ROTHAMSTED RESEARCH

Report for 1981 - Part 1


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PART I

Full Table of Content

Soil Survey of England and Wales

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SOIL SURVEY OF ENGLAND AND WALES

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Introduction

Fieldwork for the National Soil Map at 1:250 000 scale is virtually complete, and compilation of the six regional maps is underway. The project has been completed on schedule despite an increase this year in manpower deployed to contract surveys.

The broad plan for the Surveys' future mapping programme has been agreed with MAFF. Proposals have been accepted to combine a national objective to complete a general purpose map at a scale of 1:50 000 with local objectives to survey in more detail for specific purposes. A new three year programme, to start effectively from July 1982 has been constructed but awaits ratification.

Eleven books and 16 soil, climate and land capability maps have been published this year, including a *Technical Monograph* on a 'Climate Classification for England and Wales' which with four maps provides a framework for comparing climate and land capability throughout Britain, and with other countries.

At the request of ADAS the Survey has temporarily suspended publication of land use capability maps, whilst final amendments are made to a revised unified system of agricultural land classification intended for planning and advisory functions. In the revision Survey officers have contributed substantially by (i) supplying improved data for calculating Potential Soil Moisture Deficit, (ii) drawing maps of Field Capacity Days from data supplied in *MAFF Technical Bulletin* No. 34 and (iii) integrating field capacity days with soil parameters to assess workability and machinery work days.

A grid survey of the peat soils and resources of the Somerset Moors has been published at 1:50 000 scale. The map shows the thickness and types of peat and indicates where peat is overlain by up to 90 cm of clay. It is a further contribution to information already supplied by the Survey over the years for an area where major land use conflicts exist. Extension of the methods used to the whole of the lowland peats and peat soils is being discussed with ADAS.

Contract surveys form an increasing proportion of the Survey's activities, giving staff a variety of work and extending their experience and responsibilities. In addition there have been very many requests for information, advice and demonstrations from ADAS, ARC Institutes, Scientific Societies, Naturalist Trusts, Water Authorities, Universities and Colleges, Schools, Local Authorities, farmers, fertiliser companies, consultants and others.

The contacts which Survey Officers have made with farmers attending demonstrations and exhibitions sponsored by the Royal Agricultural Society of England, Soil and Water Management Association (SAWMA) and by *Farmers Weekly* have been particularly beneficial since there has been opportunity to explain the role of soil surveys in the context of practical farming.

National map programme

Fieldwork for the 1:250 000 National Map is now almost complete, previously unsurveyed areas being finished slightly ahead of schedule. Some older reconnaissance mapping needs reviewing in both South-west and South-east Regions and in East Anglia, but fieldwork elsewhere is complete.

Survey proceeded steadily throughout the year helped by mild spring and autumn weather; in most districts soil moisture remained sufficient during the summer to dig and auger without difficulty.

Over 34 000 km^2 have been surveyed to complete 83 000 km^2 since mapping started in April 1979, 70 500 km^2 of which had not been mapped before at any scale. The density of observations for previously unmapped country averaged about 2·2 per km^2 compared to an overall average of 2.

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SOIL SURVEY OF ENGLAND AND WALES

During the year more than 1700 pits dug and sampled for the National Soil Inventory gave a total of 3700 since the survey began; most of the remaining sites are in areas which will not be re-surveyed during the current programme. Excepting some sites in Cornwall, Northumberland and East Anglia the present programme has been completed.

Over 120 larger pits have been dug, fully described and sampled to characterise selected soil classes to modern standards. Most were sampled to determine soil water release characteristics as well as to meet usual needs like micromorphological study, and mechanical analysis.

A revised list of the provisional map units was compiled in March following correlation meetings at Swanwick and further extensive revision followed smaller meetings dealing with soils in Tertiary and Jurassic rocks; minor modifications have again been made in consultation with field staff. The list now comprises 291 units—some of limited extent but all distinctive at the publication scale of 1:250 000. There are approximately 100 other provisional units, mainly of small extent; those insufficiently extensive to appear at the publication scale will be amalgamated with larger units

Compilation of outline soil maps at 1:50 000 scale for final cartographic reduction is well advanced in several regions; base maps for the six regional soil maps already have been prepared by Ordnance Survey.

Format, style and content for the six regional memoirs has been settled after consultation between senior staff. Writing will require inter-regional cooperation and a detailed guide for authors has been prepared to simplify and standardise procedures and to avoid duplication of effort. Plans concerning memoir content have been revised following advice from MAFF not to proceed with the Agricultural Land Classification maps which were to accompany each 1:250 000 soil map.

The regional reports that follow give further details of progress during the year.

East Anglia

Some 5675 km² were surveyed during the year, including 1300 km² of the Suffolk coastal area and 2075 km² of Essex, Hertfordshire, Bedfordshire and Northamptonshire. All unsurveyed areas were mapped by the planned date of 31 August, including 517 km² in south Hertfordshire where there was some unpublished post-war surveying. Reappraisal of the previous published reconnaissance survey of the Saffron Walden and Bedford and Luton areas started in the spring and 2300 km² have been examined so far.

Much of East Suffolk is a low, boulder clay covered plateau (with Beccles soils), but towards the coast the more clay rich Ragdale series becomes dominant and on valley-side slopes the Hanslope series prevails. A coastal belt of glaciofluvial outwash up to 10 km wide between Ipswich and Lowestoft is dominated by Freckenham series with some areas of podzols of the Redlodge series. Intersecting valleys are infilled by marine alluvium with Wallasea, Newchurch and Pondersbridge soils but further inland these pass into peat soils (Adventurers' series).

On slopes south of Woodbridge the Crag crops out from the covering glaciofluvial sands with their Freckenham and Redlodge soils, revealing in a narrow band a sequence of previously undescribed ferruginous typical brown sands, argillic brown sands and calcareous brown earths.

In south Hertfordshire the main soils are the Windsor series associated with London Clay, and Wickham and related soils where thin drift caps the clay. Areas of boulder clay tend to carry Ragdale soils, especially on flat crests, whilst stony Titchfield soils seem most common where pebbly gravel drift and Bagshot Beds cap high ground. Hamble and Hook soils in loess derived Brickearth are sufficiently extensive to map near Hoddesdon in the Ware valley and near Hatfield. The Carstens series with a fine silty topsoil overlying

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clay is the most common soil on the Clay-with-flints near St. Albans. Between St. Albans and Saffron Walden Hanslope soils are most common on the Chalky Boulder Clay plateau but south of Great Dunmow and east of Harlow, including The Rodings, the better drained Stretham series is more widespread. (Hodge and Regional Staff)

The Midlands

With the exception of some small areas in Cheshire the whole of the Midland Region has now been mapped; about 40% of the 14 000 km² completed has been revision of previous reconnaissance surveys in Cheshire, Derbyshire and Shropshire. Most of the new work has centred on Warwickshire, west Leicestershire, Nottinghamshire and north and west Lincolnshire. Approximately 500 National Soil Inventory sites were described and sampled, while a further 20 profiles have been described in detail and cores taken to determine moisture release characteristics.

In Lincolnshire a large extent of coarse loamy brown rendzinas and brown calcareous earths (Rauceby and Cranwell series) have been mapped on the Jurassic limestone dipslope. Loamy soils predominate on the Cornbrash and fine sandy Kellaways Beds and range from gleyic brown calcareous earths (Aswarby series) on the limestone to argillic and cambic gley soils on overlying strata. Large areas of sandy and gravelly glaciofluvial outwash were encountered in the Jurassic Clay vale to the west of Lincoln. These deposits support typical sandy and cambic gley soils (Blackwood and Quorndon series). Fine loamy over clayey soils (Trench series) usually surround these areas but, where the drift is thin or absent between Grantham and Newark, clayey soils predominate (Denchworth, Evesham and Haselor series). Fine loamy over clayey and clayey soils (Salop and Crewe series), were encountered near Gainsborough in reddish till.

Typical brown sands (Newport series) are dominant on Bunter Sandstone in Nottinghamshire, but there are also brown podzolic soils and humo-ferric podzols (Howard and Crannymoor series) in remnants of Sherwood Forest.

The Coal Measures outcrop in north-eastern Derbyshire has many fine grained sandstones interbedded with clay and silt shales. These rocks support a map unit consisting mainly of cambic stagnogley soils (Bardsey and Ticknall series) together with pelo-stagnogley soils (Dale series). Coarse loamy and fine loamy typical brown earths (Swindon Bank and Neath series) occur within this soil association where outcrops of micaceous sandstone are extensive. Further south, the clay shales are more common and the main map unit is dominated by Dale soils. In most areas, there is a substantial amount of land restored after opencast coal mining.

In northern parts of the county very steep slopes below the blanket peat of the High Peak plateau have an association of ironpan stagnopodzols (Belmont series), ferric stagnopodzols (Lydcott series) and typical brown podzolic soils (Withnell and Manod), the first being best developed on convex upper slope facets. This area contrasts with the eastern gritstone moors where peat soils are generally absent and mineral soils comprise humo-ferric podzols, ironpan and humus-ironpan stagnopodzols (Anglezarke, Belmont and Maw series) with occasional humic rankers. Below 300 m in Central Derbyshire fine loamy brown earths (Neath series) have been encountered on the Shale Grits. Variable thicknesses of Head over Millstone Grit clay-shales give rise to three stagnogley soils (Bardsey, Brickfield and Dale series) and above 300 m their humose equivalents are developed. Tills on the eastern slopes of the Derbyshire uplands are also dominated by stagnogley soils (Dunkeswick and Brickfield), but those fringing the Wye valley near Bakewell and Hassop have a significant limestone content and develop stagnogleyic brown earths and calcareous brown earths.

Pelo-alluvial gley soils (Compton and Fladbury series) are developed in the alluvium of

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the Trent in southern Nottinghamshire, but with loamy and silty typical and gleyic brown alluvial soils (Alun, Wharfe and Trent series) fringing the present river course. In Derbyshire, the composition of alluvia of the River Derwent and its tributaries varies according to gradient and depositional regime. Typical brown alluvial soils (Alun and Wharfe series) occur to the north of Rowsley but the loamy, calcareous alluvial deposits of the Wye and Lathkill give rise to gleyic brown calcareous alluvial soils (Usher series) and calcareous alluvial gley soils. The broader floodplain to the south of Rowsley has mainly gleyic brown alluvial soils (Trent series).

In south Warwickshire large areas of pelo-stagnogley soils and typical calcareous pelosols (Denchworth and Evesham series) were mapped on Lower Lias rocks. There was some variety in the Vale of Moreton where chalky till around Moreton in Marsh gave typical and pelo-stagnogley soils (Beccles and Ragdale series) and some areas of paleo-argillic stagnogley soils (Oak series). Fine loamy over clayey typical stagnogley soils and stagnogleyic brown earths form an important association in the red tills of southern Leicestershire and northern Warwickshire (Salop and Flint series). Where the drift is thin and red rocks predominate, these are replaced by a similar association of Brockhurst and Whimple soils. Around Henley in Arden, Whimple soils also are common but, on the grey mudstone facies of the Keuper Marl, Fen End and Balsall series are prominent. (Ragg and Regional Staff)

Northern England

Fieldwork in previously unmapped districts was completed in March. These areas and their principal soils are listed below, in order of size:

Southern Lake District, Cumbria. Humic rankers, brown podzolic soils and cambic stagnohumic gleys on Borrowdale Volcanic rocks and Silurian siltstones, shale and derived drifts on the fells: brown rankers and typical brown earths on Silurian siltstones and shales in the lowlands, mostly east of Windermere: brown rankers in loess-like, non-calcareous drift on the Carboniferous Limestone hills near Grange-over-Sands: typical humic-alluvial gleys on the levels fringing Morecambe Bay.

Southern Yorkshire Wolds and south part of Holderness to the Humber estuary, Humberside. Typical brown calcareous soils on the Chalk Wolds: stagnogleyic argillic brown earths and typical stagnogley soils in chalky glacial drift of Holderness: gleyic brown calcareous alluvial soils in river alluvium: and pelo-alluvial gley soils in marine alluvium beside the Humber.

Carnforth, Lancashire, to Ingleton, North Yorkshire. Typical brown earths and cambic stagnogley soils in drifts derived from Silurian siltstone and shale: typical brown alluvial soils and typical alluvial gley soils in river alluvium in the Lune valley: cambic stagnohumic gley soils in drifts derived from Carboniferous shales and sandstones on the western flanks of the Pennines.

West and south-west of Carlisle, Cumbria. Typical stagnogleys and stagnogleyic argillic brown earths in reddish glacial drifts: typical brown earths on Solway Plain, in glaciofluvial drift; cambic stagnogleys on higher land in the south, in glacial drift derived from Carboniferous shales and sandstones.

Other fieldwork included revision of previously mapped areas in Cumbria, Lancashire and Yorkshire; sampling for the National Soil Inventory; describing representative soil profiles for the regional memoir to accompany the 1:250 000 map.

In addition, map units were rationalised and the regional map legend updated; soil boundaries at the Scottish border were checked and agreed with those of the Soil Survey

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of Scotland; 1:25 000 field sheets were reduced to the compilation scale of 1:50 000; writing the regional memoir has started. (R. A. Jarvis and Regional Staff)

South-east England

About 6800 km² were surveyed for the National Map Project, and a further 2300 km² of Berkshire, Buckinghamshire and Kent mapped earlier at 1:250 000 were re-evaluated. The soils at over 360 National Soil Inventory points were described.

In general, soil patterns identified earlier have proved to be widespread in the region and few new map units have been established, though many have been modified in the light of further work.

Shallow brown rendzinas and brown calcareous earths are associated with the Oxfordshire limestone plateaux, though typical argillic brown earths and calcareous pelosols occur locally. Over Oxford Clay the principal soils are typical and pelo-stagnogley soils and calcareous pelosols; stagnogleyic argillic brown earths occur where there is thick drift.

The chalklands of Hampshire are characterized by a few simple units and mapping has been straightforward; brown soils in drift over Chalk are more extensive than was anticipated.

Plateau Drift covers much of the North Downs, giving silty over clayey paleo-argillic brown earths in the east above about 165 m O.D. In the west and on lower slopes further east, admixture of coarser material gives loamy over clayey paleo-argillic brown earths; coarse deposits at Headley Heath have humo-ferric podzols.

Most areas of Tertiary rocks have complex soil patterns due to variations in lithology, although wet stagnogley soils are consistently dominant since clays comprise much of the succession in Reading Beds, London Clay, and Bracklesham, Barton and Hamstead Beds. There is a wide range of soils under semi-natural vegetation in the New Forest. Stagnogley soils typify large areas, associated with restricted occurrences of drier soils and with humic gley soils or thin peat in valley bottoms. Where ridges or plateaux are capped by stony Plateau Gravel or other coarse loamy drift over clay, stagnogley podzols are dominant with paleo-argillic podzols on more stable land surfaces. Broad spreads of low lying stony loamy drift have argillic gley soils. Extensive deposits of Brickearth along the southern edge of the New Forest have argillic gley soils and argillic brown earths; stony brown soils occur where Brickearth is thin or absent.

On the North Downs dipslope, typical argillic brown earths are associated with Thanet Beds, whereas wetter typical stagnogley soils, argillic gley soils and stagnogleyic argillic brown earths are most common on Woolwich Beds. The Blackheath Beds are variably pebbly and have coarse loamy humo-ferric podzols and argillic brown earths.

Soil patterns in the High Weald are complex but stagnogleyic (argillic) brown earths predominate with stagnogleys more important in some areas and typical (argillic) brown earths associated with local persistent sandstone beds. In East Sussex north of Battle argillic brown earths occur on slopes mantled by Brickearth.

In the middle Thames valley, river terrace deposits are partially covered by Brickearth and map units with argillic brown earths in both Brickearth and terrace gravels have been identified. Low-lying terrace deposits affected by groundwater have argillic gley soils. (M. G. Jarvis and Regional Staff).

South-west England

5 000 km² were surveyed during the year, completing coverage of previously unsurveyed parts of the region.

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The broad soil patterns previously reported over the Bude Formation in west Devon have been extended eastward. However between the Chulmleigh sheet (SS61) and the Triassic vales around Tiverton and Wellington silty profiles appear more commonplace, both in the drier sites of the Neath/Holsworthy association and among the Tedburn/Brickfield stagnogley soils. In parts of this area the soils are redder adjacent to the Permo-Triassic outcrops. Brown soils on the Bideford Formation form a belt a few kilometres wide running from the coast near Abbotsham eastward to Bishops Nympton. On the Crackington Formation around Okehampton the hydrological sequence of Tedburn/Dunsford/Halstow is developed as distinct from the variation (noted in the *Report for 1979*) which dies out east of the River Taw.

The Devonian outcrop of north Devon and west Somerset is dominated by fine loamy brown earths with brown podzolic soils more common above about 200 m O.D. and on steep valley sides. Many soils are reddened over the eastern parts of the outcrop close to rocks of Permo-Triassic age.

Around Tiverton fine loamy brown earths predominate over Permian breccias with few very stony (gravelly) profiles of the kind previously described in the Exeter area (Clayden 1971). The Triassic sandstone outcrop south from Watchet has typical brown sands of the Bridgnorth series and coarse loamy brown earths of the Bromsgrove series. Bromsgrove soils predominate on rocks of Pebble Beds age though they may become more argillic in character eastwards. Keuper Marl deposits in west Somerset have argillic pelosols of the Worcester series with fine silty brown earths on terraces in the Dunster area.

Bodmin Moor has extensive ferric and ironpan stagnopodzols over the granite, although there is little now left of the heathy moorland vegetation formerly associated with these soils. Basins carry humic gley and peat soils, and there are brown podzolic soils at lower altitudes and on steep slopes. Stagnohumic gley soils are confined to flattish ridges. Bouldery outcrops are common and tors are well developed along the eastern flanks of Bodmin Moor. Compared with Dartmoor many mineral soils contain more silt and fewer small and very small stones.

Granite soils on the island of Lundy form a complex pattern more closely linked with the coastal granites of west Cornwall than with the higher moors. Enclosed land at the southern end has brown podzolic soils passing northward into ferri-humic cryptopodzols under bent-fescue grassland and heath. At the northern extremity of the island shallow rocky soils are interspersed with granite outcrops and boulders.

In the Jurassic clay vales of Dorset and south Somerset, loamy over clayey stagnogley soils and pelo-stagnogley soils are common, with loamy gleyic argillic brown earths in thicker drift over flint gravels. In west Dorset, Lias sands, siltstones and marls support loamy brown earths, typical brown earths and silty and clayey stagnogley soils; in places on the siltstones, cherty drift gives more stony soils. When traced northwards to Yeovil and Ilminster these sandy and silty facies give coarse silty typical brown earths and fine silty stagnogleyic argillic brown earths. The upper Greensand outcrop in Dorset gives both glauconitic and non-glauconitic argillic brown earths. In west Wiltshire, drift of mixed origin caps a wide plateau of Upper Greensand around Shaftesbury and Stourhead, on which paleo-argillic and argillic brown earths form a complex: on Greensand slopes typical brown earths and humo-ferric podzols are mixed. Loamy over clayey stagnogleyic paleo-argillic brown earths occupy the extensive Plateau Drift deposits over Middle and Upper Chalk, which often continue over the Lower Chalk outcrop in west Dorset.

On the sandier Tertiary Beds in east Dorset and in the New Forest there is a variety of podzols and gley podzols whilst clayey, and loamy over clayey, stagnogley soils are commoner on the more clayey beds. Plateau Gravels in parts of the New Forest have very stony paleo-argillic podzols and some stagnogley podzols.

Well drained loamy argillic brown earths are common on the extensive terraces of the

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Hampshire Avon whilst smaller areas of loamy argillic gley soils and brown sands are found near Christchurch.

Soil patterns previously mapped on the Wiltshire Chalk were extended northwards from the Vale of Pewsey to the wide Lower Chalk bench between Calne and Wroughton. In the Jurassic clay vale around Swindon, especially over the Kimmeridge Clay, there are extensive pelo-stagnogley soils and fine loamy over clayey typical stagnogleys with both swelling and non-swelling clay subsoils. Calcareous pelosols are also common north of Swindon. In the upper Thames valley deep pelo-calcareous alluvial soils are restricted to the very narrow meander belt. Adjacent low-lying soils are mainly loamy calcaro-cambic gley soils over limestone gravel on the northern reaches, and pelo-cambic gley soils over limestone gravel on the southern tributaries.

Around Cirencester, the Cornbrash gives rise to clayey brown rendzinas and fine silty or fine loamy variants close to the Kellaways Beds. A variety of soils is developed on the complex lithologies of the Forest Marble including fine silty, fine loamy and clayey brown rendzinas, patches of calcareous pelosols, and isolated patches of argillic brown earths and brown earths. (Findlay and Regional Staff)

Wales

Most of the year's fieldwork has been directed towards revision of areas previously mapped at low or moderate intensity to allocate soils to units of the new National Classification (Avery, 1980) and in accordance with current guidelines for soil series rationalisation. A total of 7300 km^2 were covered in Wales with a further 900 km^2 in Shropshire and 100 km^2 near the border in Herefordshire and Gloucestershire.

In north Wales and Anglesey many areas previously mapped as gleyed brown earths (Sannan and Deiniol series) are cambic stagnogley soils in the new classification, and are now included with Cegin and Brickfield series respectively; Denbigh map separates proved to contain a significant proportion of stagnogleyic rankers (Eriviat series). Soils over the Carboniferous Limestone are mainly typical brown earths with some argillic brown earths. In reddish drift, stagnogleyic argillic brown earths (Flint and Salwick series) and typical stagnogley soils (Salop series) are most common. Many of the previous 'rock dominant' units in Snowdonia are reallocated to humic rankers with rock inclusions.

Survey in south and mid-Wales has largely confirmed earlier unpublished mapping. On the levels between Newport and Caldicot pelo-calcareous alluvial gley soils are developed in marine alluvium (Newchurch series), and a strip of land to the north has clayey alluvium over peat allocated to pelo-alluvial gley soils (Midelney series). Brown soils are dominant in the undulating lowland further north associated with Carboniferous Limestone and related drifts, but there are limited areas of brown calcareous earths and rendzinas on the flanks of the Wye valley. Within the Old Red Sandstone lowland of Gwent, typical argillic brown earths (Bromyard series) are recognised over the Raglan Marls, but typical brown earths in reddish drift (Castleton series) and over red siltstones and sandstones (Milford and Eardiston series) are generally more widespread. Upland soils of the Brecon Beacons include blanket peat (Winterhill series) on gentle dipslopes above 500 m. On lower, steeper summits, stagnopodzols (Lydcott and Burcombe series) and shallow cambic stagnohumic gley soils (Beacon series) are common. The upland valley floors are mantled by thick drift and cambic stagnohumic gley soils (Wenallt series) predominate with some amorphous peat soils (Crowdy series). The Black Mountains further east are generally drier and dominated by stagnopodzols with fewer peat soils.

Most of the south Wales Coalfield comprises the Pennant Sandstone uplands, dissected by numerous deep narrow valleys. On the summits the pattern of soils is complex.

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Blanket peat (Winterhill and Crowdy series) is extensive on the highest ground above 500 m. On the lower summits two main associations are identified: broader plateaux have stagnopodzols (Gelligaer and Ebbw series) and shallow cambic stagnohumic gley soils (Rhondda series) while on narrow ridges there are ferric stagnopodzols (Gelligaer series) and humo-ferric podzols (Anglezarke series). The valley sides carry typical brown podzolic soils (Garth series) and typical brown earths (Neath series). The lower ground of the Lower and Middle Coal Measures has a thick drift cover and the soils are mainly cambic stagnohumic gleys (Wilcocks series) and cambic stagnogley soils (Brickfield series).

The Gower Peninsula is mostly covered by drift from Carboniferous rocks. In the north east there is indurated till with the Wilcocks and Brickfield series. Elsewhere the drift is less compact and typical brown earths (East Keswick and Wick series) occur in association with stagnogleyic and gleyic brown earths (Nercwys and Arrow series). Rendzinas and shallow brown earths occur on the limestone cliffs with small areas of paleo-argillic brown earths (Nordrach series). On the Old Red Sandstone ridges there are typical brown earths (Milford series) and humo-ferric podzols over conglomerate. Typical brown earths of the Neath series occur on hills of Carboniferous sandstone and shale.

In Shropshire most of the landscape is covered by reddish drift from Triassic sediments but with some local additions from Lower Palaeozoic rocks. Typical stagnogley soils (Salop and Clifton series) and pelo-stagnogley soils (Crewe series) occur in the till with typical brown sands (Newport series) and typical brown earths (Wick series) in glacio-fluvial drift. Typical brown sands of the Bridgnorth series occupy more hilly land with sandstone bedrock, but cultivation has made it difficult to find humo-ferric podzols of the Crannymoor series previously mapped in the same districts. The Aber soils near Wem are re-allocated to Salop series, Wem and Prees soils to Clifton series and Baschurch soils to Newport series. Pelo-alluvial gley soils (Compton series) and eutro-amorphous earthy peat (Adventurers' series) occur in alluvium and wet peat-filled hollows. (Rudeforth and Regional Staff)

Acid sulphate soils in the Broads area

Previous survey work in river valleys in Norfolk has indicated that acid sulphate soils (sulphuric humic-alluvial gley or sulphuric peat soils), or potential acid sulphate soils containing oxidisable pyrite, occupy significant areas in river valleys in East Anglia (Price, 1978; Corbett, 1979), and there have been other reports of similar conditions in the Norfolk Broads (Trafford *et al*., 1973, Gosling & Barker, 1980). It is likely that such soils are associated with the presence of pyrite in originally non-calcareous or slightly calcareous estuarine alluvium of the lower courses of the east Norfolk rivers.

Areas of peat and adjacent estuarine alluvium in valleys of the Yare, Bure, Ant and Thurne were sampled at National Grid kilometre intersections in order to determine the frequency and distribution of these potentially troublesome soils. Paired bores with a hand auger were made at each point, one at the intersection and a second 50 m distant. Samples were collected at depths of 30–40 cm, 60–70 cm, and 100–110 cm. Many sites were in undrained or partly drained fen-carr woodland with a watertable at the surface. Some sampling points could not be accurately located or were remote from firm ground and thus could not be reached.

Measurements of pH were made immediately after sampling and again three months later after moist storage in porous polythene bags. Powlson (1975) suggests that such storage permits maximum catalytic oxidation of any pyrite (FeS_2) present by *Thiobacillus ferrioxidans*, so giving the lowest pH values likely to result from drainage of previously waterlogged horizons. Samples with pH values of 3·5 or less after such oxidation were

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identified as acid sulphate soils or potential acid sulphate soils. Thirty four per cent of the 97 profiles sampled gave pH values meeting this requirement at some depth, and in most cases the values measured shortly after sampling were higher, indicating the presence of unoxidised pyrite. The paired profiles 50 m apart commonly gave different results, confirming that the distribution of pyrite in such soils is often irregular. Considering each pair of profiles as a site, 42% of the sites showed acid sulphate or potential acid sulphate conditions at some point (Fig. 1). Whilst this rapid survey showed that pyritic soils are widely distributed, they are evidently commonest around Hickling, Filby and Ormsby Broads and in the Yare valley between Surlingham and Reedham. As expected, they are mainly located where peat adjoins estuarine alluvium.

Recognition that these soils occur widely is of considerable land use importance and the survey has now been extended by the Environmental Sciences department of the University of East Anglia, to whom these results were made available. Not only could much

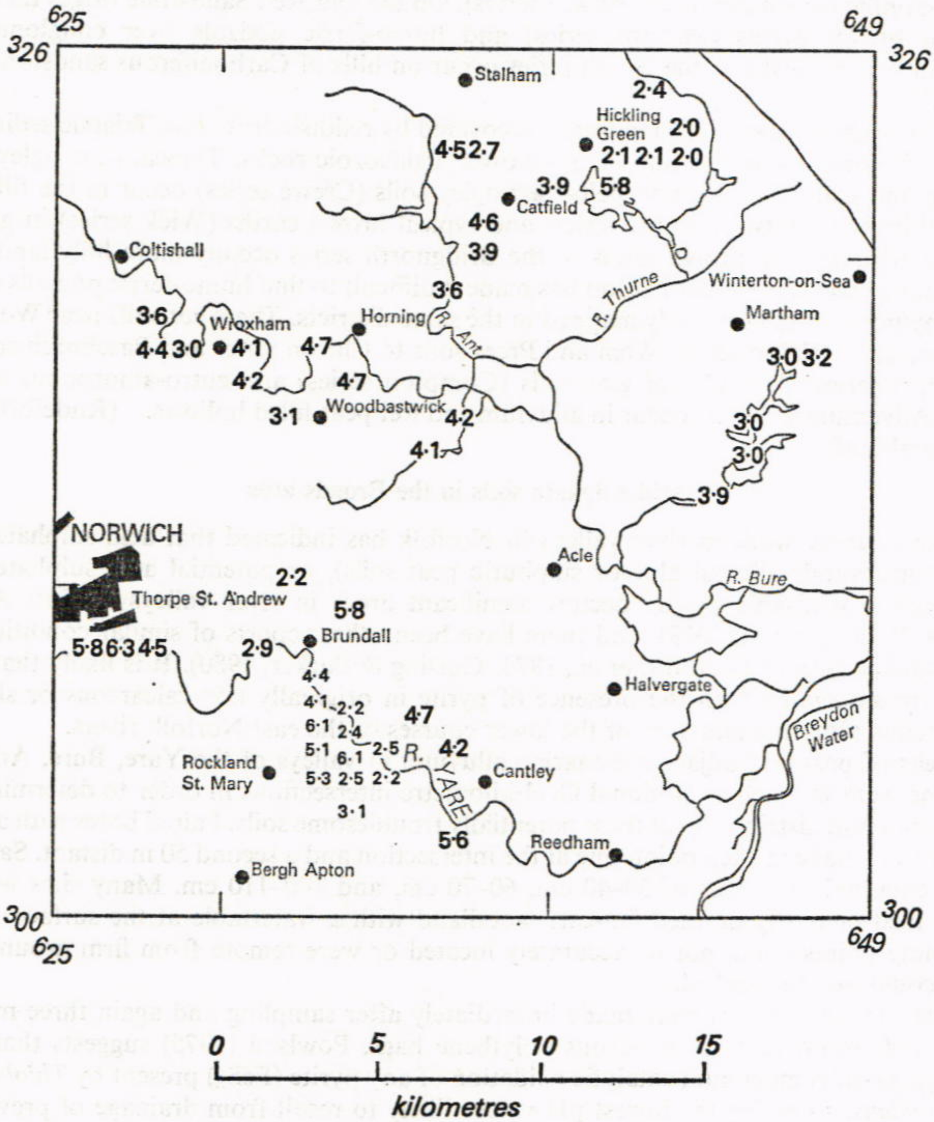

FIG. 1. Lowest pH value per pair of profiles

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of the peatland, if drained, be of lesser agricultural value because of persistent acidity than perhaps hitherto realised, but the presence of acid sulphate soils could also affect management of nature reserves. As Gosling and Baker (1980) have shown at Calthorpe Broad, altering the water levels of the peatlands can severely effect the fauna and flora. (Price and Hodge)

Investigation of upland grazing value

The vegetation of unimprovable uplands has been studied in relation to its grazing value for sheep—the main livestock of British hill farms. This continues work initiated by the Soil Survey of Scotland (Birse and Robertson, 1976) to establish land-use priorities for terrain largely in the Land Use Capability Class 6 (unimprovable) category.

The method relies on assigning grazing values (Klapp *et al.*, 1953) to individual species ranging from −1 (for poisonous species) to 8 (for the most palatable and nutritious grasses such as *Lolium perenne*). Relative grazing value (RGV) of plant communities is calculated from quadrat samples—the grazing value of each species is multiplied by its percentage cover and the sum of products is divided by 100. From a number of quadrats an average RGV can be determined for the community.

The communities are identified and classified using plant sociological methods of the Zürich-Montpellier School, relying on constant species. Many fit into the European hierarchy at the Association level, others fit at higher levels. For the purposes of the grazing classification the associations and communities have been sub-divided into field units. For example the bent-fescue grasslands are in the Association *Achilleo-festucetum tenuifoliae* which is divided into four field units:

A. Rich bent-fescue grassland
B. Upland bent-fescue grassland
C. Acid bent-fescue grassland
D. Bent-fescue grassland with bracken

The field units are identified by the presence or abundance of key species.

About 90 Associations and communities have been established by the Soil Survey of Scotland, most of which occur in England and Wales. The main ones fall into the groups listed in Table 1. They are ranked according to RGV into good, moderate and poor grazing divisions. Those classed as good have RGV greater than 5, moderate is 2 – 5 and poor is less than 2.

It should be noted that these values are generalised over the year and do not take account of seasonal variations in palatability. For example *Calluna* is useful in winter and early spring, providing food when many other plants are not available—especially under a grazing intensity sufficient to prevent it becoming coarse and woody.

TABLE 1

Vegetation groups on unimprovable hill land

Vegetation Group	Relative grazing division
Bent-fescue grassland	Good
Soft rush pasture	Moderate
Nardus grassland	Moderate
Molinia grassland	Moderate
Herb-rich heather moor	Moderate
Mires and flushes	Poor–Moderate
Heather moor	Poor
Bog-moss water track	Poor
Blanket bog	Poor

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The ratings given in Table 1, which result from investigations by the Soil Survey of Scotland, have been broadly confirmed by preliminary work in Wales for the national soil map.

Relative grazing value represents a useful way of subdividing land capability classes and this concept will be used in future land capability mapping of the uplands of England and Wales. (Hartnup)

Climatic classification

An assessment of the climate of England and Wales is presented in Soil Survey *Technical Monograph* No. 15, the aim being to provide a framework for comparing climates and land capability throughout Britain. The scheme broadly follows that developed by the Soil Survey of Scotland, but potential water deficit (PWD) is replaced by moisture deficit (MD) which, being a maximum value for the year, can be compared with soil available water capacity to calculate drought risks for perennial crops. Also, an index of continentality based on annual temperature range replaces oceanicity criteria, based on altitudinal limits of accumulated frost.

Three single feature maps at a scale of 1:1 million are published showing:

1. Accumulated temperatures above a base of 5.6°C (in °C days).
2. Average maximum potential cumulative soil moisture deficit (MD) (mm).
3. Wind exposure—an assessment of the effect of exposure on vegetation and crops, broadly correlated with average annual windspeeds (m s^{-1}).

These maps were produced to give an overall impression of the variations of the features and to facilitate comparisons with the 1:1 million Soil Map of England and Wales and derivative Land Capability and Grassland Suitability Maps.

A Bioclimatic Map at a scale of 1:625 000 combines the three features above with an assessment of oceanicity. Five thermal and five moisture deficit zones combine with three exposure categories to give fifty-five combinations, and these are presented as bioclimatic subregions within four subsectors of oceanicity. Areas of land are thus described in terms of their warmth, wetness, exposure and oceanicity. For example the area around Rothamsted is 'slightly cool, slightly moist, unexposed in the meioceanic subsector'. The map symbol for this is D4m04.

The classification, which is compatible with that for Scotland, is intended to identify areas of similar climate and to provide a basis for comparing climate with other characteristics of land. To this end the bioclimatic classification is being recorded at points on the National Soil Inventory (*Rothamsted Report for 1979*, Part 1) and stored in conjunction with soil and site data. The combined data can be used to establish relationships between soil, site and climate. Study of these relationships could lead to improvements in the classifications of climate, soil and land capability.

Data sheets used in constructing the maps are available from Rothamsted Experimental Station. (Bendelow and Hartnup)

Basic research

Soil structure. Experiments on the natural regeneration of soil structure following compaction have continued in collaboration with the Soils and Plant Nutrition Department, Rothamsted. The experiment on Pastures Field, Rothamsted has been concluded. Compaction by wheeling reduced the large (> 60 μm) pore space by about half compared with the original unwheeled parts. Over the subsequent 18 months, particularly the summer, the amount of large pores in the upper 5 cm increased to about that of the uncompacted soil, but the zone 5–15 cm remained compacted. The regeneration of pore

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space in the compacted 0–5 cm layer is apparently a result of cycles of drying and re-wetting, giving rise to horizontal planar voids and differs in this respect from the un-compacted soil in which the pores were mainly biologically induced vughs and channels.

In order to predict the ability of structurally damaged soils to naturally regenerate, the work is being extended to other soils under contract from the EEC. Two new experiments have started, one at Writtle Agricultural College on Hamble series and another at NIAE on soils of the Evesham series. As with the Pastures experiment the main measurements will include: surface profiles of the wheeled area, clod density, water release characteristics, mercury porosimetry and image analysis. In addition, yield differences between compacted and uncompacted parts of the plot are being monitored at the Writtle site. (Bullock and Thomasson, with Newman, Soils and Plant Nutrition Department)

Soils on Chalky Boulder Clay. The project to develop a better understanding of the complex soil patterns associated with this parent material in East Anglia and the east Midlands has continued. Profiles of the Hanslope and Ragdale series were sampled in the Milton Keynes area and of the Hanslope and Hadstock series to the north and south of Cambridge. Despite earlier claims that the Chalky Boulder Clay is homogeneous, studies of profiles from north of Cambridge and Milton Keynes show that even unweathered deposits contain very variable amounts of carbonate and non-carbonate clay, and slightly different heavy mineral assemblages. At Milton Keynes there is 17–23% total carbonate, compared with 37% at Boxworth, and the fine sand fraction has more tourmaline, zircon, staurolite and rutile, but less hornblende and pink garnet. At Boxworth, there is 10–20% less clay (on a carbonate-free basis) than at Milton Keynes. Thus some soil variation reflects local or regional differences in the parent material.

Thin sections of all the profiles studied show that the till contains many uniformly disseminated calcite crystals, 5–10 μm diam., as well as chalk fragments of various sizes. Particle-size analysis of the carbonate fraction showed that these crystals account for 35–40% of the total <2 mm carbonate. In all profiles there is evidence for decalcification in the upper horizons. Judging from the carbonate size distributions, the clay-sized carbonate is most prone to dissolution. In lower horizons carbonate has been redeposited as crystals 10–20 μm diam., especially along old root channels, which penetrate to at least 2 m.

Work continues, to establish the effects of parent material composition, landscape position, and weathering, translocation and oxidation-reduction processes on soil profile morphology and distribution. (Bullock, with Dr M. Wieder, University of Bar-Ilan, Israel and Catt and Bateman, Soils and Plant Nutrition Department)

Methodological research

Particle-size analysis. The precision of our current method (Avery & Bascomb, 1974) has been investigated using 12 soils with a range of particle size distributions, and different organic matter and calcium carbonate contents. The standard deviations (four replicates) for eight samples are <1%, for three samples <2% and for one sample (with an organic matter content of 25%) between 2 and 3%. Various stages of the method have been modified with the view to giving a smoother flow of work and improved throughput. The most radical of the changes has been to reduce sampling depth for clay in the sedi-mentation cylinder from 9 cm to 7 cm. Standard deviations for the same 12 samples give exactly the same grouping as above indicating that the various changes have caused no systematic loss in precision. (Loveland)

Data management. A database of approximately 3000 purposive field records from the

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Welsh borderland was set up for trials using the GRASP database management system. This exercise established the usefulness of storing and manipulating purposive records as lists and tables. Records selected on various criteria were spatially displayed using CAMGRID. A small database of soil properties and classes was also created as a precursor to the creation of a National Soil Catalogue (NATCAT), which will eventually replace LINDAT. These trials gave useful experience and aided the design of a peripheral system to validate, convert and sequence data before submission to master files. Approximately 40 000 purposive and 3700 National Soil Inventory records have been punched and secured on magnetic tape. Five thousand of these records have been validated by the system and error reports and decoded versions of the documents have been passed to surveyors and clerical staff for attention. Work on the remaining part of the peripheral system, to update and cross-check data within the master files, is well advanced.

Recent improvements to the GRASP system and the introduction of RIRO C by the Computer Department have improved performance. Searches involving more than one database, however, are still slow. A small test using the INFO system on the Prime 550 has confirmed that in many respects it is superior to GRASP. Further trials using INFO on Soil Survey data are planned.

A system to keep laboratory information in 'on-line' master files has been written and is now running on a regular basis. A service to keep 'on-line' files of comprehensive profile descriptions up to date and to provide decoded versions is well established. Approximately 120 descriptions have been added to these files during the year and 350 records updated.

Prototype recording forms for purposive and probability records for the proposed 1:50 000 mapping programme have been designed and tested in the field. Like the current generation of recording forms they present a friendly-face without the necessity for encoding. (Proctor and Ragg)

Soil mapping methodology. Soil survey methods used or proposed in this and other countries have been reviewed preparatory to compiling a technical monograph on the subject, and writing it has begun. The aim is to improve and standardise procedures for conventional soil mapping at various scales, incorporating realistic measures of quality control (Avery)

Soil series differentiation. The proposals for the rationalisation of soil series concepts outlined earlier have been critically examined and tested by staff. While most separations based on the stratigraphic age or assumed derivation of the soil parent material are abandoned, broad links with geological bodies maintain continuity with past work. A monograph explaining the system is in preparation. (Clayden)

Soil micromorphology. Micromorphology is being more extensively used than hitherto in a number of disciplines. At a recent International Society of Soil Science Meeting in London some 13 different applications in agriculture were reported which included elucidation of the effects of changing land use on soils, soil compaction, mole drainage and water flow through soils. In Quaternary geology, micromorphology has been effective in establishing soil stratigraphic units and in archaeology it has been used to distinguish soil from non-soil material and transported from *in situ* soil material.

A *Handbook for the description of thin sections* prepared under the auspices of the International Society of Soil Science, will be published in 1982. This new system will encourage inter-disciplinary consistency—both nationally and internationally—particularly between pedologists, geologists, archaeologists and engineers. (Bullock, Murphy and Waller)

https://doi.org/10.23637/ERADOC-1-128

Applications research

Soil erosion. Evidence for water erosion in arable areas is accumulating; some 2000 fields are known to have suffered erosion in the last 12 years (Evans, 1980; Reed, 1979), aerial photographs providing some of the evidence. Although the amount of soil moved is often small, particularly when soils are clayey, much can be removed from sandy or coarse loamy soils over sands and gravel and large gullies do form; less than 5 t ha^{-1} is usual but 95 t ha^{-1} was recorded where gulleying was extensive (Evans & Nortcliff, 1978). The area of land affected in one field amounted to 30% but the mean of 234 estimates, obtained by scanning air photographs, is 2·9%.

This is a measure of the short term loss of agricultural productivity. Associated short-term consequences of erosion include crop redrilling, gulley infilling, ditch excavation, farm track maintenance, public road clearance and the nuisance of polluted streams.

Sustained erosion of fertile topsoil is clearly to be avoided, particularly where nutrient poor and structurally disadvantageous subsoils are brought nearer to the surface.

Soil erosion in Britain has a long history, as evidenced by alluvium and colluvium more than a metre thick that has accumulated in many valleys since the land was settled and cleared (e.g. Hazelden & Jarvis, 1979).

In a study of current erosion, the associated environmental factors have been identified and used to locate potentially erodible land in an area of 10 000 km^2 in eastern England. The work indicates that nearly 25% of the area is potentially erodible.

Monitoring erosion. At present it is not known whether erosion is increasing or exactly what the long- and short-term effects will be. For these reasons a study of erosion-prone areas will start in 1982, in collaboration with the Air Photographic Unit of ADAS. The main objectives are:

(1) to monitor the frequency and extent of water erosion in 16 selected localities
(2) to estimate the effect of erosion on agricultural production
(3) to relate erosion to site factors

Air photography will be provided by ADAS at least once a year for 12 localities where erosion has occurred. In four areas where erosion could occur as land is converted from grass to arable, air photograph cover will be obtained less frequently. A dispersed area of 644 km^2 is to be studied with a total transect length of 266 km, extending over 18 counties.

Eroded fields seen on photographs will be visited and estimates made of the soil removed and the effects on crop growth. Where adjacent uneroded fields have similar soils they also will be sampled to compare soil properties such as particle size distribution, bulk density, surface roughness, surface crusting and infiltration rates.

The selected localities mostly have coarse loamy or sandy topsoils derived from a variety of parent materials such as sandstone of Devonian, Permo-Triassic, Jurassic and Cretaceous age as well as Quaternary glaciofluvial outwash over chalk. Clayey soils are represented in two localities, one associated with Chalky Boulder Clay and the other with Jurassic clays, whilst in another the susceptibility of coarse silty loessic soils to erosion will be monitored. (Evans)

The European SAR-580 experiment. Radar imagery, being almost independent of weather conditions, in theory gives more control and should enable ground conditions to be recorded at appropriate times of the year. If the soil is bare of vegetation then different strengths of radar signal returned from the ground may also give information on soil moisture content and surface roughness.

The SAR-580 Experiment funded by the Commission of the European Communities

https://doi.org/10.23637/ERADOC-1-128

and the European Space Agency, has involved the use of an aircraft fitted with synthetic Aperture Radar equipment. The Cambridgeshire Fens and adjacent uplands were surveyed in 1981, signals being recorded from soils in a wide variety of parent materials. The soils included fine loamy stagnogleyic brown earths, pelosols, humose and non-humose coarse loamy, fine silty and clayey alluvial gley soils, earthy peat soils, coarse loamy calcareous brown earths and brown sands.

Synthetic aperture radar images in the x and c bands were obtained on 16 and 30 June 1981. During and shortly after the flights, in fields with little or no crop cover, plough layers were sampled to determine soil moisture content and bulk density, and surface roughness and plant height were measured; photographs were taken of the ground surface to assess the crop cover. Data were collected from 17 fields on the first flight and from eight fields on the second. Sorties, to provide air photographs at 1:10 000 scale, were flown by the Air Photography Unit of MAFF to approximately coincide with each radar recording flight.

At present, only the poor quality optical radar imagery has been received, and visual and qualitative comparison of the ground data with the SAR-580 images awaits high quality output from the digital channels of the radar which are being calibrated at the Royal Aircraft Establishment, Farnborough. (Evans)

Supporting work

Soil water retention. Soil water retention properties were determined for 1034 samples from 85 profiles during the past year. These included 23 profiles used for demonstration during the field meeting of the International Society of Soil Science on Soil Micromorphology in August and six representative profiles from Broom's Barn Experimental Farm.

Soil water regimes. The soil moisture regimes of five soils near Abbotts Bromley in Staffordshire were monitored for a further year with the neutron probe. The sites of the Denchworth and Swilcar soils on the Bagots Park Estate were ploughed and it is intended that the study should continue under arable use to compare the pattern of water extraction of wheat with nearby sites under grass. (Hall and Jones)

Dipwells have been installed and monitored in Upper Greensand soils near Selborne and Petersfield in Hampshire, and in a stagnogley soil over Ashdown Beds near Frant in East Sussex. (Moffat, Jarvis and Sturdy)

The moisture regimes of six soils near Shardlow were monitored by a neutron probe and dipwells during the past year. Saturated hydraulic conductivity measurements were made in the field using both pump out and pump in methods; a falling head permeameter was used in the laboratory as a comparison. The soils were described and samples taken for moisture release measurements, particle size analysis, clay mineralogy and Atterberg limits. Micromorphological samples were also taken at three different times of the year to compare the structure of the soils when both wet and moisture deficient. (Dr R. H. Wilde (DSIR, New Zealand), Hall and Bullock)

Micromorphology. Seven hundred and thirty thin sections were made. Most of these were prepared for research projects on Quantifying Soil Structure and Structure Regeneration. The remainder were described to aid classification and characterisation of soils for the current mapping programme. (Bullock, Murphy and Waller)

Special and Contract surveys

A wide variety of surveys have been undertaken for and in cooperation with ADAS and

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ARC staff. There has been an increase in contract surveys and this trend is expected to continue. The following projects illustrate the scope of the work.

Detailed surveys at a scale of 1:10 000 were made of 600 ha at Harnage Grange, Cressage, Shropshire for the Royal Agricultural Society of England (RASE) Autumn Cultivations Demonstration and for the Society's 14 ha 'Cereals '81' site. Both maps were interpreted for land drainage design in conjunction with MAFF drainage officers. (Jones, Beard and Whitfield)

The 48 ha site of the Farmers Weekly National Drainage Demonstration at Moreton in Marsh was surveyed at 1:10 000 scale. Monoliths of Oak and Beccles series were prepared and staff attended the event to answer farmers' and contractors' questions. (Whitfield and Beard)

A detailed survey was made of 3600 ha in the Tern Valley, Shropshire for Laurence Gould Associates in conjunction with the Severn-Trent Water Authority. The work entailed 1200 bores to 2m depth to assess parts of the 1:63 360 soil map of the Wem district (Crompton & Osmond, 1954) and to prepare a 1:10 000 map and report. Particular attention was paid to soil water relationships to appraise areas likely to be affected by the proposed Water Authority scheme to extract water from the Triassic aquifer in North Shropshire. (Hollis, Beard, Lea, Palmer, Thompson and Whitfield)

At the request of the Grassland Research Institute three permanent grassland farms in Buckinghamshire were surveyed in detail, and assessments made of soil available water and trafficability for a yield and utilisation study. (Beard, Fordham and Whitfield)

Detailed surveys were made of drainage development trials at Church Minshall, Cheshire (25 ha) and at Bushey Green near Tewkesbury (15 ha) at the request of the Land and Water Service of MAFF. (Jones and Palmer)

A soil map at 1:10 000 and report including interpretations for recreation and civil engineering were prepared for about 1 km^2 of land at Coldharbour Farm, Furzton, Milton Keynes at the request of the Milton Keynes Development Corporation (Evans, Burton, Hodge, Seale and M. G. Jarvis)

A soil map at 1:10 000 was prepared for about 1 km^2 of land at Elm Farm, Hamstead Marshall, Berkshire for the Elm Farm Research Centre (Fordham and M. G. Jarvis)

Description of soils at proposed experimental sites has been undertaken for the North Buckinghamshire Soil Management Study Group, a group of farmers concerned with heavy land management. Dipwells have been installed at five sites. (M. G. Jarvis)

The soils at BASF United Kingdom Ltd experimental sites have been described. (Allen, Hodge, Robson, and M. G. Jarvis)

Soil maps were provided for the following proposed opencast coal sites. Northumberland: Plenmeller (465 ha), Milkhope Bank Extension (14 ha) and Chester House (243 ha). Durham: Brusselton Heaps and Hill Top (138 ha), Kibblesworth (81 ha), Chapman's Well (303 ha), and Black Prince (138 ha). Dyfed: Ffoslas (430 ha) and Garnant (130 ha). (Allison, Bradley, R. A. Jarvis, Kilgour, King and Wright)

A soil map of the 80 ha site of a proposed spoil tip extension at South Kirkby Colliery, Hemsworth, South Yorkshire, was supplied to the National Coal Board. (Bradley)

The Northumbrian Water Authority was provided with a soil map for the proposed Nunthorpe Stell and Main Stell Improvement Scheme (526 ha) at Great Ayton, Cleveland. (Allison, and Bradley)

Sites at NIAE, Silsoe, Bedfordshire were intensively augered to ascertain suitability for a long term trafficability experiment being mounted in cooperation with the Letcombe Laboratory. (Hodge)

A provisional soil map based on fieldwork for the National Map and air photo interpretation was provided for the Forestry Commission Pantspydded Farm in the Dovey Forest, Gwynedd. (Hartnup)

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A survey of 100 ha at Rowden Manor, Okehampton, Devon, has been carried out for the Grassland Research Institute. This land lies close by North Wyke Experimental Station which the Institute recently acquired and which was reported on by the Soil Survey in 1957. (Harrod)

Physiographic, climatic and land-use data relating to 67 soil associations mapped in England and Wales, together with field and laboratory data on representative soil profiles, were assembled and supplied to the Geological Institute, University of Ghent. This information will be incorporated in an explanatory text to accompany the 1:1 000 000 soil-association map of the EEC countries which is now being prepared for publication. (Avery)

The soils of 14 sites where rabbit populations are being studied by MAFF have been described (Allen, Fordham, Moffat and Sturdy); a related study has started in Wales. (Thompson)

A soil map of Wales based on previous and current work was compiled for the National Atlas of Wales. The map is to be published at a scale of 1:500 000 and will show the distribution of dominant and associated soil groups. (Rudeforth and Regional Staff)

Soil series, with particular reference to texture, drainage and stone content, were demonstrated at Ulverston and Sedgwick, Cumbria, to Reading Agricultural Consultants Ltd. (Bradley)

A 1:250 000 scale winter rain acceptance potential (WRAP) map of Dorset and parts of Somerset and Wiltshire has been prepared for the Wessex Water Authority from information acquired during the 1:250 000 National Map Programme. (Staines)

Staff

Staff changes during the year were few. Mr. A. Ringrose-Voase joined us for 3 years on an ARC Studentship to work on 'Quantification of Soil Structure'. Dr Moshe Wieder, Bar-Ilan University, Ramat Gan, Israel worked for 5 months on 'Soil Development on Chalky Boulder Clay' and Dr A. C. Dimase of Florence University worked jointly with staff of the Survey and of the Soils and Plant Nutrition Department. J. W. Allison resigned and Sylvia Bloomfield retired after 12 years dedicated service in the Publications section. We welcome the continuing support of Christine Royston (née Bembridge) following her marriage.

R. J. Sturdy and J. Hazelden occupied a new office at East Malling.

D. Mackney visited Florence at the invitation of the National Research Council of Italy to lecture and discuss problems connected with land evaluation.

P. Bullock visited Belgium on four occasions to chair meetings of the ISSS Sub-Commission of Soil Micromorphology specifically dealing with the development of an internationally acceptable system for the description of thin sections. He also visited Sweden (September 22–29) to give lectures at the invitation of the Swedish University of Agricultural Sciences.

A. J. Thomasson was consulted on land drainage and land potential in Yugoslavia as a guest of the Croatian Government. He served on ADAS committees concerned with Soil Management and Land Classification and represented The Survey at an EEC Conference on Land Drainage.

R. Evans attended a meeting of the SAR-580 Project in northern Italy to discuss the guidelines for Ground Data Collection.

D. M. Carroll read a paper at the International Society of Soil Science symposium, 'Remote Sensing for Soil Surveys', held in June at Warsaw.

Following a request from MAFF, J. M. Ragg reconvened the joint ADAS/Soil

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Survey Working Party on a Common Soil Information System which now has the declared aim of making progress towards the establishment of such a system.

Dr R. H. Wilde (Soil Bureau, DSIR, New Zealand) completed his work on the measurement of structure and hydraulic conductivity in the field and returned to New Zealand in October.

P. J. Loveland attended the 2nd meeting of the International Working Group on Submicroscopy of Undisturbed Soil Materials at Poitiers, France.

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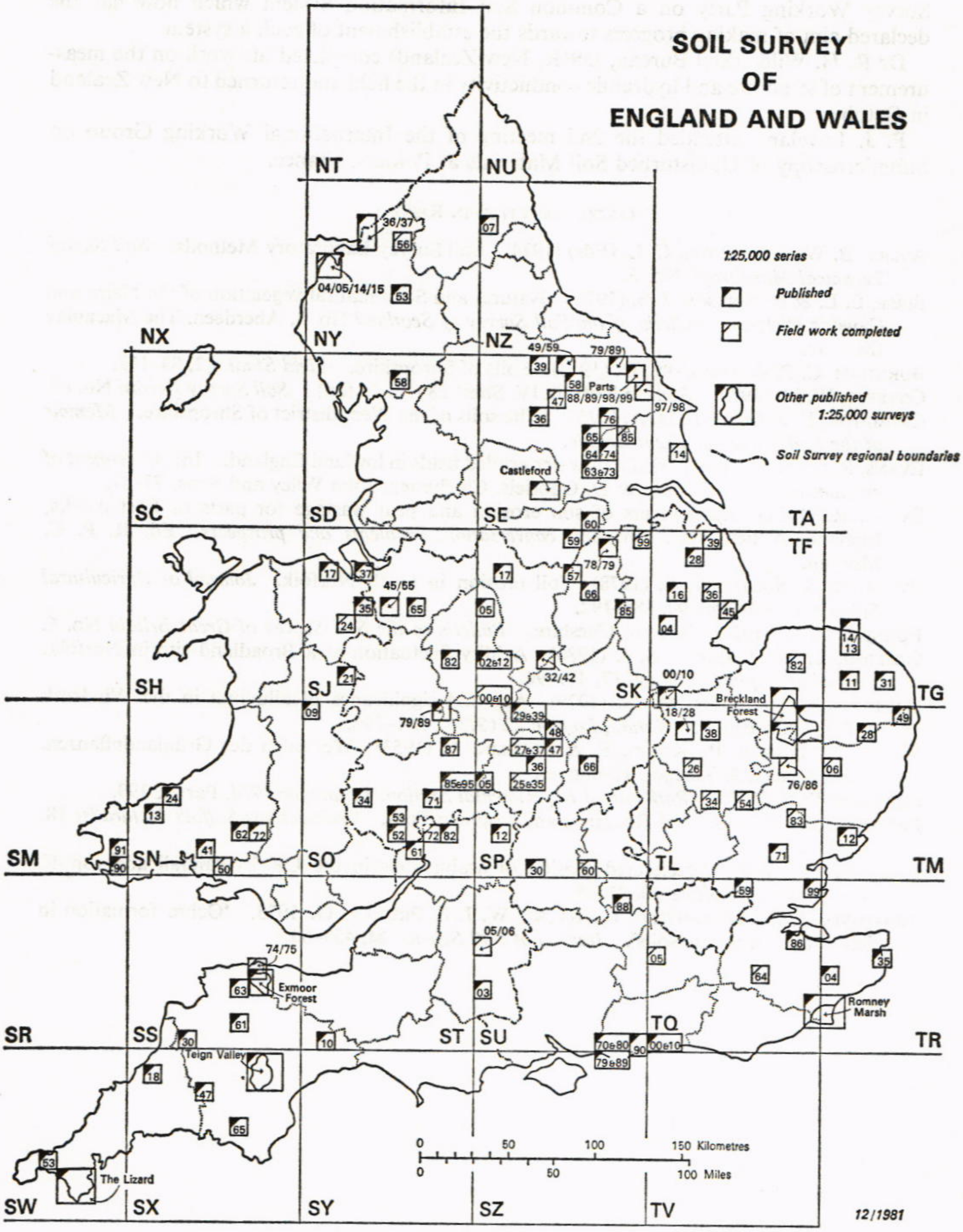

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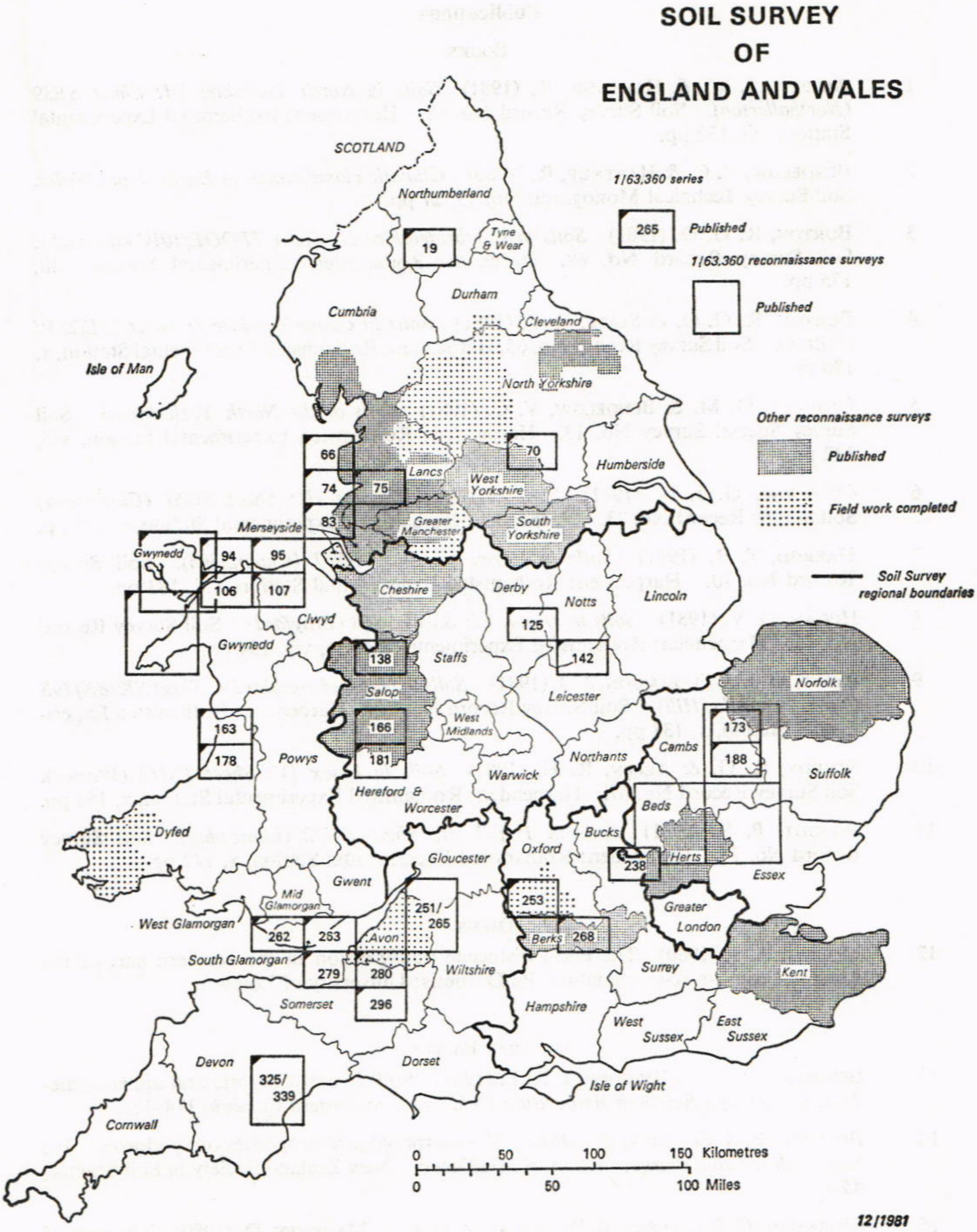

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