THE LAND OF BRITAIN

The Report of
The Land Utilisation Survey of Britain

EDITED BY
L. DUDLEY STAMP, B.A., D.Sc.

Part 55

BEDFORDSHIRE

by

C. E. FITCHETT, B.A., A.K.C. (London)

THE LAND OF BRITAIN

The Report of
The Land Utilisation Survey of Britain

EDITED BY
L. DUDLEY STAMP, B.A., D.Sc.

Part 55

BEDFORDSHIRE

by
C. E. FITCHETT, B.A., A.K.C. (London)

LONDON
PUBLISHED FOR THE SURVEY BY GEOGRAPHICAL PUBLICATIONS LTD
1943

NOTE

The publication of this Report is being made possible by a grant from the Pilgrim Trust and by a donation from the Patron for the County
The Right Honourable LORD LUKE OF PAVENHAM, K.B.E.,
H.M. Lieutenant

The appropriate One-inch coloured maps to accompany this Report are Sheet 84 (Bedford) and Sheet 95 (Luton). A small section of the north lies on Sheet 74 (Kettering) and of the east on Sheet 85 (Cambridge). Price 4*s.* 0*d.* each (flat, unmounted), 5*s.* 0*d.* (folded in covers).

Maps and Report are obtainable from
THE LAND UTILISATION SURVEY OF BRITAIN
London School of Economics, Houghton Street, London, W.C.2,
or Bentboughs, Horton, near Slough, Bucks.

Part 55

COUNTY OF BEDFORD

by

C. E. FITCHETT, B.A., A.K.C. (London)

EDITORIAL INTRODUCTION

THE Land Utilisation Survey of Bedfordshire was carried out entirely in the year 1931 under the direction of Mr. H. E. Baines, M.A., Director of Education, and the whole work was a model of efficient organisation, enthusiastic co-operation and attention to detail unsurpassed by any other county in Britain. The matter was first discussed in December 1930; by February 1931 the Director of Education had mapped out the campaign, asked about fifty Head Teachers to help, arranged with the Bedford Branch of the Geographical Association to cover Bedford, and the Luton Education Committee to cover Luton, ordered three sets of six-inch maps from the Ordnance Survey and arranged a meeting of all interested at the Shire Hall. This meeting I addressed on 28 February, 1931 and settled outstanding queries and the field work was started immediately. Typed instructions, together with a covering letter of authority signed by the Chairman of the Bedfordshire Education Committee, were sent to all volunteers.

On 20 August, 1931 the Director of Education reported " we have to all intents and purposes completed the survey of Bedfordshire " but the maps were retained till all were checked and some discrepancies along the margins adjusted. The whole set of 121 sheets, completely checked, was sent in on 26 November. As Mr. Baines said in a covering letter " the task was not undertaken with the idea of reward, but of assisting in a national effort, and at the same time introducing a valuable piece of educational work. . . . The work has been a great joy to all concerned, in fact many have lamented its finish."

Much help was given the surveyors in Bedfordshire by Land Agents of some of the large estates, but some doubts arose as to the purpose to which the information collected might be put and the matter was referred to the Land Agents' Society. As a result Mr. W. J. Fleet, at that time Agent for the Luton Hoo Estate, came to see me at the instance of the Council of the Society and the aims and objects of the Survey were explained. Mr. Fleet became a whole-hearted supporter of the Survey and represented the Land Agents' Society for ten years on the Advisory Committee rendering invaluable help through his ever-ready counsel and advice based on a wide and life-long experience of land management.

In 1932–33 the Luton Sheet (Sheet 95, covering the South of Bedfordshire) was prepared for publication and issued in April 1934. It was reprinted in 1942. Sheet 84 (Bedford) was published in 1937 with the help of generous support from Lord Luke of Pavenham, His Majesty's Lieutenant for the County, who kindly consented to become County Patron.

The author of this Report, Mr. Fitchett, has had ten years' experience of helping with the field work of the Land Utilisation Survey in many parts of the country and so brings to bear on his task a wide practical knowledge combined with a sound academic training.

L.D.S.

I. INTRODUCTION

BEDFORDSHIRE is one of the lesser known English counties. It has at first sight no obvious claim to distinction. In area it is one of our smallest counties, it has few natural boundaries, and possesses large tracts of uniform or gently undulating country. Situated in the southern Midlands, and lying at present outside the expanding orbit of London, it occupies an indeterminate position which is neither in the Midlands proper, nor yet within the real influence of the metropolis. In the Ministry of Agriculture's regional division Bedfordshire is included in the eastern division of England, whilst the Land Utilisation Survey has included this report with those of the south-east Midlands.

It is clear that Bedfordshire is a transitional, almost a thoroughfare county, with no very marked centre of local tradition ; an agricultural county with few industries of any importance. These two factors provide individuality for Bedfordshire and they are much in evidence in any study of its land utilisation. The proportion of land under crops and grass in Bedfordshire is well over 80 per cent. of the total area—higher than that for most English counties. Particularly in the Vale of Bedford and towards the north of the county the rural nature of the landscape is most striking, whilst in the well-known market gardening region of Biggleswade some exceptional development in agricultural production is evident. The transitional character of Bedfordshire which is the result of its position, its geology and its relief is brought out still more by a consideration of the county's agriculture. Most of the gradations from the typical arable farming of eastern England to the dairying of the west are to be noted as one proceeds from east to west across the county. This is clearly seen on the Types of Farming map[1] which shows in order from east to west arable types of farming, intermediate types, and finally pasture types. Bedfordshire presents an agricultural surface of great variety owing to the large number of geological outcrops, and almost every large farm will show differences of soil dependent on the underlying rock. Only the Greensand Region and parts of the chalk area in the south exhibit any uniformity of soil conditions, for even in the Oxford Clay country of the Vale of Bedford considerable variety results from the drift deposits.

The greater part of the county is covered by the Land Utilisation one-inch maps, Sheets 84 (Bedford), published 1937, and 95 (Luton), published 1934, but a small portion lies on Sheets 74 and 85. The six-inch sheets used for the field work were dated 1902 or 1927, but they proved to be quite adequate for the purpose, since few changes had occurred either in field boundaries or in urban development. The main exception to this was in the Luton–Dunstable region where a good deal of expansion and ribbon development has gone on. It would appear that there has been a certain stability of land use in Bedfordshire, and comparison with past utilisation has tended to confirm this.

The survey in the county was carried out entirely in one year, 1931, and in consequence a truer picture has been obtained than if the work had been spread over a number of years.

Throughout the difficult period during which this report has been prepared Dr. Willatts has constantly given his valuable time and experience whenever asked. All the farmers who were visited proved most friendly and co-operative and took a great deal of trouble to provide all the information required. Finally sincere thanks are due to Mr. J. W. Dallas, the County Agricultural Organiser, Mr. F. W. Mitchell, Head Forester of the Duke of Bedford's estate at Woburn, Mrs. K. Munn, M.A., of the Records Office, Bedford, and Messrs. Copo Ltd. of Cockayne Hatley for all the assistance given.

[1] Prepared by the Ministry of Agriculture and Fisheries and published by the Land Utilisation Survey. The area covering Bedfordshire is reproduced in Parts 76–77 and in Part 68 of The Land of Britain.

II. AN OUTLINE OF THE GEOGRAPHICAL BACKGROUND

A. GEOLOGY.

THE main features of the solid geology of Bedfordshire are strikingly clear (Fig. 1), but considerable complications appear when the superficial or drift deposits are taken into account. Both solid and drift geology need to be emphasized, for they very largely determine the relief, the soils and therefore, to a considerable extent, the agriculture of the county.

The general trend of the geological outcrops is from south-west to north-east in conformity with the major structure lines of this part of the country, and since the direction of dip is mainly south-east and south, successively older strata are exposed to the north-west. Apart from an outlier of Reading Beds near Caddington, the newest rock is the Chalk of the Upper Cretaceous system, whilst the oldest rocks exposed are those of the Upper Estuarine series of mid-Jurassic age. The Lower Greensand formation is the oldest member of the Cretaceous system present in Bedfordshire. Between Leighton Buzzard and Sandy it forms a very well-marked ridge, which defines the limits of the Cretaceous and Jurassic systems. Beyond this ridge most of the north of the county is floored by Oxford Clay, but the clay is usually masked by drift deposits mainly of Boulder Clay. The Upper Jurassic rocks, represented by the Kimeridge and Ampthill Clays, are not conspicuous in Bedfordshire, though quite extensive outcrops occur to the north and south in Cambridgeshire and Buckinghamshire. Where the Ouse has cut down through the Oxford Clay above the town of Bedford, Cornbrash and Great Oolite limestones and clays are exposed.

TABLE OF GEOLOGICAL FORMATIONS IN BEDFORDSHIRE

Recent	Alluvium
	Valley gravel
Pleistocene	Brickearth
	River drift
	Glacial gravel and sand
	Boulder Clay (with chalk erratics)
	Clay-with-Flints
Eocene	Reading Beds
Upper Cretaceous	Upper chalk
	Middle chalk
	Lower chalk
	Upper Greensand
	Gault clay
Lower Cretaceous	Lower Greensand
Upper Jurassic	Kimeridge clay
	Ampthill clay
	Oxford clay and Kellaways rock
Middle Jurassic	Cornbrash
	Great Oolite clay
	Great Oolite limestone
	Upper Estuarine series

Great Oolite limestone and clay

The outcrop of these formations is confined to the extreme north-west of the county around Podington near the Northamptonshire border, and along the valley of the river Ouse

It is only above the town of Bedford that the river has cut down below the Cornbrash to expose the Great Oolite series, and in places the outcrop reaches a mile in width. The limestone includes layers of marl and clay, whilst the Great Oolite clay consists of variegated clays which are in part calcareous.

Cornbrash

Like the Great Oolite rocks immediately below it, the Cornbrash outcrop is confined to the north-west of Bedfordshire, and to a narrow belt, rarely more than a quarter of a mile wide, along the valley of the Ouse. The Cornbrash is composed of tough grey limestone and clay, and varies from two to fifteen feet in thickness. The word is an old agricultural term for strong or " brashy " soils with rubble on the surface, which were especially suited to the growth of corn.

Oxford clay and Kellaways rock

The Kellaways rock is a comparatively thin bed of calcareous grit, shale and sandstone at the base of the Oxford clay. The Oxford clay itself is a greenish grey and brown clay of great thickness (three to four hundred feet), and extends over the greater part of north Bedfordshire, north of the Greensand ridge. It is largely overlain by Boulder clay, particularly north of Bedford, but gives rise to a tenacious soil, retentive of moisture, and suited to wheat. Topographically it forms the rather damp, undulating lowland, known locally as the Vale of Bedford, between the Greensand escarpment and the higher ground to the west developed on the Oolite and Lias series.

Lower Greensand

Between Leighton Buzzard and Potton the outcrop of Lower Greensand gives rise to the ridge of high ground running across the county. The fairly well defined escarpment decreases in height and significance to the north-east, whilst the width of the outcrop (as much as four miles in the neighbourhood of Woburn), diminishes in the same direction. Erosion has brought the Oxford clay to the surface south of Ampthill, and again near Biggleswade, whilst in other parts the Greensand is covered by Boulder clay, and by alluvium from the river Ivel. The formation, which is a brown, ferruginous sandstone with layers of sand and clay, is known locally as the Woburn sands and Potton beds, and reaches a maximum thickness in Bedfordshire of 280 feet.

Gault clay and Upper Greensand

The Gault clay belt runs parallel to the Lower Greensand ridge, and has a more uniform width of something under two miles. Two divisions are recognized—the Lower Gault, which is a grey, marly and sandy clay, and the Upper Gault, a much thinner deposit of varied coloured clay with a larger lime content. Drift deposits occur, particularly east of Heath and Reach, and where the Ivel crosses the Gault there is to be found the usual stretch of alluvium.

There is but a small exposure of Upper Greensand in the county, around Tilsworth.

Chalk

The Chalk covers practically all the rest of the county south-east of the Gault, and next to the Oxford clay occupies the largest area of any formation. The escarpment of the Chalk, rising 200 feet above the plain, is the most prominent relief feature of Bedfordshire. At the base of the Lower Chalk is the Chalk marl, the outcrop of which stretches from Stotfold to Eaton Bray. It is an impure limestone, and with the downwash from the escarpment it gives rise to the good loamy soil of the so-called Icknield Loam Belt (see below, p. 158). Included in the

Lower Chalk is the Totternhoe Stone which has long been quarried for building stone, and above this is some 60 to 80 feet of white blocky or hard grey chalk.

The Middle Chalk is more uniform, consisting of about 200 feet of fairly soft white limestone with few flints. The associated soils, though comparatively shallow and inclined to dry out quickly, are mainly given over to arable cultivation.

In south Bedfordshire the Upper Chalk outcrops, and is often covered with drift deposits of gravel, loam and clay. It is a soft white chalk with a considerable number of flints.

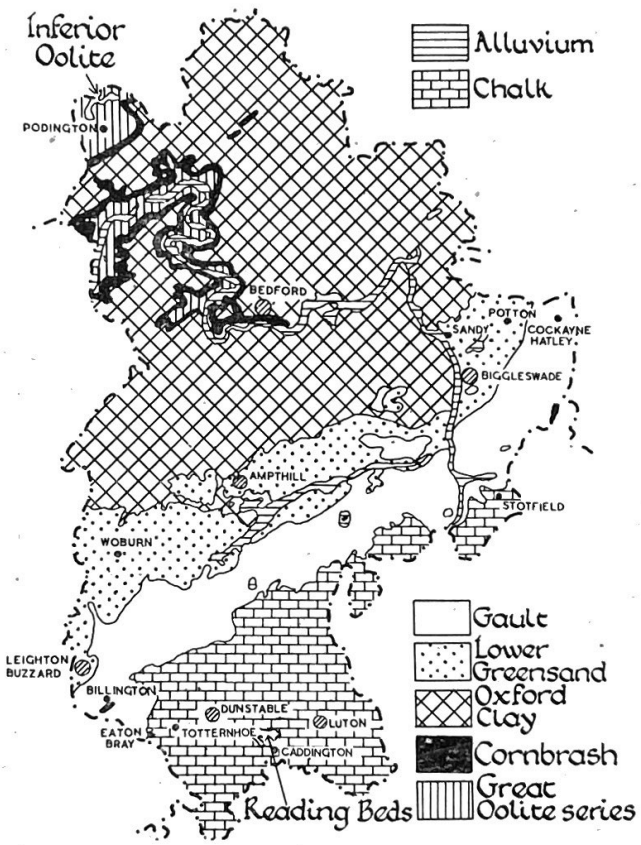


FIG. 1.—The Solid Geology of Bedfordshire.

The extent and importance of superficial deposits, especially the Boulder Clay which extensively overlies the Oxford Clay, should be remembered in interpreting this map.

The foregoing outline of the solid geology will obviously be misleading unless it is remembered that very extensive areas are covered with glacial and other deposits of Pleistocene and recent age. These are so varied and considerable in extent, and play such a large part in determining soils, and therefore the agricultural practice of a region, that they deserve special emphasis here.

Drift Deposits

The Drift deposits of Bedfordshire have not yet been completely surveyed, and since no other accurate information for the whole county is available no attempt has been made to give here a drift map of the county. They include at least three distinct groups of deposit. The Clay-with-Flints has been formed in situ ; there are the glacial deposits of gravel, sand and boulder clay, and the gravels and silts of present and former rivers.

Clay-with-Flints

The Clay-with-Flints is a somewhat stiff, brown and reddish clay overlying the Chalk. It has been formed by solution of the Chalk, leaving the flints in a matrix which largely represents the insoluble residue of the chalk, sometimes mixed with the remains of Tertiary clays. Where it covers the Chalk plateau, it completely changes the character of the region, considerably modifies the soil profile, and results in differences of land utilisation.

Boulder Clay

Although no map is available to show the extensive areas of boulder clay in Bedfordshire, yet it is known to cover a very large part of the county. It is continuous over most of the north, except for the Ouse valley, but is less in evidence south of Bedford, and in the Greensand and Chalk regions it is of minor importance. It is a tenacious, brownish or bluish clay with boulders, and is of a distinctly chalky nature, though it varies greatly in composition and texture, largely according to the parent material and the underlying rock.[1] In the Oxford and Gault clay regions the effect of the admixture is to lighten and improve the texture and composition of the soil, resulting in good agricultural land. The thickness of the Boulder Clay cover varies considerably. At Biggleswade it is 90 feet, whilst in the Ivel valley at Sandy it reaches a thickness of 104 feet ; 30 to 50 feet seems to represent an average thickness.

Glacial gravel and sand

These deposits cover a comparatively small area, mainly in the Ivel valley. Apart from the Blunham district, they are small, isolated deposits occuring as thin cappings on the Boulder clay. In the Blunham area they give excellent yields of market garden produce.

Brickearth

Brickearth occurs in a patch to the south-east of Biggleswade, and is also found overlying the Chalk at Caddington. It consists of a loam and sandy clay, derived mainly from re-sorted Boulder Clay material.

Valley gravel

Valley gravel occurs in a narrow strip south of the Ouse, and expands considerably to the east where it occupies a large area along the Ivel valley. It is often more than a mile in width in the valley of the Ouse. Its composition varies according to its origin, for where the parent material was Greensand the gravel is coarse with a low calcium carbonate content, but with an admixture from the Gault and Chalk areas the resulting gravel is more finely textured. Near Biggleswade and Stanford extensive valley gravel deposits are to be found at higher levels on either side of the Ivel, and they were evidently formed by a much larger river flowing through Greensand country from Flitwick to Shefford. Two areas of finer material (south of Biggleswade on the right bank of the Ivel, and south of Sandy on the opposite bank) are probably of more recent origin, and are due to a mixture of material brought down by the Ivel tributaries which flowed over Greensand, Gault and Chalk country.

[1] See *Report on Huntingdonshire*, p. 416.

As in the case of the Terrace gravels of Middlesex and the London Basin,[1] the soils derived from the Valley gravels in this area give rise to some of the most fertile and productive land of the county in the Biggleswade Market Gardening Region.

Alluvium

The most recent deposit of all, consisting of river mud and silt is to be found in belts of varying width along the flood plains of the principal rivers. Here again the parent material determines the nature of the deposit, but of more importance from the agricultural point of view are height of water table and liability to flood which limit the utilisation of these areas.

B. RELIEF AND DRAINAGE.

A comparison of the relief and geological maps of the county will show the intimate relation between the two, and an appreciation of the foregoing account of the geology is essential for a correct interpretation of the resulting relief.

Apart from the Chiltern Hills in the south, and the Lower Greensand ridge, which are of course notable exceptions, the relief is subdued, and the land gently undulating, with a general slope to the north-east and north to the Bedford Level. The larger part of the county forms a section of the broad low-lying clay vale between the two great escarpments (chalk and limestone) which run from south-west to north-east across the country. Most of the shallow valleys and gently rising hills, as well as the major relief features, tend to follow the strike of the strata. The highest point in the county is to be found on the Dunstable Downs which form part of the Chiltern escarpment, where the land rises to nearly 800 feet above sea level. Like Cambridgeshire most of the county is below the 400-foot contour line, whilst the Ouse valley near St. Neots lies below 50 feet.

Bedfordshire lies almost entirely within the catchment basin of the Great Ouse, which with its tributaries drains north-eastwards to the Wash. These streams are mainly longitudinal, though above the town of Bedford the Ouse and the Ouzel in their middle courses cut transversely across the grain of the country, probably owing to the occurrence of drift deposits in their former courses. Below Bedford the Ouse valley widens considerably to a flood plain, which after its junction with the Ivel, reaches three miles in width. Some very prominent meanders are to be found near Bedford, and these accentuate the marshy character of the whole valley. At Tempsford the Ouse is joined by the Ivel from the south. Rising in the chalk country north of Baldock, this river crosses the Gault clay vale (drained longitudinally by its tributaries) and the Greensand region, before flowing through the market gardening district of Biggleswade. The development of this region owes something to the Ivel, for its productive soils are developed on the sands and gravels deposited by that river in the past.

A drainage map would bring out the difference between the porous Chalk and Greensand regions, and the clay areas with considerable surface water, although the difference is not so great as might be imagined owing to the existence of superficial non-porous deposits over the chalk and sand.

RELIEF REGIONS OF BEDFORDSHIRE

Bedfordshire may readily be divided into four or five major relief regions, but closer examination will reveal the necessity of further subdivision since these regions are not uniform

[1] See the *Report on Middlesex and the London Region*, pp. 130–1.

throughout, and slight changes in topography will result in differences in land utilisation. Thus the Greensand ridge may be subdivided into :

(*a*). The Leighton Buzzard–Woburn Plateau.

(*b*). The ridge between Ampthill and Potton, which is lower and more cultivated.

The relief regions reflect very largely the underlying structure including the superficial

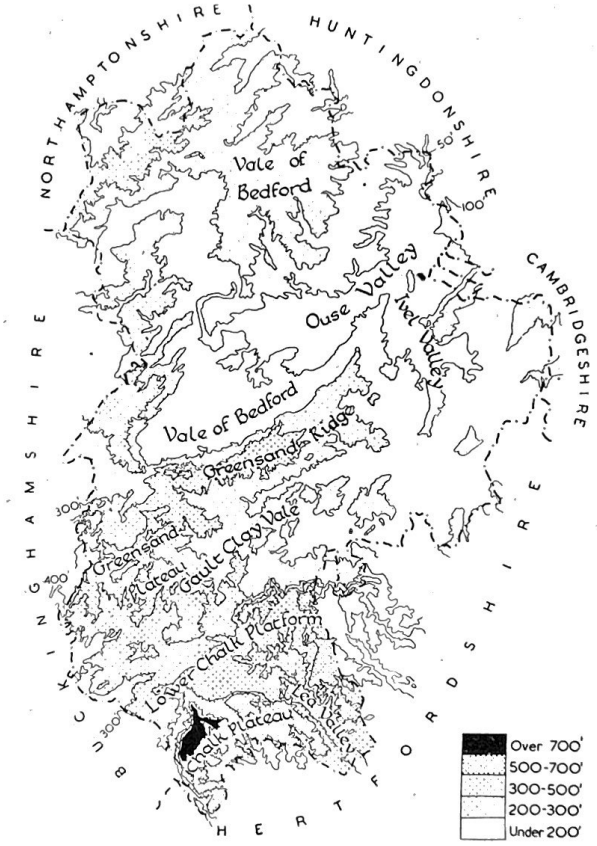


FIG. 2.—The Relief of Bedfordshire.

The extreme east of the county towards Cambridgeshire is also a region of Gault Clay but it lacks the individuality of the Gault Clay Vale. The Vale of Bedford actually extends over most of the north of the county.

deposits, and in consequence it will be found that the Land Use regions described later in this report follow them very closely.

Region 1. The Chalk Plateau

The Chalk Plateau in the extreme south and south-east of the county occupies only a comparatively small area owing to the position of the county boundary which leaves most of the Chilterns in Hertfordshire. Nevertheless the typical features of scarp and dip slope are well developed, though the occurrence of drift deposits, especially east of Luton, means that it is

not always typical chalk country. From the escarpment which is very well marked at Dunstable Downs and Blow's Downs the land slopes gradually south-eastwards into Hertfordshire. It is here between Luton, Dunstable and Whipsnade that the true downland scenery is to be seen, with its bold contours and open landscape. Elsewhere coverings of clay-with-flints, and high level brickearth mask the chalk, and give diversity to the soils, and to land utilisation. Beyond Luton this changed character of the plateau has led to its distinction by Dr. Wooldridge as a "High Level Loam Region."[1]

The dip slope is drained by the Upper Lea, the Ver and the Gade, though the two latter valleys are dry in their upper parts and lead to wind gaps in the escarpment. Apart from these major valleys which are followed by important routes to the Midlands, there is a noticeable lack of surface drainage and many dry valleys occur.

Region 2. The Lower Chalk Platform

Reference to the geological map (see Fig. 1) will show that beyond the Chiltern escarpment the Lower chalk forms a fairly broad platform, often three miles wide, ending in quite a steep secondary escarpment overlooking the Gault clay vale. It extends from Eaton Bray in the south-west to Stotfold, whilst the Icknield Way which runs below the main escarpment roughly between the 400 and 500 foot contours, provides a useful boundary line as well as a suitable name for the region. The underlying rock is chalk marl, and this together with downwash from the scarp and mixture with the Gault where it adjoins this formation, gives it a different character from the chalk dip slope. There is more surface drainage, north-eastwards to join with the streams of the Gault into the Ivel, and westwards to the Ouzel. East of the Hitchin gap in Hertfordshire the platform widens to five miles and becomes known as the Vale of Baldock.[2]

Region 3. The Upper Lea Valley

The upper Lea forms a narrow gap through the Chiltern Hills. It is followed by the L.N.E.R. line to Luton and Bedford, but as a main routeway it is scarcely comparable with the Hitchin gap to the north-east. It is fairly deeply incised into the chalk plateau, and lacks the extensive glacial deposits which characterize the Hitchin area.

Region 4. The Gault Clay Vale

Beyond the platform of the Lower Chalk the character of the country completely changes, and the change is as apparent in land utilisation as in topography. This narrow vale, floored with Gault over which have been spread considerable quantities of drift, extends between the Chalk and Greensand regions, and may be considered as a north-easterly prolongation of the Vale of Aylesbury. As far as Shefford it maintains the character of a vale, but beyond this where it is crossed by the Ivel the country opens out and its individuality is lost.

The surface water of the Gault region is considerable, and the many streams which drain it may originate either in the Chalk or the Greensand country. Drainage is mainly longitudinal to the Ouzel and the Ivel, the divide being in the neighbourhood of Toddington.

Region 5. The Leighton Buzzard–Woburn Greensand Plateau

In Bedfordshire the Lower Greensand forms the well-marked ridge running for 25 miles between Leighton Buzzard and Potton. The Leighton Buzzard–Woburn Plateau extends from the county boundary to Ridgemont and Tingrith and attains a maximum width of about four

[1] Wooldridge, W. S. "Evolution of the London Basin," *Geography*, June 1932.
[2] See *Report on Hertfordshire*, p. 311.

miles. It forms a mass of high ground, reaching over 500 feet in places with a prominent escarpment in the neighbourhood of Woburn Sands and Aspley Guise. The hilly nature of the region with its sub-soil of Greensand and its considerable areas of woodland makes it very attractive country scenically as well as a valued area for settlement—especially for large houses with considerable land.

Region 6. The Greensand Ridge

As one proceeds north-eastwards the Greensand develops into a definite ridge, with a bold escarpment facing north-west, which is particularly striking at Lidlington and Ampthill. Towards Biggleswade the ridge becomes narrower and lower, and is increasingly covered with drift material, until finally the Greensand is completely obscured by Valley gravel deposits of the Ivel. Beyond the river, between Sandy and Gamlingay, it reappears once again, forming a ridge with a well-defined escarpment. In addition to this gap at Biggleswade, the continuity of the ridge is broken also at Flitton, where a tributary of the Ivel has worn away the Greensand, exposing the clay beneath.

The ridge separates two clay regions, and forms the water parting between the Ouse and Ivel drainage.

Region 7. The Ivel Valley

The Ivel enters the county at Stotfold and flows roughly northwards in a fairly well-defined valley to its junction with the Ouse at Tempsford. It is floored with a narrow belt of alluvium flanked on either side by wide stretches of Valley gravel. It flows through the heart of the market garden region, and is followed by the Great North Road, and the main L.N.E.R. line.

Region 8. The Ouse below Bedford

Above the town of Bedford the Ouse occupies a fairly narrow valley, with frequent large meanders, but below this town the valley opens out, with a flood plain more than two miles wide below its junction with the Ivel. Although drainage problems are not so acute as in Huntingdonshire and in the Fens proper, parts of the valley are liable to flooding, and drainage channels have been found necessary, but for considerable stretches arable land is to be found in close proximity to the river.

Region 9. The Vale of Bedford

This broad, gently undulating lowland is by far the largest region, and its topography is most typical of the county as a whole. The greater part lies below 250 feet and presents a somewhat uniform appearance, which tends to become monotonous. Little variety is obtained by superficial deposits, for although they are widespread, particularly north of Bedford, the principal material is Boulder Clay which has little effect in changing the character of the landscape.

The Vale is drained longitudinally by the Ouse which is fed by numerous small tributaries on either side. The Ouse is a sluggish stream bordered by a narrow belt of alluvium, and below Bedford its drop is very gradual as the country opens out.

Region 10. North-western Bedfordshire

Towards the north-west of the county there is a slight rise above the general level of the Oxford clay plain, and the landscape becomes less monotonous with the outcrop of Cornbrash and Great Oolite rocks. Included in this region is the Ouse valley from Harrold to Bedford, where the river has cut down to the older rocks in a series of incised meanders. Apart from

this valley the land is mostly well above 200 feet in height, and really forms part of the Jurassic dip slope.

C. SOILS

" Every soil and every mixture of soil commonly seen on high land in the United Kingdoms may be found in this county, from the strongest clay to the lightest sand." So said Thomas Batchelor some 130 years ago,[1] and what was true then is true of soil conditions today, provided one excludes the typical mountain soils.

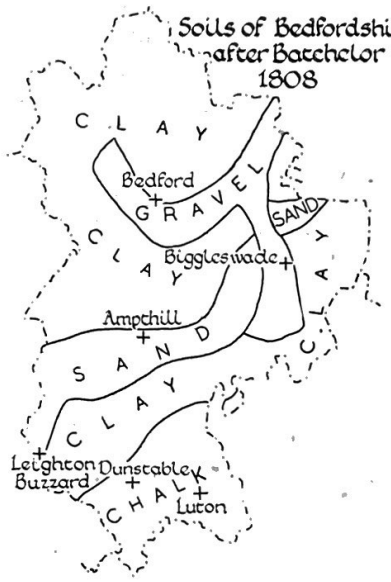


FIG. 3.—The soils of Bedfordshire as distinguished by Batchelor (1808).

The variety is of course due to the different geological strata which outcrop over the county, and especially to the superficial deposits which are often the controlling factor in soil formation. In view of the importance of these deposits in Bedfordshire, it is a little unfortunate that for the greater part of the county no drift map exists. Nor are there any detailed soil studies for the county as a whole; in both these fields valuable work remains to be done. But for one region at any rate—the Biggleswade market gardening region[2]—much detailed and useful information is available. Although the methods of soil analysis employed in that survey are no longer in use today, much of the information is of considerable value and will be found relevant to our study of the region at the present day.

Correlation with the main geological formations should not be carried too far in view of the absence of a detailed soil survey, for many local soil types will be found to exist throughout the county. However, it will be useful to examine the main soil formations developed on the different strata over the county as a whole, and to analyse a little more closely the soils of one particular region. Batchelor's Soil map (Fig. 3) gives a clear idea of the main soil types

[1] Batchelor, Thomas, *General View of the Agriculture of Bedfordshire*, p. 4.
[2] See Rigg, T. " The Soils and Crops of the Market-Garden District of Biggleswade, *Jour. of Agric. Sci.*, Vol. III, Part 4, April 1916.

occurring in Bedfordshire, and although it is rather generalised, it serves as a useful reference for a study of the soils of the county.

Chalk Soils

Where the soil has been derived directly from the chalk its lime content is high, and it is light and easily worked, although its high porosity necessitates constant attention to humus and maintenance of structure. Such true chalk soils occur at Dunstable, Sundon and Streatley, where they are mainly under the plough.

But a large proportion of the chalk surface, particularly the Upper Chalk, is covered by deposits of gravel and Clay-with-Flints, and in consequence the variety of soils is greatly increased. Where sands and gravels overlie the Chalk, adequate water supply is difficult to maintain, whilst on the other hand the soils of the Clay-with-Flints tend to be damp and heavy, and frequently have a covering of woodland. But where drainage is improved by the large number of flints, and an admixture of Chalk, there is a very high proportion of arable land. Reference has been made already to the good loamy soil of Chalk marl formed from downwash from the scarp. It is heavier than the soils of the Chalk plateau, is largely devoted to arable farming, and gives excellent yields of wheat, barley and beans.

Clay Soils

Clay formations cover two-thirds of Bedfordshire, and soils developed on them are typical of the county as a whole. In the south they stretch without interruption from Billington to Cockayne Hatley, giving rise to stiff, tenacious soils, generally wet and badly drained. These heavy clay soils of the Gault, which formerly carried woodland, are now almost entirely under permanent grass. (See Land Use Region Number 3.) Soil structure is more easily preserved in the chalky clay soils occurring near the Chilterns, and since they are lighter and more easily worked they are largely devoted to arable farming. *Boulder clay soils* too are lighter than the pure clay series of the Gault, though they range widely in composition according to the material from which they have been derived, and the nature of the sub-soil.

(*a*) *Pure Boulder Clay*. In Bedfordshire the Boulder Clay is mainly chalky and the soils derived from it have a high content of clay and calcium carbonate and a good percentage of stones and fine gravel. It requires scientific treatment with phosphatic dressings for nearly every crop, but yields of cereal crops are good, and much of the land is devoted to arable farming.

(*b*) *Clay loam*. This is found where Boulder Clay is in association with alluvial deposits, resulting in lighter soils comparable with the brickearth. Where they occur in the Ivel valley near Langford they form good market garden soils.

(*c*) *Sandy loam*. Boulder clay often forms a thin capping over Greensand, and the intermingling of the clay and sand gives a light loamy soil devoted to mixed farming with some market gardening.

In the *Oxford clay* region of Bedfordshire the soil is a very heavy dark brown clay containing the highest clay fraction of any soil in the county. Batchelor (*op. cit.*, p. 12) speaks of it as "a dark poor soil, coming too loose after frosts, infected by the worst of grasses, and of such general properties as to keep the cultivators poor"—a sweeping statement, and yet even today this soil is very difficult to drain, and lies very wet in winter. Fifty years ago fair crops were obtained from it, but the fall in wheat prices led to the reversion to poor pasture land, and even to rough grazing, some of which remains today. The low percentage of calcium carbonate

in this soil makes the application of lime and phosphatic manures (basic slag) essential for any crops or for improving poor meadowland.

From Bedford northwards to the county boundary the surface is uniform, and the soil a brownish clay derived from the drift overlying the Oxford Clay. The chalky nature of the Boulder Clay tends to make the soil comparatively light and marly, and gives a higher proportion of arable land than is to be found in the south.

In the extreme north-west the rocks of the Middle Jurassic series give rise to clays that are tenacious and wet, and generally there is a greater proportion of pasture than arable land. In the same part of the county the red, ferruginous soils of the Cornbrash occur in limited areas, and are relatively productive compared with the surrounding clays.

Greensand Soils

The soils of the Lower Greensand are in striking contrast to those of the rest of the county. They are described by Batchelor as being too hilly for cultivation, and it is true that there remain today large areas of forest and heathland, as well as plantations of fir and larch, although much of the lower land has been cleared for market gardening. Lack of available plant food in the soil (*cf.* Folkestone Beds) seems to be the chief drawback, and the marl or clay needed for improvement is generally to be found only at inconvenient distances. Reference should be made to the ferruginous peats of Tingrith, Flitton and Flitwick which have accumulated on the marshy ground along the valleys of the Ivel tributaries.

In the Biggleswade area the sandy soils derived from the Greensand and the drift deposits form the basis of the market gardening industry. Their value for this specialized farming lies in their lightness, and the ease with which they can be worked and manured. Long years of experience in the treatment of these soils, and the constant large-scale application of manures has maintained the organic content, and in many cases the available plant food is in excess of requirements. For many years daily trains ran from London with trucks full of street "sweepings". The best garden land in the county is said to be that of the Greensand near Sandy, where the wash of finer material from the plateau above increases the depth of soil and gives a more uniform texture, with fewer stones and gravel.

Valley Gravel Soils

The soils of the Valley gravels, which almost cross the county in a narrow belt south of the Ouse, vary according to their location and age. Where derived from Greensand they are rather coarse gravel sands low in calcium carbonate, but the more recent deposits at lower levels nearer the rivers are darker and more loamy. Just south of Bedford, and again in a belt from Biggleswade through Wyboston to Eaton the gravel sub-soil is covered with a great thickness of black mould or red-brown earth, which has proved very fertile and yields ample crops. Where the gravel occurs near the surface the upper soil is too sharp and generally too dry, and whilst products typical of lighter land can be grown, it is not suitable for crops like wheat and beans. Near the Ouse the admixture of flood plain alluvium gives a higher clay fraction to the soil, and the land is occupied by water meadows which now support a plentiful though rather coarse grass.

The soils of the more recent Valley gravels which are found near Biggleswade and Sandy are the most productive of all the market garden soils. They are rich, light loams, derived from the mixture of material brought down by the Ivel tributaries which have crossed Greensand, Gault and Chalk country. Therefore they do not usually lack lime, and the organic matter content is higher than for other soils of the series. There are sufficient of the finer

particles to prevent drying out in summer, and since they are underlain by gravel there is little trouble with drainage. Small wonder then that these are the soils which according to Batchelor have been devoted to market gardening for centuries.

Other Soils

Of the remaining soil types Glacial gravels may give rise to cool, good-working loams heavier than the Valley gravels, or they may sometimes occur as thin cappings on Boulder Clay. Brickearth soils consisting of brown, heavy loams are found only in limited areas, but are specially suited to small seeds, such as onion, carrot and parsley. In narrow belts along the river valleys soils of the alluvium give good quality meadowland, though liability to flooding may restrict their use.

The Soils of the Biggleswade Market Gardening Area [1]

We are dealing here with the most productive part of the county where the highly specialized farming which goes on requires a thorough analysis and understanding of soil conditions. Within the area under consideration there are considerable soil variations, and these exercise a controlling influence on land use, for market garden crops are susceptible to even slight differences in the soil. In this more detailed account it will be found that the underlying geological formations give rise to what are called the soil series, which are of similar mineral structure to the parent material, whilst each series may be sub-divided into soil formations, each with different agricultural properties. Mechanical and chemical analysis have shown that there is uniformity between soils of the same formation, and has justified the following classification :

Soil Series and Formations.

1. Oxford Clay series giving two formations :
   - (*a*) Pure clay soil.
   - (*b*) A clay loam.
2. Greensand :
   - (*a*) Dark sands.
   - (*b*) Brown sands.
3. Gault Clay :
   - (*a*) Pure clay soil.
   - (*b*) A sandy loam (known locally as " Redland ").
4. Boulder Clay :
   - (*a*) Pure Boulder Clay soil.
   - (*b*) Heavy loam.
   - (*c*) Sandy loam.
5. Brickearth soils.
6. Glacial series.
7. Valley gravels :
   - (*a*) A brown soil (Old Brown).
   - (*b*) A heavy brown soil.
   - (*c*) A more recent dark soil (New Dark).

In the main the soil series coincide with a geological formation. Several agencies may have been responsible for producing the different soil formations :

[1] Based on the account by Rigg, *op. cit. sup.* " Series " is here used in the older sense and not in accordance with the modern classification based on the soil profile.

1. River wash depositing coarser grained material on the clays leading to more loamy soils.
2. Slight changes in the upper and lower beds of a geological formation (e.g., Greensand, or in another part of the county, the Chalk).
3. Variation in the depth of the Boulder Clay cappings. A thin deposit over Greensand will give a sandy loam.
4. Variation in the type of material deposited by different river systems (e.g. in the Valley gravel series).

Comparison of the two maps—of geology and soil formations (Figs. 17 and 18)—will bring out the relation between them, and of equal importance, the differences.

The pure clay soil of the Oxford Clay series covers a considerable part of the low-lying plain north of the Greensand scarp, whilst the Clay loam soil is limited to a much smaller area along the Ivel valley north of Sandy. The two formations differ in the percentage of the clay fractions which they contain, and consequently in texture. The clay loam soil which is due to the intermixture of alluvial wash with the underlying clay, contains more sand and is therefore lighter, and far more amenable to the plough. Although it is not really a suitable market gardening soil, with the application of soot and a light dressing of dung, good crops of mangolds, wheat, oats and certain vegetables are produced. It should be clear then that the difference in the land utilisation of these two soils is sufficient justification for treating them separately, and it would be misleading to class them together simply as the Oxford clay soils.

The Dark sand and Brown sand formations of the Greensand series seem to be due to a variation in the Greensand itself. The Brown sand has a larger proportion of coarser particles and more available plant food, and is therefore almost entirely devoted to market gardening, producing large crops of early potatoes. Owing to the coarser nature of the soil there is little rise of water from the sub-soil, and the success of the crops will depend largely on the amount of rainfall during the period of growth. The area of Brown sand stretches from Everton through Potton to Gamlingay, while the Dark sand occurs on the scarp between Sandy and Everton and extends some distance southwards. The Land Utilisation map confirms the distinction between these two Greensand soils, for whilst a good deal of heath and woodland is to be observed on the darker soil, further north on the Brown sand the land is almost entirely arable.

The two soil formations of the Gault series show similar differences in composition and texture. The pure clay is the typical heavy soil always associated with the Gault, whilst the Redland formation is a coarse sandy loam due to the surface wash of Greensand over the clay. Both are found only in narrow belts. The Gault occurs west of the Boulder Clay hills between Cockayne Hatley Wood and Sutton, whilst Redland soil occupies a quarter of a mile wide strip between this and the Greensand. A higher content of calcium carbonate distinguishes the pure Gault from the soils of the Oxford Clay, whilst its higher percentage of clay makes it heavier than the soils of the Boulder Clay. It is too heavy for market gardening and is generally farmed in conjunction with the lighter land surrounding it. Redland soil varies in texture and composition, and may be classified somewhere between the two soils which it separates. It is deficient in calcium carbonate, and is not suitable for market gardening since it is too wet and is liable to cake under a hot sun. Mangolds, kohlrabi, oats, wheat and barley all give good yields on this soil.

The soil formations of the Boulder Clay series have already been discussed, whilst those of the Glacial series and Brickearths are fairly uniform throughout. Glacial gravel soils may be described as loams, and have a good calcium carbonate and potash content, but cannot be

cropped so heavily as the Valley gravels. Nevertheless they are rich soils giving high yields of wheat and other cereals, and excellent crops of strawberries. In the Blunham Glacial gravel area market garden crops such as peas, runner beans and brussels sprouts are extensively grown. Isolated patches of gravel occurring over Boulder Clay are often to be found on large farms which contain heavier land as well, and the farmers may either go in for market gardening themselves or sub-let their best fields to tenants.

Reference to the map (Fig. 18) will show that of the Valley gravel soils the Old Brown is the most extensive, and considerable local differences occur in this. Thus on the Biggleswade plateau the heavy manuring with London dung has noticeably increased the organic matter content, and in spite of the long continued production of market garden crops, good yields of carrots and parsnips are still obtained. The soils of the Stanford-Broom plateau have a smaller percentage of organic matter, and more stones and fine gravel, and because of this a thin hard cake is liable to form on the surface making it unsuitable for crops requiring a good seed bed. The Biggleswade Common plain and the Ouse gravels give soils similar to those of the Stanford–Broom plateau, though owing to the wash of Greensand material from the scarp the surface soil is more uniform in texture. Where the gravel comes near to the surface market gardening is precarious in dry seasons.

In general the Old Brown soil formation will give good crops of late and early potatoes, brussels sprouts, peas and spring cabbages, whilst a considerable acreage is farmed for mangold seeds, cereals and clover. The large owners, who concentrate on market garden crops, generally winter a number of cattle for the sake of the dung. The rivalry between the market gardeners of Biggleswade and Potton for priority in the market emphasises the importance of soil control in this highly specialised district. The Potton market gardeners on the Brown sand formation can put their early potatoes on the market a fortnight sooner than the farmers of Biggleswade, where the heavier soil retains the water and holds up growth.

The heavy brown soil occupies a much more limited area, stretching north of Southill to Upper Caldecote. It is characterised by larger amounts of clay and fine silt, and a higher percentage of mineral salts. Market gardening crops are grown, and the farming practice is similar to that of the Old Brown formation.

The New Dark soil formation to which reference has already been made (see p. 113) is entirely given over to market gardening, and is the most productive soil of the region. It is darker, more loamy and younger than the other Valley gravel soils, has been well manured with London dung and soot, and gives crops of better appearance and yield. It is found in an almost continuous strip along the Ivel valley, first on the right bank and then on the opposite bank as far as its junction with the Ouse. A third area occurs further north around St. Neots. Brussels sprouts, early and late potatoes, onions, carrots, parsnips, spring cabbages, parsley, peas and beans are all grown on the New Dark soil.

D. THE CLIMATE OF BEDFORDSHIRE[1]

Rainfall

The accompanying map shows the average annual rainfall over Bedfordshire for the standard period 1881–1915. This varies from about 22 inches in the Ouse Valley below Bedford and south of Biggleswade to about 28·5 inches over the Downs south of Dunstable. Bedfordshire is one of the driest counties in Great Britain, the general rainfall amounting to 24·1 inches.

[1] Supplied by the Director of the Meteorological Office, Air Ministry.

The only drier counties are Huntingdonshire, Essex and London with general rainfalls of 22·5, 23·5 and 23·7 inches respectively.

The distribution of the average monthly rainfall at Woburn is given below :—

AVERAGE MONTHLY RAINFALL (1881–1915)

	Jan.	*Feb.*	*Mar.*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Woburn, 291 feet.	1·71	1·48	1·72	1·50	1·94	1·96	2·23	2·31	1·79	2·67	2·24	2·34

Year . 23·89

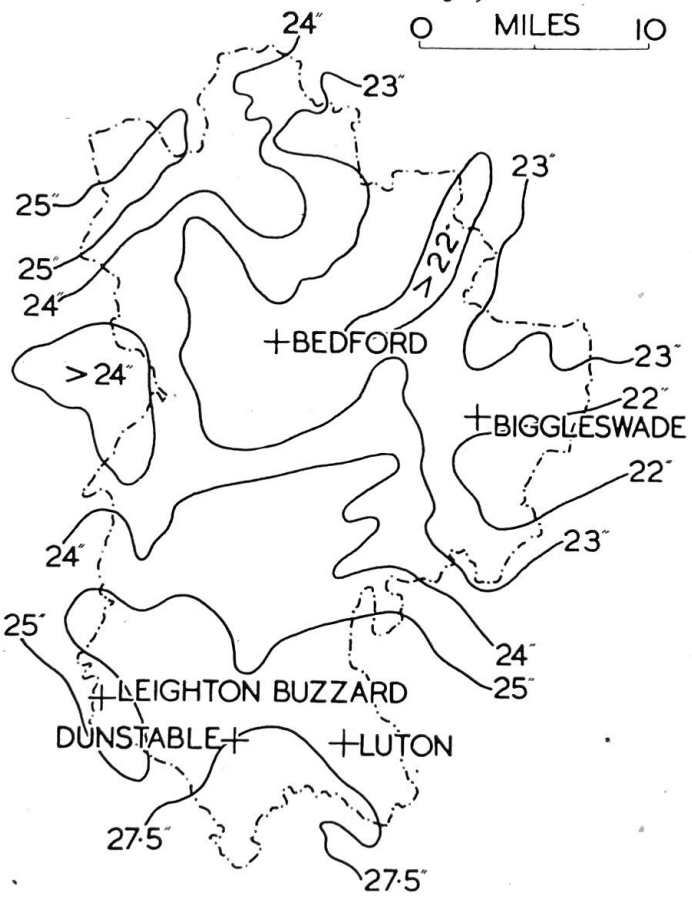


FIG. 4.—Bedfordshire. Average Annual Rainfall.

The month of maximum rainfall is October, and February is the driest month, although April *days* are drier. If the rainfall of groups of three consecutive months be considered, the greatest contrast is between October, November and December with 30 per cent. of the annual average and February, March and April with only 20 per cent. The rainfall of the winter six months (October to March) is slightly greater than that during the summer half-year. The driest year over the county since 1868 was 1921 when there was 14·19 inches or 59 per cent. of the average at Woburn ; the wettest year was 1903 with 34·47 inches or 144 per cent. The

heaviest daily rainfall recorded in Bedfordshire occurred on 20 May, 1924 when there were severe thunderstorms in this part of the country. At Shefford the total for the 24 hours commencing at 9h. G.M.T. on 20 May was 3·81 inches of which 2·25 inches fell in 2 hours.

The average annual number of days with thunder over Bedfordshire varies from about 10 in the north to about 14 in the south. The occurrence of days with thunder shows a marked concentration in the warmer months and at Woburn (1901–30) 73 per cent. of the days with thunder occurred during the 4 months May to August and 82 per cent. during the 5 months May to September. Over the British Isles the variation in the annual totals ranges from about 2 in north-east Scotland to more than 20 in parts of eastern England and the Midlands.

The mean annual number of days on which snow or sleet was reported is about 17·5 for the county as a whole. This figure is based on data which have been reduced to sea-level by reducing the observations by one day for every 50 feet above 200 feet, and the actual number of days with snow or sleet is therefore greater in the south of the county than the north. The mean annual number of mornings on which snow was reported as lying over half or more of the surrounding countryside was rather less than 10 in the northern half of the county and rather more than 10 in the southern half.

Temperature

The table below gives the mean, mean maximum, mean minimum and mean range of temperature at sea-level at Woburn. The values have been corrected for altitude by adding 1°F. per 300 feet above sea-level to the temperatures obtained from thermometers exposed in a Stevenson screen.

TEMPERATURE AT SEA-LEVEL °F. 1901–30
WOBURN, 291 ft.

	Mean	*Mean Daily Max.*	*Mean Daily Min.*	*Range*
January	39·9	45·0	34·8	10·2
February	39·8	45·6	34·0	10·6
March	42·5	49·7	35·3	14·4
April	46·4	55·0	37·8	17·2
May	53·3	62·8	43·7	19·1
June	57·5	66·9	48·0	18·9
July	61·4	70·7	52·1	18·6
August	60·9	69·7	52·0	17·7
September	56·5	65·3	47·7	17·6
October	50·3	57·7	43·0	14·7
November	42·9	49·0	36·7	12·3
December	40·5	45·6	35·5	10·1
Year	49·5	56·9	41·7	15·2

During January and February the mean sea-level temperature over Bedfordshire is less than 40°F. and the county is as cold as Cape Wrath which is more than 6° further north. In July the mean sea-level temperature is between 61°F. and 62°F. and the annual range of mean monthly temperatures is thus about 22°F. This high range of temperature indicates the comparative continentality of the climate of Bedfordshire. This is also emphasized by the high monthly and annual mean range of temperature which are among the greatest recorded in the

British Isles. The extreme temperatures which have been recorded at Woburn since January 1908 range from 1°F. on 30 December, 1908 and 9 February, 1919 to 94°F. on 9 August, 1911. The coldest months over the county as a whole were probably January 1940 and February 1895 with mean temperatures of less than 29°F. or some 10°F. below the average. The warmest month was probably July 1900 with a mean temperature of about 67°F. which is 5°F.–6°F. above the average. It will be seen that there is a much greater deviation from the mean during these coldest months than during the warmest months.

Some information is available concerning the occurrence of the first and last days with temperatures of 32°F. or less in the screen. At Woburn, the 84 days 21 June to 12 September, were completely frost-free during the period 1901–5 and 1910–30. The variation in the annual period without a screen-frost ranges from 118 days in 1914 (29 May to 23 September) to 191 days in 1916 (9 April to 16 October).

Sunshine

The mean daily sunshine at Woburn and Luton for each month and for the year is given below :—

MEAN DAILY SUNSHINE IN HOURS

Station and Period	*Jan.*	*Feb.*	*Mar.*	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*
Woburn												
1906–35	1·64	2·39	3·72	4·75	6·04	6·40	5·85	5·72	4·76	3·29	2·06	1·20
					Year	3·99						
Luton												
1921–35	1·62	2·28	4·13	4·40	6·12	6·85	6·56	5·98	4·94	3·53	1·93	1·35
					Year	4·15						

Over the county as a whole the annual mean daily sunshine is close to 4 hours as compared with 5 hours in the sunniest parts of the country along the south coast and less than 3 hours in the interior of northern Scotland and in the industrial district of south Lancashire. December is the dullest month with about 1·25 hours of bright sunshine and June the brightest month with more than 6·5 hours over much of the county. An indication of the order of the extremes which are likely to be experienced is given by the monthly means for February 1940 with 0·8 and 0·6 hours at Woburn and Luton respectively and July 1911 when the corresponding values were 9·6 and 10·2 hours.

III. LAND UTILISATION IN BEDFORDSHIRE

THE classification adopted by the Land Utilisation Survey is such a comprehensive one that the published maps present a complete picture of the country surveyed. According to the Ministry of Agriculture statistics a very large proportion of land in each county is unaccounted for, but under the present survey every acre and fraction of an acre is included in one or other of the categories.[1]

[1] See Appendix I.

Even from a casual inspection of the maps several important and significant facts may be noted. Apart from the urban centres of Luton and Bedford the predominantly rural nature of the county is obvious. Of the total population of 220,525 for the whole county in the 1931 Census, Luton (70,440) and Bedford (42,606) contain 50 per cent. Roughly 16 per cent. of the occupied male population is engaged in agriculture, a very high proportion compared with only 8·5 per cent. for the country as a whole. This rural characteristic is most striking in the north, where villages are much more scattered, and first class roads non-existent.

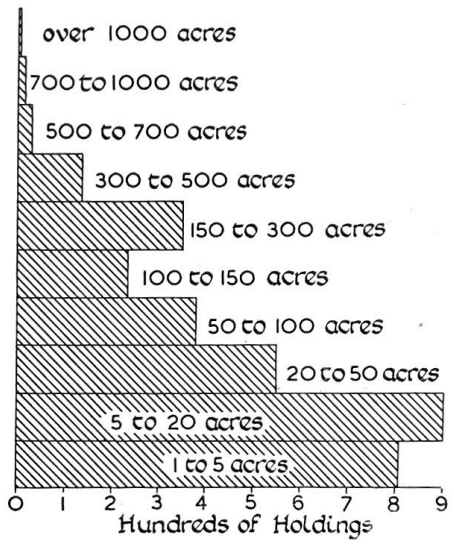


FIG. 5.—Size of Holdings in Bedfordshire.

More than half the holdings are under 20 acres in area, a reflection of the high proportion of small market gardens.

Like Huntingdonshire and the Isle of Ely,[1] Bedfordshire is a county of small farms. The diagram (Fig. 5) shows that more than half the holdings are less than twenty acres in extent. This is of course exceptional, and is largely accounted for by the smallness of the market gardening holdings in the east of the county where land is valuable.

The high value of much of the agricultural land of Bedfordshire must be emphasised. In a recent study of the fertility and productivity of land in Britain, Dr. Stamp attempts a classification of land according to its agricultural value, and Bedfordshire is seen to contain some of the best land in the country. No land in the county falls below the " intermediate " standard, whilst the whole of the east is of high agricultural value, with the Biggleswade and Greensand market gardening area conspicuous as land of the highest agricultural value. Reference has already been made in the Introduction to the map of Farming Types to show the transitional nature of Bedfordshire as one goes from east to west. There is adequate confirmation of this when one examines first the Land Utilisation map, which shows a steady, well-marked decrease in arable land towards the west, and second the Land Fertility map, which illustrates the fall in the quality of agricultural land in the same direction.

[1] See *Report on Ely*, p. 282.

The comparatively small amount of heathland, the outstanding wooded nature of the Greensand ridge, the arable concentration around Biggleswade all appear with startling clarity. The south-west to north-east zoning of the agricultural belts in conformity with the geological outcrops which occurs in the south of Bedfordshire shows up in contrast to the more haphazard pattern of land use towards the north.

It is now necessary to analyse in greater detail the land utilisation of the county, and for this purpose each type of land will be dealt with in order.

A. ARABLE LAND

Arable land in Bedfordshire occupied 46·5 per cent. of the total area under crops and grass for the year 1938, almost as much as the total grassland acreage. But although over the county as a whole there are roughly equal amounts of grass and arable land it is only in certain areas that the balance is preserved. Elsewhere there is a marked predominance of one type or the other (see Fig. 6).

The greatest concentration of arable land occurs in the east along the Cambridgeshire border, and reference has already been made to the marked decrease in this type of land towards the west. Cambridgeshire with three times as much arable as grass is typical of the agriculture of eastern England, whilst on the other hand Buckinghamshire and Northamptonshire show a definite predominance of meadowland, and therefore belong to the southern Midlands type.

In an analysis of the arable land of Bedfordshire it should be remembered that both rotation grass and market gardening are included in this category, and that the intensive market gardening area of Biggleswade accounts for a very large proportion of this arable land. Both the quality and the value of the arable land vary very considerably, and there is no comparison between the highly developed market garden regions and the cultivated clay lands of the Vale of Bedford.

Distribution of Arable Land

From the map showing the distribution of arable land the following areas stand out :

1. *The Biggleswade Market Gardening Region.*

This extends from Henlow in the south, along the Ivel and Ouse valleys, to Eaton Socon in the north. Apart from the river valleys and a few isolated patches of meadowland, arable land is continuous over the whole area, and stretches away eastwards into Cambridgeshire to link up with the typical arable lands of East Anglia.

2. *The Icknield Loam Belt.*

Though by no means a continuous stretch of ploughed land, this belt does stand out quite clearly on the Land Utilisation map. From Eaton Bray in the south-west it can be traced through Streatley, Upper Stondon and Stotfold and into Cambridgeshire, with the percentage of arable land increasing to the north-east.

3. *The Greensand Ridge from Ridgemont to Shefford.*

The marked development of ploughed land on the Greensand ridge is better seen from the coloured Land Utilisation map, rather than from the black and white outline map reproduced here. For it is significant and striking in contrast to the well-marked zones of pasture land on either side, and although the proportion of cultivated land is greater than that of any other single type, this is essentially an area of mixed utilisation.

4. *The Chalk Plateau east of Luton.*

To the east of Luton there is a slight though definite increase in the proportion of arable land. This is probably due to an increase in the extent of superficial deposits overlying the Chalk, which give rise to soils of a more loamy character.

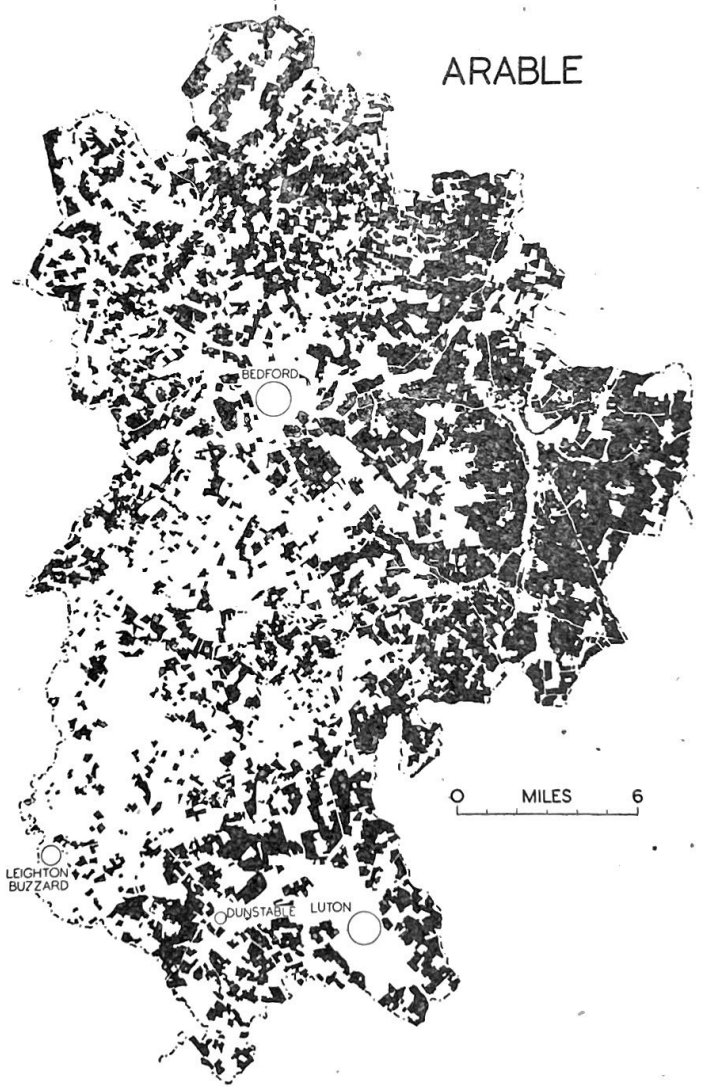


FIG. 6.—The Distribution of Arable Land in Bedfordshire.
The marked concentration in the east (Market Gardening Region and Eastern Clay Region) is very striking.

5. *Northern Bedfordshire, between Sharnbrook and Little Staughton.*

Here again the concentration of arable is not especially well marked, for the heavy Oxford

and Boulder Clay soils of this region are not comparable with the more fertile soils of the county. The somewhat higher proportion of land under the plough which is noticeable here, is not so much due to soil differences as to the increased elevation and the consequent improvement in the drainage. In attempting to account for the distribution of arable land depicted on the map it is rarely possible or wise to limit the discussion to one factor only. Soil, climate, elevation, drainage and economic factors all play their part and are inter-related.

In Bedfordshire at any rate soil is generally the determining factor, though the greatest concentrations of arable land will often be on easily worked soils, and not necessarily on the most fertile. Particularly is this the case in the Biggleswade and Sandy district, where the lighter sandy soils of the Greensand and the mixed Glacial soils are of the utmost importance to the market gardener. The mixed soils which often occur at the junction of two geological outcrops, or in relation to drift deposits will increase the value of the land. This is true of the Icknield Loam Belt, and of those areas where chalky Boulder Clay overlies Oxford or Gault clay. Near Caddington, where the Chalk is covered by Brickearth deposits there is an increase in the proportion of arable land.

In only one or two parts of the county is cultivation limited by elevation or steepness of slope. The highest parts of the Chalk scarp, where gradients are rather steep, and parts of the Greensand ridge are too hilly for arable land. On the other hand certain areas are too low-lying and in consequence badly drained and very damp, and there is a predominance of meadow-land and in extreme cases rough pasture. Examples of this type may be found in the Gault clay vale and in the Ouse valley.

Economic factors must be analysed and explained if a complete understanding of the existing arable pattern is to be obtained. The paucity of cultivated land in the south and west is not solely due to soil conditions, but is also a reflection of the change over from arable to grass-land characteristic of the country as a whole.[1] The large and increasing amount of arable land around Biggleswade, and indeed along most of the Greensand ridge is to be explained at least in part by the increasing demand for market garden produce.

To a more limited extent transport facilities, especially for market garden and dairy produce, may affect land utilisation. With fast and frequent services both by rail and road greater specialisation is possible, and the all-important manures and feeding stuffs can be brought as return freights.

Changes in Arable Land

The decline in the amount of arable land in Bedfordshire has been more or less offset by a corresponding increase in permanent grassland, so that the total area of agricultural land has fallen only slightly in the last 70 or 80 years. The comparative stability is due to distance from London, and from any other large urban centre, and the problem of conflicting interests of builder and farmer has hardly arisen here. In Middlesex and the London region agricultural land is now one third of its area in 1866, whilst even in Hertfordshire there has been a loss of over forty thousand acres in the same period.

Apart from a temporary sharp rise in the latter part of the 1914–1918 war, the drop in arable land in Bedfordshire has been continuous, and for the first time in 1932 the arable acreage was exceeded by that of permanent pasture, a position which will soon be reached in the neighbouring county of Hertfordshire.[2]

[1] See *Report on Middlesex and the London Region*, "Changes in the Chilterns Mixed Farming Region."
[2] See *Report on Hertfordshire*, p. 321.

Types of Arable Farming

According to the Farming Types map there are two definitely arable types which occur in Bedfordshire, and these are of course to be found in the east of the county.

1. *Corn and Sheep supplemented by Cash Crops.*

In Bedfordshire this region stretches from Streatley to Stondon, though any exact delimitation is not possible. The same type of farming extends over into Hertfordshire, and the whole belt continues north-eastwards to link up with the arable belt of Cambridgeshire and East Anglia. It roughly corresponds to the Lower Chalk platform to which reference has already been made.

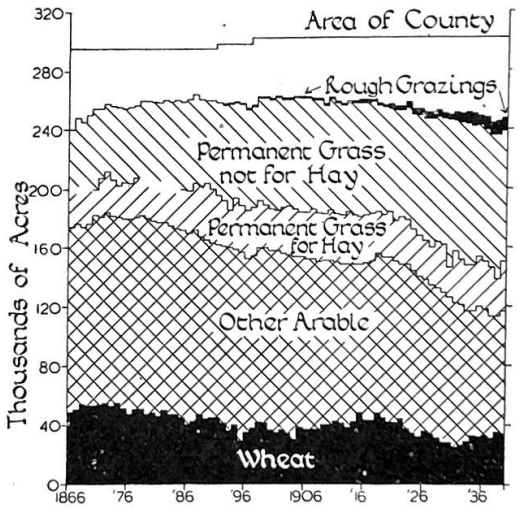


FIG. 7.—Changes in Land Utilisation in Bedfordshire 1866–1938.
(*Based on statistics of the Ministry of Agriculture*)

Since the 1914–1918 war the decline in the amount of Arable Land has been very marked, and for the first time in 1932 the arable acreage was exceeded by that of permanent grassland. In spite of this steady decrease of arable land the acreage under wheat has not fallen to anything like the same extent.

2. *Market Gardening.*

This is the type of farming associated with the sands and gravels of the Biggleswade district, and it is the most distinctive type in the county. It is coincident with the Land Use Region Number 7 described later in this report.

Apart from the predominantly pasture regions of the clay vales, over the rest of the county farming is of the intermediate type, with emphasis on some particular activity. The proportion of arable land varies on different farms, but there are nearly always crops of wheat, oats and beans in addition to root crops and fodder crops for the livestock.

Crop Farming in Bedfordshire

As wheat and bean land Bedfordshire has always had a reputation, and although the acreage under both these crops has decreased considerably in the last seventy years, the reputation is

still deserved. Whilst the heavy clay soils have no doubt been the determining factor, climate and topography have also played their parts though to a lesser degree than in the counties further east.

The following table shows the relative importance of the main crops in Bedfordshire for the year 1938.

Crop	*Percentage of Arable Land occupied*
Wheat	31·35
Oats	9·65
Potatoes	9·65
Brussels Sprouts[1]	8·97
Beans	4·7
Barley	4·1
Peas	3·2
Clover and Rotation Grasses	6·06
Cabbage, etc. (Human consumption)	1·5
Orchards	1·47
Mangolds	1·3
Cabbage for fodder, kohl-rabi and rape	1·0
Sugar beet	0·8

Wheat, oats and potatoes occupy fifty per cent. of the cultivated land. It should be remembered that the position of crops in the above table is not necessarily an indication of their relative importance, for acreage alone may be misleading. The type of crop must be taken into account. Brussels sprouts are infinitely more important cash crops than wheat or oats, whilst the relative importance of crops like mangolds and turnips is not indicated by mere figures of acreage.

Bedfordshire has always afforded a great variety of crop courses (see p. 178), ranging from three to six-year rotations and often longer. Today, however, most farmers seem to adopt the four or five-course system with periods of fallow when necessary on the poorer lands. A farm on the medium to heavy clay land of the Vale of Bedford used the four-year course as follows : wheat—beans—clover—roots (or fallow), whilst at another farm in the Chalk country the five-year course adopted was : oats (barley or wheat)—seeds—wheat—winter oats—roots (or fallow).

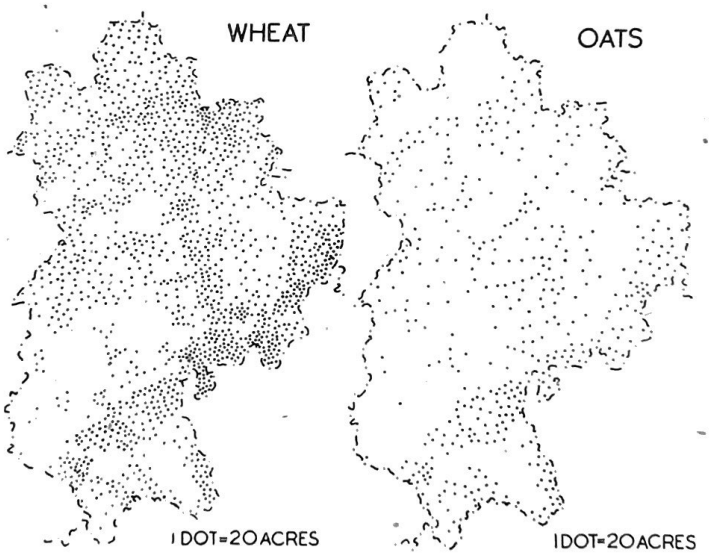
Maintenance of soil fertility and humus content, so essential for continuous cropping, is achieved by the application of artificial fertilisers (phosphates, sulphate of ammonia, basic slag), though these have never proved equal to farmyard manure. In the past London provided loads of manure and soot especially for the market gardening region of Biggleswade.

Wheat. The outstanding importance of wheat in Bedfordshire is obvious from a glance at the preceding table. In 1938 not only did it occupy 31·35 per cent. (35,915 acres) of the arable land but it had no rival. The next crops in order of importance (oats and potatoes) each took up only 9·65 per cent. of the arable land of the county.

As in the neighbouring counties of Cambridgeshire, Huntingdonshire and the Isle of Ely wheat is the mainstay of the Bedfordshire farmer. Some land on each of the farms visited (see below, Section on Land Use Regions) was devoted to it, and in most localities it was the chief crop. The dot map (Fig. 8) shows clearly its wide distribution over the county as a whole, and a closer inspection indicates the areas of greatest concentration which show a very marked correlation with soils. These areas include the whole of the Eastern Clay Region, the Lower Chalk marl of the Icknield Belt especially in the neighbourhood of Gravenhurst and Shillington, the Clay-with-Flints areas in the south, and the northern part of the Vale of Bedford where Boulder Clay overlies the Oxford clay. Only in the Greensand region and the Gault clay vale

[1] This represents more than a quarter of the total English production.

where soils are unsuitable, and in parts of the market garden region where other crops are more profitable, is there a noticeable falling off in the acreage under wheat. There is a contrast between the north and south parts of the Vale of Bedford, for the Boulder Clay soils of the north are very suitable for wheat when adequately drained, whilst the heavier soils of the southern part tend to be left in grass for dairying. Climatic conditions which are fairly uniform over the northern and eastern parts of the county are favourable, though prolonged spells of rain in late winter and spring will make the heavier clay soils cold and therefore late. Thunderstorms too may have disastrous effects on the harvest, and these account in part for the yearly fluctuations in the wheat yields.



FIGS. 8–9.—The Distribution of Wheat and Oats in Bedfordshire in 1937.

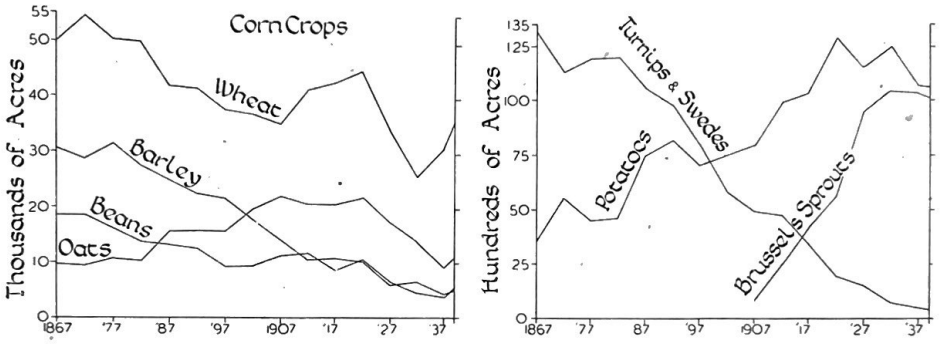
The decline in the total arable acreage in the last seventy or eighty years is reflected in a corresponding decrease in the amount of land under wheat. The graph (Fig. 10) shows the changes in five-yearly periods from 1867. The very low figure for 1932 due to the world trade depression, and the sharp increase in recent years after the wheat subsidy of 1931 reveal the important part played by economic factors.

Oats. Though of far less importance as a cereal crop in Bedfordshire oats is widely grown over the county. The actual distribution follows closely that of wheat, though there are no areas of outstanding importance except for the Chalk marl region. In the last twenty years the acreage under oats has dropped considerably, for in comparison with wheat and barley it is a less profitable crop and today it is grown mainly for feeding to livestock.

Potatoes. In 1938 potatoes with a slightly larger acreage than oats, ranked as the second crop of the county. Though not comparable with the extremely large production of Lincolnshire and the Isle of Ely, Bedfordshire provides a very important contribution to the potato harvest of the country. Unlike the two crops already considered potatoes are not grown extensively over the whole county, but show a well-marked concentration in the market garden region of the east, with an extension westwards along the Greensand ridge, and on the peaty soils of

Flitwick. They are grown also on the gravels along the Ouse valley, and on the Chalk marl near Shillington and Stotfold. The correlation with the lighter soils and the absence of potatoes on the heavy clays of the north and Clay-with-Flints in the south are very striking features of the distribution.

The large scale production in the east is essentially part of the specialisation associated with the market garden region, and most of the crop reaches the London markets, as well as some of the northern markets, both by road and rail. First earlies constitute nearly thirty per cent. of the total crop, a very high proportion in comparison with other counties. Only two others, Cheshire and West Sussex, show a higher proportion. The light, warm soils of the Greensand and Valley gravels largely account for this, though an important controlling factor is the incidence of late spring frosts.

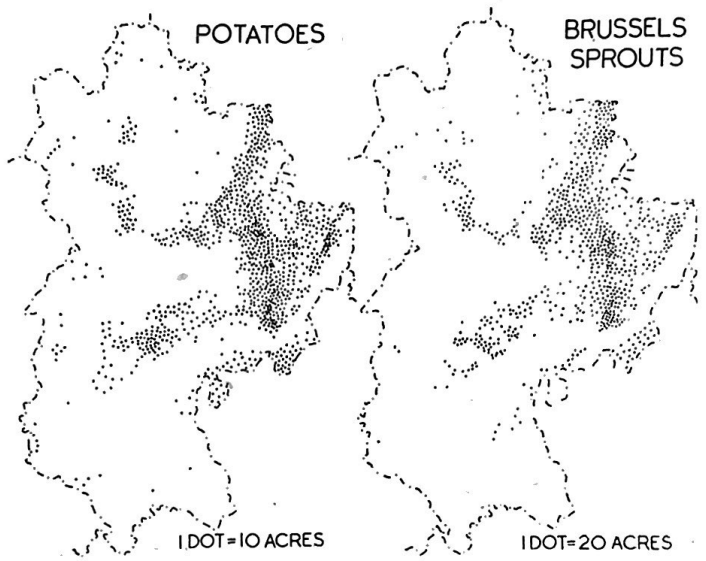


FIGS. 10–11.—Crop changes in Bedfordshire
(*Based on the statistics of the Ministry of Agriculture*)

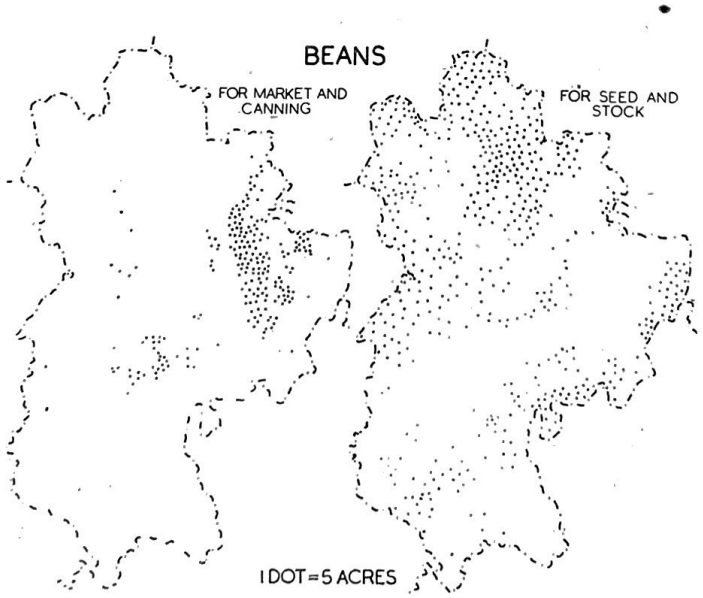
In his study of the relation of crops to soil formations in the Biggleswade area Rigg has shown in a very impressive manner how close is the connection between certain crops and soils. Early potatoes he finds almost entirely confined to the Greensand and Valley gravel soils, and comparison of the distribution map with the map of soil formations (Figs. 18) shows in detail the importance of these soils. Late potatoes are much less restricted in distribution, and are found on all soils except the Oxford clay and Gault. They are particularly associated with the Old Brown soils of the Valley gravel, with glacial soils, Boulder Clay with wash and with Brickearth. To get the best out of the land it must be well dunged (thirty tons to the acre and sixty bushels of soot), and this is facilitated by the lightness of these soils and the ease with which they can be worked.

The increased importance of the potato crop in Bedfordshire is well illustrated by the graph (Fig. 11). The favourable soils, ease of transport and marketing, and increasing tendency to specialisation have largely accounted for this expansion of the acreage.

Other Crops. Beans have always been extensively grown in Bedfordshire, mainly for stock feeding, and although there has been a very big decrease in acreage in the last few decades, they still form an essential part of the county's husbandry. They are included in most of the rotation systems practised today, and do particularly well on the heavy clays of the north. Parts of the Gault and Chalk marl regions and the Eastern clay region show a considerable acreage of the crop, but they are noticeably absent on the lighter soils of the Chalk and Greensand, and in the market garden region. An interesting contrast is provided by the two maps showing the distribution of beans (Figs. 14–15). Beans for market and canning are confined to the Biggles-



FIGS. 12–13.—The Distribution of Potatoes and Brussels Sprouts in Bedfordshire in 1937.



FIGS. 14–15.—The Distribution of Beans for market and for stock in Bedfordshire in 1937.

wade region with its lighter market garden soils, and a significant extension of the area westwards along the Greensand ridge is apparent.

Of the peas grown in Bedfordshire the vast majority are picked green for market, and there are only three other counties producing more of this type. The excellent transport facilities of the Biggleswade area largely account for this, for they can be marketed very easily to London and to the industrial towns of the north. Peas are grown mainly in the eastern arable district where they do particularly well on the Valley gravel and glacial soils. Extra labour is employed during the period of pea picking which is an exceedingly busy time.

The decline in the acreage under barley has been phenomenal (see Fig. 10), though it is still widely grown and often proves more profitable to the farmer than oats. There is no well-marked concentration in any particular district though the crop does not do well on the heavy clays south of the Ouse.

There were only ten acres of rye grown in the county in 1938, but sugar beet has increased in importance in the last twenty years. It is grown especially on the Greensand soils of the east, though there is also a considerable acreage around Eaton Socon and some is also grown near Bedford.

Root crops and Fodder crops. The principal fodder crops grown in Bedfordshire are clover and rotation grasses, turnips, swedes, mangolds, cabbage, kohl-rabi and rape, and of course beans. Together these occupied nearly 13 per cent. of the total arable land in 1938, and the greater part of this acreage (more than nine per cent. of the total arable land) was under clover, rotation grasses or beans. These are grown widespread throughout the county, for livestock farming is of considerable importance in Bedfordsdire and most farms like to produce as much of their own feeding stuffs as possible. In addition they help to maintain soil fertility by providing a break in the continuous cropping of the land and so occupy an essential part in the rotation systems. On the heavier soils where the four-course system is practised, a clover ley may complete the sequence, the first clover crop being cut, and the second being ploughed into the soil for manure.

The decline in the acreage under turnips and swedes is very marked (see Fig. 11), and is a reflection of the big increase of imported feeding stuffs. Mangolds too show a decrease though not to nearly such a great extent. Other fodder crops like kohl rabi, rape and mustard are no longer of great importance today though they are still grown on many farms. Kohl-rabi originally developed in Bedfordshire as a substitute for turnips, and has the advantage of being hardy as well as forming an excellent cattle food.

Market Gardening in Bedfordshire

Bedfordshire is one of the most important market gardening counties in the country, and for many years past has poured constant streams of fresh vegetables into the markets of London and the industrial cities of the north. The industry is almost entirely confined to the region centreing on Biggleswade, where the farming is both specialised and intensive. All the usual market garden crops are grown, carrots, onions, greens, peas, beans, etc., and in 1938 they occupied 17,467 acres, or more than 15 per cent. of the total arable land of the county (excluding potatoes). By far the most important crop is brussels sprouts, for well over half the market garden land is devoted to this vegetable alone.

The extraordinary suitability of the region for market gardening is very striking in view of its long association with this type of farming. Batchelor writing in 1808 says that the gardeners of Sandy and Girtford had long been celebrated even then, and he adds certain information obtained from Sir John Sinclair, who put forward a number of queries about the gardens of

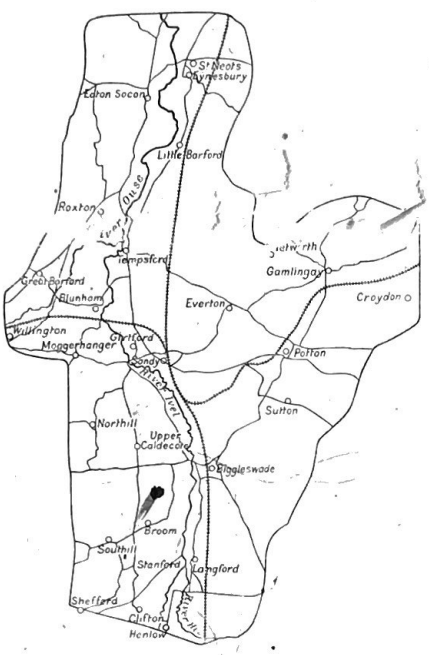


FIG. 16.—Topographical Map.

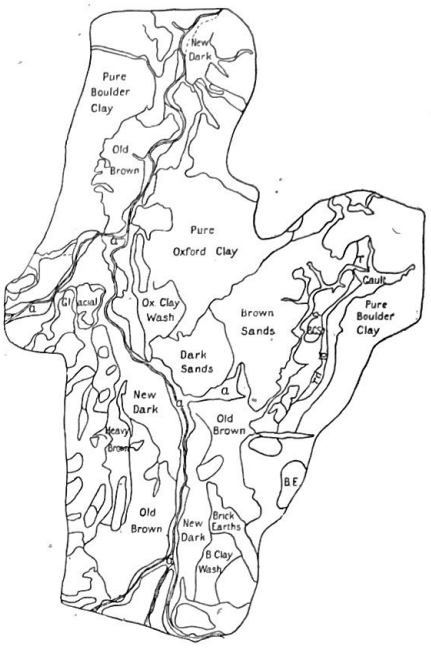


FIG. 18.—Soil Formations.
a=alluvium; rd ld=redland; BCS=boulder-clay on greensand.

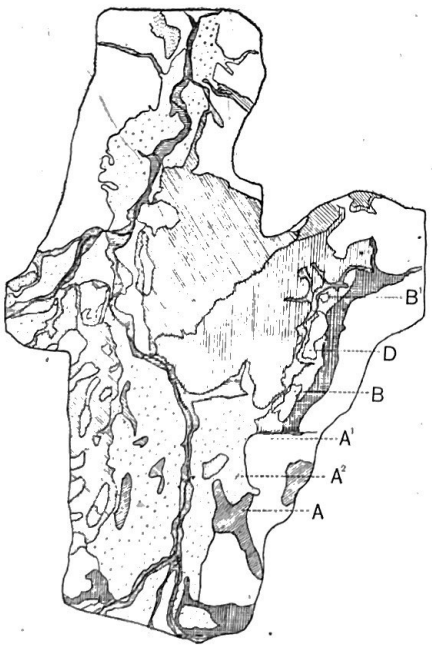


FIG. 17.—Geological Map.
Horizontal ruling=alluvium; dots=valley gravel; white=boulder clay; close oblique lines=brick earth; vertical broken lines=glacial gravel; cross ruled=gault; vertical ruling=greensand; oblique ruling=Oxford clay.

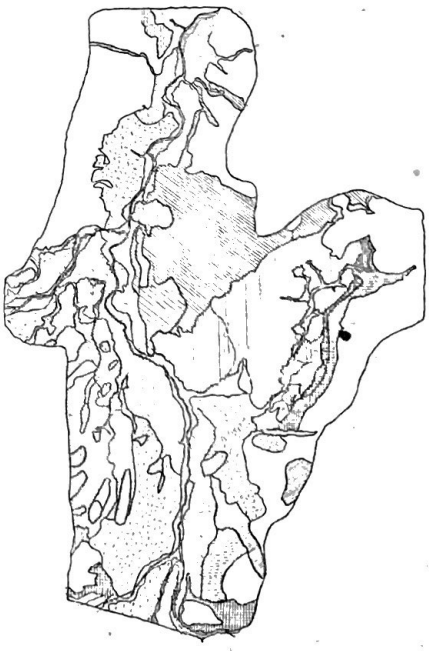


FIG. 19.—Outline Soil Map.
This map should be read in conjunction with Fig. 17 and Fig. 18. On the Oxford clay are 'pure' and 'wash' soils; on the greensand are 'brown' and 'dark' sands; on the gault are 'pure' and 'redland' soils; on the boulder clay are 'pure', 'wash' and 'greensand' soils; on the valley gravels are 'old brown', 'new dark' and 'heavy brown'. See pp. 114–16.

Figs. 16–19.—These four maps, on the scale of 4 miles to one inch, of the Biggleswade Market Gardening area are by Theodore Rigg and are reproduced from the *Journal of Agricultural Science*, Vol. VII, 1915–1916, by kind permission of the Editor and the Cambridge University Press.

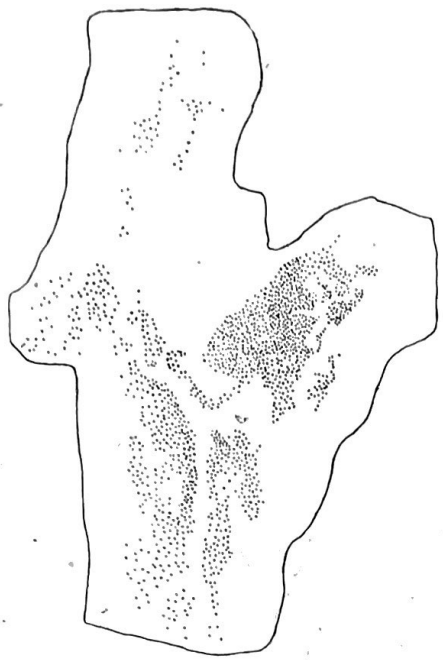


FIG. 20.—Early Potatoes.
Each dot represents 2 acres. Notice the concentration on the brown sand of the Lower Greensand and on the Valley Gravel soils.

FIG. 21.—White Turnips.
Each dot represents 1 acre. Notice the concentration on the brown sands of the Lower Greensand.

FIG. 22.—Carrots.
Each dot represents 1 acre. Compare the distribution with that of Early Potatoes.

FIG. 23.—Brussels Sprouts.
Each dot represents 2 acres. Notice the avoidance of the Lower Greensand.

Figs. 20 to 27 inclusive.—The Crops of the Biggleswade Market Gardening area, reproduced from Theodore Rigg, *Journal of Agricultural Science*, Vol. VII, 1915-16, by kind permission of the Editor and of the Cambridge University Press.

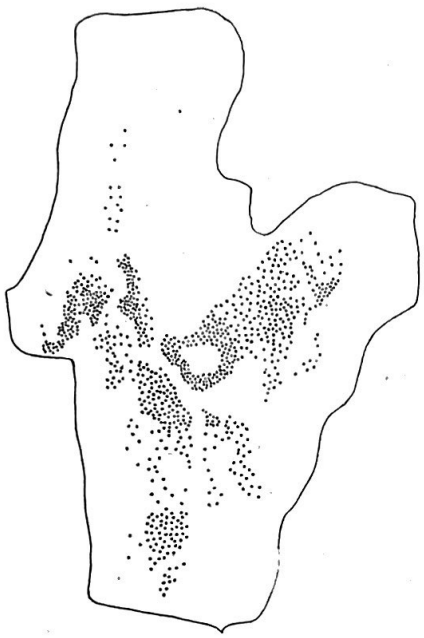


FIG. 24.—Runner Beans.
Each dot represents ½ acre.

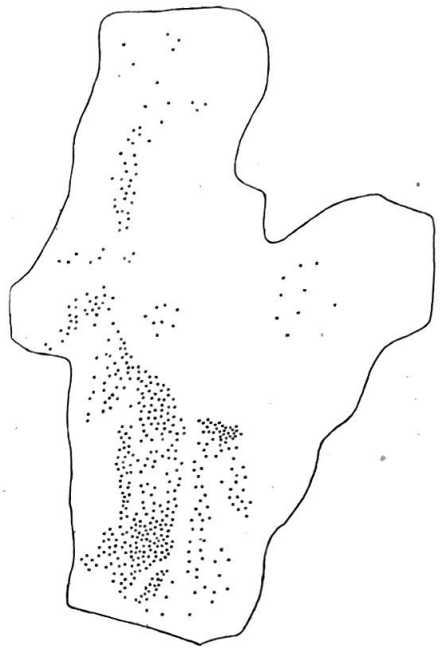


FIG. 25.—Green Peas.
Each dot represents 1 acre.

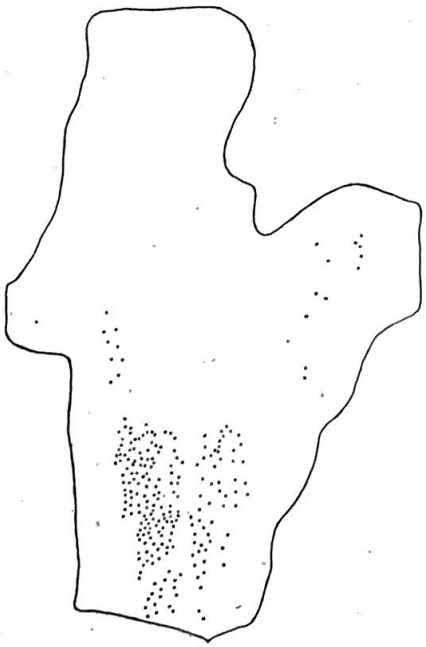


FIG. 26.—Cauliflowers.
Each dot represents ½ acre.

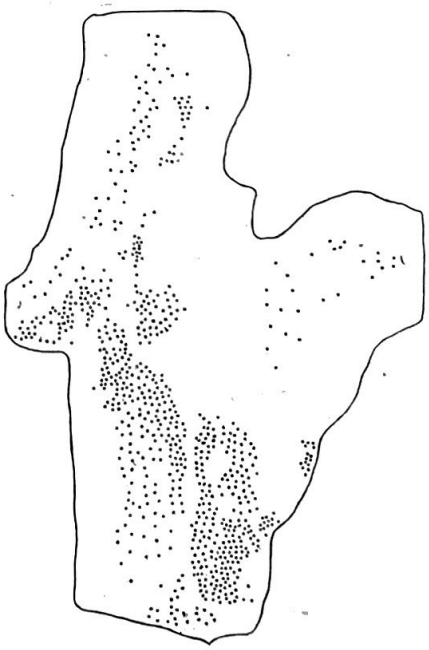


FIG. 27.—Onions.
Each dot represents 1 acre.

Sandy in the late eighteenth century. According to him, gardening had been carried on from time immemorial, the chief crops being peas, beans, cucumbers, potatoes, parsnips, carrots, radishes, cabbages and turnips. The usual rent per acre was £2 10*s.* to £3, though he gives an example of one field at Biggleswade being let for one year for potatoes and onions at £5 and £6 per acre. Even in those days it was not uncommon for the produce to go sixty miles and farther to be marketed.

Batchelor described the soil as a deep sand of a yellowish brown colour (*op. cit.*, p. 456), and emphasised its suitability for carrots and other tap root vegetables. Their roots were able to grow freely downwards for nutriment; the soil was kept warm since there was free exit for the super-abundant water; and yet sufficient moisture was retained, for the smallness of the grains diminished the pore spaces and prevented undue loss. Soil conditions in the neighbourhood of Potton were almost as good, and unless Batchelor was given to exaggeration, carrots of four to five inches diameter were the rule in those days.

About the middle of the last century development in the market garden industry became more rapid. The richness and variety of the soils were being realised, and the increasing transport facilities allowed further specialisation and more rapid marketing of the produce. Some indication of the development can be obtained from the Ministry of Agriculture statistics in which up to 1895 the market garden acreage was given separately. In 1872 the acreage was only 891, but in just over twenty years this had increased to 7,997 acres. From the end of the last century market garden produce was included under the heading "other crops" and it has been more difficult to follow the development. But since the 1938 acreage was 17,467 it is clear that the increase has been fairly constant. The same is not true of individual crops, for some have declined in importance in spite of general development in the market gardening industry as a whole. The following table shows the principal changes that have occurred.

Year	*Total market garden acreage*	*Acreage under market garden crops.*				
		Cauli-flowers	*Brussels Sprouts*	*Cabbage (human consumption)*	*Onions*	*Carrots*
1867	—	—	—	—	—	688
1872	891	—	—	—	—	669
1877	539	—	—	—	—	601
1882	755	—	—	—	—	579
1887	3,593	—	—	—	—	689
1892	6,828	—	—	—	—	679
1903	6,980	—	—	—	—	—
1905	7,479	—	—	—	—	—
1907	—	—	—	—	824	1,011
1912	—	—	—	—	1,406	1,062
1917	—	299	4,176	—	1,322	599
1922	8,196	208	5,606	527	970	829
1927	14,059	350	9,649	800	295	344
1932	17,272	424	10,397	995	357	438
1937	—	473	8,358	1,379	105	247
1938	17,467	422	10,274	1,715	155	218

Totals in recent years are not comparable because the crop classification has been changed from year to year.

The Biggleswade market garden region covers approximately a hundred square miles of the county, and extends from Henlow in the south to St. Neots in the north, and from Gamlingay just within the borders of Cambridgeshire to Willington in the west. (See map, Fig. 16.) But it is within the belt extending about two miles on either side of the main L.N.E.R. line that the most intensive cultivation is to be found. In addition to the main railway line which affords express services to London and the north, the district is served by the L.M.S.R. to Cambridge and Bedford, as well as by the Great North Road which passes through the heart of the region. Today most of the produce goes by road to London. There is a marked extension of market gardening south-westwards along the Greensand belt towards Ampthill and Flitwick, and again in a narrow belt south of Bedford which continues north along the Ouse valley through Biddenham.

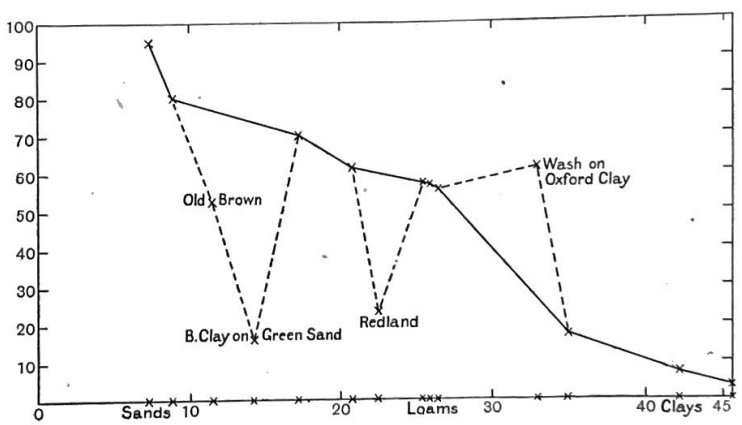


FIG. 28.—Diagram showing the relationship between market garden crops and the coarseness or fineness of the soil. On the heaviest soils the crops become unimportant.

The drift geological map for this part of the county (Fig. 17) shows a surprising variety of deposits in such a limited area, and these give rise to diversity in the soils. Besides the mixed soils occurring at the junction of the Oxford clay and Greensand, there is a greatly increased variety due to the presence of many types of superficial deposit. It is the richness and diversity of these light and easily worked soils which is the basis of the market gardening industry. Under the section on soils they have been dealt with in some detail, and it is now necessary to consider the chief crops and their relation to these soils.

Hall and Russell in *The Agriculture and Soils of Kent, Surrey and Sussex* attempted a correlation of crops and soils by means of dot maps based on the parish crop returns. This may be effective when a parish contains but one soil formation, but the result is inaccurate and misleading where there is a variety of soils in the same parish. It would be most unsatisfactory in the Biggleswade area where so many soils occur. (See Figs. 18 and 19.)

Rigg (*op. cit.*, p. 412) used the six-inch Ordnance Survey maps and obtained his crop statistics by *fields*. The total acreage of each crop for the soil formation was calculated and then plotted by the dot method. The resultant maps reveal those soils which farmers have found by experience to be best suited to the various market garden crops.

In general the area devoted to market garden crops decreases fairly regularly with an increase in the percentage of finer particles in the soil. This is shown graphically in Fig. 28,

where the percentage of arable land under market garden crops is plotted against the percentage of clay and fine silt in the soil. The four exceptions to this, indicated on the graph, are :

1. Redland soil
2. Boulder Clay on Greensand

} The comparatively small acreage of market garden crops on these soils is due to difficulty of cultivation because of their tendency to cake into steely lumps in a hot sun.

3. Old Brown gravel. Adequate manuring is important on this soil, and since it is difficult to obtain London dung for those areas away from the railway line farm crops are often grown at the expense of vegetables.

4. Oxford clay with wash. Once again an economic reason explains the exception There is a demand for small holdings in the neighbourhood of Sandy where this soil occurs, and although it is not particularly suitable the land here has been divided into allotments.

The relative importance of market gardening and farming on each soil formation is shown in the following table.

		Percentage of total arable land	
Series	*Soil formation*	*Market garden crops*[1]	*Farm crops*
Oxford clay	Pure	4·0	96·0
	Clay-with-wash	61·3	38·7
Greensand	Brown sands	80·0	20·0
	Dark sands	94·7	5·3
Gault	Pure	7·8	92·2
	Redland	23·6	76·4
Boulder Clay	Pure	17·4	82·6
	With wash	57.0	43·1
	On Greensand	16·3	83·7
Brickearths	Brickearths	57·5	42·5
Valley gravels	Old brown	52·7	47·3
	New dark	70·4	29·6
	Heavy brown	61·7	38·3
Glacial	Glacial	55·6	44·4

Examination of the results of Rigg's investigations reveals that as a rule each market garden crop is associated with a particular soil formation, though it often does well on others also.

Brussels sprouts. This is such an outstanding crop in Bedfordshire that its distribution must first be considered in relation to the county as a whole. With an acreage of 10,274 in 1938 Bedfordshire was easily the leading county. Worcestershire came next with 5,807 acres. Fig. 11 shows the enormous increase in acreage in the last thirty years. The crop is confined to the east of the county (see map, Fig. 13), except for an area extending along the Greensand belt, and another south of Bedford and along the Ouse.

In the market gardening region brussels sprouts show a fairly wide distribution (see Fig. 23), and are found on all soils except the pure Oxford and Gault clays. They are not, however, particularly suited to light soils deficient in calcium carbonate, for such soils becomes "sick" if the crop is grown too frequently on them. They do best on loams and heavy loams, such as the New Dark gravel, glacial soils, boulder clay with wash and brickearths.

Early Potatoes. Light, warm soils are best suited to the growth of early potatoes, and in consequence there is a concentration on both Greensand and the Valley gravel soils.

[1] Including brussels sprouts and late potatoes.

Late Potatoes. These are grown on all soils except the Oxford clay and Gault. The best yields are obtained on the Old Brown valley gravels, glacial soils, boulder clay with wash and brickearth soils.

Onions. Although not grown today to anything like their former extent they are still of great importance, and Bedfordshire ranks third amongst the counties in its acreage under this crop. The most suitable soils are the New Dark gravel, wash on Oxford clay, wash on boulder clay and the glacial deposits.

Carrots. These too have declined in importance, though Biggleswade still specialises in bunched carrots. They are grown on the New Dark gravel and on both Greensand soils, the Brown sands producing more late carrots.

White Turnips are grown on both Brown and Dark Greensand soils.

Green Peas. These seem to do best on glacial soils and on all the Valley gravel soils.

Runner Beans are grown on Dark Greensand, glacial, and New Dark Valley gravel soils.

Parsley has a less restricted distribution, and is found on the Dark Greensand, New Dark valley gravel, glacial soils, and on parts of the Old Brown valley gravels.

Parsnips have a similar distribution to onions, appearing on the New Dark valley gravel and the boulder clay with wash.

TABLE SHOWING PROPORTIONS OF VARIOUS MARKET GARDEN CROPS GROWN ON EACH SOIL

Figures give percentage of the total area occupied by each crop.

	Oxford Clay		*Greensand*		*Gault*		*Boulder Clay*			*Brick earth*	*Glacial*	*Valley Gravels*		
	Pure	*With Wash*	*Brown Sands*	*Dark Sands*	*Pure*	*Redland*	*Pure*	*With Wash*	*On Green-sand*			*Old Brown*	*Heavy Brown*	*New Dark*
White turnips	—	—	23·3	32·3	—	3·4	—	—	2·3	—	—	0·3	—	—
Cereals	72·5	25·0	14·2	5·3	63·5	60·0	62·5	31·9	62·3	40·0	36·5	35·2	26·2	22·5
Roots	—	4·0	4·8	—	5·9	9·7	1·9	2·5	11·4	0·4	2·1	2·1	—	1·5
Brussels sprouts	1·9	23·5	18·8	16·0	4·9	11·0	8·3	21·3	2·5	16·9	19·8	20·5	6·3	21·2
Parsley	—	3·8	1·5	5·8	—	—	0·5	1·5	—	2·1	7·8	3·4	3·4	5·5
Legumes	14·3	6·3	0·9	—	14·4	6·7	10·3	4·7	8·4	1·3	4·2	6·7	—	2·3
Late Potatoes	2·2	11·4	12·1	17·6	2·4	4·3	5·5	16·3	10·2	20·7	14·2	13·9	19·4	11·7
Early Potatoes	—	2·8	61·0	66·5	—	0·6	—	—	—	—	6·8	12·2	25·8	21·0
Cauliflowers	—	—	—	—	—	0·8	—	—	—	—	—	1·8	8·7	0·5
Summer cabbages	—	—	0·2	—	—	0·8	—	—	—	—	—	0·9	—	1·2
Carrots	—	1·0	16·2	9·8	—	—	—	2·3	—	1·3	0·8	1·1	—	8·3
Onions	—	7·7	0·7	—	—	—	1·2	6·7	—	3·8	6·8	3·6	8·2	6·7
Runner beans	—	1·6	5·3	15·4	—	—	—	—	—	—	6·0	1·7	—	3·2
Beet	—	—	1·3	—	—	—	—	0·6	—	—	—	—	—	0·6
Parsnips	—	1·8	0·8	—	—	—	0·2	6·9	1·3	2·5	0·5	3·1	2·6	5·2
Marrows	—	0·7	0·3	2·5	—	—	—	—	—	—	2·8	0·7	2·3	2·0
Mangold seed	1·5	2·8	—	—	1·3	—	4·0	3·3	—	—	3·1	2·6	12·1	2·4
Horse beans	7·0	0·5	—	—	5·3	—	3·9	0·7	1·3	0·8	1·6	0·7	—	0·9
Peas	—	1·6	0·4	—	—	—	0·3	—	—	—	4·0	5·9	16·8	2·9
Spring cabbages	—	1·7	4·8	0·7	—	0·6	—	0·8	—	5·5	1·3	3·6	11·3	6·5
Small seed	—	2·4	—	—	0·5	—	0·5	—	—	2·2	3·6	1·3	—	0·7
Asparagus	—	—	—	—	—	—	—	—	—	—	—	0·3	—	1·2

Marrows are not extensively grown, but are found on parts of the New Dark valley gravel and on glacial soils.

Spring Cabbages grow on the New Dark formation, brickearth soils, and Heavy Brown gravels.

Cauliflowers. There has been an increased production in the last twenty years, and they are now grown especially on the Old Brown and Heavy Brown gravels.

Mangold seed is confined to the heavier soils like Boulder clay, Oxford clay with wash, and and Heavy Brown gravels.

Horse Beans appear on the heaviest soils—Oxford, Gault and Boulder Clays.

Roots. These, including mangolds, swedes and kohl-rabi, are grown chiefly on loams and heavy loams, especially wash on Oxford clay, Redland, and Boulder Clay on Greensand.

Small seeds (onion, carrot, parsley, turnip) do best on the glacial soils, Oxford clay with wash and the brickearths.

Legumes such as clover, sainfoin and lucerne are confined to the heavier soils and also appear on the Brown gravel.

Cereals show a wide distribution in the market gardening region though naturally they are concentrated more on the heavier soils.

Pasture. Permanent grassland occurs on both Oxford and Boulder Clay soils, and on the alluvium along the Ouse and Ivel valleys.

B. ORCHARDS, NURSERIES AND GARDENS

As in Huntingdonshire the amount of land devoted to orchards and small fruit is not large (1·5 per cent. of the arable land in 1938), since the extensive areas of cold and heavy clay soils are not suitable for the growth of fruit trees. Where soil conditions are favourable the land will be devoted to market gardening, and consequently there is little commercial fruit growing on a large scale.

In addition to the large estate of Messrs. Copo Limited at Cockayne Hatley, there are two or three areas in the south which stand out on the Land Utilisation One-inch maps, but apart from these there is no localisation of fruit growing, and orchards are scattered over the whole county, many farms having a few fruit trees to provide for home needs. The greatest concentration of orchard land is to be found at Cockayne Hatley in the east and at Eaton Bray and Totternhoe in the Icknield Loam Belt, where the soil is lighter and drainage adequate. At Holwell too there is a considerable area occupied by orchards. Most orchards at Eaton Bray are of the pasture type, and there is some specialisation in plums.

Up to the Great War period there was a more or less steady increase in the amount of orchard land in the county. Then a marked decline in acreage took place, but in the last few years there has been quite a sudden and definite increase once again, due mainly to the development of orchard land at Cockayne Hatley. The increase has been from 934 acres in 1930 or 937 in 1931 to 1,687 in 1938. In the last thirty years the amount of land under small fruit has dropped from 493 to 140 acres, though again there has been an increase in acreage in the last few years. Strawberries and blackcurrants are the chief small fruits grown now.

The Orchard Lands of Cockayne Hatley

The following information has been supplied by Messrs. Copo Ltd.

The area controlled by Copo Ltd. (Cox's Orange Pippin Orchards) totals approximately

2,500 acres, and comprises five farms at Cockayne Hatley, one at Wrestlingworth, one at Biggleswade and two at Buntingford in Hertfordshire.

At Cockayne Hatley the land surface throughout is undulating country, the hills being backed with long, gradual slopes towards the open dykes and drains in the valleys which intersect them. The soil varies in texture from medium to heavy loam passing to subsoil of the same character of considerable depth. Geologically the general formation is glacial drift principally of Boulder Clay, with gravel here and there in the Valley bottoms. The long, gradual slopes are conducive to excellent air drainage throughout the critical period of the customary May frosts, thus reducing this danger to a minimum. The heavy loam soil has a somewhat high natural potash content, which is in no small measure responsible for the good colour, fine texture and flavour of the fruit.

Intensive planting has been adopted through the entire orchards, hence the necessity of soil cultivation during the early years. Then follows a period of what is termed " half-sod culture." After the completion of the framework or the " scaffold " branches of the trees, a permanent system of complete cover crops is introduced in order to control excessive tree growth. This in turn encourages the early formation of the necessary carbohydrates within the tree, making for high yields per acre. The grass is mown once a year and allowed to rot down *in situ*. This avoids any reduction in the humus content of the soil upon which the bacterial population is so dependent. The trees are subsequently fed through the grass with suitable fertilisers.

The type of tree used is known as the " dwarf pyramid " or " fusean." The supporting structure so necessary for cordon trees, costing £60 per acre, is entirely dispensed with in the dwarf pyramid system. The firm has its own extensive nurseries for the raising of large numbers of trees which are propagated on their own pedigree root stocks. Approximately 2,400 dwarf pyramids comprise each acre of orcharding. Centrally placed in the plantations there is a large building which houses both the mechanical graders for the fruit and a considerable space set aside for gas storage which is, of course, run mechanically on modern scientific lines.

Bee-keeping and pollination are very important aspects of these orchards, since Cox's Orange Pippin is normally a self-sterile variety. Fertile varieties which flower concurrently with the Cox's are thoroughly dispersed throughout all the plantations. To ensure that the maximum cross-pollination takes place, the firm has established upwards of 500 stocks of bees, which are introduced into the plantations prior to the blossom season. These are then spread over an area of approximately 40 miles diameter in close proximity to various farm crops. The benefits to agriculture in general accruing from this are considerable, whilst the honey yield is an added source of income to the orchards.

There is naturally a keen demand for the highest grades of Cox's Orange Pippins, and the fruit is radiated to most of the larger provincial towns of the British Isles, as well as to Covent Garden.

W91

Nurseries are not of outstanding importance in Bedfordshire. Their main occurrence is on the lighter and easily worked soils associated with market gardening, and both glasshouse and frame cultivation goes on. Flowers are grown especially around Biggleswade, and Bedfordshire ranks seventh among the counties for the production of bulb flowers other than daffodils and narcissi. Elsewhere the nurseries are of the general mixed type, comparatively small concerns near the towns, supplying local needs.

Shown in purple on the Land Utilisation maps are allotments and houses with gardens, the latter being shown by purple over the black outline. Since Bedfordshire is a rural county with little more than a hundred thousand people outside the towns of Luton and Bedford,

gardens are widely scattered, every village and farm having its garden area. This scattered distribution is particularly marked north of Bedford where villages are smaller and fewer in number.

The concentrations of garden land indicating residential districts occur round Luton and Bedford, where there is the typical outer ring of better-class dwellings with gardens of considerable size. The smaller rural market centres like Leighton Buzzard, Woburn and Ampthill have considerable areas of garden land, and in each case the purple predominates over the red of the closely built up areas. It is interesting to notice the development of better-class dwellings on the higher and better-drained land of the Greensand region. In the south of the county between Luton and Dunstable there is an unfortunate example of ribbon development, confined as yet to the main road. Should this extend there is a danger of encroachment on really first-class arable land, the evils of which have been pointed out by Dr. Willatts in his *Report on Middlesex and the London Region* (pp. 164 and 170).

There seems to be no indication that big changes in building development will take place in the near future, for distance from London is a controlling factor, and train services to Luton and Bedford contrast very unfavourably with those to such towns as Watford and St. Albans.

On the coloured One-inch Land Utilisation Map of South Bedfordshire (Sheet 95) new orchards, new housing areas, nurseries and allotments are all shown in plain purple, so the separate categories cannot be distinguished. The principal orchard and nursery districts have already been noted, whilst the new housing areas generally occur as extensions of existing built-up areas around the towns. The remaining purple areas are the allotments, of which three distinct types may be noted :

1. The concentrations around towns like Luton, Bedford and Dunstable. These of course supply the local needs.

2. Allotments on the loamy soils of the Icknield Belt, in the neighbourhood of Houghton Regis, Shillington and Stotfold.

3. Allotments on the Greensand area, with its lighter soils, which can be easily worked and manured. Considerable areas are found around Leighton Buzzard, Flitwick, Ampthill and Maulden.

The Zoological Society's park at Whipsnade, represents a distinctive type of utilisation but is also shown in purple.

C. PERMANENT GRASSLAND

Just over fifty per cent. of the area under crops and grass was devoted to permanent grassland in 1938. The marked increase from east to west is the most striking feature, and in the extreme south-west of the county across the Buckinghamshire border it merges into the grassland region of the Vale of Aylesbury.

The important grass regions of Bedfordshire are :

1. The Gault clay vale from the river Ouzel which forms the county boundary in the south-west, north-eastwards to Wrest Park. Arable fields are scarce and the country contrasts very markedly with the Chalk and Greensand regions on either side.

2. The southern part of the Vale of Bedford. This typical grass region runs parallel to the Gault belt on the other side of the Greensand ridge. It can be traced from beyond Whilshamstead through Marston Mortaine and Salford into Buckinghamshire.

3. The grass areas associated with Bedford and Luton. Apart from the water meadows

along the Ouse there is a noticeable increase of grassland in the neighbourhood of Bedford, especially north of the town. Luton, too, has a grass belt in the vicinity, associated with milk production for the urban population, though a very considerable amount of this is the parkland type covering the large estates of Stockwood and Luton Hoo Parks.

Water meadows occur in well-marked though narrow strips on the low lying alluvium of the river valleys. Between Tempsford and Little Barford, after the Ouse has been joined by the Ivel, the valley opens out and there is an increase in the amount of permanent grassland extending eastwards into Huntingdonshire. Beyond the Ouse in the north of the county there is a generous though scattered distribution of grassland, with higher proportions on the lower and damper areas such as Podington and Pertenhall.

It will be clear from the analysis of the distribution of permanent pasture that the determining factor is soil, for the two most extensive and continuous grass regions occur on the heavy, damp soils of the Gault and Oxford clays. It is the difficulty of working such soils rather than their infertility which counts, for they have in the past produced good crops of wheat and beans. Low-lying land liable to flood will generally be in grass, and the more elevated and exposed tracts with steep slopes will also tend to be devoted to pasture. Economic factors account largely for the grassland areas around Luton and Bedford, where dairy cattle are required for the urban milk supply.

Changes in grassland in Bedfordshire

In the days of Thomas Batchelor at the beginning of the last century Bedfordshire was renowned neither for the quantity nor the quality of its grassland (*op. cit.*, p. 440). " The quantity of land in a state of pasture is not very considerable " he declares, and goes on to quote the rather decided opinion of a farmer in the north of the county who believed that " Bedfordshire contained no land sufficiently rich to fatten an ox " (p. 445).

The graph (Fig. 7) shows the steady increase in the amount of permanent grassland, which has practically doubled in area since 1866. Conservative factors as well as distance from London have probably made this increase less than it would otherwise have been. The greatest changes have occurred on the " marginal " soils in the Vale of Bedford, and in the south-west, where cultivation ceased to be profitable.

Utilisation of the Grassland

As shown on the Farming Types map there are three distinct types of farming in the grassland or grass-arable regions :

1. *Dairying supplemented by other enterprises.* This refers to the definite pastoral economy associated with the heavy clay lands of the Gault and Oxford clay regions. Fields are generally small, and attached to most farms there are one or two arable fields providing root crops for the livestock.

2. *Mixed farming with substantial dairying side.* This is an intermediate type (i.e., with between one third and two thirds of the farm land in grass), characteristic of the English mixed farming economy, with diversity in both crops and livestock. It is carried on mainly in the Chalk region of the south, and in a small area in the north-west.

3. *Mixed farming with substantial rearing or feeding side.* This is another intermediate type of farming, the emphasis on rearing indicating its association with the Midlands rather than with London and the south. It is confined to the northern part of the Vale of Bedford where soils are somewhat lighter than in the dairying region further south.

Livestock

Cattle. The total number of cattle in Bedfordshire is not large, though a considerable increase has taken place in the last sixty or seventy years (see graph, Fig. 29), an increase which

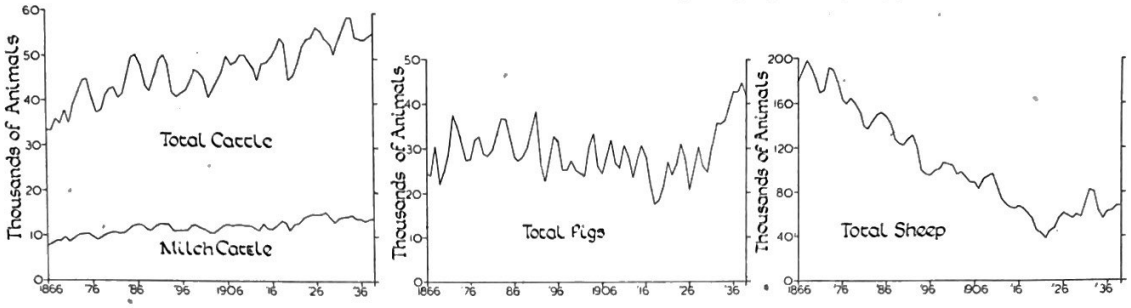
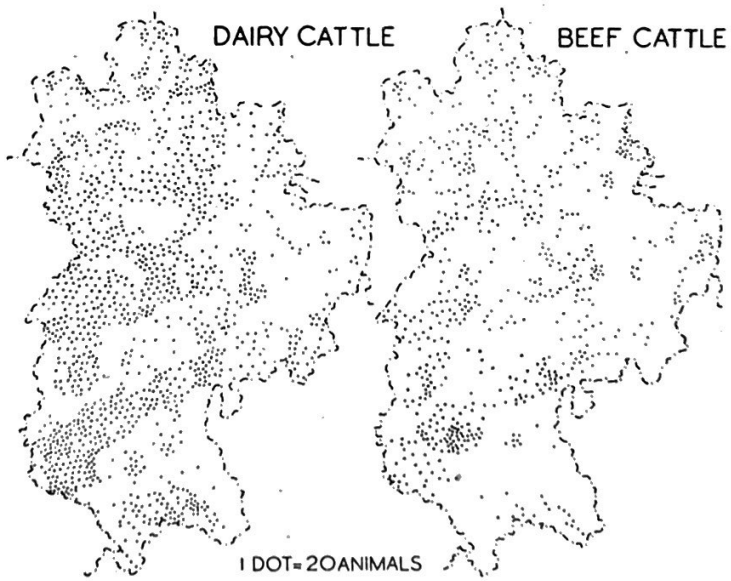


FIG. 29.—Changes in Livestock in Bedfordshire, 1866–1938.

is more noticeable in the rearing side than in dairy cattle. The two distribution maps (Figs. 30 and 31) show the relative importance of beef and dairy cattle in the county. Apart from the negative areas of the Chalk and Greensand country, there is a marked increase in the number of livestock towards the west. The important areas are the clay vales, particularly the Gault and the southern part of the Vale of Bedford. Beef cattle show a very scattered distribution,



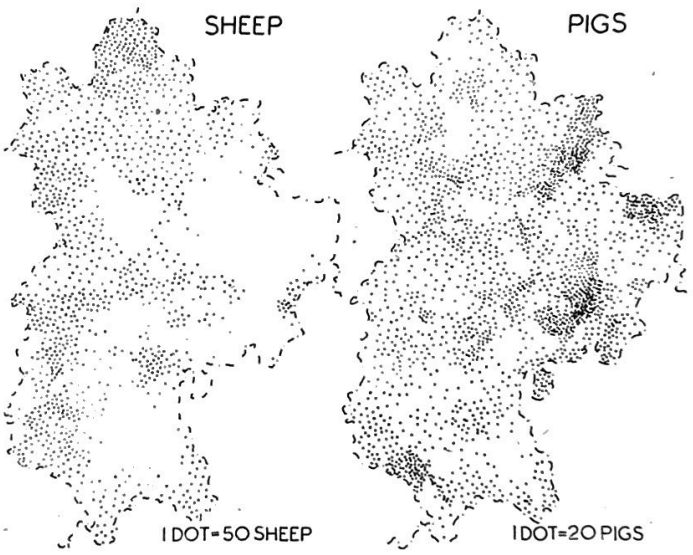
FIGS. 30–31.—The Distribution of Dairy and Beef Cattle in Bedfordshire in 1937.

but are reared in greater numbers in the north, where there is less demand for fresh milk than in the south where a number of urban centres have to be supplied. Dairying is by no means unimportant in the north, but the southern part of the county has always produced more dairy cattle, and as long ago as 1794[1] was producing butter of superior quality for the London market.

[1] See Stone, William. *General View of the Agriculture of Bedfordshire.*

Sheep. The decline in the number of sheep in Bedfordshire is very remarkable (see Fig. 29), and although there has been some increase in the last year or two, it still ranks low in comparison with other counties. According to the 1931 census of occupations, of the 10,298 shepherds in England and Wales only 60 were in Bedfordshire.

Sheep are reared particularly on the clays (see Fig. 32), and are almost absent from the market gardening area and parts of the Chalk region. The northern part of the county shows a very even distribution, for sheep form an essential part of the mixed farming economy. There



FIGS. 32–33.—The Distribution of Sheep and Pigs in Bedfordshire in 1937.

is a concentration in the southern part of the Gault region, and again further north between Woburn and Lidlington, where sheep rearing has always gone on. The annual Woburn sheep shearing (see below, p. 179) was an event of outstanding importance, not only for Bedfordshire but for farmers of the whole country.

Horses. Besides their use for agriculture, horses were often used in the past to draw carts taking produce to London with manure as their return load. The big decline in the total number of horses in the county shown by statistics indicates the importance of motor and rail transport today, whilst the increasing use of tractors for ploughing and general farming operations has meant that in the last twenty years the number of horses for agriculture has been halved.

Pigs. Bedfordshire has always produced a considerable number of pigs, partly at least because their manure is greatly valued. A serious drop in numbers just after the Great War has been more than made up by a very rapid rise in the last few years. The distribution map (Fig. 33) shows that in addition to one or two especially important districts (Totternhoe, and near Henlow and Roxton) they are reared in all parts of the county. Most farmers keep a few pigs as a profitable side line in association with their normal mixed farming economy.

Poultry. Fowls, ducks, geese and turkeys are all of some importance, and are characteristic of the mixed farm, but there is little specialisation as in other parts of the country.

Future Utilisation of the Grassland

The increase of permanent grass at the expense of arable has become an accepted fact in the farming economy of the last few decades, and little has been done to prevent it. As shown by Sir George Stapledon and Mr. William Davies in the course of their *Grassland Survey of England and Wales*, most of our permanent grassland areas represents units of low production, which under the plough and with the effective use of lime and manures as well as proper seed mixtures, could be vastly improved.

In the Grassland Survey the various types of pasture have been classified according to their botanical composition, and a Grassland map produced for the whole country. But since no single type is found isolated in a given area, some modification has been necessary, and the groupings finally employed take account of other types of pasture as well as the dominant type in the area concerned.

Only the groups associated with lowland pasture types need be considered here, and these are graded according to their ryegrass content. On the best grazing lands perennial ryegrass with white clover forms the basis of the pasture, but as the amount of ryegrass decreases *Agrostis* takes its place, until it becomes dominant in the pasture. Any improvement in the permanent pasture is always indicated by the changed botanical character of the herbage, and this change may be effected by manuring, improved grazing or, if quick results are wanted, by the plough. In the latter case different rotations will be adopted dependent on soil and climate as well as on the demands of livestock, in some cases the land being re-seeded at once to grass.

In Bedfordshire the first three groups representing the best types of pasture do not occur The Grassland Groups recognized by Stapledon and Davies are as follows :

Group IV. Chiefly *Agrostis*-with-ryegrass pasture. The other types occurring in this group in order of their importance are : (1) Ordinary *Agrostis*, (2) Second grade ryegrass, (3) occasional first grade ryegrass.

This is the best permanent pasture of the county and occurs in one restricted area only between Leighton Buzzard, Stanbridge and Eaton Bray. The soil is a heavy loam developed on Gault, and most of the land is down in grass. But with the use of tractors and appropriate implements much could be converted to arable production.

Group V. *Agrostis*-with-ryegrass pastures are again dominant, but there is a very large proportion of ordinary *Agrostis*, and only occasional fields of second and first grade ryegrass. It is found in three districts in Bedfordshire: (1) As a narrow strip along the Ouse valley, extending practically all the way from St. Neots to Turvey, occurring on the alluvium and gravels ; (2) A belt in the south of the Vale of Bedford on the heavy clay lands, including Kempston, Marston Mortaine and Lidlington ; (3) Smaller areas in the north of the county around Farndish and Wymington associated with the Great and Inferior Oolite outcrops.

Group VI. Ordinary *Agrostis* occupies more than fifty per cent. of the total area of permanent grassland, and *Agrostis*-with-ryegrass covers most of the remainder. Two large areas of this group occur extending from south-west to north-east across the county.: (1) In the Vale of Bedford. The northern boundary is roughly a line through Souldrop, Bletsoe, Ravensden and Colmworth, whilst in the south the boundary passes through Woburn Sands, Wilshamstead, Bedford and along the Ouse to St. Neots (excluding areas in Group V above). This is an area of Oxford Clay, with deposits of Boulder Clay, and old leys of low productivity form a high proportion of the grassland. The outrun leys together with most of the permanent grassland could be brought under the plough and into immediate arable cropping. (2) A belt roughly corresponding to the Gault clay vale. It is of variable width bounded in the north by the line Soulbury, Milton Bryant, Toddington, Pulloxhill and Henlow, and in the south by the points

Leighton Buzzard, Tilsworth and Hexton. Soils and land utilisation vary according to the occurrence and extent of superficial deposits, for west of Barton-in-the-clay heavy loams and clays predominate with most of the land under permanent grass, whilst to the east soils are medium or light loams under intensive arable cultivation.

Two smaller areas occur in Group VI, one east of Luton on the drift covered Chalk, and the other west of Yelden in the north of the county.

Group VII. *Agrostis* pastures, with only a few of the best fields representing the *Agrostis*-with-ryegrass type. This is found in the north of Bedfordshire between the points Souldrop, Ravensden and Colmworth and the county boundary, and the soils are chiefly of Boulder Clay origin overlying Oxford Clay. The pastures tend to contain an excess of red and tall fescue as well as tussock grass and tor grass, and the poorest fields are in a derelict condition and invaded by thorn. Other problems are the lack of clean water for livestock in the fields, the derelict condition of many fences and field boundaries, and the destruction caused by rabbits. These areas should be brought back into cultivation, where necessary to be cropped, but certainly to be brought back into a ley system of farming.

Group VIII. *Agrostis* dominant, with poor grassland almost everywhere. This is the Lower Greensand region and soils are very light, except where variations occur due to small deposits of Boulder Clay, or to the outcrop of the Corallian beds (Ampthill clay) near Ampthill. The need here is to increase fertility by the application of large quantities of plant food for the light, hungry soils, and with heavy manuring market gardening may be possible. Under more normal agricultural conditions there remains the alternative method, namely to plough and re-seed directly to short duration grazing leys, with or without a cereal crop, supported by applications of lime and phosphates. On the poorest pastures " pioneer " crops (Yorkshire fog, with rib-grass and hardy green turnips) provide a means of increasing the fertility of the soil.

Downs Type. The steep escarpment of the Chalk as at Barton Hills and Dunstable Downs is in fescue pastures, though over the majority of this country arable cultivation is possible.

Summarizing, the permanent grassland and rough grazings of Bedfordshire comprise the following :

	Acreage	*Percentage*
First grade ryegrass pastures	1,000	0·7
Second grade ryegrass pastures	6,500	4·9
Agrostis with ryegrass pastures	40,700	31·0
Ordinary *agrostis* pastures, including fields invaded by tussock grass, fern and small scrub . .	74,700	56·8
Agrostis with excess of rushes and sedges (many of these fields will carry quantities of tussock grass)	5,000	3·8
Fescue pastures including downland . . .	3,700	2·8
Total permanent pastures and rough grazings .	131,600	100·0

Of the 122,605 acres of permanent grassland (excluding rough grazings) for 1938 it is estimated that 83,000 acres are easily ploughable.

The allocations for all newly ploughed grassland suggested by the Grassland Survey are as follows :

Rotation 1. Starting with cereals or other arable crop and followed by the normal cropping of the district . . . . 78 per cent.

Rotation 2. Starting with cereals *undersown directly* with a short (1–3 years) or long (4–6 years) ley . . . . 20 per cent.

Rotation 3. Direct re-seeding to grass without a cereal cover crop.

2 per cent.

Rotation 4. Starting with a pioneer crop (and if necessary a succession of these) designed to build up soil fertility prior to taking a cereal crop, or of re-seeding to a ley.—Occasional fields.

The above figures based on the findings of the Grassland Survey take into account the normal demands of livestock as well as the nature of the soil. They are applicable to the county as a whole, and particular allocations must take into account local factors. Thus on light soils the rotation might start with potatoes, followed by cereals and a ley. On heavy soils and where livestock are important a considerable proportion of land should be re-seeded to grass with the first, or at latest with the second cereal crop, or even without a nurse crop. In most districts a series of arable crops, including cereals and pulses, could be grown on the newly ploughed grasslands, but ultimately all should be re-seeded to high quality leys.

D. HEATHLANDS, COMMONS AND ROUGH PASTURE

Heathland and rough pasture in Bedfordshire occupy a comparatively small area, for in 1938 only three per cent. of the county, according to official statistics, came into this category. Even so this represents a very marked increase in the last twenty years, for up to the end of the last century there were less than a thousand acres in the county (see Fig. 7). The sudden rise after the Great War reflects the state of agriculture, the neglect of farms and estates, and the general lack of interest in the problem of land utilisation.

Reference to the map (Fig. 34) will show the far larger amount of heathland in the south of the county, and the few scattered patches in the north, indicative of the more highly farmed nature of this part. By far the largest areas are associated with the higher and steeper parts of the Chalk and Greensand ridges, though a considerable extent covers the lower ground in the region of Flitwick and Flitton. The areas shown in yellow on the Land Utilisation map are not all of the same type, and it is necessary to distinguish them in order to explain their distribution.

There is really no land in Bedfordshire which could reasonably be classed as rough hill pasture, for cultivation is possible up to the highest levels found in the county. The tracts shown in yellow on the Chalk escarpment and the Greensand ridge belong to the areas of reverted land which were formerly improved, or had a forest cover.

Rough marsh pasture occurs on the low lying, poorly drained areas of the Gault vale near Stanbridgeford, at Flitton and Flitwick, and east of the Ivel between Biggleswade and Sandy. In each of these regions the land is marshy, and rushes and coarse grasses predominate. At Stanbridgeford the rough pasture lies between two small tributaries draining the clay vale to the Ouzel, whilst between Biggleswade and Sandy it occurs mainly on the alluvium of the Ivel tributaries. Flitwick Moor is rather exceptional, for it is an area of ferruginous peat developed on the waterlogged gravel soils overlying the sand. On the six-inch map chalybeate spring is marked on the edge of the moor. The rough grazing areas can be traced from Tingrith along the river valley through Flitwick to Flitton. Neglect of the land and ineffectual drainage have probably caused an increase in the extent of this land, particularly in the neighbourhood of Flitton.

In certain parts of this country a large proportion of rough pasture is due to the survival of the old public and manorial commons and heaths (" wastes ") attached to villages.[1] In

[1] For a fuller account, see Willatts' *Report on Middlesex nd the London Region*, pp. 149-150.

Bedfordshire most of these have been enclosed and improved, and today not many are left. The remaining few are found mostly on the Chalk dip slope, where sandy superficial deposits overlie the Chalk. Stopsley Common survives today as merely a narrow strip of heathland,

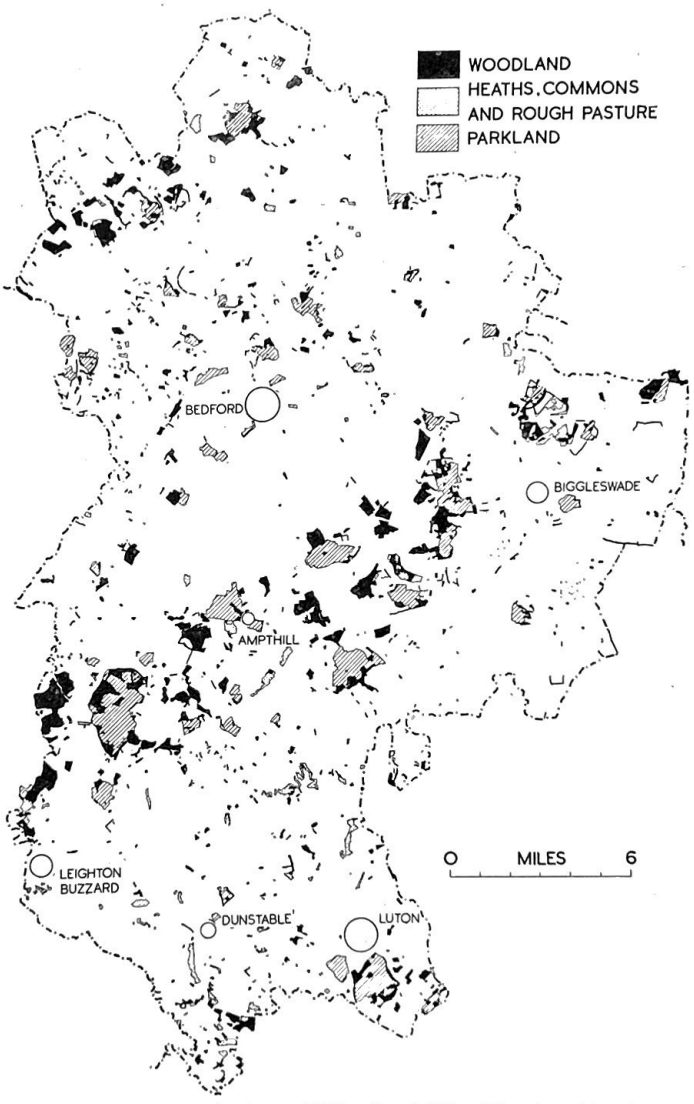


FIG. 34.—The Distribution of Woodland, Heathland and Parkland in Bedfordshire.

The association of Parkland with the Greensand Region in a noteworthy feature.

but at Kensworth and Studham considerable tracts of common land still exist. Gravel and clay overlie the Chalk at Studham where there are more than three hundred acres of common land, and until recently the villagers had the rights of cutting furze and carting gravel.

Most of the remaining heathland and rough grazing in Bedfordshire may be included in the category of reverted land, which was formerly enclosed and improved, but which has been allowed to pass out of cultivation, and has steadily deteriorated to its present condition. This type of land may be an index of a poor soil which is cultivated only under favourable economic conditions. Such conditions have led to the heathland tracts of Rowney Warren and Sandy Heath where the gravelly soils are too poor for cultivation. But generally soil conditions are satisfactory and the land is kept in agriculture. Along parts of the Chalk escarpment steepness of slope will be the determining factor, and the land may pass out of use owing to difficulties of cultivation. Similar areas of rough pasture occur at Warden Hill and Galley Hill, and to the north of Sundon and Streatley along the Lower Chalk scarp.

The large areas shown in yellow in the Greensand country represent felled woodland, and indeed this accounts for a very great deal of the " heathland " in Bedfordshire. To the north of Leighton Buzzard and again west of Ampthill cut-over woodland has been occupied by areas of poor scrub, whilst parts of Sandy Warren and Rowney Warren are obviously heathland areas of the same type.

At Totternhoe (chalk pits) and Millbrook station (brick works) there are two instances where rough grazings are associated with old industrial workings.

In certain of the types outlined above there is little chance of improvement, but in the case of reverted land much can be done under favourable conditions. The fact that such land has been utilised for agriculture in the past is sufficient justification for the attempt being made. But in considering any such improvements, the recreational importance of these areas must be emphasised, for this is an essential aspect of land utilisation today. Fortunately the Dunstable Downs and Whipsnade region have been preserved by the National Trust. Other areas are used for rifle ranges and golf courses, and there seems little likelihood of interference with these.

E. FOREST AND WOODLAND

Woodland represents the natural vegetation of Bedfordshire, though like many other English counties it has lost the greater part of its forest cover since mediaeval times. But even as late as the end of the eighteenth century there were, according to William Stone, 21,900 acres of woodland in the county, which represented more than seven per cent. of the total land area. Writing only fourteen years later (1808) Batchelor calculated an area of only 7,000 acres, which although probably a somewhat low estimate, indicates the beginnings of the ruthless cutting which went on during the corn boom of the early nineteenth century. Large areas of woodland were destroyed to make way for the plough, some trees being wastefully burned on the spot.

Batchelor found a deficiency of woodland in the south-east, increasing amounts towards the north-west, but the largest areas of all on the hill slopes, particularly of the Greensand ridge. Woods were generally cut over at fourteen years growth. In spite of the deforestation already beginning, a considerable amount of replanting was going on to preserve the balance, mostly in the west of the county. Near Woburn Abbey the Duke of Bedford planted hundreds of acres of barren and waste land, and other wealthy landowners followed his example on a smaller scale. Much oak and ash as well as firs were planted, and often potatoes were grown on the land first as the necessary hoeing helped to clear and prepare the ground. In the east Sandy Warren was planted with firs.

By 1891 the acreage of woodland, excluding plantations, had risen to 12,027 acres, and in 1908 the total woodland area was 13,313 acres, divided as follows :

Coppice	3,562 acres
Plantations	492 ,,
Other woods	9,259 ,,

The 1924 census of woodlands undertaken by the Forestry Commission revealed an acreage of 13,139 or 4·4 per cent. of the total land area of the county. This compares with a percentage of 5·1 for the country as a whole.

BEDFORDSHIRE FOREST AND WOODLAND, 1924 CENSUS

		Percentage of total woodland area of county
Total High Forest	7,134 acres	54·3
Coppice	214 ,,	1·6
Coppice with Standards	3,489 ,,	26·6
Scrub	46 ,,	0·3
Felled or devastated	1,363 ,,	10·4
Uneconomic	893 ,,	6·8
Total	13,139 ,,	100·0

It is encouraging to see the small amount of scrub and uneconomic woodland in the county, and to note that over 80 per cent. of the total is High Forest and Coppice with Standards. But in order to assess the value of the timber it is necessary to know the type of woodland and the age of the trees.

High Forest	*Conifers*	*Hardwoods*	*Mixed*	*Total*
1–10 years	910	43	44	997
11–20 ,,	134	66	19	219
21–40 ,,	174	310	119	603
41–80 ,,	136	1,329	756	2,221
Over 80	334	2,158	602	3,094
Total	1,688	3,906	1,540	7,134

The large number of trees over 41 years old is very significant, although it is an encouraging sign to see that there is a greater acreage under 10 years old than in both the succeeding categories put together. That most of the recent plantings have been conifers is an indication of the general tendency over the country as a whole, and in particular of the suitability of the sandy soils of Bedfordshire for this type of woodland.

The map (Fig. 34) shows the distribution of forest and woodland. The one outstanding feature is the striking correlation with the Greensand ridge, for even today the woodland belt can be clearly traced along its entire length from Leighton Buzzard to Potton. It is especially extensive around Woburn, where the outcrop is wide, but even towards the north-east where it is less in evidence the areas of woodland still coincide to a remarkable degree with this formation. In the parish of Woburn the acreage of woodland (700 acres) is equal to the area under the plough, whilst Aspley Guise and Leighton Buzzard show similar high proportions of forest land. A good deal is amenity woodland connected with large estates like Woburn Park and

Wrest Park, but much also of the present woodland area represents land that is unsuitable for agriculture owing to the poverty of the soil or steepness of slope. On these light sandy soils there has been considerable afforestation, mainly coniferous, and in one way these new plantations may be considered as " improved " land. Fir and pine have been planted in the neighbourhood of Aspley Heath and Woburn Sands, which with their sandy soil and dry salubrious climate have become wealthy residential centres. Certain tracts of woodland have been lost where felling has taken place and the land has reverted to heath and scrub.

Small scattered patches of forest occur over the north of the county, and there is a definite increase in the amount towards the north-west away from the main arable region. Odell Great Wood, Park Wood and West Wood are the chief of these smaller areas on the heavier clay lands. South of the Greensand belt there is a marked absence of forest land. Apart from Luton Hoo Park and an area north of Studham there are few areas of forest on the Chalk dip slope, whilst the Icknield Belt with its loamy arable soils is almost devoid of woodland. Groves of beeches still form prominent landmarks at Sundon and Streatley.

Only one area in Bedfordshire, east of Ampthill between Maulden and Clophill, is controlled by the Forestry Commission. Planting did not begin till 1928, and in the four years 1928–1931 17 acres of conifers and 12 of hardwoods were planted—Scots and Corsican pines, oaks and beech.

Part of the area controlled by the Forestry Commission is devoted to a forest nursery, and additional plantings have taken place since 1938.

The Woburn Woodlands

The following information has been supplied by Mr. F. Mitchell, the Head Forester of the Duke of Bedford's estate at Woburn.

The Woburn Estate, situated in the south-east corner of Bedfordshire, has an area of about 20,000 acres, of which 4,300 acres are woodland. The elevation of this tract ranges from 300 to 500 feet above sea-level, and the average annual rainfall is 24–26 inches.

The soil generally is of a sandy nature. belonging to the region of the Lower Greensand, forming the well-known Woburn Sands. In the southern part of the estate a fairly large area of strong loam is to be found, with pockets of clay here and there, even intermixed with the sandy soils.

The main crop of timber on the lighter soils is invariably Scots pine which is much at home, and produces a volume up to 5–6,000 cubic feet per acre. Larch and spruce do equally well but are much shorter lived than the Scots pine. Silver firs have also done remarkably well and produce sound timber of high quality.

The Park itself, with a circumference of 12–13 miles, has soils of light loam in the north-east, ranging to strong clay in other parts. It is thickly timbered with both sessile and pedunculate oaks with a sprinkling of beech, Spanish chestnut and both English and Dutch elm. Trees of large dimensions are to be seen near the Abbey, including the well known Woburn Beech, a perfect specimen, containing 535 cubic feet to the first branch. Elm disease has given rise to some anxiety during the last ten years, but it is found that early pollarding gives a further lease of life. Most of the old trees in the Park are about 300 years old. Records show that the elm avenue leading to the Abbey was planted about 1730 or 1740.

One of the most beautiful woods in the Park, known as the " Evergreens ", was planted about 1743 by the then Duke of Bedford to commemorate the birth of a daughter who later became the Duchess of Marlborough. This wood consisting of Scots pine, larch and spruce was badly damaged by the 1916 gale, and today only about half the older trees are left standing. Some very fine cedars are to be found on the lower levels with a content of upwards

Coppice	3,562 acres
Plantations	492 ,,
Other woods	9,259 ,,

The 1924 census of woodlands undertaken by the Forestry Commission revealed an acreage of 13,139 or 4·4 per cent. of the total land area of the county. This compares with a percentage of 5·1 for the country as a whole.

BEDFORDSHIRE FOREST AND WOODLAND, 1924 CENSUS

		Percentage of total woodland area of county
Total High Forest	7,134 acres	54·3
Coppice	214 ,,	1·6
Coppice with Standards	3,489 ,,	26·6
Scrub	46 ,,	0·3
Felled or devastated	1,363 ,,	10·4
Uneconomic	893 ,,	6·8
Total	13,139 ,,	100·0

It is encouraging to see the small amount of scrub and uneconomic woodland in the county, and to note that over 80 per cent. of the total is High Forest and Coppice with Standards. But in order to assess the value of the timber it is necessary to know the type of woodland and the age of the trees.

High Forest	*Conifers*	*Hardwoods*	*Mixed*	*Total*
1–10 years	910	43	44	997
11–20 ,,	134	66	19	219
21–40 ,,	174	310	119	603
41–80 ,,	136	1,329	756	2,221
Over 80	334	2,158	602	3,094
Total	1,688	3,906	1,540	7,134

The large number of trees over 41 years old is very significant, although it is an encouraging sign to see that there is a greater acreage under 10 years old than in both the succeeding categories put together. That most of the recent plantings have been conifers is an indication of the general tendency over the country as a whole, and in particular of the suitability of the sandy soils of Bedfordshire for this type of woodland.

The map (Fig. 34) shows the distribution of forest and woodland. The one outstanding feature is the striking correlation with the Greensand ridge, for even today the woodland belt can be clearly traced along its entire length from Leighton Buzzard to Potton. It is especially extensive around Woburn, where the outcrop is wide, but even towards the north-east where it is less in evidence the areas of woodland still coincide to a remarkable degree with this formation. In the parish of Woburn the acreage of woodland (700 acres) is equal to the area under the plough, whilst Aspley Guise and Leighton Buzzard show similar high proportions of forest land. A good deal is amenity woodland connected with large estates like Woburn Park and

Wrest Park, but much also of the present woodland area represents land that is unsuitable for agriculture owing to the poverty of the soil or steepness of slope. On these light sandy soils there has been considerable afforestation, mainly coniferous, and in one way these new plantations may be considered as " improved " land. Fir and pine have been planted in the neighbourhood of Aspley Heath and Woburn Sands, which with their sandy soil and dry salubrious climate have become wealthy residential centres. Certain tracts of woodland have been lost where felling has taken place and the land has reverted to heath and scrub.

Small scattered patches of forest occur over the north of the county, and there is a definite increase in the amount towards the north-west away from the main arable region. Odell Great Wood, Park Wood and West Wood are the chief of these smaller areas on the heavier clay lands. South of the Greensand belt there is a marked absence of forest land. Apart from Luton Hoo Park and an area north of Studham there are few areas of forest on the Chalk dip slope, whilst the Icknield Belt with its loamy arable soils is almost devoid of woodland. Groves of beeches still form prominent landmarks at Sundon and Streatley.

Only one area in Bedfordshire, east of Ampthill between Maulden and Clophill, is controlled by the Forestry Commission. Planting did not begin till 1928, and in the four years 1928–1931 17 acres of conifers and 12 of hardwoods were planted—Scots and Corsican pines, oaks and beech.

Part of the area controlled by the Forestry Commission is devoted to a forest nursery, and additional plantings have taken place since 1938.

The Woburn Woodlands

The following information has been supplied by Mr. F. Mitchell, the Head Forester of the Duke of Bedford's estate at Woburn.

The Woburn Estate, situated in the south-east corner of Bedfordshire, has an area of about 20,000 acres, of which 4,300 acres are woodland. The elevation of this tract ranges from 300 to 500 feet above sea-level, and the average annual rainfall is 24–26 inches.

The soil generally is of a sandy nature. belonging to the region of the Lower Greensand, forming the well-known Woburn Sands. In the southern part of the estate a fairly large area of strong loam is to be found, with pockets of clay here and there, even intermixed with the sandy soils.

The main crop of timber on the lighter soils is invariably Scots pine which is much at home, and produces a volume up to 5–6,000 cubic feet per acre. Larch and spruce do equally well but are much shorter lived than the Scots pine. Silver firs have also done remarkably well and produce sound timber of high quality.

The Park itself, with a circumference of 12–13 miles, has soils of light loam in the north-east, ranging to strong clay in other parts. It is thickly timbered with both sessile and pedunculate oaks with a sprinkling of beech, Spanish chestnut and both English and Dutch elm. Trees of large dimensions are to be seen near the Abbey, including the well known Woburn Beech, a perfect specimen, containing 535 cubic feet to the first branch. Elm disease has given rise to some anxiety during the last ten years, but it is found that early pollarding gives a further lease of life. Most of the old trees in the Park are about 300 years old. Records show that the elm avenue leading to the Abbey was planted about 1730 or 1740.

One of the most beautiful woods in the Park, known as the " Evergreens ", was planted about 1743 by the then Duke of Bedford to commemorate the birth of a daughter who later became the Duchess of Marlborough. This wood consisting of Scots pine, larch and spruce was badly damaged by the 1916 gale, and today only about half the older trees are left standing. Some very fine cedars are to be found on the lower levels with a content of upwards

of 1,000 cubic feet. Two clumps of Wellingtonias, planted in the year 1863, are worthy of note. Several of these trees are now 110–115 feet high with an average content of 150 cubic feet. Also enclosed in the Evergreens is a young collection of conifers, consisting of 166 species and varieties.

The late Duke of Bedford was a great planter of trees and shrubs. About the year 1900 the Duke decided to plant 560 acres of poor agricultural land. This was the beginning of several large planting schemes. During the 1914–1918 war about 610 acres of woodland were cleared. Replanting followed and was completed in 1926. It was always the Duke's policy to replant immediately all areas cleared by annual fellings, and since the year 1900 well over 6 million forest trees have been planted. It is interesting to note that the result of this early planting has proved to be of the utmost value during the present war in providing the Midland collieries with large quantities of pitprops and other mining timber necessary for the production of coal. To provide this material more than 120 acres of woodland were felled between the beginning of the war and the end of 1941.

To provide the necessary young forest trees for replanting, a nursery was formed in the year 1896, and since that date a large proportion of young transplants required for replanting have been produced from seed gathered in the woods and raised in this nursery.

An estate sawmill was laid down in the year 1911 to provide the necessary materials for estate requirements. Timber in the round is purchased from the estate and is sold back again in a converted state, any surplus being sold in the open market.

It will be seen therefore, that from the collecting of seed to the converting at maturity, all branches of forestry have been practised at Woburn during the lifetime of the eleventh Duke of Bedford.

F. LAND AGRICULTURALLY UNPRODUCTIVE

The land described by the Land Utilisation Survey as agriculturally unproductive, and coloured red on the one-inch maps, falls roughly into two categories. First there are the closely built-up areas associated with urban settlement, and secondly the tracts of waste land connected with quarries, tip heaps and industrial undertakings.

Fifty per cent. of Bedfordshire's population of 220,525 (1931 Census) live in the towns of Luton and Bedford. Both of these owe their importance to rivers, Bedford an important bridge point on the Ouse, and Luton controlling a narrow gap cut through the Chalk hills by the Lea. Both show the typical central built-up area, surrounded by an irregular belt of better class dwellings, and both are important market centres for the county. Bedford is developing northwards and towards the south-west in the neighbourhood of Kempston, whilst Luton reaches out north along the main road and railway to link up with the settlement on the low marshy ground round Leagrave. By far the worst type of development is that between Luton and Dunstable where houses along both sides of the Icknield Way destroy much of the natural attractiveness of the country. A well-marked contrast exists between the southern part of the county and the region north of the Ouse. In the south, particularly on the picturesque, healthy sites of the Greensand ridge, villages and small residential settlements are numerous, but on the clay lands beyond the river villages are very much smaller and more widely spaced. The preponderance of the purple-colour indicating the settlements of the Greensand country emphasises its wealthy residential character, especially near Woburn and Woburn Sands. The importance of the Ouse as a controlling factor in the distribution of settlement is obvious from a

glance at the map (Fig. 35) which shows a line of villages, Harrold, Odell Sharnbrook, Milton Ernest, etc., situated on or very close to the river.

When the distribution of waste land resulting from industrial workings is considered, there is an equally apparent contrast between the north of the county and the south. The bare red

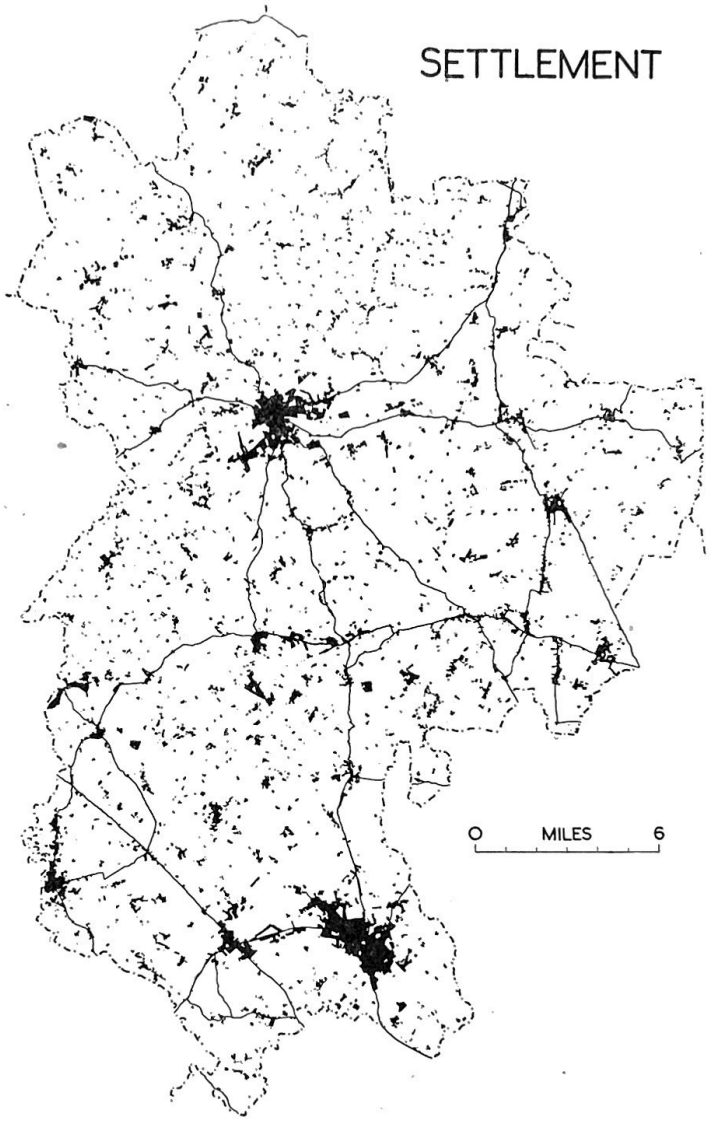


FIG. 35.—Distribution of Settlement in Bedfordshire.
Luton and Bedford stand out as the only settlement of any size in the county.

patches denoting land of this type are entirely absent in the north, whilst several large areas occur south of Bedford. In the main they refer either to brickworks or to chalk pits. Along the railway line between Lidlington and Bedford are situated the brickworks owned by the

London Brick Company, whose tall thin chimneys dominate the flat landscape of the clay plain. Two of these brickworks are of fairly recent origin, and the surrounding land has rapidly become derelict. Adjoining fields are sometimes affected by the sulphurous fumes from the chimneys, and these may have a poisonous influence on the pasture. But the covering of coarse vegetation which appears in due course often justifies the inclusion of this land in the category of heath-land or rough grazing, though it is doubtful whether such land would be grazed. A considerable proportion of the bricks go by road to London, and the brick-laden lorries are a common sight on the main road through Luton. In the east of the county near Arlesey are further brickworks associated with the Gault and Boulder Clay.

Chalk pits and quarries are numerous in the south, and several of the lime and cement works are still functioning. Along the railway line near Sundon is an extensive area of waste land occupied by the Sundon Lime and Cement Works the property of the Portland Cement Company. Between Luton and Dunstable a considerable part of the Chalk escarpment has been scarred by former quarrying. The Lower Chalk north of Totternhoe is much valued for the manufacture of cement, and often as many as a hundred trucks leave in a day, mainly for Rugby.

The only other conspicuous areas of unproductive land are the sand pits north of Leighton Buzzard, and the aerodrome at Henlow, which is really a special type of " built-up " area.

Much of this land which is designated " agriculturally unproductive " has gone out of the farmer's reach in comparatively recent times, and because of its special nature is practically a permanent loss to agriculture.

IV. THE LAND USE REGIONS OF BEDFORDSHIRE

THE analysis of the land utilisation of Bedfordshire, based on an appreciation of the geographical background, makes it possible to attempt a division of the county into Land Use Regions. In spite of its small size there is such variety in soils and relief, there are such differences in farming type and practice, that some subdivision is essential. The map of Farming Types shows a simple general division, and reveals the big differences occuring within the county.

Soils determine to such a great extent the character of the farming, that further sub-division must be based primarily on the soil differences and on the underlying geology. Five major regions can be readily distinguished on this basis, corresponding roughly to the divisions shown on Batchelor's Soil Map (Fig. 3), the Chalk Region, the Gault Clay Vale, the Greensand Belt, the Clay Vale of Bedford, and the Ouse and Ivel Valley Gravel Region.

Further study of the soils in each of these regions makes sub-division both possible and necessary. Because of the fertility of its soils the Lower Chalk Marl belt must be recognised as a separate region, whilst variation in the type and heaviness of the clays north and south of Bedford justifies sub-division here. On the basis of relief, and because of certain economic factors which determine land use, the Greensand belt may be divided into the higher plateau region around Woburn, with its large wooded estates, and the ridge itself decreasing in significance towards the east.

There is a close correlation with the Relief Regions outlined earlier in this report, though it has not been considered necessary to make such small regions as the Lea and Ivel valleys into separate Land Use Regions, since their utilisation approximates very closely to that of the

surrounding areas. The ideal has been to avoid too great a generalisation without introducing unnecessary complications into the regional division thereby destroying its significance.

The distinction between Land Use Regions and the divisions shown on the map of Farming Types should be noted, for several important differences occur. The descriptions on the Farming Types map give a general idea of the farming practice typical of the region, but there

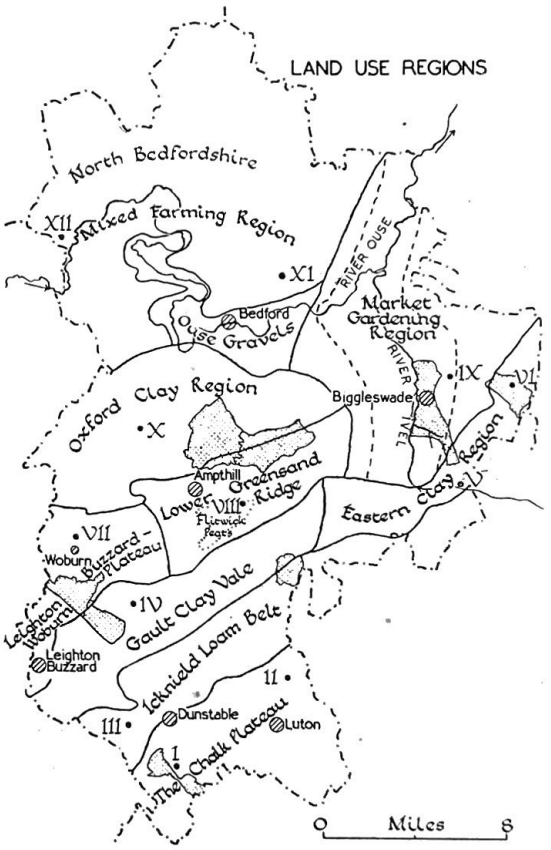


FIG. 36.—The Land Use Regions of Bedfordshire.

The dotted line in the Market Gardening Region defines the area of most intensive production.

The Roman figures refer to the specimen farms studied, and the stippled areas are those parishes selected for comparison of past and present utilisation. (See Section V of this Report.)

is a good deal of overlapping and it is difficult to insert exact boundaries. Surface utilisation may be similar, yet differences may occur in farming practice, and where the description is a somewhat broad one (Type K) marked variations will occur within the area.

Taking these varied facts into consideration the following divisions are suggested. Each has a character of its own, and a degree of unity which is sufficient to justify its consideration as a separate Land Use Region.

1. The Chalk Plateau.
2. Icknield Loam Belt.
3. Gault Clay Vale.
4. Eastern Clay Region.
5. Woburn–Leighton Buzzard Plateau.
6. Lower Greensand Ridge (including the Flitwick Peat Area).
7. The Biggleswade Market Gardening Region.
8. The Oxford Clay Region.
9. The Ouse Gravel Belt.
10. The Northern Bedfordshire Mixed Farming Region.

Region 1. The Chalk Plateau of the South

The prolongation of the county boundary towards the south takes in a small portion of the Chalk plateau. Physiographically it is a continuation of the Chiltern Hills of Buckinghamshire, though the typical chalk features become less marked towards the north-east. The region includes the whole of the county south of the line of the Icknield Way, and extends over the borders into Hertfordshire. Beyond the Lea valley the increasing amount of drift gives greater variety to the soils, but the resulting differences in land utilisation are hardly sufficient to justify its distinction as a separate land use region.

The physical features of the Chalk plateau have been described elsewhere, and they need be considered here only in-so-far as they affect land utilisation. The chalky sub-soil, which is varied by patches of Clay-with-Flints and brickearth, the absence of surface drainage and the steep escarpment all contribute to the general character of the region. Clay-with-Flints is found particularly on the higher parts of the plateau, and its occurrence in any thickness may lead to drainage problems not usually associated with chalk country. Elsewhere the high porosity of the sub-soil is a disadvantage, and on the steeper slopes bare chalk may be exposed at the surface. The deposits of sand and gravel which occasionally mask the chalk of the dip slope often support a poor grass or heathland vegetation, and greatly increase the variety in the landscape which is characteristic of the region. As the escarpment is approached the typical features of chalkland scenery are more apparent, the country opens out, fields are larger, and there is a notable lack of woodland. This absence of trees contrasts markedly with the true Chilterns of Buckinghamshire where even today the woodland is famous. The only parts of the county where steepness of slope prevents cultivation are to be found along the chalk escarpment, and in two other areas only—Dunstable Downs and Warden and Galley Hill.

The Chalk Region of Bedfordshire is one of intermediate type between arable and grass, and the land utilisation pattern is a varied one. Reference to the Farming Types map will show the area under the heading " Mixed Farming with substantial dairying side," a title which sufficiently describes the economy of the region. South-eastwards it passes into the Harpenden and Chiltern Hills Mixed Farming Regions of Hertfordshire. The rather small mixed farms of the region producing a few cash crops, most of their own feeding stuffs, and with the emphasis on dairying represent a typical English farming economy. With the exception of the narrow strip of grassland along the Lea valley, and the extensive areas of grassland associated with Stockwood and Luton Hoo Parks, notable exceptions it is true, the amount of arable land increases towards the east. On the Chalk dip slope west of Watling Street, the land utilisation pattern is very varied and the country is very attractive for there are scattered areas of woodland and heath in addition to the large tract of parkland occupied by the Whipsnade Zoological Gardens. Patches of Clay-with-Flints and brickearth between Caddington and Dunstable have given

rise to a higher proportion of arable land, and in the parish of Caddington 60 per cent. of the land is under the plough. The undulating country beyond the Lea, with its covering of Chalky Boulder Clay, as well as patches of glacial material which have been washed from the north and north-east, contains much good arable land. The excellent loams have been lightened by plateau brickearth, making them rich, easily worked arable soils capable of producing excellent crops of wheat and oats.

Grassland covers a considerable area of the Chalk plateau, though its distribution is somewhat scattered. Generally the amount of pasture land increases with height as the escarpment is approached, the highest parts of the ridge being entirely under grass save for the stretches of heathland and the area occupied by Whipsnade Park. The grass around Dunstable and Luton supports dairy cattle for the urban milk supply, though much of the grassland in the vicinity of Luton has remained because of the large estates of Stockwood and Luton Hoo.

There are very few orchards in the region, and most of the garden land is associated with the two towns of Luton and Dunstable, or along the main road between them. Much of the purple on Sheet 95 refers to the gardens of new housing areas, but a good deal also represents the allotments which are a customary feature on the outskirts of many of our provincial towns.

The occurrence of woodland and rough pasture mainly west of Watling Street emphasises the transition which takes place towards the north-east. Near the Buckinghamshire border there is a good deal of scattered woodland, especially on the heavier soils of the Clay-with-Flints away from the escarpment. Here also most of the rough pasture of the region is to be found, and in fact the more varied character of the country corresponds much more closely to that of the true Chiltern Hills with its beechwoods, and scattered patches of heath and common lands. Studham and Kensworth Commons may be compared with those of Ivinghoe and Aldbury in the adjacent region, whilst the heathland of Ivinghoe Beacon has its counterpart on the scarp of Dunstable Downs in Bedfordshire.

Two important main roads from London cross the region, making use of gaps or valleys through the Chalk, one to Luton, the largest town of the county with its millinery, hat making and brewing industries, and the other, Watling Street, to Dunstable.

To supplement the land utilisation map, and to provide some additional information on the crops and livestock of the Chalk region, the following table has been prepared. It is based on the parish statistics supplied by the Ministry of Agriculture, and shows the utilisation of approximately 10,000 acres of the land of the region.

UTILISATION OF 10,000 ACRES OF LAND OF THE CHALK REGION.

Holdings	112	Greens	— acres
Labour (casual and regular)	164	Orchards	6 ,,
Arable land	4,197 acres	Rotation grass and fodder crops	914 ,,
Grassland	4,843 ,,	Bare fallow	1,066 ,,
Rough pasture	956 ,,		
Wheat	1,292 ,,	Dairy cattle	1,588
Barley	163 ,,	Beef cattle	203
Oats	609 ,,	Sheep	2,123
Beans	24 ,,	Pigs	1,083
Potatoes	25 ,,	Poultry	13,012
Roots	84 ,,		

The slightly larger amount of grassland than arable land may be taken as typical of the region as a whole, though it may vary considerably between farm and farm according to local differences of soil, relief and drainage, and shows marked fluctuations in time according to

economic factors. Rough pasture which amounts to almost 10 per cent. of the sample under consideration occurs mainly along the Chalk escarpment and on the Common lands. Wheat is easily the most important crop on most farms, particularly in the neighbourhood of Caddington and Kensworth, and east of the Lea. Oats shows a similar distribution, and figures in most rotations, but barley is little grown now, except east of Luton, where it is used for the town's brewery.

The importance of dairy farming in the Chalk region is evident, and in addition many farmers go in for sheep, pigs and poultry. Mixed farming, with the emphasis on dairying, is certainly the keynote of the region.

The following studies of two farms of the Chalk country will add precision to the preceding description, and will also aid in the understanding of local farming practice. Care should be

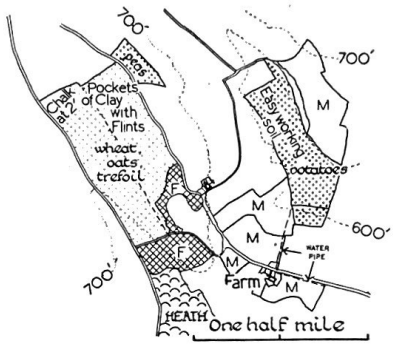


FIG. 37.—Specimen Farm I.—The Chalk Plateau.

In Figs. 37 to 47; A (stippled) = arable; A (heavier stipple) = Wartime arable; M = Meadow and Pasture; F (cross shading) = Woodland.

taken in drawing conclusions from the crops and the conditions on these farms alone, for it cannot be emphasised too strongly that each farm is an individual unit with its own local features, and its own special difficulties. Whilst they have been selected with some care to illustrate actual conditions, it would be unwise to assume that they are necessarily typical of the region as a whole.

Specimen Farm I.

Situation. Kensworth. The farm is at a height of 660 feet above sea-level, has a N.N.E. aspect and is exposed.

Area. 152 acres (7 fields). It is larger than the average for the county. The farmer is the owner, but the rental value is £1 per acre.

Soil. Clay-with-Flints and chalk.

Land use. Arable, 55 acres; grass, 97 acres.

Labour. 2 men. There is a shortage of labour.

Crops. Wheat (chief crop), oats, rotation grasses, roots.

Rotation. Oats—wheat—trefoil. Trefoil is planted on the newly broken land.

Fertilisers. Phosphates, kainite, basic slag.

Livestock. 48 cattle. 3 only were milking at the date of interview. 68 sheep (300 were kept before the war). 50 poultry (200–300 kept before the war).

Feeding stuffs. Mostly purchased.

Markets. St. Albans, Hitchin, Luton and Bedford—by road.

Water. Wells 330–380 feet deep.

Power. Electricity.

Notes. The accompanying map (Fig. 37) shows the farm boundaries and indicates one or two of the variations in soil. The letters refer to the utilisation at the time of the survey, and any war-time ploughing is indicated by a heavier stipple. In 1900 most of the land was arable, but after the 1914–1918 war grassland predominated, and drainage was poor. Drainage is still difficult on the clays, though it is implemented where the slopes are steep. Foxes are the worse pests.

Specimen Farm II.

Situation. Stopsley near Luton. The farm itself is 450 feet above sea-level but some of the farmland is at a height of 600 feet. It has a south aspect and is exposed.

Area. 576 acres (21 fields). This is one of the largest farms in the county. The farmer is a tenant, and pays a rent of 15*s.* per acre.

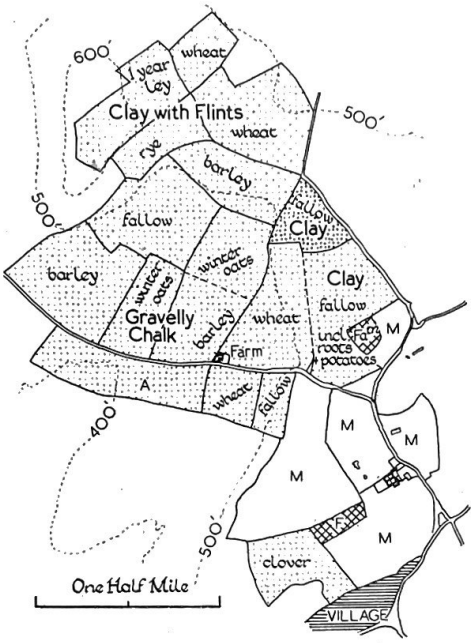


FIG. 38.—Specimen Farm II.—The Chalk Plateau.
This is one of the largest farms in the county.

Soil. Gravelly chalk, and Clay-with-Flints on the hills.

Land use. Arable, 464 acres; grass, 112 acres—fair quality.

Labour. 7 men and farmer's son who drives tractor.

Crops. Wheat, 108 acres. Barley. Oats (not profitable). Rye, 18 acres.

Rotation. The farmer had always farmed on the five-course system. 1. Fallow or roots. 2. Wheat, barley or oats. 3. Seeds. 4. Wheat. 5. Winter oats.

Fertilisers. Top dressing of phosphates and sulphates.

Livestock. 50 cows (4 milkers), (before the war, 100). 14 sheep (before the war, 100–200). No pigs now (before the war, 200–250).

Feeding stuffs. Cattle cake is purchased, but most feeding stuffs are grown on the farm.

Market. Luton.

Water. Mains supply.

Power. No gas or electricity.

Notes. The hillsides were sown with grass between 1925–30 and brought back into cultivation between 1936–39. The top lands, where Clay-with-Flints occurs, need draining. To the query regarding pests the farmer replied that they were troubled with " everything on earth."

Region 2. The Icknield Loam Belt

Below the Chalk escarpment and running roughly parallel with it is the ancient track known as the Icknield Way, which forms a convenient boundary to this region as well as providing it with an appropriate name. The outcrop of Lower Chalk Marl, which gives rise to rich loamy soils, heavier than the chalk, defines the region, which extends from Eaton Bray to Stotfold, and attains a width of three miles in places. In the section on relief regions it has been described as the Lower Chalk Platform, for it is in effect a subsidiary region of the Chalk extending beyond the main escarpment, with an escarpment of its own, which is particularly prominent at Sharpenhoe and Sundon. A large part of the area is over 400 feet in height, though beyond Barton the land becomes much lower, and patches of Boulder Clay overlie the Chalk. The region retains much of the character of the Chalk Plateau ; large arable fields are to be found, especially round Totternhoe, Houghton Regis and Arlesey ; numerous chalk pits scar the landscape ; slopes are steep and considerable stretches of rough pasture occur along the subsidiary escarpment, and there is a similar lack of surface drainage.

Agriculturally this is one of the most productive regions of the county. The arable land is almost continuous, and is found at heights up to 600 feet, though the greatest concentrations are along the foot of the main escarpment on the mixed soils and downwash from above. Between Eaton Bray and Watling Street most of the land is under the plough, with small meadows around the villages, but a break occurs to the north of Luton on the marshy ground near Leagrave where there is a considerable extent of grassland. Towards the north-east the proportion of arable land increases again, and the region links up with the Northern Arable Belt of Hertfordshire,[1] and the Chalk Marl Region of Cambridgeshire. The following figures which give the arable land as a percentage of the total land under crops and grass for three parishes of the region indicate the change which takes place towards the east.

Barton-in-the-Clay	Shillington	Stotfold
67	76	78 per cent.

With the exception of the extensive new orchards of Cockayne Hatley, the largest orchard areas of the county are to be found in the Icknield Loam Belt at Eaton Bray and Holwell. At Eaton Bray they are almost all pasture orchards, and are not usually of any great size. Though there is no fruit growing on a large commercial scale, there is some specialisation in plums and damsons.

The fertility of the soil means that most of the land is cultivated, and woodland is scarce. Groves of beeches occur between Sundon and Streatley on the higher parts of the Chalk, but elsewhere there are few trees.

A continuous belt of rough pasture exists along the top of the escarpment, where the thin covering of soil and the steepness of the slopes make cultivation difficult. The rough pasture is confined to this area, and there are no Common lands comparable with those of the Chalk Plateau. The numerous quarries scattered throughout the area are evidence of the value of the Lower Chalk for the manufacture of lime and cement. In the extreme east of the region the waste areas are brickworks associated with coverings of Boulder Clay over the Chalk. No large towns are found in the Icknield Loam Belt, and there are no built-up areas to take up the valuable agricultural land.

The outstanding importance of wheat in this region is indicated from the table as well as from the distribution map (Fig. 8). This crop occupies about a third of all the arable land,

[1] See *Hertfordshire Report*, p. 336.

UTILISATION OF 10,000 ACRES OF LAND OF THE ICKNIELD LOAM REGION.

Holdings	100	Greens	83 acres
Labour (casual and regular)	166	Peas	15 ,,
Arable land	5,353 acres	Orchards (including small fruit)	87 ,,
Grassland	3,827 ,,	Rotation grass and fodder crops	1,082 ,,
Rough pasture	952 ,,	Bare fallow	735 ,,
Wheat	1,737 ,,		
Barley	294 ,,	Dairy cattle	1,023
Oats	801 ,,	Beef cattle	321
Beans	160 ,,	Sheep	1,966
Potatoes	47 ,,	Pigs	2,171
Roots	125 ,,	Poultry	12,926

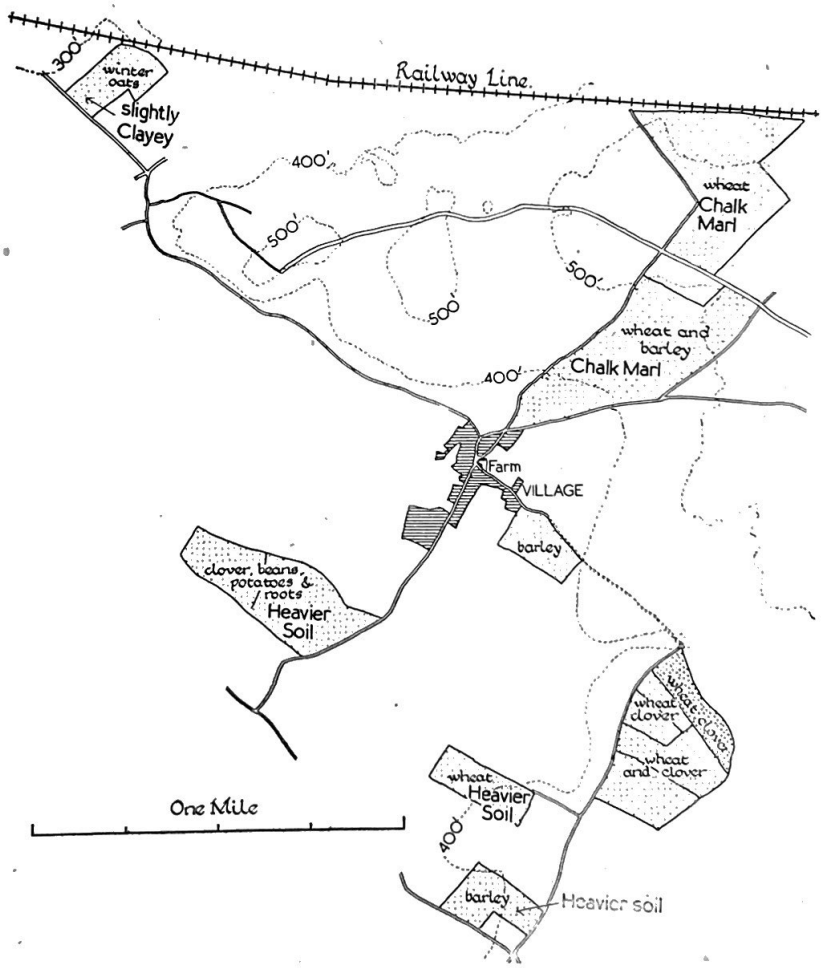


FIG. 39.—Specimen Farm III.—The Icknield Loam Belt.
Practically all the land on this farm is under the plough.

and is grown throughout the region from Eaton Bray to Stotfold, with a special concentration in the parish of Shillington. Oats, barley and beans (for seed and stock) are also widely grown, the far greater importance of beans here in comparison with the Chalk region is a direct reflection of the heavier soil. The rich loamy soils give rise to a greater diversity of crops, and also account for the lower proportion of fallow land.

Livestock are not so important as in other parts of the county, though pigs are kept in some numbers and their manure is greatly valued by farmers. Insufficient of this is available, and one farmer has an arrangement whereby he obtains pig manure in exchange for straw.

Specimen Farm III.

Situation. Totternhoe. The farm is at a height of 377 feet above sea-level, but much of the farmland lies above 500 feet. It faces south and is exposed.

Area. 420 acres (13 fields). The land is very scattered, and some fields are at a distance from the farm. The farmer is partly owner and partly tenant.

Soil. Chalk marl, with one or two fields of heavier soil.

Land use. Arable, 406 acres ; Grassland, 14 acres—medium quality.

Labour. 5 men and 2 casual workers.

Crops. Wheat, 155 acres ; Barley, 44 acres ; Oats, 33 acres ; Potatoes, 4½ acres.

Rotation. 3-course. Wheat—Winter oats or barley—Clover (sainfoin or trefoil). There is some fallow on the poorer land.

Fertilisers. Phosphates and sulphate of ammonia. Farmyard manure from Dunstable. Soot and manure were formerly obtained from London. Forty years ago it was a common practice for a horse and cart to drive to London with straw, and return with a load of manure.

Livestock. 20 cows (8 or 9 in milk). (Before the war 50–100 pigs were kept.)

Feeding stuffs. Mostly produced on the farm. Cake is bought.

Markets. Dunstable and Luton.

Water. Mains supply.

Power. Electricity and gas.

Notes. The land on this farm has nearly always been under the plough, and the chief war-time changes are revealed by an increase in the wheat acreage. Drainage is much improved since brooks and ditches have been cleared. Wire worms are a problem on the lighter soils.

Region 3. The Gault Clay Vale

In the section on relief it has been made clear that the topographic region of the Gault Clay Vale loses its character towards the north-east, although the outcrop of Gault continues. Similarly the utilisation of the Gault changes from predominantly grassland to almost pure arable farming. The map (Fig. 36) shows the boundary which has been drawn to demarcate the region, which extends from the Buckinghamshire border roughly as far as Wrest Park. Even in its widest part it does not attain a width of three miles, for surface features and land utilisation soon change with the outcrop of Greensand to the north. At its junction with the Chalk Marl the contrast in utilisation is very marked, and makes the Gault one of the most distinctive of the land use regions. Boulder Clay covers large parts of its surface, and although this does not radically alter the character of the country, it lightens the soil and generally allows more cultivation. At Toddington glacial sands and gravels occur, and the " island " of arable land which results is in marked contrast to the surrounding region.

The Gault Clay Vale can be clearly distinguished on the Farming Types map, where it is shown as a region of dairying supplemented by other enterprises. The heavy wet loams and clays make permanent grassland the rule, and arable fields are few and scattered, and are generally devoted to fodder crops. Little rough pasture land exists, and although the whole region was probably once forest-covered few relics of this remain. Only at Wrest Park is there any considerable area of woodland, and much of this is of the parkland type.

UTILISATION OF 10,000 ACRES OF LAND OF THE GAULT REGION.

Holdings	131	Greens	147 acres
Labour	186	Peas	21 ,,
Arable land	1,940 acres	Orchards	76 ,,
Grassland	8,043 ,,	Rotation grass and fodder crops	367 ,,
Rough pasture	23 ,,	Bare fallow	415 ,,
Wheat	445 ,,	Dairy cattle	2,299
Barley	19 ,,	Beef cattle	824
Oats	172 ,,	Sheep	5,022
Beans	52 ,,	Pigs	1,337
Potatoes	77 ,,	Poultry	12,873
Roots	49 ,,		

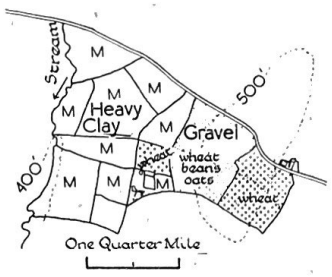


FIG. 40.—Specimen Farm IV.—The Gault Clay Vale.
Note the wartime increase in arable on the higher land.

Over 80 per cent. of the land in this sample is under grass, whilst the parish of Hockliffe shows that as much as 90 per cent. of the total area under crops and grass is permanent grassland. The pasture land is of good quality, though much is capable of improvement with scientific treatment (see above, p. 144). Farms are relatively small, and farmers concentrate on dairying, and to a surprising extent on the rearing of sheep. In fact, the south-western part of the Vale is one of the important sheep areas of the county. The importance of dairy cattle in the Gault region is evident from the map (Fig. 30), and beef cattle too are reared in some numbers.

Wheat is still the most important crop grown. The importance of potatoes and greens indicated by the above figures is not typical of the whole region, though they are grown more and more towards the north-east.

Specimen Farm IV.

Situation. Toddington. The farm is between 400 and 500 feet above sea-level. The aspect is south and it is fairly sheltered.

Area. 138 acres (12 fields). The farmer is a tenant, and the rent 30*s.* per acre.

Soil. A good deal is heavy clay typical of the Gault Region, but on the higher land gravel occurs.

Land use. Arable, 54 acres ; grassland, 84 acres—medium to good quality.

Labour. 2 men and 1 casual worker.

Crops. Wheat, oats and beans each occupy roughly one third of the arable land, whilst clover and roots figure in the normal 4-course rotation practised.

Fertilisers. Mostly farmyard manure. Some basic slag is used.

Livestock. 15 milking cows ; 23 heifers ; 35 breeding ewes ; 200 poultry. Before the war 40–45 cattle were kept, but since the farmer has some calving-in at intervals this number should soon be reached again. Pigs were also kept before the war.

Feeding stuffs. Mainly grown on the farm.

Markets. Dunstable and Luton.

Water. Water supply is a constant difficulty. A shallow well is at present in use, but the farmer is anxious to get a mains supply.

Power. Petrol engine installed.

Notes. Before the war only one field was arable, but today there are four arable fields and a good deal of wheat is grown. The farm lay-out is shown on the accompanying map, which also indicates the war-time changes. Drainage presents problems, but with the clearing out of the brook a big improvement will be effected. It must be emphasised that much of this farmland is not typical of the Gault Region, since it lies at a considerable elevation, and contains a good deal of gravel soil.

Region 4. The Eastern Clay Region

Although geologically a continuation of the Gault Clay Vale, this region differs so markedly in land utilisation that its distinction is essential. The boundary line between the two regions has been drawn to the east of Wrest Park where there is quite a large and sudden increase in the amount of arable land. This increase continues towards the north-east until beyond the Ivel the only grassland to be seen is that in the immediate vicinity of the villages. The region links up in the east with the Northern Arable Belt of Hertfordshire,[1] and in the opposite direction it merges into the market gardening district.

The land is at a low elevation, but there is little in the relief to distinguish it from the surrounding areas. It is a region of heavy soils derived from the Gault or Boulder Clay formations. Gault covers the whole of the eastern part, and Boulder Clay the western half, although patches of gravel (e.g., at Dunton) do add a little variety. The Gault soils are as usual very wet and badly drained particularly at their junction with the Boulder Clay, and they cannot be used for market garden purposes. They are generally farmed in conjunction with the lighter soils of the Boulder Clay which can be more easily cultivated because of their higher proportion of chalk, stones and fine gravel and their better natural drainage. Both soils, however, are devoted mainly to arable farming. Fields are very much larger than in the Gault Clay Vale, whilst some of the largest holdings of the county are in this region. There is little woodland or rough pasture, and grassland occurs either round the villages where it is utilised for pasturing the few livestock kept for local needs, or as meadows along the Ivel valley.

UTILISATION OF 10,000 ACRES OF LAND OF THE EASTERN CLAY REGION.

Holdings	108	Other greens	78 acres
Arable land	7,607 acres	Orchards	56 ,,
Grassland	2,214 ,,	Rotation grass and fodder crops	1,157 ,,
Rough pasture	181 ,,	Bare fallow	1,218 ,,
Wheat	2,548 ,,	Other crops	70 ,,
Barley	476 ,,		
Oats	600 ,,	Dairy cattle	628
Beans	245 ,,	Beef cattle	549
Potatoes	603 ,,	Sheep	1,580
Roots	144 ,,	Pigs	2,554
Peas	139 ,,	Poultry	6,437
Brussels sprouts	273 ,,		

Wheat is of outstanding importance. With adequate drainage both soils are capable of producing good crops, though those on the Gault thresh somewhat lightly, the average yield being a little over three quarters to the acre. Barley—somewhat surprisingly—is more important here than in the Chalk regions, and oats and horse beans occupy a considerable amount of land. The influence of the market gardening economy of the adjoining region is revealed

[1] See *Hertfordshire Report*, p. 336.

by the importance of potatoes, peas and especially of brussels sprouts, mainly on the Boulder Clay formation. The usual course of crops is : beans — wheat — oats — potatoes — with clover and rotation grasses introduced into the rotation occasionally. The amount of bare fallow land emphasises the need for scientific treatment of these heavy clay soils which require fairly heavy manuring.

As might be expected, livestock are of no great importance in the region, though many farmers keep a few pigs largely for their manure.

Specimen Farm V.

Situation. Astwick near Stotfold. The farm lies at a height of 130 feet above sea-level, and faces south.

Area. 480 acres. The farmer is a tenant, and the total rent amounts to £580. This represents approximately 24*s.* per acre.

Soil. The soil varies from heavy clay, which is typical of the region as a whole, to strong gravels and good black land (see diagram).

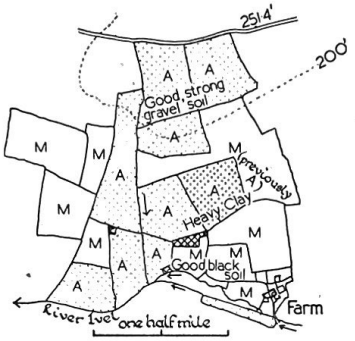


FIG. 41.—Specimen Farm V.—The Eastern Clay Region.

Arable. 280 acres.

Grassland. 120 acres of good grassland ; 80 acres of rough grazing.

Labour. 10 men, 1 woman and 1 boy. In addition, 2 men and 2 women are employed on milk rounds, and the farmer's two sons and a boy work in the dairy.

Crops. The 4-course rotation is followed, and this includes on the heavy land a 1 or 2 years' ley or lucerne, and beans, whilst on the lighter soils potatoes, mangolds and cabbages are grown.

In addition to the cereal crops, a little sugar beet seed is produced, kale is grown for cattle, whilst before the war both peas and brussels sprouts were grown.

Fertilisers. Farmyard manure ; Potato or beet manure ; Nitrate of lime and sulphate of ammonia.

Livestock. A self-contained herd of 117 cattle, including 3 bulls.

Feeding Stuffs. Principally beans and oats, with bran when available. Dairy cake is purchased for the best milkers.

Notes. About 200 gallons of milk are retailed daily from this farm. Since the war there has been an increased acreage under wheat and mixed corn at the expense of barley.

Specimen Farm VI.

Situation. Eyeworth. The farm is at a height of 150 feet above sea-level, and has an easterly aspect.

Area. 365 acres. The farmer is a tenant and the rent £1 per acre. In addition, he farms a considerable acreage in the same locality.

Soil. Medium heavy clay.

Arable. 330 acres.

Grassland. 30 acres.

Labour. The farmer estimated that on all his land he had about one man to 50 acres, and a boy or a land girl to every 200 acres.

Crops. The cropping, which has not changed much since the war is roughly as follows :

Wheat	120 acres	Potatoes	30 acres	Sugar beet	10 acres
Barley	30 ,,	Brussels	35 ,,	Roots	2 ,,
Oats	25 ,,	Seeds hay	30 ,,		
Beans	15 ,,	Peas	10 ,,		

Rotation. 7-course. Seeds—wheat—potatoes, roots or sugar beet—wheat—sprouts or peas—wheat—oats or barley.

Fertilisers. The chief fertilisers required are ammonia and super-phosphate. In addition for certain crops special fertilisers are used as follows : Potatoes, 10 cwt. of compound per acre with about 8 tons of dung. Sugar beet, 6 cwt. of compound with dung. Brussels sprouts, 1 ton of soot or 6 cwt. of compound. Four cwt. of compound is used for a second white straw crop and for some wheat usually after sprouts.

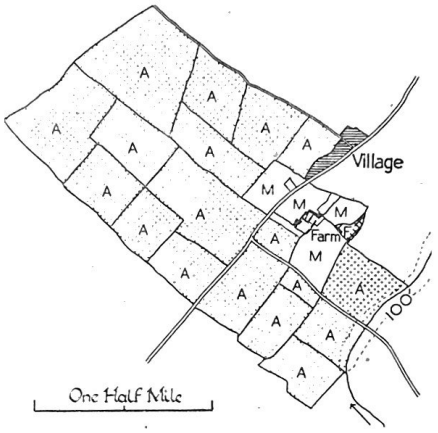


FIG. 42.—Specimen Farm VI.—The Eastern Clay Region.

Livestock. 25 cattle are grazed during the summer months, and about 40 are kept in the yards during winter.

Feeding Stuffs. Oats, beans, sugar-beet pulp and straw.

Market. Bedford for cattle market and corn. London for potatoes and vegetables.

Notes. Although the soil of this farm is not the heaviest of the district, yet farming economy here is typical of the Eastern Clay Region. This is especially true of the high proportion of arable land, and of the few home meadows.

Region 5. The Woburn–Leighton Buzzard Plateau

Sub-division of the Greensand Region is justified not only on account of relief, but also because of important differences in utilisation. From the county boundary in the west as far as Ridgemont and Tingrith the Greensand country has the character of a plateau at an average elevation of 400 feet. Woodland covers much of the surface, and a large area is occupied by Woburn Park, the Duke of Bedford's 5,000 acre estate. The sandy soils derived directly from the Greensand are often too hilly for cultivation, though the clays and loams in the valleys are capable of tillage.

Arable land is scarce and occurs in limited areas only. Round Husborne Crawley it is due to the mixed soils at the junction of the Greensand and Oxford Clay, and elsewhere is associated with superficial deposits over the Greensand. Improvement of much of the land is no doubt possible, but the marl or clay required is often at inconvenient distances. Apart from a small amount of heathland, which is mostly cut over woodland, the rest of the region is either

forested or under grass. Although there is actually a higher proportion of land under grass than in the Gault Region the pastures are some of the poorest in the county, and are not capable of supporting many livestock.

In addition to the large forested areas such as King's Wood and Aspley Wood, there is a good deal of scattered woodland in the region, much of which is pine and fir plantation. In the west the strip of woodland is almost continuous from Leighton Buzzard to Woburn Sands, whilst a large part of Woburn Park is high forest.

Leighton Buzzard on the river Ouzel is the chief market town for the region, and the other settlements like Woburn and Aspley Guise are wealthy residential areas taking advantage of the healthy sites and attractive surroundings. This type of development has gone on to a considerable extent round Woburn Sands in spite of its lack of direct rail communication with London.

The Greensand Plateau belongs to the same farming type region as the Gault, though there are some important differences. It is essentially a dairying region, but the poorer quality of the grassland accounts for the fewer dairy cattle. Sheep are relatively more important than in the Gault Region, and many farmers have gone in for poultry on a large scale. Sheep are especially important in the parish of Woburn, whilst the pastures of Woburn Park support a large number of dairy cattle.

UTILISATION OF 10,000 ACRES OF LAND OF THE GREENSAND PLATEAU

Holdings	135	Peas	50 acres
Arable land	1,642 acres	Orchards	26 ,,
Grassland	8,155 ,,	Rotation grass and fodder crops	337 ,,
Rough pasture	208 ,,	Bare fallow	239 ,,
Wheat	271 ,,	Other crops	15 ,,
Barley	95 ,,		
Oats	177 ,,	Dairy cattle	1,410
Beans	21 ,,	Beef cattle	638
Potatoes	175 ,,	Sheep	4,510
Roots	117 ,,	Pigs	1,275
Greens	119 ,,	Poultry	24,059

In view of the small amount of arable land there is a surprisingly wide variety of crops grown. Cereals are of minor importance, whilst the production of potatoes and other vegetable crops indicates the suitability of the light sandy soils for market gardening. It certainly is a potential market garden region, though it is doubtful whether the development of this industry along the rest of the Greensand ridge is likely to spread any further westward at the moment.

Specimen Farm VII.

Situation. Woburn. The farm is 350 feet above sea-level. It has a north-easterly aspect, and experiences early and late frosts.

Area. 340 acres. The farm is one of four on the Duke of Bedford's estate, and together they occupy 1,500 acres. The farmer is a manager for the Duke.

Soil. Sandy, with one or two fields of heavier soil.

Land use. Arable, 136 acres ; grassland, 204 acres—useful quality but deficient in lime.

Labour. 21 men and two land girls for the whole 1,500 acres.

Crops. Wheat, 50–60 acres ; Barley, 7 acres ; Oats, 12½ acres. Roots are grown for livestock.

Fertilisers. Phosphates and potash.

Livestock. On all four farms : 315 cattle, 54 horses, 105 pigs, 600 poultry.

Feeding stuffs. Grown on the farms.

Markets. Leighton Buzzard and Bedford.
Water. Mains supply.
Power. Petrol and gas engines.
Notes. For the 1942 harvest there were 410 acres under corn crops on the whole estate.

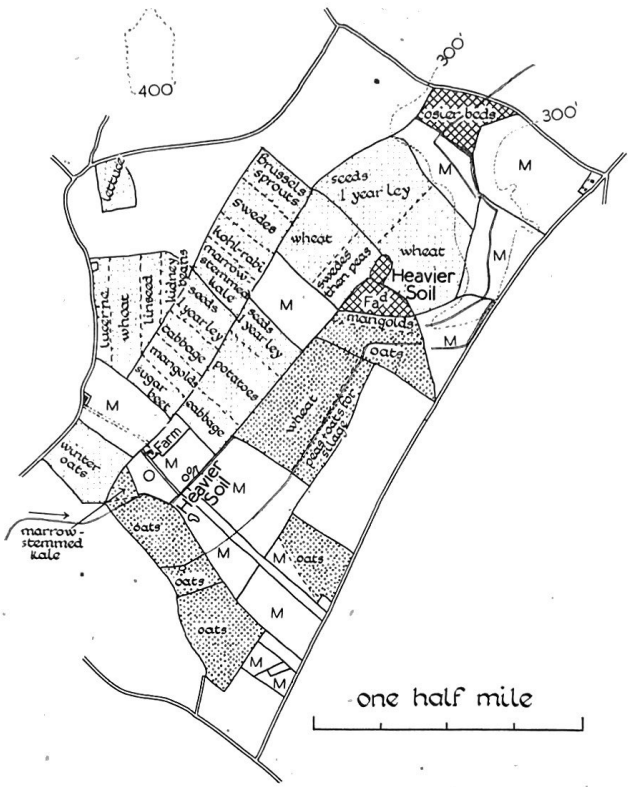


FIG. 43.—Specimen Farm VII.—The Woburn–Leighton Buzzard Plateau.
There is a considerable increase in the arable acreage since the war.

Region 6. The Lower Greensand Ridge

As a land use region the Greensand ridge does not correspond with the region outlined under the section on relief. From the Woburn plateau area it extends as a fairly well marked ridge with an escarpment overlooking the plain to the north, but it diminishes in height to the north-east where it gradually merges into the market gardening region of Biggleswade. The somewhat arbitrary boundary in the east has been drawn roughly through Shefford, beyond which market gardening becomes of predominant importance in the farming economy.

Physically and agriculturally this is a most interesting and varied region, and it may be regarded as transitional between the rather negative farming area of the plateau and the intensive farming of the Biggleswade district. It includes the Flitwick peat area where the Greensand has been eroded away by a tributary of the Ivel and the Oxford Clay has been exposed. Deposits of alluvium along the valley tend to increase the marshy character of this low-lying area, and the

development of peaty vegetation makes the region a distinctive one. Most of the land along the river is in rough pasture, and there are large stretches of grassland on the clays, but the Greensandsoils of Flitwick and the peaty soils along the Flitt valley produce a considerable amount of market garden crops.

Elsewhere the soils are mainly sands and gravels, and though they are not nearly so varied as in the Biggleswade district they are easily worked and with careful treatment and manuring are capable of producing many of the market garden crops. Farming is of the intermediate type with specialisation in vegetables, and the region is best considered as an extension of the true market gardening area. The land utilisation pattern is most varied, and includes besides a fairly even distribution of arable land and grassland, a good deal of scattered woodland, as well as nurseries around Ampthill and Maulden. Marked arable areas seem to be associated with the occurrence of glacial and other superficial deposits. On the sands and gravels near Flitwick market gardening is carried on, and brussels sprouts and cabbages are grown. In Maulden parish, where sand and clay rest on the Greensand, between 60 and 70 per cent. of the land is arable, and most of the usual market garden crops are produced. Ampthill is the centre for the region, and as long ago as 1219 a market was established there.

UTILISATION OF 10,000 ACRES OF LAND OF THE GREENSAND RIDGE.

Holdings	240	Other vegetables	118 acres
Arable land	5,083 acres	Orchards	63 ,,
Grassland	4,671 ,,	Small fruit	28 ,,
Rough pasture	268 ,,	Nursery stock	134 ,,
Wheat	918 ,,	Rotation grass and fodder crops	423 ,,
Barley	205 ,,	Bare fallow	546 ,,
Oats	327 ,,		
Beans	140 ,,	Dairy cattle	938
Potatoes	948 ,,	Beef cattle	408
Roots	148 ,,	Sheep	1,706
Brussels sprouts	649 ,,	Pigs	2,165
Cabbages	242 ,,	Poultry	28,827
Peas	244 ,,		

The much smaller holdings of this region are indicative of the change to market gardening. More than half the land is ploughed, and wheat still occupies a prominent position amongst the crops grown, with quite a substantial acreage under other cereals. The chief arable areas where these crops are grown occur near Maulden and Clophill where the soil contains a much higher proportion of clay. Orchards, small fruit and nursery stock around Ampthill and Maulden show that variety is one of the keynotes of the region.

Livestock are of no great importance. Dairy cattle are found more in the east of the region where the soils tend to be slightly heavier; a large number of pigs are kept in the parish of Flitton, whilst poultry are of outstanding importance round Flitwick.

Specimen Farm VIII.

Situation. Maulden. The farm is at a height of 200 feet above sea-level, faces south and is fairly exposed.

Area. 69¼ acres. The farmer has certain rights in two adjoining fields known as Horse Common and Cow Common. He is the owner of his farm and values the land at £3 per acre.

Soil. Soils are very mixed, ranging from heavy (3-horse land) to loams, gravels and sands, with an area of peat down by the river (see accompanying diagram).

Land use. Arable, 57¾ acres; grassland, 6½ acres. 4 acres of this is rough pasture land, and the remaining 2½ acres is of medium quality. Pasture Orchard, 5 acres.

Labour. 6 men.

Crops. No strict rotation is adhered to, but potatoes are usually followed by greens and then a cereal.

Wheat . .	10 acres	Early potatoes .	6 acres	Swedes . .	½ acres
Barley . .	3 ,,	Main crop potatoes	16 ,,	Mangolds .	1 ,,
Oats . .	4½ ,,	Brussels sprouts .	5 ,,	Beet . .	2 ,,
Mixed corn	6 ,,	Cabbages . .	1½ ,,	Cauliflowers	¾ ,,
		Seed beds . .	½ ,,	Runner beans	1 ,,

Less wheat and potatoes were grown before the war.

Fertilisers. Farmyard manure, shoddy, mixed fertilisers. Roughly 20 tons are used per annum on the whole area.

Livestock. 1 cow and 2 heifers; 39 pigs. Before the war 12–20 cows and 80 pigs were kept.

Feeding stuffs. Grown on farm.

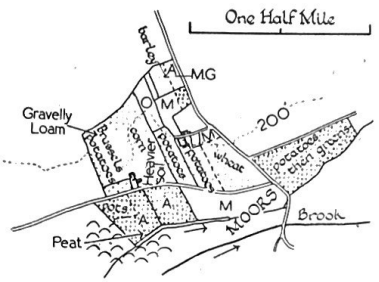


FIG. 44.—Specimen Farm VIII.—The Lower Greensand Ridge.
A wide variety of market crops are grown on this farm.

Markets. The produce goes via market salesmen who collect from the farm, to St. Albans, Luton and London. The fruit goes mostly to Bedford.

Notes. The farm was originally part of a large estate which was cut up. It is now the centre of a very intensive market garden region, though more cereals are grown here than on the surrounding land. The patch of rough pasture on the peaty soils is gradually being broken up, and in 1941 part of it yielded a crop of potatoes (see diagram).

Region 7. The Biggleswade Market Garden Region

It is extremely difficult to describe any exact boundaries to this region, for whilst the area of most concentrated production is certainly to be found along the valleys of the Ivel and Ouse, development is less intense in adjoining districts. The spread of market gardening along the Greensand ridge has already been noted, whilst a similar development gives rise to an extension of the region westwards along the Ouse valley towards Bedford. It remains to be seen how far this development will continue, but it is necessary to remember that market gardening is practised on a considerable scale beyond the boundaries of the region as shown on Fig. 36.

The region stretches roughly 15 miles from north to south with an average width of about 6 miles, covering most of the eastern part of Bedfordshire and a smaller area in western Huntingdonshire. The Farming Types map assigns a somewhat larger area to market gardening, and emphasises the peripheral area of lesser importance as well as the two westerly extensions.

Apart from a marked development of the Greensand ridge near Sandy, the region is of low relief—under 200 feet above O.D.—and is drained northwards by the Ivel and the Ouse. The soils and the formations from which they have been derived have been dealt with in detail

elsewhere, and their value for market gardening has been emphasised. Although areas of medium and heavy soils occur on the Oxford and Gault clays, most of the soils are light loams and gravels which can be easily worked and manured. " Around Biggleswade," said Batchelor, " the subsoil of gravel is covered with a great thickness of black mould or red-brown earth, and in both of them the fertility is very great, every sort of corn or seeds never failing to yield an ample crop." (*Op. cit.*, p. 8.)

The figures given below show that nearly 80 per cent. of the land is devoted to crops—the highest proportion of arable land in the county. The only grassland is to be found along the river valleys, on the heavier clay soils which are inadequately drained, and in small scattered patches which represent the home meadows of farms. Rough pasture occurs mainly on the steeper slopes of the Greensand escarpment and on the low-lying marshy ground on some of the clay and alluvium areas. On the Dark Sand formation of the Greensand scarp near Sandy there still remain considerable areas of fir and larch plantations, although much has been removed to make way for market gardening. These are some of the few remaining negative agricultural areas in this intensive farming region.

UTILISATION OF 10,000 ACRES OF LAND OF THE MARKET GARDEN REGION.

Holdings	382	Peas	555 acres
Labour	869	Cauliflower and broccoli	65 ,,
Arable land	7,978 acres	Carrots	113 ,,
Grassland	1,778 ,,	Onions	36 ,,
Rough pasture	244 ,,	Orchards	7 ,,
Wheat	1,091 ,,	Nursery stock	772 ,,
Barley	159 ,,	Rotation grass and fodder crops	238 ,,
Oats	300 ,,	Bare fallow	799 ,,
Beans (mostly for market)	315 ,,		
Potatoes	1,769 ,,	Dairy cattle	248
Mangolds	89 ,,	Beef cattle	164
Turnips, swedes, etc.	10 ,,	Sheep	—
Sugar beet	106 ,,	Pigs	1,191
Brussels sprouts	1,345 ,,	Poultry	11,233
Cabbages	209 ,,		

In the true market gardening area the farmers are mostly tenants of small holdings, with a variety of land which may include soils of three distinct formations. Reference to the section showing the relation of crops to soil formations shows that a farmer cultivating Greensand, gravel and Gault soils is able to produce a very wide range of vegetable crops.

Normal farm crops are grown and wheat still occupies a large acreage, mainly on the clays (see Table, p. 136). Sugar beet is grown on the sandy soils round Biggleswade and Sandy, and mangolds and other roots are produced for the dairy and store cattle.

All market garden crops are grown ; early and late potatoes, brussels sprouts, peas, runner beans, carrots, beetroot, parsley, vegetable marrows, parsnips, cauliflowers, cabbages, lettuce and onions. Some flowers are grown, and there are a number of glasshouses in the district. Potatoes and brussels sprouts are of outstanding importance and are grown widespread throughout the region. (See distribution maps.) The production of these vegetables has increased partly at the expense of others such as carrots and onions which have shown a startling decrease in the last 20 or 30 years.

Land in the market gardening region is always valuable whether devoted to normal farming crops or to vegetables. Rents for ordinary farm land vary from 25*s*. to 50*s*. per acre per annum which is well above the average, whilst from 50*s*. to 100*s*. per acre may be paid for market garden

land. Much more labour is required here than in other parts of the county, and labourers have to be skilled in market garden work. Casual labour on a fairly large scale is necessary for pea and potato picking.

Fertilisers and manures are of vital importance to the industry and include farmyard manure, soot, shoddy and chemical fertilisers. Less London stable manure is available now since the decline in horse traffic, though it once bulked largely as return loads for vehicles taking vegetables to the city. More lime has been used on the land in recent years.

Rail and road transport have always played a large part in the development of the region, for both the important centres of Biggleswade and Sandy have direct communication with London and the north. Biggleswade which still specialises in bunched carrots, parsley, marrows and to a lesser extent in flowers, formerly sent an average of 50 railway wagons a day to London and the south. Now, however, most of the produce for London goes by road. On the other hand Sandy on the main L.N.E.R. line supplies the northern cities, and has dispatched as much as 100 tons of produce in one night.

The Biggleswade Market Gardening Region is one of our few areas of first-class arable land, and although its value has long been realised, there is still room for development in the marginal districts, and beyond its present boundaries along the Greensand ridge. Its value is enhanced by its position and transport facilities, and if the greatest use can be made of all the available market gardening land, it should continue to develop as one of the country's chief sources of fresh vegetables.

Specimen Farm IX.

Situation. Sutton near Biggleswade. The farm is less than 100 feet above sea-level.
Area. 133½ acres (8 fields). The farmer is a tenant and the rent is £2 10*s.* per acre.
Soil. Light sandy loam and dark loam.
Land use. Arable, 90 acres; grassland, 43½ acres.
Labour. 10–12 regular men. Casual labour for pea picking and potato harvesting.
Crops. No rotation is strictly adhered to. A wide variety of crops both cereals and vegetables are grown.

Wheat	15 acres.	Onions	5 acres
Oats	12 ,,	Parsnips	5 ,,
Brussels sprouts	14 ,,	Peas	4 ,,
Potatoes	16 ,,	Cauliflowers	2 ,,
Cabbages	8 ,,	Parsley	5 ,,
Mangolds	2 ,,	Marrows	2 ,,

Fertilisers. Complete fertilisers for potatoes and other market garden crops. Sulphate of ammonia and nitrate of soda for top dressing for most crops. 40–50 tons of these fertilisers are used annually.
Livestock. 30–40 store cattle from 12–24 months old.
Feeding Stuffs. Nearly all grown on the farm.
Markets. London by road. Glasgow and north of England towns by rail.
In addition to the land at Sutton the farmer also has 60 acres of light arable land (cropped similarly to the above) at Old Warden. The amount of labour and tonnage of fertilisers includes this land.
Notes. 1. The meadowland and parts of the arable are subject to floods. The land comes within the Ivel Internal Drainage Scheme.
2. Tithes. Queen Anne's Bounty about 2*s.* 6*d.* per acre per annum.
3. In addition to the chemical fertilisers, farmyard and London stable manure, soot and shoddy are all used.
4. About 50 tons of lime is used annually on the whole area. (200 acres.)

Region 8. The Oxford Clay Region

The whole of the north of the county beyond the Greensand escarpment is topographically

one large region, but the extensive drift deposits, mainly of Boulder Clay north of the Ouse, as well as the occurrence of a gravel strip along the Ouse valley make sub-division into three land use regions desirable. The true Oxford Clay region which is limited to the southern part of the Vale of Bedford is a low-lying area of heavy, damp soils, and is separated from the Boulder Clay region by the gravel along the Ouse. Much is below 200 feet above O.D., though there is a noticeable increase in height towards the west. Numerous small streams drain northwards to the Ouse, and the nature of the sub-soil makes for marshy conditions which greatly hinder farming operations. The exceedingly high clay content in the soil makes it sticky and intractable, and unless it is ploughed in the autumn cultivation becomes almost impossible. The pastures are deficient in lime and large quantities of basic slag are needed for improvement.

Arable land in the region is to be found mainly in the west in a strip along the Buckinghamshire border, where an increase in height has lessened the drainage difficulties. Elsewhere ploughed land is very scarce, only a field or two here and there producing a little wheat and a few fodder crops. Cranfield in the west shows the highest proportion of cultivated land, for other parishes like Houghton Conquest and Marston Mortaine have more than twice as much grassland as arable. There was formerly much more land under the plough, and wheat and beans were produced on the heavy clays.

Today the very high proportion of permanent grassland makes the region comparable with the Gault Clay Vale, and there is little variation in the land use pattern, except for the large areas of unproductive land associated with brickworks, and a few patches of woodland towards the west.

UTILISATION OF 10,000 ACRES OF LAND OF THE OXFORD CLAY REGION.

Holdings	97		Greens	44	acres
Labour	125		Orchards	7	,,
Arable land	2,792	acres.	Seeds	31	,,
Grassland	7,023	,,	Rotation grass and fodder crops	525	,,
Rough pasture	284	,,	Bare fallow	786	,,
Wheat	871	,,			
Barley	79	,,	Dairy cattle	1,491	
Oats	231	,,	Beef cattle	756	
Beans	114	,,	Sheep	3,247	
Potatoes	56	,,	Pigs	924	
Roots	48	,,	Poultry	11,603	

The pastures are not of high quality for most of the region lies within the grassland group VI (see page 143), where ordinary *Agrostis* predominates. There is, however, a belt of better grassland extending from Lidlington through Marston Mortaine to Kempston, in which the dominant type is *Agrostis*-with-ryegrass.

This part of the Vale of Bedford links up with the Vale of Aylesbury, and dairying and sheep rearing are the chief enterprises. Dairy cattle are well distributed throughout the region, but beef cattle and sheep are more important in the south and west, particularly in the parish of Lidlington. Wheat and beans are still important crops, and rotation grasses and fodder crops figure in most rotations to supply feeding stuffs for the livestock.

Specimen Farm X.

Situation. Marston Mortaine. The farm is on low-lying ground between 130 and 140 feet above sea-level. It has a south-easterly aspect and is fairly exposed.

Area. 300 acres (13 fields). The farmer is a tenant.

Soil. The soil varies from heavy clay to medium loam, and there are two fields of gravel soil. The best results are obtained in an average summer, for in a particularly dry spell the gravels do not retain sufficient moisture.

Land use. Arable, 2 fields. But there were 6 arable fields for the 1942 harvest. (See map.) Grassland, 11 fields before the war—average quality.

Labour. 3 men.

Crops. Wheat, oats and beans are chief crops. The farmer practises the four-course rotation, ending with a clover ley. The last clover crop is often ploughed in for manure.

Fertilisers. Mainly farmyard manure.

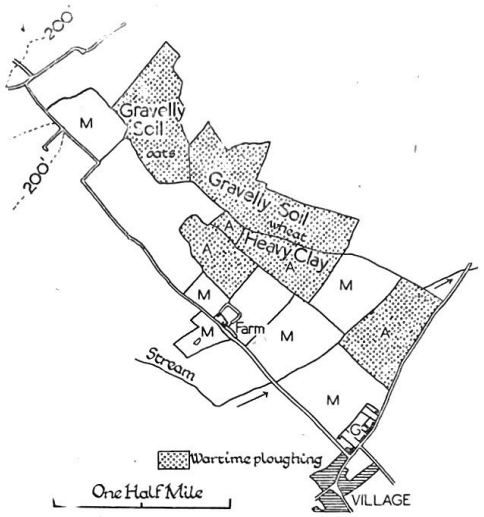


FIG. 45.—Specimen Farm X.—The Oxford Clay Region.
A large acreage on this farm has been ploughed up since the war.

Livestock. 25 milking herd ; 40–50 other cattle ; 5 horses. Pigs and poultry are also kept.
Feeding stuffs. Cake and linseed are purchased in addition to the feeding stuffs grown on the farm.
Market. Milk goes by road to Bedford. Formerly it went by rail to London.
Water. Mains supply.
Power. Main supply.
Notes. Much of the land is subject to flooding, but drainage is now much improved since the clearing out of the ditches. Poisonous fumes from the near-by brickworks are liable to contaminate the pastures.

Region 9. The Ouse Gravel Belt

Batchelor's Soil Map (Fig. 3) shows the area of gravelly soils extending along the Ouse and Ivel valleys. Much of this is within the true market gardening region and has already been considered, but the strip of gravel to the east and west of Bedford forms a distinctive land use region of intermediate type. The belt of gravel soils stretches from Pavenham and Oakley in the west and widens in the east where it merges into the market gardening region.

Although gravels predominate within this narrow belt, the soils are surprisingly varied, for above Bedford they are often derived from the Cornbrash and the limestone and clay of the Oolite series. Then along the river itself a strip of marshy alluvium is to be found, frequently flooded, and almost entirely under grass. These soil differences account for the intermediate character of the farming ; the gravels are devoted to market gardening ; ordinary farm crops

are grown on the loams and clays of the Jurassic strata ; whilst pasture land is continuous on the alluvium along the Ouse.

Over the region as a whole there is roughly the same amount of grassland as arable land, though the general tendency is for an increase in the arable land towards the east. The solid blocks of arable around Oakley and Biddenham are areas of gravel soil mainly devoted to market garden crops, whilst the soils of the Cornbrash are generally under the plough and produce good crops of wheat. The maps showing the distribution of potatoes and brussels sprouts illustrate the importance of market gardening in the region, and suggest that it may well be considered as an extension of the Biggleswade area. At present potatoes and brussels sprouts are the only crops of any significance, but there is every reason to suppose that all the other market gardening crops could be produced along the Ouse valley.

The strip of grassland on the alluvium and gravel is of fairly good quality, consisting of *Agrostis*-with-ryegrass pasture and areas of ordinary *Agrostis*. One field on either side of the river generally marks the limit of the water meadows, though in some places cultivation extends to the river bank itself. Dairy cattle are as a rule more important than beef cattle, especially in the neighbourhood of Bedford. The purple areas are mostly nurseries associated with market gardening.

The parish of Biddenham lies almost wholly within this region, and the figures given below will give some idea of the actual land utilisation. The soils of the parish are mainly gravels changing to loams and clays in the north.

LAND UTILISATION IN THE PARISH OF BIDDENHAM.

Total area under crops and grass	1,090 acres	Brussels sprouts	195 acres
Holdings	14	Peas	24½ ,,
Labour	38	Other greens	28½ ,,
Arable land	733 acres	Nursery stock	1½ ,,
Grassland	357	Bare fallow	82 ,,
Wheat	155		
Barley	7½	Dairy cattle	27
Oats	36	Beef cattle	113
Beans	21¾	Sheep	—
Potatoes	176¾	Pigs	54
Roots	4½	Poultry	1,675

Region 10. The North Bedfordshire Mixed Farming Region

This is the largest land use region in the county, and although differences of soil and land utilisation occur, the whole area is characterised by fairly heavy clay soils and general mixed farming is the rule. In the north-east it links up with the Clay Uplands Region of Huntingdonshire, and westwards it adjoins the Mixed Farming Region of Northamptonshire.

Except for a small area in the north-west and along the Ouse valley where older rocks outcrop, the whole of the region is underlain by Oxford clay. But the characteristic clay soils are derived not from this formation, but from the extensive drift deposits mainly of Boulder Clay which have been spread over this part of the Vale of Bedford. Where the Ouse tributaries have cut through the drift, Oxford Clay is exposed at the surface, and heavier soils mainly under grass result. The Boulder Clay soil is here a tenacious, brownish or bluish clay with boulders, and its high content of chalk increases its value for agriculture. Lighter soils occur on the glacial sands and gravels. The outcrop of Cornbrash and the Oolite series does little to vary

soil conditions since they are themselves largely covered by superficial deposits. The Cornbrash soils, especially along the Ouse, carry a higher proportion of arable land and have always been valued for wheat.

Topographically northern Bedfordshire is a dissected upland between 200 and 300 feet in height, drained eastwards by the Ouse and its tributaries. The Ouse valley with its wide meanders incised deeply into this upland breaks the undulating monotony of the region. In the extreme north-west a small area drains towards the Nene, the watershed passing roughly along the line of the Forty Foot Lane.

There is a marked correlation between land utilisation and topography. Most arable land is to be found at greater elevations, on the Boulder Clay, whilst the lower areas of heavier and damper soils are mainly under permanent pasture. A marked concentration of arable land occurs on the belt of higher land which stretches between Milton Ernest and Little Staughton. Drainage difficulties are not so acute in Bedfordshire as they are further east in Huntingdonshire, nevertheless much improvement could be effected if the problem was seriously tackled. As it is much of the lower land north of Bedford and on the Huntingdonshire border is damp and cold and unsuited to crops. The quality of the grassland deteriorates towards the north-east though it is capable of improvement with scientific treatment.

A considerable amount of woodland and smaller patches of heathland occur within the region, relics of far larger tracts of unimproved land which formerly existed on the heavy clay soils.[1]

Although concentrations of arable land and grassland occur in the region the Land Utilisation map shows that northern Bedfordshire is a typical mixed farming region. The emphasis is on rearing and feeding rather than dairying, fat cattle and lambs are produced for the Bedford market, whilst most farmers grow their own root crops and two or three varieties of sale crops also. Dairying is of more importance in the south-west and near Bedford, and sheep become more numerous towards the north-west.

UTILISATION OF 10,000 ACRES OF LAND OF THE NORTH BEDFORDSHIRE MIXED FARMING REGION

Holdings	123	Greens	81 acres
Labour	150	Orchards	4 ,,
Arable land	5,148 acres	Seeds	19 ,,
Grassland	4,438 ,,	Rotation grass and fodder crops	1,117 ,,
Rough pasture	452 ,,	Bare fallow	1,042 ,,
Wheat	1,794 ,,		
Barley	88 ,,	Dairy cattle	1,070
Oats	503 ,,	Beef cattle	407
Beans	316 ,,	Sheep	2,914
Potatoes	78 ,,	Pigs	780
Roots	52 ,,	Poultry	19,298
Peas	54 ,,		

Wheat is easily the leading crop, with oats and beans each occupying a large acreage. A little flax is produced in the north of Bedfordshire, and at Carlton and Chellington where gravel lightens the soil a good deal of barley is grown. The relatively high proportion of fallow land indicates the poorness of the soil over most of the region, and most farmers find it necessary in their rotations to allow the poorer fields to recuperate.

[1] During the last century the parish of Knotting lost one-half of its total woodland area.

Specimen Farm XI.

Situation. Renhold near Bedford. The farm is at a height of 160 feet above sea-level. The aspect is south and it is fairly sheltered.

Area. 240 acres (11 fields).

Soil. Clay. Fairly heavy working land.

Land use. Arable, 7 fields ; grassland, 4 fields ; one of these has now been ploughed up. (See map).

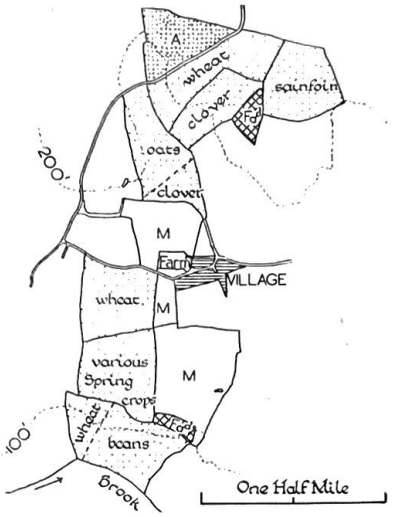


FIG. 46.—Specimen Farm XI.
The North Bedfordshire Mixed Farming Region.

Labour. The farmer's 2 sons, 1 old age pensioner, and a boy.

Crops. The four-course rotation is practised : Wheat—beans—clover—roots. A certain amount of fallow is necessary every year. In addition to wheat (40 acres) the chief crops are beans, oats and barley.

Livestock. Cattle, sheep and pigs are all kept but in fewer numbers since the war.

Feeding stuffs. Mostly grown on the farm.

Market. Bedford.

Specimen Farm XII.

Situation. Harrold. The farm is approximately 200 feet above sea-level, and the farmland slopes down to the Ouse. The aspect is west and the farm is exposed.

Area. 311 acres (21 fields). The farmer is a tenant and the rent £1 per acre.

Soil. Several soil types are included ranging from light gravel by the river to a strip of Cornbrash and heavier clay further west. (See map.)

Land use. Arable, 13 fields ; grassland, 8 fields, including water meadows and home meadows. The grassland is of rather poor quality except for the water meadows.

Labour. 8 men.

Crops. Wheat, 60 acres. Yield is 4 bushels per acre, which is about the average for the county. Potatoes and roots are also grown.

Rotation. Five-course system : Wheat—beans—wheat—oats—clover. Land is left fallow when necessary.

Fertilisers. 20–30 tons phosphates and nitrogen per annum, in addition to farmyard manure.

Livestock. 80–90 cattle. 160 sheep. 30–40 pigs (200–300 were kept before the war). 100 poultry (many more were kept before the war).

Feeding stuffs. Mostly grown on the farm.

Market. Bedford.
Water. Obtained from a well near the river, going down 12 feet into the gravel.
Power. Paraffin engine. Electricity is too expensive.
Notes. The meadows are flooded in winter and the land is generally wet and cold. Drainage on a large scale is needed. Foxes are pests. The farmer emphasised the extent to which a successful harvest depended on favourable weather conditions.

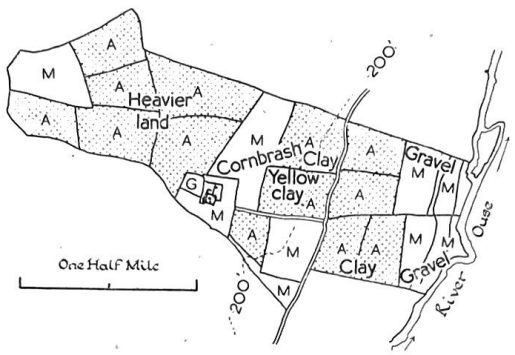


FIG. 47.—Specimen Farm XII.
The North Bedfordshire Mixed Farming Region.

V. A SURVEY OF THE AGRICULTURE OF BEDFORDSHIRE IN THE PAST

ALTHOUGH it is difficult to obtain any exact information about past land utilisation in this county, the few commentaries and reports which are available throw a good deal of light on the state of agriculture. No complete or continuous account is possible, and the result is a series of " stills " rather than a comprehensive moving picture. From the Bedfordshire Domesday one or two interesting facts emerge, whilst the pre-enclosure (" strip ") maps illustrate the open field cultivation in the county. The agrarian revolution of the late eighteenth century naturally produced a spate of literature, of which probably the most valuable were the County Reports published by the newly formed Board of Agriculture. The two of these for Bedfordshire, by William Stone (1794) and Thomas Batchelor (1808) contain a wealth of information on the agriculture of the county. Writing at about the same period, Arthur Young, too, has a useful contribution to give, and makes a point of emphasising the part played by the Duke of Bedford in the development of farming practice. Enclosure maps and Tithe maps show cartographically still later developments.

For the Domesday Record Bedfordshire was surveyed by " hundreds ", and after the sworn jurors had made their returns the contents were cut down and re-arranged under the fiefs of tenants-in-chief. In those days there were 10 whole hundreds and 4 half hundreds, making a total of 12 hundreds compared with 10 today (including Bedford). Woodland of course covered a much larger area than today, and was valued mainly as " mast " or food for swine. At Meppershall the woodland yielded " de consuetudine silvae " 10 shillings in addition to providing feed for 200 swine. It is recorded that at Stagsden Hugh de Beauchamp owned a "park"

for beasts of the chase. Grassland was mainly confined to the water meadows along river valleys, and the rest of the improved land was mostly under the plough. The manorial plough was drawn by 8 oxen, pastured on the hay derived from the water meadows. Around Biggleswade these meadows along the Ivel valley provided hay for 10 plough teams of the manor, and the surplus hay realised 5 shillings a year. 300 sheep were pastured on the meadows of Langford, and here the surplus hay produced 6 shillings a year.[1] Along the Ouse water mills were used for grinding the peasants' corn. One very interesting reference is to a certain Eudo Dapifer who at Eaton Socon owned two acres of vineyard.

Although no precise information is available for several hundred years after the Domesday Survey it is known that from the very earliest times Bedfordshire has produced good crops of wheat and barley, and that specialisation has taken place in market gardening in the east of the county, and in dairying for the London market in the south.

The development in agriculture towards the end of the eighteenth century found Bedfordshire well to the fore, largely owing to the enthusiastic interest of successive Dukes of Bedford, who did their utmost to encourage Bedfordshire farmers and make them the best in the country. But even as late as 1794 according to William Stone agriculture was very much neglected, and farms were managed by ignorant persons. He remarks with some bitterness, " with the same propriety might a mere husbandman be called from the plough to amputate a limb." Breeds of cattle were mixed, and the sheep reared were of unprofitable quality, especially those kept on the common fields. Stone's grievances, however, covered a wider range, for he lamented the lack of local agricultural societies, and showed an unusually enlightened policy by advocating better housing conditions for the agricultural classes. It must be remembered that at this time only 25 parishes had been enclosed, and the big changes and improvements were still to come. But already experiments in sheep breeding were being made by Francis, the 5th Duke of Bedford, who soon discovered the superior quality of sheep bred on enclosed lands. In arable farming he called for suggestions for the improvement in the management of common fields, and enclosed arable and pasture. Stone put the area of the county at 307,200 acres, comprising 68,100 acres of meadowland, 21,900 acres of woodland, and the rest (217,200 acres) was accounted for by the open fields, common meadows, commons and waste lands.

Although a long period elapsed before the completion of the enclosure movement in Bedfordshire, the main changes took place at the end of the eighteenth and the beginning of the nineteenth centuries. The following table gives a rough idea of the course of enclosures in the county.

1742 . .	First Enclosure Act passed for the parish of Sutton.
1761 . .	First Award for the parish of Aspley Guise.
1760–69 .	6 parishes enclosed.
1770–79 .	7 parishes enclosed.
1780–89 .	Nil.
1790–99 .	23 parishes enclosed.
1800–07 .	21 parishes enclosed
1891 . .	Last award for the parish of Totternhoe.

In the year 1794 three-quarters of Bedfordshire was still open, but by 1810 two-thirds of the parishes had been enclosed.

In the year 1808, 12 years after the publication of Stone's *Report*, Thomas Batchelor, a farmer at Lidlington, produced a more comprehensive report on the agriculture of Bedfordshire. Not all his details or comments are relevant to the present survey, and some have already been mentioned in the appropriate sections of this Report. He confirms Stone's dissatisfaction with

[1] V.C.H., *Bedfordshire*, Vol. I, p. 212.

the mixed breeds and poor quality of the livestock as well as the poorness of most of the pasture. At this time the Duke of Bedford was experimenting on the breeds and feeding of sheep, and although on the enclosed lands mixed Lincolns and Leicesters were generally to be found the advantage of the South Downs variety was being realised. These were preferred because of the fineness of their wool, their aptitude to fatten themselves and their lambs, and because more could be kept on a given acreage. Folding was being advocated in Bedfordshire, particularly because of the value of the manure for the wheat crops.

Batchelor's description of the soils of the county together with his soil map was a useful contribution to agricultural knowledge and practice. He realised the necessity of maintaining soil fertility, and suggested methods of improvement. To the light sandy soils marl was added, though it was essential for this to be close at hand. Deficiencies in other soils could be made up by the addition of clay and sand, and both chalk and limestone were found to give mellowness and friability to strong soils. The beneficial effects of these attempts at improvement, however, were often doubted by farmers who were sceptical of any innovation. Yard dung was the chief manure used, especially north of the Chalk Region, whilst London manure (including animal manure, hair, rags, clippings and soot), in spite of the expense of transport found their way on to the land of Bedfordshire. Some farmers maintained the humus content of their soil by ploughing in green crops. At Tingrith the iron content of the peaty soils was found to be of value as a fertiliser.

According to Batchelor the average size of the Bedfordshire farm was 150 acres, and provided a distinction is made between farms and holdings, this is probably a fairly true figure today. But the diagram (Fig. 5) shows that the average size of *holdings* in the county is more in the neighbourhood of 20 acres. He found that farms were larger in the south and centre, and tended to become smaller on the poorer clay soils of the north.

The county afforded a great variety of crop courses, and often a 10–12 year rotation was employed. The following examples show some typical rotations practised in different parts of Bedfordshire.

1. Sharnbrook (fairly heavy clay soil) : 6-year course. Fallow — wheat (folded) — peas and beans — fallow — barley (dunged) — beans.
2. Lidlington (light sands and gravels) : 6-year course. Fallow and turnips — barley or oats (grass sown with corn) — grass seeds — grass — wheat — peas. (The last two in either order).
3. Bedford :
   (*a*) 4-course. Summer fallow — wheat — clover eat off — wheat or beans.
   (*b*) 5-course. (On heavy soils with town manure) : Turnip fallow — barley — clover eat off — wheat — beans.
4. Cardington (Gravels) : Turnips — barley — red clover or grass — wheat — peas or oats.
5. Sundon (Chalky sub-soil) : Turnips — barley — red clover — wheat — peas or oats.

The progressive nature of agriculture in Bedfordshire is illustrated by two events which took place at the end of the eighteenth and the beginning of the nineteenth centuries. In June, 1797 the first Woburn Sheep Shearing took place, and three year later saw the formation of the Bedfordshire Agricultural Society.

Arthur Young[1] records that the first meeting of this society took place at the Swan Inn,

[1] *Annals of Agriculture*, Vol. 37.

Bedford, in October, 1800, and after the meeting the members adjourned to a near-by field to watch a ploughing competition for which prizes were given. But in addition to their interest in agricultural efficiency the Society appears to have been genuinely concerned for the welfare of the farm labourer. A prize of 5 guineas was offered to the labourer in husbandry in Bedfordshire who had brought up the greatest number of children upon his own earnings without parochial relief. The winner was a man with 8 children, who had contrived to put them all to different trades. One feels a little sympathetic towards the candidate who, although he had brought up 16 children, missed the prize because on one occasion he had received 20 shillings from the parish. A further award was made to the labourer who had worked the longest time in the same place.

The annual Woburn Sheep Shearing, established by the Duke of Bedford, was an event of outstanding importance not only for Bedfordshire but for farmers all over the country. Arthur Young describes in some detail[1] the meeting in June, 1801, at which all the landed gentry were represented. Farmers from Wales, Scotland and Ireland congregated at Woburn to exchange ideas, and to compete for prizes for tillage, for the best breeds of livestock and for the invention of new implements. Coke of Holkham was there, the Prussian Ambassador attended, and " the drillers of Norfolk describe their system to the adherents of broadcasting from Cornwall and Kerry." Fat cattle were exhibited, different breeds of cattle and sheep were compared, and the conversation was entirely on farming. The value of such a gathering can hardly be overestimated. Apart from the practical results leading to all-round improvements in farming practice, the distribution of the better breeds of livestock up and down the country, and the adoption of improved farming implements, the Woburn Sheep-Shearing was responsible for a great stimulation of interest in farming, not only amongst farmers themselves but amongst the general public. Similar schemes for encouraging and developing such an interest might well be instituted in the twentieth century by those concerned with the post-war reconstruction of our agriculture.

An interesting feature of the sheep shearing was the rivalry between farmers of different districts, and this would frequently lead to bets being made. One of these, worthy of recording, stated that Coke of Holkham was to plough an acre of land in a day in a husbandlike manner with a Norfolk wheel-plough and two horses, whilst Sir J. Sebright was to plough an acre in the same time with a Hertford plough and four horses. The ploughing was to take place the following October near Beechwood in Hertfordshire. Other bets were made for the production of fat wethers at the next meeting. A turnip drill won the prize for the best implement. For farmers of his own county the Duke of Bedford offered special prizes. These were given for fat sheep and pigs ; for the introduction of Leicester and South Downs breed of sheep into Bedfordshire ; for the best sheep shearer ; for the best new implement at the next sheep shearing; and for the most satisfactory account of the comparative trials between drill and broadcast culture. The meeting concluded with a special speech by the Duke of Bedford, in which he announced all the decisions.

Another valuable piece of work accomplished by the Duke of Bedford was the preparation of an abstract of all the crops grown on his lands from the year 1795 to 1800. That the importance of such a record was realised is clear from the suggestion made at the time to the Prime Minister, William Pitt, that such figures should be prepared annually for the whole country. " For want of this knowledge how many measures are taken in the dark ! " it was declared. The figures given below are for the year 1800, and refer to land farmed by the Duke and 55 tenants in the following parishes : Ampthill, Aspley, Crawley, Eversholt, Flitwick, Houghton Conquest,

[1] See *Annals of Agriculture*, Vol. 37.

Houghton Regis, Luton, Maulden, Milton Bryant, Postsgrove, Ridgemont, Steppingly, Totternhoe, Tingrith, Toddington, Woburn, and Wavendon (Bucks.).

Total area of arable land	4,723	acres
Total area of grassland	3,174	,,
Wheat	822	,,
Barley	611	,,
Oats	495	,,
Peas	91	,,
Beans	155	,,
Rye	101	,,
Potatoes (exclusive of gardens)	14	,,
Beans and peas mixed	131	,,
Vetches or tares	96	,,
Cole	56	,,
Turnips	479	,,
Fallow	594	,,
Clover, sainfoin and ryegrass (grazed)	495	,,
ditto (mowed)	523	,,
Old pasture land (grazed)	1,929	,,
ditto (mowed)	1,245	,,
Spinneys, small plantations, or land (generally waste and unfit for cultivation) intended to be planted, sheep-walks, etc.	383	,,
Homesteads, yards, gardens, etc.	61	

It is unfortunately not possible to make any comparison with present day utilisation since the exact location of these lands is not specified, and they are fairly widely scattered over the county. Of special interest, however, is the high acreage of barley, and the importance of turnips and rye compared with the same crops today, and the surprisingly small area devoted to potatoes.

Land Utilisation in Bedfordshire in the past may be studied cartographically by reference to the pre-enclosure strip maps, and to the maps illustrating the enclosure awards for various parishes. The county is indeed fortunate in possessing many interesting and excellent specimens of these, and it is a pity that so little use can be made of them for purposes of direct comparison with present land use. But since they were concerned primarily with areas and the distribution of allotments the state of cultivation was rarely recorded. No map of past utilisation such as that of John Rocque for Middlesex (1754)[1] is available for Bedfordshire, and so it is not until the Tithe maps of approximately a century ago that we have some definite and accurate information with which to compare present utilisation. Even these may have their limitations, for in certain parishes it was found that arable and grassland were not distinguished, whilst in others the state of cultivation was not given, and in no cases were details of crops recorded. Accordingly it has not always been possible to select the most suitable parishes for study for the choice would often be dictated by the information available. Not every Land Use Region will be found to be represented, nor will the parish necessarily occupy the most satisfactory position in the region. Finally in endeavouring to correlate changes in utilisation with variations in soil the lack of a drift geological map is a serious handicap. But something at least of the changes and developments in land utilisation will be revealed in the following brief studies.

[1] See Willatts, Report on Middlesex and the London Region, Fig. 71.

CHANGES IN LAND UTILISATION FOR EIGHT SPECIMEN PARISHES OF BEDFORDSHIRE.

Although important changes have taken place in each type of land distinguished, yet undoubtedly stability of land use is the keynote throughout—and this in spite of the fluctuations in the prosperity of British agriculture in the last hundred years. It is true that the parishes selected are extremely rural, but they are fairly representative of the county as a whole.

Arable land has decreased in amount in keeping with the general tendency throughout the country. But this decrease is never as obvious as in counties nearer to London and other big urban centres. The parish of Houghton Conquest perhaps shows the decrease most markedly for here the heavy Oxford clay soils no longer repay cultivation. But in at least one case there is evidence that arable land has increased in area, whilst both Haynes and Biggleswade illustrate how remarkable the stability in land use can be. The arable acreage for Biggleswade in 1905 was 2,932, and in 1938, 2,931¾! Occasionally the relative amounts of arable and grassland may be the same in one parish but their location may have changed in the last 100 years. It is safe to say that the best lands usually remain arable and that any changes that do occur tend to take place on land of marginal character.

Woodland, too, shows hardly any change in the last 100 years except for a slight decrease. There is little evidence of new plantation in the parishes studied. Large estates and parks have tended to preserve their woodland, though undoubtedly the increased death duties and the present war are taking their toll of this. In some cases after felling, old woodland has become grassland or even arable, and in part of Whipsnade parish it has degenerated to heathland.

Very few changes are apparent in the distribution of settlement. Apart from a slight increase in the size of some villages the pattern has remained essentially the same. It must of course be remembered that a parish in the neighbourhood of Luton, Dunstable or Bedford would reveal a very different development.

1. The Chalk Region

Whipsnade is a typical parish of the chalk region, and its elongated shape makes it particularly suitable for study since it stretches from the escarpment well down the dip slope. Situated between the valley of the Ver (followed by Watling Street), and the Gade (followed by the Leighton Buzzard road) it is essentially a parish of the plateau and is extremely rural in character. Although the geological map shows besides the chalk a small outcrop of Reading beds in the centre and a narrow strip of valley gravel in the south, it must be remembered that superficial deposits, notably Clay-with-Flints, are widespread. Thus the soils of the parish are by no means uniform and in addition they are further modified by the topography. The relief range is considerable, for the summit of the escarpment on Dunstable Downs is nearly 800 feet above sea-level, whilst on the Hertfordshire border the land falls to under 500 feet. A dry valley passes through the parish and is followed by a minor road giving access from Watling Street to the village of Whipsnade, which is little more than a hamlet.

At the time of the Tithe Survey woodland covered the whole of the eastern part of the parish, stretching along the bottom and on both sides of the dry valley. Higher up towards the escarpment there were smaller scattered patches mainly of beech which is so characteristic of chalk country. To-day there is a noticeable decrease in the amount of forest land, for of the eastern area only Oldhill wood and Dedmansey wood remain, and much of the former woodland is now arable, whilst some is meadow and some heathland.. In the west, Fallowspring wood, a deciduous area, and Whipsnade wood, a mixed woodland, still remain.

Whipsnade Heath and an area known as The Green have remained in a state of rough pasture for the last 100 years. The former is underlain mainly by Reading beds, and the latter is a survival of the old common land adjoining the village. At the top of the escarpment a piece of former arable land has been allowed to go out of cultivation, and in the east the heathland tract represents woodland that has been cut down but not replanted. There is very little change in the category of settlements and garden land, though a small part of Whipsnade Zoo, formerly under cultivation, comes within the parish.

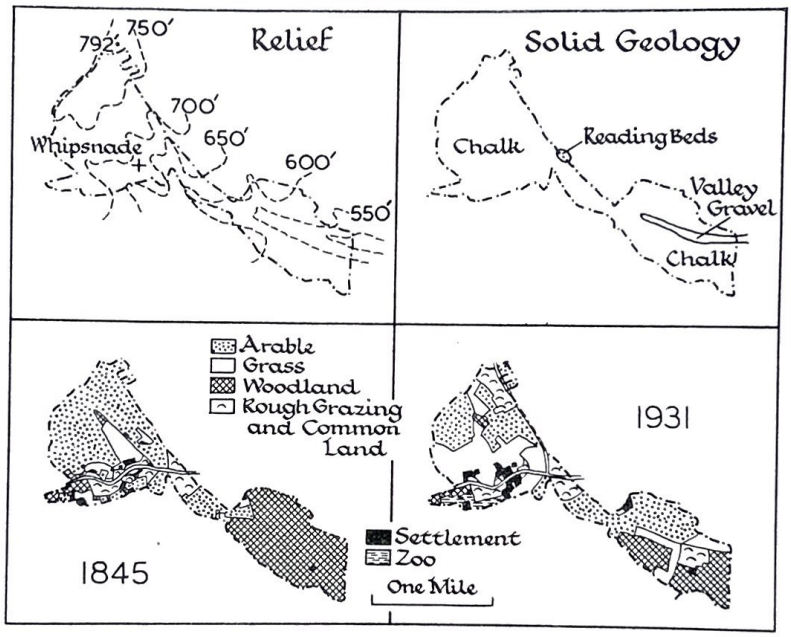


FIG. 48.—Changes in Utilisation in the Chalk Plateau Region. The Parish of Whipsnade.

The salient features are the increase in grassland in the west, and the decrease in woodland lower down the dip slope of the chalk.

The reduction of the Tithe maps shows a few fields of grass near the village and a large block of arable land in the west extending to the top of the scarp. There is some diminution in arable land to-day, though the changes have come mostly in the last 20 or 30 years. Much of the western area, formerly arable, is now under grass, and the existing ploughed land here tends to be confined to the heavier Clay-with-Flints soils.

2. The Icknield Loam Belt

The rather small parish of Higham Gobion (1,298 acres) has been chosen as representative of the fertile chalk marl region, though the northern part lies within the Gault Clay belt. The detached portion of the parish farther west has not been included for this is entirely on the Gault. The geological map shows the boundary between the two main formations and indicates also a patch of gravel in the centre. The average height above sea-level is 200 feet, and the general

slope is northwards on to the Gault whence the land drains eastwards to the Ivel. Only one minor road crosses the parish and the village itself consists of little more than the church and farm.

If further evidence were needed of the high agricultural value of the chalk marl soil the two maps of land utilisation are thoroughly convincing. For more than a hundred years the region

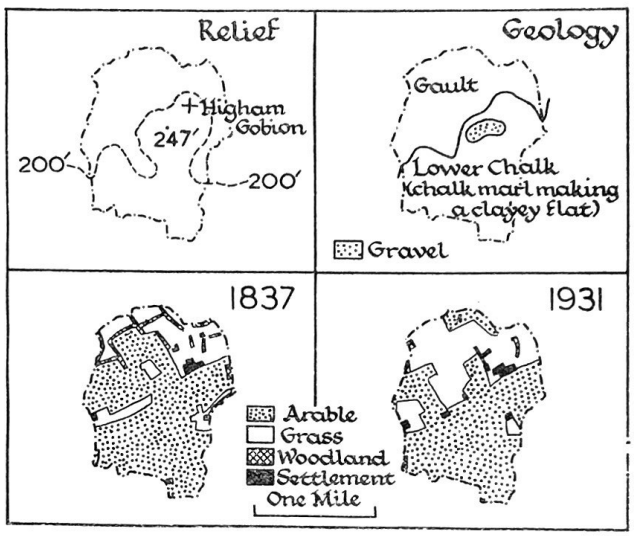


FIG. 49.—Changes in Utilisation in the Icknield Loam Belt.
The Parish of Higham Gobion.

south of the road has remained arable and it is only on the Gault that changes have occurred. On these heavier soils grassland has gradually extended and only the best fields remain under the plough.

Woodland has never been of any importance even on the Gault, and to-day it is almost non-existent. The position of the village is interesting, being situated on the gravel at the junction of the chalk marl and Gault, but no development has taken place in the distribution of settlement in the last century.

3. The Gault Clay Region

The parish of Battlesden was selected to illustrate changes in the Gault Region. The clay formation underlies most of the surface except for the extreme north-west which lies in the greensand region, and the valleys of two streams flowing to the Ouzel where gravel rests on the clay. Battlesden is a parish of somewhat heavy soil with considerable surface drainage. But the land is by no means low-lying and the highest point is well over 400 feet above sea-level. Like the neighbouring parish of Potsgrove, which is studied later, it is bounded on the south-west by Watling Street; it has a farm in the centre known as Hill Farm and is essentially rural in character.

At the date of the Tithe Survey in 1845 there were only small areas of woodland near the village, in Battlesden Park, and a small stretch in the south near Watling Street. To-day only the latter, known as the Coops, remains.

As in Potsgrove the present arable and grassland areas do not correspond with their former distribution, though the quantity of each is about the same. Some old arable land is now under

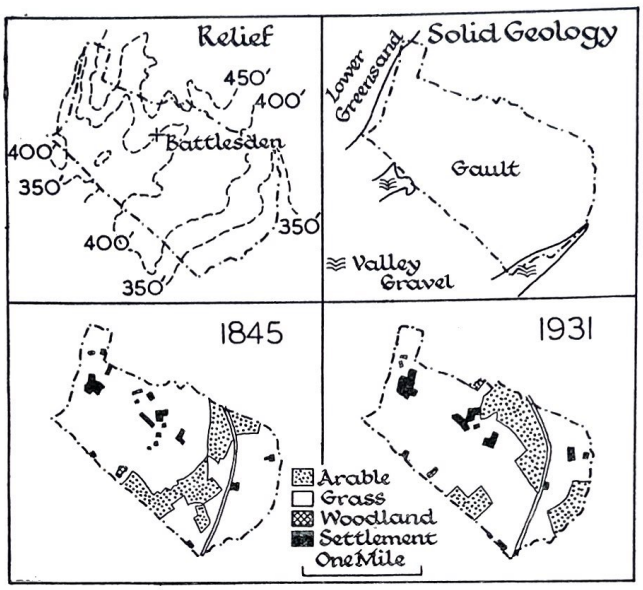


FIG. 50.—Changes in Utilisation in the Gault Clay Region. The Parish of Battlesden.

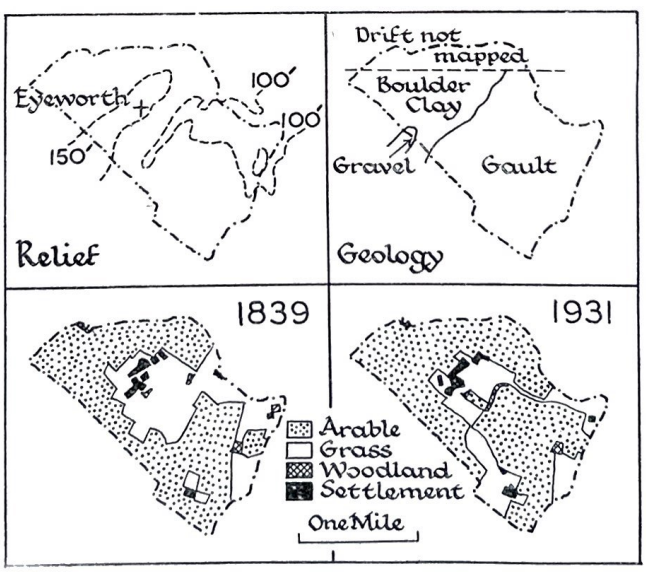


FIG. 51.—Changes in Utilisation in the Eastern Clay Region. The Parish of Eyeworth. Stability of land use is obvious here.

grass, whilst a good deal of the existing grassland was arable a century ago. Slight local soil differences may account for these variations, or more probably they are due to differences in farming economy.

4. The Eastern Clay Region

In the extreme east of the county, bordering on Cambridgeshire, lies the small parish of Eyeworth, which is representative of this clay arable belt. It is definitely outside the market gardening region, and both in relief and farming type it belongs rather to the neighbouring county. The parish is one of heavy clay soils, for Gault underlies the entire surface east of the village, whilst boulder clay occupies the rest except for one small patch of loam. The ground is generally low-lying, and the highest point of 160 feet is reached on the road near the village. Drainage is eastwards to the Cam, which here forms both the parish and county boundary.

The general land utilisation pattern has remained substantially the same since the Tithe Survey, and the two maps are strikingly similar. If anything there has been some increase in the amount of arable land especially since the beginning of the present century as the following figures will show :

	1905.	1938.
Arable . .	819½	896¼ acres
Grassland . .	358	303¾ ,,

The boulder clay area is almost entirely under the plough, but on the Gault formation much of the land near the Cam and its tributary stream is under grass. There has been a shrinkage in the amount of grassland around the village of Eyeworth, and one or two fields of former grassland north and south of the stream have now become arable.

5. The Woburn-Leighton Buzzard Plateau

With most of its acreage under grass, a good deal of woodland and only a small amount of land under the plough, the parish of Potsgrove is typical of the Greensand plateau. It is bounded by Watling Street and reaches to the Buckinghamshire border in the west, and is underlain throughout by the Lower Greensand formation. Most of the surface is above the 400-foot contour line, and in the centre at Hill Farm the land rises to 523 feet above sea-level. The general slope of the land is towards the south and drainage is effected by several small streams which cross the Gault to join the Ouzel. In addition to the two small settlements of Potsgrove and Sheeplane there are a few scattered farms, and in the extreme north-east a small part of Woburn Park falls within the parish.

The light sandy soils of the Greensand plateau have tended to preserve their woodland cover, and in the past hundred years few changes have occurred. Comparison of the two maps will show that only one wood of any size has disappeared, and that is now under grass. Like Battlesden this parish shows little development since the time of the Tithe Survey and there are practically no changes to record in the distribution of garden land and settlement.

The only arable land to-day consists of three fields to the west of the village which in 1845 were under grass. But the region has never been an arable one, though the Tithe map shows several scattered arable fields which have since reverted to grass. Nevertheless the decrease in ploughed land in the past thirty years has been significant, for in 1905 the arable acreage was 246 whilst to-day only 65 acres remain.

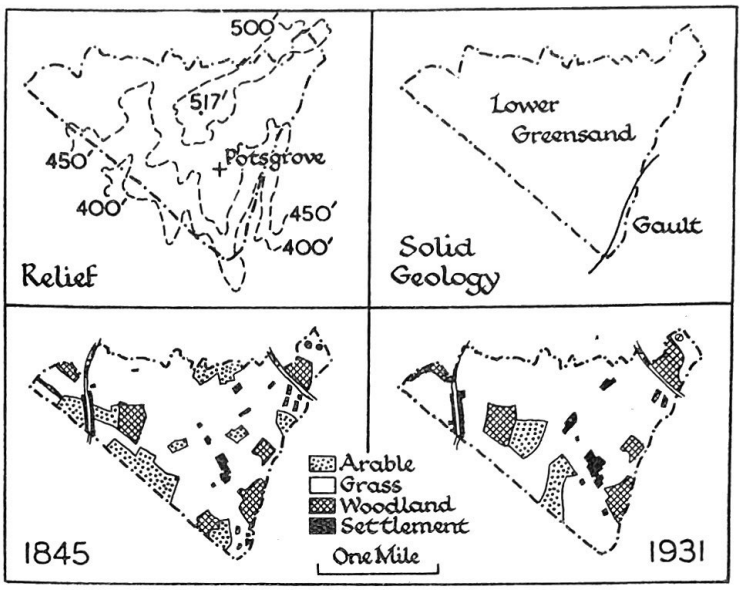


FIG. 52.—Changes in Utilisation in the Woburn–Leighton Buzzard Plateau Region. The Parish of Potsgrove.

The distribution of woodland has remained almost the same since the Tithe Survey.

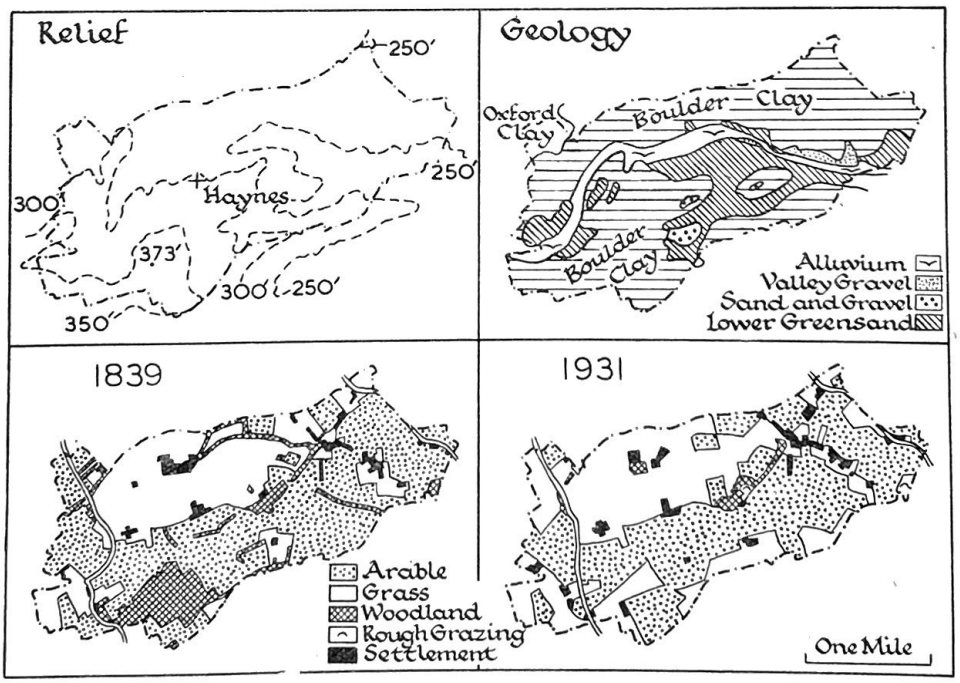


FIG. 53.—Changes in Utilisation in the Lower Greensand Ridge Region. The parish of Haynes.

Apart from the disappearance of the large area of Woodland in the south stability is the keynote here.

6. The Lower Greensand Ridge

Although the parish of Haynes has been chosen to illustrate changes in the utilisation of the Lower Greensand Ridge the geological map indicates that a very large part of the surface is underlain by boulder clay, which of course considerably modifies soils and land use. The western part is an elevated region and the main drainage is eastwards to the Ivel. The escarpment of the Greensand lies just beyond the parish boundary in the north, but it is not so well marked here as it is further west. The main Luton–Bedford road crosses the western part of the parish and another main road passes through the extreme eastern end, close to which is the chief settlement of Northwood End.

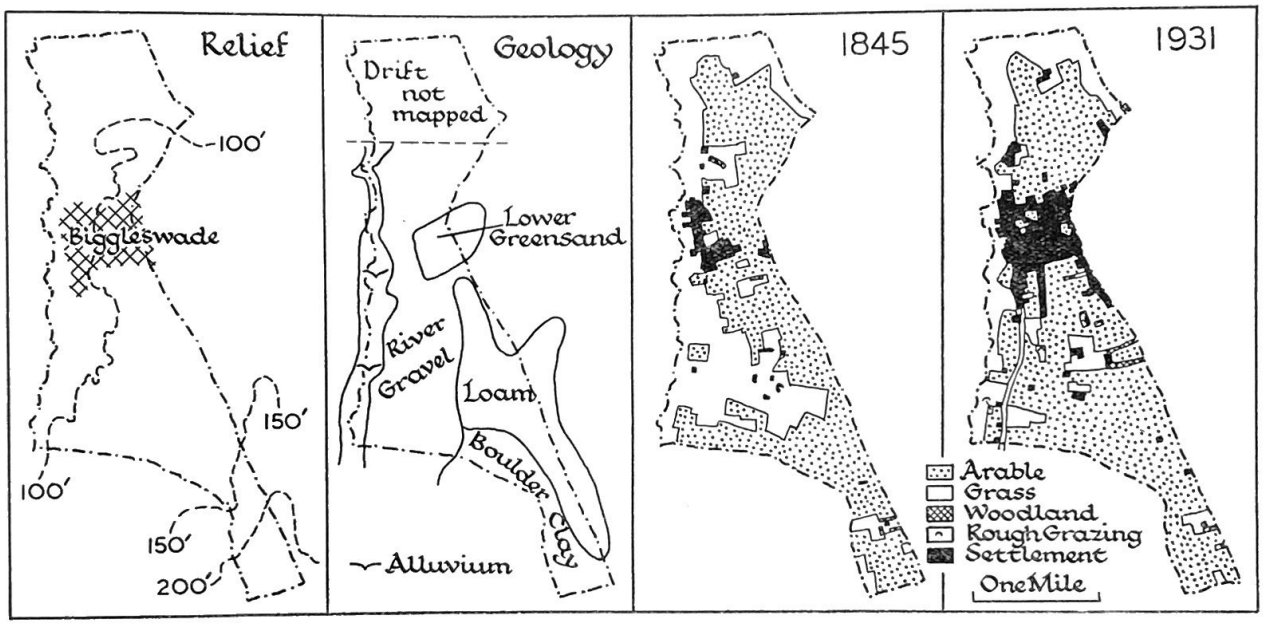


FIG. 54.—Changes in Utilisation in the Biggleswade Market Garden Region.
Part of the parish of Biggleswade.
Note the increase in arable land, and the growth of the town eastwards on the Greensand formation.

Very little of the former woodland is left to-day. The large area of forest on the Boulder Clay in the south shown on the 1839 map has entirely disappeared, and part of it is now under the plough. The existing woodland is associated with the large estate of Haynes Park which is partly on the Greensand and partly on the clay. The two patches of heathland covering some 20 acres are both relics of former woodland.

Comparison of the two maps indicates a remarkable stability in the amount and location of both arable and grassland, whilst few changes have occurred in the settlement pattern. The chief grass area was and still is Haynes Park, whilst a narrow strip occurs along the southern boundary of the parish. Although there is no very marked contrast between the utilisation of the two soil formations there is as a rule more arable land associated with the heavier soils of the Boulder Clay.

7. The Biggleswade Market Garden Region

Biggleswade is the heart of the market gardening region, and the western part of the parish

centring on the town itself has been chosen as most suitable for showing changes in utilisation. The area under consideration extends north and south of the town and between the Ivel on the west and the Great North road and the Potton road on the east. The land is low-lying and drains to the Ivel which here occupies quite a narrow alluvial-floored valley. The wide variety of soils has already been emphasised (see page 134), and the accompanying geological map shows the position of the chief formations.

Although always an important market gardening area the most rapid development has taken place since the Tithe Survey when improved transport facilities and the increased demand for

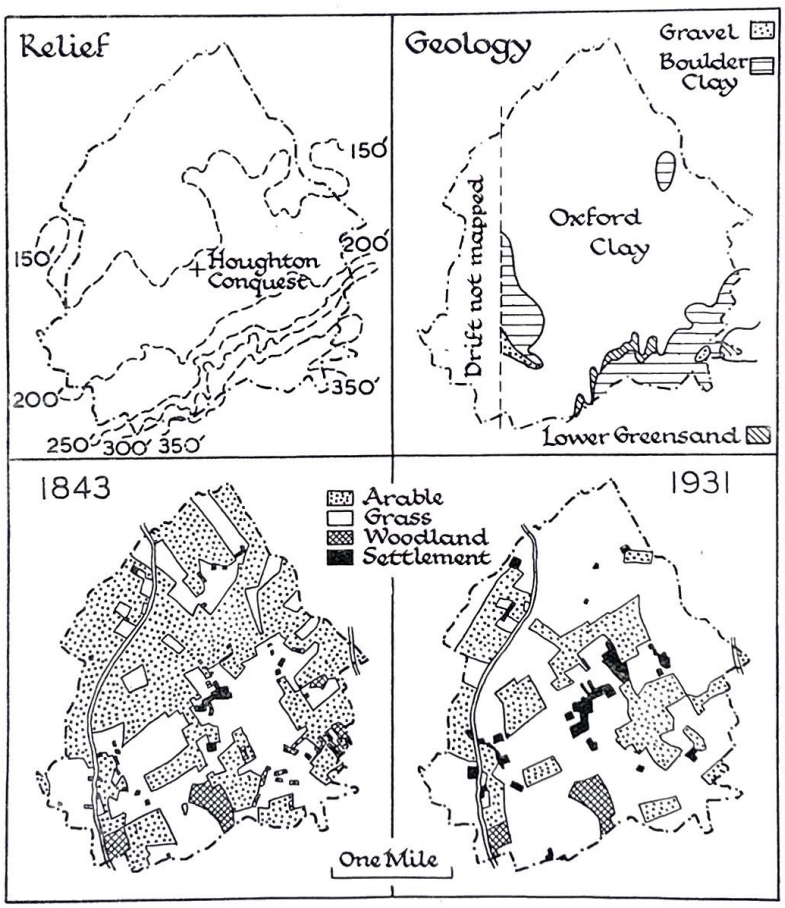


FIG. 55.—Changes in Utilisation in the Oxford Clay Region. The parish of Houghton Conquest.

A very large proportion of arable land on the heavier soils in the north has now become grassland.

fresh vegetables provided opportunities which have not been missed. And today, Biggleswade itself has grown into a most important town and market centre with main rail and road communications to London and the north. The growth of the town has been chiefly eastwards, a development corresponding very closely with the outcrop of the Lower Greensand formation.

The most significant change in land utilisation has been the increase in the amount of arable land, and Biggleswade must be one of very few parishes in the whole country which show such an increase. As fresh land has been taken up for market gardening purposes the water meadows on the Ivel alluvium have narrowed, and to-day all the available land is under intensive cultivation. A century ago meadowland occupied a fairly wide strip along the main stream, as well as other low-lying marshy areas like Biggleswade Common where small tributaries flowed westwards to the Ivel. Biggleswade Common is still meadowland to-day, but the grassland area in the south developed on loam and gravel soils has now become arable. The extension of the arable area in this parish is typical of the general development of the market gardening region of Bedfordshire, and illustrates the tendency to make use of every piece of land not perhaps originally regarded as suitable for such type of farming.

8. The Oxford Clay Region

Houghton Conquest, a fairly large parish of 3,431 acres, lies in the Oxford Clay region south of Bedford. In the south it comes well into the Greensand area though the solid formation is largely masked by Boulder Clay and an occasional patch of gravel. The Greensand scarp is well marked however and overlooks the main Oxford Clay vale, flat, featureless country mainly 100 to 150 feet above sea-level. Drainage is northward to the Ouse; the land is inclined to be marshy, and lies cold and wet in winter.

There is no woodland on the Oxford Clay soils, but in the south the two areas of King's Wood and Redding's Wood have remained in the past 100 years. The small woods on the patch of Greensand in the east shown on the Tithe map have now disappeared. The village of Houghton Conquest has extended a little since the Tithe Survey, but elsewhere there are no changes to record in the settlement pattern.

Considerable changes are to be noted in the amount and distribution of arable and grassland. The 1843 map shows large arable concentrations on the heavier clay soils west and north of the village. Today most of the northern part has become grassland, and arable land is found in the extreme west and in a few fields east of the village. At the junction of the Oxford Clay and Boulder Clay on greensand arable has taken the place of former grassland.

Economic reasons have largely determined this change-over to grass on the heavy soils of the north, but even so the best lands still remain arable. Today there are only 830 acres of arable land and 2,367 acres under grass, but the principal changes have taken place since the beginning of this century.

APPENDIX I

STATISTICAL SUMMARY

The Land Utilisation of Bedfordshire according to the Official Statistics of the Ministry of Agriculture and Fisheries

All areas in acres

Year	Total Area	Crops and Grass	Arable Land	Permanent Grass		Rough Grazing
				For Hay	Not for Hay	
1866	295,582	242,290	174,416	67,874		
1867		249,615	176,365	73,250		
1868		246,952	174,442	72,510		
1869		251,197	176,310	74,887		
1870		255,174	183,034	72,140		
1871		255,083	181,877	73,205		
1872		257,634	184,174	73,450		
1873		256,471	182,305	74,165		
1874		256,626	181,737	77,889		
1875		256,407	180,620	75,787		
1876		256,567	180,972	24,092	51,502	
1877		258,791	181,836	26,917	50,038	
1878		259,527	181,153	78,374		
1879		260,853	180,752	80,101		
1880		260,375	179,285	81,090		
1881	295,509	259,171	177,550	81,621		
1882		259,224	177,169	82,055		
1883		259,927	175,545	84,382		
1884		260,370	173,104	87,266		
1885		260,298	172,354	87,944		
1886		260,080	169,144	29,905	60,931	
1887		260,559	172,263	31,377	60,499	
1888		260,791	167,013	35,783	57,995	
1889		259,959	165,953	38,777	55,229	
1890		259,396	163,693	36,254	60,449	
1891		259,072	162,256	33,436	63,880	
1892		257,539	161,014	30,733	65,792	655
1893		257,203	159,961	25,309	71,933	724
1894		256,983	158,168	34,948	63,872	742
1895		254,997	155,224	32,107	67,666	764
1896		252,099	151,282	32,924	67,893	722
1897		233,263	152,574	33,046	67,643	762
1898		257,272	155,981	32,109	69,191	973
1899		257,001	155,231	28,552	73,218	985
1900		257,346	154,562	28,215	74,579	978
1901		257,034	155,264	27,865	76,194	979
1902		256,607	152,464	31,041	73,102	996
1903		256,804	151,028	33,643	72,133	1,231
1904		257,006	149,990	33,278	73,738	1,119
1905		256,863	149,311	30,859	76,695	1,347
1906		256,680	147,500	32,668	76,512	1,053
1907		256,305	147,867	34,397	73,541	1,204
1908		256,627	147,201	33,820	75,186	1,256
1909		256,430	146,802	31,858	72,684	1,344
1910		256,606	147,133	34,350	75,123	1,848
1911	301,829	255,276	147,516	33,370	74,390	1,622
1912		255,259	146,814	34,528	73,917	1,683
1913		254,934	144,642	37,558	72,734	1,519
1914		254,748	144,600	32,835	77,313	1,554
1915		254,652	144,025	32,826	77,801	1,906
1916		256,236	145,882	33,155	77,199	2,023
1917		255,461	146,694	32,652	76,120	1,843
1918		256,960	156,296	28,902	71,762	1,313
1919		259,787	153,277	29,152	72,363	1,425
1920		254,582	153,775	31,170	69,637	1,652
1921		252,929	150,505	27,128	75,296	3,082
1922		253,142	148,055	32,297	72,830	2,886
1923		253,574	147,908	28,946	76,670	3,606
1924		250,779	144,870	28,847	77,042	4,083
1925		249,982	140,395	27,760	81,327	4,434
1926		249,672	138,756	26,411	82,505	4,439
1927		248,715	135,487	26,817	86,411	5,046
1928		248,764	133,570	31,725	83,469	5,141
1929		247,281	129,359	32,065	85,857	5,582
1930		247,198	127,163	20,580	99,455	5,675
1931		245,877	123,618	33,695	86,566	6,094
1932		244,188	120,480	31,516	92,192	7,526
1933		243,165	117,730	31,114	94,318	8,110
1934		241,326	117,329	31,163	92,834	8,709
1935		242,265	120,290	34,162	97,813	7,622
1936		239,567	118,567	32,697	88,289	8,160
1937		257,849	115,093	32,686	90,072	8,473
1938		237,168	114,563	25,543	97,062	8,977
1939		238,095	116,816	33,819	87,460	8,603

SUMMARY OF THE FINDINGS OF THE LAND UTILISATION SURVEY, BEDFORDSHIRE

Acreages calculated approximately from the One-inch Maps.

	Ministry of Agriculture 1931		*Land Utilisation Survey* 1931	
	Acres	*% of County*	*Acres*	*% of County*
Forest and Woodland	13,168 [1]	4·4	13,340	4·4
Arable	123,618 [2]	40·9	128,060 [3]	42·4
Permanent Grass	122,259	40·5	119,660	39·7
Rough Grazing	6,094	2·0	3,020	1·0
Houses with Gardens	—	—	23,940	7·9
Land Agriculturally Unproductive	—	—	12,810	4·3
Orchards	*937*	*0·3*	1,000	0·3
Unaccounted for	36,690	12·2	—	—

[1] 1924 census of woodland, with the addition of subsequent plantings by the Forestry Commission.
[2] Including orchards. [3] *Excluding* orchards.

4/-