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ROTHAMSTED RESEARCH

Report for 1964

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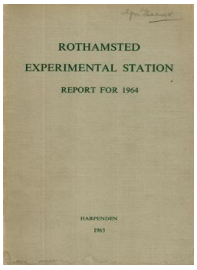

Soil Survey of England and Wales

D. A. Osmond

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SOIL SURVEY OF ENGLAND AND WALES

D. A. OSMOND

C. P. Burnham resigned to become a lecturer in the University of Aberdeen, and D. J. R. Manley and Audrey M. Du Feu to take posts in commercial organisations. M. J. Pettersson and D. J. Robson were appointed. J. M. Hodgson was transferred to the Wolverhampton centre. P. Bullock was awarded the degree of M.Sc. of Leeds University and is working in Cornell University, U.S.A. D. A. Osmond and B. W. Avery attended the Working Party on Soil Classification, Survey and Soil Resources at Florence, Italy, and C. P. Burnham, C. A. H. Hodge and A. J. Thomasson took part in the 8th International Congress of Soil Science at Bucharest, Rumania. An exchange visit was arranged between Dr. J. Deckers of the Belgian Soil Survey and G. D. Ashley, who also went to the meeting of the British Grassland Society in Ireland. C. C. Rudeforth attended the course in micromorphology at Arnhem, The Netherlands. The joint Field Meeting was held in South-west England, and soils near Bristol and Exeter were demonstrated and discussed.

The total area mapped during the year is 1,100 sq miles, including 310 sq miles on 3rd Edition sheets and the revision of some 80 sq miles, the remainder being continuation of reconnaissance survey.

The Cartographic Section produced coloured soil maps for inclusion in the bulletins on the Middle Teign Valley (1 : 25,000) and the West Midlands (1 in. to 10 miles), and work is proceeding on soil maps on seven of the 3rd Edition sheets. Numerous diagrams and other maps were drawn for various publications. The Analytical Section made routine analyses of 1,500 samples and silica/sesquioxide ratios were determined on the clay fractions of 106 samples from 23 profiles. A further 139 samples were analysed mainly in connection with surveys in overseas territories.

It is with deep regret that the death of H. Greene (Tropical Soils Adviser) at Lagos, Nigeria, is recorded; his genial personality and intimate knowledge of soil problems of many tropical countries will be greatly missed. A. O. Ballantyne resigned to take a post with the Government of Northern Rhodesia. D. M. Carroll was assigned to work in Basutoland, and J. R. F. Hansell completed his duties in Tobago and went to Western Nigeria for survey work.

The aim of the Soil Surveys of England and Wales and of Scotland is to prepare soil maps that will be of help to all whose interest lies in the land. Observations are made in the field, by auger borings or specially dug pits, to a depth of about 3 ft, of such properties of the soil as the colour, texture, structure, consistence, kind and distribution of roots and organic matter of each distinguishable soil horizon, and information is collected about the environment of the soils and of the use made of the land. Soil samples are

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taken for analysis to confirm and give precision to field observations, to obtain further information helpful in characterising the soil and explaining soil formation. The results of the surveys are published as memoirs or bulletins, with maps, in which the soils are described and some account is given of the geography, geology, climate, vegetation and agriculture of the district surveyed.

Northumberland

3rd Edition Sheets 19 (Hexham) and 14 (Morpeth). Surveying and some revision was continued along the southern and western edges of Sheet 19. As the survey was extended westward evidence of the increasing influence of climate, particularly precipitation, on soil formation became strikingly apparent. Annual rainfall increases from about 32 in. around Hunstanworth, where acid brown soils and weakly developed podsols are prominent, to 45 or 50 in. on the west side of the Alston block, where there are more and larger areas of basin- and flush-peat deposits which have frequently coalesced to form what appears to be blanket bog. In addition, soils with mor humus usually occur at altitudes 150–200 ft lower than in the east.

Some new series were required to describe soils in the valley of the South Tyne, where wide spreads of alluvium are flanked by well-drained soils developed in coarse- or medium-textured drifts, commonly fluvial sands and gravels. These drifts contain a high proportion of far-travelled material, for example, Triassic sediments, Criffel granite and occasional erratics of Shap granite.

Mapping on Sheet 14 (Morpeth) was chiefly confined to the western edge of the Northumbrian Plain. The underlying solid strata play a more important part in soil genesis and morphology than in the upland. The terrain is at a higher elevation than that previously mapped and is more strongly undulating, with thin beds of sandstone, limestone, shales, etc., cropping out and only slightly contaminated with drift. The weathered products have frequently yielded colluvial material indistinguishable from the glacial drift, which is very heterogeneous. There are, however, notable areas of soils, mainly derived from limestones, that include coarse- or medium-textured rendzinas, red clay loams and brown rankers in which there is possibly some contaminating drift. This area seems to be transitional between the lower ground of Sheet 19 and the Northumbrian Plain. (Ashley and Nowland)

Lancashire

7th Series, Sheet 101 (Manchester). Forty sq. miles were surveyed between Radcliffe and Heywood. The boulder clay, which gives rise to gley soils, is often covered by thin fluvio-glacial sand on which gley soils are interspersed with small patches of peat. Thicker sandy deposits in strongly undulating country occur north of Middleton carrying freely drained brown earths.

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7th Series, Sheets 88 (Barrow-in-Furness) and 89 (Lancaster and Kendal). After detailed mapping near Coniston to establish mapping units, approximately 205 sq miles were mapped in Furness on Sheet 88. Rocks of the Borrowdale Volcanic Series form the Furness Fells (2,000 ft) north-west of Tover and Coniston, where rock outcrops and shallow rankers are dominant above 1,200 ft, whereas peaty gleyed podzols develop in thick drift on moderate slopes. Peaty gleyed podzols, peaty gley soils and peat are widespread between 700 and 1,200 ft, with ochreous brown soils on similar material below 700 ft.

Silurian slates, flags and shales with widespread drift and Head deposits are rare above 1,000 ft, but occur south-east of Furness Fells. Peat, peaty gley soils and peaty gleyed podzols occur on the craggy ground above 750 ft, with ochreous brown soils dominant on the steep valley sides, which are fringed with undulating, very stony moraine deposits with freely drained brown earths; hollows are occupied by fine-textured colluvial deposits. Esthwaite and Coniston Waters have considerable deposits of peat and alluvium. The Duddon and Leven estuaries are infilled with Downholland Silt, and raised moss has developed in places.

Silurian rocks in the west of the Cartmel lowland provide a complex of rankers, ochreous brown soils, peaty gley soils and peat. The limestone, which crops out around Grange, is mostly drift-covered, and the soils are stony, freely drained brown earths.

North-east of Lancaster, on Sheet 89, 80 sq miles were mapped, including Caton Moor, Tatham Fells and Leck Fell, where hill peat, peaty gleyed podzols, peaty gley soils and gley soils occur on sandstones, shales and local drift. Limestone outcrops on Leck Fell are mostly covered by sandy and shaly drift on which peaty gley soils predominate. Drumlin tracts between Wray and Cowan Bridge consist of boulder clay, derived from (*a*) Carboniferous sandstones and shales, with gley soils and imperfectly drained brown earths, and from (*b*) Triassic sandstones and marls, which carry freely and imperfectly drained brown earths: peat and peaty gley soils occur in all the hollows. The very stony terraces in the Lune Valley give free drained soils, but on the silts and sands of the present flood plain between Caton and Kirkby Lonsdale poorly drained soils also occur.

7th Series, Sheet 94 (Preston). Forty-five sq miles were mapped on the southern slopes of the Forest of Bowland and on Longridge Fell, where there is also a sequence like that on the Fells on Sheet 89. Longridge Fell is separated from the Forest of Bowland by an extensive lowland with gley soils developed in boulder clay of Carboniferous origin. Similar soils occur on the southern slopes of the Fell adjacent to the freely drained brown earths and gley soils of the Ribble alluvium.

7th Series, Sheet 95 (Blackburn and Burnley). About 60 sq miles were surveyed in the Forest of Pendle and the Forest of Trawden, where peat, peaty gleyed podzols, peaty gley soils and gley soils occur on Carboniferous sandstone and shale and on local drift. Gley soils are extensive on drift from Carboniferous rocks between Whalley and Clitheroe, but limestone

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knolls give rise to rendzinas and to freely drained brown earths when covered by drift. (Hall and Folland)

Yorkshire

3rd Edition, Sheet 63 (York). Following reconnaissance survey of the sheet in previous seasons, more detailed mapping was made on the area north and east of York. In contrast to the larger part of the sheet, where outcrops of the solid geological formations are frequent, the area surveyed is mainly covered by drifts. Lacustrine clays and boulder clays are covered by thin deposits of sand, either water deposited or wind sorted, on which a range of podzols and ground-water gley soils is developed similar to that on Sheet 71 (Selby) to the south. On Sheet 71 lacustrine clay is the commonest substratum, but in the area surveyed this season pinkish-brown boulder clay largely derived from Keuper Marl is widespread.

On slightly higher ground north and east of an arc curving through Stillington, Farlington and Flaxton, the soils, derived from boulder clays, are surface-water gley soils and brown earths with gleyed subsoil horizons. Classification of soils on the drifts is difficult, as some of them clearly show the influence of the Jurassic rocks, which crop out near by, whereas others are very strongly influenced by Keuper Marl, and yet another group shows no very obvious affinities with local rocks but contains far-travelled cobbles, including many from rocks of the Carboniferous formation.

Reconnaissance survey of 7th Series, Sheet 90 (Wensleydale), was continued, and increased use was made of aerial photographs. (Crompton and Matthews)

Leicestershire and Nottinghamshire

3rd Edition, Sheet 142 (Melton Mowbray). A further 20 sq miles of detailed surveying was completed, the greater part in the Vale of Belvoir on the Lower Lias Clay; neighbouring areas of Middle Lias, Upper Lias and Inferior Oolite were also examined. Most of the soils associated with these formations could be correlated with established series on the same formations in Gloucestershire and Oxfordshire.

The commonest soils in the Lias clay lowlands are the calcareous gley soils, Evesham series, consisting of an A horizon or plough layer of well-structured clay overlying olive-brown, finely mottled clay which passes into grey, highly calcareous clay at about 18 or 20 in. Many of these soils are calcareous to the surface, and thin bands of limestone occur in the substratum. The Lower Lias formation becomes less calcareous in its higher zones, giving rise to non-calcareous gley soils of the Charlton Bank series in which the A horizon of clay texture overlies dense, prominently mottled clay.

Parts of the Lias clay areas are covered with a thin sandy or stony superficial deposit which affects the soil profile in two ways. In some profiles the surface horizon is sandy clay loam and the profile becomes less sandy with depth. Elsewhere the texture of the surface soil is clay, but

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sporadic lenses or pockets of sandy, calcareous gravel are encountered in the lower layers. (Thomasson and Robson)

Cambridgeshire

3rd Edition, Sheet 173 (Ely). Following the completion of the field work of a reconnaissance of the soils within the area covered by 7th Series Sheet 135 (Cambridge and Ely), a soil association map has been drawn. This is being used in connection with the detailed survey of the 3rd Edition Sheet 173, which lies wholly within its boundaries. Some 30 sq miles were mapped in the district around Ely; all the soils seen had been described during work around Cambridge on 3rd Edition Sheet 188 to the south. (Hodge and Seale)

Cardiganshire

3rd Edition, Sheets 163 (Aberystwyth) and 178 (Llanilar). A further 105 sq miles were mapped at the scale of 1 : 25,000 with the object of completing, for publication, these two sheets, which cover about 300 sq miles of agricultural land and upland around Aberystwyth. Rocky phases of Manod and Hiraethog soil series are extensive in the uplands in the northern part of the county covered by Sheet 163. The distribution of about 50 soil units including previously described soils has been mapped, and coloured copies of the field sheets have been prepared in conjunction with writing the memoir. (Rudeforth)

Brecknockshire

A further 270 sq miles were surveyed, thus completing a reconnaissance survey of Glamorganshire, Monmouthshire and Brecknockshire, of which a full account is being prepared for publication. In Brecknockshire the Old Red Sandstone dip slope rises from the Vale of Usk towards the north-west, meeting the outcrop of Silurian shales and grits along the Mynydd Eppynt escarpment. The valleys are occupied by superficial deposits in which the Castleton series, *sols bruns acides*, gley soils of the Frog Moor association and peaty gleyed soils of the Wenallt complex occur. On ridge crests south of the dip slope *sols bruns acides* of the Tanyard complex occur, but north of it they are replaced by "podzols with gleying" of the Talybont complex and peaty gleyed soils (Beacon series). The best agricultural land is in the valleys on the Castleton series and on the ridge crests on soils of the Tanyard complex.

In the Vale of Irfon, north of Mynydd Eppynt, Silurian rocks crop out and there are shallow soils of the Powys series, *sols bruns acides*. The Vale is largely filled with drift deposits, which are thick in places. In the eastern part of the Vale occur gley soils of the Cegin association and *sols bruns acides* (Denbigh series), the latter soils being the best agricultural land in the Vale; gley soils (Ynys series) occur in the west of the Vale.

North of the Vale of Irfon and between the county boundaries, the ridge crests of the high land of Mynydd Bach carry peaty gleyed soils and

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peaty gleyed podzols (Drosgol and Hiraethog series). The valleys are occupied by superficial deposits which give rise to peaty gleyed soils (Ynys series).

Throughout the district surveyed soils on steep slopes have been separated as Scethrog series in the Old Red Sandstone country and as the Cymmer series on Silurian rocks.

The survey of the Vale of Glamorgan has been revised and the constituent series of the associations have been mapped. A memoir to accompany a soil map at 1 in. to 1 mile is being prepared. (Crampton)

Berkshire

3rd Edition, Sheet 253 (Abingdon). Following the work done last year, mapping was concentrated west of the area surveyed by Kay (*Bull. Fac. Agric. Hort. Univ. Reading* (1934) **48**, 186 pp.) in a strip 12 miles long by 2 miles wide, which extends from north to south across the sheet; most of the parent materials that will eventually be encountered occur in this strip.

The northern boundary of the sheet closely approaches the Thames valley with its narrow belt of calcareous gley soils developed on alluvium. A much wider zone of fine-textured, imperfectly and poorly drained soils overlying gravel follows and extends to the Oxford Clay, which here gives rise to a soil akin to the Evesham series. Above the Oxford Clay, the low scarp of the Corallian marks a change to better-drained, deep loamy sands and shallow soils over oolitic, flaggy and rubbly limestones. To the south these give way to poorly drained, non-calcareous gley soils on the Kimmeridge Clay and the Gault, while, finally, in front of the Chalk scarp, the Upper Greensand yields the loamy, well-drained soils of the Harwell series. Fans of gravelly deposits lie over the Gault and opposite the mouths of coombes deeply cut in the north-facing triple scarp of the Middle Chalk, Lower Chalk and Upper Greensand. (Jarvis, R. A. and Jarvis, M. G.)

Wiltshire

3rd Edition, Sheet 265 (Bath). A large part of this sheet has been covered by a reconnaissance survey of 7th Series Sheet 156 (Bristol and Stroud), and, with the resurvey of 80 sq miles and new work covering 26 sq miles, the eastern part, lying in Wiltshire, is complete.

South-east of Chippenham the small part of the scarp of Corallian and Lower Greensand consists mainly of a complex of imperfectly drained soils on uneven slopes.

In the Oxford Clay Vale a primary division was made between soils derived from the Kellaways Beds and those from the higher beds of the Oxford Clay, which is a uniform dark grey, calcareous clay giving rise to soils correlated with the Denchworth series. The Kellaways Clay is non-calcareous and yields poorly drained sandy clay loams on slopes. Kellaways Sands are best developed on the gentle dip slope north of Chippenham, and the soils are mapped as the Langley complex of loamy sands with variable, but usually imperfect, drainage.

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The Avon is flanked by wide terraces of gravel covered by slightly flinty deposits of variable thickness and texture. Where gravel lies within 18 in. of the surface, as at the bevelled edges of the terraces, the soils are well drained and are equated with the Badsey series. Deeper soils, with mottled clay loam or clay subsoils on the main terrace surfaces, are similar to the Isle Abbots and Isle Brewers soils of Somerset. On the left bank the soils are sandier and incorporate gravelly Head derived from the Corallian and Lower Greensand. At the backs of terraces and associated with tributary streams, thin Head overlying Oxford Clay gives imperfectly and poorly drained soils of the Podimore and Holwell series.

The areas of the Forest Marble were mapped in more detail in an attempt to separate the soils derived from this variable formation more effectively. The calcareous Chickerell clay soils are extensive, but are replaced by non-calcareous, imperfectly-drained clay loams or well-drained sandy loams of the Hadden series. The limestone facies gives rise to soils very like those of the Sherborne series on oolitic limestones or to duller, less-well-drained soils or, where it is sandy, to soils of the Hadden series. (Findlay)

Devon

3rd Edition, Sheet 325 (Exeter). About 70 sq miles were surveyed in the north around Crediton, Thorveton, Silverton, Bradninch, Broadclyst and Ashclyst Forest. The narrow strip of Culm rocks north of the Crediton valley consists of red-stained sandstones with subsidiary shales giving well-drained, reddish-brown loams of moderate depth becoming shallower on ridge crests and upper slopes. Soils of finer texture and with various degrees of drainage impedance occur on the inlier of red-stained Culm shales at Ashclyst Forest. On Permian breccias the soils are freely drained, gravelly loams of the Shillingford series with some small areas between Shobrooke and Thorveton of finer-grained, imperfectly drained soils associated with marly bands. The Bridgnorth series is extensively mapped on the red sandstones and is separated from fine sandy loam soils of similar morphology developed on fine-grained sandstones. The soils on the flood plains and terraces of the Creedy, Exe and Culm were also investigated.

3rd Edition, Sheet 339 (Teignmouth). Between the Teign Valley and the coast 40 sq miles were mapped. The podzolised soils on the flint gravel and Greensand of the Haldon Hills were re-examined and mapped as the Haldon complex. In flush sites on the slopes below the Greensand outcrop imperfectly or poorly drained soils are developed in loamy Head overlying red clay. Most of the soils on the Permian rocks below Great Haldon and Little Haldon are mapped as either the Shillingford or Bridgnorth series, but iron-humus podzols, developed locally on the sandstones around Kenton, are also separated. (Clayden and Manley)

Sussex

About 12 sq miles were mapped mainly east of the Arun, and a considerable area surveyed by D. W. King in 1953 and early in the present

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survey was checked and, where necessary, revised. The soils encountered were similar to those previously described, but those developed on Brick-earth around Worthing are deeper than those west of the Arun and the pattern of their distribution is simpler. Most of them are of the well-drained Hamble series, on which the local glasshouse industry is established.

The field work is now complete, and the maps and report of the soils of this area are being prepared for publication. (Hodgson)

Other Work

1. Reports were made of soils and sites investigated for the Ministry of Agriculture, Fisheries and Food, the National Agricultural Advisory Service, the Agricultural Land Service, the Ministry of Housing and Local Government, the Nature Conservancy, the Council for Nature and other official bodies.

2. Sites were examined for the Forestry Commission in connection with Working Plans, catchment areas, experimental plots, wind-blow of trees and other subjects.

3. Several surveyors contributed to a paper on soil-drainage status and profile morphology for the M.A.F.F. Drainage and Water Division.

4. Courses of lectures with field work were given at the Field Studies Council centres at Preston Montford, Slapton Ley and Juniper Hall. (Burnham, Clayden and Green)

5. Exhibits were prepared for the Great Yorkshire Show and the Royal Lancashire Agricultural Show. (Crompton, Folland and Hall)

6. Meetings of the Regional Land Restoration Committee and the Opencast Coal Survey Panel were attended. (Ashley and Hall)

7. Considerable assistance was given in the preparation of a guide and with the excursions organised by the International Geographical Congress. (Green and Hall)

8. A soil map ($\frac{1}{2}$ in. to 1 mile) was prepared of the Cambridge district and, with Dr. R. S. M. Perrin, an account of the soils was written for the meeting of the British Association for the Advancement of Science in 1965. (Hodge and Seale)

9. Observations of soil-water régimes were begun in the 1963–64 winter. Good correlation was found in general between the degree of waterlogging and the type of gley morphology, but some anomalies were apparent. A soil developed on Keuper Marl showed much waterlogging with relatively weak gley effects, whereas a very acid soil on Upper Lias Clay showed prominent gley morphology but relatively little waterlogging above 18 in.

Volumetric sampling for moisture content using the Proline soil corer gave reproducible results from several sites in early April. In most of the clay soils, whether on drift deposits or solid geological formations, moisture content and air space decreased with depth; horizons at 18–36 in. had no air space, and all pores were apparently filled with water. In soils developed on Keuper Marl, however, horizons from 18 to 30 in. were saturated, but measurable air space (3–5% of the volume) occurred from 30 to 60 in. (Thomasson and Robson)

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