Report for 1979 - Part 1

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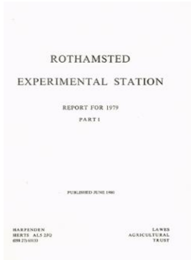
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REPORT FOR 1979
PART 1

Soil Survey of England and Wales

D. Mackney

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SOIL SURVEY OF ENGLAND AND WALES

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Introduction

In April, under a revised contract from the Ministry of Agriculture, Fisheries and Food (MAFF), the Survey started its new 5 year programme to compile a 1:250 000 map for England and Wales. The Soil Survey of Scotland is producing a similar map for Scotland.

The aim is to publish by 1984, maps for the eight MAFF regions in England and Wales, each accompanied by a descriptive *Memoir*. The soil map will also form the main physical basis for a national agricultural land classification map to be published concurrently at the same scale.

The memoirs will be oriented to practical aspects of farming, and to identification and pattern recognition criteria for soil classes, in order to extend interest in our national soil resources and provide a foundation for advisory work and planning. The construction of the land classification map will be a fully cooperative venture with the Science, Lands, Drainage and Agriculture Services of ADAS, and will be a basis for improving existing maps.

The new programme relies heavily on knowledge gained in the successive periods of detailed surveys when maps at 1:63 760 and 1:25 000 scale were produced for some 20% of the land surface of England and Wales. To this cover of detailed map should be added a further 30% of reconnaissance and other small-scale surveys leaving 50% for which there is little or no systematic information. In this phase, the main soil types were identified and their distribution patterns in relation to geology, landscape, and climate established. This knowledge coupled with the experience accumulated by the staff over the past 3 decades, is the foundation for the rapid completion of the 1:250 000 map. The first 2 years will be spent surveying the last area and a further 6 months on revising earlier work, interpreting all the information on a uniform basis.

Each member of the field staff will aim to survey about 1400 km² per year, completing a standard 1:25 000 map in about 10 days. The average density of auger borings or small pits will be about 1·5–2·5 per km², localised or evenly distributed as the complexity of the terrain or the nature of map separates require. Observations are recorded on specially designed computer-compatible forms, of which there will be some 275 000 on completion of the survey.

A working list of provisional map units has been compiled. This will be added to and revised as necessary during the survey. The soil classification used is based on Avery (1973).

Staff have joined the programme in stages as their commitments to the 1:25 000 programme have ended. Since April, a total of 138 man/months has been spent in the field and approximately 17 000 km² surveyed (Fig. 1). So far 180 of the 384 provisional map units originally envisaged have been recognised and 40 further possible map units identified.

The relatively large number of units in the draft legend makes it unwieldy as at present laid out. The long-term correlation and rationalisation of existing soil series also under way will enable some reduction in the number of units for the 1:250 000 map.

Field work is most advanced in the north and south-west where mapping started earlier but it is now sufficiently forward in Wales and the western Midlands for the data collected on the standard field recording forms over 2500 km² of the Welsh Borderland to be punched for the computer and a trial of soil survey data handling to start in January.

An inventory of soil data is being constructed to accompany the National Map. It will contain descriptions of soil made from pits sited systematically throughout England and Wales at grid intersects 5 km apart. Bulk topsoil samples are being collected from an area around each pit for analysis at Soil Survey and ADAS laboratories. Data from over 6000 sites will be recorded on computer compatible cards, and will provide comprehensive unbiased national and regional information on the soils of the country. (Hodgson and Mackney)

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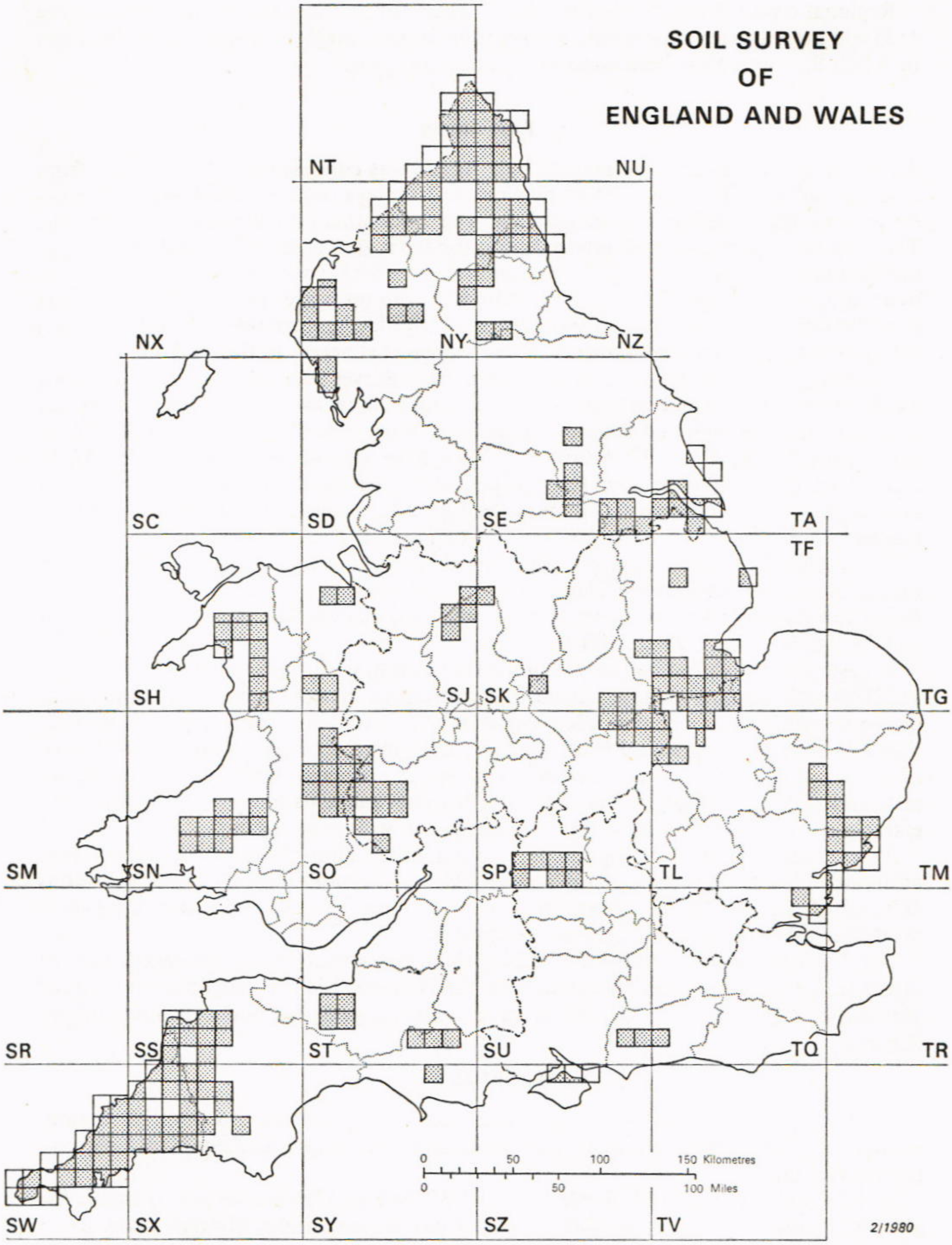

FIG. 1. Progress of the 1:250 000 mapping programme.

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Regional reports follow with a tabular summary of progress in the final stages of the 1:25 000 programme; after which, are accounts of four projects selected from the many in which the Survey has been concerned during this year.

East Anglia

An initial quarter million soil map of East Anglia was compiled as a 'desk study' from available information consisting of previous soil surveys, both detailed and reconnaissance, and interpretation of geological maps in areas where no surveys were available. The map together with a preliminary legend for the region enabled the likely balance of the final map to be assessed and forms a basis for the field work when the validity of the boundaries and the composition of the proposed map units are checked. Five surveyors were involved in the work, the earliest starting in April. The work was interrupted during July and August when continuous crop cover prevented access to the land.

Mapping has concentrated in areas distant from Survey centres where little previous work has been done. Some 800 km^2 have been mapped in fenland and its margins between Wisbech, Peterborough and Ramsey comprising all or parts of Sheets TF 10, 20, 30, 40 and 41, and TL 28, 29 and 39. A further 175 km^2 have been surveyed on sheets TL 07, 17 and 18 on the Chalky Boulder Clay plateau and Jurassic Clay vale country west of Huntingdon. Work commenced in West Suffolk after harvest and 400 km^2 have been mapped on Sheets TL 75, 85 and 86, and TM 04 and 05 (Fig. 1).

The coastal areas of Essex east of Colchester and behind Clacton on Sea and Walton on the Naze, and between the Thames estuary at Southend and the Blackwater estuary have been mapped; 420 km^2 have been completed on sheets TM 00, 03, 11, 13, 21, 22 and 23, TQ 88, 89 and 98 and TR 09.

In Essex 17 soil associations were identified in the desk study with control from previous 1:25 000 scale detailed mapping. Field work confirmed the composition and boundaries of the associations on London Clay, estuarine marshland, cover loam, and brickearth, but soils on river terraces and Head require more sampling and correlation. Work west of Huntingdon also showed that associations are as predicted. However, in the fenland area and in West Suffolk, where there has been no previous mapping from which to extrapolate, some alterations to the desk study map will be necessary.

As an aid to the national programme, photo-interpretation of vertical air photographs at about 1:50 000 scale has been made for Essex and Suffolk in this region, as well as 400 km^2 of the Lincolnshire Fens, 800 km^2 of Hampshire and Sussex, and the Isle of Wight for other regions. (Hodge and Regional Staff)

The 1:250 000 County Map of Norfolk which has already been completed is to be incorporated with some simplification into the National Map. A separate soil map of Norfolk at 1:100 000 scale will be published to accompany a Bulletin in preparation. (Corbett)

The Midlands

Work on the new programme commenced in southern Lincolnshire, eastern Northamptonshire and in parts of Hereford and Worcestershire. Approximately 1700 km^2 have been surveyed.

Initially areas in the Welsh Borderland (SO 35, 36 and 37) were chosen to enable the already detailed knowledge of soils derived from Devonian and Silurian rocks to be extended westwards into Powys. It has been possible to use many established map units from Shropshire, although constraints dictated by scale have led to some amalgamations.

The most widespread map unit on Silurian rocks is dominated by fine silty Barton and Stanway soils (typical brown earth and stagnogleyic argillic brown earth) in siltstones

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and fine sandstones. These Ludlovian rocks become progressively more argillaceous westwards and the associated fine silty soils reflect these bedrock changes. The parent materials from Devonian rocks are principally sandstones and mudstones and clay shales. On high ground with sandstone outcrops a map unit dominated by Eardiston series (typical brown earth) has been used, while on low ground, underlain by the argillaceous rocks, mainly Bromyard soils (typical argillic brown earth) are found. To the west of Kingston, the terrain is underlain by deposits of the Wye glacier with units dominated by Wootton and Vernolds series (argillic brown earth and stagnogley soil), the latter being restricted to areas of low relief or basin sites within the till landscape.

In parts of north Herefordshire (SO 44, 45, 54 and 55), the soil pattern over the Devonian rocks is complicated by the terminal moraine of the Wye glacier which runs approximately N–S across the area. To the west of the moraine much of the land is covered with a veneer of till on which a unit dominated by Wootton series has been mapped. An upstanding drift-free area within the till and land to the east of the moraine have generally been included in a unit dominated by the Bromyard series developed in silty shale/mudstone.

In eastern Northamptonshire (SP 99, TL 08 and 09) a complex geological succession ranging through ten main Jurassic formations (often within a distance of 1–2 km) is common in the Nene and Welland valleys. The soils associated with these alternating limestones and clay shales are mainly Sherborne, Somerton and Denchworth/Evesham series (brown calcareous earth, calcareous pelosol and pelo-stagnogley soil). Where clay crops out over a wider area, Denchworth and Rowsham series (stagnogley soils) comprise up to 75% of the soil variation, but where the limestones are of sufficient extent, Sherborne soils are often dominant.

The till-covered hill tops have a fairly simple soil pattern although a major change occurs across the Nene valley. To the east, 70% of the Chalky Boulder Clay soils are Hanslope series (calcareous pelosol) but to the west, in Rockingham Forest, wetter Ragdale soils (pelo-stagnogley soil) predominate. Slopes below the till usually have a veneer of decalcified clayey or loamy drift over Jurassic clays with Holdenby (argillic pelosol) and Oxpasture series (stagnogleyic argillic brown earth).

River floodplains are uniformly clayey, mainly Fladbury series (pelo-alluvial gley soil) with occasional Thames series (pelo-calcareous alluvial gley soil) and some Uffington series (gleyic brown calcareous alluvial soil) in smaller valleys draining predominantly calcareous catchments. River terraces carry a mixture of Sutton and Badsey series (argillic brown earth and brown calcareous earth) over calcareous gravels.

Most of the mapping in southern Lincolnshire (TF 01, 02, 11, 12, 21 and 31) has been on estuarine and marine alluvium; the main units are dominated by Downholland, Wallasea or Wisbech series (ground-water gley soils and gleyic brown calcareous earth).

Upland areas examined have Wolstonian till, alternating limestone and clayey Jurassic beds, and sandy and clayey Kellaway beds. Ragdale and Beccles series (pelo-stagnogley and stagnogley soils) are dominant on the till, but the soil pattern on the Jurassic beds is similar to that described for Northamptonshire with Sherborne and Denchworth series in close proximity. Many of the provisional map units for the National programme have been used but some are more complex than anticipated.

Just prior to the compilation of this report, mapping commenced in northern Staffordshire (SJ 95, 96, SK 04 and 06) but map units have yet to be confirmed. (Ragg and Regional Staff)

Northern England

Field work for the National Soil Map commenced in the Northern region in early April and all surveyors were working on the project by June.

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The region comprises 35 486 km². Of these, 5024 km² had previously been surveyed for publication at 1:25 000 or 1:63 360 and a further 13 932 km² for publication at 1:100 000 or 1:250 000 scale. Some 16 530 km² remained unsurveyed, of which about a quarter was completed this year.

The main area of work has been Northumberland, others being north and west Cumbria, the Lake District, the Vale of York and South Humberside.

Of the 386 map units in the provisional national legend, approximately one-fifth have been used in the north this year. The dominant soils recorded so far are raw peat, stagnogley and stagnohumic gley soils. (R. A. Jarvis and Regional Staff)

South-east England

Following a desk study to identify provisional map units in the region, field work has commenced in Oxfordshire, West Sussex and the Isle of Wight and about 950 km² have been completed.

In Oxfordshire soils developed in Jurassic and Cretaceous strata, fluvial and glaciofluvial drifts, Head and alluvium have been examined. The composition of most map units is as predicted though a few additions have been proposed.

Soils associated with the Upper and Lower Greensand in West Sussex had been less studied before the project commenced and this has been reflected in the need to identify additional units on these formations and associated drifts. The Upper Greensand has pelo-stagnogley soils and typical calcareous pelosols on the lower dipslope with shallow stagnogleyic argillic brown earths and typical stagnogley soils elsewhere. Though most Lower Greensand soils are similar to those encountered in earlier work, land over Sandgate Beds in this area has many typical stagnogley soils and stagnogley-podzols locally. Stagnogleyic argillic brown earths are developed in Head over Hythe Beds sandstone and silty typical argillic brown earths are associated with the lower flanks of spurs. Mapping on the South Downs has shown that soil distribution in chalklands is generally well understood and predictable.

Field work on the Isle of Wight has been confined to land over Oligocene strata (Hamstead Beds and Bembridge Marls). Pelo-stagnogley and typical stagnogley soils predominate. (M. G. Jarvis and Regional Staff)

South-west England

In order to cover more distant parts of the region in the early stages, two members of staff were detached to Cornwall during the summer. This ensured systematic cover of Cornwall and west Devon and allowed a useful level of contact between staff.

Field mapping started in the Scilly Isles and continued eastwards. Soil type on the Scilly Isles is strongly influenced by silty drift (loess) which occurs extensively as a coarse silty stoneless layer up to 1·5 m thick over gravelly granitic Head. There are thin (40 cm) granitic drifts over much of the silty drift on flattish sites at the base of low hills forming most of the islands. The commonest soil developed in the silty drift is a humus-ironpan stagnopodzol which often has a very well developed pan and Bs horizon. The remains of such well developed soils were discovered up to 6 m below present high-water mark. Bronze Age field boundaries occur below sea level on Bryher and Samson.

Blown sand is important on some islands and in contrast with the mainland it is non-calcareous; sand-rankers are most common. Small areas of man-made humus soils are common on all the islands where seaweed has been deeply incorporated.

On Land's End silty drift is again an important part of many soil profiles and coarse silty brown podzolic soils are commonly found in intimate association with the coarse

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loamy Moretonhampstead series (brown podzolic soil). The loess seems to have accumulated on gently sloping ridge crests sheltered from the north and west, pointing to an origin in the Irish Sea. On the hills of Land's End the Trink series (humus-ironpan stagnopodzol) occurs with other podzolic soils. In contrast, the higher St. Austell granite supports Hexworthy and Rough Tor series (ironpan and ferric stagnopodzols) above 200 m whilst below this altitude Moretonhampstead soils are dominant. Coarse silty horizons are fairly common, again mainly on gently sloping ridges sheltered from the north and west.

Most soil patterns mapped have been recognised previously but many flat remnants of marine-planation surfaces in mid and east Cornwall support a stagnogleyic brown earth and cambic stagnogley soil correlated with Sannan and Cegin series. The distribution of these is closely related to moorland as shown on maps about 150 years old. The presence of podzolic features in some profiles supports the idea that they are old moorland soils greatly changed by cultivation.

On the more rolling slate outcrop two major map units have been recognised. One dominated by deep Highweek series (brown earth) on gentle slopes and the other in more dissected country, is characterised by shallow Highweek and Powys soils (rankers). Some steep slopes, especially where wooded, have the Dartington series (brown podzolic soil) which is also mapped on the metamorphic aureoles of most of the granite outcrops. Basin sites mostly support the Yeollandpark series (fine loamy cambic gley soil) but many, along with alluvial strips, are too small to be shown.

Igneous and volcanic rocks within the slate outcrop are associated with Trusham and Rydon series (brown earths) although Carboniferous tuffs and lavas along the Inny valley give a loamy brown podzolic soil of the Davidstow series.

Extensive sand deposits along the north coast support calcareous sand pararendzinas.

The Devonian slate country of south-east Cornwall and south-west Devon is dominated by Highweek soils. Within the map unit hydromorphic soils are uncommon in those areas so far surveyed. Dartington series predominates on steep often wooded slopes, notably in the Tamar and Tavy valleys. The Highweek unit has also been distinguished in the Plymouth area. Small patches of Yeollandpark soils occupy depressions. Sporadic outcrops of basic igneous rocks (tuffs, lavas and dolerite) produce loamy brown earths with some brown podzolic soils. In places these are sufficiently extensive to separate from adjacent slate soils but where soil patterns are too intricate, a compound map unit of brown earths from both slate and basic igneous material is used. On high ground dominantly of sandstone parent materials, coarse loamy cambic stagnogley soils mark land relatively recently reclaimed from heath or moorland. On metamorphosed rocks of the Dartmoor Granite aureole brown earths dominate the enclosed farmland with a variety of very stony podzols under dry heather or grass moor communities. Enclosed land under granite is occupied by coarse loamy or loamy skeletal Moretonhampstead soils. On open moorland the change from the aureole to the granite outcrop is marked by an abundance of bouldery ground, often steeply sloping. Ferri-humic podzols predominate with dry vegetation of moderate or good grazing value comprising bent/fescue grassland often with patches of bracken or heather and bilberry. At higher altitudes are cambic stagnohumic gley soils mostly under a bog heather moor association dominated by moor-grass, though in places bearing the drier vegetation more typical of podzols. Stagnopodzols are noticeably absent from the northern parts of Dartmoor between Princetown and Okehampton. So far they have been mapped at around 300 m O.D. in the south-western parts of Dartmoor though known to be more extensive in the Postbridge area. Vegetation is characteristically the moist phase of the Atlantic heather moor association (*Calluna*, *Molinia* and *Erica tetralix*). Hill grazing value is normally moderate or poor. Extensive blanket peat occurs both to the north and south of Princetown in which the Crowdy series

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(raw oligo-amorphous peat soil) is developed. Former peat cuttings are in evidence with gully erosion widespread, particularly on the northern parts of the Moor. Vegetation is bog heather moor or blanket bog of poor grazing value, or with more extensive moor-grass when grazing value may be moderate. The Winter Hill series (raw oligo-fibrous peat soil) occupies shallow cols at the heads of many of the major rivers. Perennially water-logged blanket bog vegetation of poor grazing value is ubiquitous. Valley bogs with a variety of peat and gley soils are floristically much richer than surrounding hill peats and generally have a better hill grazing value.

In west Devon and north Cornwall mapping has been concentrated on soils over Carboniferous rocks where an earlier detailed survey had indicated distinctive soil patterns on the extensive rocks of the Bude and Crackington Formations.

Mapping over wider areas has confirmed the importance of the Tedburn-Brickfield (stagnogley soils) and Neath-Holsworthy (brown earths) map units over the sandstone dominated Bude Formation. Of less extent is the Loxhore-Neath (brown podzolic soil/brown earth) unit on steep valley sides.

Previous work on soils over the Crackington Formation has confirmed the Halstow-Dunsford-Tedburn hydrological or soil landscape sequence first recognised on Carboniferous shales in the Teign valley. Work this year between Holsworthy and Launceston shows this pattern does not always prevail although it is well expressed in west Devon along the Thrushel valley for example. Variation from the Teign valley hydrological sequence is most marked in gently convex interfluvial sites, which by that scheme might be expected to be dominated by clayey Halstow soils. Where this typical non-calcareous pelosol is present it shares the ridge crests more or less equally with typical brown earths, stagnogleyic and gleyic brown earths forming a more diverse map unit. Surface-water gley soils are extensive in basins and on some ridges but are dominated by Tedburn soils, although some variety is added by silty profiles. This deviation from the Teign valley hydrological sequence is known to extend eastward from the north Cornwall coast as far as Broadbury (the present eastern limit of mapped ground). Limited mapping between Okehampton and the Exeter survey show Teign valley type patterns to predominate there. (Findlay and Regional Staff)

Wales

Survey has been completed for twenty-nine of the 1:25 000 map sheets covering areas where little or no mapping had previously been carried out. Most of the work has been concentrated in Powys between Newton and Hay-on-Wye, in Gwynedd from Snowdon to Cader Idris, and in central Dyfed between Llandovery and Newcastle Emlyn. Sheets have also been completed in north Powys and Clwyd. The Welsh Borderland sheets are part of a pilot study with adjacent areas of the western Midlands to solve problems of data handling and correlation, as a guide to future work.

In Powys, 11 sheets have been completed: SJ 01, SO 06, 14, 15, 16, 17, 18, 24, 25, 26 and 27. Most of the soils have been formed in drift from Paleozoic sediments and some igneous rocks. The soils on Silurian shales and mudstones are well documented in Wales, and mapping confirmed the known relationships between climate, altitude and soil types (Rudeforth, 1970). Most of the typical brown earths are fine textured Barton and Denbigh soils but a few coarse silty profiles of the Munslow series have been described. Humic rankers on the basic igneous rocks of the Llandrindod Wells inlier are associated with brown podzolic soils. To the east some 30 km^2 of Llanvirn shales (Ordovician) have pelo-stagnogley with associated cambic stagnogley soils. The red soils from Devonian sediments in the hills around Hay-on-Wye are also mainly fine textured but unlike those in the west Midlands no clear evidence of argillic horizons has been found.

In Gwynedd, ten sheets have been surveyed: SH 53, 54, 55, 64, 65, 71, 72, 73, 74 and

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75. Basic and intermediate igneous rocks around Dolgellau have humic rankers with much bare rock exposed on craggy and broken ground in the foothills of Cader Idris. Bands of igneous rocks form similar ground amongst slaty mudstones and grits further north where brown podzolic soils, stagnopodzols, stagnohumic gley soils and raw oligo-fibrous peat soils have been mapped.

In Dyfed, work has been completed on seven sheets: SN 32, 33, 53, 54, 63, 73 and 74. This is a hill area of Lower Palaeozoic mudstones and sandstones ranging from 30 m O.D. in the west around Carmarthen to 450 m in the east on Mynydd Mallaen. The pattern of soils is similar to that shown on existing detailed maps of south Dyfed and on similar parent materials in north Dyfed. On valley sides there are Manod soils (typical brown podzolic soil) with restricted occurrences of Denbigh and Powys soils. Stagnogley soils predominate on footslopes and broad interfluves with Cegin series (cambic stagnogley soil) widespread below 200 m and Ynys series (cambic stagnohumic gley soil) more common at higher elevations. On summits above 350 m Hiraethog (ironpan stagnopodzol) and Hafren (ferric stagnopodzol) series are associated with Ynys soils. Valley floors are mostly narrow; and extensive areas of alluvium and terrace deposits are found only in the Tywi, Cothi and Teifi valleys. (Rudeforth and Regional Staff)

TABLE 1

Progress of mapping

Region	Map No.	Soil	Land Capability
East Anglia	TF41	Incorporated in new programme	
	TF60/61	Suspended	
	TL34	Complete	To be finalised
	TL54	Complete	To be finalised
	TL76E/86W	Complete	Complete
	TM06	50% complete	
Midlands	SK00/10	Complete	In preparation
	SK02/12	Complete	Complete
	SK78N/79S	Complete	Complete
	SK99	Complete	In preparation
	SO85/95	Complete	Complete
	SP25/35	Complete	Complete
	SP27/37	Complete	To be finalised
	TF36	Complete	In preparation
	TF39	Complete	To be finalised
	TF45	Complete	In preparation
North	NY14/15	Complete	To be finalised
	NY56	Complete	
	SE47	Complete	In preparation
	SE85	To be finalised	
	SE97N/98S	To be finalised	
	TA14	To be finalised	In preparation
South-east	SP60	Complete	In preparation
	TL83	Complete	In preparation
	TQ05	Complete	In preparation
	TQ64	70% complete	In preparation
South-west	Lizard	Complete	In preparation
	SO61	Complete	
	SO72	Complete	In preparation
	SS74	Complete	In preparation
Wales	SJ21	Complete	Complete
	SJ24	Complete	Complete
	SN72	Complete	Complete

1:25 000 Mapping Programme

From April 1979, with the agreement of MAFF, the 1:25 000 mapping programme has been in abeyance, work continuing only to complete existing projects (Table 1). Sixty-four

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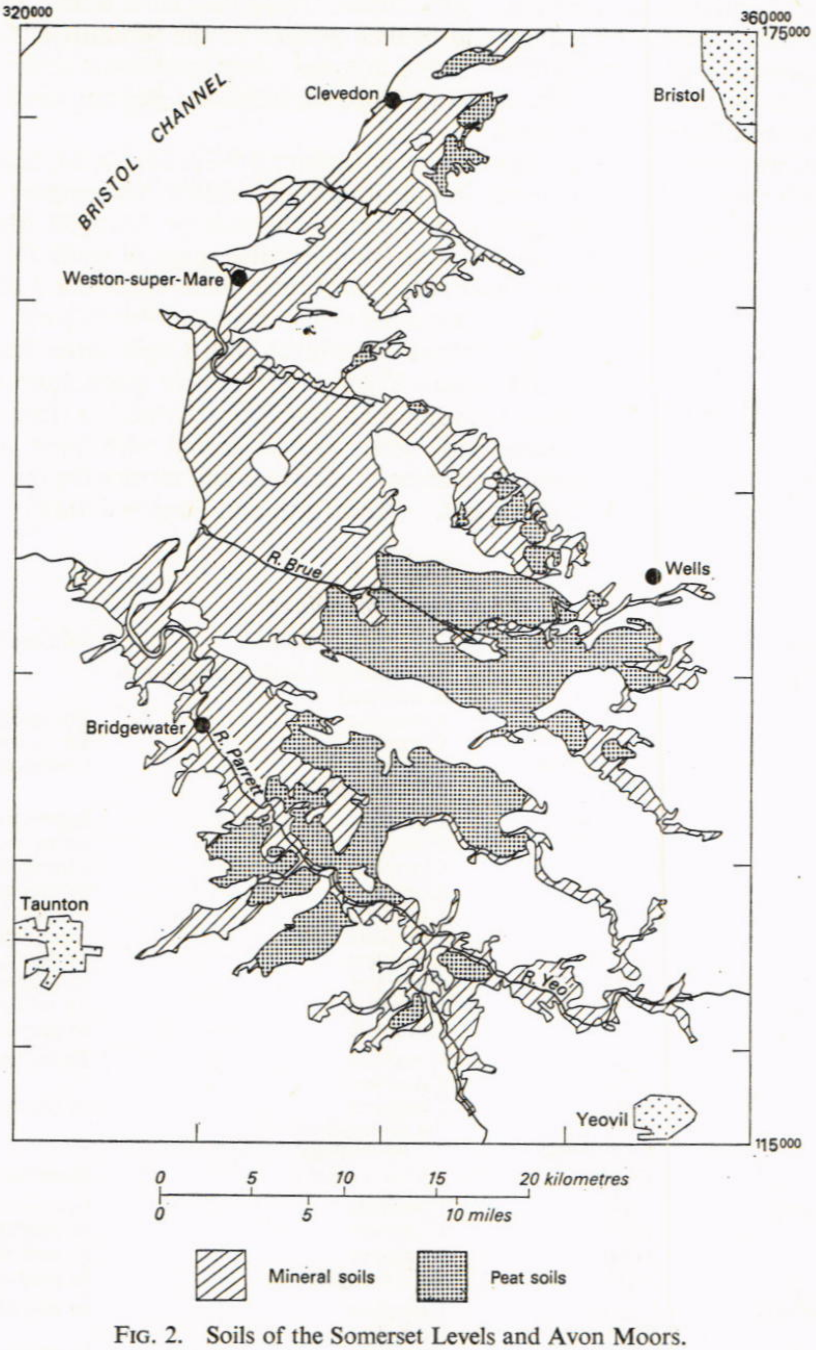

FIG. 2. Soils of the Somerset Levels and Avon Moors.

Soil Survey Records with appropriate maps have been published in this series, and with work in progress the total number will exceed 100.

Together with earlier detailed surveys, these maps and text provide full information about the main soil types and their distribution patterns in England and Wales. Detailed surveys now cover about 20% of the country, mostly in lowland situations.

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The peat soils of Somerset

Peat deposits and their associated soils acquire an importance proportionately greater than equivalent areas of mineral soil. In their semi-natural state they often merit conservation as wetland habitats distinct even from mineral marshlands. When reclaimed by drainage however, they have increasing value as agricultural land and much drained peat in lowland sites are in Class 1 or 2 of the Land Capability Classification. Peat is also being exploited more and more for horticulture. The consequent loss of land of high potential has added to the existing concern for the slow but none the less permanent loss by wastage.

In Somerset the traditional use of peatland is dairying, based on summer grass, usually with a water-table within 50 cm throughout most of the year. Recently pump drainage schemes have allowed the introduction of arable crops, though more extensive changes would depend on large scale improvements in arterial drainage. Running in parallel with agricultural development has been an escalation of peat extraction and Somerset now supplies a significant proportion of production in England and Wales. Both these changes conflict with the indigenous wetland flora and with the large populations of migratory wetland birds in spring.

These competing uses for a limited and shrinking resource demand a land use policy based on a systematic inventory, and the work described here provides this for the Somerset peats. It could also pave the way for an inventory of peatlands on a national scale.

Published soil surveys show the location of about 18 000 ha of peats in central Somerset (Fig. 2) but little was known about their properties in depth. The basis of the new survey was a grid of borings by gouge auger at 1 × 0·5 km spacings, covering the area mapped as Sedgemoor and Midelney series.

Peat thickness. The peats which occupy two separate basins, north and south of the Poldens, have an overall pattern of increasing thickness inland. The thinnest are in the Lower Brue, adjacent to the raised mosses where extraction is now concentrated. When cutting has advanced further these two tracts of land west of Meare will together constitute an area of about 4000 ha of thin peat, ranging in thickness from 50 to 250 cm. Elsewhere west of a line from Hartlake in the north to Stathe in the south the peat is moderately thick, between 250 and 400 cm. East of this line lie the thicker peats, usually 400–600 cm but occasionally exceeding 700 cm in Queen's Sedgemoor and South Moor; each of these two classes accounts for about 6000 ha. The peats rest nearly everywhere on soft grey silty clay near to the level of Ordnance Datum.

Peat type. Thin remnants of *Sphagnum*, cotton-grass and heather extend beyond the main raised moss deposits in the Brue basin but no mappable occurrences of this type were found elsewhere. Woody peats are now known to attain considerable thickness and, within the upper 2 m, peat of this kind is dominant in south-east King's Sedgemoor and almost all the peatland to the south excepting the central part of West Sedgemoor. Elsewhere the peat deposits are essentially of sedge remains.

Fibre content and humification. While botanical composition has formerly been the main basis for classifying peats, current systems in North America use rubbed fibre contents. This property was determined on peat from 50–100 cm depth from a range of peat types using the methods tested by Bascomb *et al.* (1977) in which samples are treated with pyrophosphate solution, stirred in a blender and sieved through a 200 μm sieve. Rubbed fibre constituted 15–33% by weight in these samples, the largest amount in woody peat from King's Sedgemoor.

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Evidence of soil formation in these peats is seen in thin layers usually between 25 and 45 cm depth which are blacker in colour than the underlying dark brown peat. In these subsurface layers vertical cracking outlines well developed prismatic or coarse blocky structure distinct from the horizontal laminations of the peat. These layers are a product of aeration and humification and their fibre contents, determined on samples from the same sites as above, ranged from 8–25% indicating fibre loss of about 7%. Measurements of light absorbance on the pyrophosphate extracts from both sets of samples showed an increase in the humified layers attributable to higher content of extractable humic compounds.

These results demonstrate the degree of alteration of peat and the increased amorphous content at the expense of fibrous plant remains. This process has also been confirmed micromorphologically, thin sections showing loss of plant structures and increases in black humified material, with some evidence of micro-faunal activity in the form of excreted pellets. Subsurface horizons are also characterised by a greater bulk density ($1{\cdot}1$–$1{\cdot}2$ g cm^3) than lower wetter layers ($0{\cdot}9$ g cm^3) and hence a greater bearing capacity.

Hydraulic properties. Effective water control at both arterial and field scale is the prime factor in peatland management. Measurement of hydraulic conductivity of the peat by the auger hole method gives values of $0{\cdot}5$–$2{\cdot}0$ m day^{-1} in the lower layers and more rapid rates in the structured upper layers. Performance of slotted pipe drains in recent field drainage works does not always meet these modest rates because of blockage of slots by peat fibres.

Mineral topsoils. The recent peatland survey has allowed reassessment of the agricultural significance of the Sedgemoor and Midelney series. These two map units distinguish land with less than 30 cm of clayey cover to the peat from those with 30–80 cm of clay over peat. Sedgemoor soils with thin clayey topsoils are more or less confined to the moors south of Othery, the remainder of this unit to the north being dominated by topsoils classed as either peat or loamy peat in which thin clay layers were never present or have been incorporated by cultivation in former times. The recognition of these distinctions is of importance when choosing land for small seeded cash crops where a fine tilth is required. Even thin clay layers, particularly where broken from old pasture require many seasons of careful cultivations to produce fine even tilth.

Fertility. While the nutrient status of these soils has not been a part of the study the slight acidity of the fen peats to 1 m depth is confirmed. Most pH values are in the range $5{\cdot}0$–$6{\cdot}0$. The occurrence of appreciable amounts of gypsum in the peat and clayey cover of the pump drained land on West Sedgemoor is a local phenomenon and other deposits such as shell marl are very rare.

Careful appraisal of these various properties of the peats, together with considerations for improved water control, should help to create plans for improved agricultural use and to recommend areas where it might be possible to integrate agriculture with conservation of the deposits and their related flora and fauna. (Findlay, Colborne and Cope)

Crop patterns on air photos

Crop patterns occur widely throughout lowland arable England; they are common on soils in or over chalk, sands and gravels, Chalky Boulder Clay and Jurassic limestone, but rare on soils in or over Carboniferous shales, Keuper Marl and Jurassic clays. Patterns in crops are caused by differences in growth of individual plants and are seen on the ground or recorded on air photographs as differences in crop height and leaf area densities.

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In 1974 and 1975 the Soil Survey was asked by the Council for British Archaeology to explain the soil factors which could lead to the formation of crop patterns related to archaeological features (Jones & Evans, 1975).

An explanation of many such patterns was provided by Evans (1972) in which differences in growth were attributed to variations in soil depth and hence to amounts of water available to plants. In general, the shallower a soil the less water it can supply and the sooner crop growth is checked.

Further work (Evans & Jones, 1977; Jones, 1979) confirmed that most archaeological and natural crop patterns are related to differences in depth of soil over horizons from which water cannot be drawn by the plant. Crop growth is checked when the potential moisture deficit cannot be made good by water held in the soil. Patterns generally occur on soils over sands or gravels, with rooting depths between 0·3 and 0·6 m, at potential moisture deficits exceeding 50 mm. However, it seems that compared with arable crops larger potential soil moisture deficits are required to produce patterns in grass. Once established, patterns often remain visible even when water again becomes available to the stressed plant.

Within-field crop patterns at Maxey, Cambridgeshire (NGR TF 117075). Here, cereal growth and yield on soils of different depths over terrace sands and gravels were monitored between 1975 and 1978. The soils are a typical calcareous brown earth and a calcareous cambic stagnogley soil. The poorest growth occurred on soils only 0·27 m deep to a stony horizon impenetrable to the auger; it was better on soils of 0·56 m depth, and best on soils 1·16 m deep.

There were no differences in germination rates, and plant numbers were similar at the three sites. However, differences in numbers of tillers became apparent as the season progressed (Table 2), and growth was checked, but not stopped. Growth on the shallowest soil was checked at moisture deficits of 55–70 mm; whereas growth on the moderately deep soil was not checked until the deficit was between 90–97 mm. The estimated amounts of water available to the plant are respectively 52 mm, 92 mm and 182 mm for the shallow, moderately deep and deep soils; yields (Table 2) reflect these differences.

TABLE 2

Ratios of tillers and yields at Maxey*

	Soil depth	0·27 m	0·56 m	1·16 m	Cereal type
Tiller ratios at harvest	1975	0·95	0·91	1·00	Spring barley
	1976	0·62	0·90	1·00	Winter wheat
	1977	0·70	0·82	1·00	Spring barley
	1978	0·59	0·82	1·00	Spring barley
Yield ratios	1975	0·59	0·64	1·00	
	1976	0·23	0·60	1·00	
	1977	0·59	0·87	1·00	
	1978	0·51	0·93	1·00	

* Tillers and yields are expressed as ratios, of the deepest soil

Crop patterns and soil temperature. Though differing amounts of available water seem to explain most crop patterns in lowland England (Jones & Evans, 1975), differences in crop growth can be a response to other factors, such as soil temperature, workability, nutrient status, or disease. Preliminary results are reported for two studies on soil temperature and workability affecting crop patterns at sites where disease and nutrient and moisture status were not major influencing factors.

Valley floor patterns (Evans, 1972) are widespread on soils on Chalky Boulder Clay.

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Unlike those caused by differential moisture stress these, as in chalk areas, are visible for most of the year, in the bare soil or as crop patterns. In winter and spring, it is the contrast between the darker coloured valley floor soils with the adjacent paler tones on the valley sides and spurs which is seen, whereas in summer it is the darker toned denser crop of the valley floor which is apparent.

At Great Paxton, Cambridgeshire (TL 217631) growth and yields of winter wheat (1976 and 1977) and barley (1978) were monitored on a typical brown calcareous earth in a valley floor, and on a stagnogleyic rendzina on the adjacent valley side. Both soils are fine loamy over clayey or clayey throughout.

Germination rates were up to 1·8 times greater in the valley than on the sides. As factors such as topsoil moisture content, structure, pH and nutrient status varied little across the transect from valley floor to sides, the differences in growth were possibly related to soil temperature.

In late March 1978 when soils were very moist, surface colours differed only slightly between the floor (10 YR 3/3, dark brown) and sides (2·5 Y 3/2, very dark greyish brown) and the soil temperatures at 5 cm in the early afternoon were very similar (within 0·2°C). In early April, following three fine days, the dry colour of the clods on the floor was 10 YR 4/3 (brown) and of the side was 2·5 Y 5/3 (greyish brown to light olive-brown). Soil temperature at 5 cm was 3·5°C warmer in the valley floor in the early afternoon perhaps because the paler colours of the valley side soils reflected more energy, and therefore were cooler. Numbers of tillers and yields at harvest on the valley floor, were greater by factors of 1·6 and 1·7 respectively.

Crop patterns and soil workability. The explanations given are probably valid for most of the crop patterns seen on air photographs of lowland England. However, a small proportion may be attributable to differences of workability of the soil within fields. A relevant within-field study was undertaken at Tickencote, Leicestershire (SK 978114) on a typical stagnogleyic calcareous earth and a pelo-stagnogley soil with fine loamy and clayey topsoils. The pattern was recorded in spring barley in 1977 when clayey topsoils were drilled at above the lower plastic limit and smeared, whereas the fine loamy topsoils in other parts of the field were below the lower plastic limit and did not. Germination of the seed in the wetter, more anaerobic conditions of the smeared clayey topsoil was 68% of the fine loamy topsoils; tillering at harvest was 52% and yield 44% of that on the fine loamy soil. No crop patterns appeared in the same field under winter barley in 1976 or beans sown in good conditions in spring 1978. (Evans and Jones)

Acidity in Wood Walton, Conington, and Holme Fens

The cultivated peatland of Wood Walton Fen is shown on Agricultural Land Classification maps as Grade I. Because of acidity problems affecting crop yields and management problems associated with bog oaks, it was agreed that a reassessment of the grading should follow a more detailed site survey.

In September 1978 auger borings were made over an area of about 25 km² at 500 m intervals throughout Wood Walton, Conington and Holme Fens (Fig. 3) at the kilometre and half kilometre intersections of the National Grid. Samples were taken at 25, 50, 75, 100, 125, 150, 200, 250 and 300 cm depths where the thickness of the peat allowed. The total thickness of the peat was recorded as well as the nature of the mineral substrata. Five hundred and ninety-five samples were collected from 105 borings. The first 30 samples were air dried and ground before pH values were measured; the pH of the remaining samples was measured in a 1:2·5 soil water solution without preliminary treatment.

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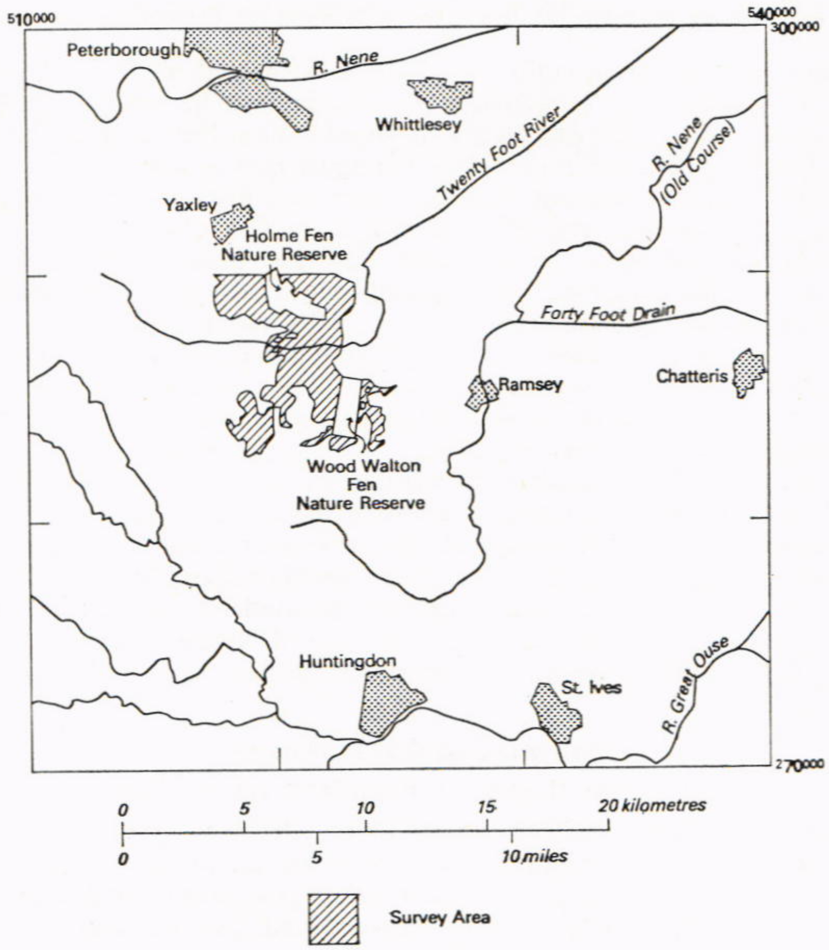

FIG. 3. Location of Wood Walton, Conington and Holme Fens.

These analyses demonstrated a marked change in soil reaction from the north of the area to the south. Whereas the western part of Holme Fen is slightly acid and the eastern part neutral or alkaline, Wood Walton Fen and the peat in the adjoining basin is strongly acid. Over a third of the samples in the area have a pH of 4·5 or less and one in ten has a pH of 3·5 or less. Moreover these low values occur in virtually every sampled profile, low values being found especially at the 50, 75, and 100 cm depths. Three samples had pH values of less than 3·0.

Such low values are an indication of the presence of pyrites (iron sulphide) which on oxidation releases sulphate anions in the soil with resultant acidity. Oxidation of pyrites takes place chemically in slightly or moderately acid conditions but below pH 4·0–3·5. *Thiobacillus ferrioxidans* is a catalyst to the reaction which is much accelerated at increasingly low pH values. Soils with pH values of 3·5 or below as measured in 0·01 M-$CaCl_2$ solution are classed as acid sulphate soils and are recognised as being difficult to ameliorate because of the persistent acidity arising from continuous oxidation of pyrites.

To confirm the presence of the pyrites indicated by the grid survey three additional profiles were sampled from Wood Walton Fen and Sulphate S and Oxidisable S determined by the Soils and Plant Nutrition Department of Rothamsted. The results show up

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to 1·5% by weight of oxidisable S in the peat and both the peat and the underlying clay is pyritic.

Acid sulphate soils are generally associated with drained marine alluvium, pyrites having been formed during the accretion of the deposit at the sea margin. This is the likely source of acidity on the east margin of Wood Walton Fen which is within the area of marine Fen Clay with profiles in which the upper peat is separated by a thin inter-digitated band of marine silty clay from the lower peat. Elsewhere it seems more likely that pyrites may be derived originally from beds in the Oxford Clay.

The acid area lies mainly to the south of the low ridge in the Fenland floor that runs north-east across Conington Fen. The most acid zone in each profile is generally between 50 and 125 cm, the acidity decreasing at greater depths. This is probably an effect due to drainage because acidity in potential acid sulphate soils containing pyrites only develops when oxidation follows improvements to drainage. The lower, less acid, layers in Wood Walton Fen are still constantly or frequently waterlogged and anaerobic conditions will have prevented the development of acidity.

On the basis of the additional information the soil maps have been amended and the grading of the peatland was re-assessed jointly by the Soil Survey, and the Soil Science and Land Services of ADAS. It was agreed that a separation of an area of lower capability than previously recognised due to the combined effects of deep, extreme acidity and the presence of numerous bog oaks was desirable. The southern area has been graded as Class 3se as compared to Class 1e for the peat area of Holme Fen. (Hodge, Burton, Bloomfield, Soils and Plant Nutrition Department, and Langford, student worker)

National Coal Board Contracts

Soil surveys of opencast sites prior to coal working

During 1979 it was agreed with NCB and MAFF that detailed soil surveys be carried out for sites where opencast workings for coal are proposed. In general it was felt that improved advance soil information will lead to better standards of land restoration, and hence more efficient agricultural use of the restored land. The Soil Survey is contracted to carry out this work which is funded by the NCB.

The normal procedure is to prepare a detailed soil map at 1:10 000 scale based on observations at roughly one per ha. All sites have a record of completed deep bore holes drilled to establish the general geological structure of the site, from which cores are selectively taken to give samples of both coal and inter-seam strata for detailed examination. This information is available to the Soil Survey to help characterise the nature of the overburden and assess its suitability for soil-making purposes.

Normally, a soil series and land capability map is produced. Thicknesses of topsoil, organic layers, or overburden materials which may be superior to the general cover of the sites are identified. The working and handling properties in terms of earth-moving machinery are described, the most relevant being ease of stripping and susceptibility to compaction and smearing under wet conditions.

The conventional terminology for the regolith on opencast sites consists of:

(a) topsoil—containing appreciable organic matter;
(b) subsoil—0·5–2 m thick which can be moved by scrapers or similar equipment;
(c) overburden—requiring a drag-line or similar tackle.

Layers (a) and (b) are normally stripped and stored separately. Layer (c) is commonly removed from above the coal seams and dumped on the previously worked strip by the dragline.

On most sites the dominant 'subsoil' is impermeable boulder clay or silty clay weathered

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from Coal Measures shales, giving rise to surface-water gley soils, generally classified in Land Capability terms as class 3 or 4sw depending on local soil and climatic conditions. In South Wales some class 5 or 6 land is worked. Commonly there are also old colliery shale heaps and other areas of dereliction with little or no topsoil cover.

Most workings are on land of below average quality which presents considerable problems of wetness, workability, poaching risk and shallow rooting even when farmed efficiently. After working, rationalisation of field boundaries and the installation of a drainage system are obvious benefits, but the intrinsic problems of the soils often appear to be accentuated.

During the past 20 years, restoration standards have specified that topsoil and subsoil should be stripped and stored separately, that the upper 1 m of the restored profile should be free of stones capable of turning a plough and that drainage systems shall be installed as necessary.

Over the last few years as new implements and techniques have been developed specifications have been revised so that new contracts now specify that topsoil should not contain stones greater than 115 mm diameter and subsoil should not contain stones greater than 230 mm.

The dominant subsoil materials on opencast sites are rather poor soil forming materials. Locally more amenable deposits occur such as glaciofluvial drift or soft sandstones with good permeability suitable for handling at a wider range of moisture contents but their volume is rarely sufficient to cover the whole site to the required depth. Some investigation work is desirable to assess whether the harder sandstone can be used to provide a better subsoil material than the normal clay.

The restoration plan for individual sites is the responsibility of NCB and ADAS staff. Commonly, on a site with mainly clayey subsoils the aim is to minimise shifting of soil and subsoil materials under wet conditions. However the fact that soils are often plastic and easily deformable at moisture contents well below field capacity raises considerable problems.

After re-instatement the soil profile may require removal of large stones and measures to relieve compaction. Most sites also require a full drainage installation and very careful management in the following years.

Although British practice in this field is generally in advance of other countries, sites consist predominantly of poor soil-forming materials. Further progress will require better evaluation of materials such as hard sandstone, greater emphasis on progressive restoration of sites by stripping and reinstating subsoil material in a single operation over the bulk of the site, and more efficient procedures and equipment to disrupt compacted layers produced by earth moving under, inevitably, sub-optimal conditions.

The overall energy situation will possibly require some expansion of opencast working in the next decades. More efficient machinery is now capable of working to greater depths and re-working of earlier sites is likely. These considerations reinforce the need for better soil and geological information, and a continued search to improve restoration standards. (R. A. Jarvis and Thomasson)

Basic research

Acid brown soils. Determinations were made of the pH-dependent charge, measured as the difference between the cation exchange capacity at the natural soil pH and at pH 8·2, on samples from 28 podzolic B horizons in soils of differing drainage status and parent material. The relationship between pH-dependent charge and phosphate adsorption index (Bache & Williams, 1971) is being investigated and the project is being extended to include soils of some other major groups. (Loveland)

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Loveland and Bullock (1976) showed that large amounts of poorly ordered or amorphous aluminosilicates of the kind normally associated with Andosols, can occur in the clay fractions of soils in England and Wales. Such compounds confer irreversible P-fixation properties on soils (Fox, 1974). Evans and Smillie (1976) found a good correlation between the phosphate sorption index (Bache & Williams, 1971) and levels of extractable Al in Irish soils. Analyses to test the relationship between the phosphate sorption index and a range of other soil chemical parameters thought to indicate amounts of amorphous alumino-silicates, have been completed on soils from the Llangadog district (Sheet SN 72). Statistical analysis of the data is in progress. (Loveland, Rudeforth, Wright, with Mr. R. Dight, ADAS)

Palaeosols. Samples from a reddish flinty clayey soil (Winchester series) overlying Calcethorpe Till in the area around Donington-on-Bain, Lincolnshire (Sheet TF 28) were studied to determine the nature and origin of the soil material. On the basis of particle-size distribution, fine sand mineralogy and stone types, it was concluded that almost all the soil could have been derived from the till by decalcification. (Bullock, Heaven, Catt, Soils and Plant Nutrition Department, and Cotton, vacation worker)

Methodological research

Chemical analysis. A field calcimeter was designed and is now being tested by surveyors in the field. Measurement of pressure developed on addition of acid to a standard volume of soil gives $CaCO_3$ content with a relative accuracy of 10%. (Thanigasalam)

The reproducibility of the method used to determine the cation-exchange capacity of freeze-dried clay separates (Bascomb, 1964) was improved by (a) shaking the sample for 1 h with a large excess of distilled water prior to treatment with the $BaCl_2$-triethanolamine buffer solution, and (b) increasing the concentration of the index cation solution ($MgSO_4$) from 0·05N to 0·1N. (Loveland)

Micromorphometry. The use of image analysis to quantify soil structure was further investigated. Well aggregated soil material was characterised by measurements of the aggregates and by inter and intra aggregate pore patterns. The structure of unaggregated soil material was quantified by reference to pore patterns in terms of type, size, statistical distribution, irregularity and orientation. (Bullock and Murphy)

Grazing classification. The grazing value of uplands in capability classes 6 and 7 (i.e. unimprovable land) is being assessed as part of the National Map programme. Five surveyors with upland responsibilities attended a course at the Macaulay Institute for Soil Research, Aberdeen on vegetation mapping. The Soil Survey of Scotland has developed a grazing evaluation based on the nutritional value of grassland and heath plants to grazing animals. By estimating the proportions of different species in the vegetation, its overall grazing potential can be assessed. These assessments are being made at National Soil Inventory sites, as well as for the main vegetation types of the uplands. Surveyors in upland regions are continuing to train in the recognition of plant communities. (Hartnup)

Data management. Due to unrewarding performance on the 4-70 and other difficulties, trials of the G-EXEC data management system have been discontinued.

Discussions have taken place with members of staff of the Computer Department on how the Soil Survey's data management requirements can be achieved. Plans outlining the requirements of a Soil Survey Information System during the next 5–10 years have

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been prepared and a report circulated internally. Two options are to be pursued in the near future.

(i) *Ad hoc* programs for information retrieval to be written in order to meet immediate needs.
(ii) Experimentation to be undertaken by the Computer Department in order to test new database management systems available on university computers. (Ragg)

Spatial analysis. Investigation of the application of regionalised variable theory to soil survey has continued. It is now clear, at least for the examples studied, that lateral variation in soil can be partitioned into three main components, namely:

(i) Variation deriving from natural discontinuities, usually where the soil changes from one type to another, and from soil boundaries recognised in survey.
(ii) A component that increases as the separating distance between places increases. This can occur within parcels of distinct soil types, or between types if transition from one to another is gradual.
(iii) An unaccountable component caused by variation within the shortest sampling interval. This is called 'noise' or 'nugget variance'.

Evaluation of components (ii) and (iii) in intensive large scale surveys has been followed by optimal interpolation ('kriging') to produce isarithmic ('contour') maps of individual soil properties. Present indications are that the most profitable form of interpolation is block kriging, in which average values of soil properties are estimated over areas, rather than punctual kriging, in which values are estimated for volumes of soil the same sizes and shapes as those at the sampling points. Universal kriging, in which account is taken of changing drift, appears to have limited applicability in soil survey because of the large nugget variances that usually obtain. (Webster and Burgess)

Applications research

Soil related diseases. Study continued into the relationship between soil conditions and the distribution of the snail host (*Lymnea truncatula*) of liver fluke (*Fasciola hepatica*). A vacation worker was employed to map and describe the habitats in the Llangendeirne district of Dyfed to relate their occurrence to an existing soil map. Eight hundred snails were sent to the Central Veterinary Laboratory, Weybridge for infection levels to be checked to assist with the annual forecast of the incidence of liver fluke disease. (Wright and Grant, student worker, with Mr. P. W. Swire, ADAS)

Supporting work

Soil water regimes. Neutron probe access tubes were installed at four more sites in the Abbots Bromley district following the loss of one site previously in use because of ploughing. The soil moisture regimes of the Wick, Whimple, Denchworth and a similar unnamed series are now being monitored. The last two series are on Rhaetic shales, the unnamed being a fine silty typical cambic gley soil on silty shales with a large available water content and the Denchworth, a pelo-stagnogley soil.

Water-tables dropped rapidly following a dry spell lasting for most of July and large cracks developed in the Denchworth soil. By the end of the month, these were 2–4 cm wide at the surface. Smaller cracks developed in the unnamed profile but the water-table remained above 90 cm depth until the weather broke early in August.

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Soil water retention. Soil water retention properties have been measured on 700 cores from 77 profiles over the past year. A selective sampling programme has been devised to increase the amount of information held on certain soil and textural groupings. These include podzols, brown podzolic soils, brown calcareous earths, lithomorphic soils, and gley and stagnogley soils developed in medium textured materials. (Hall and Bembridge)

Special surveys

At the request of the Forestry Commission a detailed survey was made of Penllergaer Forest, West Glamorgan (200 ha) as part of an investigation into severe windthrow. (Wright and Clayden)

A total of 1·5 km^2 of the North Wirral Coastal Park were surveyed for Merseyside County Council and information given on suitability for market gardening, playing fields and wildlife habitats. The survey was commissioned as part of the development programme for the park. (Palmer and Thompson)

A map of the Shenley Brook catchment near Bletchley, Bucks. (2·5 km^2) was prepared for ADAS. (Hazelden)

A map of Rowhill Nature reserve near Farnham, Surrey (1 km^2) was prepared for the Rowhill Nature Reserve Society. (Fordham)

A survey of the Demonstration Farm, Kingston Deverill, Wilts. (1180 ha) was carried out on behalf of the Countryside Commission and a report and land capability map submitted as one of several specialist single-purpose plans. The farm is representative of chalk downland with humic and brown rendzinas on the higher ground and colluvial rendzinas or brown calcareous earths on the footslopes. Valley floor soils are capability class 2 or class 3 where moderate wetness occurs. Downland soils are class 3 on account of shallowness and stoniness or are placed in class 5 or 6 on steep or very steeply sloping land. (Cope)

At the request of the Countryside Commission soil surveys were made of two farms, near Knaresborough and Carlisle respectively, which are to be used as demonstration farms in conservation practice. (Allison and Kilgour)

Soil surveys of the Broom's Barn Experimental Station were made prior to and after its acquisition for sugar-beet research. Subsequent experiments have shown the great local variations of the soil. The farm has been revisited to reassess the general soil map and to reclassify the soils in the light of recent Survey work. Six profile pits were described and sampled. The resurvey confirms the general outlines of the original map but the local soil variability over most of the farm is such that only very detailed survey of experimental plots is likely to express the soil variation adequately for experimental purposes. Completion of the map and report await analytical results. (Seale)

A 1:2500 soil survey was made of a 30 ha proposed waste disposal site at Ince Blundell for Merseyside Metropolitan County Council. (Allison and Bradley)

At the request of the Northumbrian Water Authority, 1:2500 soil maps and land capability assessments were prepared for Van Dieman's land (106 ha), Greta Bridge, and Ricknall Carrs (49 ha), Newton Aycliffe, both in Durham. (Allison, Carroll and R. A. Jarvis)

Staff

B. Clayden and A. J. Thomasson have been transferred to Rothamsted for special duties. J. M. Hodgson has undertaken the general direction of the new mapping programme. The East and Western Midland Regions have been combined and J. M. Ragg appointed Regional Officer. With the completion of the survey in Cornwall, the office at St. Austell has been closed; a new office has been opened in Dorset to which S. J. Staines has been

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transferred. Bedfordshire, Essex and Hertfordshire have been transferred to the East Anglian Region, and Cheshire to the Midlands.

D. Mackney, J. M. Ragg, A. J. Thomasson, P. Bullock and C. P. Murphy visited the Netherlands Soil Survey Institute.

C. P. Murphy visited the Swedish University of Agricultural Sciences, Uppsala by invitation to train their staff in making and describing thin sections of soil and in pore space analyses using the Quantimet Image Analysing computer.

Dr. M. Kooistra and Mr. S. J. M. de Groote from the Netherlands, Dr. S. Ledin from Sweden and Miss Baastrup from Denmark worked with the Survey.

Six senior staff from the Netherlands Soil Survey Institute were conducted on a study tour of Eastern England.

C. L. Bascomb retired after 29 years with the Survey during which period he founded, organised and directed the Analytical Laboratories as well as contributing many original studies of methods.

Mrs. J. K. Foster has retired after 26 years of dedicated service to the Department.

R. Webster resigned to take up a new post in the Soils and Plant Nutrition Department; Theresa Toghill, Beverley Poulton, Elaine Kavanagh, Valerie Sandy, Liz Johnson, Marie Cox, Moira Beynon, D. Harding and P. Mayton, resigned, the last on the grounds of ill health. A. J. Moffat, Patricia Bond, Sheila Talbot, Jean Thompson, June Cooles, Sylvia Waldron, Helen Garthwaite and Elaine Avis were appointed.

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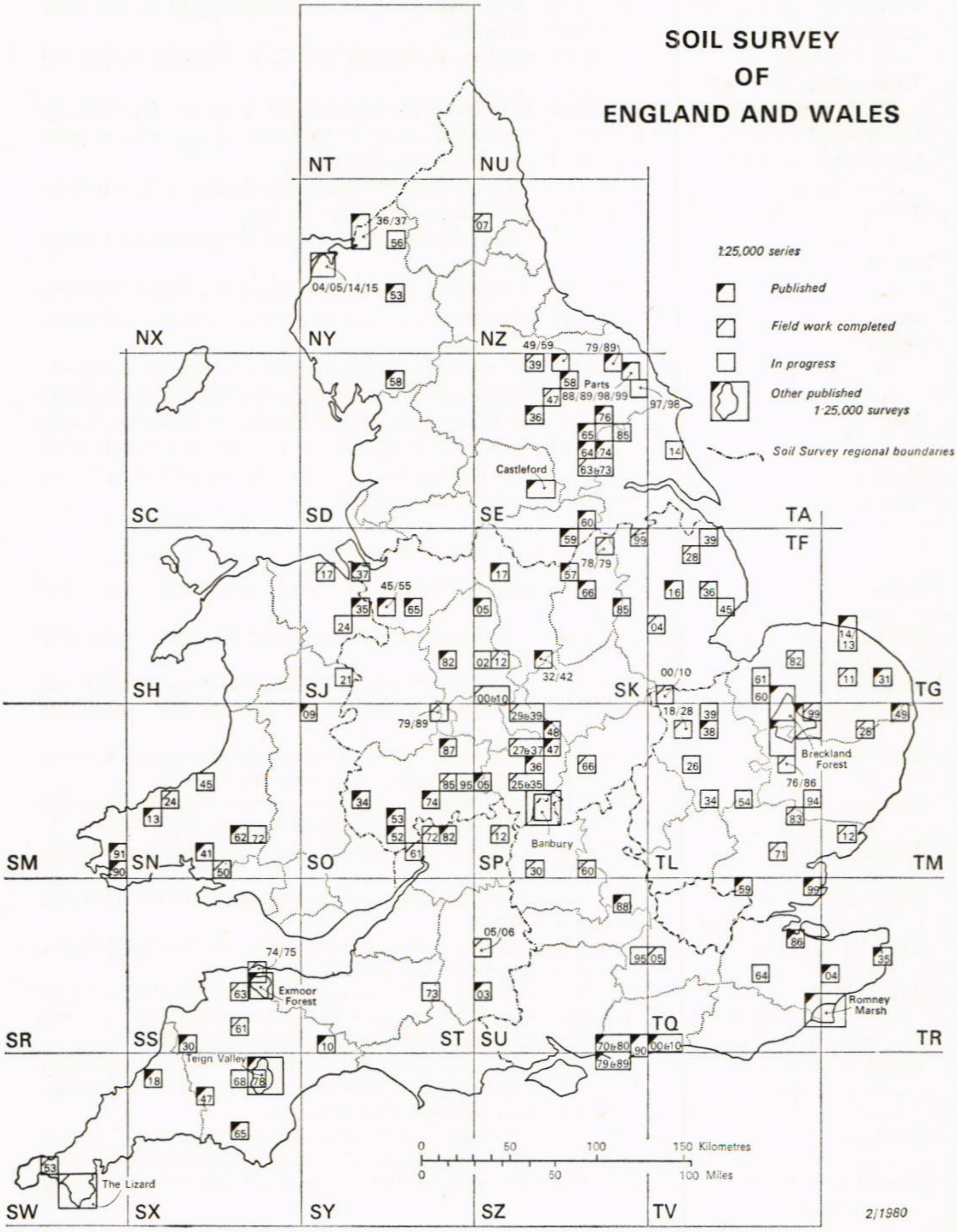

FIG. 4

https://doi.org/10.23637/ERADOC-1-136

SOIL SURVEY OF ENGLAND AND WALES

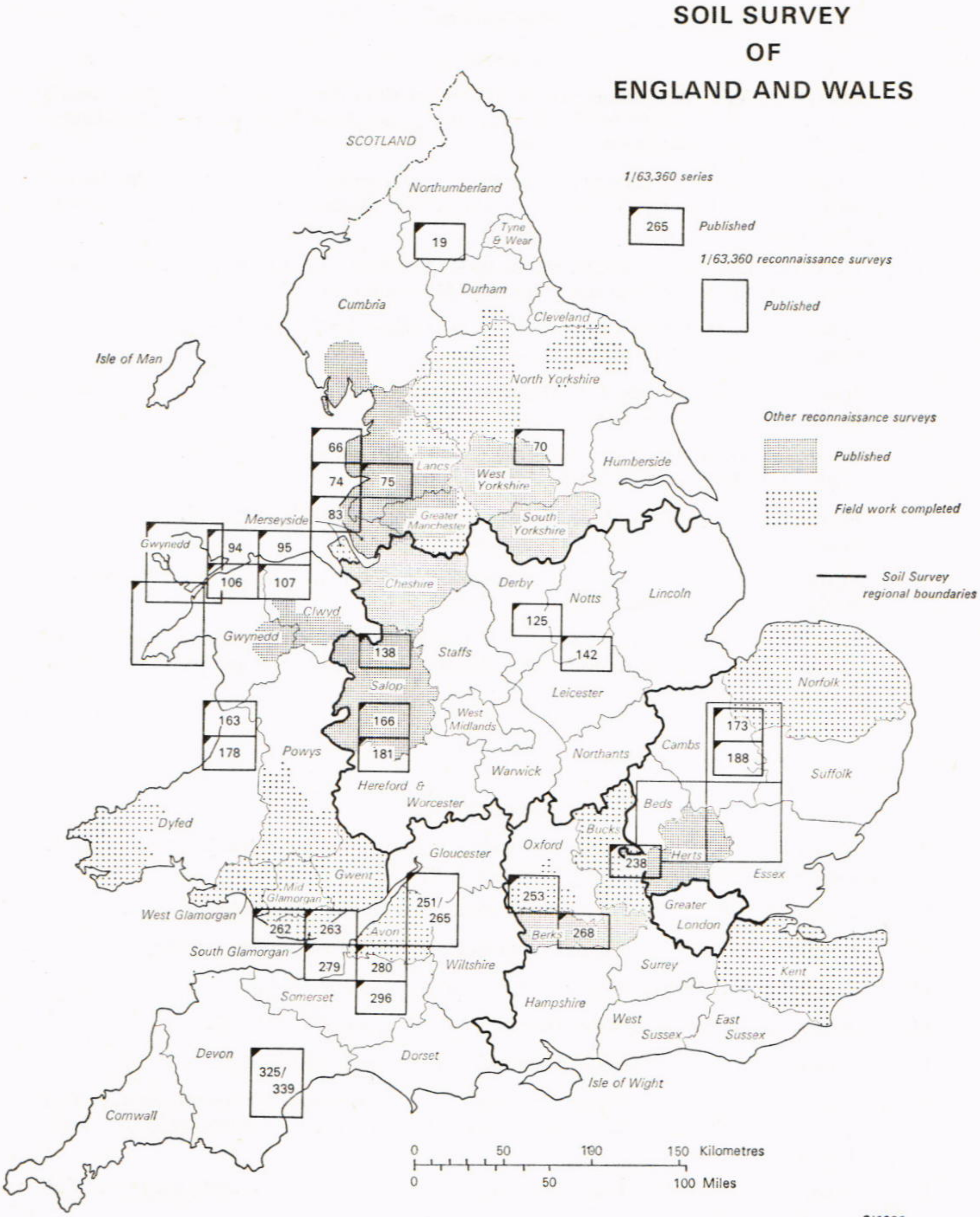

FIG. 5

https://doi.org/10.23637/ERADOC-1-136

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