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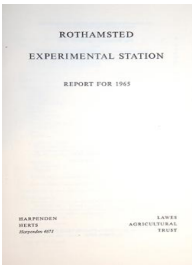
Full Table of Content



Soil Survey of England and Wales

D. A. Osmond

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SOIL SURVEY OF ENGLAND AND WALES

D. A. OSMOND

It is with deep regret that the death of A. Crompton, one of the senior members of the staff, has to be recorded. C. J. Folland left to take a position in the Lancashire County Planning Department, J. L. Nowland to join the Soil Survey of Nova Scotia and P. Bullock to continue his studies in Cornell University, U.S.A. T. R. Harrod, P. A. Johnson, A. H. Maclean and P. R. Tomlinson were appointed.

D. A. Osmond attended a meeting of rapporteurs of the ECA Working Party on Soil Classification and Survey held at Bonn, W. Germany. C. A. H. Hodge, J. M. Hodgson and M. G. Jarvis worked with Scottish soil surveyors for a month. A. J. Thomasson organised courses in soil morphology and drainage status for new entrants into the Ministry of Agriculture, Fisheries and Food, Drainage Division. C. B. Crampton played a major part in organising the meeting of the British Society of Soil Science at Swansea. A soil exhibit was arranged at the Bath and West Agricultural Show.

Exclusive of the area mapped in Buckinghamshire and of necessary revision at some centres, 485 sq. miles were mapped during 1965 and several *ad hoc* surveys made.

The Cartographic Section prepared numerous block diagrams and figures for publications, and the coloured soil map of the district north of Derby (3rd Edn. Sheet 125) was published. Work is proceeding on seven 3rd Edition sheets and on six maps at scales other than 1: 63,360 (1 in. to 1 mile). The Analytical Section analysed 1,150 samples and determined the mechanical composition of a further 385; silica/sesquioxide ratios of 100 clay fractions were determined. Four hundred samples were examined for the Directorate of Overseas Surveys, which is now responsible for surveyors who constituted the Colonial Pool of Soil Surveyors.

The task of editing map legends and memoirs increases. Accounts were completed of the soil maps on 3rd Edition Sheets 75 (Preston), 74/83 (Southport and Formby), 125 (Derby), 166 (Church Stretton) and 188 (Cambridge); manuscripts for Sheet 268 (Reading), and the soil maps of the Sussex Coastal Plain and Lancashire await editing; descriptions are being written of Sheets 163/178 (Aberystwyth and Llanilar), 262/263 (Bridgend and Cardiff) and, at other scales, of Romney Marsh and the counties of Brecknock, Glamorgan and Monmouth.

The aim of the Soil Surveys of England and Wales and of Scotland is to describe, classify and prepare maps of the distribution of the soils of Great Britain. From auger borings and from the soil profile, as seen exposed in the face of pits dug to a depth of about 3 ft, observations are made of such properties as the colour, texture, structure, consistence, kind and distribution of roots and organic matter of each distinguishable soil horizon.

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Information is also collected about the environment and the use made of the land. Soil samples are taken for analysis to confirm and give precision to the field observations, and to provide further information useful in characterising the soil and considering its origin. The properties of the soils delimited are described in a memoir which, together with the soil map, provides an account of the geography, geology, climate, vegetation and agriculture of the district surveyed.

Northumberland

3rd Edition Sheet 19 (Hexham). Approximately 12 sq miles were mapped in the west and north-west parts of the sheet, without the need to describe any new series. Some areas were revised in the light of additional information acquired while surveying in the Henshaw district. Some soils, the parent material of which had been thought to be glacial drift from Carboniferous rocks, have probably developed in colluvium from Carboniferous rocks lying higher up the slope above the reddish-brown drift that entered the area from the west.

The soil pattern is still further complicated by the presence of large spreads of coarse-textured colluvial material on the dip-slope of the Carboniferous sandstone escarpments. The sandy colluvium extends a considerable distance from the sandstone outcrops and overlies gleyed, clayey drift or weathering shales. The soils developed in the coarser-textured colluvium are podzolised, but where possible the land has been reclaimed and has become very useful for agriculture.

Further work suggests that the dark grey tenacious clay occurring in depressions and previously thought to differ from Carboniferous drift is of the same origin as the drift. Large exposures, for example open-cast mining sites, show no sharp boundary to suggest different origins, and the more open fabric and different colour of the upper 4–5 ft probably result from post-glacial weathering and the action of plant roots and soil fauna. On steeply sloping valley sides the differences are greater and springs are thrown out. At Steel the road was blocked when a landslip occurred because the saturated upper layers slid over the more compact basal layers. (Ashley)

Lancashire

3rd Edition, Sheet 74 (Southport) and 83 (Formby). The soils mapped on these two sheets will be described in one memoir now being prepared for publication together with the maps. (Hall and Folland)

3rd Edition, Sheet 75 (Preston). Work was resumed on the memoir to accompany this sheet; the greater part had been written by the late E. Crompton and a part edited by the late A. Muir. Much of the manuscript has been revised and is now almost ready for publication together with the soil map. (King)

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Soil map of Lancashire. The field work necessary for preparing a reconnaissance map of the soils of the county was completed and a map showing 25 soil associations was drawn. It is being prepared for publication at the scale of ½ in. to 1 mile and the accompanying bulletin describing the soils and their environments was drafted. (Hall and Folland)

Yorkshire

3rd Edition, Sheet 63 (York). A further 45 sq miles were surveyed, mainly on the drift deposits at the western edge of the map and on the Jurassic outcrops and till at the northern edge.

Near York, the soil series on the mixed deposits of the York moraine are the same as those already mapped on them towards the east and on the Escrick moraine on Sheet 71 (Selby) to the south. West of York the drift contains more Triassic material, which gives the soil a reddish colour. Lacustrine clay is the commonest parent material north-west and north of York and gives rise to gley soils of the Foggathorpe and Biggin series. Near Skelton a few small hills of reddish brown, loamy drift rising above the clay plain carry *sols lessivés* of the Escrick series. North of Skelton, the lacustrine clay is progressively buried by water-deposited and wind-resorted sands, in which gley soils and podzols of the Stockbridge, Holme Moor and associated series develop.

Several new series were needed when mapping on the Jurassic rocks and the tills of the Howardian Hills, particularly for the podzolic soils, *sols bruns acides* and brown rankers formed on Estuarine sandstone and the surface-water gley soils in the thin, sandy or loamy drift overlying Lower Lias Clay or till derived from it. Nevertheless, most of the soils on the Lias Clay and Oolitic Limestone could be correlated with series established on the same formations in southern England.

Although *sols bruns acides*, mapped as the Bulmer series, are widespread on Jurassic sandstone, well-developed podzols are rare and the situation contrasts with that in the Farndale district on the North York Moors (*Soil Survey Report* No. 11 (1959)). Soils of the Welburn series, podzolised brown earths with horizons of bleached sand up to 2 in. thick below mor humus, are fairly common, especially in coniferous and beech woodland. None of the profiles examined showed horizons where iron or humus had accumulated.

Broad outcrops of Lower and Upper Lias Clay on the lower slopes of the Jurassic scarp give rise to fine-textured, imperfectly and poorly drained soils respectively of the Evesham and Charlton Bank series. The micaceous sandy shales of the Middle Lias yield imperfectly drained loamy soils provisionally classified as the Whitwell series.

On gentle slopes near High Hutton, reworked Oxford and Kimmeridge Clays yield poorly drained soils correlated with the Denchworth series; the gleyed brown earths on steeper slopes are provisionally named the Hutton series.

The late A. Crompton had written a considerable part of a memoir to accompany the soil map on the 3rd Edition Sheet 70 (Leeds); the work is

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being continued, and additional information, including profile descriptions to be quoted in the memoir, has been collected. (Matthews)

Leicestershire and Nottinghamshire

3rd Edition, Sheet 142 (Melton Mowbray). With the mapping of a further 68 sq miles about one-half of the sheet is complete. The district surveyed this year comprises part of the Vale of Belvoir, the valley of the Wreake and the intervening low plateau. The plateau is occupied by fine-textured gley soils developed in Chalky Boulder Clay, and although the upper layers of the soil are non-calcareous, a calcareous horizon is usually reached at 20–30 in. below the surface. On sloping terrain, towards the edges of the plateau, the Hanslope series of gleyed calcareous soils becomes dominant. Cropping out from beneath the greyish Chalky Boulder Clay in the Wreake valley, a reddish-coloured boulder clay, derived mainly from Keuper Marl, gives rise to imperfectly drained, non-calcareous soils resembling those of the Cottam series (Mackney and Burnham (1964), *The Soils of the West Midlands*).

The underlying strata are of Lower Lias Clay, but they rarely occur as a soil parent material because they are mainly covered by a complex system of river-terrace gravels and deposits of Head at low elevations in the valley. Deep, reddish-brown, sandy soils containing quartzite pebbles from the Bunter formation occur locally, but the commonest soils are somewhat stony, sandy clay loams or clay loams overlying Lower Lias Clay, which appears at depths ranging from 24 to 60 in. (Thomasson and Robson)

Shropshire and Herefordshire

3rd Edition, Sheet 181 (Ludlow). Approximately 55 sq miles were mapped at the scale of 1: 25,000, mainly on the northern edge of the map and adjacent to the published Sheet 166 (Church Stretton). The range of soils is similar to that in the southern half of the Church Stretton sheet; the Bromyard, Munslow, Haymore and Stanway series are predominant, and smaller areas are occupied by the Wootton, Rowton, Hamperley, Speller, Eardiston, Middleton, Yeld, Wilderhope and Peaton series (Mackney and Burnham (1964), *The Soils of the West Midlands*). Alluvium and river terraces associated with the Teme and its tributaries are extensive, and the soils on them are grouped into five mapping units, which are not necessarily correlated with separate terrace levels and may individually encompass several terraces at different levels.

The alluvium of the Vale of Wigmore is mainly silty in texture and imperfectly or poorly drained, though freely drained brown warp soils occur on either side of the shifting course of the Teme. Dwerryhouse and Miller (*Q. Jl geol. Soc. Lond.* (1930) **86**, 96–128) suggested that the Vale represents the site of a former glacial lake, but at least the upper 6 ft of the deposits seem to be of riverine rather than lacustrine origin. Soils of the Rowton complex (Rowton and Hamperley series) in glacial gravels and till also occur on the edge of the Vale.

Soils developed in alluvium and on terraces outside the Vale are pre-

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dominantly freely drained and differ mainly in the source of the parent material. Deep, reddish, medium-textured alluvium is associated with the tributary valleys of Ledwyche Brook and other small streams draining the outcrops of the Old Red Sandstone rocks. Brown stoneless alluvium occurs on the lower terraces and the flood plain of the Teme, and the higher terraces are stony, with characteristic small, well-rounded, hard stones from Welsh rocks.

The Peaton series, occurring on calcareous gravel, occurs on small terrace features above the main valley terraces, and as in places, the deposit is thickly covered with Head, the distribution of the series is limited and discontinuous. (Hodgson and Maclean)

Cambridgeshire

3rd Edition, Sheet 173 (Ely). Forty-eight sq miles were surveyed, mainly in the south-west quadrant of the map between Ely and Chatteris. The northern part of the Isle of Ely around Downham and Ely together with Burnt Fen, east of Littleport, were also mapped and the small area of silt fen around Welney was investigated in detail.

The soils likely to occur on knolls and low hills that have been glaciated or subjected to a periglacial climate are less reliably predicted than those on the level post-glacial deposits of the Fenland. It is therefore necessary to spend more time and to make more soil inspections of the Upland than of the Fenland soils. Many of the Upland soils, derived from fine-textured Chalky Boulder Clay, reworked Gault and Kimmeridge or Ampthill Clay and from terrace deposits, together with most of the Fenland soils have already been described. (Hodge and Seale (1966), *The Soils of the District around Cambridge*)

In the Fenland, south-east of Chatteris, an area of coarse-textured soils was mapped in a district from where the original peat surface has disappeared. The soils have a compact, grey sub-surface layer of sandy loam and will probably be separated as a series. A decision on this, and on soils near Welney derived from estuarine silt and provisionally assigned to the Romney, Agney and Dowels series described from Romney Marsh, awaits the results of analyses of selected profiles.

The memoir describing the soils of the district around Cambridge (Sheet 188) was completed. (Hodge and Seale)

Pembrokeshire

3rd Edition, Sheet 228 (Haverfordwest). Field work on Sheets 163 (Aberystwyth) and 178 (Llanilar) is complete, and a memoir describing the soils is being prepared.

Work was started on Sheet 228 (Haverfordwest), where the strata delimited on the Geological Map (Drift) range from Cambrian age to the Coal Measures of the Carboniferous formation. In the Pleistocene period ice from the direction of the Irish Sea swept eastwards over the area, leaving deposits of boulder clay and other traces of its passage. Preliminary

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studies, over about 20 sq miles in the east between Narbeth and Saundersfoot, north of Tenby, were made on a range of rocks of Devonian and Carboniferous age.

The highest land occurs on a smooth ridge of Old Red Sandstone Marl, south of Narbeth extending from east to west, on which brown earths and shallow rankers are common. Signs of imperfect drainage are occasionally visible in the soil, and there are limited areas of poorly drained soils in the valleys. On the lower slopes of the south side of the ridge, boulder clay of fine texture covers limestones, shales and occasional sandstones of the Carboniferous formation. Poorly drained soils are common in the clayey or silty drift and in low-lying tracts underlain by Coal Measures shales. The depressions in the drift mantle around Templeton and Ludchurch are probably caused by solution of the underlying limestone. The soils they contain have a range of drainage characteristics resulting from differences in the thickness and permeability of the superficial deposit, and where the substratum is least permeable water accumulates in ponds. Near the coast, in the more dissected landscape with steep-sided valleys leading into Saundersfoot Bay, drainage is improved and brown earths are common. (Rudeforth)

Glamorgan

3rd Edition, Sheets 262 (Bridgend) and 263 (Cardiff). Considerable time was spent resurveying the relevant parts of the 7th Series sheets 154 and 155, where the soil associations had been delimited, so that these two sheets can be published with a descriptive memoir. The southern part of the district had been surveyed in some detail, so there was already considerable information on the distribution of the soil series. Elsewhere, however, the distribution of series comprising the associations has had to be ascertained. The legend was drawn up and additional information necessary for the memoir obtained.

A start was made on a bulletin to accompany soil maps of the counties of Glamorgan, Monmouth and Brecknock, which it is expected will be published at the scale of ½ in. to 1 mile. (Crampton)

Berkshire

3rd Edition, Sheet 253 (Abingdon). Thirty-seven sq miles were mapped at the scale of 1 : 25,000. In the central northern part of the map an area between Charney Bassett and Hinton Waldrist consists mainly of freely and moderately well-drained soils developed on Corallian rocks, but includes some fine-textured, poorly drained soils on Oxford Clay. The soils were mapped on and near a gravel fan at Grove near the foot of the Chalk outcrop; in the western part of the Vale of the White Horse, mapping was started in a tract relatively free from drift of coarse texture and where fine-textured soils on Gault and Kimmerdige Clay are dominant.

On the Chalk formations forming the southern third of the sheet area, surveys were made in the Ashbury–Upper Lambourn and Lockinge–Farnborough–Blewbury districts. The dominant soils are rendzinas,

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formed directly from Lower, Middle or Upper Chalk, and brown calcareous soils, developed in chalky drift. Brown earths with a horizon of illuviated clay are less common, but occur in decalcified drifts on broad valley floors, e.g., on the Chilton gravels, or in non-calcareous plateau deposits of flinty residual material as at Farnborough. In the latter district, which comprises the remains of a Tertiary capping, are small patches of Reading Beds clay and sand, although Plateau Drift and Clay-with-flints are the main soil parent materials.

The memoir describing the soils around Reading on Sheet 268 is being edited for publication. (Jarvis, R. A. and Jarvis, M. G.)

Wiltshire and Gloucestershire

3rd Edition, Sheet 265 (Bath). Excluding built-up areas, approximately 100 sq miles were surveyed, thus completing the field work on the sheet. It is not proposed to issue a memoir of this area but to continue surveying on the adjacent Sheet 251 (Malmesbury) and to publish an account of the two sheets together.

The limestones of both the Great and Inferior Oolite formations give rise to extensive areas of soils of the Sherborne series in which variations in the depth to rock and the texture are recognised (Avery (1955), *The Soils of the Glastonbury District of Somerset*). More attention was given to the soils on the Fuller's Earth which, in addition to the imperfectly drained soils of the Trip series, also gives rise to deep, brown clays, shallow soils on marly clay and to brown stony clays where limestone occurs.

Around Bath, the Great Oolite rocks have been deeply dissected by the Avon and its tributaries, and erosion of the underlying soft Liassic strata has led to pronounced cambering and landslipping. Three soil associations have been recognised: (*a*) soils on Fuller's Earth and Great Oolite rubble on steep, slumped slopes, now often wooded and covered with scrub; (*b*) well-drained shallow, stony soils on Fuller's Earth Rock and Inferior Oolite, occurring on spurs with moderate slopes that are usually under arable cultivation; (*c*) fine sandy and silty soils on Upper Liassic strata, mainly of the Atrim series but locally including Martock soils on slumped slopes. Around Batheaston these and small areas of brashy soils are used for horticultural crops.

On the Lower Lias rocks, north of Doynton, soils of the Haselor and Charlton Bank series are extensive, but in more dissected country to the south of Doynton, shallow Somerton soils on limestone and Evesham soils on clay are more commonly found (Findlay (1965), *The Soils of the Mendip District of Somerset*). Somerton soils become dominant on the gentle dip-slope of Lias limestone, south of the Avon.

The narrow outcrop of Keuper Marl gives rise mainly to Worcester series, but locally there are poorly drained Spetchley clay and coarser-textured soils. On the Coal Measures the soils on the shales are mapped as the Coalpit Heath complex, and stony loams on the sandstone are included in the Nibley series. (Findlay and Tomlinson)

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Devon

3rd Edition, Sheet 325 (Exeter). With the survey of a further 100 sq miles only about 20 sq miles remain to be surveyed to complete the sheet. West of the Exe, the survey was completed of a belt between Exeter and the area previously surveyed (Clayden (1964), *Soils of the Middle Teign Valley District of Devon*). Both in the south around Exminster and in the Crediton valley freely drained gravelly loams of the Shillingford series, developed from red Permian breccia, are the most widespread soils. The pattern of the soils mapped on the Culm shales around Whitestone is similar to that farther west in the Teign valley; the shallow, well-drained, but fine-textured soils of the Dunsford series occur widely on steep slopes, whereas fine-textured, surface-water gley soils of the Halstow or Tedburn series occupy gentler slopes.

East of Exeter a block of country was mapped between the Clyst and the scarp of the Pebble Beds extending along the eastern edge of the map from Woodbury in the south to Plymtree in the north. Almost all the area is underlain by red Permian marl, usually mantled by a thin deposit of loamy drift that includes quartzite stones from the Pebble Beds. The predominant soils show only slight evidence of gleying and consist of reddish-brown loam overlying brownish-red silty clay at about 15 in. Soils with a pronounced horizon of variegated brown loam above the finer-textured subsoil were distinguished and tentatively correlated with the Brinsea series (Findlay (1965), *The Soils of the Mendip District of Somerset*). Soils of a third soil series have well-developed sub-surface horizons of pale brownish-grey loam or sandy loam and are formed in thicker gravelly Head below the Pebble Bed scarp, where flushes of water from springs give wetter conditions. (Clayden)

Other Work

1. Observations on soil–water régimes were continued with the co-operation of several surveyors in different parts of the country. Although gley features are more intense in the Blackwood series than the Stockbridge series, both developed in Yorkshire on fluvio-glacial sands overlying lacustrine clay, preliminary observations suggest little difference in the degree of waterlogging during the past year.

Tensiometers were installed in soils of the Charlton Bank, Evesham and Worcester series at depths of 5, 15, 24 and 36 in. Negative pore-water pressures greater than 1 atm occurred during only four weeks of June and early July at 5 in. and only in the Worcester soil was 1 atm exceeded at 15 in. for a few days in June. (Avery, Clayden, Findlay, Matthews, Robson and Thomasson)

2. Continuous pen recorders were installed at Leeds and Malham to record the vertical movement of the soil surface during frost. During the 1964/65 winter frost-heave occurred 21 times at Leeds on loamy soil derived from till and 15 times at Malham on silt loam over limestone. At Leeds the greatest heaves (20–25 mm) were caused partly by the formation of needle ice (pipkrabe), which was observed on five nights. (Matthews)

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3. Continuing experiments at Borth Bog, Cardiganshire, in co-operation with the Chief Drainage Officer (Wales), include the drainage of peat by plastic drains and open ditches; water levels are measured in stand pipes. First results show that both plastic and tile drains laid by machine and without permeable fill may be ineffective. Open ditches are more efficient, but during wet periods the small permeability of the peat may limit their effectiveness. Even after the dry October, water in an open ditch was standing about 4 ft below the land surface, but 15 yards away the level in the peat was only 2 ft below the surface.

The rooting depth of reeds was investigated, at the request of the National Agricultural Advisory Service, with A. Troughton (Welsh Plant Breeding Station), to assess their possible use in increasing the hydraulic conductivity of peat. (Rudeforth)

4. Work in co-operation with the N.A.A.S. continued on the reclamation of hill land at Greenhill, Northumberland, where the removal of water from the superficial soil layers is a significant factor. (Ashley)

5. Assistance was given to the Agricultural Land Service in connection with proposed sites of new towns in Dorset and Montgomeryshire. (Findlay and Rudeforth)

6. Soil maps were made of 185 acres at Colney and Dereham, Norfolk, where the John Innes Institute will be sited and of 420 acres at Wymondham for the Norfolk Experimental Station. The soils of 1,800 acres for possible use for fruit plantations at Hollesley Bay, Suffolk, were mapped and, in Essex, the Fingeringhoe Nature Reserve, Colchester, of 150 acres was also surveyed. (Hodge and Seale)

7. Soil maps were supplied in connection with a proposed pipe-line from Barrow to Preston. (Hall)

8. A report and soil associations map of the district around Ingleborough were supplied to the Nature Conservancy. (Matthews)

9. A request was received for a small-scale map of the soils of Buckinghamshire, and about one-third of the county has been traversed. (Mackney)

10. Reports were made on the soils of about 70 field trials of various kinds; information collected on the soils of over 200 sites in connection with the National Wheat Survey is being examined by the Statistics Department.

11. Surveyors described the soils at various sites for the N.A.A.S., the A.L.S., Nature Conservancy and other official bodies.

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