerfield, Computing Unit)

Bulk density measurements. Six methods of measuring bulk density have been compared to determine the best techniques for Soil Survey purposes, three of them using undisturbed cores from 222 cm^3 to approximately 2 litres volume—the largest a slice from a Proline core 1 m long. Another used a Jarrett auger and the remaining methods used plastic ball replacement and gamma transmission probe (Scottish Institute for Agricultural Engineering design). Replicate measurements using each method were made on topsoils and subsoils of four soil series (Cuckney, Hall, Salop and Trent). Preliminary results showed that the gamma transmission technique gave the least variable replication but emphasized the need for precise calibration. Plastic ball replacement also gave good replication together with good estimates of stone content. The most variable results were from 2 litre cores taken by a mechanical Proline corer. (Carter and George)

Seasonal changes in soil structure. A Denchworth soil was sampled to investigate change in soil porosity; this is a pelo-stagnogley with 60% clay and a clay mineral suite dominated by interstratified mica-smectite. Sampling was chosen to correspond with wet and dry states, 45 and 35% moisture contents respectively as measured with the neutron probe. The samples were dried by acetone replacement of the water, impregnated with a Crystic resin containing a fluorescent dye (Bascomb and Bullock 1976) and images of the structure taken by photographing a flat face of the impregnated soil in UV light. Measurements of structure were made on the image analysing computer.

The main changes in structure were associated with the fissure pattern. The porosity due to fissures is reduced by 55% in the wet state compared with the dry one. There is a reduction of mean fissure width of 42% from 1.08 mm in the dry soil to 0.63 mm in the wet soil.

The fissure width distribution is skewed at both sampling dates but there is a shift to smaller widths in the wet soil. The areal extent contributed by larger fissures is small compared to smaller ones but is significant in view of the fact that water flow through fissures is proportional to the cube of the width. Thus the decrease by 92 and 63% in areal extent of the two largest width classes on wetting is important in relation to hydraulic flow.

Using image analysis, the proportion of conducting pores, the areal extent of fissures and their mean width in a clay soil at different moisture contents can be obtained. (Ringrose-Voase and Bullock)

International descriptions of soil thin sections. Seven thin sections were described by seven experienced micromorphologists independently using the new *Handbook of Soil Thin Section Description* (Bullock *et al.* 1984). The sections were from soil horizons representing a range of soil material formed by a variety of processes throughout the world. The aim of the 'round robin' exercise was to determine the degree of similarity of descriptions by different individuals.

The overall uniform approach was encouraging. The main problem areas were some aspects of description of microstructure and coarse/fine related distribution patterns, coarse to fine limits, coarse basic mineral components, fine material and some pedofeatures. The recommendations arising from this international comparison will be valuable in revising the

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Handbook. (Murphy and Bullock; with Dr J. A. McKeague, Canada; Dr L. M. Bresson, France; Dr M. J. Kooistra and Dr R. Miedema, The Netherlands; Professor G. Stoops, Belgium)

New Forest soils and vegetation. The relationships between soils, peat deposits and plant communities have been investigated in Hive Garn Bottom in the northern New Forest. The soils and vegetation have been described at 20 m grid intersects in a 1 ha plot and a close correlation has been found between the plant communities and soil water regimes. It has been shown that the continued existence of the seepage mires at flushes on the valley sides depends on maintaining the existing water regimes in the surrounding catchment. Examination of soil thin sections suggests that several phases of pedogenesis can be identified and these are being related to the vegetational history of the New Forest using pollen and macrofossil analysis and radiocarbon dating of the peat. (Allen with M. J. Clarke, Department of Geography, University of Southampton)

Soil engineering. To measure soil shrinkage, civil engineers use a linear shrinkage test on re-wetted sieved air-dried soil, while soil scientists prefer measurements on coated soil clods. In order to compare the two techniques, linear shrinkage was determined for samples from clayey horizons of known 'clod shrinkage'. The correlation between linear shrinkage and 0.05 bar to air-dry clod shrinkage was moderately close ($r = 0.78$) for subsoils, less close for topsoils. However, 0.05 bar to 15 bar clod shrinkage is more representative of field conditions, and this was poorly correlated with linear shrinkage. (Reeve)

Replacement of water from soil and sediments prior to impregnation. Rates of water removal from clay, peat and sandy loam soil materials have been monitored by NMR spectroscopy. The time period of six weeks previously necessary for removal of water in the preparation of thin sections has been considerably reduced. This is achieved by more frequent changes of acetone and by causing gentle movement of acetone using a magnetic stirrer. Using this new approach the water in peats and clays can be removed within 12 days of initial immersion, with no apparent detrimental effect to the sample. (Murphy)

Supporting work

Soil water regimes. Nine sets of piezometers were installed in Wallasea soils at four sites, three in drained arable fields and the fourth in undrained grassland; a further set was installed in drained Agney series. The sets of piezometers were placed in pairs to investigate the effects of microrelief, each set consisting of three 35 mm diameter pipes to 40, 80 and 120 cm depths. At two of the Wallasea sites on drained arable land, median water levels in the deep piezometers were between 75 and 100 cm and at the third site at 55 cm with a level 15 cm higher on the low ground. The levels in the undrained grassland were only a few centimetres higher than in the drained arable land, suggesting that the drainage system is ineffective. Water levels in the shallower piezometers indicated that a slowly permeable horizon occurred at about 80 cm depth. No waterlogging was recorded in the Agney profile. (Sturdy and Hazelden)

Groundwater levels on sandy soils in the area of the Selby coalfield, within 1:50000 sheet 106, were monitored for a further year. Samples were taken for water retention measurements in order to complete investigations on the hydraulic conductivity of these soils. (Furness)

Crop exploitation of available water has been investigated using a Wallingford neutron probe and a CPN Hydroprobe. The latter was calibrated in the field and used to monitor existing grassland sites as well as new sites under winter oilseed rape and winter barley on

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Hanslope series in Leicestershire. Sites on Andover and Millington series in Hampshire, each under grass and cereals, were monitored weekly using the Wallingford probe. With a much drier than average growing season in 1984, the results are expected to give useful data on the moisture utilization of common soils on chalk. (Reeve, Moffat, Carter and Royston)

Water-level monitoring in dipwells in the Dale, Staunton, Worcester, Salop and Wighill series has continued and hydraulic conductivity has been measured. Piezometer tubes have been installed at the Dale site to monitor water regimes in horizons with low permeability. (Carter and Royston)

Dipwells and piezometers have been installed on Denchworth and Evesham soils at Drayton EHF and at Long Marston. Weekly measurements (September–May) will supplement data from 1983 concerning moisture relationships in these soils. (Beard)

Clay, silt and sand fractions for 115 surface and subsurface samples have been analysed at the Wellesbourne laboratory to support field assessments. (Beard and Whitfield)

Structural instability of marshland soils. Dispersion ratios (MAFF 1982) have been determined on a further 520 samples from 173 profiles, including some from Tertiary clays and river alluvium for comparison. The mean dispersion ratio value for Wallasea topsoils under arable cultivation in north Kent was about 20%, making them 3–8 times more unstable than other non-saline clayey soils. Data analysis has shown that dispersion ratios are positively correlated with the exchangeable sodium percentage. (Sturdy, Hazelden and Loveland)

National catalogue of soils. A full range of available data has been assembled for about 200 series and is being made available on word processor disks. Entries for other series in current use (420) as well as those previously used by the Soil Survey (about 470) have been started. (M. G. Jarvis, T. R. Brewer and N. Boothroyd)

Soil water retention. Due to the increased capacity of the Shardlow laboratory, soil water retention properties have been measured on approximately 1400 samples from over 100 profiles during the last year. These include samples taken for the British Society of Soil Science meeting in Southampton, profiles dug to characterize soil series for which few data are available, research projects and occasional contract work. The extensive Shardlow database has been invaluable for answering enquiries about soil physical properties from ADAS, ICI, environmental consultants and research institutions. (Carter and Royston)

Soil micromorphology. Over 400 samples have been impregnated with resin and either made into thin sections or used in image analysis of soil structure. A large proportion are related to a project to compare topsoil structure of saline soils under grass and arable cropping. (Bullock and Murphy)

Special and contract surveys

The volume of special purpose surveys has continued to increase during the year. About a half of this work is for MAFF, the remainder for other public bodies, consultants, agricultural manufacturers, private owners and farmers. The scale and intensity of surveys varies in relation to identified needs or problems.

Work for MAFF. Seventeen crop trial sites in Yorkshire, Northumberland, Durham and Cumbria were surveyed. (Bradley, Kilgour and Payton)

Three GRI/ADAS trial sites in Cumbria and Yorkshire were surveyed and profiles described. (Bradley, Carroll, Kilgour and Payton)

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Information relevant to proposed reclamation was given for soils of Rockcliffe Marsh, Cumbria. (Kilgour)

In Northumberland, detailed soil surveys for drainage schemes were made at Plashetts Farm (>1 km^2), Kirkwhelpington and at Redesdale EHF. (Payton)

A detailed soil survey was made of Durtrees Farm, Otterburn, Northumberland, to locate a site suitable for land drainage experiments on Wilcocks soils and to assess soil uniformity. (Payton)

The site of a proposed drainage scheme at Thornthwaite, near Harrogate, was investigated. (Bradley and Carroll)

A detailed soil survey (2 km^2) was made in alluvial deposits to a depth of 250 cm at Doddington, near Wooler, where a major drainage scheme for groundwater-affected soils was under consideration. (Payton)

A survey was made of 246 ha proposed as an ADAS Development Farm on hill land at Brough-under-Stainmore, Cumbria, and interpretations made of grassland and drainage suitability. (Bendelow)

A survey of 5 km^2 adjoining the southern shore of Morecambe Bay was completed in connection with the Preesall and Hackensall (Cocker's Dyke) pumped drainage scheme. In addition to basic soils information, maps were produced inferring both current soil moisture regimes and achievable soil moisture regimes given full arterial and field drainage. The information provided will explain the implications of the new drainage scheme to farmers and land owners and provide a basis for future advisory and promotional work. (King)

Irrigation requirements were assessed following a soil survey of about 2 km^2 of warpland, mainly of Blacktoft series, at Burringham North Farm, Scunthorpe. Soil available water for silty warpland is so large that irrigation is necessary only in very dry years. (Furness)

A grassland yield category map of Wales was prepared at 1:250000 based on units of the National Soil Map interpreted according to climatic parameters of warmth and moisture available for growth. Poaching risks for the map units have also been rated. (Rudeforth and Hartnup)

Soil maps of 21 farms on about 5200 ha of heavy land in North Buckinghamshire were produced at 1:10000 scale. Soil structure, workability, crop suitability and droughtiness were assessed for the major soils in an effort to explain why crop yields were lower than on similar soils in East Anglia. (Whitfield, Beard and Fordham)

Detailed maps covering 42 km^2 were made of farms comprising West Essex Farmers Agronomy Ltd. A report in preparation includes assessments of topsoil structure, drainage need, workability and droughtiness. (Wright)

Rabbit populations for selected square kilometres have been monitored over 39 km^2, 11 in the South East (Allen, Fordham and Moffat), seven in Wales (Thompson and Hartnup), ten in Midland and Western England (George), and 11 in South West England. (Staines)

Soils of two winter wheat irrigation experiments at Gleadthorpe EHF were examined in detail following reported anomalies in irrigation response and crop yields. The farm's new permanent irrigation plots were surveyed in detail and their instrumentation discussed. (Reeve)

A detailed survey (42 ha) was made of Kirton Experimental Horticulture Station south-west of Boston, Lincolnshire. The intricate soil pattern found there is typical for this district of marine alluvium deposits. The main road, on an old reclamation bank roughly bisecting the farm, is a boundary between mainly coarse silty soils to the north and fine silty soils to the south. The northern part is dominated by Wisbech and Romney series, with non-calcareous Rockcliffe and Snargate soils occurring sporadically; fine silty soils are rare. The southern part has mainly non-calcareous soils—Tanvats and Pepperthorpe series and an unnamed fine silty gleyic brown alluvial soil—but calcareous Agney soils occur locally and there are small patches of clayey Wallasea series. A soil map and report have been produced, together

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with two interpretive maps showing the distribution of different topsoil texture and calcareous/non-calcareous soils. (Heaven)

Six pits were described and sampled on joint ADAS/GRI experimental sites in the Northern, South-eastern, South-western and Welsh regions. The experiments are to assess the response to nitrogen fertilizer of permanent and reseeded pasture on contrasting soils in different climatic regimes. The Survey is contributing water release measurements and assessing soil variability. Ten more sites remain to be sampled in the next 18 months. (Bradley, Carroll, Harrod, R. A. Jarvis., Kilgour, Moffat, Payton and Rudeforth)

Vron Farm, New Radnor, Powys (100 ha) was surveyed at 1:4000 and the soil management characteristics were detailed at a joint ADAS–National Lime Producers Council demonstration at the farm. (Hartnup)

Drainage experimental sites at Brithdir, Powys and Pwllpeiran, Dyfed were examined and soil series identified for ADAS Land and Water Service. (Rudeforth)

Other work. On sheet 157 (St David's and Haverfordwest) the classification of nearly 400 previously described soil profiles has been reviewed, and soil units appropriate to the 1:50000 scale were drawn for the southern half of the sheet which confirmed the soil patterns shown on the National Map. The most extensive soils belong to the reddish Milford series of typical brown earths, closely associated with deeper Newbiggin series and shallower reddish phases of Powys and Newtondale series. Llangendeirne and Fforest soils are separated in wetter patches. The Moorgate series of humic brown podzolic soils dominates over Skomer volcanic rocks with stagnohumic gleys belonging to the Wilcocks series in wet hollows. Well drained Gunnislake soils are common on the acid and intermediate igneous rocks of the mainland. Coarse loamy brown earths (Rivington series) have been distinguished from the fine loamy Neath series on brownish sandstones of both Carboniferous and Devonian age. (Rudeforth)

Some 110 ha were surveyed for the proposed extension of the CEGB fly-ash disposal site at Gale Common, North Yorkshire. Optimum soil stripping depths were assessed, together with the best methods of working and restoring the site. (Bradley and Furness)

A profile was described at a buried site in Northumberland for Edinburgh University Department of Archaeology. (Payton)

Part of Cockle Park Experimental Farm (University of Newcastle) was re-surveyed and profiles described to characterize a redefined map unit. (Payton)

The soils at four fenland sites in Oxfordshire were examined for the Nature Conservancy Council and a report has been prepared. (Allen).

A scheme for reporting the soils within Sites of Special Scientific Interest for the Nature Conservancy Council is being developed. (Allen).

Hampshire County Council has been advised on the identification and classification of the soils associated with old permanent grassland. (Allen)

Detailed soil surveys of some 2700 ha of private farmland in Berkshire, Oxfordshire and Hampshire were undertaken to aid management and cropping policies. (Fordham, Moffat and Staines)

Soil data were supplied to Dames and Moore International for an area of land near Salisbury. (Allen, N. Boothroyd, Cope, Kilgour, Staines and Thompson)

A map and report on soil quality and quantities for restoration was provided for the Gilfach Iago opencast coat site (133 ha). (Hartnup)

A soil map at 1:5000 scale of the grounds (40 ha) of the Welsh National Folk Museum at St Fagans, Cardiff, was prepared. Also a map showing soil pH and a report describing the management and cropping characteristics of the soils. (Rudeforth and Hartnup)

A report describing the soils of Llysfasi College of Agriculture, Clwyd, was produced. (Lea)

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The soils of Bronydd Mawr and adjacent hill farmland near Trecastle, Powys, are currently being mapped (250 ha) at the request of the Welsh Plant Breeding Station. (Hartnup and Rudeforth)

Surface soil acidity in Wales was mapped from 800 National Soil Inventory data points at the request of the Department of the Environment to form part of an assessment of the environmental effects of acid precipitation. All topsoil pH analyses from Wales were categorized by soil series, land use and bioclimatic classification, in order to calculate mean pH values for combinations of these parameters. The work provides the most comprehensive statement on the acidity of Welsh soils available. (Thompson and Loveland)

A survey of a 300 ha farm near Gainsborough was completed. In addition to interpretation of soil data for field drainage, workability and maintenance of nutrient status, the report identified areas of structural deterioration and reviewed the capability of the farm and surrounding land for different cropping regimes. (Reeve)

A 1:2500 soil map and simple legend of Elvaston Country Park (125 ha) were prepared for Derbyshire County Museum Service to accompany the 'Down to Earth' soils exhibit. Three soil pits were excavated to demonstrate different soils of the Park and a soil inspection exercise was prepared for visiting groups. (Reeve)

Soils of winter oilseed rape experimental sites near Sutton Bonington and Bunny were described for the University of Nottingham School of Agriculture. (Reeve)

The National Coal Board are funding an 18 month study into soil water content and soil strength changes during stripping operations on opencast sites and preparations have been made for this work. (Reeve)

The structural state of several restored NCB opencast sites in the east Midlands has been examined and discussed with ADAS and NCB staff in relation to methods of restoration. (Reeve)

A detailed survey (131 ha) was undertaken of the Staffordshire College of Agriculture, Rodbaston, and monoliths were prepared to demonstrate representative soil profiles to students. (Smith)

Six farms in Devon, totalling 470 ha, were mapped in detail for the Grassland Research Institute to support a study concerning the efficient utilization of grass on contrasting soils. (Harrod)

Some 50 ha of land were surveyed in the vicinity of Long Ashton Research Station where more land is required for experimentation, particularly for weed research. (Findlay and Cope)

The soils at the AFRC Letcombe Laboratory's experimental site at Compton Beauchamp, Oxfordshire were described. (Jarvis)

Detailed soil maps were made of some 1200 ha of private farmland in Northamptonshire and Bedfordshire, to aid management policy on drainage, tillage and irrigation. (Wright)

The suitability of land for liquid sewage-sludge disposal north and east of London was assessed for the Thames and Anglian Water Authorities. (Wright, Seale and Hodge)

The floristic composition of chalkland soils under old semi-natural woodland is being recorded, with soil samples taken for pH determination, during the survey of the 1:50000 Winchester and Basingstoke sheet. (Allen and Moffat)

Staff

R. A. Jarvis and R. S. Seale retired after 33 and 37 years service respectively. V. C. Bendelow resigned to start a consultancy business, and C. A. Smith to take up an appointment at the West of Scotland Agricultural College. Other resignations through the year have come from Susan Harrop, Jean Thompson, Geraldine Warnes, Sylvia Waldron and I. Fullstone.

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Tim Brewer returned to Manchester Polytechnic on completion of his sandwich student year, and was replaced by Nicholas Boothroyd.

J. M. Ragg visited Niedersachsisches Landesamt für Bodenforschung, Hanover, West Germany in March to examine progress in field data capture, computer mapping and soil information systems. A. J. Thomasson and P. Bullock joined a AFRC/INRA discussion on soil hydrology at Dijon in May and presented papers. D. C. Findlay and R. G. O. Burton attended the 7th International Peat Congress in Dublin and presented a poster. R. G. Sturdy, A. Ringrose-Voase, P. Bullock and P. J. Loveland attended the ISSS International Symposium on 'Water and Solute Movement in Heavy Clay Soils' in Wageningen and presented two papers. D. Mackney attended the EEC Land Use Programme Committee at Brussels in July. The EEC sponsored a visit by C. P. Murphy to laboratories at Montpellier and Montfavet, and Mary Proctor attended the EEC workshop on Computerization of Land Data at Copenhagen. The British Council sponsored a visit by R. J. A. Jones to the USSR to discuss soils and agroclimatology. M. J. Reeve was invited to The Soil Survey Institute, Wageningen to discuss collaborative work on soil physical measurements. A. J. Thomasson attended the EEC Workshop on Land Evaluation at Wageningen in December.

A NERC CASE award was secured in conjunction with the Geology and Geography Department of Hull University for a study of the mineralogy and pedology of the Humber warplands.

Visiting Workers. Dr G. P. Bhargava, visiting scientist and British Council Scholar from the Central Soil Salinity Research Institute, India, returned home after four months with the Survey working on the mineralogy and microstructure of saline soils.

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