

A NOTE ON THE SERIES

These maps of Great Britain are produced in two sheets, are on the Transverse Mercator Projection, and carry the new National Grid lines at ten kilometre intervals.

The series was initiated at the suggestion of the Advisory Maps Committee of the Ministry of Works and Planning (now the Ministry of Housing and Local Government) whose members included representatives of the British Association National Atlas Committee.

The planning maps already published or in preparation on this scale have been sponsored by the Ministry of Housing and Local Government and the Department of Health for Scotland and form a related series depicting the primary physical, economic, human and social facts concerning the country as a whole. They are listed within. For convenience of reference, maps prepared independently by the Ministry of Agriculture, the Geological Survey and by research organisations such as the Land Utilisation Survey are included in the list.

The series will be found valuable not only by those concerned with planning, but by all who wish to see in convenient form essential facts about Britain as a whole. They should be invaluable to schools, business men, and administrators, and constitute the nucleus of a National Atlas.



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No. 5

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Introduction

THIS map was compiled by the Welsh Plant Breeding Station for the Ministry of Agriculture and Fisheries in 1940. As far as England is concerned, the field work on which the map is based was started in the autumn of 1938 and finished in the spring of 1940. In Wales the field work was completed in 1935. The work throughout was organised by Sir R. George Stapledon, C.B.E., M.A., F.R.S., and William Davies, D.Sc., with the assistance of T. E. Williams, B.Sc., G. P. Hughes, B.Sc., and A. G. Davies, M.Sc., B.S.A. This text is very largely the work of William Davies and T. E. Williams.

The map shows the distribution of various kinds of grassland in England and Wales. The term "grassland" for this purpose covers only permanent grass together with the rough and hill grazings; it does not include leys or rotation grass. In constructing the map no account has been taken of arable land, nor of leys and rotation grasses which are normally included with arable land. As the field work was completed early in 1940, this survey relates to conditions before the war-time campaign for the ploughing up of permanent grassland, but this in no way invalidates the map as a valuable pointer towards the various qualities of grassland or as a general guide to land use policy.

This map is an attempt to classify on a floristic basis the permanent grasslands of England and Wales; rough and hill grazings are included and the distribution of the various types of grassland is distinguished. It will be evident that this map does not indicate the territorial extent or the importance of grassland relative to other forms of land use in any particular district. For this it is necessary to consult the relevant Agricultural Statistics (1), or the Land Utilisation Survey Maps (2).

(1) The Agricultural Statistics of the Ministry of Agriculture, normally published annually. These distinguish, for each administrative county, the acreage of the major agricultural land use categories and also of each crop.

(2) The one inch to one mile Land Utilisation Survey Maps, or the 1:625,000 map of Land Utilisation which is also published in this series of Planning Maps.

THE BASIS OF THE CLASSIFICATION

By cultivation and by control of the grazing animal, man has changed the natural forest vegetation of lowland England and Wales to the permanent grasslands of today. His influence has been most marked on the lowlands where enclosure of the land into relatively small fields has made these practices possible. On the unenclosed hill and mountain areas and in areas where enclosures are so large as to permit only a limited degree of grazing management, the quality of the grass is lower, and here the bulk of the rough grazings are found. It is worth noting also that in some formerly enclosed areas neglect of the practices which enclosure makes possible has caused a deterioration to rough grazings.

It should also be remembered that the results of human effort towards the improvement of grazings are always conditioned by the inherent fertility of the soil, as well as by such factors as climate (working predominantly through elevation and aspect), the natural plant life, and non-domestic grazing animals such as rabbits or deer. It is thus evident that the present day grasslands of England and Wales are the outcome of a large number of environmental factors, of which the relative weights have been subject to considerable changes over the years. It is not surprising, therefore, that grasslands may show abrupt changes in botanical composition from field to field, and with different and contrasting elevations and slopes, soil types, and degrees of soil fertility.

In surveying the enclosed lowlands, the individual field has been taken as the unit of classification. Each field was allocated as a whole to the appropriate grassland type. In doing this the sward carried on the greater proportion of the field has determined the pasture type, and no account is taken of sward variation around gateways, watering points, and tracks. In most cases the allocation of the whole field to a single category is satisfactory, particularly with permanent grassland

of long standing where the controlling factors have operated for a considerable time. Moreover, field boundaries themselves often have their origin in separating areas of different soil types, drainage, aspect, and the like. With unenclosed rough and hill grazings the actual boundaries of the different categories of plant associations have been directly transferred to the field maps.

The type of pasture existing on enclosed lowland may vary from field to field and the whole grassland area of such a district is therefore a mosaic of a number of pasture types. In compiling a map on the present reduced scale of about ten miles to an inch it is clearly impossible to show a field to field distribution, while to allocate an entire area to the one sward type which is dominant within it would have been too generalised. The procedure has been to distinguish pasture groups which are composed of various pasture or sward types in a defined order of importance. This is illustrated in the diagram showing the relative composition of each lowland pasture group. To make this important distinction between pasture groups and pasture types clear by an example: the pasture group 1 is composed chiefly of the pasture type "first-grade ryegrass", with three other pasture types in declining importance, namely "second-grade ryegrass pasture", "agrostis-ryegrass pasture", and "agrostis pasture". Although these four types are also present in pasture group 2, their proportions are very different. It is therefore important to realise the distinction between type and group, the former being the type of pasture on a specific unit of land, generally a lowland field or enclosure, the latter the occurrence and relative importance of types over a somewhat larger region. In upland rough grazings the groups are very close to pasture types since they consist largely of one predominant type and a very small proportion of subsidiary plant associations. On this map, in dealing with lowland grassland, only the pasture groups have been represented.

Since the concept of pasture type is basic to the concept of pasture group and to the Survey as a whole, it is convenient to discuss pasture types first.

PASTURE TYPES

A. LOWLAND TYPES

(a) First-grade Ryegrass Pasture

Perennial ryegrass (*Lolium perenne*) contributes 30 per cent or more of the pasture by ground cover.

Wild white clover is always plentiful.

Other good grasses present include rough stalked meadow grass (*Poa trivialis*), timothy (*Phleum pratense*), cocksfoot (*Dactylis glomerata*), meadow fescue (*Festuca pratensis*).

Agrostis is at a minimum in comparison with the other types of ryegrass swards.

Pasture of this type is frequent in the more productive grassland areas of Leicestershire, Cheshire, Kent and Northumberland but occurs as individual fields in many areas.

(b) Second-grade Ryegrass Pasture

Perennial ryegrass contributes from 15 to 30 per cent by ground cover.

Wild white clover is normally plentiful.

Other good grasses such as cocksfoot, timothy, and meadow foxtail (*Alopecurus pratensis*) may be present together with rough stalked meadow grass.

Agrostis and other less productive grasses such as crested dogtail (*Cynosurus cristatus*) are more abundant than in (a).

Pastures of this type have a distribution similar to that of the first-grade ryegrass pastures but occur over more extensive areas.

(c) Agrostis-Ryegrass Pasture

Perennial ryegrass is present but contributes less than 15 per cent to the sward by ground cover. *Wild white clover* is always present.

Agrostis is usually the dominant grass.

Other good grasses such as cocksfoot, timothy, meadow foxtail and meadow fescue together contribute less to the sward than in the previous type, but rough stalked meadow grass and miscellaneous grasses and herbs may be numerous.

Pastures of this type are abundant throughout lowland dairying districts.

(d) Agrostis Pasture

Agrostis tenuis (common bent grass) is dominant. *Perennial ryegrass*, cocksfoot and timothy are absent or present only in trace quantities.

These two features distinguish this type.

Characteristic associated grasses over a wide range of soil types are red fescue (*Festuca rubra*), crested dogtail, rough stalked meadow grass and Yorkshire Fog (*Holcus lanatus*).

This *Agrostis* pasture type can be subdivided according to the acidity of the soils on which it occurs:

(i) On acid soils the flora is restricted.

Agrostis tenuis forms almost the entire sward. Red fescue, Yorkshire Fog, sweet vernal (*Anthoxanthum odoratum*) and crested dogtail are present only in small quantities.

Wild white clover is at a minimum.

Bird's foot trefoil (*Lotus corniculatus*) may be present in small quantities.

Miscellaneous weeds are not abundant, the most common being the field woodrush

(*Luzula campestris*) and other species, in small quantities only, which also occur under more fertile conditions. Transition to *mountain fescue pastures* is through *agrostis-fescue pasture* which occurs under lower conditions of fertility and management when red fescue becomes more abundant.

On better soils (i.e. with increasing fertility and soil base status):

Agrostis tenuis is less dominant.

Crested dogstail and *rough stalked meadow grass* may each contribute substantially to the sward.

Wild white clover is present in varying amounts but only infrequently is it a major sward constituent.

Miscellaneous weeds are frequently abundant, the most widespread being buttercups (*Ranunculus bulbosus*, *R. reprens*, *R. acris*), ribgrass (*Plantago lanceolata*), hardheads (*Centaurea nigra*), dandelion (*Taraxacum officinale*), selfheal (*Prunella vulgaris*), hawkbits (*Leontodon spp.*), cat's ear (*Hypochoeris radicata*) and daisy (*Bellis perenne*).

- (ii) *On lime-rich soils*, such as on some of the Chalky Boulder Clays, Chalk, Oolitic Limestone, Lias, and occasionally on soils of Carboniferous Limestone origin, the *Agrostis* pasture types are readily distinguished by the more extensive flora and the presence of calcicolous species. *Agrostis tenuis* is still the dominant grass. *Crested dogstail*, *rough stalked meadow grass* or *red fescue* are associated grasses.

Calcicolous grass species present include torgrass (*Brachypodium pinnatum*), upright brome grass (*Bromus erectus*), quaking grass (*Briza media*), oat grasses (*Avena pratensis* and *Avena pubescens*).

Leguminous species are abundant and include white and red clover, black medic (*Medicago lupulina*), vetches and vetchlings (*Lathyrus spp.* and *Vicia spp.*). *Miscellaneous herbs* present include most of those listed for the other categories of *Agrostis* pasture types.

Calcicolous species typical here are dwarf thistle (*Cirsium acaule*), burnet (*Poterium sanguisorbia*), wild thyme (*Thymus serpyllum*), and cathartic-flax (*Linum catharticum*).

On less fertile calcareous soils:

Red fescue is very abundant the sward being transitional in type to the downland and Cotswold fescue pastures.

- (e) **Agrostis with Rushes, etc.**

Agrostis tenuis is dominant.

Rushes and sedges are present of which the most abundant and widespread rush species is the common rush (*Juncus conglomeratus et effusus*); hard rush (*Juncus glaucus*) is seldom present in quantity.

Jointed rush (*Juncus articulatus*) may be found in *Agrostis* pasture in upland situations and under conditions of the lowest fertility.

Characteristic associated grasses are tussock (*Deschampsia caespitosa*), Yorkshire Fog, and sweet vernal. Bird's foot trefoil (*Lotus corniculatus*) is frequent and buttercups are always to be looked for.

This is a common pasture type scattered throughout the valley bottoms but by no means restricted to these situations.

Agrostis-with-rush swards develop in areas of high rainfall and impeded drainage combined with low base status. The development of rushes is accelerated by under-grazing in the summer.

B. FESCUE PASTURE TYPES

These are subdivided as follows:—

- (a) **Mountain and Hill Fescue Pasture**

Sheep's fescue (*Festuca ovina*) is dominant.

Agrostis and *red fescue* are present in small quantities.

This type occurs on steep slopes and shallow, well-drained upland soils. The flora is restricted but in many instances the mountain and hill fescue pastures are being invaded by gorse, bracken or heather.

- (b) **Down and Cotswold Fescue Pasture Types.**

These are types developed on the Chalk and Oolitic Limestone respectively.

Red fescue and *Sheep's fescue* are dominant.

Other grasses are present in great variety, amongst which torgrass (*Brachypodium pinnatum*), upright brome grass (*Bromus erectus*), and oat grasses (*Avena pratensis* and *A. pubescens*) are characteristic.

The flora of *miscellaneous herbs*, including the legumes, is extensive, but in some situations where leaching has increased the acidity of the top soil, the number of species may be considerably reduced.

C. ROUGH GRAZING TYPES—UPLAND

- (a) **Nardus-Fescue Moor**

Nardus stricta dominates this type of moorland vegetation.

Sheep's fescue (*Festuca ovina*) is sub-dominant and locally dominant.

Heath bedstraw (*Galium saxatile*), tormentil (*Potentilla tormentilla*), field woodrush (*Luzula campestris*), heath rush (*Juncus squarrosus*), heather (*Calluna vulgaris*) and bilberry (*Vaccinium myrtillus*) are frequently present; the flora is restricted.

- (b) **Nardus-Fescue Moor with Rushes**

Rushes are the characteristic of this type of moor. The most abundant rush species is the jointed rush (*J. articulatus*), but the common rush (*J. conglomeratus et effusus*) is also present in localised areas.

The *Nardus-fescue moor with rushes* is developed under wetter soil conditions than the *Nardus-fescue moor*, contains more *Agrostis*, and shows affinity to the *Molinia-Nardus moor*. It is typically developed on the Pennine enclosures (or "hill allotments"). There is much observational evidence that enclosure (even in comparatively large units) and increased stocking have largely eliminated *Molinia*, which is a species very sensitive to grazing. In the *Molinia-Nardus* association the *Molinia* has been largely replaced by rushes, *Agrostis* and fine-leaved fescue.

- (c) **Molinia Moor**

Molinia caerulea is the dominant species over extensive areas.

Associated species include *Nardus*, fine-leaved fescues, *Agrostis*, heather, crossed-leaved

heather (*Erica tetralix*), bell heather (*Erica cinerea*), jointed rush (*J. articulatus*), and deer grass (*Scirpus caespitosus*).

Molinia moor is typically developed under upland and hill conditions upon wet heavy soils on gentle slopes. It occurs over wide expanses upon glacial soils from the North Tyne to the Cheviot Hills and westwards into Cumberland.

(d) **Molinia-Nardus Moor**

This moorland type is a mosaic of the *Nardus-fescue moor* and *Molinia moor* plant communities, developed where changing soil and topography produce different vegetation within comparatively small areas. The Molinia-dominant communities occur in the wetter hollows and Nardus communities on the drier slopes and knolls.

(e) **Heather Moor**

Heather (*Calluna vulgaris*) is dominant and upon well managed moors grows almost to the exclusion of other species.

Associated plants are Nardus, Molinia, bell heather, cross-leaved heather, the heath rush, and cotton grass (*Eriophorum vaginatum*).

Bracken fern may be abundant at lower elevations particularly where indiscriminate burning has occurred.

(f) **Heather "Fell"**

Heather "fell" is a very mixed vegetation group. It occurs characteristically on steep broken country, often on boulder-strewn land. It is made up of a number of plant communities, each occurring over comparatively small areas, and incapable of being mapped except on the

most detailed of scales. Heath communities are characteristic of the areas as a whole, but other communities are also typical, in which Nardus, fine-leaved fescues, bracken fern, gorse or scrub may each form the dominant species according to the situation.

Mixed heather, Molinia, fern and gorse moors of Devon and Cornwall have been mapped as Heather "fell". They differ, however, from the typical heather fell of the Lake District and North Wales which occurs at higher elevations than those of the south-west of England. The "fell" vegetation of the latter region contains more gorse and fern while Nardus is restricted and *Agrostis setacea* is typically present.

(g) **Cotton Grass and Deer Grass Moor**

Cotton grass (*Eriophorum vaginatum*) and *deer grass* (*Scirpus caespitosus*) are dominant.

This type of moor is typically developed upon wet peat at high elevation. It occurs extensively on the Pennine plateau at elevations above 1,500 feet.

D. ROUGH GRAZING TYPES—LOWLAND

(a) **Heaths**

Lowland heaths are typically developed in the New Forest, Breckland, and upon other sandy soils of the south and east of England.

Heather, bracken, scrubby thickets and gorse all occur upon undisturbed areas and the herbage can be very varied.

Sheep's fescue and Agrostis setacea may be dominant locally.

Sand sedge (*Carex arenaria*) is found on the dry sandy heaths of Breckland, and is abundant in situations where rabbit infestation is heavy.

(b) **Other Lowland Rough Grazing Types**

(i) *Lowland bogs* are nowhere extensive. They are usually dominated by rushes (*Juncus spp.*), sedges (*Carex spp.*), reed grasses (*Arundo* and *Phalaris*), and Molinia.

(ii) *Sand dunes* occur around the coasts where the characteristic dominants include marram grass (*Psamma arenaria*), sea lyme (*Elymus*), and the fescues.

(iii) *Saltings* are developed chiefly along the river estuaries and show considerable zonation of plant communities between low and high water mark.

(iv) *Fen "Carr"* occurs in East Anglia, mostly along the Norfolk Broads. The vegetation contains reed grasses (*Arundo, Phalaris* and *Glyceria spp.*), sedges (*Carex spp.*), alder (*Alnus glutinosa*), and other aquatic species.

Land infested with bracken, gorse and thorn

In addition to the various pasture types there are certain other agriculturally important plant occurrences, the most extensive being bracken, gorse and thorn infested land.

Bracken infestation is associated chiefly with mountain fescue and fescue-agrostis pastures and flourishes where no active preventive measures are taken. Bracken invasions are frequently strong on the mountain fescue pastures situated on the deeper soils. Bracken is also a serious ingressor of heather moors at lower elevations, particularly after injudicious burning of heather.

Similarly gorse and mixed gorse and bracken are present on some neglected fields. Many lowland fields on heavy clay soils were gradually being invaded and colonised by thorn, chiefly hawthorn, in 1938-40.

RELATIVE IMPORTANCE OF THE DIFFERENT PASTURE TYPES IN ENGLAND AND WALES, 1938-39

The table shows the acreage of each pasture type contributing to the permanent grassland and rough grazings in 1938-39, before the influence of the war-time plough-up campaign. (For method of calculation, see below).

Pasture Type	Area in Acres	Per cent of total permanent grassland including rough grazings
A. Lowland Types		
First-grade ryegrass pasture ...	251,000	1.2
Second-grade ryegrass pasture ...	912,000	4.4
Agrostis-ryegrass pasture ...	4,317,000	20.2
Agrostis pasture including Agrostis-with-fescue, torgrass, etc. ...	9,580,000	45.0
Agrostis with rushes and sedges	734,000	3.4
B. Fescue Pasture Types		
Fescue pasture including the Down and Cotswold fescue swards ...	1,499,000	7.0
C. Rough Grazing Types—Upland		
Areas of dense bracken fern ...	406,000	1.9
Areas of dense gorse ...	665,000	0.3
Areas of mixed fern and gorse (including those based on <i>Agrostis setacea</i> in Devon and Cornwall) ...	45,000	0.2
Nardus-fescue moor ...	292,000	1.4
Nardus-fescue with rushes ...	136,000	0.6
Molinia moor ...	176,000	0.9
Molinia-with-Nardus moor ...	866,000	4.1
Mixed Molinia, heather, fern and gorse moor (largely S.W. England) ...	106,000	0.5
Heather moor ...	794,000	3.7
Heather "fell" ...	361,000	1.7
Cotton grass and deer grass moor ...	414,000	1.9

Pasture Type	Area in Acres	Per cent of total permanent grassland including rough grazings
D. Rough Grazing Types—Lowland		
Lowland heaths (New Forest type)	154,000	0.7
Lowland heaths (Breckland type)	45,000	0.2
Lowland bog	30,000	0.1
Sand dunes	31,000	0.1
Estuarine saltings	57,000	0.3
Fen "carr"	36,000	0.2
Fields (lowlands) invaded by tall thorn	12,000	less than 0.1
TOTAL permanent pasture and rough grazings	21,319,000	100.0

THE PASTURE GROUPS

It is again to be emphasised that the map illustrates the distribution of pasture *groups* and not of the pasture types which have been briefly described above. As explained before, each group is composed of a number of pasture types in a defined order of frequency.

In the lowlands, the system employed was to select a large number of sample areas each of which was examined critically field by field, and the pasture types mapped on the 6 in. scale. By examination of the constituent pasture types, an estimate of the contribution of individual types to each pasture group was made, and thus the pasture groups were determined (see diagram).

Once the pasture groups had been fixed and the acreage calculated, it was possible to estimate the acreage of pasture types knowing the mean contribution of each pasture type to the known area of pasture group. This

of course is the method used in compiling the table on this page.

In the case of the rough and hill grazings a similar system was employed, but here however, the characteristic plant community is more pronounced than on the enclosed lowlands, and the pattern of types is far more sharply defined into plant communities, each having its characteristic dominants. For this reason, grouping of closely allied pasture types is normally not necessary in these areas.

Since 1939 the arable acreage has been greatly increased by the war-time plough-up campaign. Clearly the acreages in permanent grass are now reduced and it is probable that the mean contribution of the various types to the several lowland groups will also have changed, for it is possible that the pressure of war-time ploughing has been greater on some pasture types than on others. For example, it may well be that a larger proportion of low-grade permanent grass (e.g. *Agrostis* pastures) has now been ploughed up as compared with the relatively high-grade grasslands (e.g. ryegrass pastures). However, the authors feel that the post-war distribution of pasture groups is not materially dissimilar from the pre-war.

THE DISTRIBUTION OF PASTURE GROUPS

This map of the distribution of pasture groups inevitably reflects to a marked degree the quality of the land as shown in the Land Classification Map. It demonstrates how extremely limited is the best grassland in Britain.

The best quality grasslands (Lowland Pasture Groups 1-4, i.e. fields chiefly ryegrass and Agrostis-ryegrass), have their most widespread occurrences in three areas extending across the North Midlands. These are:—

- (a) The southern part of the Cheshire Plain, centring on Chester, Nantwich and Crewe.

- (b) Several areas in Leicestershire and south Northamptonshire.
- (c) The Fens, with the coastal "marshes" of Lincolnshire and extending beyond the Humber to include part of Holderness.

Other noteworthy areas include much of the alluvial plain of Somerset, parts of north Dorset, Romney Marsh, parts of the Severn Plain around Gloucester and Cheltenham, the Vale of White Horse between Swindon and Abingdon, and parts of the alluvial marshland bordering the Thames Estuary, both in north Kent and south-east Essex. Even in aggregate, however, these areas are but a small proportion of the total national area, and it must be remembered that as this map is not a map of *land use*, the regions shown as having grasslands of the best quality are not necessarily utilised mainly for grass. The Fenlands in particular have little grass, though what grass does exist there is of good quality; thus the territorial extent of the best quality grassland is actually more limited than the map shows.

The poorer quality grasslands (*Lowland Pasture Groups 7 and 8, i.e. fields chiefly Agrostis, and often with rushes*), occupy much larger areas. They include much of the pasture land of Wales (as distinct from the rough pastures), as well as of the South West Peninsula and the lower slopes of the Pennines. These are essentially areas of high rainfall, steep slopes, and poor or thin soils. Generally poor grass of the same type also occurs

in parts of East Anglia, and especially on the sandy fringes of Breckland, the coastal sandlings of Suffolk, and a large area on the edges of the East Anglian Heights in south Bedfordshire and south Cambridgeshire.

Lowland Pasture Groups 5 and 6 (i.e. fields chiefly Agrostis-ryegrass and Agrostis) cover much of the remainder of lowland Britain away from the chalk and limestone lands.

Fescue Pastures are characteristic of the limestone and chalk formations such as the Cotswolds, Salisbury Plain, the South Downs, the Lincoln and Yorkshire Wolds—a reflection of the dry and relatively shallow calcareous soils; mountain fescues occupy many of the steeper slopes of the Welsh Mountains and the Pennines, below the rough grazing groups but above the lowland types.

The Grasslands map gives some indication of the effects of altitude, climate, soil and management on grassland quality. In Wales, for example, the higher land is picked out by *Molinia-Nardus* moor and mountain fescues; the lower slopes are covered by *Agrostis* pasture, often with rushes, while the sheltered valleys with their deeper soils usually support better quality *Agrostis* pasture with some ryegrass. In Cornwall and Devon, the higher ground, where rainfall is greater, is largely occupied by *Molinia* moorland; in the Pennines these conditions favour cotton grass and deer grass moor, but in the Lake District and the North Yorkshire Moors, heather moor and heather "fell".

THE AVERAGE CONTRIBUTION OF PASTURE TYPES TO EACH LOWLAND PASTURE GROUP (GROUPS 1-8)

