Chapter (non-refereed)

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The extent and composition of upland areas in Great Britain

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1 Introduction

Despite the many conferences on the uplands, the difficulties inherent in producing an adequate definition have led to no generally accepted figure being available for the area involved. This deficiency is due to (i) the difficulty of defining the upland characteristics, and (ii) the problem of obtaining national coverage.

The main purpose of the present paper is, therefore, to define the area concerned, and then to use the Institute of Terrestrial Ecology's Merlewood land classification system data base to estimate the upland area of Britain and its vegetation composition.

Bunce and Heal (1984) summarized the current situation regarding information on the rural environment, and concluded that the disparate nature of much of the information available on vegetation and land use meant that there was no adequate, co-ordinated data base for defining the composition of the countryside. A comparable situation exists in the uplands, although a relatively restricted area is involved.

The first problem is recognized in many publications, with particularly useful summaries being given by MacEwen and Sinclair (1983) and Sinclair (1983). The problem is caused by the range of latitude in Britain, with sea level in Cornwall supporting vegetation generally considered as lowland in character, whilst in Shetland, at the same altitude, vegetation of upland character would be present. A further confusing factor is that, in general, it is easier to identify the affinities of species as upland in character, rather than to analyse the complex of controlling environmental factors. There is, therefore, an element of circularity in the discussion, in that upland character (an environmental definition) is frequently inferred indirectly from the species composition.

Altitude is the most widely used parameter (eg Ball *et al.* 1983) and gives a useful general overall estimate, but underestimates the area in the north. Birse (1970) provides more sophisticated integrated classes, but the information is given as maps, and only covers Scotland. The agricultural land classification does not provide adequate figures because valley-bottom grade 3 land in the uplands cannot be separated from the general occurrence of that category elsewhere. The soils pose comparable problems, although, as Ball (1978) has shown, estimates can be obtained from appropriate soil types. The soil maps of Avery *et al.* (1975) and Bibby (1980) could, therefore, be used to obtain useful estimates, although the problem remains of the better soil types in upland areas. Concerning vegetation, the classification of Robertson (1984) defines upland types in Scotland but gives no figures for their relative coverage. Likewise, the classification of Ward (1971) defines the major upland types, as does the national vegetation classification currently being produced at the University of Lancaster, but gives no consistent areal estimates.

Turning now to the consistency of coverage, the various publications by the Countryside Commission contain a range of figures for England and Wales, but do not cover Scotland. The disparate nature of such information is well summarized by the Centre for Agricultural Strategy (1978). Published figures by the Hill Farming Research Organisation are related to the agricultural land classification, and other general statements available do not provide adequate definition of the way they were derived.

In conclusion, the best available figures seem to be those derived from the designation of Less Favoured Areas (LFAs) under European Community Directive 75/268. These figures are useful because of the indirect correlation between part of the definition used, that of declining population, with upland characteristics. A separate 'mountain area' definition is not applied in Britain. The map of LFAs corresponds closely to the generally considered area of uplands as shown by Ball *et al.* (1982), and the figure for this category is used for comparison with those derived independently below. It should be noted that the area of LFA was extended in 1983 to include marginal areas of hill land.

2 Upland definition

The figures presented in Table 1 are derived from a dual system of definition reflecting the difficulties mentioned above.

i. The land classes (defined by the Merlewood land classification system (Bunce *et al.* 1983), which have a combination of high rainfall, low evapotranspiration, low insolation and generally poor soils, provide the basic upland area.

ii. Within that area, vegetation which is of upland character, ie comprises species such as deer-grass (*Trichophorum cespitosum*), mat-grass (*Nardus stricta*) and purple moor-grass (*Molinia caerulea*), is separated from the mainly agricultural grasslands of predominantly lowland species, such as rye-grass (*Lolium perenne*), which can still exist in the uplands following improvement.

Table 1. A comparison of 2 methods of estimating the major components of upland vegetation in Britain

i. derived from areal measurements of land cover types in 256 sample squares (8 from 32 classes);

ii. derived from the proportion of 1280 200 m² quadrats placed at random within the 32 classes, classified according to TWINSPAN and summarized at a similar level (proportion only — areal measurements not applicable)

Total area of Britain (excluding water and urban) = 19.8 Mha

Total area of uplands (including forest and agricultural grass) = 7.7 Mha (39%)

Area of upland vegetation (bog, moorland and grassland) = 4.6 Mha (23%)

i.	Bog	Moorland	Grassland
	1.5 Mha	1.7 Mha	1.4 Mha
	(32%)	(37%)	(31%)
ii.	Bog	Moorland	Grassland
	Sundew *(Drosera rotundifolia)*, cotton-grass *(Eriophorum angustifolium)*	Heather *(Calluna vulgaris)*, tormentil *(Potentilla erecta)*	Bent-grass *(Agrostis tenuis)*, heath bedstraw *(Galium saxatile)*
	34%	37%	28%

Table 2. Major upland species covering land in the uplands, determined from cover in 1280 200 m² quadrats (40 in each of 32 classes)

	Mha	GB %	% upland
Heather *(Calluna vulgaris)*	1.4	6	25
Bent-grass *(Agrostis tenuis)*	0.8	3	14
Purple moor-grass *(Molinia caerulea)*	0.6	3	10
Mat-grass *(Nardus stricta)*	0.3	1	6
Bracken *(Pteridium aquilinum)*	0.3	1	6
Deer-grass *(Trichophorum cespitosum)*	0.2	1	3
Sheep's fescue *(Festuca ovina)*	0.2	1	3
Wavy hair-grass *(Deschampsia flexuosa)*	0.2	1	3
Sweet vernal-grass *(Anthoxanthum odoratum)*	0.2	1	3
Bilberry *(Vaccinium myrtillus)*	0.1	1	1

Taking the upland land class definition, the uplands cover 7.7 Mha (39%) of GB as compared with the figure of 8.7 Mha for LFAs, redefined and extended in 1983. On the other hand, only 4.6 Mha (23% of GB) is upland vegetation. This reduction is due, in part, to inherently better soils in otherwise upland situations, but also to agricultural improvement converting upland soils and vegetation to more productive species of predominantly lowland character. Further details of the breakdown of the individual categories are given by Bunce *et al.* (1984) but, for present purposes, the types were grouped into 3 broad categories, bog, moorland and grassland. Two methods were then used to compare their relative cover within the upland land class:

i. by areal measurements of land cover types in 256 sample squares (Bunce *et al.* 1983), which can then be converted to national estimates from their occurrence within land classes;

ii. by classifying sample quadrats, within which all species are recorded into classes for the comparable groupings described under (i).

Although the sampling system was identical, the results from the contrasting methods of survey show a high degree of consistency, which would suggest that the figures are reasonable estimates of the major breakdown of upland vegetation in Britain. This suggestion is supported further by the comparison of 7.4 Mha from LFA measurements. Further details of the areal coverage of more detailed categories are given by Bunce *et al.* (1984).

A further important aspect of upland vegetation is the coverage by individual species. Within 1280 200 m² quadrats, the percentage cover of individual species was also recorded, and was used to obtain the national estimates of cover in Table 2. This Table shows that surprisingly few species, with heather (*Calluna vulgaris*) being outstanding, are involved in the vegetation cover of the uplands, and that the residual cover is provided by a limited range of other species.

A further example of the use of the sampling framework to estimate the extent of upland areas is given in Table 3. In this case, the land classes containing the upland plateaux referred to by Thompson (1987) were extracted. Whilst the plateaux themselves will form a relatively small proportion of the uplands, the Table shows how the relative proportions change when different categories are considered. In particular, the example of the extent of bare rock shows how an individual component of a resource can be estimated and shown to have a restricted distribution — an essential activity when making recommendations about the conservation of an individual ecosystem.

Table 3. Contribution of land classes 23 and 24 to the uplands of Great Britain

Britain 19.8 Mha

Mountain core 1.35 Mha
Uplands 7.7 Mha = 6.8% of Britain

Mountain core 1.35 Mha
Upland vegetation 4.6 Mha = 17.5% of uplands

Mountain core 1.35 Mha =29.3% of upland vegetation

Bog	Moorland	Grassland	Rock
1.5 Mha	1.7 Mha	1.4 Mha	0.14 Mha
MC = 0.4 Mha	0.44 Mha	0.6 Mha	0.05 Mha
26.3%	25.9%	4.3%	39.0%

MC, mountain core

3 Discussion

The above results show how the land classification system has been used to produce the first co-ordinated estimates of the extent and composition of the uplands. In the present case, only general categories are used, but further details on vegetation or habitats could be added, if required. Such basic statistics concerning the resource are essential for strategic planning purposes, as they provide the baseline against which changes can be assessed. Other studies are currently in progress to examine various impacts, eg afforestation (Bunce 1987), on the uplands so that the extent of the impact can be determined. In this particular case, the very wet deer-grass/cotton-grass (*Trichophorum/Eriophorum*) bog was affected to a much lesser degree than other semi-natural vegetation types. The impact also differs according to the extent of the category — a loss of 70% of 10 000 ha is more significant than 70% of 100 000 ha. A monitoring programme is, therefore, required to follow the changes that are taking place, together with the consequences, so that pressure can be brought to bear for the necessary policy changes to be made.

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