INSTITUTE OF TERRESTRIAL ECOLOGY

BANGOR RESEARCH STATION

A DICHOTOMOUS KEY TO BRITISH SUB-MONTANE PLANT COMMUNITIES

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1. INTRODUCTION

The object of the Dichotomous Key is to provide a means by which the commoner types of hill vegetation can be rapidly identified and assessed in a national context.

The present Key is a development of an interim key produced in 1971 by S.D. Ward, and is intended to supersede it. This earlier version was the response to a demand from the regional staff of the (then) Nature Conservancy. They required a key that would enable observers with limited botanical knowledge to carry out surveys of upland areas. The key was to be used either for mapping, or as a means of making a quick determination of the variation present in an area.

The main changes incorporated into the new key are:-

(1) The incorporation of 631 limestone samples supplementing the original 871 which, because of an objective sampling method, were predominantly on acidic substrata.

(2) The use of a new method of analysis replacing the Association Analysis of the original key. The new method is one due to HILL, BUNCE and SHAW (1975) called Indicator Species Analysis, which has as its main feature the use of polythetic division criteria (as opposed to the monothetic criteria of Association Analysis). This greatly reduces the likelihood of mis-classification arising through chance occurrences of key species.

(3) A reduction from 37 to 26 in the number of vegetation groups described. Experience with the first key showed that the overlap between some groups was too great, and amalgamations of end groups resulting from the new analysis have been made with this in mind.

(4) The use of "pseudo-species" (see Section 3) as a means of introducing quantitative information into the analysis. Species dominance was thereby given greater weight than had been possible previously.

As the Key stands it has three main deficiencies:-

(1) Its omission of bryophytes. Some of the more conspicuous species: Polytrichum commune, Rhacomitrium lanuginosum and Sphagnum (as a genus only) were recorded, but were not used in the subsequent analysis. They do not therefore appear as key species, and are only occasionally mentioned in the Group descriptions. This was a deliberate policy adopted in the interests of making the Key useful to observers with little knowledge of bryophyte taxonomy (a common deficiency even among botanists). We are confident that the vegetation classification that has emerged from a consideration of vascular species only, would not have been much altered by the inclusion of bryophytes. There is no reason why bryophytes should not be progressively added to group descriptions as the key is used and records accumulate.

(2) The lack of data from vegetation types which by their nature occupy only small areas. Mountain tops, cliffs, streams, lakes and flushed areas do not appear in specific groups for this reason.

(3) The lack of acidic data from Scotland north of the Central Lowlands, and in England from the North York Moors (including the Cleveland Hills).

2. COLLECTION OF DATA

2.1 Field personnel

The bulk of the data from the first year's field work was collected by a team of twelve undergraduates specially recruited for the project. The students were put through a preliminary course of training in recording methods by Dr. S.D. Ward, and were supervised in the field through a series of visits by the Nature Conservancy staff. All the students were asked to maintain a herbarium of species about which they were doubtful, and in any case of all grasses, sedges and rushes that they encountered. This proved to be a valuable way of checking records, and probably

also acted as an incentive for accurate species identification. It was through the herbaria that a number of species confusions were exposed. Festuca ovina and F. rubra were not generally distinguished, Luzula campestris was confused with L. multiflora and Juncus articulatus with J. acutiflorus. For computational purposes these pairs were treated as single species.

Some data were also collected by Regional and Scientific staff of the Conservancy. In the second year, only two students were employed, both of whom had also been involved in the first year's work. Nature Conservancy staff themselves made the main contribution to the data collection of the second year.

2.2 Location of samples

It was initially intended that data should be collected from all the main blocks of upland country in Great Britain, and that this should be achieved in a single season's field work. Not surprisingly, this turned out not to be feasible with the manpower available, and a more modest programme had to be adopted. Sampling in the first year (1970) was accordingly confined to the regions to the south of the Central Scottish lowlands (Glasgow), but excluding the North York Moors.

Sampling was based on the 10 km squares of the Ordnance Survey National Grid. Squares eligible for sampling were defined as those containing appreciable proportions of land mapped as non-agricultural (i.e. unimproved) in the Clarendon Press Atlas of Great Britain and Northern Ireland (1963). There were approximately 300 such squares, and sampling in every other square (a total of 150) was finally accepted as a realistic target for the year. Theoretically the perfect sampling programme would have been the placement of quadrats within each 10 km square using random co-ordinates. This would however have been too slow for the present purpose, and a more efficient (though slightly less correct) method was adopted. This used a transect within each square, positioned so that its ends coincided with easily identified landmarks. Transects were usually about 3 miles long, and recorders were instructed to sample at intervals of 1,000 paces (about ½ mile), so that about six samples were

required to complete each transect. This meant that recording of each 10 km square could usually be completed by a two-man team in a single day.

The 871 stands in the first year's data set were made up of 767 collected specifically for the project, and a further 104 abstracted (using random numbers) from existing data sets. These were 42 from the data collected by S.D. Ward on Dartmoor in 1969; 12 from the data collected on the Rhinogau by M. D'Oyly under the supervision of R. Goodier; 26 from the Cader Idris data collected by M.C.R. Edgell; and 24 from a Snowdon data set, also collected by M.C.R. Edgell in 1968.

In the second year (1971) the sampling programme was designed to make good the deficiency of limestone plots among the data collected in the first year. For this purpose transects were distributed among the main limestone exposures of Britain, excluding the Magnesian Limestone, but including the relatively small limestone areas in Scotland.

The distribution of the 10 km squares included in each year's sample is shown on the map in Fig. 1.

2.3 Recording procedure

Recording was based on a 2 m x 2 m quadrat marked out with canes and coloured string at each sampling position. The records were entered on a specially prepared two-part form as follows:-

(1) A complete list of the vascular species occurring within the quadrat, together with a visual estimate of their cover-and-abundance on the Domin scale (see Table 1). Bryophytes and lichens were not generally required, although the form did provide for entries under Sphagnum spp., Rhacomitrium lanuginosum, Polytrichum commune and Cladonia spp.

(2) Any additional species occurring in areas of apparently similar vegetation adjoining the quadrat, and within 5 m of the plot-centre. Such records were kept distinct from those within the 2 m x 2 m area by the omission of Domin values.

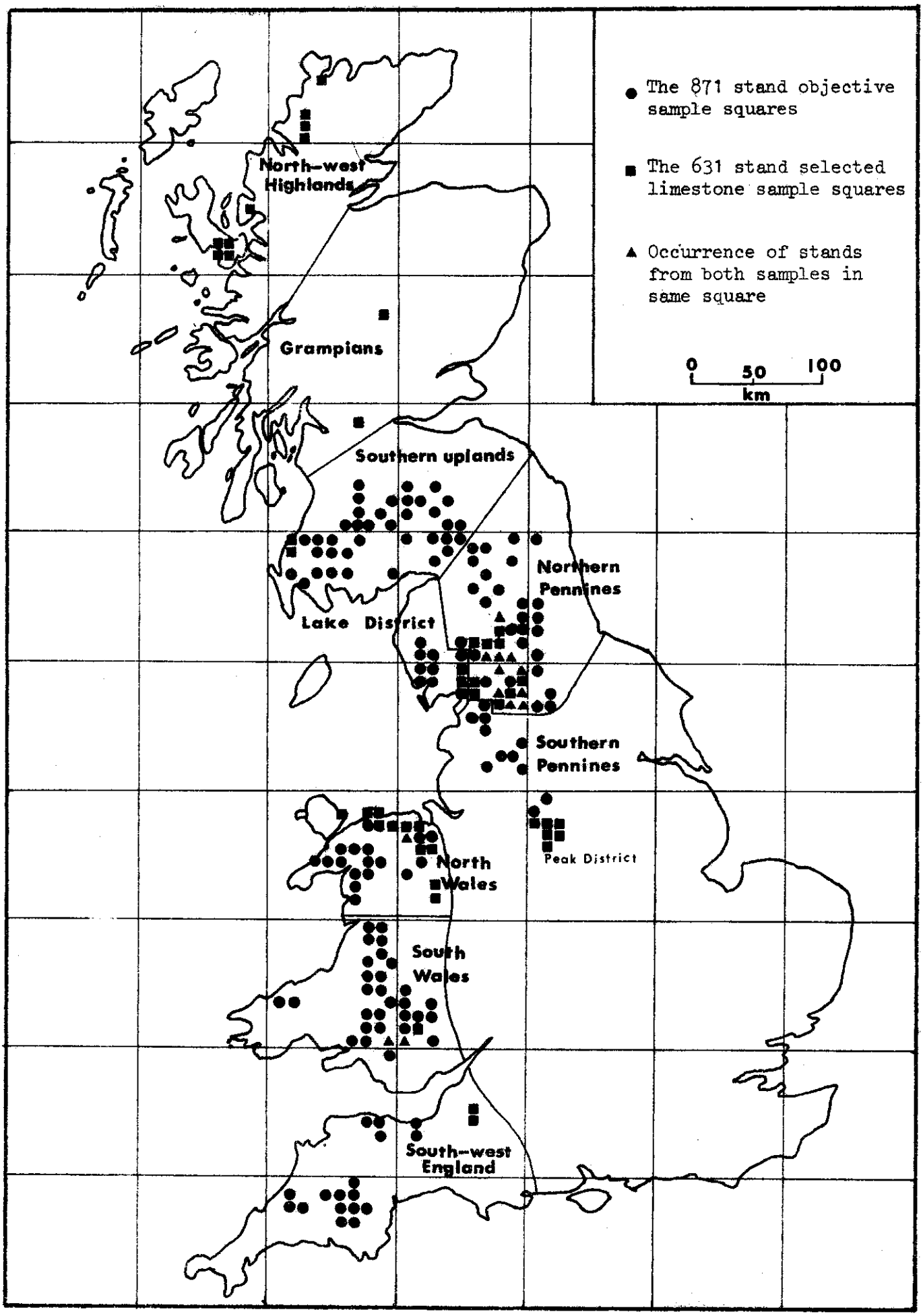

Fig. 1. Map showing distribution of the 10 km sample squares, and the regional boundaries.

(3) A variety of environmental factors including altitude, aspect, slope (using a Dr. Dollar's clinometer), grazing intensity on a six point scale and drainage on a five point scale.

(4) A brief soil description based on an auger sample taken down to a depth of 60 cm. Observations included: horizon depths, colour, texture and drainage.

3. ANALYSIS OF DATA

The 1502 stands were classified on a computer using the method of Indicator Species Analysis (I.S.A.) (HILL, BUNCE and SHAW, 1975). This successively classifies the stands, using polythetic criteria, until a predetermined level of division is reached. The decision as to which limb of the division should be followed by a particular stand is made by adding either positive or negative units for each of the key species present in the stand, and referring the result to a specified threshold level (specific to each division). The version used here was one which allows for 10 indicator species where the group size exceeds 50 stands, and 7 species for all smaller groups. The analysis was initially carried out for two levels of division only using presence-and-absence data (because of computer storage limitations), and subsequently for a further three levels using semi-quantitative data. The strategy here was to set up "pseudo-species" corresponding to genuine species whose cover values exceeded specified levels. In this instance pseudo-species were established for species with Domin ratings exceeding 3 (cover $\geq$5%), and again for ratings exceeding 5 (cover $\geq$25%). In all cases reference numbers for the pseudo-species were chosen to avoid ambiguity.

The 64 end groups that emerged from the analysis were finally reduced by amalgamations to 26, although treatment was rather uneven with respect to the two sides of the first limestone-acidic dichotomy. Variation within the 32 limestone groups was less than within the 32 acidic groups, and could be encompassed by only 7 final Groups, as compared to 19 final Groups on the acidic side.

The final groupings were decided mainly through inspection of computer-generated group summary tables. These made use of a short species list composed of species which had been recorded with Domin values exceeding 3 (>5% cover), or alternatively had achieved 80% constancy in one or more of the 64 end groups resulting *from* I.S.A. *The tables showed:-*

(1) The composition of each stand in terms of the 50 most frequent species within the group. The species were tabulated in descending order of frequency, and occurrences entered with Domin cover values.

(2) Species Domin values averaged over all the stands in the group. These were used to distinguish the species most likely to achieve dominance in the group. Because of the method of analysis used, one or two species usually stood out in this respect.

The affinities between groups were judged using a combination of constancy and dominance criteria. Dominance was generally the factor used to separate associations, and constancy to distinguish sub-associations.

The groupings to emerge from this procedure have as far as possible been related to associations already described in the Scottish studies of McVEAN and RATCLIFFE (1962), BIRKS (1973) and, to a minor extent, BIRSE and ROBERTSON (1976). Where there is a match, the names attached to these associations have been adopted, and where there seem to be no equivalents, new names of the McVean and Ratcliffe type have been devised.

The Dichotomous Key appears in Fig. 2 in the form of a field record sheet. It duplicates the process of successive division of the computer analysis, and lists only the species employed for keying purposes. This makes it unsuitable for the compilation of a complete stand record, but gives much greater convenience in that it allows the key to be condensed into a single side of A4 size paper.

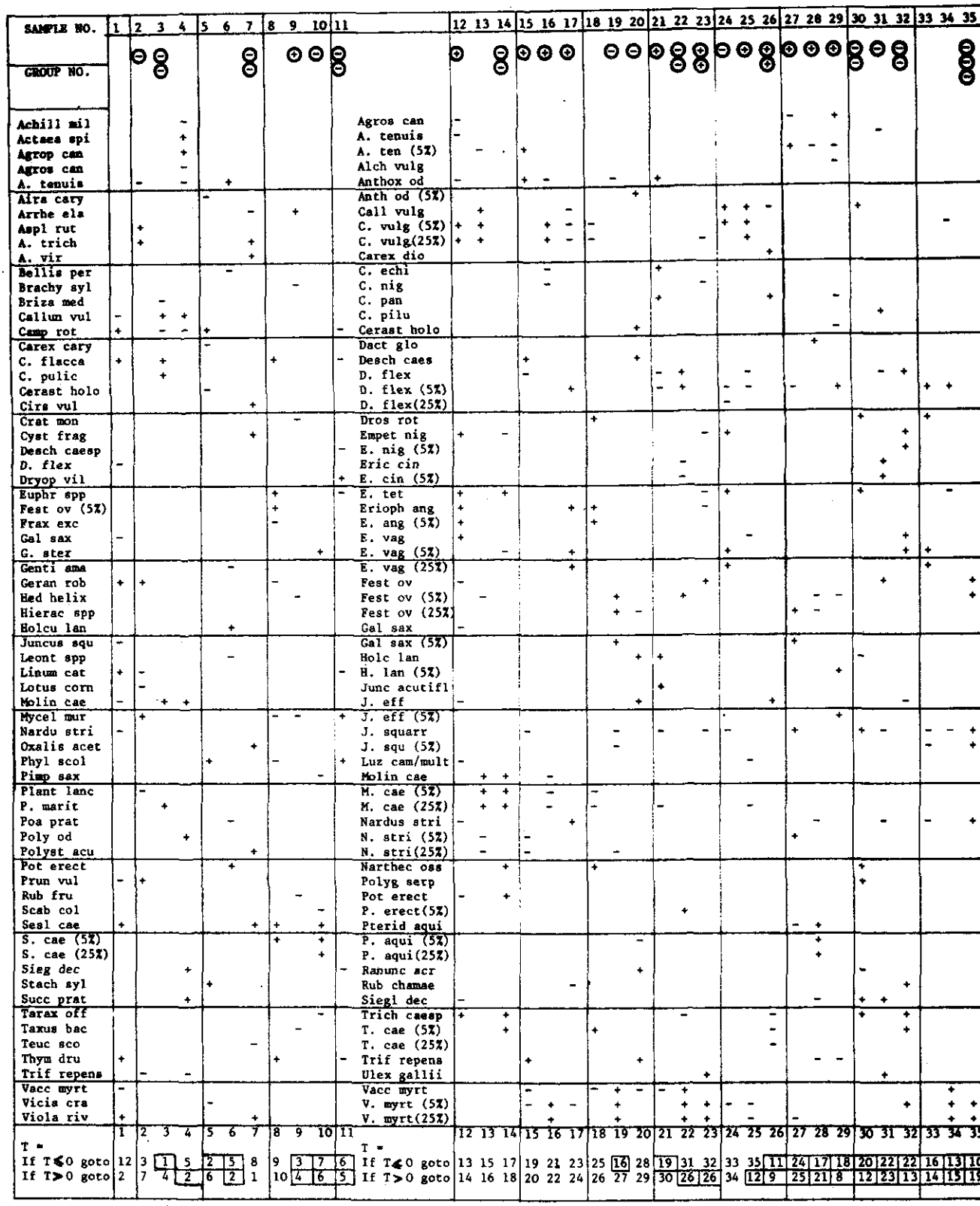

Fig. 2 The Dichotomous Key field sheet

Note Columns 1 and 12 of the key include more than the normal maximum of 10 key species. This is a precaution to increase the precision of these important dichotomies. The additional species were all satisfactory indicators, and were only omitted from the computer's final selection because of the 10 species limit.

4. INSTRUCTIONS FOR USING THE KEY

The Key has been based upon data from 2 m x 2 m quadrats (with supplementary records), and ideally this size of quadrat should also be used when the key is applied. This is not however essential, and there is no reason why larger samples should not be used, provided that they are reasonably homogeneous. Smaller samples should be used only with caution, because there then arises a risk of common, and possibly key, species being excluded by chance.

To key out a sample proceed as follows:-

(1) Record all the Key species in the sample by striking through their names on the keying form. Where the list specifies a cover value, the species should be struck off only when its cover exceeds that value.

(2) Beginning in column 1 on the keying form, ring the pluses and minuses against species that have been registered in the sample.

(3) Sum the entries in the column. Score +1 for every ringed + and -1 for every ringed -. Include the ringed signs at the head of the column.

(4) Enter the result on the line marked T =, and depending on whether it is less than or equal to 0, or greater than 0, refer to the number that appears in the relevant line at the bottom of the keying form. An unboxed number refers to the column to be used in the next stage of the keying routine; a boxed number to one of the Groups in the classification.

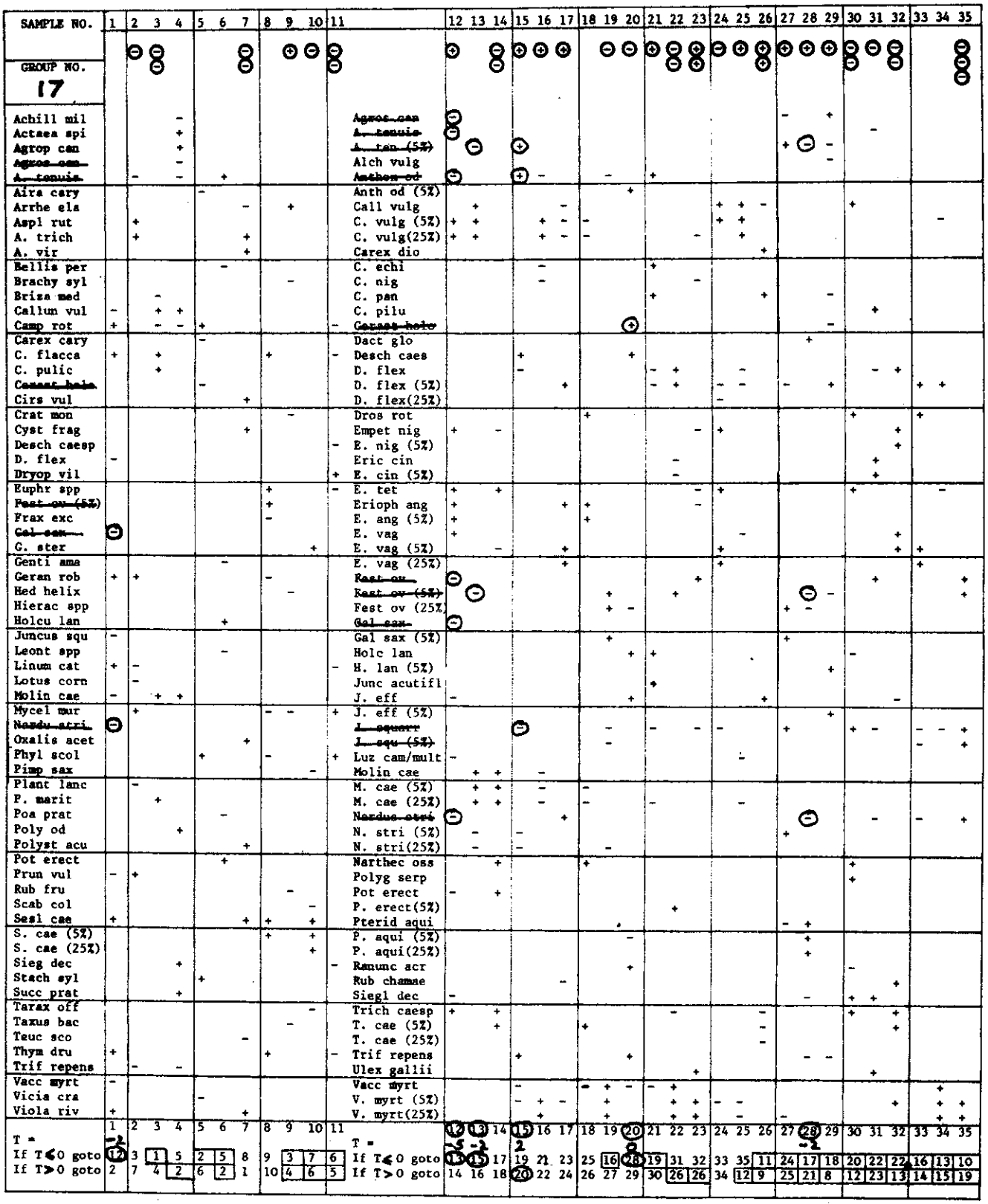

Fig. 3 Illustration of keying proceedure

These short-cuts should not however be relied upon, and if the Group or Groups so specified seem inappropriate, the full Key must be used.

It is best in general to key out stands in the field so that a comparison with the Group descriptions can be carried out on the spot. There are however occasions when it may be necessary to classify stands retrospectively, and this can be done, either on paper, or if the data are in machine-readable form, by use of a suitable computer program. Such a program has been written in BASIC for the DEC-PDP 11 computer at Bangor, and successfully used for this purpose.

5. GROUP DESCRIPTIONS

For the 871 objectively placed samples, the following regions were represented: South-west England (including Dartmoor and Exmoor), South Wales, North Wales, the Southern Pennines (including the Peak District and the Forest of Bowland), the Northern Pennines, the Lake District and the Southern Uplands of Scotland (including the Cheviots).

The 631 samples of the second phase were all on limestone, and included two additional regions in Scotland: the Grampians and the North-west Highlands.

The distributions of the samples and the boundaries of the above regions are shown on the map in Fig. 1.

Frequency of occurrence is expressed as a percentage of the stands from the first year's 871 stand sample only. Inclusion of the second year's sample would have been less informative because of the selective nature of the sampling programme in the second year.

All species names follow Clapham, Tutin and Warburg (1962).

Table 1. KEY TO THE GROUP DESCRIPTIONS

Slopes: gentle 0°-10°, moderate 10°-20° and steep in excess of 20°

Grazing:
- grade 0 - stock excluded by fencing
- grade 1 - undetectable but accessible to stock
- grade 2 - light
- grade 3 - moderate
- grade 4 - heavy
- grade 5 - very heavy

Drainage:
- grade 1 - waterlogged
- grade 2 - poor
- grade 3 - imperfect
- grade 4 - good
- grade 5 - very good or excessive

Soils:
- mineral soils - organic material present only in the form of litter or rotting plant remains and grading quickly into the top mineral horizon
- shallow peat - peat less than 60 cm deep
- deep peat - peat more than 60 cm deep

The average figures given under grazing and drainage are the averages of the above grades.

The Domin cover-and-abundance scale, used in the field and referred to here is:

1. one or two individuals
2. sparsely distributed
3. frequent but with low cover; less than 5%
4. cover 5-20%
5. cover 20-25%
6. cover 25-33%
7. cover 33-50%
8. cover 50-75%
9. cover 75-90%
10. cover complete or almost so

The "Preferential species" are those whose frequency within the group exceeds their frequency in either

(a) the limestone groups (1-7), or

(b) the acidic groups (8-26), by a factor ≥ 5, and which have at least three occurrences in the group.

Table 2. SYNOPSIS OF BRITISH SUBMONTANE PLANT COMMUNITIES

Group	Amalgamated I.S.A. Groups	Name
1	33-40	Festuco-Geranietum robertianae rupicola
2	41, 42, 44-48	Festuco-Geranietum robertianae pavimenticola
3	49, 50	Thymo-Festucetum typicum
4	51, 52	Thymo-Festucetum sesleriosum
5	43, 61-64	Thymo-Festucetum boreale
6	53, 54	Thymo-Agrosto-Festucetum typicum
7	55-60	Thymo-Agrosto-Festucetum plantaginosum
8	8	Juncetum effusi
9	31	Sphagneto-Caricetum sub-alpinum
10	25	Molinietum atlanticum
11	29, 30	Trichophoreto-Callunetum
12	12, 27, 28	Molinieto-Callunetum
13	18, 23	Calluneto-Eriophoretum typicum
14	22	Calluneto-Eriophoretum deschampsiosum
15	24	Calluneto-Eriophoretum myrtillosum
16	1, 2, 21	Nardo-Juncetum squarrosi
17	5	Agrosto-Festucetum
18	7	Trifolio-Agrosto-Festucetum
19	9, 10, 26	Festuco-Molinietum deschampsiosum
20	11	Festuco-Molinietum anthoxanthosum
21	6	Pteridietum aquilinae
22	13, 17	Callunetum vulgaris typicum
23	14	Callunetum vulgaris cinereae
24	3	Festuceto-Vaccinetum pteridosum
25	4	Festuceto-Vaccinetum nardosum
26	15, 16, 19, 20	Vaccineto-Callunetum typicum

Note: I.S.A. group 32 contained only a single sample which could not be related to any other I.S.A. group. It has therefore been ignored.

Group 1 — FESTUCO-GERANIETUM ROBERTIANAE (assoc. nov.), sub-association RUPICOLA.
The association occurs on limestone exposures where there is too little soil to support grassland species. The sub-association differs from that of Group 2 in its lack of species which depend on the shelter provided by deep fissures in the rock, e.g. the "grikes" in a limestone pavement.

Frequency: 89 stands, but not encountered in the 871 stand objective sample. Though often conspicuous in the landscape, these rocky features usually occupy only comparatively small areas.

Distribution: Wherever limestone exposures occur. The greatest number of examples comes from the Northern Pennines, but there are also stands from South-west England (the Mendips), South and North Wales, and from the Southern Pennines.

Principal species:		Mean Domin
Constancy ≥80%	Festuca ovina	2.2
Constancy ≥60%	Geranium robertianum	1.4
Constancy ≥40%	Asplenium ruta-muraria	0.9
	Campanula rotundifolia	0.8
	Fraxinus excelsior	1.1
	Sesleria albicans	2.1
	Taraxacum officinale	0.9
	Teucrium scorodonia	1.3
	Thymus drucei	1.2

Preferential species:

Acer pseudoplatanus, Centaurea scabiosa, Epipactis atrorubens, Fraxinus excelsior, Geranium sanguineum, Hedera helix, Origanum vulgare, Prunus spinosa, Rubus idaeus, Taxus baccata, Teucrium scorodonia, Valeriana officinalis.

Group 2 FESTUCO-GERANIETUM ROBERTIANAE (assoc. nov.), sub-association PAVIMENTICOLA.
The sub-association contains species which depend for their survival upon the sheltered conditions, and possibly protection from grazing provided by deep fissures in the rock. It is usually, though not invariably, associated with well developed limestone pavement.

Frequency: 94 stands, 5 from 871 = 0.6%. Though rather rare over the country as a whole, it is comparatively frequent in the Northern Pennines.

Distribution: Overwhelmingly in the Northern Pennines, but with a few stands also from North and South Wales, and two from Scotland (Blair Atholl and Ghlaschnoic).

Principal species:

		Mean Domin
Constancy ≥80%	Festuca ovina	2.2
	Geranium robertianum	1.8
	Sesleria albicans	2.6
Constancy ≥60%	Asplenium ruta-muraria	1.6
	A. trichomanes	1.6
	Cystopteris fragilis	1.5
	Mycelis muralis	1.2
	Oxalis acetosella	1.4
	Thymus drucei	1.4
	Viola riviniana	1.1
Constancy ≥40%	Asplenium viride	1.1
	Euphrasia officinalis agg.	0.9
	Linum catharticum	1.0
	Taraxacum officinale	1.1
	Urtica dioica	1.1

Preferential species:

Allium ursinum, Anemone nemorosa, Arabis hirsuta, Asplenium ruta-muraria, A. trichomanes, A. viride, Athyrium filix-femina, Cardamine hirsuta, Chamaenerion angustifolium, Cystopteris fragilis, Dryopteris filix-mas, D. villarii, Epilobium montanum, Geranium robertianum, Mercurialis perennis, Mycelis muralis, Oxalis acetosella, Phyllitis scolopendrium, Polypodium vulgare, Polystichum aculeatum, Rubus idaeus, Saxifraga tridactylites, Thelypteris robertiana, Urtica dioica.

Group 3 — THYMO-FESTUCETUM (assoc. nov.), sub-association TYPICUM.
A limestone grassland association usually dominated by Festuca ovina and containing Thymus drucei. The species list is usually long, and can contain any from a very wide range of calcicolous herbs and grasses. The Group differs from the Group 4 sub-association mainly in its lack of Sesleria albicans.

Frequency: 90 stands, but none from the 871 stand objective sample. This reflects the comparative scarcity of limestone grassland outside the North of England i.e. in those regions lacking Sesleria albicans.

Distribution: Mainly North Wales and the Southern Pennines, but also with a few examples from South-west England (one only), South Wales, and the Grampians (Blair Atholl).

Altitude:	In the range 60 m to 440 m.	Average = 232 m
Slope:	Usually on steep slopes	Average = 30.4°
Grazing:	No definite relationship	Average = 1.9
Drainage:	Good to very good	Average = 4.4
Soils:	Shallow mineral soils	

Principal species:

		Mean Domin
Constancy ≥80%	Briza media	2.0
	Carex flacca	2.2
	Festuca ovina	5.6
	Lotus corniculatus	1.8
	Thymus drucei	2.4
Constancy ≥60%	Campanula rotundifolia	1.6
	Helianthemum chamaecistus	2.1
	Hieraceum pilosella	1.3
	Koeleria cristata	1.7
	Linum catharticum	1.5
	Plantago lanceolata	1.5
	Poterium sanguisorba	1.7
Constancy ≥40%	Carex caryophyllea	1.0
	Crataegus monogyna	1.1
	Dactylis glomerata	1.0
	Euphrasia officinalis agg.	1.2
	Galium verum	0.9
	Sieglingia decumbens	1.3
	Viola riviniana	0.9

Preferential species:

Agrostis stolonifera, Aira caryophyllea, Anthyllis vulneraria, Arenaria serpyllifolia, Betonica officinalis, Carduus nutans, Carlina vulgaris, Centaurea scabiosa, Filipendula vulgaris, Helianthemum canum, H. chamaecistus, Hypericum hirsutum, H. montanum, Leontodon hispidus, Medicago lupulina, Orchis mascula, Poterium sanguisorba, Primula veris.

Group 4 — THYMO-FESTUCETUM (assoc. nov.), sub-association SESLERIOSUM.
A limestone grassland. This sub-association differs from the Group 3 sub-association in its inclusion of Sesleria albicans, a species that in many instances replaces Festuca ovina as the dominant.

Frequency: 66 stands, but only 1 from the 871 = 0.1%. Apparently not very common even in the Northern Pennines; certainly less so than Group 6 (Thymo-Agrosto-Festucetum typicum).

Distribution: The Northern Pennines.

Altitude: In the range 60 m to 535 m — Average = 310 m

Slope: Can be on any slope, but most often on steep ones. — Average = 19.6°

Grazing: No definite relationship — Average = 2.3

Drainage: Good to very good — Average = 4.3

Soils: Shallow mineral soils

Principal species:

		Mean Domin
Constancy ≥80%	Briza media	1.8
	Carex flacca	1.9
	Campanula rotundifolia	1.8
	Festuca ovina	4.2
	Linum catharticum	1.6
	Sesleria albicans	5.6
	Thymus drucei	2.1
Constancy ≥60%	Agrostis tenuis	1.3
	Euphrasia officinalis agg.	1.3
	Lotus corniculatus	1.6
	Viola riviniana	1.5
Constancy ≥40%	Anthoxanthum odoratum	1.3
	Carex caryophyllea	1.2
	Cerastium holosteoides	0.8
	Koeleria cristata	1.0
	Potentilla erecta	0.9
	Sieglingia decumbens	1.0
	Trifolium repens	0.8

Preferential species:

Asperula cynanchica, Draba incana, Primula farinosa.

Group 5 THYMO-FESTUCETUM (assoc. nov.), sub-association BOREALE.
A Festuca ovina grassland developed over limestone or other basic parent material, but with the soil proper deficient in calcium carbonate. This may arise as the result of excessive leaching in high rainfall zones, or through the presence of shallow glacial drift. The stands may be dominated by Festuca ovina, by Dryas octopetala, or less often by Molinia caerulea or Carex panicea. As the list of preferential species clearly shows, acidophilous species are generally much more common than in other limestone grassland groups.

Frequency: 55 stands. There were no examples from the 871 stand data set, but this did not include samples from the Grampians.

Distribution: Except for two Northern Pennine stands, entirely from the Grampians and the North-west Highlands.

Altitude: In the range 150 m to 610 m — Average = 387 m

Slope: No apparent preference — Average = 12°

Grazing: Usually moderate or heavy, but occasionally in the other categories — Average = 3.4

Drainage: Usually imperfect or good, sometimes very good — Average = 3.7

Soils: Mineral soils

Principal species:

		Mean Domin
Constancy ≥80%	Carex flacca	2.3
	Festuca ovina	3.7
	Linum catharticum	1.9
	Potentilla erecta	1.7
	Prunella vulgaris	1.7
	Sieglingia decumbens	1.8
	Succisa pratensis	1.7
	Thymus drucei	2.3
	Viola riviniana	1.6
Constancy ≥60%	Calluna vulgaris	1.7
	Carex pulicaris	1.5
	Dryas octopetala	2.6
	Euphrasia officinalis agg.	1.4
	Lotus corniculatus	1.3
	Molinia caerulea	2.1
	Plantago lanceolata	1.6

Group 5 (continued)

		Mean Domin
Constancy ≥40%	Anthoxanthum odoratum	0.9
	Asplenium viride	0.8
	Bellis perennis	0.8
	Carex lepidocarpa	1.3
	C. panicea	1.5
	Erica cinerea	0.8
	Pteridium aquilinum	0.9
	Selaginella selaginoides	1.1

Preferential species:

Agrostis canina, Alchemilla alpina, A. vulgaris, Allium ursinum, Anemone nemorosa, Angelica sylvestris, Antennaria dioica, Arctostaphylos uva-ursi, Asplenium viride, Athyrium filix-femina, Betula spp., Blechnum spicant, Calluna vulgaris, Carex binervis, C. capillaris, C. lepidocarpa, C. panicea, C. pulicaris, Cirsium heterophyllum, Coeloglossum viride, Dactylorchis maculata, Dryas octopetala, Epipactis atrorubens, Erica cinerea, Empetrum nigrum, Filipendula ulmaria, Galium boreale, Gentianella amarella, Geum rivale, Lathyrus montanus, Leontodon autumnalis, Hypericum pulchrum, Molinia caerulea, Pinguicula vulgaris, Plantago maritima, Polygala vulgaris, Polygonum viviparum, Polystichum aculeatum, Primula vulgaris, Pteridium aquilinum, Sanicula europaea, Saxifraga tridactylites, Selaginella selaginoides, Solidago virgaurea, Sorbus aucuparia, Succisa pratensis, Trollius europaeus.

Group 6 — THYMO-AGROSTO-FESTUCETUM (assoc. nov.), sub-association TYPICUM.
A calcareous grassland in which Festuca ovina is usually dominant and Agrostis tenuis present. It is allied to Group 18 (Trifolio-Agrostо-Festucetum) but is drier and more definitely calcareous. The greater dryness of the group is reflected in the higher frequency and abundance of Thymus drucei and the lower frequency of Holcus lanatus and Nardus stricta. The list of preferential species emphasises its relatively acidic tendencies when compared with the other calcareous groups.

Frequency: 96 stands, 15 from 871 = 1.7%

Distribution: Mainly the Northern Pennines, but also in North Wales, South Wales (one stand), the Southern Pennines, the Southern Uplands and in the Grampians (Blair Atholl).

Altitude:	In the range 15 m to 455 m	Average = 190 m
Slope:	Frequently on steep slopes, less often on gentle and moderate ones	Average = 13.4°
Grazing:	Usually moderate or heavy	Average = 3.4
Drainage:	Usually good	Average = 3.7
Soils:	Mineral soils	

Principal species:

	:	Mean Domin
Constancy ≥80%	Agrostis tenuis	3.2
	Campanula rotundifolia	1.8
	Festuca ovina	7.2
	Luzula campestris/ multiflora	1.6
	Thymus drucei	2.2
	Trifolium repens	1.9
Constancy ≥60%	Anthoxanthum odoratum	1.6
	Carex caryophyllea	1.6
	Cerastium holosteoides	1.4
	Galium saxatile	1.3
	Koeleria cristata	1.4
	Potentilla erecta	1.3
	Viola riviniana	1.4
Constancy ≥40%	Briza media	1.2
	Deschampsia caespitosa	1.6
	Euphrasia officinalis	1.1
	Linum catharticum	1.0
	Lotus corniculatus	1.1
	Prunella vulgaris	0.9
	Sesleria albicans	1.5

Preferential species:

Cardamine pratensis, Deschampsia caespitosa, D. flexuosa, Galium saxatile, Minuartia verna, Nardus stricta, Polygala serpyllifolia, Luzula campestris/multiflora, Vaccinium myrtillus, Veronica officinalis, Viola lutea.

Group 7 — THYMO-AGROSTO-FESTUCETUM (assoc. nov.), sub-association PLANTAGINOSUM

A damp limestone grassland in which Festuca ovina is usually dominant and Agrostis tenuis usually present, often with appreciable cover. Thymus drucei is also often present. The group differs from Group 6 in its much greater frequency of Holcus lanatus, Plantago lanceolata and Primula vulgaris, and in its comparative lack of Galium saxatile and Sesleria albicans (in the Northern Pennine stands)

Frequency: 117 stands, 6 from 871 = 0.7%

Distribution: General, but rather rare in South-west England and in the Southern Uplands. Many of the Scottish limestone grasslands are in this group.

Altitude: In the range 15 m to 395 m — Average = 190 m

Slope: On any slope, but with some preference for steep ones — Average = 13.4°

Grazing: No apparent relationship — Average = 2.6

Drainage: Imperfect to very good — Average = 3.9

Soils: Mineral only

Principal species:

		Mean Domin
Constancy ≥80%	Agrostis tenuis	2.9
	Festuca ovina	5.0
	Plantago lanceolata	1.8
Constancy ≥60%	Anthoxanthum odoratum	1.6
	Campanula rotundifolia	1.3
	Cerastium holosteoides	1.4
	Holcus lanatus	1.6
	Linum catharticum	1.2
	Lotus corniculatus	1.7
	Thymus drucei	1.6
	Trifolium repens	1.8
Constancy ≥40%	Bellis perennis	1.1
	Briza media	0.9
	Carex flacca	1.3
	Cynosurus cristatus	1.4
	Dactylis glomerata	1.2
	Euphrasia officinalis agg.	1.1
	Galium verum	1.0
	Hieracium pilosella	0.9
	Koeleria cristata	1.1
	Luzula campestris/ multiflora	1.1
	Potentilla erecta	1.2
	Sieglingia decumbens	1.2
	Veronica chamaedrys	0.9
	Viola riviniana	1.2

Group 7 (continued)

Preferential species:

Cirsium arvense, C. palustre, Coeloglossum viride, Conopodium majus, Cynosurus cristatus, Galium cruciata, Gentianella amarella, Holcus lanatus, Hypochaeris radicata, Juncus articulatus, Leontodon autumnalis, Lolium perenne, Phleum pratense, Plantago media, Ranunculus acris, Rumex acetosa, Trifolium dubium, T. pratense, Trisetum flavescens, Ulex europaeus, Veronica chamaedrys, Vicia sepium.

Group 8 — JUNCETUM-EFFUSI (assoc. nov.)

An association with Juncus effusus and/or J. conglomeratus, the latter being much less frequent than the former. Anthoxanthum odoratum is usually present. The association is close to the Ranunculus repens-Juncus effusus community described by Birse and Robertson (1976).

Frequency: 20 stands, 19 from 871 = 2.2%

Distribution: Not recorded from South-west England, but otherwise widespread

Altitude: In the range 240 m to 670 m — Average = 334 m

Slope: Gentle to moderate — Average = 5°

Grazing: No apparent relationship — Average = 2.2

Drainage: Usually poor or imperfect — Average = 2.7

Soils: Usually on mineral soils, occasionally on shallow peat (one example on deep peat)

Principal species:

		Mean Domin
Constancy ≥80%	Anthoxanthum odoratum	3.2
	Galium saxatile	2.1
	Juncus effusus	4.7
Constancy ≥60%	Agrostis tenuis	2.3
	Deschampsia caespitosa	2.0
	Festuca ovina/rubra	1.6
	Nardus stricta	1.5
	Potentilla erecta	1.6
Constancy ≥40%	Carex nigra	1.5
	Deschampsia flexuosa	2.4
	Holcus lanatus	1.5
	Luzula campestris/ multiflora	0.9

Preferential species:

Cardamine pratensis, Carex echinata, C. nigra, C. ovalis, Cerastium holosteoides, Cirsium palustre, Deschampsia caespitosa, Epilobium palustre, Galium palustre, Holcus lanatus, H. mollis, Poa pratensis, Juncus acutiflorus, J. conglomeratus, J. effusus, Ranunculus acris, R. repens, Rumex acetosa, Trifolium repens, Viola palustris.

Group 9 SPHAGNETO-CARICETUM SUB-ALPINUM (McVean and Ratcliffe, 1962)
An association containing, and often dominated by, Eriophorum angustifolium with appreciable Sphagnum cover and usually one or more Carex sp. Molinia caerulea may also have high cover. Among the Carex sp. present may be C. echinata, C. nigra or C. panicea. The Carex echinata-Carex panicea community described by Birse and Robertson (1976) is comparable.

Frequency: 12 stands, 12 from 871 = 1.4%

Distribution: Most frequent in North Wales, but also recorded from South Wales, the Northern Pennines and the Southern Uplands.

Altitude:	In the range 90 m to 485 m	Average = 334 m
Slope:	Usually on gentle slopes	Average = 5°
Grazing:	Undetectable to light	Average = 1.0
Drainage:	No apparent preference	Average = 3.0
Soils:	Usually deep peat	

Principal species:

		Mean Domin
Constancy ≥80%	Eriophorum angustifolium	4.3
Constancy ≥60%	Carex panicea	2.5
	Erica tetralix	1.7
	Molinia caerulea	3.9
	Narthecium ossifragum	1.3
Constancy ≥40%	Carex echinata	1.9
	C. nigra	1.4
	Eriophorum vaginatum	1.0
	Juncus effusus	1.0
	Potentilla erecta	1.0

Preferential species:

Agrostis canina, Carex demissa, C. echinata, C. nigra, C. panicea, Drosera rotundifolia, Erica tetralix, Eriophorum angustifolium, Juncus acutiflorus, J. bulbosus, Narthecium ossifragum, Polygala serpyllifolia.

Group 10 MOLINIETUM ATLANTICUM (assoc. nov.)
An association dominated by Molinia caerulea. The association usually contains Deschampsia flexuosa. It is far less rich in herbaceous and grass species than Festuco-Molinietum, with only three preferential species as compared to 30 in Group 20.

Frequency: 26 stands, 126 from 871 = 3.0%

Distribution: General, but not frequent in the Southern Uplands

Altitude: In the range 120 m to 560 m Average = 360 m

Slope: Gentle to moderate Average = 6.0°

Grazing: Undetectable to moderate but not usually more than light Average = 1.4

Drainage: In the range poor to good Average = 2.7

Soils: Usually on deep peat, only rarely on mineral soils

Principal species:

		Mean Domin
Constancy ≥80%	Deschampsia flexuosa	3.0
	Molinia caerulea	8.2
Constancy ≥60%	Calluna vulgaris	1.3
	Potentilla erecta	1.3
	Trichophorum caespitosum	2.6
	Vaccinium myrtillus	2.1
Constancy ≥40%	Erica tetralix	0.9
	Eriophorum angustifolium	1.1
	E. vaginatum	1.8

Preferential species:

Molinia caerulea, Trichophorum caespitosum, Vaccinium oxycoccus.

Group 11 TRICHOPHORETO-CALLUNETUM (McVean and Ratcliffe, 1962)
An association containing Trichophorum caespitosum and usually Molinia caerulea, either of which may be dominant. Calluna vulgaris, Erica tetralix and Eriophorum vaginatum are also often present and can have appreciable cover. The stands included here differ somewhat from McVean and Ratcliffe's samples in their comparative lack of Myrica gale. Myrica gale is however a preferential species for this group even though its overall frequency is low. Also similar to this association is Birse and Robertson's (1976) Erico-Sphagnetum magellanici, but again the match is closest for their variant that lacks Myrica gale.

Frequency: 26 stands, 26 from 871 = 3.0%

Distribution: Well represented in South-west England and in the Southern Uplands, but with no examples recorded from South Wales or the Southern Pennines.

Altitude:	In the range 90 m to 610 m	Average = 355 m
Slope:	Usually gentle, sometimes moderate	Average = 5.6°
Grazing:	Usually undetectable to light	Average = 1.3
Drainage:	Usually waterlogged or poor	Average = 2.0

Soils: Usually deep peat, but with some examples on shallow peat.

Principal species:

		Mean Domin
Constancy ≥80%	Calluna vulgaris	3.1
	Erica tetralix	2.6
	Eriophorum angustifolium	2.8
	Trichophorum caespitosum	5.5
Constancy ≥60%	Eriophorum vaginatum	2.6
	Molinia caerulea	4.0
	Narthecium ossifragum	1.6
	Potentilla erecta	1.3
Constancy ≥40%	Juncus squarrosus	1.3

Preferential species:

Carex echinata, Drosera rotundifolia, Erica tetralix, Eriophorum angustifolium, E. vaginatum, Juncus bulbosus, Narthecium ossifragum, Myrica gale, Polygala serpyllifolia, Trichophorum caespitosum.

Group 12 MOLINIETO-CALLUNETUM (McVean and Ratcliffe, 1962)
A group with both Molinia caerulea and Calluna vulgaris usually present in quantity. Either of these species may be dominant. Erica tetralix and Potentilla erecta are usually present. The group closely matches McVean and Ratcliffe's association: their four vascular constants being also the four most frequent species in the group.

Frequency: 59 stands, 59 from 871 = 6.8%

Distribution: Predominantly a South-west England and Southern Uplands group, but with examples also from North and South Wales, and from the Northern Pennines.

Altitude: In the range 90 m to 595 m Average = 330 m

Slope: In the range gentle to moderate Average = 8.2°

Grazing: Often undetectable or light; less often moderate or moderately heavy Average = 1.7

Drainage: Usually in the range poor to good Average = 2.8

Soils: Usually on shallow peat, with occasional examples on deep peat and on mineral soil.

Principal species:

		Mean Domin
Constancy ≥80%	Calluna vulgaris	5.4
	Molinia caerulea	5.5
Constancy ≥60%	Erica tetralix	2.2
	Potentilla erecta	1.6
	Trichophorum caespitosum	2.3
Constancy ≥40%	Carex panicea	0.9
	Juncus squarrosus	1.4
	Nardus stricta	1.6
	Vaccinium myrtillus	1.4

Preferential species:

Agrostis setacea, Carex demissa, C. echinata, C. panicea, C. pulicaris, Drosera rotundifolia, Erica tetralix, Juncus bulbosus, Molinia caerulea, Myrica gale, Narthecium ossifragum, Pedicularis sylvatica, Polygala serpyllifolia, Succisa pratensis, Trichophorum caespitosum.

Group 13 CALLUNETO-ERIOPHORETUM (McVean and Ratcliffe, 1962) sub-association TYPICUM
A sub-association containing Calluna vulgaris and Eriophorum vaginatum, either of which can be dominant. E. angustifolium and Empetrum nigrum are usually present.

Frequency: 60 stands, 58 from 871 = 6.7%

Distribution: No examples from South-west England, and only one from South Wales, otherwise widespread.

Altitude:	In the range 200 m to 740 m	Average = 472 m
Slope:	Usually gentle to moderate	Average = 6.6°
Grazing:	Usually undetectable to light	Average = 1.5
Drainage:	Usually imperfect to poor	Average = 2.4

Soils: Usually deep peat; some examples on shallow peat and mineral soil.

Principal species:		Mean Domin
Constancy ≥80%	Calluna vulgaris	5.7
	Empetrum nigrum	2.3
	Eriophorum angustifolium	1.9
	E. vaginatum	5.4
Constancy ≥60%	Deschampsia flexuosa	1.7
	Erica tetralix	1.5
	Vaccinium myrtillus	2.0
Constancy ≥40%	Juncus squarrosus	1.2
	Trichophorum caespitosum	1.3

Preferential species:

Empetrum nigrum, Erica tetralix, Eriophorum angustifolium, E. vaginatum, Rubus chamaemorus, Vaccinium vitis-idaea.

Group 14 — CALLUNETO-ERIOPHORETUM (McVean and Ratcliffe, 1962), sub-association DESCHAMPSIOSUM (sub-assoc. nov.)
A sub-association dominated by either Deschampsia flexuosa or Eriophorum vaginatum, and usually containing Vaccinium myrtillus and Eriophorum angustifolium. Calluna vulgaris occurs only rarely.

Frequency: 15 stands, 14 from 871 = 1.6%

Distribution: The Pennines. One example from North Wales.

Altitude: In the range 230 m to 790 m — Average = 312 m

Slope: Gentle to moderate, occasionally steep — Average = 10.2°

Grazing: Undetectable to moderate — Average = 2.6

Drainage: Imperfect or poor — Average = 2.7

Soils: Usually deep peat, rarely on shallow peat or mineral soils

Principal species:

		Mean Domin
Constancy ⩾80%	Deschampsia flexuosa	6.6
	Eriophorum vaginatum	5.3
	Vaccinium myrtillus	3.5
Constancy ⩾60%	Eriophorum angustifolium	1.6
Constancy ⩾40%	Empetrum nigrum	0.8
	Juncus squarrosus	1.1

Preferential species:

Eriophorum angustifolium, E. vaginatum.

Group 15 CALLUNETO-ERIOPHORETUM (McVean and Ratcliffe, 1962), sub-association MYRTILLOSUM (sub-assoc. nov.)
A sub-association usually dominated by Eriophorum vaginatum, but with Vaccinium myrtillus often contributing appreciable cover. Calluna vulgaris is not always prominent and may be absent. Eriophorum angustifolium is usually present. The group is similar to Birse and Robertson's (1976) Vaccinio-Ericetum tetralicis associations but with Erica tetralix occurring much less frequently than in their samples.

Frequency: 15 stands, 15 from 871 = 1.7%

Distribution: Examples from North Wales, the Southern Pennines and the Southern Uplands

Altitude:	In the range 350 m to 690 m	Average = 460 m
Slope:	Gentle to moderate	Average = 8.3°
Grazing:	Undetectable to light	Average = 1.4
Drainage:	Imperfect or poor	Average = 2.6

Soils: Usually deep peat, occasionally shallow peat

Principal species:

		Mean Domin
Constancy ≥80%	Deschampsia flexuosa	2.5
	Empetrum nigrum	2.3
	Eriophorum angustifolium	1.9
	E. vaginatum	7.8
	Vaccinium myrtillus	4.8
Constancy ≥60%	Calluna vulgaris	1.5
Constancy ≥40%	None	

Preferential species:

Empetrum nigrum, Eriophorum angustifolium, E. vaginatum.

Group 16

NARDO-JUNCETUM SQUARROSI (Birks, 1973)
A rather variable association, usually dominated by either Nardus stricta or Juncus squarrosus, but also in some instances by Festuca ovina, Galium saxatile, Vaccinium myrtillus or Empetrum nigrum. Deschampsia flexuosa can also have appreciable cover. The group is similar to Birse and Robertson's (1976) Junco squarrosi-Festucetum tenuifoliae association, but lacks the Molinia caerulea element that comprises their Molinia sub-association.

Frequency: 171 stands, 162 from 871 = 18.6%

Distribution: Common everywhere except in South-west England, where only one example was recorded.

Altitude: In the range 90 m to 670 m — Average = 435 m

Slope: With a definite preference for moderate and steep slopes — Average = 7.5°

Grazing: Often moderate to heavy — Average = 3.1

Drainage: Usually imperfect to heavy — Average = 3.1

Soils: Usually mineral or shallow peat, rarely on deep peat

Principal species:

		Mean Domin
Constancy ⩾80%	Deschampsia flexuosa	2.4
	Festuca ovina	2.9
	Galium saxatile	2.2
	Juncus squarrosus	3.1
	Nardus stricta	5.6
Constancy ⩾60%	Vaccinium myrtillus	1.7
Constancy ⩾40%	Agrostis tenuis	1.6
	Anthoxanthum odoratum	1.2
	Potentilla erecta	1.3

Preferential species:

None.

Group 17 AGROSTO-FESTUCETUM (McVean and Ratcliffe, 1962)
A Festuca ovina, Agrostis tenuis grassland usually with Galium saxatile. Equivalent to McVean and Ratcliffe's species-poor Agrosto-Festucetum.

Frequency: 46 stands, 42 from 871 = 4.8%

Distribution: Not recorded from the Southern Pennines, otherwise widespread

Altitude: In the range 90 m to 1050 m Average = 432 m

Slope: Over a wide range but with a preference for moderate to steep slopes Average = 21.3°

Grazing: Usually moderate to heavy Average = 3.2

Drainage: Usually imperfect to good Average = 3.6

Soils: Usually mineral, but occasionally on shallow peat

Principal species:

		Mean Domin
Constancy ≥80%	Agrostis tenuis	4.8
	Festuca ovina	6.5
	Galium saxatile	3.1
Constancy ≥60%	Anthoxanthum odoratum	1.8
	Luzula campestris/ multiflora	1.4
	Nardus stricta	1.6
Constancy ≥40%	Potentilla erecta	1.5
	Sieglingia decumbens	1.3
	Vaccinium myrtillus	1.1

Preferential species:

Achillea millefolium, Campanula rotundifolia, Cirsium vulgare, Digitalis purpurea, Polygala serpyllifolia, Rumex acetosa, R. acetosella, Sedum anglicum, Thymus drucei, Trifolium repens.

Group 18 TRIFOLIO-AGROSTO-FESTUCETUM (assoc. nov.)
A Festuca ovina-Agrostis tenuis grassland, usually with Trifolium repens, Anthoxanthum odoratum and Potentilla erecta, together with a selection from a wide range of moderately basicolous species. The association is equivalent to McVean and Ratcliffe's (1972) species-rich Agrosto-Festucetum, and is allied to Group 6 (Thymo-Agrosto Festucetum typicum).

Frequency: 49 stands, 36 from 871 = 4.1%

Distribution: Not recorded from the Southern Pennines or the Lake District, and with only one example from South Wales, otherwise generally distributed.

Altitude: In the range 105 to 760 m — Average = 328 m

Slope: Usually gentle to moderate but occasionally steep — Average = 13°

Grazing: Often moderate or heavy — Average = 2.7

Drainage: Usually imperfect to good — Average = 3.4

Soils: Almost always on mineral soils

Principal species:		Mean Domin
Constancy ≥80%	Agrostis tenuis	4.0
	Anthoxanthum odoratum	3.1
	Festuca ovina	3.7
	Potentilla erecta	2.0
	Trifolium repens	2.1
Constancy ≥60%	Cerastium holosteoides	1.4
	Deschampsia caespitosa	1.8
	Galium saxatile	1.6
	Holcus lanatus	1.5
	Luzula campestris/ multiflora	1.4
	Nardus stricta	2.0
Constancy ≥40%	Cynosurus cristatus	1.1
	Deschampsia flexuosa	1.1
	Juncus effusus	1.0
	Ranunculus acris	0.9
	R. repens	1.0
	Rumex acetosa	1.1

Group 18 (continued)

Preferential species:

Achillea millefolium, A. ptarmica, Alchemilla vulgaris, Bellis perennis, Briza media, Campanula rotundifolia, Cardamine pratensis, Carex caryophyllea, C. flacca, C. ovalis, C. pulicaris, Cerastium holosteoides, Cirsium arvense, C. vulgare, Crataegus monogyna, Cynosurus cristatus, Deschampsia caespitosa, Digitalis purpurea, Epilobium palustre, Euphrasia officinalis agg., Filipendula ulmaria, Galium palustre, Holcus lanatus, H. mollis, Hieracium pilosella, Juncus acutiflorus, J. conglomeratus, Lolium perenne, Lotus corniculatus, Oxalis acetosella, Plantago lanceolata, Poa annua, P. pratensis, Prunella vulgaris, Ranunculus acris, R. repens, R. flammula, Rumex acetosa, R. acetosella, Succisa pratensis, Thymus drucei, Trifolium repens, Veronica chamaedrys, V. officinalis, Viola riviniana.

Group 19 FESTUCO-MOLINIETUM (assoc. nov.)
A Molinia caerulea dominated association usually with Festuca ovina, Deschampsia flexuosa, Juncus squarrosus and Vaccinium myrtillus, all of which may occasionally replace Molinia as the dominant species.

Frequency: 88 stands, 85 from 871 = 9.8%

Distribution: No examples from the Lake District and only one from the Southern Pennines, but otherwise well represented in all the regions.

Altitude: In the range 120 m to 565 m Average = 365 m

Slope: Usually gentle to moderate slopes Average = 9.4°

Grazing: No clear relationship Average = 2.0

Drainage: Usually imperfect to poor Average = 2.8

Soils: Usually shallow peat, occasionally deep peat

Principal species:		Mean Domin
Constancy ≥80%	Deschampsia flexuosa	2.7
	Festuca ovina	2.8
	Molinia caerulea	6.9
Constancy ≥60%	Galium saxatile	1.5
	Juncus squarrosus	2.6
	Nardus stricta	2.0
	Potentilla erecta	1.6
	Vaccinium myrtillus	2.6
Constancy ≥40%	Anthoxanthum odoratum	1.0
	Calluna vulgaris	1.6
	Trichophorum caespitosum	1.3

Preferential species:

Molinia caerulea

Group 20 FESTUCO-MOLINIETUM (assoc. nov.)
sub-association ANTHOXANTHOSUM
An association dominated by Molinia caerulea. The sub-association contains a Juncus element which may be represented by J. effusus (most commonly), J. articulatus or J. acutiflorus, Anthoxanthum odoratum, Holcus lanatus, Festuca ovina and Potentilla erecta are usually present. A range of basicolous herbs and grasses is also well represented.

Frequency: 27 stands, 23 from 871 = 2.6%

Distribution: Predominantly Scottish with examples from the Southern Uplands and the North-west Highlands (Strath Suardal and Durness). Other examples come from South Wales, North Wales (one only), and the Lake District.

Altitude:	In the range 20 m to 470 m	Average = 267 m
Slope:	Usually gentle to moderate, rarely steep	Average = 8.7°
Grazing:	In the range undetectable to moderate	Average = 2.0
Drainage:	Usually imperfect or poor	Average = 2.5
Soils:	Shallow peat or mineral soils	

Principal species:		Mean Domin
Constancy ≥80%	Anthoxanthum odoratum	2.4
	Molinia caerulea	5.3
Constancy ≥60%	Festuca ovina/rubra	1.8
	Holcus lanatus	1.6
	Nardus stricta	1.8
	Potentilla erecta	1.6
Constancy ≥40%	Agrostis tenuis	1.4
	Carex echinata	0.8
	C. nigra	1.6
	C. panicea	1.5
	Cynosurus cristatus	0.9
	Deschampsia caespitosa	1.0
	Galium saxatile	1.1
	Juncus effusus	1.4
	Luzula campestris/ multiflora	1.2
	Ranunculus acris	1.2
	Trifolium repens	1.2

Group 20 (continued)

Preferential species:

Anthoxanthum odoratum, Briza media, Cardamine pratensis, Carex echinata, C. nigra, C. ovalis, C. panicea, C. pulicaris, Cerastium holosteoides, Cirsium palustre, Cynosurus cristatus, Deschampsia caespitosa, Epilobium palustre, Euphrasia officinalis agg., Filipendula ulmaria, Galium palustre, Holcus lanatus, Lotus uliginosus, Molinia caerulea, Plantago lanceolata, Poa annua, Prunella vulgaris, Succisa pratensis, Ranunculus acris, R. flammula, R. repens, Juncus acutiflorus, J. conglomeratus, J. effusus, Trifolium repens.

Group 21 PTERIDIETUM AQUILINAE (assoc. nov.)
A Pteridium aquilinum dominated association. Anthoxanthum odoratum, Festuca ovina and Galium saxatile are usually present, and in various proportions can contribute appreciable cover.

Frequency: 19 stands, 17 from 871 = 2%

Distribution: Examples have been recorded from South-west England, South Wales, North Wales, the Northern Pennines and the Lake District.

Altitude:	In the range 190 m to 485 m	Average = 321 m
Slope:	No apparent preference	Average = 12°
Grazing:	No apparent relationship	Average = 1.9
Drainage:	Usually good to very good	Average = 4.0
Soils:	Usually mineral, occasionally on shallow peat	

Principal species:

		Mean Domin
Constancy ≥80%	Anthoxanthum odoratum	2.9
	Festuca ovina	4.1
	Galium saxatile	3.1
	Pteridium aquilinum	8.7
Constancy ≥60%	Agrostis tenuis	3.4
	Potentilla erecta	1.6
Constancy ≥40%	Vaccinium myrtillus	0.8

Preferential species:

Anthoxanthum odoratum, Pteridium aquilinum, Rumex acetosa

Group 22 CALLUNETUM VULGARIS (McVean and Ratcliffe, 1962), sub-association TYPICUM
An association dominated by Calluna vulgaris and often containing Vaccinium myrtillus. Empetrum nigrum and Juncus squarrosus are both more frequent than in McVean and Ratcliffe's association.

Frequency: 60 stands, 56 from 871 = 6.4%

Distribution: Particularly common in the Northern Pennines and the Southern Uplands, but with examples from all the regions.

Altitude: In the range 180 m to 485 m — Average = 382 m

Slope: No apparent preference — Average = 11.2°

Grazing: Often undetectable, but can be moderate — Average = 1.8

Drainage: Usually imperfect to good — Average = 3.4

Soils: No apparent preference for peat or mineral soils, but rarely on deep peat

Principal species:

		Mean Domin
Constancy ≥80%	Calluna vulgaris	8.2
	Vaccinium myrtillus	2.0
Constancy ≥60%	Deschampsia flexuosa	1.2
	Juncus squarrosus	1.2
Constancy ≥40%	Agrostis tenuis	0.7
	Empetrum nigrum	0.7
	Festuca ovina	1.1
	Galium saxatile	0.9
	Nardus stricta	1.4
	Potentilla erecta	0.9

Preferential species:

Blechnum spicant, Dryopteris dilatata, Erica cinerea.

Group 23 — CALLUNETUM VULGARIS (McVean and Ratcliffe, 1962), sub-association CINEREAE (sub-assoc. nov.)
A sub-association usually dominated by Calluna vulgaris, but often with appreciable cover contributed by Erica cinerea. Equivalent to McVean and Ratcliffe's (1962) Callunetum vulgaris, but lacking their Arctostaphylos uva-ursi component (a feature of the Scottish Highlands). Ulex gallii heaths are also included in this group.

Frequency: 19 stands, 17 from 871 = 2.0%

Distribution: No examples from the Pennines or the Lake District, and as the size of the group indicates, not common elsewhere.

Altitude:	In the range 150 m to 610 m	Average = 321 m
Slope:	No apparent preference	Average = 14°
Grazing:	Often undetectable, but occasionally up to moderate	Average = 1.6
Drainage:	In the range imperfect to very good	Average = 4.0

Soils: No clear preference for shallow peat or mineral soils, but not on deep peat

Principal species:

		Mean Domin
Constancy ≥80%	Calluna vulgaris	6.8
	Erica cinerea	4.2
	Festuca ovina	2.5
Constancy ≥60%	Potentilla erecta	1.9
	Sieglingia decumbens	1.5
Constancy ≥40%	Agrostis tenuis	0.9
	Carex binervis	0.9
	Nardus stricta	0.9
	Ulex gallii	1.9
	Vaccinium myrtillus	1.6

Preferential species:

Agrostis setacea, Carex binervis, C. pilulifera, Erica cinerea, Sieglingia decumbens, Ulex gallii.

Group 24 FESTUCETO-VACCINETUM (McVean and Ratcliffe, 1962), sub-association PTERIDOSUM (sub-assoc. nov.)
A sub-association containing and usually dominated by Vaccinium myrtillus, but sometimes with Pteridium aquilinum as the dominant. Galium saxatile and Festuca ovina are usually present. The group differs from McVean and Ratcliffe's Festuco-Vaccinetum in its lack of three of their vascular constants: Vaccinium vitis-idaea, Carex bigelowii and Alchemilla alpina, and in its inclusion of Pteridium aquilinum. It could be interpreted as a low altitude variant of their association.

Frequency: 22 stands, 20 from 871 = 2.3%

Distribution: All regions, though rare in the Lake District

Altitude: In the range 170 m to 815 m — Average = 390 m

Slope: Usually moderate to steep — Average = 20°

Grazing: In the range undetectable to moderately heavy — Average = 2.3

Drainage: In the range imperfect to very good — Average = 3.9

Soils: Mineral or shallow peat

Principal species:		Mean Domin
Constancy ≥80%	Festuca ovina	4.1
	Galium saxatile	2.7
	Vaccinium myrtillus	5.7
Constancy ≥60%	Agrostis tenuis	1.3
	Deschampsia flexuosa	2.7
Constancy ≥40%	Nardus stricta	1.1
	Potentilla erecta	1.0
	Pteridium aquilinum	3.7

Preferential species:

Carex pilulifera, Pteridium aquilinum, Rumex acetosella, Ulex gallii.

Group 25 FESTUCETO-VACCINETUM (McVean and Ratcliffe, 1962) NARDOSUM (sub-assoc. nov.)
A sub-association with Festuca ovina, Vaccinium myrtillus, and Galium saxatile; and usually containing Nardus stricta. Any of these species can be dominant. The group differs from the McVean and Ratcliffe association in its greater frequency of Nardus stricta, and in its comparative lack of montane species such as Carex bigelowii and Vaccinium vitis-idaea.

Frequency: 71 stands, 68 from 871 = 7.8%

Distribution: General, but particularly common in Wales. Apparently rare in the Southern Pennines.

Altitude: In the range 205 m to 870 m — Average = 463 m

Slope: Mostly on moderate and steep slopes — Average = 15.3°

Grazing: Usually in the range light to moderately heavy — Average = 3.2

Drainage: Imperfect or good — Average = 3.5

Soils: Mineral soils or shallow peat

Principal species:

		Mean Domin
Constancy ≥80%	Festuca ovina	6.4
	Galium saxatile	3.9
	Nardus stricta	3.9
	Vaccinium myrtillus	4.5
Constancy ≥60%	Agrostis tenuis	2.6
	Deschampsia flexuosa	2.0
	Juncus squarrosus	1.7
	Potentilla erecta	1.6
Constancy ≥40%	Luzula campestris/ multiflora	1.1

Preferential species:

Carex bigelowii, Hieracium pilosella, Lycopodium alpinum, L. selago, Sedum anglicum.

Group 26 — VACCINETO-CALLUNETUM (McVean and Ratcliffe, 1962), sub-association TYPICUM (sub-assoc. nov.)
An association containing Vaccinium myrtillus and Calluna vulgaris, either of which may be dominant. Juncus squarrosus, Empetrum nigrum and Agrostis setacea (in South-west England) occur less often, but again can sometimes become dominant. The sub-association differs from McVean and Ratcliffe's hepaticosum in its greater abundance and frequency of Nardus stricta and Festuca ovina, and in its relative lack of oceanic liverworts.

Frequency: 127 stands, 121 from 871 = 13.9%

Distribution: All regions

Altitude: In the range 76 m to 745 m — Average = 415 m

Slope: No apparent preference — Average = 15°

Grazing: Usually not more than moderate — Average = 1.8

Drainage: Imperfect to very good — Average = 4.3

Soils: Usually on soils with some peat content, though sometimes on pure mineral soils, and occasionally on deep peat.

Principal species:		Mean Domin
Constancy ≥80%	Calluna vulgaris	6.4
	Vaccinium myrtillus	5.7
Constancy ≥60%	Deschampsia flexuosa	2.0
	Festuca ovina	2.3
Constancy ≥40%	Galium saxatile	1.0
	Nardus stricta	1.4
	Potentilla erecta	1.1

Preferential species:

None.

Table 3. TABLE OF DOMINANCE

Dominant species	Possible groups																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Agrostis setacea																										+
A. tenuis						+	+	+									+	+								
Anthoxanthum odoratum								+										+		+						
Calluna vulgaris										+	+	+	+													
Carex panicea					+				+													+	+			+
Deschampsia flexuosa										+				+		+			+							
Dryas octopetala					+																					+
Empetrum nigrum													+			+										
Erica cinerea																							+			+
E. tetralix											+															
Eriophorum angustifolium									+		+															
E. vaginatum											+		+	+	+											
Festuca ovina	+	+	+	+	+	+	+									+	+	+	+	+	+				+	+
Galium saxatile																+	+				+				+	
Geranium robertianum	+	+																							+	
Holcus lanatus																				+						
Juncus acutiflorus																				+						
J. articulatus																				+						
J. conglomeratus								+																		
J. effusus								+																		
J. squarrosus																+			+							
Molinia caerulea					+				+	+	+	+							+	+						+
Nardus stricta																+				+					+	+
Potentilla erecta																				+						
Pteridium aquilinum																					+			+		
Sesleria albicans		+		+																						
Thymus drucei						+																				
Trichophorum caespitosum										+	+	+														
Trifolium repens						+																				
Vaccinium myrtillus											+		+		+	+			+					+	+	+
Sphagnum spp.									+																	

Table 4. DISTRIBUTION OF PREFERENTIAL SPECIES AMONG THE LIMESTONE GROUPS (1-7)

	1	2	3	4	5	6	7
Acer pseudoplatanus	+						
Agrostis canina					+		
A. stolonifera			+				
Aira caryophyllea			+				
Alchemilla alpina					+		
A. vulgaris					+		
Allium ursinum		+			+		
Anemone nemorosa		+			+		
Angelica sylvestris					+		
Antennaria dioica					+		
Anthyllis vulneraria			+				
Arabis hirsuta		+					
Arctostaphylos uva-ursi					+		
Arenaria serpyllifolia			+				
Asperula cynanchica				+			
Asplenium ruta-muraria		+					
A. trichomanes		+					
A. viride		+				+	
Athyrium filix-femina		+				+	
Betonica officinalis			+				
Betula spp.					+		
Blechnum spicant					+		
Calluna vulgaris					+		
Cardamine hirsuta		+					
C. pratensis						+	
Carduus nutans			+				
Carex binervis					+		
C. capillaris					+		
C. lepidocarpa					+		
C. panicea					+		
C. pulicaris					+		
Carlina vulgaris			+				
Centaurea scabiosa	+		+				
Chamaenerion angustifolium		+					
Cirsium arvense							+
C. heterophyllum					+		
C. palustre							+
Coeloglossum viride					+		+
Conopodium majus							+
Cynosurus cristatus							+
Cystopteris fragilis		+					
Dactylorchis maculata					+		
Deschampsia caespitosa						+	
D. flexuosa						+	
Draba incana				+			
Dryas octopetala					+		
Dryopteris filix-mas		+					
D. villarii		+					
Empetrum nigrum					+		
Epilobium montanum		+					
Epipactis atrorubens	+				+		
Erica cinerea					+		
Filipendula ulmaria					+		
F. vulgaris			+				
Fraxinus excelsior	+						
Galium boreale					+		
G. cruciata							+
G. saxatile						+	
Gentianella amarella					+		+
Geranium sanguineum	+						
G. robertianum		+					
Geum rivale					+		
Hedera helix	+						

	1	2	3	4	5	6	7
Helianthemum canum			+				
H. chamaecistus			+				
Holcus lanatus							+
Hypericum hirsutum			+				
H. montanum			+				
H. pulchrum					+		
Hyptochoeris radicata							+
Juncus articulatus							+
Lathyrus montanus					+		
Leontodon hispidus			+				
L. autumnalis					+		+
Lolium perenne							+
Luzula campestris/multiflora						+	
Medicago lupulina			+				
Mercurialis perennis		+					
Minuartia verna						+	
Molinia caerulea					+		
Mycelis muralis		+					
Nardus stricta						+	
Orchis mascula			+				
Origanum vulgare	+						
Oxalis acetosella		+					
Phleum pratense							+
Phyllitis scolopendrium		+					
Pinguicula vulgaris					+		
Plantago maritima					+		
P. media							+
Polygala serpyllifolia						+	
P. vulgaris					+		
Polygonium viviparum					+		
Polypodium vulgare		+					
Polystichum aculeatum		+			+		
Poterium sanguisorba			+				
Primula acaulis			+				
P. farinosa				+			
P. vulgaris					+		
Prunus spinosa	+						
Pteridium aquilinum					+		
Ranunculus acris							+
Rubus idaeus	+	+					
Rumex acetosa							+
Sanicula europaea					+		
Saxifraga tridactylites		+			+		
Selaginella selaginoides					+		
Solidago virgaurea					+		
Sorbus aucuparia					+		
Succisa pratensis					+		
Taxus baccata	+						
Teucrium scorodonia	+						
Thelypteris robertiana		+					
Trifolium dubium							+
T. pratense							+
Trisetum flavescens							+
Trollius europaeus					+		
Urtica dioica		+					
Ulex europaeus							+
Vaccinium myrtillus						+	
Valeriana officinalis	+						
Veronica chamaedrys							+
V. officinalis						+	
Vicia sepium							+
Viola lutea						+	

Table 5. DISTRIBUTION OF PREFERENTIAL SPECIES AMONG THE ACIDIC GROUPS (8-26)

	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Achillea millifolium										+	+								
A. ptarmica											+								
Agrostis canina		+																	
A. setacea					+											+			
Alchemilla vulgaris											+								
Anthoxanthum odoratum													+	+					
Bellis perennis											+								
Blechnum spicant															+				
Briza media											+		+						
Campanula rotundifolia										+	+								
Cardamine pratense	+										+		+						
Carex binervis																+			
Carex bigelowii																		+	
C. caryophyllea											+								
C. demissa		+			+														
C. echinata	+	+		+	+								+						
C. flacca											+								
C. nigra	+	+											+						
C. ovalis	+										+		+						
C. panicea		+			+								+						
C. pilulifera																+	+		
C. pulicaris					+						+		+						
Cerastium holosteoides	+										+		+						
Cirsium arvense											+								
C. palustre	+												+						
C. vulgare										+	+								
Crataegus monogyna											+								
Cynosurus cristatus											+		+						
Deschampsia caespitosa	+										+		+						
Digitalis purpurea										+	+								
Drosera rotundifolia		+		+	+														
Dryopteris dilitata															+				
Empetrum nigrum						+		+											
Epilobium palustre	+										+		+						
Erica cinerea															+	+			
E. tetralix		+		+	+	+													
Eriophorum angustifolium		+		+		+	+	+											
E. vaginatum				+		+	+	+											
Euphrasia officinalis agg.											+		+						
Filipendula ulmaria											+		+						
Galium palustre	+										+		+						
Hieracium pilosella											+							+	

Table 5. (Contd.) DISTRIBUTION OF PREFERENTIAL SPECIES AMONG THE ACIDIC GROUPS (8-26)

	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Holcus lanatus	+										+		+						
H. mollis	+										+								
Juncus acutiflorus	+	+									+		+						
J. bulbosus		+		+	+														
J. conglomeratus	+										+		+						
J. effusus	+												+						
Lolium perenne											+								
Lotus corniculatus											+								
L. uliginosus													+						
Lycopodium alpinum																		+	
L. selago																		+	
Molinia caerulea			+		+							+	+						
Myrica gale				+	+														
Narthecium ossifragum		+		+	+														
Oxalis acetosella											+								
Pedicularis sylvatica					+														
Plantago lanceolata											+		+						
Poa annua											+		+						
P. pratensis	+										+								
Polygala serpyllifolia		+		+	+					+									
Prunella vulgaris											+		+						
Pteridium aquilinum														+			+		
Ranunculus acris	+										+		+						
R. flammula											+		+						
R. repens	+										+		+						
Rubus chamaemorus						+													
Rumex acetosa	+									+	+			+					
R. acetosella										+	+						+		
Sedum anglicum										+								+	
Sieglingia decumbens																+			
Succisa pratensis					+						+		+						
Thymus drucei										+	+								
Trichophorum caespitosum			+	+	+														
Trifolium repens	+									+	+		+						
Ulex gallii																+	+		
Vaccinium oxycoccus			+																
V. vitis-idaea						+													
Veronica chamaedrys											+								
V. officinalis											+								
Viola palustris	+																		
V. riviniana											+								

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APPENDIX

NUMBERS OF OCCURRENCES OF ALL RECORDED SPECIES

IN: Col. A - The 871 stand objective sample

Col. B - The 631 stand objective sample

SPECIES:	OCCURRENCES		SPECIES:	OCCURRENCES:	
	A	B		A	B
Acer pseudoplatanus	0	23	Blechnum spicant	25	21
Achillea millefolium	41	172	Botrychium lunaria	1	9
Achillea ptarmica	11	5	Brachypodium pinnatum	0	4
Actaea spicata	0	3	Brachypodium sylvaticum	0	107
Agrimonia eupatoria	0	2			
Agropyron caninum	0	6	Briza media	17	267
Agropyron repens	0	1	Bromus erectus	0	8
Agrostis canina	357	147	Bromus lepidus	2	1
Agrostis gigantea	0	2	Bromus mollis agg.	0	6
Agrostis setacea	29	0	Bromus ramosus	0	2
Agrostis stolonifera	11	16	Bromus sterilis	0	2
Agrostis tenuis	411	303			
Aira caryophyllea	0	12	Calluna vulgaris	452	145
Aira praecox	6	5	Caltha palustris	1	6
Ajuga reptans	0	3	Campanula latifolia	0	1
Alchemilla alpina	0	14	Campanula rotundifolia	44	353
Alchemilla vulgaris agg.	5	73	Cardamine spp.	2	10
			Cardamine hirsuta	3	12
Allium oleraceum	0	1	Cardamine impatiens	0	1
Allium ursinum	3	17	Cardamine pratensis	23	16
Alopecurus pratensis	2	1	Carduus acanthoides	0	2
Ammophilia arenaria	0	3	Carduus nutans	0	19
Anagallis arvensis	1	0	Carex bigelowii	13	1
Anagallis tenella	3	0	Carex binervis	132	23
Andromeda polifolia	4	0	Carex capillaris	0	13
Anemone nemorosa	5	44	Carex caryophyllea	37	192
Angelica sylvestris	3	23	Carex curta	2	0
Antennaria dioica	1	27	Carex demissa	26	5
Anthoxanthum odoratum	334	274	Carex dioica	5	4
Anthriscus sylvestris	1	7	Carex echinata	81	7
Anthyllis vulneraria	0	24	Carex flacca	16	345
Aphanes arvensis agg.	0	5	Carex hostiana	5	7
Aphanes microcarpa	0	1	Carex lasiocarpa	2	0
Aquilegia vulgaris	0	1	Carex lepidocarpa	0	44
Arabis hirsuta	2	51	Carex montana	0	3
Arctium agg.	0	1	Carex nigra	165	15
Arctostaphylos uva-ursi	0	16	Carex ovalis	17	1
			Carex pallescens	0	2
Arenaria serpyllifolia	0	24	Carex panicea	145	100
Arrhenatherum elatius	0	95	Carex pauciflora	0	1
Arum maculatum	0	2	Carex pilulifera	36	19
Asperula cynanchica	0	16	Carex pulicaris	23	101
Asplenium adiantum-nigrum	1	3	Carex rostrata	8	5
			Carex rupestris	0	4
Asplenium ruta-muraria	5	153	Carex sylvatica	0	2
Asplenium trichomanes	5	125	Carlina vulgaris	0	48
Asplenium viride	7	83	Catabrosa aquatica	0	1
Aster linosyris	0	1	Catapodium rigidum	0	7
Athyrium filix-femina	1	11	Centaurea nigra	2	75
			Centaurea scabiosa	0	12
Bellis perennis	10	132	Centaurium erythraea	0	4
Betonica officinalis	0	14	Centranthus ruber	0	1
Betula spp.	4	23	Cerastium arcticum	2	0
Blackstonia perfoliata	0	3	Cerastium arvense	2	0

SPECIES:	OCCURRENCES:		SPECIES:	OCCURRENCES	
	A	B		A	B
Cerastium holosteoides	58	233	Epilobium montanum	0	52
Chamaenerion angustifolium	2	34	Epilobium palustre	18	2
			Epipactis atrorubens	0	21
Chrysanthemum leucanthemum	0	12	Epipactis helleborine	0	5
			Equisetum arvense	4	0
Chrysoplenium oppositifolium	3	3	Equisetum palustre	5	4
			Erica cinerea	78	54
Circaea lutetiana	0	3	Erica tetralix	211	6
Cirsium spp.	1	33	Eriophorum angustifolium	221	6
Cirsium acaulon	0	8			
Cirsium arvense	20	69	Eriophorum latifolium	0	1
Cirsium heterophyllum	0	15	Eriophorum vaginatum	212	3
Cirsium palustre	42	52	Erophila verna	0	1
Cirsium vulgare	19	171	Euonymus europaeus	0	2
Clematis vitalba	0	2	Eupatorium cannabinum	0	2
Cochlearia alpina	0	2	Euphrasia spp.	50	304
Cochlearia officinalis	2	0			
			Festuca arundinacea	0	4
Coeloglossum viride	0	10	Festuca ovina agg.	583	585
Conopodium majus	2	21	Festuca pratensis	3	8
Convallaria majalis	0	2	Festuca rubra agg.	7	0
Corylus avellana	1	60	Festuca vivipara	21	18
Cotoneaster integerrimus	0	1	Filipendula ulmaria	10	34
			Filipendula vulgaris	0	34
Cotoneaster microphylla	0	4	Fragaria vesca	6	95
			Fraxinus excelsior	3	118
Crataegus monogyna	12	177			
Crepis spp.	2	6	Galeobdolon luteum	0	1
Cryptogramma crispa	4	1	Galeopsis angustifolia	0	1
Cuscuta epithymum	2	0	Galeopsis tetrahit	0	3
Cynoglossum officinale	0	1	Galium aparine	6	6
Cynosurus cristatus	37	102	Galium boreale	0	17
Cystopteris fragilis	6	97	Galium cruciata	0	22
			Galium mollugo	0	3
Dactylis glomerata	4	144	Galium odoratum	0	1
Dactylorchis maculata	0	11	Galium palustre	13	3
Deschampsia caespitosa	94	134	Galium saxatile	489	125
Deschampsia flexuosa	531	51	Galium sterneri	10	176
Digitalis purpurea	12	5	Galium verum	7	170
Draba incana	0	10	Genista anglica	0	1
Drosera rotundifolia	37	1	Gentianella amarella agg.	0	22
Dryas octopetala	0	46			
Dryopteris borreri	2	0	Gentianella campestris	0	1
Dryopteris dilatata	10	4	Geranium columbinum	0	1
Dryopteris filix-mass agg.	6	10	Geranium dissectum	0	1
			Geranium lucidum	0	3
Dropteris spinulosa	0	1	Geranium molle	0	6
Dryopteris villarii	0	30	Geranium pratense	0	3
			Geranium robertianum	6	183
Echium vulgare	0	2	Geranium sanguineum	0	15
Eleocharis palustris	1	0	Geum rivale	0	14
Eleocharis quinqueflora	0	3	Glechoma hederacea	0	3
			Glyceria fluitans	1	0
Empetrum nigrum agg.	174	24	Gymnadenia conopsea	0	7
Endymion non-scriptus	1	9			

SPECIES:	OCCURRENCES: A	B	SPECIES:	OCCURRENCES: A	B
Hedera helix	0	56	Lonicera periclymenum	0	4
Helianthemum canum	0	16	Lotus corniculatus	23	331
Helianthemum chamaecistus	3	151	Lotus uliginosus	2	2
Helictotrichon pratense	11	152	Luzula campestris	290	188
Helictotrichon pubescens	3	74	Luzula multiflora	1	7
Heracleum sphondylium	1	66	Luzula pilosa	2	1
Hieracium spp.	5	129	Luzula sylvatica	23	4
Hieracium pilosella	18	178	Lychnis flos-cuculi	0	1
Hippocrepis comosa	0	5	Lycopodium alpinum	15	0
Holcus lanatus	88	133	Lycopodium clavatum	6	0
Holcus mollis	12	4	Lycopodium selago	23	1
Hornungia petraea	0	3	Lysimachia nemorum	0	6
Hydrocotyle vulgaris	2	0	Malva moschata	0	2
Hypericum androsaemum	0	4	Meconopsis cambrica	1	1
Hypericum hirsutum	0	13	Medicago lupulina	0	17
Hypericum humifusum	0	8	Melampyrum pratense	4	0
Hypericum montanum	0	10	Melica nutans	0	9
Hypericum perforatum	0	2	Mentha aquatica	2	0
Hypericum pulchrum	2	59	Menyanthes trifoliata	1	1
Hypochoeris radicata	0	18	Mercurialis perennis	3	96
Ilex aquifolium	1	18	Minuartia verna	4	17
Inula conyza	0	6	Molinia caerulea	335	68
Iris pseudacorus	0	1	Mycelis muralis	0	84
Jasione montana	1	0	Myosotis arvensis	0	11
Juncus acutiflorus	67	2	Myosotis discolor	0	1
Juncus articulatus	4	15	Myosotis secunda	4	0
Juncus biglumis	0	2	Myrica gale	12	0
Juncus bulbosus	0	27	Nardus stricta	510	555
Juncus conglomeratus	47	8	Narthecium ossifragum	66	4
Juncus effusus	217	9	Ononis repens	0	1
Juncus inflexus	2	1	Orchis mascula	0	10
Juncus kochii	2	0	Origanum vulgare	0	17
Juncus squarrosus	448	16	Orobanche hederae	0	1
Juncus tenuis	2	0	Oxalis acetosella	22	120
Juniperus communis	0	31	Oxyria digyna	2	1
Knautia arvensis	0	5	Parietaria diffusa	0	1
Koeleria cristata	11	242	Paris quadrifolia	0	1
Lapsana communis	1	1	Parnassia palustris	4	9
Lathyrus montanus	5	23	Pedicularis palustris	4	2
Lathyrus pratensis	0	19	Pedicularis sylvatica	17	0
Leontodon spp.	24	99	Phalaris arundinacea	0	1
Leontodon autumnalis	5	13	Phleum bertolonii	0	9
Leontodon hispidus	0	13	Phleum pratense	2	13
Ligustrum vulgare	0	7	Phyllitis scolopendrium	4	79
Linum catharticum	11	342	Picris hieracioides	0	1
Listera cordata	3	0	Pimpinella major	0	1
Listera ovata	1	22	Pimpinella saxifraga	1	76
Lolium multiflorum	0	1	Pinguicula vulgaris	3	39
Lolium perenne	11	29	Plantago lanceolata	36	267
			Plantago major	1	9
			Plantago maritima	1	60

SPECIES:	OCCURRENCES		SPECIES:	OCCURRENCES:	
	A	B		A	B
Plantago media	0	11	Sagina nodosa	1	9
Poa annua	30	14	Sagina procumbens	4	12
Poa compressa	0	2	Salix aurita	6	5
Poa nemoralis	0	1	Salix herbacea	3	1
Poa pratensis	34	106	Salix nigricans	1	1
Poa trivialis	0	4	Salix repens	2	7
Polygala serpyllifolia	60	26	Sambucus nigra	1	14
Polygala vulgaris	28	105	Sanguisorba officinalis	0	2
Polygonatum odoratum	0	4	Sanicula europaea	0	20
Polygonum viviparum	0	41	Saxifraga aizoides	0	35
Polypodium vulgare	6	14	Saxifraga granulata	0	5
Polystichum aculeatum	4	45	Saxifraga hypnoides	2	19
Polystichum lonchitis	0	8	Saxifraga oppositifolia	0	1
Potamogeton spp.	1	2	Saxifraga stellaris	3	1
Potentilla erecta	491	271	Saxifraga tridactylites	1	43
Potentilla reptans	0	5	Scabiosa columbaria	0	111
Potentilla sterilis	1	47	Schoenus nigricans	0	4
Potentilla tabernaemontani	0	1	Scilla verna	0	3
Poterium sanguisorba	1	146	Scrophularia nodosa	0	4
Primula farinosa	1	17	Sedum acre	2	50
Primula scotica	0	2	Sedum album	0	1
Primula veris	0	38	Sedum anglicum	10	10
Primula vulgaris	0	28	Sedum telephium	0	4
Prunella vulgaris	35	215	Sedum villosum	0	2
Prunus avium	0	1	Selaginella selaginoides	8	61
Prunus spinosa	0	32	Senecio jacobaea	0	117
Pteridium aquilinum	106	91	Serratula tinctoria	0	4
Pyrola media	0	1	Sesleria albicans	11	253
Quercus spp.	2	33	Sherardia arvensis	0	3
Quercus ilex	0	1	Sieglingia decumbens	174	241
Ranunculus acris	47	94	Silene dioica	0	6
Ranunculus aquatilis	0	1	Silene nutans	0	4
Ranunculus bulbosus	0	56	Solanum nigrum	0	2
Ranunculus flammula	13	6	Solidago virgaurea	1	25
Ranunculus repens	44	35	Sonchus arvensis	0	6
Rhamnus catharticus	0	1	Sonchus asper	0	1
Rhinanthus minor agg.	0	10	Sonchus oleraceus	0	3
Rhododendron spp.	1	0	Sorbus aria agg.	0	4
Rhynchospora alba	1	0	Sorbus aucuparia	1	58
Ribes uva-crispa	0	1	Sorbus minima	0	2
Rorippa nasturtium-aquaticum agg.	0	1	Stachys sylvatica	1	8
Rosa canina agg.	1	30	Stellaria graminea	4	6
Rosa pimpinellifolia	0	10	Stellaria holostea	0	3
Rubia peregrina	0	4	Stellaria media agg.	5	5
Rubus chamaemorus	19	1	Succisa pratensis	28	95
Rubus fruticosus agg.	5	54			
Rubus idaeus	1	10	Tamus communis	0	2
Rubus saxatilis	0	21	Taraxacum laevigatum agg.	0	28
Rumex acetosa	74	87	Taraxacum officinale agg.	8	201
Rumex acetosella agg.	40	4			

SPECIES:	OCCURRENCES:		SPECIES:	OCCURRENCES:	
	A	B		A	B
Taraxacum palustre agg.	1	0	Ulex minor	1	0
Taxus baccata	0	29	Urtica dioica	12	97
Teucrium scorodonia	0	121	Urtica urens	0	1
Thalictrum alpinum	0	1			
Thalictrum minus	1	51	Vaccinium myrtillus	573	70
Thelycrania sanguinea	0	8	Vaccinium oxycoccos	19	0
Thelypteris limbosperma	2	7	Vaccinium vitis-idaea	33	4
			Valeriana dioica	2	2
Thelypteris robertiana	0	37	Valeriana officinalis	3	21
Thymus drucei	27	443	Verbascum thapsus	0	7
Tofieldia pusilla	0	1	Veronica arvensis	0	3
Torilis japonica	0	1	Veronica beccabunga	0	1
Torilis nodosa	0	1	Veronica chamaedrys	12	86
Tragopogon pratensis	0	1	Veronica montana	0	2
Trichophorum caespitosum	196	10	Veronica officinalis	13	75
			Veronica serpyllifolia	2	7
Trifolium campestre	0	1	Veronica spicata	0	5
Trifolium dubium	0	18	Viburnum opulus	0	2
Trifolium medium	0	4	Vicia cracca	4	8
Trifolium pratense	1	65	Vicia sepium	0	12
Trifolium repens	92	233	Viola hirta	0	36
Trifolium striatum	0	4	Viola lutea	2	25
Triglochin palustris	3	3	Viola palustris	10	5
Trisetum flavescens	0	90	Viola riviniana	64	346
Trollius europaeus	0	13			
Tussilago farfara	1	11	Wahlenbergia hederacea	2	0
Ulex europaeus	6	14			
Ulex gallii	61	10			

ADDENDA

Because of a computing error there have been some omissions from the Principal Species lists for some of the groups. The most significant of these are the omissions of Agrostis canina.

Please add the following:-

Group 2, Constancy ≥40%	Dryopteris filix-mas	1.1
	Phyllitis scolopendrium	1.1
Group 5, Constancy ≥40%	Agrostis canina	1.2
Group 6, Constancy ≥80%	Achillea millifolium	1.4
Group 7, Constancy ≥80%	Achillea millifolium	1.3
Group 8, Constancy ≥80%	Agrostis canina	1.9
Group 9, Constancy ≥40%	Agrostis canina	1.0
Group 11, Constancy ≥40%	Drosera rotundifolia	1.0
Group 12, Constancy ≥40%	Agrostis canina	1.0
Group 16, Constancy ≥40%	Agrostis canina	1.3
Group 19, Constancy ≥40%	Agrostis canina	1.2
Group 20, Constancy ≥40%	Agrostis canina	1.3
	Juncus acutiflorus	0.8
Group 21, Constancy ≥40%	Agrostis canina	1.0
Group 23, Constancy ≥60%	Agrostis canina	1.7
Group 24, Constancy ≥40%	Agrostis canina	1.5