ROTHAMSTED RESEARCH

Report for 1970 - Part1

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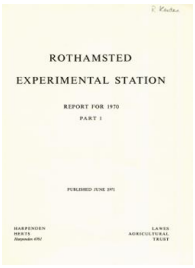

Soil Survey of England and Wales

K. E. Clare

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SOIL SURVEY OF ENGLAND AND WALES

K. E. CLARE

The aims of the Soil Survey of England and Wales and of Scotland are to describe, classify and map the different soils in Britain. Classification is mainly on the basis of properties of the soil profile as observed in the field, the parent material from which the soil is thought to come, as well as the environment and the use made of the land. Samples are analysed in the laboratory to confirm and give precision to field observations, to characterise the soils further and to study soil-forming processes. The properties of the soils shown on maps are described in accompanying publications, as are the geography, geology, climate, vegetation and land use of the district surveyed. A soil map and text together are a permanent record of the distribution and properties of the various kinds of soils. Descriptions take into account the whole depth of the soil profile (i.e. surface and subsoil to a depth of 1 m) and, with the additional information provided, are of use in agriculture, forestry, land use planning, land drainage, geography and ecology.

In England and Wales the Headquarters Office, the Analytical Laboratories and the Cartographic Section are at Rothamsted Experimental Station, Harpenden, Herts., and surveyors are stationed at 16 centres.

The new mapping programme described in 1967, in which selected areas of 38 sq miles in each county of England and Wales will be surveyed and maps published at a scale of 1 : 25 000, continues. The areas, which correspond to the Ordnance Survey 10 km × 10 km Outline Edition 1 : 25 000 map series, are chosen for their geomorphological and agricultural interest, and as a basis for later county, regional and national maps.

A new series of publications, Soil Survey Records, will accompany the maps. The first, that for Sheet TM 49 (Beccles North), was published with soil drainage and land use capability maps, in addition to the soil map. Eight further soil maps and four land use capability maps are in course of publication.

Northern England

Yorkshire (East Riding)

Sheet SE 74 (Barmby Moor). This map is complete and the Record is being prepared. (Bullock)

Yorkshire (North Riding)

Sheet SE 65 (York East). The Record is being prepared for publication. (Matthews)

Sheet SE 76 (Westow). This map is complete and the Record is being prepared. (Matthews)

Yorkshire (West Riding)

Sheet SD 85 (Hellifield). After a reconnaissance survey, 15 mapping units were set up and 30 km² mapped in detail.

The area is in the Craven lowlands which are mostly covered with till or post-glacial deposits, though there are outcrops of Carboniferous sandstone and limestone, mainly in the north and south-east. Altitudes range from 95 m to 300 m. The river Ribble

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meanders north to south, separating featureless till to the west from drumlins to the east. Rainfall is 1150 mm over much of the area but about 1250 mm in the north-east.

On Millstone Grit near Long Preston, acid brown earths of the Kirkby Overblow (1) series are on the steepest slopes, whereas peaty gley soils occupy flatter, thin drift areas. Acid brown earths in silty drift, possibly partly loess, cover much of the dip slopes of dark grey bituminous limestone near Marton Scar, whereas the scarp slopes have rendzinas.

River terrace deposits, alluvium and peat occupy one-sixth of the area, mainly in the Ribble valley. The well developed terraces are up to 1 km wide and have mainly loamy and sandy deposits over stony drift giving shallow stony acid brown earths and gleyed brown earths. East of Long Preston, loamy and sandy lacustrine deposits and peat occupy a glacial lake basin.

The drumlins are of loamy or clayey stony drift from Carboniferous sandstone, limestone and shale, either with mainly gley soils and gleyed brown earths or acid brown earths and gleyed brown earths. The last group, mainly near Bank Newton, has many stones below 20 cm; the better drainage reflects their stoniness, coarser texture, possibly a limestone core, and the slightly smaller rainfall. Gleyed calcareous and brown calcareous soils are on the summits of some drumlins near Coniston Cold and Martons Both.

A gently undulating till-covered plateau near Paythorne has loamy peaty and humose gley soils with many *Juncus* spp. (Matthews)

Sheet SE 36 (Boroughbridge). A reconnaissance survey was completed, a provisional legend prepared, and 22 km² mapped.

The area is at the western edge of the Vale of York just north-east of Harrogate, and crossed by the river Ure. Altitudes range from 15 m to 100 m. Mean annual rainfall is 635 mm.

Magnesian Limestone is in the west and centre, Bunter Sandstone in the east, and drift is ubiquitous. Till from Carboniferous rocks of the Pennines and from local Permian and Triassic rocks is predominant, giving clayey and loamy brown earths and gleyed brown earths. Clayey gley soils are in late-Glacial lake deposits at Farnham Mires, Arkendale Moor and Skelton Carrs. Peat and algal marl occur in similar depressions at Staveley Carr and in the Holbeck valley. Soils of the Ure floodplain are sandy, silty or clayey, grading from brown earths to ground-water gley soils with increasing distance from the river. Two river terraces have been recognised, the upper sandy, the lower variable in texture. Soils include brown earths (*sol lessivé*) and surface-water gley soils. (Hartnup and R. A. Jarvis)

Sheet SE 60 (Armthorpe). A land capability classification was completed in collaboration with J. Webber of the National Agricultural Advisory Service. The explanatory text and Record are being prepared. (R. A. Jarvis)

Cheshire

Sheet SJ 65 (Crewe West). The soil map is being published with an accompanying Record.

Sheet SJ 37 (Ellesmere Port West). This map is of the southern part of the Wirral Peninsula. Much of the area is covered by reddish brown till and associated glacial sands, except around Burton and Neston in the west, where the Triassic sandstone below is exposed and forms a series of low hills. In the south-west are alluvial flats of the Dee

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estuary. In mapping, the area can thus be divided into three separate landscape types, and a detailed reconnaissance has been made of each.

Soils on the till are mostly of sandy loam over sandy clay loam or clay loam, and similar to the Salwick and Clifton series (2) in Lancashire. Coarse textured soils of the Newport (2) series occur on the glacial sands.

The Triassic sandstone areas give coarse textured soils of the Bridgnorth (2) series.

The alluvium of the Dee estuary consists of fine calcareous sands, often with laminae of silt, forming soils similar to those of the Hesketh (2) complex in the Ribble estuary. A pattern of old channels shows on air photos, with which it is hoped to map the soils on a series basis.

Most of the representative profiles were described and sampled and 23 km² mapped in detail. (Furness and S. J. King)

Westmorland

Sheet SD 58 (Sedgwick). Detailed mapping of 40 km² completed the sheet which is being prepared for publication with an explanatory text.

Much land consists of drumlins of very stony till largely from underlying Silurian greywackes, slates and siltstones. Four unnamed series within the Lowick (3) association were mapped on these deposits.

Smaller areas of solid Silurian greywackes and siltstones (Coniston Grits, Bannisdale Slates and Kirkby Moor Flags) were mapped as the Brantwood and Grizedale complexes (3). It is hoped to correlate these soils with those in similar areas of north Wales and the Southern Uplands.

In the west, where drift deposits are much thinner and over Carboniferous Limestone, brown earths predominate with some brown calcareous soils. Silt loam textures are common throughout.

Alluvial deposits ranging from extremely stony to stoneless silt loams occur, especially in the valley of the Beela and its tributaries. Reedswamp peat deposits occur in enclosed hollows, especially on the higher ground in the north-east. (Furness and S. J. King)

East Anglia

Cambridgeshire and Isle of Ely

Sheet 173 (Ely). The map and memoir have been prepared for publication.

The shallow phase of the Adventurers' (4) series with organic layers between 30 and 90 cm thick, covers about 220 km², and was sampled on a grid pattern to study the mapping unit in detail. In nearly half the area the peat was less than 45 cm thick. About 5% of the peat was 'drummy' (an acid soil condition restricting plant growth), and a further 25% slightly 'drummy'. Most surface horizons were of peaty loam texture and subsoils of peat, whereas the ploughed surfaces of the roddons were humose. (Seale, Hodge and Potter)

Sheet TL 38 (Chatteris). About 90 km² were mapped, including some 36 km² of higher land in the south and west needing detailed investigation. The Hanslope, Wicken and Denchworth series occur with Landbeach and Aldreth soils as a complex on lower ground (4). The fenland has fringing areas of Peacock and Bracks series with some Fordham and Isleham soils in the south-east. However, most of the fenland, covering about 60% of the map, is of thin peat over Fen Clay. This can be recognised on air photographs as a characteristic tone pattern, so intensive ground survey is not needed. Chatteris soils occur on the extensive roddon system in the Fen Clay with Adventurers'

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or Downholland soils (2) between. The proportions and distribution of the latter series is being determined by a network of samples. (Seale)

Norfolk

Sheets TG 13 (Barningham) and TG 14 (Sheringham). The map was finished and the Record is being prepared. (Corbett and Tatler)

Sheet TG 31 (Horning). This sheet was completed. The landscape, with three distinct facets, has features resembling those already mapped in east Norfolk. The upland facet, a flat or gently rolling surface on Norwich Brickearth, locally capped by varying thicknesses of gravelly sands and blanketed by a thin Cover Loam, has soils and soil patterns similar to those of the Southern Boulder Clay landscape of Sheet TG 13 (Barningham). Freely drained soils with little or no gravelly sand are classed as Wickmere (5) and Hall (6) series. Gleyed soils are classed as Gresham series and a sandy variant was recognised where there is a thin discontinuous spread of gravel giving subsurface textures of loamy sand. Stony sandy soils on sloping sites without Cover Loam are grouped with the Freckenham (4) series, and where the surface is loamy with the sandy loam phase of the Hall series. Sheringham series occurs on the floors of shallow valleys and Aylsham series on similar lower sites with a ground water table. In the south-east the upland facet has an area of Chalky Boulder Clay (Lowestoft Till) with sandy surface layers; the freely drained soils are mapped as the Ashley (4) series.

Valley gravels and Crag deposits occur on spurs and terrace remnants between the uplands and the Bure floodplain, and carry Freckenham and Hall soils.

The Bure floodplain resembles the Waveney valley near Beccles (6). Upstream there are Adventurers' and Raw Peat soils, and downstream the Waveney series occurs on the central strip of mineral alluvium. A shallow phase of the Adventurers' series with about 50 cm of organic material over silty alluvium, occurs locally. Silt loam to fine sandy loam roddon soils are associated with the Waveney series on estuarine alluvium. (Tatler)

Sheet TM 28 (Harleston). A reconnaissance survey was made during spring and the sheet mapped during the summer and autumn. The landscape consists of a flat or gently sloping upland on Chalky Boulder Clay (Lowestoft Till) with a thin coarser textured surface; level gravelly sand terraces flanking the Waveney; and the river floodplain with organic deposits locally covered by fine textured deposits which can be Head or alluvium. The soils and soil patterns resemble those of Sheet TM 49 (Beccles North) (6).

Upland sites on the very broad flat crest between the main water-courses have a continuous cover of thin sand with a mean depth of about 50 cm, but partly mixed with the boulder clay below. The sand–boulder clay junction is extremely irregular and contorted and there is unmixed loamy sand in depressions and isolated pockets in the clay to a depth of about 200 cm.

Gleyed soils with surface textures of sandy loam and subsurface textures of sandy clay loam are mapped as Beccles series, and soils with subsurface textures of loamy sand or coarse sandy loam with less than 10% clay as the Aldeby (6) series.

On flat or gently sloping (1–2°) sites, the surface sand occurs only as small pockets about 10–20 cm across in the clay. Here gleyed soils with surface textures of sandy clay loam and subsurface textures of sandy clay loam, sandy clay or clay loam are grouped as a sandy clay loam phase of the Beccles series. Similar soils occur on still steeper slopes without sandy pockets. Steep slopes of 3–15° occur in the lower sections of secondary valleys and also separate the uplands from the Waveney terraces. These slopes have freely drained soils with surface textures of sandy clay loam and subsurface textures of

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sandy clay loam, sandy clay or clay loam, which are grouped as Ashley (6) series or a truncated phase where the chalky clay is just below the plough layer. The floors of upper sections of minor valleys are filled with Head of sandy loam or sandy clay loam texture over gravelly sand and have freely drained soils classed as a valley floor phase of the Hall series or gleyed soils of the Gillingham (6) series. In lower reaches, moderately gleyed finer textured Head of silty clay loam or clay loam texture is classed provisionally as Harleston series.

On the Waveney terraces, freely drained soils with surface textures of loamy sand are classed as Freckenham (6) series, but as a sandy loam phase of the Hall series where the gravelly sand is under thin loamy colluvium.

On the Waveney floodplain, humified peat is classed in the Adventurers' series and deep fine textured strongly gleyed Head or alluvium, widespread at the mouths of secondary valleys, tentatively as a poorly drained phase of the Harleston series. (Corbett)

East Midlands

Nottinghamshire

Sheet SK 85 (Newark-on-Trent East). Detailed mapping progressed rapidly because of the very early harvest in this mainly arable area. The dry summer led to small yields of cereals on well drained sandy soils, but yields were near average on soils with ground water.

On the Keuper Marl a grey variant of the Worcester (7) series was mapped and about 4 ha of Dunnington Heath (8) series on thin drift over the Marl. Soils on Lias Clay and Rhaetic Beds are mainly of the Evesham and Charlton Bank series (7). In the east, where there are more limestone bands in the Lias Clay, small patches of Somerton (7) series occur but are too small to map separately. Soils of the Rowsham (9) complex occur where the Beeston, Hilton and Floodplain Terraces thin out over Lias Clay and where cryogenic processes have mixed terrace material with clay below. Here the complex resembles the Aldeby/Beccles unit of Suffolk (6).

The thickness of the terraces and the drainage varies widely. Soils of the Newport and Astley Hall series (2) are less extensive than the imperfect and poorly drained soils. The imperfectly drained soils, tentatively correlated with the Fulford (1) series of Yorkshire, have remnants of a thin iron pan at about 35 cm. The wetter soils are, as yet, uncorrelated. Podzolisation is more evident in woodland and a forest phase was distinguished.

Soils on alluvium in the Witham valley were correlated with the Fladbury (9) and Thames (10) series. In the Trent valley fine textured alluvial soils are also correlated with the Fladbury series, but there is also a more silty alluvium on the wash-lands. (Johnson)

Lincolnshire

Sheet TF 16 (Woodhall Spa). A further 55 km² were mapped. The intricate soil pattern of the Witham Fen (5) is complicated by extensive coarse textured fluvio-glacial deposits under the clayey or silty alluvium. Here, fossil gley podzols are covered by 20–100 cm of alluvium. Aerial photographs and grid mapping were used to determine the proportion of components in the complex units.

Soils of the Aldeby and Beccles series (6) were mapped on sandy fluvio-glacial deposits over Chalky Boulder Clay. A composite Aldeby/Beccles unit was used where there is considerable variation in depth to clayey horizons within short distance. (Robson, George and Heaven)

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West Midlands

Herefordshire

Sheet SO 34 (Staunton-on-Wye). A further 50 km² were surveyed. The range of soils resembled that near Hereford and Ludlow.

Most are of the Wootton and Vernolds series (11), in till and outwash deposits of the Wye glacier. Small but widespread areas of stoneless, extremely silty and sandy soils were mapped on outwash silts and sands and were tentatively classified as a stoneless phase of the Wootton series. In places the glacial deposits are extremely stony calcareous gravels, giving the Peaton (11) series.

Alluvial soils of the Teme and Kingsland series are widespread along the Wye but many tributary streams, draining areas of Devonian rocks are lined by soils of the Lugwardine and Hollington series.

At Letton there is a large alluvial flat 3–5 km (2–3 miles) across, upstream from an old terminal moraine, running north-east from Staunton-on-Wye to Norton Canon. This low area, occasionally flooded during winter and spring, is fringed at its inner edge by clayey soils of the Wigmore and Woofferton series.

The Devonian country rock strikes approximately north-west/south-east and dips gently south-west. It outcrops in isolated hills (Garnons Hill, Tin Hill) and ridges (Wood bury Hill to Merbach Hill) aligned along the general direction of strike and rising 150 m above drift-filled lowlands. Bromyard (11) soils are typical, and steep, shallow and drift phases were separated where possible. Sandstone and cornstone bands are subordinate in the succession and there are only small areas of Eardiston series and Hayton-Eastham complex.

Not all higher ground is drift-free; the ridge at Merbach Hill (318·5 m) has been over-topped by ice and Wootton series occurs on the summit but the slopes are too steep to carry any till.

Around Eardisley, Kinnersley and Norton Canon large areas of till are below various thicknesses (0–100 cm) of brown alluvium deposited by the Wye, up to 10 m above the present flood level. Where the alluvium is thin over till, shallow phases of the Kingsland and Teme series were mapped. Much of the Vernolds series here has also had a very thin veneer incorporated in its upper horizons.

Small hollows and channels in the till plain are often filled with colluvium or alluvium on which Hollington series has been mapped, and deeper poorly drained hollows occasionally contain peat. (Palmer)

Worcestershire

Sheet SO 87 (Kidderminster). A reconnaissance survey early in the year allowed several profiles to be described. Detailed mapping has since been completed, and the map and Record are being prepared. The sheet was chosen to represent soils on Triassic rocks and the Triassic derived fluvio-glacial terraces of the Stour and the Severn. The area straddles the outcrop of the Bunter Sandstone, the Lower Keuper sandstone and the Keuper Marl, which strikes north-east/south-west dipping gently south-east. There are also small patches of glacial sands and gravels and a small outcrop of wind-blown sand in the south-west at Hartlebury Common.

Although 14 series were mapped, 70% of the area is mainly of three soils: the Newport, Bridgnorth (8) and Bromsgrove (12) series. Sandy loam soils of the Bromsgrove series, which cover almost the whole of the Lower Keuper sandstone outcrop, were tentatively split into two phases based on the dominant size of the sand particles. The sandstone parent material includes some thin interbedded seams or 'fish eyes' of marl-like material

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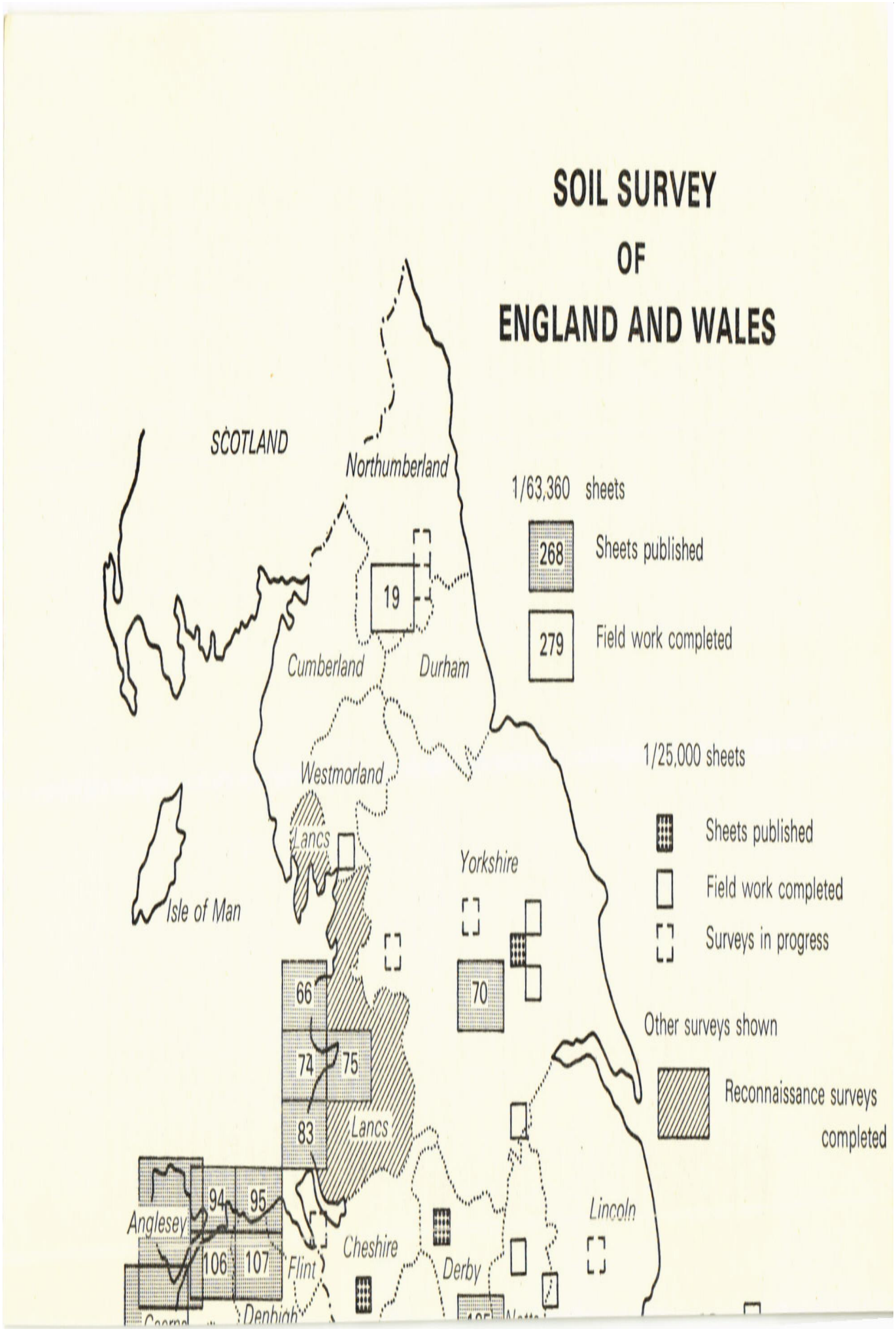

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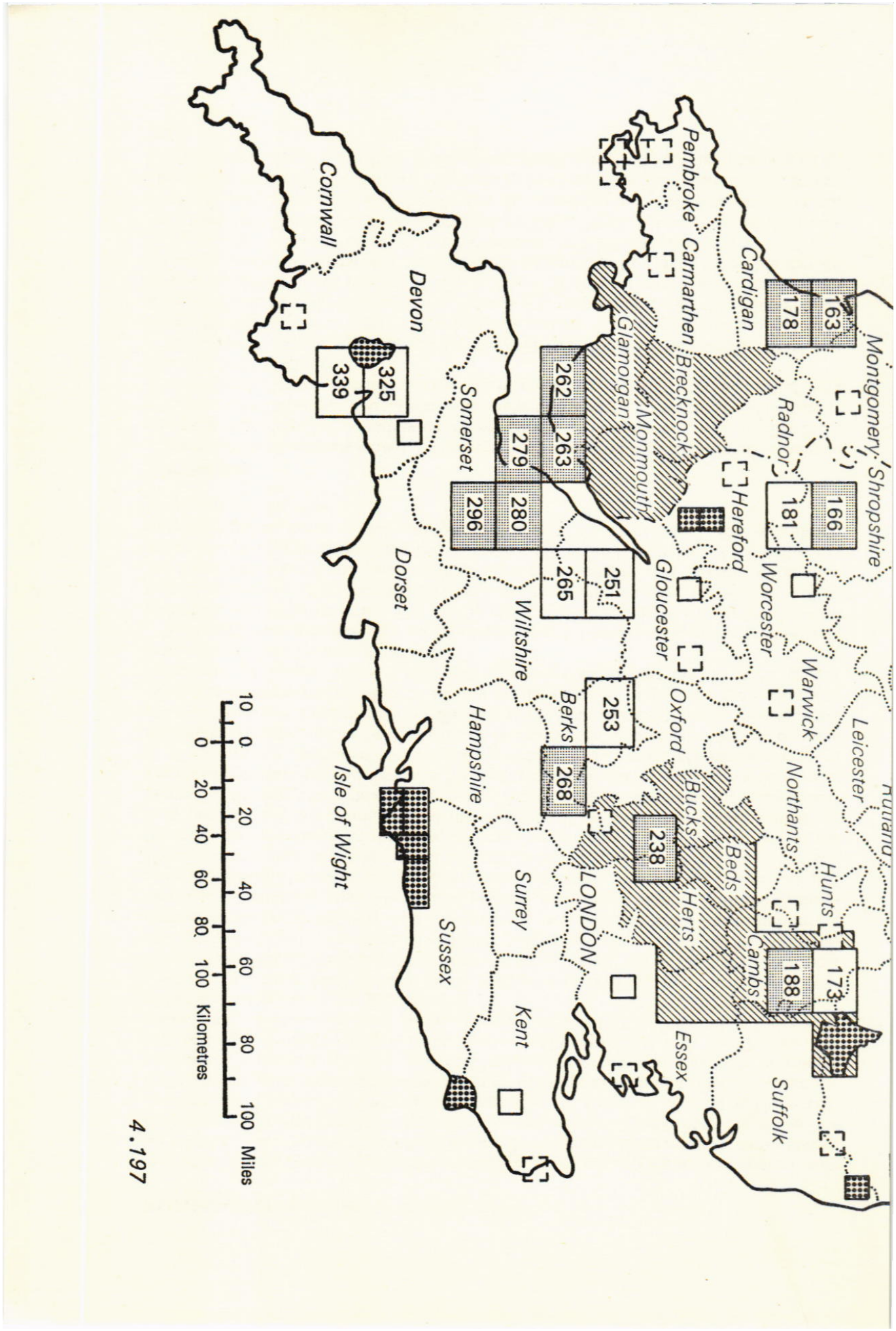

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that weather and are mixed with the weathering sandstone, giving soils of more loamy texture than those on the Bunter Sandstones. Bromsgrove soils are more water-retentive than those of the Newport or Bridgnorth series and provide valuable arable land used for a range of field crops, including vegetables and tree and soft fruit. Worcester, Hodnet (8) and Whimple series were mapped on the larger outcrops of marl and siltstone within the sandstone. Imperfectly drained soils at Chaddesley Corbett and Cakebole of similar texture to the Bromsgrove series, were provisionally correlated with the Greinton (7) series. Most of these Greinton profiles are best classified as undifferentiated gley soils rather than as surface-water gley soils.

The main Keuper Marl outcrop in the south-east gives Worcester, Spetchley, Brockhurst (8) and Whimple series and carries more grass than the rest of the district. Newport and Bridgnorth series dominate the Bunter Sandstone outcrop and the fluvio-glacial deposits in the north and west. The fine-grained Lower Mottled Sandstone round Spring Grove and The Heath gives humus-iron podzols, which were mapped with the Crannymoor (8) series. The upper terraces have mainly Newport soils but the low terrace just above the floodplain of the Stour and Severn has more loamy soils correlated with Wick (8) series. Several phases of the Newport series were mapped, reflecting the size of the sand particles and the loaminess and the stoniness of the soils. The water available to plants in representative profiles is being determined to evaluate the agricultural significance of these phase differences. Most of the Bunter outcrop around Kidderminster is of fine-grained sandstone but the Bunter Pebble Beds are mainly medium grained sandstone and give coarser Bridgnorth and Newport soils. Some higher terrace deposits are also mainly of medium sand. Soils with sandy loam textured surface horizons are classed as a loamy phase, which is mainly on the terraces. Stony soils are widespread except on the Lower Bunter Sandstone, and occur on Bunter Pebble Beds, terrace deposits and glacial sands and gravels.

Soils with ground-water gley morphology around Dunclent Farm were tentatively correlated with Ollerton series. The gleying in some of these may be caused by irrigation from a canal system that operated for about 400 years until recently. The alluvial soils of the Stour and Severn and their tributaries are very variable, and several series were provisionally recognised but need better correlation with soils elsewhere. Much alluvium around Kidderminster is wet and overgrown and no longer used for agriculture. (Hodgson and Hollis)

Warwickshire

Sheet SP 36 (Leamington Spa). This, the first of the five 1 : 25 000 maps chosen to represent Warwickshire, is mainly on Triassic marls and sandstones, with smaller areas of Upper Coal Measures and Lower Lias in the north-west and south-east. The land is drained by the Avon and its tributaries, and much is covered by Pleistocene drift of both Riss and late Würm age.

Worcester (8) series was mapped on the drift-free slopes of the Keuper Marl and clayey Spetchley (8) soils occur in low-lying marl areas. A narrow strip of brown loamy soils correlated with the Bromsgrove (12) series was mapped in the north on fine-grained Keuper sandstones with patches of Lilleshall and Shifnal series (8) in red Upper Coal Measures marls and sandstones. Soils of the Evesham, Charlton Bank (8) and Somerton (7) series are on the small area of Jurassic rocks around Ufton and Harbury.

Cottam and Flint series (8) were mapped on Older Drift, whereas surrounding outcrops of interglacial sands and gravels give discontinuous areas of Newport (8) series. Soils on the Newer Drift terraces are very variable in texture, stoniness and drainage. Brown freely drained, loamy soils of the Wick (8) series and imperfectly drained loamy soils on

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marl or marl-like material, identified as the Dunnington Heath (8) series, are widespread. Thin locally derived drifts over the Keuper outcrop also give the Dunnington Heath soil, in addition to the wetter Brockhurst (8) series.

Approximately 48 km² were surveyed and 25 mapping units provisionally identified. Correlations with neighbouring regions are being made. (Whitfield)

South-east England

Buckinghamshire

Sheet SU 88 (Marlow). A further 20 km² were mapped. The National Agricultural Advisory Service are collecting information to assess land-use capability. (Mackney)

Essex

Sheet TQ 59 (Harold Hill). Soil map and Record were completed; the Record includes a land-capability map and agricultural report prepared jointly with the National Agricultural Advisory Service, and a soil drainage map. (Sturdy)

Sheet TQ 99 (Burnham-on-Crouch). A reconnaissance survey was made during which 37 pits and cores were described. 300 auger borings were recorded on cards, mostly from six blocks of land representative of the main landscape and geological divisions. A legend with 18 series was established, and 25 km² were mapped in detail.

The land lies on the estuaries of the rivers Crouch and Roach, with Burnham on the north bank of the Crouch and Wallasea, Potton and Foulness Islands to the south. Sea defence walls surround these islands and extend along the estuaries inland to Rochford (Roach) and Battlesbridge (Crouch). The open sea is 3 km to the east.

The three main physiographic regions are: (1) the level reclaimed alluvial marshland to the east, with the islands, accounting for 50% of the total area; (2) an 'upland' of London Clay at the western edge, consisting of two blocks of high ground (30–45 m) around Althorne and Canewdon separated by the Crouch, with moderately steep slopes towards the river; (3) the very gentle slopes between (1) and (2), occupied by ill-defined sandy or gravelly terraces covered in part, especially around Paglesham and Burnham Wick, by brickearth and by inter-terrace slopes occupied by loamy or clayey Head.

Although land falls to the east, there are no obvious divisions between the terraces, which are part of the Thames terrace system.

The main soil on alluvium is a grey non-calcareous silty clay, resembling the Waveney (6) series, but without peat at depth. There are smaller areas of brown calcareous clay loams or silty clay loams, and of shallow brown loams over pale greyish or yellowish highly calcareous sand.

Windsor and Wickham series (10) occur on London Clay and on thin overlying loamy drift. Hamble and Hook series (10) are on deep brickearth, and similarly silty, but more clayey soils were identified in hollows.

Soils on terraces are mixed, reflecting the complexity of the deposits, in which aerial photographs show channels and polygonal patterns confirmed on the ground. A surface-water gley soil in greyish gravelly sandy loam over compact reddish brown gravel is common. Fine loamy or clayey, more or less gravelly, gley soils with a light grey subsoil over London Clay at depth occur sporadically at the margins of terraces. Swanwick and St. Albans series (10) also occur. (Sturdy and Reaves)

Kent

Sheet TR 35 (Deal). Detailed mapping continued, leaving 10 km² to be surveyed. Thirty representative profiles were described.

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The alluvium ranges widely in age, because of the gradual silting up of the Wantsum channel, which originally separated the Isle of Thanet from mainland Kent. Historical evidence, supported by differences in soil colour, and calcium carbonate content, indicate that the Lydden valley and other land to the south-east was occupied in Saxon times, but gradual confinement of the Stour continued up to about 1916. Except in a wide coastal belt of dunes and beaches, the soils are fine textured. Arable farming is not related to soil type and about 25% of the marshland is cultivated, although the regional drainage is less satisfactory than for comparable alluvium on Romney Marsh. (Fordham)

South-west England

Gloucestershire and Wiltshire

Sheets 251 (Malmesbury) and 265 (Bath). Table 1 gives mapping units for the combined sheets. (Findlay)

TABLE 1

Mapping Units for Sheets 251 (Malmesbury) and 265 (Bath)

Soil group	Texture and geology	Mapping unit*
Rendzina	Loamy and stony, over rubbly Jurassic limestone Head and scree	Yatton (Sherborne steepland)
Brown calcareous soils	Loamy; over calcareous gravel	Badsey
	Fine loamy to clayey and stony; fine colluvium and rubbly limestone Head	Didmarton (Sherborne)
	Fine loamy to clayey and stony; over Jurassic oolitic and shelly limestone	Sherborne
		Sherborne-Haselor complex
	Fine loamy and stony; rubbly limestone Head and scree	Sherborne steepland
	Clayey and stony; fine grained limestone and clay shale	Somerton
Gleyed calcareous soils	Clayey; grey clay-shales (Jurassic)	Evesham
		Evesham complex
	Clayey and stony; clay and limestone (Jurassic)	Haselor
	Clayey to fine silty; grey marl (Keuper)	Hurcot complex
	Clayey; grey clay-shale (Fuller's Earth)	Trip
		Trip Landslip complex
Brown earths	Loamy, micaceous very fine sands (Jurassic)	Atrim
		Tetbury complex
	Loamy over clayey; sandstone and sandy limestone (Carboniferous)	Dean
	Loamy and stony; sandstone (Devonian)	Eardiston
		(Pedington complex)
	Sandy, sand and sandstone or ironstone	Frilford
	Fine loamy to fine silty; sandstones and siltstones (Keuper)	Hodnet
	Loamy and stony; over massive limestone (Carboniferous)	Lulsgate
	Loamy and stony; andesite and basalt Head (Silurian)	Michaelwood complex
	Coarse loamy and stony; quartzitic sandstone (Devonian)	Ross
	Loamy; calcareous gravel (river)	Sutton
	Loamy and stony; sandstone (Carboniferous)	Swindon Bank
Gleyed brown earths	Clayey; clayey and stony Head (from Lias over Keuper Marl)	Ham complex
	Loamy or silty; sandstones and siltstones (Keuper Marl)	Greinton
	Loamy over clayey; Old Red Sandstone drift over Lower Palaeozoic clay substrata	Heneage complex

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TABLE 1 (*continued*)

Mapping Units for Sheets 251 (Malmesbury) and 265 (Bath)

Soil group	Texture and geology	Mapping unit*
Gleyed brown earths (*cont.*)	Loamy; (gravelly) loamy drift	Isle Abbots
	Coarse loamy; sand (Kellaways and Forest Marble)	Longworth (Langley–Longworth complex)
	Fine silty to fine loamy; silty clay-shale (Lias and Forest Marble)	Martock
	Silty; siltstone (Devonian)	Middleton (Pedington complex)
	Loamy over silty; siltstone and sandstone (Devonian)	Pedington (Pedington complex)
	Fine loamy or clayey; Jurassic drift over clay substrata	Podimore
	Loamy; sandstone Head over clay-shale (Carboniferous)	Stanley (Dale series)
	Loamy; loam, clay and limestone (Forest Marble)	Tetbury complex
	Fine loamy over clayey; Head over Keuper Marl	Whimple
	Clayey; over Keuper Marl	Worcester
Surface-water gley soils	Clayey; clay shales (Coal Measures)	Dale
	Clayey; clay-shale (Jurassic)	Denchworth
	Fine loamy over clayey; sandy or silty clay (Jurassic)	Hardenhuish
	Loamy; drift over clay substratum	Holwell
	Coarse loamy over fine loamy; sand (Kellaways and Forest Marble)	Langley (Langley-Longworth complex)
	Fine silty to clayey; clay-shales (Lias)	Long Load
	Coarse loamy over clayey; sandstone and clay (Devonian)	Milbury Heath complex
	Fine loamy to fine silty; siltstone and marl (Devonian)	Netchwood (Pedington complex)
	Clayey; drift over clay substrata	Rowsham (Podimore series)
	Fine silty to clayey; clay shales (Lower Palaeozoic)	Speller
	Clayey; shallow drift over Keuper Marl	Spetchley
	Loamy over clayey; sandstone and clay Rhaetic	Wedmore
Ground-water gley soils	Fine silty to clayey; estuarine alluvium	Wentlloog
	Clayey; riverine alluvium	Fladbury
Gleyed brown warp soils	Fine loamy to clayey; riverine alluvium	Unnamed

* Mapping units are series except where shown. Complexes are named after dominant or codominant series.

Unmapped series are followed in brackets by the mapping unit in which they occur.

Sheet SO 82 (Norton). The remaining 64 km² were mapped and the Record prepared. Soils on fluvio-glacial terraces include the Wick, Pershore and Dunnington Heath series (8). The Wick series are freely drained sandy loams of variable stone content with loamy sand or sandy subsoils. They are locally gleyed where the water table fluctuates. This series is distinguished from the loamy phase of the Newport (8) series by a greater depth of sandy loam. Imperfectly drained stony soils of the Pershore series have sandy loam upper layers over a continuous sandy clay or sandy clay loam mottled layer above 90 cm. The Lias clay below rarely occurs within the profile. The Dunnington Heath series includes soils of similar drainage class and texture to the Pershore but on Keuper Marl within 90 cm. A poorly drained soil on an isolated patch of calcareous reddish brown clayey till capping Corse Wood Hill gives a soil akin to the Salop (8) series.

The Keuper Marl derived alluvium of the Severn includes poorly drained clayey soils of the Compton (7) series and imperfect to moderately well drained fine loamy to clayey

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soils of the Tewkesbury (8) series. Soils on grey clayey alluvium also occur in the Severn floodplain and are grouped with poorly drained Fladbury (7) soils on Liassic derived alluvium in the narrow floodplains of east bank tributaries. Here, the Fladbury series also includes poorly drained soils on olive-brown alluvium which can be calcareous in the upper layers. Imperfectly drained calcareous clayey soils of the Butleigh (7) series dominate narrow upper reaches of streams draining Liassic clay country and include small areas of non-calcareous clayey soils of the Wyre (8) series. (Cope)

Sheet SP 12 (Stow-on-the-Wold). 60 km² were mapped in detail, mostly on the Jurassic limestone upland of the west and north. Separate limestone formations mapped by the Geological Survey are difficult to distinguish lithologically but give two extensive soils. The well-drained Sherborne (7) series is on wide areas of Inferior Oolite, Chipping Norton and Great Oolite Limestones. Outcropping clay bands in the limestone give shallow stony imperfectly drained calcareous clay soils. There are deeper well drained soils on dry valley floors in the uplands. The Trip (13) series is on the Fuller's Earth clay outcrop; Martock and Charlton Bank (7) soils occur on Middle Lias clay near Donnington. (Courtney)

Devonshire

Sheet SX 65 (Ivybridge). A further 50 km² were surveyed with observations recorded at 100 m grid intersections, completing the part of the sheet (60 km²) surveyed intensively; the rest will be covered by a more open 'free survey'.

Soils on the Dartmoor Granite broadly resemble those outlined by Clayden and Manley (14). However, many brown earths on the lower moorland slopes differ from the Moretonhampstead series in having B horizons of low chroma. Peaty gleyed podzols of the Hexworthy series occur on higher slopes, closely mixed with soils having peaty surface horizons over brown or ochreous subsoils with variable reddish and yellowish mottling. Peaty gley soils occupy parts of a plateau around 350 m O.D. (Harrod, Staines and Hogan)

Wales

Carmarthenshire

Sheet SN 41 (Llangendeirne). 50 km² were mapped in detail, mainly Old Red Sandstone soils of the Gwendraeth-fâch valley where two mapping units predominate. The first in a thin irregular veneer of loamy or silty reddish brown drift, consists of brown earths (*sol brun acides*) with minor inclusions of shallow rankers. The brown earths have very consistent A and B horizons with about 20–25 % clay but vary more in their C horizons below about 60 cm. Some are of fine sandstone but C horizons of gritty loam or fine sandy loam are commoner with less clay and paler colours than the soil above. Such horizons often have fragipan characters and are sometimes weakly mottled.

In contrast the gley soils are in thicker loamy drift, usually in depressions. These have striking, pale coloured loamy Eg horizons passing to fine loamy reddish brown Bg horizons. Small areas of humic gley soils with very dark coloured A horizons are also distinguished. Gleyed brown earths with less pronounced gleying occur only locally.

On the valley floor of the Gwendraeth-fâch brown warp soils in reddish brown loamy alluvium predominate below Pont Llangendeirne. Above, they are restricted to a narrow levee belt and the remainder is of very poorly drained gley soils in fine loamy alluvium. (Clayden and G. D. Evans)

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Pembrokeshire

The completion of sheets SM 90 (Pembroke) and SM 91 (Haverfordwest) was postponed to examine profiles at regular intervals over a larger part of the county, and allow the early compilation of a county map. This was requested by the Agricultural Land Service to aid land classification on O.S. sheets 138 and 151 (7th series).

A further 670 profiles were described at 1 km intervals and drainage, thickness, stoniness, texture, structure, gradient, slope shape, climate and land use were coded for computer and recorded on punched cards. Maps were made showing the distribution of land classes and subclasses (15), soil group, and single soil and site features.

Some relationships are already apparent, though much analysis remains to be done. Class 3 land covers much of the lowland receiving less than 1270 mm (50 in.) rainfall per year, and class 4 land predominates in the wetter districts. Class 2 land occupies 136 km², mainly in the south (Table 2).

TABLE 2

Land Class areas in south Pembrokeshire west of Robeston Wathen

Land Class	1	2	3	4	5	6	7
Area (km²)	7	101	229	130	25	12	0

When mapping units on sheets SM 90 and SM 91 are related to land classes, topographically distinctive valley flats and steep sided valley complexes are usually in grades 4 to 6, whereas other units are mainly in grade 3 and differentiated by wetness only at subclass level. The survey confirms that the best land is on Carboniferous Limestone, 59% of which is classed as 2 or better.

Topsoil structure is generally better in the north than in the south, and is significantly related to land use. Good structures on well to imperfectly drained soils are most common under the least intensive farming. The following uses are listed in order of increasing structural suitability for root growth: potatoes; broccoli, barley, wheat; short-term grass; long-term grass; other arable crops; rough grazing and woodland. The better structure under 'other arable crops', mainly oats and mixed corn, suggests less intensive management and possibly less urgency in preparing seed beds when land is wet. Poorly drained rough grazings and woodland are associated with a wide range of structures depending on organic matter and clay contents of the soil. (Rudeforth and Bradley)

Montgomeryshire

Sheet SO 09 (Caersws). This is land in the upper Severn valley between Trefeglwys and Newtown and extends north beyond Tregynon and Mynydd Cerrigllwydion. After study of 200 profiles 25 km² were surveyed in detail.

Silurian sedimentary rocks underlie the whole area and are largely covered by local fine textured till.

Moderate slopes rising north of the Severn valley carry mainly Cegin (16) soils. Further to the north-east steeper slopes rise to the moorland region (427 m) beyond Llynytarw where Ynys and Hiraethog soils (16) are found.

To the south, the sharply rising Penstrowed Hill area is covered by a complex of Denbigh, Powys and Cegin soils (16).

Gleyed brown earths cover most of the Severn floodplain, with gley soils of the Conway (16) series in old meander channels and below Penstrowed Hill. Conway soils are also extensive on the Tarannon and Ceryst floodplain. Brown earths of the Rheidol (16) series occur on gravel terraces mainly on the north side of the valley and on strongly dissected

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fluvio-glacial gravels in the narrow valley near Newtown. Moderately well drained soils are on the levees.

The Clywedog dam has lessened flooding of the Severn valley.

Intensive management throughout the region tends to obscure the relationship between surface features and the soil below. (Lea)

Supporting research

Supporting research is described under the headings employed in the current programme of the Soil Survey Research Board.

Identification

A 1. Soil morphology and chemistry

The A.R.C. Working Party on Soil Analysis recommended that the Survey collaborate with the National Agricultural Advisory Service to study manual assessments of soil texture by staff of each organisation at 16 centres.

Thirty 9 kg (20 lb) samples were collected from surface and subsurface horizons to represent textural classes and subclasses defined in the United States Department of Agriculture Soil Survey Manual. The samples were subdivided, and particle-size distribution, organic carbon and $CaCO_3$ content determined for each, and subsamples distributed to all centres, to standardise subsequent textural assessments within the Survey. (Avery and Bascomb)

A 2. Methods of analysis

Surface-area measurements on soils usually reflect differences in amount and nature of aluminosilicate clay minerals and organic matter. Measurements on sesquioxidic brown earths of the Bridford (17), Moretonhampstead (17) and Manod (Denbigh *mor phase*) (16) series showed increases in the B horizons unrelated to amounts of clay or organic matter. As the surface-area maxima were enhanced by peroxidation and diminished by acid-oxalate extraction, and correlated well with oxalate-extractable aluminium, they are tentatively attributed to amorphous alumina. (Pritchard)

A method for rating soil structure in the field was developed. The purpose is to grade structure for plant growth suitability from 1 for the best crumb, physically suitable for rooting, to 12 for compact massive material impenetrable by roots and almost unbreakable. The rating is based on the standard structure descriptions of the Field Handbook and distinguishes between 'strong' and 'good' structures: a strong fine crumb is good for rooting, and a strong platy structure bad. (Rudeforth)

A rapid method was devised for measuring the volume of stones in soil in the field, using plastic spheres and a minimum of other equipment. It proved practicable on profiles with wide ranges of texture and stone size. Its accuracy was compared with that of methods previously described, and it is now being tested at several centres. (Stamper and Hodgson)

A 3. Micromorphology and mineralogy

Surface-water gley soils. The genesis of soils of the Windsor (10) series with carbonate at 96 cm and of the Denchworth (9) series with carbonate at 53 cm was studied. Although particle-size analyses of <2 mm samples indicate textural B horizons in both soils,

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and especially the Windsor, microscopic examination of random soil blocks and selected ped faces showed only small amounts of illuviated clay.

Ped faces were selectively sampled in all horizons below the A and contents of coarse and fine clay compared with those for adjacent ped interiors. In both soils, ped faces in upper horizons (Eg and B1g) have slightly less coarse and fine clay than adjacent ped interiors, whereas the reverse is true of lower horizons.

Slickensided ped faces from the B2g and BCg horizons were examined micromorphologically. Though evident in the field, they are not clearly delimited in thin section because there is little more preferred orientation of clay particles in slickensides than in ped interiors. (Bullock and Mackney)

Textural B horizons in gleyed soils. Thin sections of the B horizons of 50 gleyed soils of different series with a wide range of texture were examined to find whether illuviated clay forms textural B horizons shown to be present by particle-size analysis. Although most soils have some illuviated clay, only in five was there more than 1 % and in none did this account for the difference in clay content between E and B horizons. (Bullock)

A 5. Soil moisture characteristics

To assess agricultural productivity, moisture characteristics of eight soil series, including the Bridgnorth, Newport, Bromsgrove, Eardiston and Woofferton, from east and west Midlands were examined by measuring moisture contents at 0·05, 0·1, 0·2, 0·4, 2·0 and 15·0 bars tension, total porosity, bulk density and particle density. Usually four profiles were taken from each series, and each horizon was sampled in triplicate.

Wilting points of several acid brown earths on hard rocks were measured to study the applicability of the American Soil Classification System to British soils.

A cheap water-level recorder is being developed to study seasonal movements of water tables. (Smith)

Samples of Sherborne (7) soils from the Cotswolds and of similar stony Marcham soils (18) from the Corallian ridge of north Berkshire include a wide range of textural types. Their available water capacity was calculated from release characteristics, and porosity measured on stones from the same sites to assess their contribution to the capacity. Stone content was also measured by the plastic ball replacement method. (Findlay and Smith)

Water levels were recorded in ten different soils, widespread throughout the County, at the Cheshire College of Agriculture, and water pollution is being studied in relation to soil types and farming practice, with the help of the Mid-Cheshire Water Board and the Mersey and Weaver River Authority. (Furness and S. J. King)

A 6. Soil temperatures

Soil temperatures and frost heave were again measured in soils over Magnesian Limestone at Bramham; more heaves were recorded than during the previous winter. In January the rendzina (Wetherby (1) series) was frozen, partly to bedrock, for nine consecutive days; air temperatures fell to minus 12·2°C and soil temperatures (at 8 cm) to minus 0·25°C. (Matthews)

A 7. Air conductivity in Hook soils

The work started in September 1969 (5) was continued in late November and repeated in February 1970, with the same permeameter and buried instruments but with soils at field capacity. By November mean air conductivities of most horizons were about halved, but few significant changes were noted in February. The arable soil with a capped surface

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proved exceptional, giving a conductivity at 2 cm depth about one-tenth the September figure. Its surface, originally dry and cracked, compared unfavourably with the soil under old pasture (Table 3). (Green and Fordham)

TABLE 3

Air conductivities at 2 cm depth

(litres per minute)

	Sept.	Nov.	Feb.
Capped soil	8	<1	<1
Pasture soil	8	5	4

Classification

B 1. Soil classification

Both the Oxford University KDF 9 and the Rothamsted Orion computers were used to analyse and classify soils. Different ways of classification were compared with Wilks' Criterion. Numerical methods and the usual systematic approach give classifications of about equal value. Numerically derived classes when mapped were fragmented, and numerical methods that take account of spatial proximity made fragmentation less and gave classifications equally good for generalisation. Canonical variate analysis was used to study the results of classification, and discriminant functions applied to improve classifications and allocate new soils to existing classifications. (Webster)

A COBOL computer programme, written to designate land class and subclass from profile and site information according to the system used by the Soil Survey (15), was tested on surveys from various parts of Britain and applied to 960 profiles in Pembrokeshire. Changes in classification decisions are easily accommodated to produce alternative maps. (Rudeforth)

The application of set theory to soil classification was studied using the soils mapped on Sheet TR 04 (Ashford). (Green)

Surveying

C 1. Air photography (Uplands)

Soils on Carboniferous Limestone in the West Riding Pennines were studied in the field, using previous mapping in the Craven district (19). Landform, vegetation and drainage patterns are closely related to soil distribution, which permits rapid and accurate mapping. Limestone outcrops extensively as 'pavements', and is elsewhere covered by brown silty drift or local boulder clay. The steeper slopes of the associated Yoredale series are covered by peaty gley soils and peat in a complex pattern resolvable on the air photo, but some places are too intricate to map adequately; similar patterns occur in upland drumlin fields. Blanket peat occurs everywhere at elevations of over 400 m, except on the steepest slopes or on rocky gritstone summits.

Several gritstone moorlands were also investigated and some difficulty encountered where regular burning blurred the photo-pattern. Upland areas mapped by the Geological Survey as 'boulder clay' are being studied; the soil cover is often very uniform, but some differences can be related to the local solid geology and to landform and drainage patterns seen on air photos.

Photography, specially taken for the Survey, of the North Yorkshire Moors at a scale of 1/20 000 was completed, but poor weather prevented the planned photography of Westmorland and the Peak District. Further contracts were placed for the photography

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of the North Riding Pennines and of Pembrokeshire at 1/20 000 scale. Multispectral photographs will also be taken in Pembrokeshire.

Association with other organisations interested in applying air photography continued, and the Survey was represented on a Natural Environment Research Council working party on 'Remote Sensing'. (Carroll and Bendelow)

Reconnaissance survey of the Carboniferous Limestone areas of Derbyshire distinguished two associations; the Nordrach association on gentle and moderate slopes, and Sprink association on steep slopes. At the southern limits of the limestone, boulder clay and Triassic remnants hindered the delineation of further units and this section awaits detailed mapping in Staffordshire. (Johnson)

C 2. Air photography (Lowlands)

Several soil patterns visible on air photographs were studied on the ground.

Silted estuarine and tidal marsh creek systems. This pattern is extensive in the fens of East Anglia and Lincolnshire, and in coastal deposits in Kent, Lancashire and Norfolk, and is best recorded during spring. The greater the tone contrast, the greater the difference in texture and in content of calcium carbonate, mica and surface organic matter between the calcareous, micaceous silty or very fine sandy loam creek channels and the adjacent silty clay marsh deposits. The density of creek channel per square kilometre varies. Usually where creeks are densest there is less tonal contrast on the photographs and the creeks less prominent on the ground. Occasionally the contrast of the light toned creeks and darker toned marsh is reversed, creeks forming slight depressions, with thicker organic matter.

In the fens of East Anglia tone pattern correlates well with soil properties at the soil association level.

Valley floor patterns. These patterns, on photographs taken during spring, occur on Chalky Boulder Clay in Cambridgeshire, Huntingdonshire, Bedfordshire and Northamptonshire; on drift covered Jurassic Limestone in Rutland; on the Jurassic outcrop in Gloucestershire, and over wide areas of drift-covered chalk in the Lincolnshire and Yorkshire Wolds. The deeper decalcified soils in these narrow valley floors 20–50 m wide can be rapidly and accurately outlined.

Stripe and polygon pattern. This pattern, visible on bare ground, in crops or in heath vegetation is associated with the Chalk outcrop in the counties of Yorkshire, Lincolnshire, Norfolk, Suffolk, Cambridgeshire, Hertfordshire, Oxfordshire, Berkshire and Kent. Forty-three sites were investigated.

In Breckland polygons, about 10 m across, and stripes 2–5·75 m wide, cover up to 40% of the ground surface. Outside Breckland the pattern is scarcer and in 100 km² areas examined in Lincolnshire and Berkshire, covers only about 1% of the ground. Stripes were not seen on slopes steeper than 6° or polygons on slopes of more than 2°. Polygons were rarely seen outside Breckland. Away from Breckland, soils are shallower, the depth of the chalk–soil interface varies less and dark toned stripes are wider than the adjacent light toned stripes. The soils over chalk are in several drifts and only locally can individual soil series be associated with the polygons and stripes.

Polygonal pseudomorph frost wedge pattern. This pattern is on drift or peat surfaced sand and gravel terraces. In East Anglia the diameter of the polygons ranges from 40–140 m. The pattern was seen in cereals during summer when the soil-moisture deficit

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exceeded 50 mm. The deeper the drift or peat the greater the soil moisture deficit needed for the pattern to appear.

Other less common patterns are:

Circular and vermiform patterns. On chalky and sandy drifts in East Anglia, and not associated with specific soil series.

Polygonal pattern. The polygons are about 10 m in diameter, usually in Triassic boulder clay and were seen only in Shropshire. It may be restricted to the Astley Hall and Rufford series (2) but further photography is needed.

The relative usefulness of three kinds of film in soil mapping in lowland England was studied, by taking colour, false colour and panchromatic photographs of several areas. Much photography commissioned for routine mapping in lowland England was not taken because weather during spring was unfavourable. (R. Evans)

C 4. Sampling

The Sherborne series. Within-series variation in this soil in the south Cotswolds was studied and a paper prepared. (Courtney)

Cartography

D 1. Automated cartography

Collaboration with the National Environment Research Council Experimental Cartography Unit continued. A revised version of the automatically drawn soil map of the Reading district was produced, together with an overlay and copy of part of the original 1 : 10 560 field sheets, and these were distributed for comment. (Webster)

Data recording on a 100 m × 100 m grid in the Ivybridge area of Devon (Sheet SX 65) was almost completed. The data will be used for experiments in automatic map production from sample surveys. An Algol program to calculate resections was written for this survey. (Harrod, Staines and Webster)

D 2. Block diagrams

The worth of block diagrams drawn by computer was assessed jointly with Messrs CalComp Ltd. Altitudes on a 70 × 70 m grid for a 25 km² area near Marsden (Yorkshire) were digitised and block diagrams drawn from them on a CalComp plotter, but such drawings need refinement to meet the Survey's needs. (Webster)

Special surveys

Surveys were made at the Royal Agricultural College farms at Cirencester, and Eysey alongside the Thames near Cricklade, totalling 526 ha (1300 acres). The soils include well drained Sherborne (7) series on limestones and imperfectly drained Evesham (7) and Haselor (8) series on calcareous clays, continuing the pattern of soils found in the north-east corner of Sheet 251 (Malmesbury). At Eysey about a third of the farm is calcareous clays of the Evesham series, here on Oxford Clay or clayey Head. Another third is imperfectly or poorly drained soils of the Kelmscot series, shallow clay loams on limestone gravels in flat terraces with a fluctuating water table. The remainder is poorly drained soils of the Thames (10) series on calcareous silty clay alluvium. (Findlay)

The soils of Gleadthorpe Experimental Husbandry Farm, originally surveyed by E. Crompton in 1950, were re-examined at 128 × 128 m grid intersects. Samples from each

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of the 110 intersects were taken for mechanical analysis and wilting point determination, and 60 core samples were equilibriated at a range of small suctions to measure field capacity and water release characteristics.

The results mostly confirm the original map, and only small revisions of boundaries were necessary. The soils are now allotted to the Newport (2) series and Ollerton complex. Differences in texture, stoniness and available water capacity were established by statistical analysis for phases of the Newport series. (George, Johnson, Robson, Smith and Thomasson)

A detailed soil map of Exmoor made by Mr. L. F. Curtis of the Department of Geography, University of Bristol, is being prepared for publication as a Special Survey.

Other work

A 1/1 250 000 map of England and Wales showing 11 soil associations was prepared for use by the Agricultural Advisory Council in a forthcoming report on soil-structural problems. The country was divided into humid and sub-humid zones with different potential soil-moisture deficits, and each further subdivided to indicate regional variations in soil characteristics. (Avery)

The physical properties of Jurassic limestones from which Sherborne soils are derived were determined by a temporary worker, Miss R. Washington. Fabric of 47 rock samples from quarries in six Formations was studied and classed according to the Folk system (20). Insoluble residues were measured by solution and the Munsell colours of the residues recorded. Porosity was measured by a simple gravimetric method after soaking in water. Insoluble residue content correlates with fabric class but not with stratigraphic formation. Porosity was not correlated with fabric class, and values seemed influenced by cracks and voids in the small samples. Porosity is negatively correlated with insoluble residue. (Findlay)

Past and present soil and vegetation patterns on the unenclosed moorland of Dartmoor were studied. Air photo interpretation was completed for most of the moor and the variability of the soil studied along 100 km of traverse. Evidence of past soil and vegetation conditions is being sought in pollen analysis of samples from sesquioxidic brown earths, peaty gleyed podzols and peaty gley soils. (Staines)

The excavation for a pipeline to carry North Sea Gas was inspected at intervals for 56 km (35 miles) from Tilbury to Braintree in Essex. With a minimum depth of 2 m, and 3 or 4 m deep pits at road crossings, the trench provided valuable information on the nature and distribution of superficial drifts and the solid geology of the southern part of the County. Soil profiles were described in note form and colour photographs taken to be used in the 1 : 250 000 scale mapping of Essex. (Sturdy and Reaves)

The effect of effluent on soils of the Rheidol (16) series was studied on Trawscoed Farm, by request of the N.A.A.S. Four plots received cow effluent, four pig effluent in different amounts and two neither. Pig effluent at 617 m^3/ha (55 000 gallons per acre) applied during six winter months produced by the following autumn a decrease in vegetation, especially clover, an increase in organic matter to a distinct peaty layer, rusty root traces and a more compact structure. Changes with cow effluent were less. With 662 m^3/ha (59 000 gallons per acre), soil compaction was greater than on the pig effluent plots but there was no distinct organic layer. (Lea)

The annual meeting of the British Society of Soil Science was held at Norwich and the Survey helped to organise tours, demonstrate soils and prepare a Handbook. Demonstrations of the work of the Survey were mounted for this meeting and for that of the Quaternary Research Association.

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Two Memoirs, one Bulletin, two Special Surveys, a Technical Monograph and the first of the Soil Survey Records were published, and three Memoirs, two Special Surveys and eight Records prepared for publication.

Nine maps were published and 15 prepared for publication.

Staff

P. A. Johnson, T. L. Potter and C. P. Stamper resigned. G. R. Beard, V. C. Bendelow, R. G. O. Burton, J. Hazelden, F. W. Heaven, T. R. E. Thompson and J. M. Wood were appointed.

D. M. Carroll visited Amsterdam University and the International Institute for Aerial Survey and Earth Sciences (ITC), Delft, the Netherlands to study photo-interpretation techniques.

C. A. H. Hodge attended the Quaternary Research Association Study Course in the Netherlands, Germany, Belgium and France and visited the Netherlands Soil Survey and ITC, Delft.

R. Webster visited Norway and Sweden to study computer mapping, especially the Norwegian Soil Register, a suite of programs that compiles information on agricultural and forestry resources from land classification maps quickly and economically.

Dr. J. Thorez of the Institute of Mineralogy, University of Liege spent three months in the department studying soil microfabrics.

The Regional Office for Northern England moved to Harrogate and a new centre opened at Leamington Spa. The Lancashire office closed.

A teletype terminal was installed at the Oxford Centre, and will shortly be linked to the Rothamsted System 4/70 Computer.

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