Article (non-refereed)

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Table 2 Countryside Vegetation System classification of plot and aggregate classes with area estimates (km²)

Class		Area (km²)
I	Crop/weeds	32 400
	Crop/weeds	
	Weedy leys	
II	Tall grass/herb	4 578
	Tall grass/herb boundaries	
	Tall grass/herb streamside	
	Tall grass/herb roadside	
III	Fertile grassland	34 434
IV	Infertile grassland	28 567
	Uniform, infertile grassland	
	Calcareous grassland	
	Variable infertile grassland	
	Wetland	
V	Lowland wooded	10 425
	Hedgerows	
	Woodlands	
	Streamsides	
VI	Upland wooded	14 393
	Streamside	
	Woodland	
	Conifer plantations	
VII	Grass mosaic/moor	19 530
	Grass mosaic/moor streamside	
	Herb-rich grass mosaic	
	Moorland	
VIII	Heath/bog	39 218
	Heather moor	
	Streams	
	Mountain heath	
	Bog	
	Saturated bog	

ECOFACT – ECOlogical FACTors controlling botanical diversity in the British countryside

(This work was co-funded by the Department of Environment, Transport and the Regions, the Ministry of Agriculture, Fisheries and Food, the Scottish Office, Agriculture, Environment and Fisheries Department, and NERC)

In 1990, a major survey of the British countryside was undertaken by ITE, which repeated and extended a baseline survey of vegetation established in 1978 Although the results of Countryside Survey 1990 (CS1990) were published by the Department of the Environment in 1993 (Barr *et al* 1993), resources did not permit a comprehensive analysis of botanical character and change The first two modules of ECOFACT were designed to complete this analysis by describing the botanical characteristics of the wider countryside in Great Britain and carrying out further analysis of the changes on sites previously recorded in 1978

A major part of the work completed to date has involved the development of a system of vegetation classification that deals consistently with the disturbed vegetation covering much of the British countryside In addition, because the new classification is based on mathematical procedures and stratified random sampling, for the first time error terms can be attached to national estimates of the extent of different types of vegetation New vegetation samples can also be assigned to the classification by a novel computer program, developed as part of this project This classification has a wide range of potential applications because it can be used by other ecologists who are not trained in botanical survey and analysis, but who need to describe the vegetation in which they are working

In CS1990, vegetation data were collected from almost 12 000 plots located in 508 one km sample squares drawn from the 32 land classes of the ITE Land Classification (Bunce *et al* 1996), over 2000 of these plots had been surveyed previously in 1978 The plots covered landscape elements (plot types) such as hedgerows and streamsides, as well as the vegetation of open fields and hillsides

The classification

The classification was derived from analysis of the vegetation data by multivariate procedures widely used in vegetation science and described by Barr *et al* (1993) The analysis was carried out on all the botanical data collected in 1978 and 1990, regardless of plot type, so that botanical diversity could be compared across the whole landscape The classification divides the British vegetation into 100 classes and, together with its associated supporting statistical analyses and descriptive interpretation, has been termed the Countryside Vegetation System (CVS)

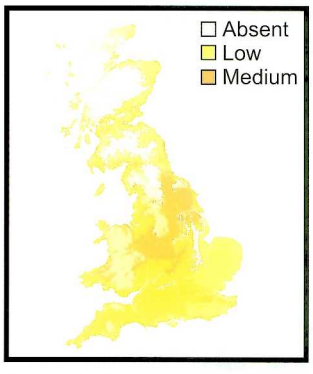
It is difficult to give short names that are fully descriptive for such a large number of classes, but these are necessary to enable users to gain familiarity with the classification and to provide some information about the composition of the classes The names assigned to classes are simply labels based on the habitats associated with the vegetation and do not affect the structure of the classification In addition to the names provided, a one-page summary has been developed to describe the character of each class A draft of the summary page is shown in Figure 3 Users can then compare the study area with the average composition The 100 vegetation classes have also been grouped by a statistical procedure into eight aggregate classes, as shown in Table 2

Vegetation class 25

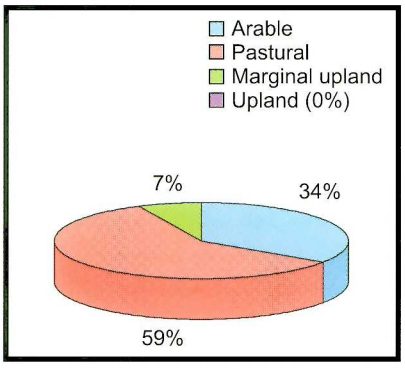
Shaded grassland/hedges

Aggregate class II Tall grassland

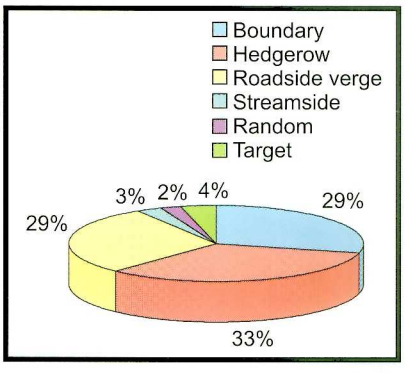
Total number of plots: 325 | Area: 607 sq km | SE: 235 sq km



Probable frequency in GB



Landscape association



Plot types

Description

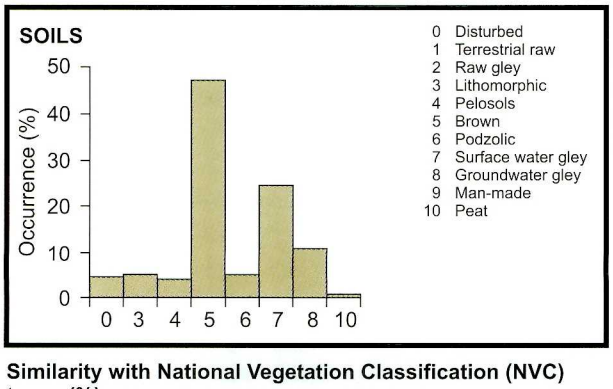
Although mainly along edges of various habitats, this class can occur in a wide variety of situations where there is some shade and some more robust woodland species are able to survive. The class is very common and hawthorn is the main hedgerow species with wild rose and blackthorn. The ground cover is mainly grasses – rye-grass, creeping bent, cock's-foot and false oat-grass. The type is quite diverse in structure and species and has characteristic plants such as bramble, ivy and hogweed. This class occurs throughout lowland Britain.

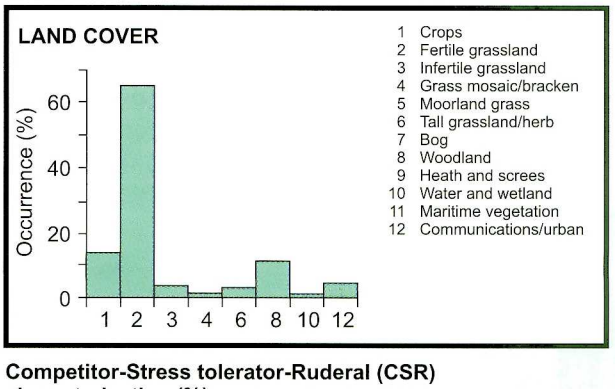
Species number: 257 (high) | No. of species groups: 9 (high) | Most frequent species group: 22

Most frequent species	%	Species with highest cover	%	Characteristic species
Dactylis glomerata	89	*Crataegus monogyna*	16	*Crataegus monogyna*
Urtica dioica	75	*Lolium perenne*	8	*Hedera helix*
Lolium perenne	72	*Agrostis stolonifera*	8	*Rosa* spp.
Holcus lanatus	67	*Dactylis glomerata*	8	*Lolium perenne*
Agrostis stolonifera	59	*Arrhenatherum elatius*	6	*Prunus spinosa*

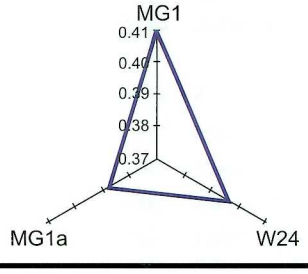
Related habitats

Biodiversity habitat: 4 | CORINE biotope: 31.8, 84 | Phase I habitat: C3, J2





Similarity with National Vegetation Classification (NVC) types (%)



Competitor-Stress tolerator-Ruderal (CSR) characterisation (%)

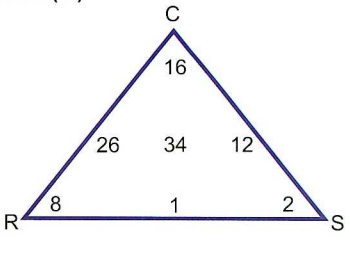


Figure 3. Example of a one-page summary describing the average composition of the 100 vegetation classes

More detailed analysis has shown that the reduction in species numbers in woodlands is largely in the arable and pastural landscapes.

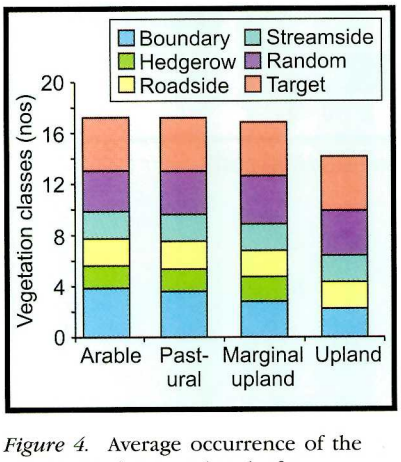


Figure 4. Average occurrence of the vegetation classes within the four landscape types described by Barr *et al.* (1993)

Distribution of the vegetation classes

The frequency of the vegetation classes within the four landscape types defines the principal patterns of distribution of British vegetation. The arable landscape is dominated by crops/weeds, tall grassland/herb and fertile grassland, but it has a small element of acidic vegetation. The pastural landscape overlaps with the arable, but is dominated by fertile grassland and has a higher degree of representation of the heath/bog class. The marginal uplands still have fertile grassland as the most abundant class, but, because they are inherently variable in character, they have almost a complete range of classes. The upland landscape is characterised by moorland heath and bog.

A novel procedure for estimating the area of vegetation classes and associated standard errors has been developed for this project, to replace the plot frequencies presented by Barr *et al.* (1993). The area covered by any given vegetation class depends upon its frequency of occurrence and the area of vegetation in the sample squares covered by the class. The areas at the higher level of the hierarchy, given in Table 2, correspond to the similar categories of land cover estimated by Barr *et al.* (1993).

Using statistical procedures, the results reveal that there is still a wide range of botanical diversity within the British countryside. Figure 4 shows that, even in the intensively managed arable landscapes of the lowlands of Britain, there is a surprisingly similar degree of variation to the pastural lowlands, as represented by the number of vegetation classes. This is because small fragments of vegetation still remain in these landscapes and the fields are more variable than they appear. However, the major division is between the lowlands/marginal uplands and the uplands, which have fewer plot classes present but more semi-natural vegetation. The variation is therefore surprisingly evenly dispersed between the plot types, which means that, as Bunce and Hallam (1993) reported, most variation is in the linear features.

Vegetation change 1978–90

Whilst all the 100 vegetation classes are required to express the variation within the data, many of the classes do not have sufficient plots to determine change between 1978 and 1990. As in CS1990, the major analyses of change have therefore been carried out using the aggregate vegetation classes combined with the four landscape types determined by grouping the ITE land classes. The results confirm the changes reported in CS1990, but add further detail. Thus, there are reductions in the diversity in arable fields, semi-improved grasslands and woodlands, but an increase in species number in the moorland of marginal and upland landscapes. However, the more detailed analysis has shown that species numbers in woodlands are only reduced in the upland wooded aggregate class. The species diversity of landscape features also showed changes, with a reduction in diversity of the ground flora of hedgerows in the pastural landscape, whereas characteristic meadow species declined in roadside verges across all landscapes. Characteristic wet meadow species were lost from streambanks in the lowlands.

The CVS allows comparisons of change to be carried out for all landscape components together. Separate analyses have also been carried out for the plot types from the different landscape components, to compare trends that

may be taking place within them and to ensure that the quadrat size has not affected the results.

The vegetation classes are arbitrary points along vegetation gradients. The principal vegetation gradient has been shown by statistical analysis to be highly correlated with fertility, the secondary gradient being shade and the third soil moisture. Shifts between individual plots from 1978 to 1990 can therefore be interpreted in terms of environmental changes.

Implications for faunal diversity

Much of the vegetation in the British countryside has been overlooked because it consists of highly disturbed assemblages of common, widespread species. However, these assemblages and species often form important food resources for birds, butterflies and bees (Plate 2). Changes in the distribution and abundance of these assemblages and plant species can, therefore, have consequential impacts on faunal populations. Analyses carried out under the ECOFACT project have explored correlations between the status of a number of butterfly and bird species and their foodplants. The results suggest that the reduction in the food resource, as shown by the 1978 and 1990 vegetation data, may be an important factor in the recorded decline of some bird and butterfly species.

Broader applications

The CVS has been compared with other classifications such as the National Vegetation Classification, to enable wider use of the results, for example in Biodiversity Action Plans. The computer program for assigning new vegetation data to the classification has been incorporated into the Countryside Information System, which enables regional estimates to be obtained. The development of a Modular Analysis of Vegetation and Interpretation System (MAVIS) to enable comparisons between all the main systems of vegetation classification in use in GB is also under way.

Plate 2. Wild rose (*Rosa* spp.) is a traditional feature of British hedgerows and is not found elsewhere in the landscape. It also supports a wide range of insect species

Further work

A full description of the CVS is in preparation and a detailed report on Modules 1 and 2 of the ECOFACT project will be published by DETR. Further work on the causes of change in botanical diversity in the wider countryside is continuing with funding from DTER, MAFF and SOAEFD.

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The reduction in food resources may be an important factor in the recorded decline of some bird and butterfly species.

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