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Report for 1978 - Part 1

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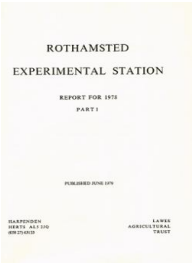
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Soil Survey of England and Wales

D. Mackney

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SOIL SURVEY OF ENGLAND AND WALES

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Introduction

Since 1966, 63 maps and 56 *Soil Survey Records* have been published in the 1:25 000 scale map series. A further 44 maps are in different stages of preparation, most of the fieldwork having been completed; they will be published within the next 5 years making a total of 107 maps, covering some 10 000 km². Together with earlier detailed surveys these achievements, though representing only part of the programme of mapping, provide unparalleled information about the main soil types in England and Wales and their distribution patterns. Detailed surveys now cover about 20% of the country, mostly in lowland situations.

A new programme, agreed with the Ministry of Agriculture, Fisheries and Food will start in 1979; relying very heavily on earlier detailed surveys, a series of 1:250 000 soil maps will be produced to be accompanied by Regional Bulletins, which identify the main soil types and explain their distribution patterns. The soil map will also form the main physical basis for derived land use capability maps at the same scale, partly constructed from additional information supplied by ADAS and other co-operating bodies.

The Land Use Capability Map of England and Wales at 1:1 000 000 has been published; it is the product of close co-operation between the Survey and ADAS staff and for the first time will give a broad picture of land quality and document the physical reasons for differences. In the 1:25 000 series, surveys have been published in the counties of Clwyd, Gloucestershire, Lincolnshire, Northamptonshire, Northumberland and North Yorkshire. At smaller scales are a soil map of South and West Yorkshire at 1:250 000 and a special survey written jointly with staff of The Institute of Hydrology on the *Estimation of run-off potential of river catchments from soil survey* accompanied by a map of England and Wales at 1:1 000 000.

No less than in previous years the staff have been involved in special surveys and consultations with our customers in ADAS, our colleagues in ARC and with a large number of other public bodies with responsibilities in the land use field. The range of these consultations many of which have been the subject of contracts is illustrated by the following list of co-operating bodies: Thames Water Authority, Thamesgro, National Parks Authority, National House Building Council, County Councils, Trusts for Nature Conservation, Nature Conservancy Council, National Coal Board, Development Board for Rural Wales, Countryside Commission, Gas Board, Electricity Board, Universities, I.C.I. and several Civil Engineering Consultants. With the support of our principal customer it is our aim that Soil Surveys contribute increasingly to the pool of information from which land use decisions are made. To this end we welcome contacts with national bodies with manifest and latent needs for soil surveys.

Northern England

Cumbria

Parts Sheets NY 04/05/14/15 (Abbey Town). A draft of the *Record* was prepared. (Matthews)

Sheet NY 56 (Brampton). The remaining 10 km² were mapped and a draft of the *Record* prepared. Surface-water gley soils in reddish and greyish drift predominate, whilst typical brown podzolic soils of the Brownrigg (1) series are common in glacio-fluvial sand at Brampton. (Kilgour)

Humberside

Sheet SE 85 (Fridaythorpe). The remaining 70 km² were mapped and 15 km² revised in the light of changes in soil classification.

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Soil differentiation is related to the depth of glacial and aeolian drift overlying the Chalk. On the high Wolds is a deep argillic brown earth in silty over clayey drift. At lower altitudes the dominant soil is a fine silty brown rendzina (Andover (2) series), which in turn is superseded on lower slopes by a silty grey rendzina (Upton (2) series) containing little drift. These rendzinas with a humic rendzina (Icknield (3) series) are in close juxtaposition on the sides of many deep dry valleys. A typical brown calcareous earth (Coombe (2) series) is on plateau margins and in chalky valley drift. (Furness, R. A. Jarvis and S. J. King)

Sheet TA 14 (Brandesburton). The remaining 25 km² were mapped, profiles described, soil and land capability legends constructed, and the *Record* begun. (Furness)

North Yorkshire

Sheet SE 39 (Northallerton). The *Record* was completed. (Allison)

Sheet SE 47 (Dalton). A further 60 km² were mapped and five profiles described and sampled. Till, mainly associated with the Hallsworth (2) and Dunkeswick (4) series, covers most of the north-east and extends towards Brafferton and Raskelf in small low hillocks. Soils from lacustrine clay are most extensive between Dalton and Norton-le-Clay in the south-west. (Bradley and Allison)

Sheet SE 97N/98S (Wykeham Abbey). The remaining 20 km² were completed and the *Record* begun. (S. J. King)

Upland maps (1:100 000)

North-Central Pennines. The remaining 250 km² on the borders of Cumbria, Durham and North Yorkshire were mapped by reconnaissance survey. Most soils belong to the raw peat or stagnohumic gley soil groups. The fibre content of soils in hill peat tends to increase to the north or on flat sites but most profiles can be included in the Winter Hill (4) series.

The survey was extended by a further 140 km² to the east between Harrogate and Richmond, where the most common parent material is greyish brown till derived from Carboniferous rocks. In Wensleydale however the drift is calcareous, and loamy brown calcareous earths predominate. (Carroll and Bendelow)

Northern Pennines. Reconnaissance survey has begun in south Durham and 165 km² have been mapped between Stainmore and Weardale. Most soils are derived from the local Carboniferous rocks or related glacial drift, and can be correlated with series in other parts of the Pennines. An unusual feature, however, is the widespread occurrence of brown earths and brown calcareous earths in loamy drift to the east of Barnard Castle. (Carroll)

Lake District. Some 95 km² were mapped by reconnaissance survey in the Howgill Fells. Ironpan stagnopodzols of the Hiraethog (5) series grade into humic brown podzolic soils and Denbigh (5) series at lower levels in drift derived from Bannisdale slate. Humic rankers in soft slate occupy most of the flat summits. (Bendelow)

East Anglia

Cambridgeshire

Sheet TF 41 (Wisbech). A reconnaissance survey was made in the autumn. The soils are formed in Flandrian marine alluvium and an understanding of its depositional

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sequence is needed to aid mapping. Borings to 3 or 4 m have helped to establish the succession and extent of salt marsh, intertidal and creek deposits. Thin peat bands at depth are good marker beds. Survey has proceeded over 17 km² in areas selected for their relevance from air photographs and topographic maps. Soils found include Wallasea (6), Newchurch (7), Romney (6) and Wisbech series. All areas contain a creek ridge (rodham) pattern giving intricate soil distribution patterns that can only be displayed, even on large scale maps, as complex units. Thus once the depositional succession has been determined and, in relation to it, the soil distribution pattern understood little further work should be needed to produce a map of soil complexes at 1:25 000 scale. (Burton)

Sheet TL 34 (Royston). The remaining 30 km² were mapped and 15 profile pits were sampled, the map was drawn and the *Record* begun. The soil pattern is simple compared with that of much of East Anglia, many series covering appreciable areas with little variation. (Seale)

Sheet TL 54 (Linton). The remaining 20 km² were mapped and four more profiles described. The *Record* is being prepared. (Burton)

Norfolk

Sheets TF 60 and 61 (Downham Market and King's Lynn South). A further 72 km² were mapped. The preliminary legend has now been extended to include four soils on Lower Cretaceous and Jurassic deposits. Gleyic brown earths and cambic gley soils on loamy Head derived from Sandringham Sands have been encountered. Rowsham and Evesham series (8) have been mapped on Gault and Kimmeridge clay and associated thin drifts. (Corbett)

County map. Further work has been done to produce an improved 1:250 000 map and legend. This has resulted in three versions of the map at 1:100 000 scale and two at 1:250 000 with differing degrees of simplification. The writing of the Bulletin continues. (Corbett)

Suffolk

Sheet TL 76E/86W (Risby). The map and legend were finally agreed after correlation with other areas. The *Record* is partly written. (Seale)

Sheet TM 06 (Finningham). Some 30 km² were mapped. The area is almost entirely on Chalky Boulder Clay with outwash sands and gravels in the south. The drift is either predominantly a clayey calcareous till with Beccles and Ragdale series (2), or to a lesser extent, a loamy calcareous deposit with Burlingham series, which, in general, is located on gentle slopes. The loamy surface is thought to have arisen from a thin Cover Sand blanketing the boulder clay landscape, the frequent sand pockets being evidence of cryoturbation. The general soil distribution is similar to that on Sheet TM 28 (Harleston). It differs in the absence of deeper sandy soils on the crests and in a more detailed pattern of gleyic brown earths on slopes. (Price)

East Midlands

Lincolnshire

Sheet SK 99 (Kirton-in-Lindsey). The map is being finalised and the *Record* is in preparation. (Heaven)

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Sheet TF 36 (Old Bolingbroke). About 55 km² were mapped in detail. The area was chosen to characterise soils formed in the Lower Cretaceous beds that are extensive in this part of Lincolnshire. Wick, Arrow, Quorndon and Newport, Ollerton and Blackwood soils (9) were mapped provisionally on sandstone residuum with Imber (2) and Frilford (10) where solid sandstone occurs within the profile. Small areas of brown rankers of the Harlestone (2) series were noted on ironstones. Ferritic brown earths of the Banbury (10) series were found on softer ferruginous beds. The Lower Cretaceous and Jurassic clays all have stagnogley soils of the Denchworth (2) and Rowsham (10) series.

Very chalky Calcethorpe Till, often with a sandy drift cover, is common on interfluves in the north. Gleyic rendzinas occur where unmodified till is near the surface and gleyic brown calcareous earths of the Block (2) series where thicker drifts overlie the till. Small areas were provisionally mapped as paleo-argillic brown earths of the Marlow and Winchester series (2).

An area of fenland in the south has a complex suite of soils. The fen is bounded in the west by reddish Devensian Skipsea Till and Elkington (2), Crewe and Salop soils (9) are present. (Heaven)

Sheet TF 39 (Covenham). Mapping was completed and representative profiles described and analysed. With the co-operation of local ADAS drainage officers, dip-wells were installed in the two main soils of the district, the fine loamy Holderness series in Devensian till and the clayey Newchurch (7) series in marine alluvium, to test the effectiveness of tile drainage systems under arable cropping, and to compare the resulting water regimes with those of undrained permanent grassland. (George)

Sheet TF 45 (Friskney). About 25 km² were mapped. Extensive areas to the west of the toftland have clayey deposits equivalent to upper tidal marsh, covered by coarse and fine silty alluvium that may represent a marine transgression of late Roman times. Here coarse silty over clayey soils of gleyic brown calcareous alluvial or calcareous alluvial gley soil subgroups, according to depth to clay, are in complex patterns. Mapping is now virtually complete and the legend and *Record* are in preparation. (Robson)

Nottinghamshire

Sheet SK 78N/79S (Gringley on the Hill). Soil and land capability maps are completed and the *Record* is near completion. (Reeve and Thomasson)

Western Midlands

Hereford and Worcester

Sheets SO 85 and 95 (Worcester and Upton Snodsbury). Mapping of the remaining 35 km² of Sheet SO 95 has been completed and the field maps checked in preparation for publication. The maps will be published together on Ordnance Survey 1:25 000 2nd Series sheet lines.

The legend has been finalised and includes 41 soil series together with undifferentiated peat soils. Ten of the series were established during the survey and several more have been redefined to conform to the current classification (11). Representative profile pits were described and sampled for analysis to characterise six more soil series.

Approximately 60% of SO 95 is underlain by Lower Lias clay shales, clays and mudstones, 20% by Keuper Marl and less than 5% by Tea Green Marl and Rhaetic sandstones, siltstones, shales and clays. The remaining 15% is covered by brownish and

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reddish fine loamy and clayey drifts occurring both as interfluve cappings and within the valleys.

In the east, the Bow and Piddle brooks flow east and then turn abruptly south near Himbleton and North Piddle respectively, to continue to the Avon near Pershore. The drifts along the two brooks form poorly-defined terraces which merge in places. Where the terrace levels are distinct, the break in slope between them is marked by outcrops of Lias clay shales giving calcareous pelosols of the Evesham (10) series. Where the drift has crept downslope by solifluxion, Oxpasture and Rowsham soils (8) are mapped on fine loamy material over Lias clay shales and Lawford (12) soils where the drift is clayey. In places on these slopes material which otherwise seems to be Lias clay *in situ* includes discrete pockets of brownish loamy drift presumably incorporated by strong cryoturbation. The highest terraces giving flat-topped interfluves form two concordant levels at approximately 65 and 55 m O.D. though they decline gradually to the south.

The terrace drifts, usually less than 3 m thick, include hard rounded Bunter quartzites, Carboniferous sandstones and flints together with soft local often calcareous mudstones, shales, siltstones, sandstones and limestones. On weathering the soft stones give an overall calcareous sandy clay matrix that is variable in colour and patchy in particle-size distribution. Occasionally, lenses of more gravelly and sandy material occur. Typical stagnogley soils, resembling in many ways Salop and Crewe series (9) occur, although profiles are generally brownish rather than reddish and the parent material is glacial outwash rather than till.

In an earlier survey of the Vale of Evesham (13) the soils on these terrace drifts were included in the Pershore series. This was a broad concept which included soils in drift of any thickness and particle-size class, over Lias clay shale. Lawford, Rowsham, Oxpasture and less frequently Quorndon, Arrow (12) and Norton (14) soils have been found within areas previously delineated as Pershore series.

Narrow outcrops of Tea Green Marl and Rhaetic rocks are associated with a westward facing cuesta from east of Oddingley, in the north, to Sneachill in the south. The Tea Green Marl occurs at the top of the scarp along the length of the cuesta and gives clayey calcareous soils of the Hurcot (8) series. Rhaetic rocks, which dip very gently eastwards, consist of approximately 15 m of thinly bedded sandstones, shales, siltstones and clays, which adjoin Tea Green Marl, at the top of the dipslope, mainly from Oddingley to just south of Crowle. Fine loamy over clayey typical stagnogley soils have developed in weathered material from these variable strata and overlie thinly bedded, often disturbed, Rhaetic rocks. They have been correlated with the Wedmore (8) series.

The *Record* which will describe both SO 85 and SO 95 is being prepared for publication. (Palmer)

Staffordshire

Sheet SK 00/10 (Lichfield). A further 43 km² have been mapped in detail and 11 representative profile pits sampled for analysis.

In the west, near Little Wyrley and Hobble End, thick Devensian tills have been reworked to depths of 1·5 m along the main watercourses which drain north-west from a low watershed between Bloxwich, Pelsall Wood and Brownhills West. Here, typical argillic gley soils are developed in coarse loamy and sandy outwash overlying finer till. Deeper in the profiles, coarse and fine components are frequently mixed, but more extensive discrete patches of till and outwash also occur. To the south and east of the watershed, the tills thin out rapidly against high ground formed by the western outcrop of Bunter Pebble Beds and Silurian rocks south of Aldridge. Extensive outwash gravels overlying till occur south of Brownhills and give humic-sandy gley soils correlated with

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the Gilberdyke (15) series and an argillic humic gley soil in stony sandy loam and sandy outwash, overlying mixed outwash and till between 50 and 100 cm depth. These soils merge into typical alluvial gley and peat soils, both overlying gravels within 1 m, which fringe streams draining from Clayhanger and Fishley. The streams have cut through the thin superficial drifts in places, revealing Coal Measures rocks on valley sides in which fine loamy over clayey stagnogley soils of the Bentley and Bardsey (4) series have been mapped. South of Rushall, Silurian shales crop out at the surface to give small isolated areas of Speller and Stanway soils (16).

Between the western and eastern outcrops of the Bunter Pebble Beds, sandy and loamy stony drifts cap the interfluves above 114 m O.D. to give stagnogleyic argillic brown earths of the Salwick series, stagnogleyic brown sands of the Rudge series and typical brown sands of the Newport series (17). The drifts, which are possibly Wolstonian in age, usually consist of a reddish brown stony sandy clay loam or clay loam till-like material, covered by 0·5 to 1·5 m of stony loamy sand or sandy loam. They are often severely cryoturbated and much of the mottling, when present, appears to be relict, thus reflecting past moisture regimes.

The vale between the two Bunter escarpments is drained eastward by the Black Brook and its tributaries which are flanked by thin strips of fluvial or glaciofluvial gravels. These widen westward, covering large tracts west of Shenstone. The gravels have a high winter groundwater-table and commonly have a thin cover of peat up to 1·5 m thick, giving earthy eutro-amorphous peat soils and humic sandy gley soils tentatively correlated with the Gilberdyke series. Where the peat is absent, typical sandy gley soils of the Blackwood (15) series predominate. Between Hilton and Little Aston, faulting brings in a thin wedge of Hamstead Beds. These reddish Upper Coal Measures marls have a thin drift cover, giving typical stagnogley soils of the Bentley series, with subordinate areas of Dodmoor soils and pelo-stagnogley soils. In places, however, the drift covering is thicker and appears to have disturbed the underlying marls to give fine loamy over clayey, typical stagnogley soils similar to the Salop (9) series. (Hollis)

Sheets SK 02 and 12 (Abbot's Bromley and Draycott in the Clay). The remaining 30 km² of SK 02 and 5 km² on adjacent sheets SK 11 and SJ 92 were mapped in detail. The maps have been prepared for publication, the legend finalised and the *Record* is being written.

Twenty-six soil series have been mapped two of which were established during the survey. Thirty profile pits were excavated, and samples taken for the usual laboratory analyses.

In Colwich parish, the distinctive first and second terraces of the Trent support stony Wick and Arrow soils (9) with smaller areas of Hopsford (2) series mainly on the second terrace. Some profiles are less stony and the land is largely under cereals.

Between Little Haywood and Hixon, much of the Keuper Marl has a thin mantle of drift giving Whimple (9) and, less commonly, Brockhurst (9) soils but drift-free places on steeper slopes and hill crests give Worcester (9) soils.

Further east around Drointon, the drift is 20–30 m thick and its distribution complex. A brownish till, the local representative of the Chalky Boulder Clay, overlies an older reddish till probably also of Wolstonian age and similar to the red till around Tatenhill. The brownish till gives mainly pelo-stagnogley soils correlated with Ragdale (2) series and the reddish till supports mainly Salop and Flint soils (10). Near the hamlet of Drointon a coarser drift capping gives Arrow (9) soils. Small areas of yellowish brown till similar to that in Bagots Park support mainly typical stagnogley soils of the Bagots series.

At Grindley, a large overflow channel is associated with a complicated pattern of ice-

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contact deposits which extends west of Chartley Park. These deposits were probably laid down by Devensian ice at the limit of its south-eastward advance and give Arrow, Quorndon and Clifton soils (9).

East of Stowe, meltwater from Devensian ice eroded earlier drift deposits to expose Keuper Marl on some slopes. The coarser drifts here support Hopsford, Wick and occasionally Salwick soils with Flint soils on the older reddish till.

In the Blythe valley and its tributaries, ground-water gley soils in brownish and greyish clayey river alluvium (greater than 75 cm thick) over gravel have been correlated with the Stixwould (18) series, and there are similar fine loamy soils.

Part of the original Bagots Wood with mature oak and common wild hornbeam survives on Bagots soils, around Goat Lodge, and beech also thrive here where the till is thin over Tea Green Marl. In Stowe parish, Chartley Moss, a deep basin mire with a floating raft of peat fills a hollow left by wasting Devensian ice. The moss is heavily wooded with indigenous Scots pine, birch and alder. (Jones)

Warwickshire

Sheets SP 25 and 35 (Stratford upon Avon East and Kineton). Detailed survey of approximately 120 km² is complete. The major soil series were reported on last year.

Extensive areas of fine loamy soils similar to Salwick and Clifton series have been mapped on the Devensian terraces between Hampton Lucy and Barford; micromorphological evidence has shown these to have argillic B horizons.

Chalky Boulder Clay has proved extensive and a large area of Ragdale soils has been mapped above 120 m (400 ft) O.D. Many profiles have some reddish Trias-derived material mixed with eastern derived drift and Ragdale subsoils are often browner than in the Wolvey area.

A calcareous phase of the Denchworth (12) series has been mapped on the clays and clay shales of the Lower Lias. Profiles are usually calcareous to the surface, are strongly gleyed and have high packing densities. Somerton (19) soils and brown non-humic rendzinas form a distinct map unit on near level surfaces on the White Lias limestone with Evesham (12) soils as occasional inclusions around the edges. Evesham soils are mainly associated with the Lower Lias but at Loxley, Haselor (8) soils frequently occur on bench-like features where limestone is near the surface; in flush sites there are small patches of very calcareous silty soils.

Middle and Upper Jurassic rocks east of Northend have mainly ferritic brown earths of the Banbury (10) series on the ironstones and Tadmarton (10) series on the sandstones, with Irondown (10) soils on fringing slopes. Thin Head or colluvium covers the Lower Lias clay in a narrow band around the Burton Dassett Hills and Podimore and Rowsham soils are recognised.

At Charlecote, Inkberrow (19) soils have been mapped on a narrow outcrop of interbedded Trias sandstone and marl; the surrounding Whimple (9) soils contain a higher proportion of sand than is usual locally. (Whitfield)

Sheets SP 27 and 37 (Kenilworth and Coventry South). A further 90 km² have been mapped in detail mainly in drift on Upper Coal Measures to the south and west of Kenilworth. The provisional legend has been extended and now contains 37 series and two phases.

Shifnal (17) soils on Upper Coal Measures sandstones commonly have a large fine sand content in this district (between 40 and 70%) and consequently a fine sandy loam phase has been mapped extensively. Small localised areas of Rivington (4) soils occur on brownish and yellowish sandstones.

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Much of the Upper Coal Measures gives fine loamy or fine silty stagnogleyic argillic brown earths tentatively named Kenilworth series. Gleyic brown earths of the Stoneleigh series developed in yellowish brown fine grained Keuper sandstone occur in low lying or level sites between the Clive and Inkberrow map units (19); the profiles are coarse loamy to at least 80 cm and usually overlie greenish grey marl. Small patches of Bromsgrove (17) soils have been mapped on reddish Keuper sandstone.

South of Barston an area of Lower Lias clay, faulted along its north–south boundary with Keuper Marl supports Evesham, Lawford and Rowsham soils.

East of Balsall above 120 m O.D. is an area of Beccles (17) series of about 1 km^2 associated with olive-brown and yellowish brown Chalky Boulder Clay. Around its edges where the chalky drift thins over reddish till, typical stagnogley soils of the Salop series have been mapped. Similar profiles were described in the Wolvey area (12).

Loamy gleyic brown alluvial soils of the Trent (20) series and a fine loamy over clayey variant have been mapped along the Avon valley at Stoneleigh. (Beard)

South-east England

Essex

Sheet TL 71 (Little Waltham). Soil and land use capability maps and the *Record* have been submitted. (Allen and Sturdy)

Sheet TL 83 (Halstead). Reconnaissance was completed and 60 km^2 mapped. Forty soil series distributed in 25 map units have been recognised and 17 pits, seven in areas of semi-natural vegetation, have been described and sampled. Thirty Proline cores have also been described.

The general sequence of soils is now clear. Loamy over clayey soils in till on level plateau surfaces have paleo-argillic horizons reflecting periods of intensive weathering prior to the Devensian glacial stage. Stagnogleyic paleo-argillic brown earths (Hornbeam series) and paleo-argillic stagnogley soils (Oak (21) series) constitute this map unit.

On more undulating land clayey soils are developed in chalky till. Argillic pelosols with chalky clay subsoils (Faulkbourne (10) series) predominate with some loamy over clayey stagnogleyic argillic brown earths (Ashley (10) series). Typical calcareous pelosols of the Hanslope (10) series occur on plateau edge slopes.

The tills are underlain by loamy, sandy and gravelly Head and glaciofluvial deposits and these form extensive parent materials for soils on valley-side slopes. Fringing the till plateau are stony loamy typical paleo-argillic brown earths in Head (Terling series). Soils in glaciofluvial deposits on steeper slopes in the Colne valley are typical brown sands with few stones and in the Stour valley gravelly typical argillic brown sands. Typical sandy gley soils of the Blackwood (15) series and loamy typical cambic gley soils occupy foot slopes locally, whereas argillic brown earths in stony loamy Head mantle lower valley sides. In the Stour valley small areas of Althorne and Windsor series (6) occur where London Clay and locally Reading Beds clay are exposed beneath glaciofluvial deposits, together with loamy argillic brown earths in Woolwich and Reading Beds and rendzinas and brown calcareous earths over chalk. Valley bottoms are complex and comprise a range of soils including argillic gley, humic gley and earthy peat soils.

The Stour valley has a wide floodplain with several terraces. Upper terraces have stony loamy over gravelly typical paleo-argillic brown earths (Sonning (21) series), whereas the lowest terrace has loamy gravelly argillic gley soils locally capped by thin clayey alluvium. Pelo-calcareous alluvial gley soils in clayey alluvium over peat (Windrush series) are extensive on the floodplain fringed by non-calcareous Fladbury (8) soils. (Allen)

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Sheet TM 12 (Weeley). Soil and land use capability maps and the *Record* have been submitted. (Sturdy and Allen)

Sheet TQ 79 (Wickford). Reconnaissance was completed and 11 km² have been mapped. A legend has been prepared.

The district comprises land around the expanding town of Wickford several kilometres north of Basildon New Town. To the north is a much dissected plateau underlain by Bagshot and Claygate beds with patchy remnants of Chalky Boulder Clay and underlying glaciofluvial deposits. Hanningfield Reservoir occupies 4 km² at the head of the northward flowing Sandon Brook, and to the south strongly sloping land on London Clay, locally with landslips, overlooks the Crouch flowing east across the district through Wickford. Remnant terraces on either side of the river, many with only thin gravelly deposits, are readily identified as a system of accordant surfaces. Head, derived from the plateau to the north and from Crays Hill and Rayleigh hills to the south, partially fills most of the tributary valleys; these are markedly asymmetric, steeper west-facing slopes in London Clay being devoid of drift whereas gentler slopes opposite are entirely mantled with Head which is often silty (loessial).

The Faulkbourne series has been identified in Chalky Boulder Clay, and a very small area of Essendon (21) series in plateau drift above the Bagshot Beds on the western margin of the district. Bursledon, Curdridge and Shedfield series (21) occur in loamy and sandy facies of the Bagshot and Claygate beds. The clayey facies of the Claygate Beds contains more silt or very fine sand than underlying London Clay, but the Windsor (21) series is recognised in both these smectitic parent materials. Related brown little-mottled typical pelosols of the Althorne series are common on steeper slopes, whereas pelo-stagnogley soils of the Ferrel (6) series occur in clayey drift 0·5–1·5 m thick that has accumulated in footslope positions. Gravelly loamy over clayey surface-water gley soils ascribed to the Titchfield (21) series occupy most of the terrace surfaces together with a pebbly topsoil phase of the Windsor series. A shallow phase of the Ferrel series in grey and yellowish brown mottled slightly flinty clayey drift over brown London Clay at about 50 cm also occurs. Stagnogleyic argillic brown earths of the Ratsborough (6) series in loamy or silty over clayey Head, and locally silty Hook (6) soils, occur on gentle east-facing terrace bluffs. In the Crouch valley, the Fladbury series was mapped in river alluvium and, downstream from Battlesbridge, the highest point to which the river is tidal, are shallow clayey over peaty marine alluvial gley soils. Grassland and woodland account for land use in much of the north-west part of the district where there is extensive dissection and slopes up to 12° are common. Mixed grassland and arable farming with dairy and beef herds is common on the heavy land of the Crouch valley and to the south, but locally, where lighter soils of the Ratsborough series are extensive, field-scale vegetables are grown. (Sturdy)

Kent

Sheet TQ 64 (Paddock Wood). A further 6 km² have been mapped along the Medway floodplain; the predominant soils were pelo-alluvial gley soils of the Fladbury series. (Green and Fordham)

Oxfordshire

Sheet SP 60 (Tiddington). The *Record* is being written. (Hazelden)

Surrey

Sheet TQ 05 (Woking). Some 50 km² were mapped and 18 profiles described.

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Pleistocene Head (Netley Heath deposits) mantles plateaux and gentle slopes above 200 m O.D. on the high Downland and flinty loamy over clayey Berkhamsted (3) soils are dominant, associated with brown soils (Maxted (22) and Frilford (10) series) and scattered podzols (Shirrell Heath (3) and Southampton (23) series). Where thin Head covers Reading Beds, clayey Ferrel soils occur. Paleo-argillic brown earths (Carstens (2) series) are developed on most steep and moderately steep valley sides with stony loamy Frilsham (3) soils in dry valley bottoms passing further down valley to calcareous Coombe and Soham soils (2). Rendzinas (Andover and locally Upton series (2)) predominate on relatively drift-free chalk interfluves.

London Clay in the central part of the district is extensively mantled by flinty Head and river terrace deposits. Most soils are gleyed. Titchfield and Hurst series (3) are dominant in valleys and Titchfield and Wickham (6) series on interfluves. Clayey soils (Windsor and Ferrel series) are mainly restricted to valley sides.

Fladbury series is extensive in the Wey floodplain but there are local very wet areas with clayey humic-alluvial gley soils and peat. Dry, coarse textured brown soils (Hurley and related series) on low river terraces adjacent to the floodplain are droughty but most crops grow well when irrigated.

Low lying areas of Bagshot Beds near Wisley include a range of gleyed soils, from humic-sandy gley soils (Netley (21) series) to pelo-stagnogley soils (Windsor series). Stagnogley-podzols (Rapley and Holidays Hill (21) series) and sandy typical podzols (Shirrell Heath series) occur on higher ground; hills capped with gravel have Southampton series.

Sandy Frilford series is widespread on upland Bagshot Beds east of Woking associated with wetter loamy and clayey soils (Bursledon, Curdridge (21) and Windsor series). (Fordham)

South-west England

Cornwall

Sheet SW 61, 62, 71 and 72 (Lizard). Representative profiles were sampled and writing of the *Record* started. Numerous thin sections are now available to help in classification and to relate soil types to parent materials. (Staines)

Sheet SW 96 (St. Columb). A short reconnaissance of moorland soils, now reclaimed, was made and 10 km^2 mapped. (Staines)

Devon

Sheet SS 74/75 (Lynton). Profile sampling was completed and the *Record* is in preparation. (Harrod and Hogan)

Somerset

Levels and moors (Peat Survey). Though the Somerset peats were mapped in earlier surveys recent events have suggested that more information is required for future land use planning. Areas formerly mapped as Sedgemoor and Midelney series have been surveyed on a $1 \times 0{\cdot}5$ km grid using a gouge auger and extension rods; more than 300 deep borings have been made.

The peat reaches maximum thickness of about 6 m in West Sedgemoor and in eastern parts of King's Sedge Moor. On the basis of occasional spot heights the borehole records support the idea that over large areas the peat overlies clay at about Ordnance Datum; this is to be checked by levelling. In places this underlying clayey alluvium thins out against Keuper Marl, Burtle Beds or gravelly Head.

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South of the Poldens woody peat accounts for great thicknesses in King's Sedge Moor and North Moor; elsewhere sedge and rush is the main component with thin moss layers south of Moorlinch. Reed remains occur in upper layers but they are most numerous in the thin basal layer over the clay. Soil formation in the near surface layers is indicated by a strong fine blocky or granular development in the topsoil and a subsurface layer which has coarse prismatic structures often with shiny ped faces, possibly indicating illuviated organic matter. (Cope and Colborne)

Wales

Clwyd

Sheet SJ 24 (Llangollen). The remaining 8 km² of moorland were mapped and the sampling of topsoils for heavy metal analysis by ADAS completed. The *Record* is in preparation. (Lea)

Dyfed

Sheet SN 24 (Llechryd). The *Record* was completed and submitted for publication. (Bradley)

Sheet SN 45 and 46 (Llanarth and Aberaeron). About 12 of the 124 km² have been mapped in detail, including the University College of Wales farm at Blaenwern. Profiles of the most extensive soils have been described and sampled. Brown soils have been sampled at a range of altitudes from 30 to 275 m O.D. to help determine the extent of brown podzolic soils. Vegetation data have been collected at 11 sites under pasture and 22 under woodland. (Hartnup)

Sheet SN 72 (Llangadog). Fieldwork was completed with the mapping of 25 km² and description of a further four representative profiles, and preparation of the *Record* has begun. (Wright)

Pembrokeshire. Work on the map and text draft is almost complete. Although brown earths and brown podzolic soils are not easily distinguished in the field, they can be distinguished by laboratory analysis. Analyses of samples from two sets of profiles across the country show a strong relationship with altitude. The drier land is dominated by brown podzolic soils above and brown earths below 130 m O.D. (Rudeforth)

Powys

Sheet SJ 21 (Ardleen). The remaining 49 km² have been completed and the *Record* is in preparation. Particle-size analysis and micromorphology confirm the absence of argillic soils, but evidence for the translocation of clay and silt in association with organic matter is apparent from thin sections of many soils. The coats are most strongly developed in the Bg and BCg horizons of silty alluvial gley soils but also occur in soils ranging from brown earths to stagnogley soils in older parent materials.

Soils close to the river Vyrnwy have been sampled to 1·5 m using the Proline Corer. Sample sites range from 0·5 to 5 m above summer river level. Organic carbon and dithionite extractable iron contents are to be determined at 25 cm intervals to see if they relate to flooding frequencies at sample sites. The study may help to distinguish the extent of alluvium since no clear division between low terraces and the floodplain exists. (Thompson)

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Basic research

Minor element studies

Carmarthenshire. In cooperation with ADAS, the investigation of Cu, Co, Mo and Se levels of the soils of the Llangadog district (Sheet SN 72) is continuing. Analyses of all grid samples has been completed and examination of the data has begun on the computer at the University College of Wales, Aberystwyth. (Wright and Rudeforth, with Mr. R. Dight, ADAS)

Pembrokeshire. Relationships between minor elements and soil series are of similar significance to those previously demonstrated for soil map units (24). Minor element contents for soil series developed in similar parent materials but differing in degree of podzolisation or gleying, vary significantly, as they do for similar soil series in different parent materials. In the sequence brown earth, brown podzolic soil and stagnopodzol there is, on average, more Mn, Cu and Zr in topsoils of the brown earths than in subsoils, but the reverse is true for the more podzolised soils. Conversely As and Pb accumulate in the organic topsoils of stagnopodzols. For the sequence brown earth, stagnogley and stagnohumic gley soil Mn contents in topsoils decrease with increased gleying, and the reverse is true for Pb; stagnohumic gley topsoils contain on average more Cu and less As than brown earths.

Soil series differences related to the main parent materials are exemplified by comparing brown earths. Most of the elements studied are equally, or more, abundant in the Denbigh series associated with Lower Palaeozoic sediments, than brown earths derived from other materials; Ni and Zr are exceptions. Milford and Cosheston series on Devonian siltstones and sandstones have relatively little Sr, and there is more Y in the Pembroke series over Carboniferous limestone than in other brown earths. (Rudeforth, with Wilkins, Soils and Plant Nutrition Department)

Soil chemistry

In co-operation with ADAS, the investigation is continuing into the relationship between phosphate sorption capacity and levels of amorphous forms of Fe and Al in samples from grid intersection points in the Llangadog district (Sheet SN 72). Determinations of phosphate sorption capacities have been completed on all samples by ADAS, and analyses of Fe and Al levels are nearly complete at Rothamsted. (Loveland and Wright, with Mr. R. Dight, ADAS)

Upper Greensand soils

The study of profiles representing the Harwell, Ardington, Coate, Urchfont, Pewsey and Puckshipton series in south-central England was completed. Glauconite in these soils is relatively unweathered and alteration of it is restricted to: (i) physical degradation of sand and silt-size grains to clay-size material; and (ii) alteration to an iron-rich randomly interstratified mica-smectite with about 60% expandable layers. There was also some evidence for neoformation of kaolinite. The absence of brownish B horizons from all except the Pewsey soil is attributed to this limited weathering and to the very small amount of ferrous iron ($\ll 1\%$) in the glauconite lattice. Such free iron oxide as occurs in the soils is thought to be derived from structural ferric iron by a reduction, segregation and reoxidation mechanism and is most marked under imperfect or poor drainage conditions. It is difficult to distinguish gleyed horizons in these soils by current morphological criteria because matrix chromas are usually <2 and there is no marked pedality.

Detailed chemical, mineralogical and particle-size studies showed very little difference

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between the Urchfont and Pewsey soils and between the Coate and Puckshipton soils. (Loveland)

Clayey soils

The shrinkage potential of natural clods from 19 clayey soils was measured and related to physical, chemical and mineralogical properties. Multiple regression equations involving initial bulk density, clay content, organic carbon and cation exchange capacity of the whole soil accounted for 87 and 82% of the variation in total shrinkage of topsoil and subsurface horizons respectively. Of the soil clay minerals, interstratified mica-smectite showed a good correlation with shrinkage.

It was concluded that due to restrictions on actual shrinkage imposed by the inter-relationships with such factors as climate, land use, groundwater situation and moisture retention properties, soils with large shrinkage potential may not behave very differently from soils with much lower potential. (Reeve, Hall and Bullock)

Paleosols

The complex developmental history of a paleo-argillic brown earth in plateau drift from North Leigh, Oxfordshire was investigated mainly using micromorphological techniques. Eight kinds of pedological features were identified, quantified and related to a probable sequence of soil forming events. Three 'stable' periods of soil formation were recognised, one pre-dating emplacement of the Plateau Drift and the other two associated respectively with one or more pre-Devensian interglacial periods and the post-Devensian (Flandrian) period. Clay illuviation and reduction and segregation of iron oxides were the main processes recognised in all three periods and reddening is associated with periods before the last glaciation. Although the soil was possibly subjected to several 'unstable' periods only two were distinguished. The first was associated with erosion, disruption and mixing of soils and sediments, followed by transport and emplacement of the Plateau Drift. The second was related to the Devensian glaciation and was characterized by erosion, and cryoturbation and finally deposition of loess on eroded surfaces. (Bullock and Murphy)

The nature and origin of a reddish brown flinty clay overlying pre-Devensian chalky till (Calcethorpe Till) around Donington on Bain, Lincolnshire (Sheet TF 28) was investigated. Particle-size, mineralogical and micro-fabric studies of selected samples of clay and of other non-calcareous or decalcified soil horizons overlying the till and associated chalky Head deposits have been completed. (Bullock, Catt, Soils and Plant Nutrition Department and Blythe, vacation student)

Coverloam and Sand

Study of the distribution of sandy Coverloam on the Chalky Boulder Clay of south Norfolk and Suffolk, has been concluded and the results are to be presented in an ADAS Drainage Service publication on boulder clay soils in Suffolk. (Corbett)

Particle-size analyses of 70 subsurface samples from Norfolk and Suffolk show that three groupings can be identified. In north-east Norfolk and south Suffolk the modal particle size of the sand and silt range is in the silt fraction (2–60 μm), in Breckland in the fine sand fraction (60–600 μm) and elsewhere it is in the medium sand fraction (200–600 μm). This study of aeolian contributions to soils continues. (Corbett)

West Midlands Pleistocene Geology

A paper has been prepared describing the sequence of Pleistocene deposits in the Worfe catchment. The drifts are more extensive than previously described (25) and include

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Irish Sea till and outwash overlying a thick sequence of proglacial lacustrine sediments that fill a large over-deepened subglacial channel at least 11 km long. They provide possible evidence of two distinct ice advances towards the maximum at the Wolverhampton line, the earlier having a predominantly local and the later a predominantly northern or Irish Sea character. It is suggested that the two advances are not separated by an interglacial or interstadial but represent minor oscillations of the Late Devensian ice front.

Quartzite gravels found in places below the Late Devensian drifts are thought to be remnants of a lag deposit flooring tributary valleys of a Middle Devensian proto-Worfe. Their lithology is very similar to gravels, thought to be reworked Wolstonian till, that cap interfluves above 90 m (300 ft) O.D. beyond the Wolverhampton line, and it is thought that they are derived from the latter. (Hollis, with Mr. A. H. Read, Wolverhampton Polytechnic)

Terrace flats on Sheets SO 85 and 95 (Worcester and Upton Snodsbury) have been mapped and their heights above Ordnance Datum recorded. Ordnance Survey spot heights and close spaced contours (5 m) on the 1:10 000 maps have proved useful for most areas. The work of Wills (26) around Worcester in the Severn and Teme valleys has been refined and the work of Tomlinson (27) in the main Avon valley extended up to its northern tributaries, the Bow and Piddle brooks. (Palmer)

Methodological research

Micromorphometry

The macroporosity ($>60\,\mu$m diameter) of six profiles of commonly occurring soil series—Hanslope, Ragdale, Evesham, Denchworth, Flint and Salop—was measured by image analysis and results compared with those derived from water retention characteristics. In most horizons, the macroporosity obtained by image analysis was larger than that by physical measurements. The reasons for such differences are thought to be twofold:

(i) samples for water release are first wetted to a suction of $<0{\cdot}05$ bar, the first equilibration point, and this may cause a change in pore space compared to the field state. No similar procedure is adopted in thin section preparation which seeks to maintain porosity as it was at the time of sampling;

(ii) image analysis records the maximum diameter of the pores whereas water retention measurements record the diameter of the exit points, i.e. the necks of the pores.

The two techniques are complementary, enabling both volume and continuity aspects of macroporosity to be studied. For some purposes the air-filled porosity on draining to field capacity is relevant. For others the total, air or water-filled, macroporosity is important. Close agreement between the two methods can only be expected in soils which change little in porosity on wetting to $<0{\cdot}05$ bar and in which the pore systems consist of numerous interconnected pores with broadly cylindrical exits and few large pores having restricted access to the main system. (Bullock and Thomasson)

Soil classification

Series differentiation. A second draft on guidelines for differentiating soil series as subdivisions of subgroups was prepared but was not accepted by the Classification Working Group for general implementation. Assessment suggested that rigid guidelines applicable to every soil subgroup were unworkable and that a more flexible approach was necessary. Subsequent progress has been made in some subgroups by aiming to

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maintain continuity with the basic concepts of the most extensive series, whilst accepting amalgamation of those currently distinguished solely by the stratigraphic age of the assumed parent rock or by minor differences in the nature or abundance of stones. This work continues. (Clayden, Avery, Carroll, Robson and Hodgson)

Automated cartography

Computer programs were written to compile map legends automatically from grid point data in relation to mapped units, and to produce automatic distribution maps of soil classes. (Rudeforth)

'Similar' soils

Work has continued to improve understanding of the mapping concepts of similar and dissimilar soils. Two papers concerning particle-size criteria have been drafted. (Green)

Data management

The joint study of a regional soil data bank with Oxford University has continued. The systems analyses were completed. Problems of handling data from several sources proved unexpectedly large, and a substantial part of the task has been to write a comprehensive validating program and pass all the data through it.

The first version of the G-EXEC data management program obtained from the Natural Environment Research Council (NERC) proved unsuitable for routine use on the Rothamsted computer. A new version has been obtained and is being evaluated by Verrier and C. M. Lessells, Computer Department. (Webster)

Spatial analysis

Regionalised variable theory has been applied to soil surveys of several places in which different properties, including morphological characters, trace elements, electrical resistivity and plant nutrients, have been recorded and at sample spacings ranging from 1 m to $\sqrt{2}$ km. In most instances surveys at the close spacings have produced data with strong spatial dependence, whereas data collected at larger spacings show only weak dependence. The results have been used for optimal interpolation and several isarithm maps drawn from gridded data. The methods may be applied to non-gridded data though at much larger cost in computing. (Webster and Burgess, NERC CASE student)

Data from photo-micrographs and air photographs of soil have been analysed similarly to identify and characterise soil patterns. (Webster with McBratney, research student)

The technique for locating soil boundaries on transects has been changed to improve its discriminating power, and its possible extension to two-dimensional data investigated. (Webster and McBratney, research student)

The problems of extending methods of multivariate classification to deal with large numbers of data points are also being studied. (Webster and Menk, research student)

Crop patterns

Differential growth and yield of crops over soil patterns were measured in four fields on Sheet TF 00E/10W (Barnack). To record these growth changes air photos were again taken along three transects covering the pattern. Measurements and photos have now been obtained for 3 years for each of the sites and data on weather, crops and soils will now be collated and analysed. (Evans)

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Soil erosion

Factors of landform, soil, land use and rainfall, which initiated and contributed to water erosion of 637 arable fields in lowland England, have been analysed. It is probable that fields which are potentially erodible can be identified. (Evans)

Applications research

Climatic classification

A technical monograph has been written on *Climatic Classification of England and Wales*. It accompanies and describes four maps showing accumulated temperature, moisture deficit and exposure at 1:1 000 000 and a bioclimatic classification which incorporates these three elements with oceanicity, at 1:625 000. (Bendelow and Hartnup)

Soil related diseases

A study was made of the relationship between soil conditions and the occurrence of *Fasciola hepatica* (liver fluke) through identification of habitats of its intermediate host *Lymnea truncatula* (dwarf pond snail), and an assessment made of the potential of soil maps to identify areas with a fluke hazard. A preliminary report was prepared, and circulated to Staff and to some ADAS officers. (Wright)

River catchment study

Preparation was completed for a joint investigation with the South West Wales River Division into the relationship between soil conditions, rainfall and stream flow in four small catchments in the Sawdde basin in the Llangadog district (Sheet SN 72). Dip-wells, rain gauges and stream flow recorders will be sited this winter and recordings taken for 5 years. (Wright, with Mr. E. Jones and Miss J. Frost, South West Wales River Division)

Soils and land drainage

The project, in co-operation with ADAS Land Drainage Service, to study soil water regimes in drained and undrained nearby fields on major soil series is now entering its fifth year. Results for the first four years (1974–78) are being collated. The winters of 1976–77 and 1977–78 were 'average' or wetter than average in many areas and water-logging was consequently more prolonged. The number of site years is approaching 900. The project is now changing from simple comparisons of water regions for many sites, to studies involving a larger variation in drainage design applied to fewer sites. (Thomasson and Regional Staff)

Land classification

A working group is considering revised and enlarged guidelines to classify land in terms of wetness, droughtiness, workability, stoniness and depth limitations. (Mackney, Thomasson and ADAS staff)

Soils and corrosion

Investigations into the corrosion properties of soils continued. A guide listing the more important properties of individual soil series affecting corrosivity is being prepared and includes sections to help non-specialists identify relevant soil types. At present information is available for some soils associated with Carboniferous, Permian and Triassic strata and related drift deposits. (Furness)

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An investigation of differences in resistivity between undisturbed soil and the adjacent disturbed soil around gas pipes was begun. (M. G. Jarvis, with Southerngas Staff)

Soil suitability for direct drilling

Seven sites were visited in Hampshire and the Isle of Wight. (M. G. Jarvis)

Soils and house foundations

The value of soil maps and data in predicting the occurrence of hazardous conditions for house foundations was investigated. (M. G. Jarvis and National House Building Council staff)

Supporting work

Particle-size and chemical analyses

Some 1500 samples from 360 profiles sampled in current mapping and research projects were analysed in the Headquarters laboratory using methods given in *Soil Survey Technical Monograph* No. 6. (Bascomb and Thanigasalam)

Seventy samples from 18 profiles from Sheets SP 25 and 35 and SP 27 and 37 were analysed at the Wellesbourne laboratory. Particle-size distribution of 50 further samples were determined to check field assessments of soils. (Beard)

Micromorphology

Over 800 thin sections were made and described to aid characterisation and classification of the soils as a contribution to the current mapping programme. Other samples were prepared and examined for supporting research projects, particularly for micromorphometry and the study of paleosols. (Bullock, Murphy and Waller)

Mineralogical analyses

The mineralogical composition of the $<2\ \mu m$ fraction from 174 samples was determined by X-ray diffraction, non-exchangeable potassium and cation exchange capacity measurements. (Bullock, Loveland and Kavanagh)

Soil water regimes

Water levels were again recorded on glaciofluvial sands in the area of the projected Selby coalfield where preliminary construction work is now well advanced. (Furness)

Water release characteristics were determined for over 200 core samples from 22 profiles from sheets SP 27 and 37 and SP 25 and 35. Water contents were determined at 0·05, 2 and 15 bar suctions. The installation of a kaolin bath will now enable 0·4 bar determinations to be made. (Beard)

Soil water retention

Water retention properties were determined for 1007 core samples from 100 profiles. Now that the apparatus has been extended in the new laboratory the backlog of samples has virtually been cleared. (Hall, Mansey and Bembridge)

Special surveys

Soil maps at 1:2500 have been made of the Cumbria College of Agriculture main farm (236 ha) near Penrith and of the enclosed land on the upland farm (171 ha) at Mungrisdale. (Bendelow, Kilgour and Matthews)

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A soil map of the Humberside College of Agriculture Farms at Bishop Burton, Beverley was made at a scale of 1:2500. (Furness and S. J. King)

Some 28 km² were mapped in the Lyth valley, Cumbria, and a report prepared. The survey was carried out for ADAS Drainage and Water Supplies Division to aid assessment of drainage needs and agricultural potential of the land, as a follow-up to the arterial improvement scheme being undertaken by the North West Water Board. Clayey typical humic-alluvial gley soils in marine alluvium and raw and earthy oligo-fibrous peat soils predominate. (Matthews, Kilgour and S. J. King)

Stockbridge House Experimental Horticulture Station, Cawood, North Yorkshire, was resurveyed at the request of MAFF, employing a boring density of 10 per hectare (27 m spacing). In two problem areas a 9 m spacing was used and more clayey layers were encountered below the sandy loam topsoil, which are presumably affecting crop growth. There was little sign of the podzolisation noted in 1950. (Bradley and Allison)

A survey of Redgrave and Lopham Fens, Suffolk, was undertaken for the Suffolk Trust for Nature Conservation as part of a general investigatory survey which has been made with the aim of preserving original fen characteristics and preventing a change from wet-land to semi-heath. The area covers 1·3 km² and is located at the headwaters of the Little Ouse and Waveney rivers. (Price)

At the request of the Ministry of Agriculture a soil map of a prospective 160 ha open-cast coal site in Derbyshire was prepared to aid planning and soil stripping, storing and restoration. (Thomasson)

Luddington Experimental Horticulture Station and Rosemaund Experimental Husbandry Farm were resurveyed at a scale of 1:2500 at the request of ADAS. (Hodgson)

A revised soil map and report on the soils of the National Agricultural Centre at Stoneleigh was made at the request of the RASE. (Beard)

Soil maps of the Massey-Ferguson farm at Stareton and the Stoneleigh estate were prepared. (Beard)

A survey of Drakelow Gorse Farm, Byley, Cheshire was made for the Land Drainage Service of ADAS in preparation for the *Farmers' Weekly* national drainage open day 1979. (Hollis and Jones)

Particle-size class, stoniness, colour, $CaCO_3$ content and other properties determinable in the field were recorded in 1200 1·2 m borings at 50 m intervals on the Rothamsted estate, and three additional profiles were described and sampled for particle-size, chemical and mineralogical analyses. A soil map was compiled from the data, which will be used in preparing an improved account of the soil at Rothamsted. (B. W. Avery, with C. G. G. van Beek and L. G. de Klerk, temporary workers)

A survey of about 60 ha of heavy land on London Clay adjacent to Abberton Reservoir, Essex was made for ADAS to aid drainage design and to provide information for an International Drainage Demonstration organised by the *Farmers' Weekly*. (Sturdy and Allen)

A detailed soil survey of 10 ha of land on boulder clay at Shuttleworth Agricultural College was made to confirm its suitability as a site for an ADAS drainage economics experiment. (Sturdy)

Maps predicting trafficability of 6800 km² of land near London were prepared for Thamesgro, a group within the Metropolitan Health Division of the Thames Water Authority. (M. G. Jarvis)

A report for the Thames Water Authority on the soils and land use capability of 80 km² of the Thames, Cherwell and Evenlode floodplains was written. (Hazelden and M. G. Jarvis)

A survey of Lone Farm, Wendlebury, Oxon was carried out for the Nature Conservancy Council; a land capability map and report on the soils was prepared. (Hazelden)

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Developments in land use on Exmoor have been highlighted by the Porchester Report. At the request of the Land Service of ADAS and Dr. L. F. Curtis (National Park Officer) several areas of particular interest, totalling 60 km^2, were mapped in detail. (Harrod and Hogan)

At the request of the Land Service of the Welsh Office Agricultural Department detailed soil surveys were carried out of 100 ha near Llansamlet in the Tawe valley near Swansea and 160 ha on the marine alluvium of Margam Moors near Port Talbot. The information was required particularly to assist in responding to proposals in the West Glamorgan Structure Plan, and the maps and short reports were submitted by the Land Service to the Public Examination of the Structure Plan. (Wright and Clayden)

Other work

The possible contribution of vegetation maps to soil mapping on Dartmoor was investigated. An existing soil association map was revised and attempts made to relate soils and vegetation map units. Extensive grazing and burning pressures have influenced vegetation types dramatically and there appears to be little close relationship between soil subgroups and vegetation, although broad patterns can be recognised. (Staines)

The soils of part of a new open-cast colliery site at Kingswood, Staffs. were mapped, to assist ADAS Soil Scientists to monitor the development of anaerobic conditions within large topsoil spoil heaps. (Hollis)

Under a contract with the Development Board for Rural Wales a survey was made of peat resources which might be suitable for horticultural use when extracted. A report presented to the Board described a short-list of sites in central Wales. (Hartnup, Rudeforth, Clayden and Wright)

In conjunction with the Ministry of Agriculture work continued on a feasibility study concerning the reclamation of 70 ha of the Humber Estuary. A preliminary survey was made and rates of natural accretion are being monitored. (S. J. King)

Trench sections exposed in a gas pipeline across the Fens, and logs of deep bores for civil engineering works have been inspected, and the stratigraphic sequence for part of the Cambridgeshire and Lincolnshire fens described. The information obtained relates well to surface patterns seen on air photos of the Fens. (Evans)

The mapping of the large peat-filled depression in Farcet Fen, Whittlesey was completed and an interpretation of the landform as a well-preserved fossil Pleistocene *alas* proposed. A Fen Gravel terrace developed a polygonal system of ice wedges in a periglacial environment during the Devensian Stage. Localised melting of the large ground-ice content caused thermal subsidence and erosion resulting in an oval thermokarstic basin with a narrow drainage outlet. It is thought that much of the western edge of the fens of Cambridgeshire was subjected to this type of landscape development with now only a few arcuate topographical features, or less well-preserved depressions as at Conington Fen remaining. Study of the sediments associated with the *alas* development has given a better understanding of the relationships between drift soil parent materials of the area. (Burton)

An investigation into the use of soil surveys in engineering and land planning was continued. Map unit variability of a detailed soil survey in the Didcot area was assessed by random sampling together with particle-size distribution analysis and determination of consistency limits; correlation of map units with soil engineering properties was measured. Staff of organisations concerned with the planning process were interviewed. (Johnson and M. G. Jarvis)

Soil data were provided to assist Cumbria County Council in its Rural Planning Study of the Sedbergh district. The Survey has been invited to join the Steering Group responsible for supervising the study. (Carroll and Bendelow)

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Following a soil and land use capability survey of Bovingdon Hall, working party meetings for the Demonstration Farms Project of the Countryside Commission were attended and assistance given in the preparation of a working plan. (Sturdy)

Many recreational areas in the Peak District National Park have unfavourable soils. The effects of trampling and compaction have been examined by measuring bulk density and water content of upland peat soils subject to recreational pressures. Where land has a dual role for recreation and rough grazing, usually in marginal areas, it is necessary for management techniques to ensure that recreational use does not adversely affect agricultural potential. (George)

Further soil samples have been subjected to strength tests using the tensile tester reported last year. The data are now nearly complete and show a wide range of variation for fine and coarse loamy soils and a narrow range for clays. (Whitfield)

The moisture extracted under grass and potatoes from Wick soils has been recorded for a second year. Profile pits from nine sites on the plot will be excavated and sampled in the winter when the soils have returned to field capacity. (Whitfield)

A paper comparing soil moisture deficits on four Lincolnshire soils as measured with the neutron probe and those predicted from meteorological data has been completed. Three sites near to Draycott-in-the-Clay (Staffs) were studied for a further year. The site on Rudge series has now been closed after sampling for particle-size, water retention and micromorphological analyses. Tubes installed in limestone soils near Kirton-in-Lindsey were extracted in October 1978. Two further papers are in preparation. (Hall, Heaven and Jones)

A study was made into relationships between air-photo patterns, soil conditions and vegetation communities on the uplands of Sheet SN 72 (Llangadog). (Hartnup and Wright)

A soil map, land capability map and report of the soils of long-term and annual plots of the Arable Demonstration Unit at Ropsley, Lincs, were prepared under contract for ICI (Agriculture Division). (Robson)

A study tour of English soils was arranged and conducted for a party of 30 students and three members of staff from the Soils Department, Utrecht University. (Loveland with Regional Staff)

The autumn meeting of the British Society of Soil Science was held at Exeter and important soils of south-west England were seen on four excursions, for which 21 pits and exposures were prepared and demonstrated. Additionally a handbook was produced presenting detailed profile descriptions and micromorphological and water retention data. (Harrod, Hogan and Clayden)

Some soils of Mid-Devon and Exmoor were shown to the Land Use Capability Working Party of ADAS and their potential discussed. (Harrod and Hogan, with Dr. A. D. Hughes, ADAS)

A clayey soil (Halstow series) over Carboniferous shale was shown to Pre- and Post-Conference excursions of the Sixth International Clay Conference. (Harrod)

An excursion illustrating the soils of Kielder, Northumberland, was organised for the North of England Soils Discussion Group. (Carroll)

Excursions illustrating the soils and drainage problems of Holderness, Longtown, Northallerton and Silloth areas were organised for Land Drainage staff of ADAS. (Furness, Kilgour, Allison and Matthews)

A map of the Onecote district showing soils suitable for mole draining was demonstrated at an ADAS Hill Land Improvement open day near Bottom House, Leek. The soils on site were demonstrated to visitors. (Hollis)

The stratigraphy of Fenland deposits was demonstrated to a party of Dutch students from the Vrije Universiteit, Amsterdam. (Seale)

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Five sites were visited and their variability evaluated for an extensive joint experiment by the Letcombe Laboratory and the Field Drainage Experimental Unit of ADAS. Six profiles were described in detail at the chosen site. (M. G. Jarvis)

Advice and assistance was given to many governmental and private organisations, and to individuals.

Publications

The first issue of *Profile* was published in September. This is an internal newsletter intended to keep staff better informed on developments in the Survey and related organisations and fields of interest. Items for publication are collected by regional representatives and assembled at Mold. (Thompson)

During the year 21 coloured soil and land capability maps were published as part of the 1:25 000 series. Twenty-four maps are being prepared for publication.

The first of the new series of Bulletins describing the soils of the counties of England and Wales, that for Cheshire, was published, together with ten *Records* and one *Special Survey*.

Two *County Bulletins*, 11 *Records*, 3 *Technical Monographs* and 2 *Special Surveys* are being published.

Staff

Mr. K. E. Clare retired on 31 March after 12 years as Head of the Soil Survey, during which time he initiated and carried through a major programme of soil surveys at scales between 1:25 000 and 1:250 000. He introduced a regional structure, negotiated the substantial increases in staff and launched three new series of publications. His friendly optimism will be missed.

B. W. Avery, D. C. Findlay, C. A. H. Hodge, C. C. Rudeforth and R. Webster attended the 11th Congress of the International Society of Soil Science, Edmonton, Canada. Rudeforth visited several Universities and Institutes in the United States and Canada.

R. A. Jarvis spent 10 weeks with Soil Survey organisations in Argentina and Colombia (Royal Society Latin-American Programme).

R. J. A. Jones was invited by the Director of the Rheinisches Lander Museum, Bonn to lecture at the 18th International Symposium on Archaeometry and Archaeological Prospecting. A paper on the relationship between soils and crop marks has been prepared for publication in the conference proceedings.

P. Bullock attended an International Working Group meeting on soil micromorphology in Stuttgart. He was elected chairman of the newly formed International Society of Soil Science Sub-commission on Soil Micromorphology for the period 1978–82.

P. J. Loveland visited the Department of Soil, Utrecht University and the Soil Survey Institute, Wageningen.

R. Evans gave a paper on erosion in lowland England at a workshop on Soil Erosion at Ghent, Belgium.

R. C. Palmer and S. J. Staines were seconded to Groundwater Development Consultants (International) Ltd., for 4 months each, and mapped soils in the Eastern Province of Saudi Arabia to aid recognition of areas of potential arable land.

M. J. Reeve spent the year in New Zealand working with the Soil Bureau of the Department of Scientific and Industrial Research. He was mainly involved in a soil and irrigation suitability survey of a 4000 hectare alluvial area in Hawke's Bay but also attended the inaugural conference of the New Zealand Irrigation Association in Ashburton and examined soils in other parts of the country.

P. J. Loveland was awarded the Ph.D. degree of London University for his Thesis 'An

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investigation into the nature and genesis of some glauconitic soils in south-central England'.

V. C. Bendelow transferred from Harrogate to Penrith.

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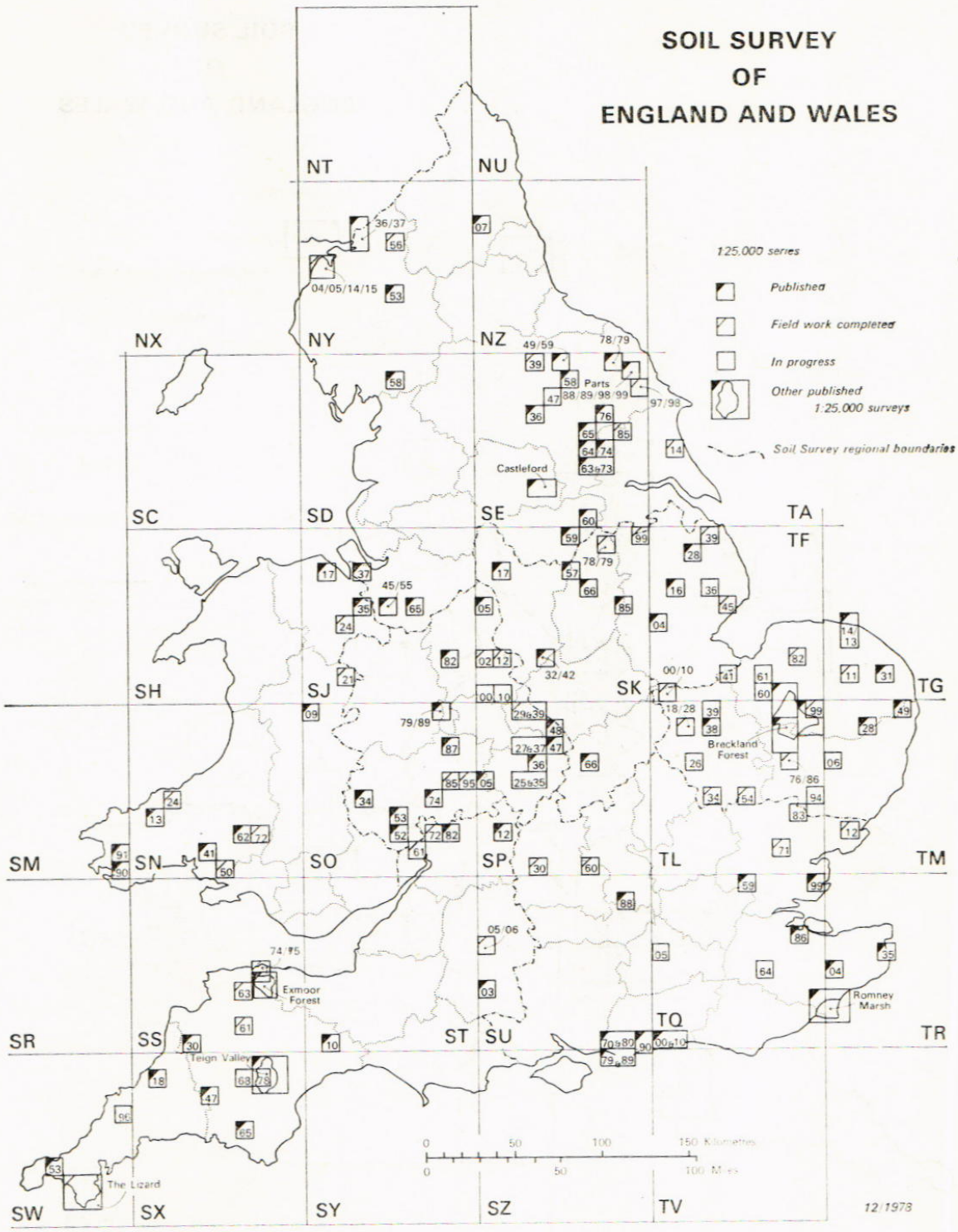
SOIL SURVEY OF ENGLAND AND WALES



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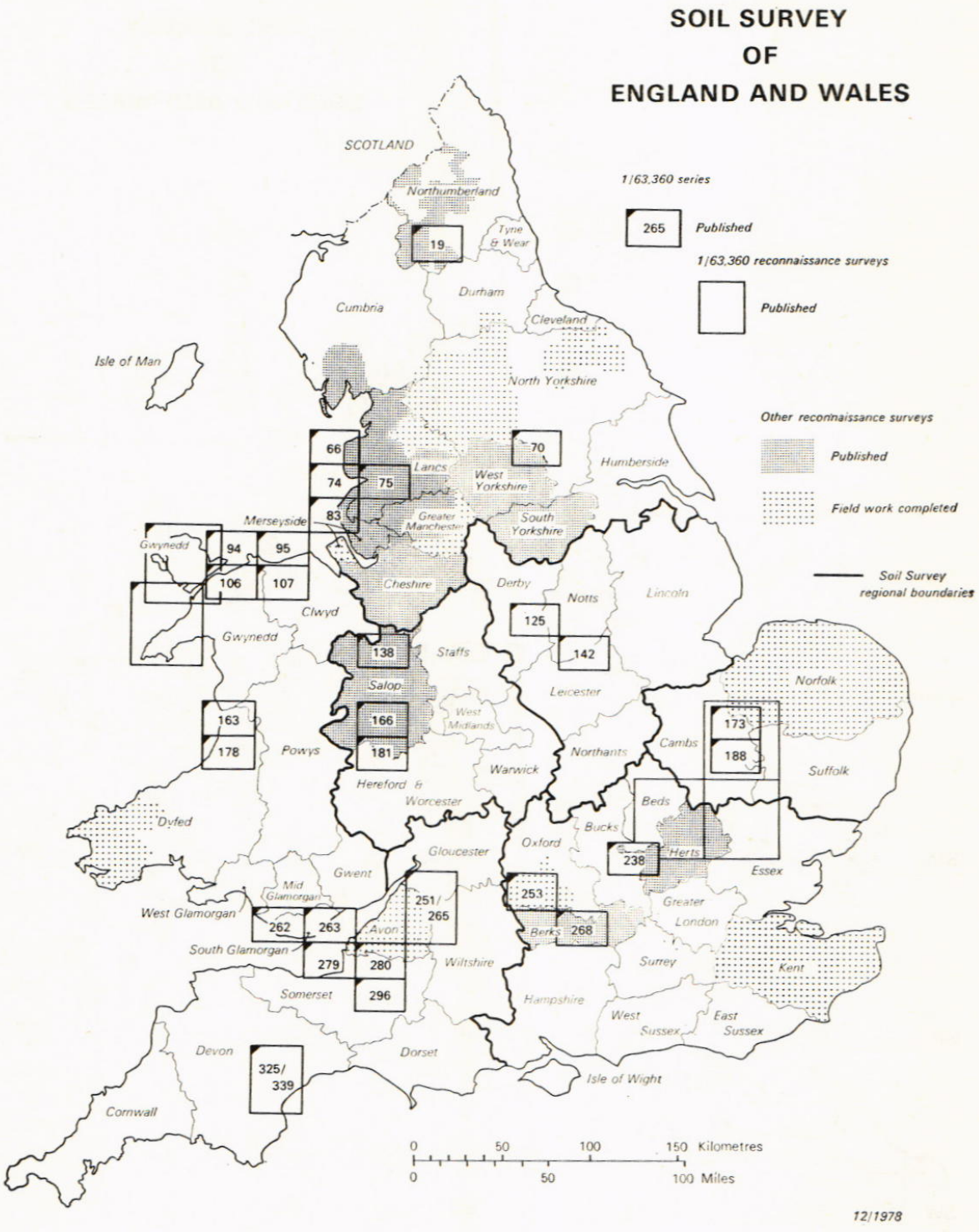

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