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6 Classification, distribution and productivity of UK grasslands

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AREA OF GRASS AND FORAGE CROPS

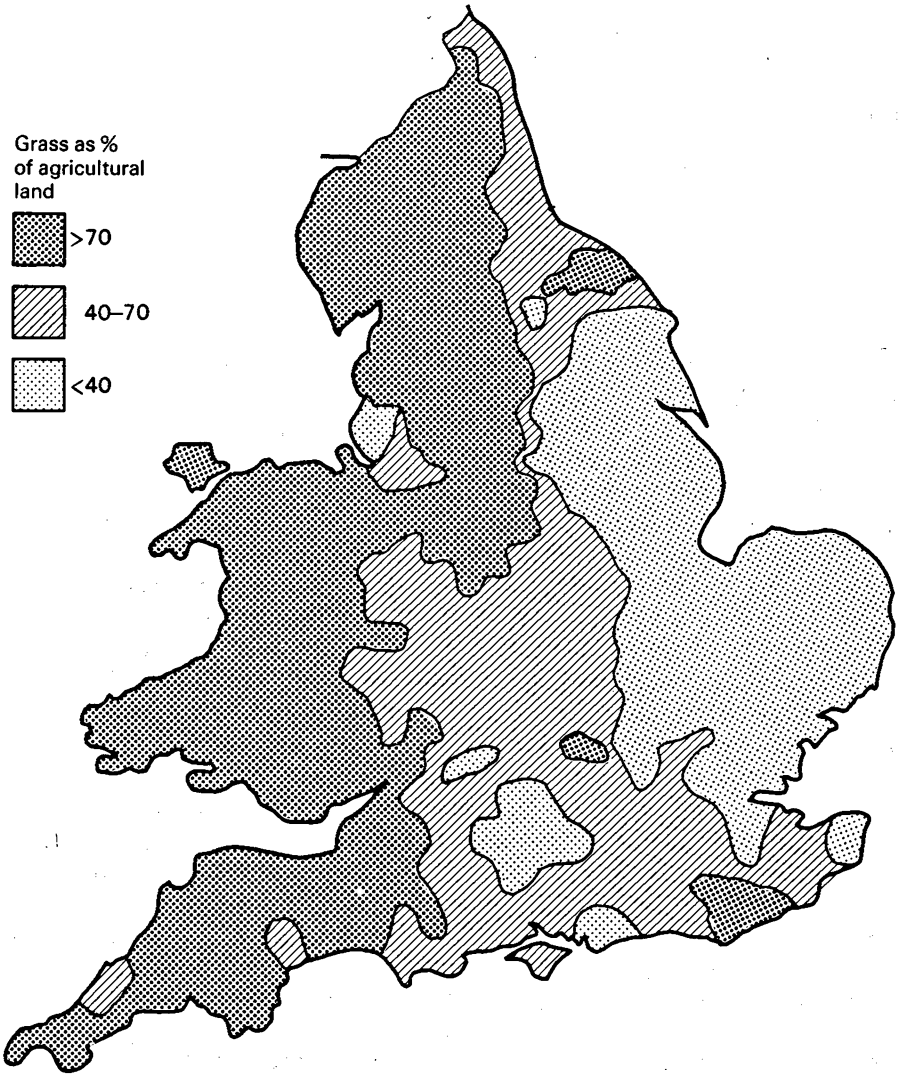
The major source of forage in the UK is the 7.2 million ha of land described in the Agricultural Census as 'grass'. There is an almost equal area, 6.5 million ha, returned as 'rough grazings'. Most of this latter land is characterised by associations of heather, bilberry, cottongrass, deergrass, rush, sedge, matgrass, flying bent, gorse and bracken; however, a proportion of it is rough in the topographic sense only and carries vegetation similar to much of that returned as 'grass'. It is estimated, from surveys of grassland (Davies, 1941; Green, 1974), that more than half the land in England and Wales returned as 'rough grazings excluding common grazings' falls into this category. It would, therefore, be more accurate to say that there are almost 8 million ha of grassland. The 6 million ha of heath and moorland includes approximately 4 million ha of 'deer forest' in Scotland.

Annual forage crops, though locally important, make a comparatively small contribution to the total supply of fodder: turnips, swedes, kale, rape, maize and sundry other forage crops occupy only a quarter of a million ha.

Distribution of grass

The distribution of the 6 million ha of grassland in England and Wales is shown in Figure 1. Approximately two-thirds of the grassland lies within the western zone, where most of the land is used exclusively for forage production; about a quarter lies in the mixed farming zone, and less than one-tenth lies in the arable zone. Northern Ireland and the West of Scotland form an extension of the 'grassland' zone, while the eastern lowlands of Scotland are comparable to the 'mixed farming' zone of England.

Figure 1
The proportion of agricultural land under grass (England and Wales)



Source: Adapted from Agricultural Land Service Research Group – private communication.

Age structure of grass

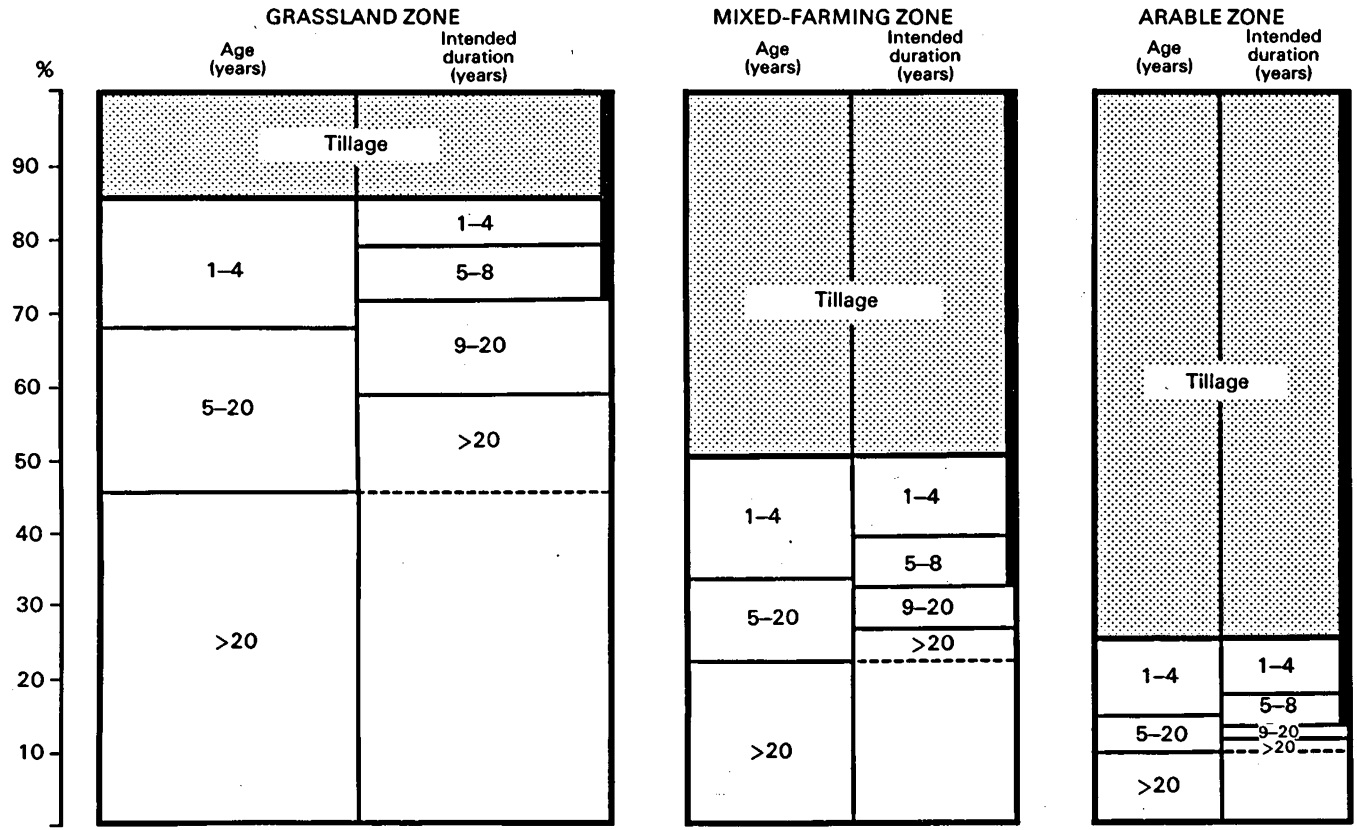
The age structure of the grassland is extremely varied, but this is not solely due to variations in the proportion of arable land. In the UK as a whole, a quarter of the grass is less than four years old. This is loosely assumed to be grass in arable rotation but much of it is in areas where there is very little cropping. In Northern Ireland, it occupies three times as much land as tillage crops. In western and upland Britain, too, the area of grass under four years old exceeds the area of tillage crops. But in the mixed farming areas of lowland England, grass under four years old occupies less than half as much land as tillage crops, while in the main tillage areas of Lincoln and East Anglia there is less than one ha for every 20 ha under tillage crops.

The polarisation of cash cropping and grass livestock farming that has occurred in England over the past 25 years has not greatly reduced the total area of grass sown each year. The conclusion is that much of the land used exclusively for forage production is being reseeded at intervals. This is borne out by the sample survey, of enclosed grassland in England and Wales, by the GRI between 1970 and 1972 (Green, 1974). This survey showed that, whereas 74% of the grassland was described in census returns as 'permanent grass', less than 50% carried swards older than 20 years, and some of these had clearly been sown since the war. Half of the swards under 20 years old were intended to remain longer than eight years, and most of these would be on land rarely used for tillage crops. However, all grass over four years old is still referred to as 'permanent grass' – even in government circles – and this gives the misleading impression that it is never ploughed.

The age structure of grassland is best described with reference to the intended duration of the swards. This is done in Figure 2 for the three major zones distinguished in Figure 1, summarising data from sampled areas representing each zone. Even within the 'grassland' zone (where less than 15% of the enclosed land is under tillage crops) 46% of the grass is under 20 years old. This proportion is not much lower than the 58% and 63% in the 'mixed farming' and 'arable' zones respectively. However, the proportion of this sown grassland that is over four years old is higher in the west than in the east. Consequently, about two-thirds of the grass under four years old in the grassland zone is destined to remain much longer than four years. It follows that not all of the grass under four years old is in arable rotation. The area of grass on land used for cropping is probably better identified with swards intended to last for one to eight years. It is incidental that, for England and Wales as a whole, these occupy a similar area to grass under four years old.

Figure 2

Proportions of grass and crops and age structure of grass in three zones of England and Wales



Notes: The horizontal scale indicates relative areas of agricultural land, excluding common grazings. The thick line indicates intention to return to tillage.

Source: Adapted from Green (1974).

ENVIRONMENTAL FACTORS DETERMINING THE DISTRIBUTION AND AGE STRUCTURE OF GRASSLAND

The major concentrations of grass coincide with land classified as Grade 3 or 4. The predominance of grassland in western Britain and Northern Ireland may be ascribed in the first place to the humid climate, which restricts cultivation and makes cereal harvesting difficult or risky. This same climate, while being generally favourable for the growth of grass and other forage crops, presents obstacles to utilisation: humidity impedes wilting and field curing of forage for storage, while wet soil renders grass inaccessible to stock.

The proportion of strictly permanent swards is partly determined by physical features of the land. In the western grassland zone, a third of the grass over 20 years old is on steep or irregular land or on shallow soils; a further third is on slowly permeable or wet soil. Within the mixed farming zone, irregular relief and shallow soils are less common, but 40% of the old grass is on land relegated from cultivation because it is deficient in natural drainage. In the arable zone, substantial aggregations of permanent swards are found only on heavy or low-lying land, or on very sandy or gravelly soils.

While much of the old grass is on difficult land, 38% of it is on land which, climate apart, offers no obstacle to cultivation. Some is on Grade 2 land. Some of it is kept unploughed because it gives access to other grazing land; some because it is a vital retreat, during the wetter months, for the stock that are needed to exploit less amenable grassland, including some reseeded land that is susceptible to poaching.

Some of the long-term sown grass is on land with physical impediments, but most of the grass intended to last less than eight years is on land that presents no serious problems. Thus, in all three zones, more than half of the total grassland area is free from physical limitations to intensive livestock farming, other than those imposed by excessive rainfall.

BOTANICAL COMPOSITION

The composition of grass swards, particularly those of considerable age, is complex and very variable. It is, therefore, not easy to describe concisely without resort to some broad classification. Fortunateiy, the proportion of the ground cover, contributed by those species normally sown in seeds mixtures, appears to be a relevant basis for classifying both sown swards and old pastures. This group of 'preferred species' may not be inherently more valuable than some of the other major constituents of grassland. However, their survival in sown swards and their status in older grass are directly related to the fertility of the land and to the standard of management.

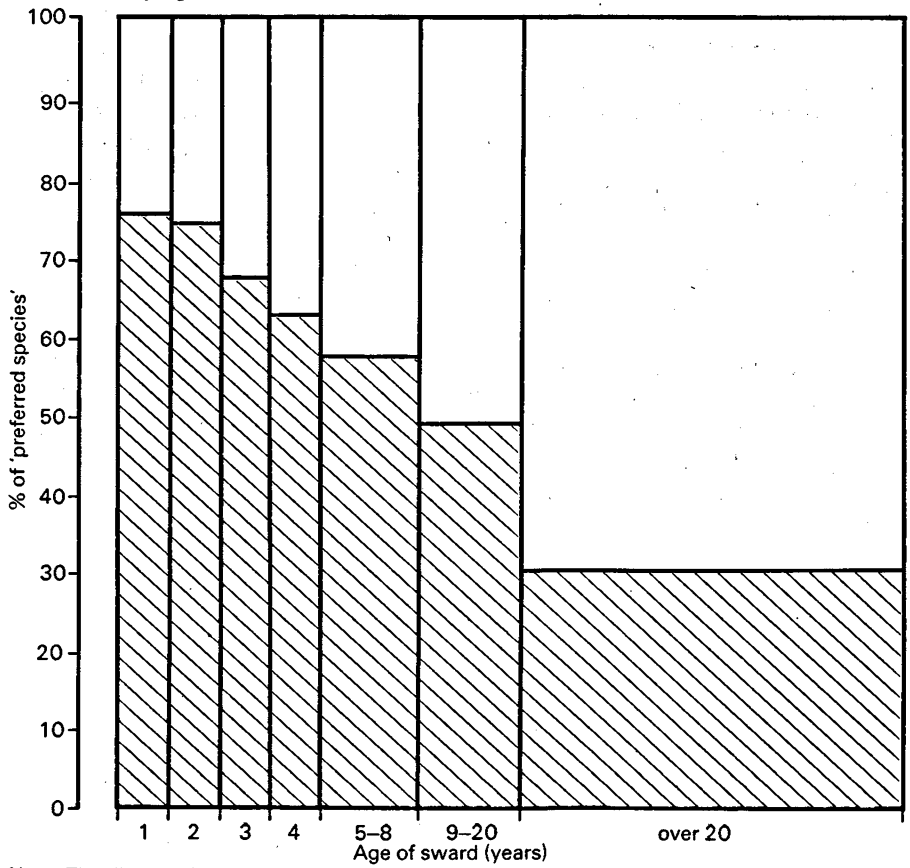
Botanical analyses were made in the random sample of more than 10 000

Source: Adapted from Green (1974).

grass fields surveyed between 1970 and 1972 (Green, 1974) and in some 6 000 grass fields surveyed by the Joint Permanent Pasture Group between 1974 and 1978 (Forbes *et al.* 1978), again spread over England and Wales. The two surveys yielded similar results, which are summarised below.

Among swards of a given age, there is a complete range of 'preferred species' contents within every region and there is little difference in distribution between regions. There is, however, a difference in the average 'preferred species' content between swards of different ages. This is illustrated in Figure 3. The relative area of grass in each age group, derived

Figure 3
Average content of 'preferred species' (shaded) in swards (classified by age)



Note: The diagram is to scale for the land areas.

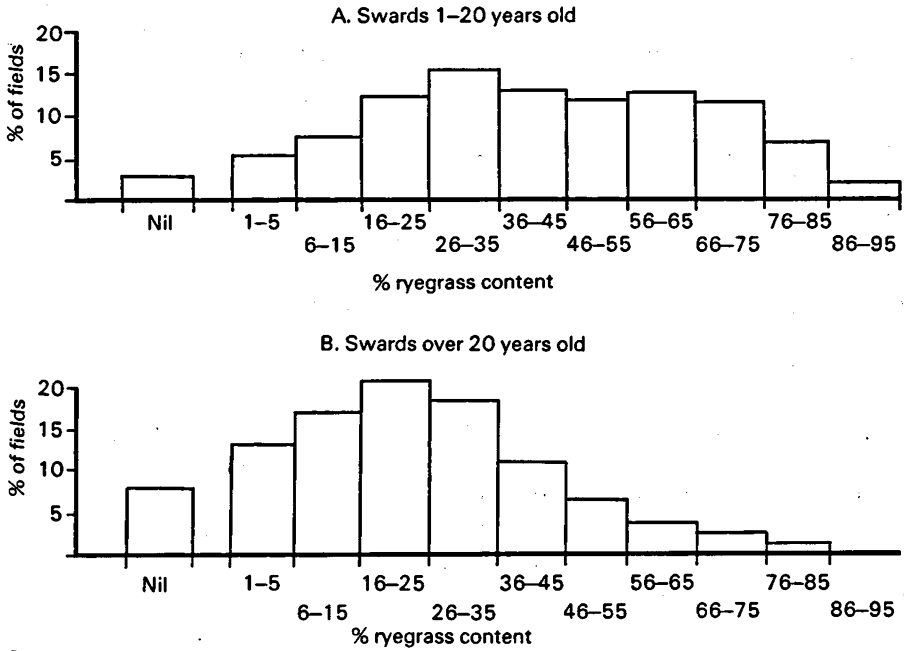
Source: Adapted from Green (1974).

from the earlier, random survey, is also shown in the diagram in order to present an overall picture of the quality of the grassland.

There is a decline in 'preferred species' content in the average sown sward, from 75% in the first harvest year to 50% around year ten. The average for all swards over 20 years old is 30%. The average for all enclosed grassland, other than that covered by moorland or scrub vegetation, is around 45%.

The distribution of fields with different contents of ryegrass (the main component of the 'preferred species') is shown in Figure 4. Although high contents are less common among old swards than in sown grassland, there are a few old pastures that are comparable to the best sown swards, and examples are to be found in all three zones. However, stable associations dominated by 'preferred species' are confined to well drained, well stocked and well managed grassland. There is little doubt that, given the last two conditions, much more of the grassland could be raised to, and maintained at, a level of 'preferred species' well above the present average.

Figure 4
Frequency distribution of fields classified by their ryegrass content



Source: Adapted from Green (1974).

Although much of the grassland is suitable for the cultivation of other forage crops, it is doubtful if this would be as profitable as improvement of the existing perennial crop. Possibly the greatest deficiency of much of the grassland is in its clover content. More than a third of the swards are virtually devoid of clover and less than a quarter of them have a well distributed clover content contributing more than 5% to the ground cover.

CONTRIBUTION OF GRASSLAND TO THE DIET OF RUMINANT LIVESTOCK

Total feed energy requirements for cattle, sheep and horses, and the quantities provided by feeds other than grass, have been calculated by Baker & Wilkins (1975) from statistics available for Great Britain. After up-dating to 1976, these data have been raised by 10% to give approximations for the United Kingdom, which are shown in Table 1. (Northern Ireland has one-tenth the number of livestock units, and one-tenth the area of grassland, recorded for Great Britain.)

Between 1951 and 1976, the total feed energy requirement rose by 36%. The change was mainly due to an increase of 31% in the total number of livestock units, which was brought about by increasing numbers of beef cattle and sheep. A lesser part of the change was due to improvements in animal performance, notably in the average yield of the dairy herd. The quantity of ME required per LU per annum increased from 35.1 GJ in 1951 to 37.4 GJ in 1976.

During the same period, the area of grassland increased slightly at first but later declined, so that the average stocking rate rose from 1.0 LU's per ha in 1951 to 1.4 LU's in 1976 and the total energy requirement per ha of grassland increased by 46%. The amount supplied by a hectare of grassland increased by a similar margin (44%), so the proportion derived from grass remained almost unchanged at about 70%. The proportion provided by other forage crops and arable by-products fell from 12% to 5%, while the contribution from grain and other concentrated feeds rose from 16% to 24%.

The average annual input of fertiliser N per ha of grassland rose from less than 15 kg in 1951 to approximately 100 kg in 1976 (Church & Lewis, 1977). While this made it possible to keep more livestock on the grassland, the improved level of animal performance was achieved mainly by doubling the usage of grain and concentrates per ha of grassland.

The current offtake of energy from grassland, approaching 40 GJ per ha per annum, represents about 4 tonnes of utilised dry matter. Allowing for normal wastage in the process of grazing and conservation, the amount of grass grown is probably between 5 and 6 tonnes DM per ha. There is copious evidence from nitrogen fertiliser trials that this is well below the

Table 1

Requirements and sources of metabolisable energy (ME) for all cattle, sheep and horses in the UK

		1951	1961	1971	1976	Change 1951–1976 (%)
Total livestock units	$\times 10^6$	8.75	10.05	10.15	11.20	+31
Total ME requirement	PJ	307	363	378	418	+36
ME from concentrates [1]	PJ	48	69	85	99	+106
ME from bulk feeds [2]	PJ	37	30	21	21	−43
ME from grassland	PJ	222	264	273	297	+34
Area of grassland [3]	10^6 ha	8.6	9.0	8.0	8.0	−14
Per hectare of grassland						
Livestock units		1.0	1.1	1.3	1.4	+38
ME requirement per LU	GJ	35.6	40.2	47.3	52.1	+46
ME from concentrates	GJ	5.6	7.7	10.6	12.4	+121
ME from bulk feeds	GJ	4.3	3.3	2.6	2.6	−40
ME from grassland	GJ	25.7	29.2	34.1	37.1	+44
Proportion of ME						
from concentrates	%	16	19	22	24	
from bulk feeds	%	12	8	6	5	
from grassland	%	72	73	72	71	

1 Including grain.

2 Forage crops, straw and other arable by-products.

3 Including rough grazings other than moorland vegetation.

Source: Adapted and updated from Baker & Wilkins (1975).

potential of the crop: an improvement of 50% in the average yield of grass would be a modest target. However, if the trends described above were to continue, any increase in grass production would be associated with a further increase in stocking rate and with a proportional increase in the demand for concentrated feeds.

It is worth noting that, in the 25-year period reviewed, while the total feed energy requirement of grass-based livestock increased by 36%, the total output of home-grown cereals was doubled – partly by an increase of 20% in the area grown but mainly by an 80% increase in the average yield of grain. Any further demand for cereals to feed ruminant livestock would have to be

met by further improvements in yield, or by increasing the cereal area, or by additional imports.

With dairy cattle now dependent on concentrated feeds for about one-third of their energy requirements, and beef cattle for about one-fifth (see Table 2), further exploitation of grassland by increasing the number of cattle could be limited by the availability of cereals. In fact, there has been no increase in the number of cattle since 1975.

Table 2

Contribution of grain and other concentrated feeds to the energy requirements of different classes of livestock (%)

Livestock	1951	1961	1971	1972	1973	1974	1976
Dairy	21	29	33	37	31	31	40
Beef	16	19	20	21	17	17	21
Sheep and horses	7	4	6	6	5	5	3
All classes	16	19	22	24	20	19	24

Source: Calculated from various official statistics.

Whilst further increases in the productivity of UK grassland are possible, they will depend mainly on the demand for meat and milk. Improvements in the quality of the forage (especially of that which is conserved for winter feeding) could have a significant impact on productivity in the livestock rearing and feeding sector. There is less scope on the most intensively stocked dairy farms where, despite a comparatively high input of fertiliser nitrogen, the total amount of nutriment produced by the grass is little more than that required for maintenance. For dairy farmers to become more reliant on grass, there would have to be a reversal of trends which have persisted for many years, namely, concentration of the cow population into fewer and larger herds, rising milk yields, and increasing consumption of concentrates. These trends may diminish, but there is no indication that they will be reversed in the foreseeable future.

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