

The Plant Communities of Selected Grasslands on and Adjacent to the Malvern Hills in 1992

Dr PJ Alma & Mrs JL Jones
(University College Worcester, Henwick Grove, Worcester WR2 6AJ)

Introduction

Large numbers of quadrat samples were taken from three areas of open vegetation (mainly grasslands) on and adjacent to the Malvern Hills in 1992 in order to determine the nature of the plant communities and their relationship with the National Vegetation Classification (NVC) groups of Rodwell (1991a, b, 1992). The work was undertaken with financial support from University College Worcester as a pilot for a more detailed study of all the grasslands managed by the Malvern Hills Conservators. The three study sites examined were:

1. The northern part of the Malvern Hills ridge grasslands, including End Hill, Table Hill, North Hill, Green Valley and Sugar Loaf Hill;
2. Part of Castlemorton Common, including the area designated as a Site of Special Scientific Interest;
3. Hollybed Common.

The location of the sample areas is shown in Figure [##1 and 2, or 1]. This paper provides a summary of the results obtained from the study and a brief analysis of their significance.

Methods and Analysis

167 1 x 1 m quadrats were taken from the Malvern Hills site, 61 2 x 2 m quadrats from the Castlemorton Common site and 31 of the same size from Hollybed Common. A series of equidistant transects were established across each of the sites. Samples were taken at regular intervals along the transects in such a way that the each site was completely covered by a series of regular but unbiased samples. Sampling was restricted to the open ground and field type vegetation (*sensu* Elton & Miller 1954); scrub was not sampled. All plant species in the sample quadrats were identified to species and their cover-abundance scored using the Domin scale (Dahl & Hada_ 1941).

The data were analysed using TWINSpan (Hill 1979), a polythetic divisive classification technique which divided the samples from each site into groups of similar species composition. TWINSpan groups are traditionally identified with a binary numbering system derived from the sample group divisions; these numbers are used to identify the groups in the results presented below. Details of the

TWINSpan analyses are not given here, but are available as a computer printout from the authors.

The TWINSpan groups were then subjected to a further analysis using the computer programme MATCH (Malloch 1990), which allocates the groups of samples to the best ten ranked matches with NVC descriptions. The MATCH determinations were then used as a guide to the final assignment of each of the sample groups to an NVC category together with the keys and descriptions in Rodwell (1991a, b, 1992). Some of the differences in scores shown between the top ten matches of groups of closely related vegetation types were very small and use of Rodwell (1991a, b, 1992) did not always produced unequivocal identifications. This is believed to be the result of the uniqueness and isolation of the acid grasslands of the Malvern Hills (see later). The difficulties of precise identification of NVC groups in this instance must be carried in mind when interpreting these results.

It is noted that MATCH analysis is designed to be used with 2 x 2 m sample quadrats for grassland surveys. It is believed that the fact that the survey of the Malvern Hills (north area) site used 1 x 1 m quadrats would make very little difference to the analysis and the assignment of NVC categories, in this instance.

Results and Discussion

The following plant communities were identified from the three sites (with the caveats noted above). The species found at each site are given in Appendix 1.

Malvern Hills (north area) (see Table 1)

Table 1. TWINSpan Groups from the Malvern Hills (north area) samples and their NVC Affiliations (2 aberrant samples were omitted from this analysis).

Group	TWINSpan Group	NVC Group	Comments
1	000 (26 samples)	U1e <i>Festuca ovina</i> - <i>Agrostis capillaris</i> - <i>Rumex acetosella</i> grassland; <i>Galium saxatile</i> - <i>Potentilla erecta</i> sub-community.	Possibly a U2 <i>Deschampsia flexuosa</i> grassland, the next highest score in the MATCH analysis.
2	001 (10 samples)	H8e <i>Calluna vulgaris</i> - <i>Ulex gallii</i> heath; <i>Vaccinium myrtillus</i> sub-community.	It is noted that the eponymous species <i>Calluna vulgaris</i> did not occur in samples taken from North Hill.
3	010	The closest sub-community matches were with U20b	A particularly difficult group to classify, showing affinities to

	(32 samples)	<i>Pteridium aquilinum-Galium saxatile</i> community; <i>Vaccinium myrtillus-Dicranum scoparium</i> sub-community and U2a <i>Deschampsia flexuosa</i> grassland; <i>Festuca ovina-Agrostis capillaris</i> sub-community.	U2 and U20 grassland; perhaps an intermediate form. U2 grasslands normally contain <i>Calluna vulgaris</i> as a constant, which appears to be absent from this part of the Malvern Hills.
4	011 (19 samples)	U20b <i>Pteridium aquilinum-Galium saxatile</i> community; <i>Vaccinium myrtillus-Dicranum scoparium</i> sub-community.	With some affinities with U2 <i>Deschampsia flexuosa</i> grassland.
5	1000 (21 samples)	U20a <i>Pteridium aquilinum-Galium saxatile</i> community; <i>Anthoxanthum odoratum</i> sub-community.	
6	1001 (27 samples)	U20a <i>Pteridium aquilinum-Galium saxatile</i> community; <i>Anthoxanthum odoratum</i> sub-community.	The closest group of these U20 grasslands to a U4 <i>Festuca ovina-Agrostis capillaris-Galium saxatile</i> grassland.
7	101 (20 samples)	U20a <i>Pteridium aquilinum-Galium saxatile</i> community; <i>Anthoxanthum odoratum</i> sub-community.	
8	110 (10 samples)	W23a <i>Ulex europaeus-Rubus fruticosus</i> scrub; <i>Anthoxanthum odoratum</i> sub-community.	<i>U. europaeus</i> was not found in these samples, all <i>Ulex</i> found on the hill was assigned to <i>U. gallii</i> .

Thus the following NVC categories were identified:

U1e *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland; *Galium saxatile-Potentilla erecta* sub-community (TWINSPAN Group 1);

U20a *Pteridium aquilinum-Galium saxatile* community; *Anthoxanthum odoratum* sub-community (TWINSPAN Groups 5, 6 and 7);

U20b *Pteridium aquilinum-Galium saxatile* community; *Vaccinium myrtillus-Dicranum scoparium* sub-community (TWINSPAN Group 4 and probably 3);

H8e *Calluna vulgaris-Ulex gallii* heath; *Vaccinium myrtillus* sub-community (TWINSPAN Group 2, heathland type);

W23a *Ulex europaeus-Rubus fruticosus* scrub; *Anthoxanthum odoratum* sub-community (TWINSPAN Group 8, a woodland and scrub type).

The TWINSPAN analysis has shown that there are consistent sub-divisions of the NVC sub-communities which are recognisable on the ground and which are probably of some ecological significance. These are worthy of further study. It is interesting that the most frequent community is the U20 *Pteridium aquilinum-Galium saxatile* community, with over half the 167 samples falling in TWINSPAN groups assigned to this community. This particular plant community was not found by Davies (1994) in her study of the Malvern Hills' grasslands. Davies found the following plant communities in the grasslands of the spine of the whole extent of the Malvern Hills:

U1b *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland, typical sub-community;

U1e *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland *Galium saxatile-Potentilla erecta* sub-community;

U2a *Deschampsia flexuosa* grassland *Festuca ovina-Agrostis capillaris* sub-community (wavy hair grass);

U4a *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, typical sub-community.

The detailed analysis of the present data shows little concordance of the grasslands of North Hill area with the picture from the whole of the grasslands of the hill's spine found by Davies (1994). However, the matches of these plant communities to the descriptions in Rodwell (1991a,b, 1992) are not perfect. Davies came to the same conclusion in the analysis of her samples.

Many species that ought to be present in the identified plant communities are absent or occur at different levels of abundance or frequency on the hills than expected from Rodwell's descriptions. Other species are found that are not normally present in the descriptions of the identified plant communities. For example the H8e *Calluna vulgaris-Ulex gallii* heath *Vaccinium myrtillus* sub-community on the hills does not contain any of the eponymous *Calluna vulgaris*! These differences are not altogether surprising given the geographical isolation of the hills from other elevated, acid soils and other similar vegetation types. Furthermore, some of the communities identified appear to be intermediates between one or more of the groups described by Rodwell. This is strongly suggestive of a certain uniqueness of the plant communities on the hills, further emphasising their particular significance in nature conservation terms. It is likely that detailed studies of other plant communities on the Hills will prove to be equally interesting and further add to the specialness of the hills.

Castlemorton Common (see Table 2).

Table 2. TWINSPAN groups from the Castlemorton Common sample areas and their NVC Affiliations.

Group	TWINSpan Group	NVC Group	Comments
1	0000 (5 samples)	MG6b <i>Lolium perenne</i> - <i>Cynosurus cristatus</i> grassland; <i>Anthoxanthum odoratum</i> sub-community	Next closest community with MATCH analysis was MG5 <i>Cynosurus cristatus</i> - <i>Centaurea nigra</i> grassland.
2	0001 (11 samples)	MG6b <i>Lolium perenne</i> - <i>Cynosurus cristatus</i> grassland; <i>Anthoxanthum odoratum</i> sub-community	Next closest sub-community with MATCH analysis was U4b <i>Festuca ovina</i> - <i>Agrostis capillaris</i> - <i>Galium saxatile</i> grassland; <i>Holcus lanatus</i> - <i>Trifolium repens</i> sub-community.
3	0010 (20 samples)	U4b <i>Festuca ovina</i> - <i>Agrostis capillaris</i> - <i>Galium saxatile</i> grassland; <i>Holcus lanatus</i> - <i>Trifolium repens</i> sub-community.	Next closest sub-community with MATCH analysis was MG9a <i>Holcus lanatus</i> - <i>Deschampsia cespitosa</i> grassland; <i>Poa trivialis</i> sub-community.
4	0011 (6 samples)	MG9b <i>Holcus lanatus</i> - <i>Deschampsia cespitosa</i> grassland; <i>Arrhenatherum elatius</i> sub-community	Next closest sub-community with MATCH analysis was U4b <i>Festuca ovina</i> - <i>Agrostis capillaris</i> - <i>Galium saxatile</i> grassland; <i>Holcus lanatus</i> - <i>Trifolium repens</i> sub-community.
5 & 6	01 (15 samples)	MG9a <i>Holcus lanatus</i> - <i>Deschampsia cespitosa</i> grassland; <i>Poa trivialis</i> sub-community.	There is little doubt about the assignment of Group 5 to MG9a, or Group 7 to MG10b; Group 6 samples are somewhat intermediate and have been included in both groups of samples here.
6 & 7	011 + 1 (7 samples)	MG10b <i>Holcus lanatus</i> - <i>Juncus effusus</i> rush-pasture; <i>Juncus inflexus</i> sub-community.	

In the analysis of the Castlemorton Common data, the scores of the closest matches of the TWINSPAN data groups with the NVC data in the MATCH programme were very close. Furthermore, the keys and information in Rodwell (1992) were also not particularly useful in discrimination, thus the second closest matches from the analysis are given in Table 2 for some of the TWINSPAN groups.

The mixture of soils of different pH, derived from the Severn Valley flood-plain and from out-wash from the Malvern Hills, the influences of the proximity of upland grassland flora of the hills and the presumed historical influences of species rich mesotrophic grassland flora (probably MG5 *Cynosurus cristatus*-*Centaurea nigra* grasslands) of the Severn Valley, the varying land-use, and the high water table of the common, has produced an intimate mix of grassland types. The plant communities identified were:

MG6b *Lolium perenne*-*Cynosurus cristatus* grassland; *Anthoxanthum odoratum* sub-community (TWINSPAN Groups 1 and 2);

MG9a *Holcus lanatus*-*Deschampsia cespitosa* grassland; *Poa trivialis* sub-community (TWINSPAN Groups 5 and possibly 6);

MG9b *Holcus lanatus*-*Deschampsia cespitosa* grassland; *Arrhenatherum elatius* sub-community (TWINSPAN Group 4);

MG10b *Holcus lanatus*-*Juncus effusus* rush-pasture; *Juncus inflexus* sub-community (TWINSPAN groups 7 and possibly 6);

U4b *Festuca ovina*-*Agrostis capillaris*-*Galium saxatile* grassland; *Holcus lanatus*-*Trifolium repens* sub-community (TWINSPAN Group 3).

It is probable that intermediate plant community types, in comparison with those of the NVC, exist on the sites.

Interestingly no specimens of the MG5 constant *Centaurea nigra* were found in the survey, although English Nature's Site Management Statement for the SSSI states that the designated area, completely within the survey boundary, supports neutral grassland of the common knapweed and crested dog's-tail type. However, Group 1 samples have some affinities with MG5 grassland. It has been observed that MG5 grassland regresses to MG6 grassland on improvement and towards tussocky MG9 or MG10 grassland under lax grazing and poorly drained conditions (Rodwell 1992 and personal observations of MG5 grasslands). Grazing levels have been reduced at Castlemorton Common over the last few decades at least. The Common is being invaded by gorse and scrub communities (which were not examined in this survey) (Alma 1998). Despite the fact that MG6, MG9 and MG10 grasslands are not considered to be of high botanical interest (NCC 1989), Castlemorton Common's grasslands are species rich, with 161 species being recorded from 61 2 x 2 m quadrats. Some of the Common's rarer species were recorded in the survey, *Oenanthe fistula*, *O. lachenalii*, *Carex hirta*, *C. pilularis* and *C. demissa*, but the survey was designed for phytosociological analysis rather than as a means of recording all the species present. Other notable plants known from the SSSI, such as *Blysmus compressus*, *Bupleurium tenuissimum*, *Genista anglica*, *Triglochin palustris* and *O. silaifolia*, were not found.

One of the TWINSPAN groups (Group 3, consisting of 20 samples) conformed to an upland grassland category, U4b *Festuca ovina*-*Agrostis capillaris*-*Galium saxatile*

grassland; *Holcus lanatus-Trifolium repens* sub-community. This community was also identified in English Nature's Site Management Statement for the SSSI area. It shows close affinities to one of the communities recorded from the spine of the hills by Davies (1994).

The site's substantial area, the mosaic pattern of the wide variety of unimproved grassland types, the long history of management and the security of the current management is unusual. The site sampled is intimately linked with the vegetation of the rest of Castlemorton Common, which, in turn, is contiguous with the grasslands of the spine of the Malvern Hills and the lowland grasslands of Hollybed Common. The species rich grasslands of Castlemorton Common, together with the scrub and gorse plant communities and their associated animal communities, of which the birds are well-known from a BTO Constant Effort ringing site, are thus of high conservation significance in their own right and in relation to other important grasslands in the locality.

Hollybed Common (see Table 3)

Table 3. TWINSPAN groups and their NVC Affiliations.

Group	TWINSPAN Group (See Table 1)	NVC Group	Comments
1	000 (4 samples)	MG6b <i>Lolium perenne-Cynosurus cristatus</i> grassland; <i>Anthoxathum odoratum</i> sub-community.	Species poor samples, with high bracken cover.
2	001 (5 samples)	U4b <i>Festuca ovina-Agrostis capillaris-Galium saxatile</i> grassland; <i>Holcus lanatus-Trifolium repens</i> sub-community.	
3	010 (18 samples)	MG6b <i>Lolium perenne-Cynosurus cristatus</i> grassland; <i>Anthoxathum odoratum</i> sub-community.	Higher species richness than Group 1.
4	1 (4 samples)	S14 <i>Sparganium erectum</i> swamp.	Wet areas only.

The soil characteristics for Hollybed Common are similar to those for Castlemorton Common (see above), but are probably more heavily influenced by the River Severn deposits than the Malvern Hills out-wash and are generally drier. The vegetation is more uniform than at Castlemorton, as are probably the soils, and this produced a large area dominated by two main grassland types. The main constituent of the grasslands (22 of the 31 samples, TWINSPAN Groups 1 and 3) conform to the

description of MG6b *Lolium perenne-Cynosurus cristatus* grassland; *Anthoxanthum odoratum* sub-community, a plant community not considered to be of high botanical interest (NCC 1989). The samples from Group 1 were species poor because of their association with bracken, those from Group 3 were species rich samples, towards the higher range of richness expected from Rodwell's (1992) descriptions of MG6b grasslands. One of the TWINSPAN groups (Group 2, consisting of 5 samples) conformed to an upland grassland category, U4b *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland; *Holcus lanatus-Trifolium repens* sub-community, indicating the influence of acid soil forming minerals. It shows close affinities to one of the communities recorded from the spine of the hills by Davies (1994) and also from Castlemorton Common SSSI. Group 4 samples, from wet areas, conform to S14 *Sparganium erectum* swamp. The uncommon species *Triglochin palustris* was found in these wet areas during the survey .

The habitat diversity, as expressed by the number of communities in the open vegetation sampled, is relatively small compared to Castlemorton Common. The Common does, however, contain gorse, bracken and scrub stands and small brooks which add interest to the site. It is important in nature conservation terms because of its large area of unimproved grassland, its contiguity with Castlemorton Common, and the continuity and security of its management.

The grasslands of Castlemorton Common are the most species rich (161 species from 61 samples) of those sampled. The grasslands of the Hills are relatively species poor, but 74 species recorded from 167 samples is at the higher end of expectation for acid grasslands. The less interesting grassland communities of Hollybed Common supported 106 species from 31 samples, and thus are intermediate in species richness between the two other sites.

References

Alma PJ 1998 *Malvern Hills Conservators' Management Plan Review. The ecology and nature conservation value of the land under the control of the Malvern Hills Conservators.* Unpublished Report.

Dahl E & Hada_ E 1941 Strandgesellschaften der Insel Ostøy im Oslofjord. Eine pflanzensoziologische Studie. *Nytt Magazin for Naturvidenskapene* **B 82** : 251 - 312.

Davies S 1994 *The Malvern Hills SSSI: Feasibility study for the re-introduction of grazing.* English Nature.

Elton CS & Miller RS 1954 The ecological survey of animal communities with a practical system of classifying habitats by structural characters. *Journal of Ecology* **42** : 460 - 496.

Hill MO 1979 *TWINSpan - a FORTRAN program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes.* Cornell University.

Malloch AJC 1990 *MATCH. A computer programme to aid the assignment of vegetation data to the communities and subcommunities of the National Vegetation Classification.* Unit of Vegetation Science, Lancaster University.

Nature Conservancy Council 1989 *Guidelines for the selection of Biological SSSIs.* NCC.

Rodwell JS (Editor) 1991a *British Plant Communities. Volume 1. Woodlands and scrub.* Cambridge University Press.

Rodwell JS (Editor) 1991b *British Plant Communities. Volume 2. Mires and heaths.* Cambridge University Press.

Rodwell JS (Editor) 1992 *British Plant Communities. Volume 3. Grasslands and montane communities.* Cambridge University Press.

Appendix 1.

Species from the Malvern Hills (north area)

- | | |
|----------------------------------|--|
| 1 <i>Achillea millefolium</i> | 38 <i>Vaccinium myrtillus</i> |
| 2 <i>Agrostis stolonifera</i> | 39 <i>Blindia acuta</i> |
| 3 <i>Agrostis capillaris</i> | 40 <i>Brachythecium albicans</i> |
| 4 <i>Aira praecox</i> | 41 <i>Brachythecium velutinum</i> |
| 5 <i>Anthoxanthum odoratum</i> | 42 <i>Campylopus introflexus</i> |
| 6 <i>Arrhenatherum elatius</i> | 43 <i>Campylopus pyriformis</i> |
| 7 <i>Carex muricata</i> | 44 <i>Ceratodon purpureus</i> |
| 8 <i>Epilobium angustifolium</i> | 45 <i>Dicranum scoparium</i> |
| 9 <i>Corydalis claviculata</i> | 46 <i>Eurhynchium praelongum</i> |
| 10 <i>Crataegus monogyna</i> | 47 <i>Pleurozium schreberi</i> |
| 11 <i>Dactylis glomerata</i> | 48 <i>Pohlia nutans</i> |
| 12 <i>Deschampsia flexuosa</i> | 49 <i>Polytrichum commune</i> |
| 13 <i>Digitalis purpurea</i> | 50 <i>Polytrichum juniperinum</i> |
| 14 <i>Dryopteris dilatata</i> | 51 <i>Polytrichum piliferum</i> |
| 15 <i>Epilobium montanum</i> | 52 <i>Pseudoscleropodium purum</i> |
| 16 <i>Festuca ovina</i> | 53 <i>Rhytidiadelphus squarrosus</i> |
| 17 <i>Festuca rubra</i> | 54 <i>Lophocolea cuspidata</i> |
| 18 <i>Galium saxatile</i> | 55 <i>Ptilidium ciliare</i> |
| 19 <i>Holcus lanatus</i> | 56 <i>Cladonia chlorophaea</i> |
| 20 <i>Holcus mollis</i> | 57 <i>Cladonia coniocraea</i> |
| 21 <i>Juncus effusus</i> | 58 <i>Cladonia fimbriata</i> |
| 22 <i>Lolium perenne</i> | 59 <i>Cladonia floerkiana</i> |
| 23 <i>Lotus uliginosa</i> | 60 <i>Cladonia furcata</i> |
| 24 <i>Luzula campestris</i> | 61 <i>Cladonia gracilis</i> |
| 25 <i>Oxalis acetosella</i> | 62 <i>Cladonia impexa</i> |
| 26 <i>Poa annua</i> | 63 <i>Cornicularia aculeata</i> |
| 27 <i>Poa pratensis</i> | 64 <i>Parmelia saxatilis</i> |
| 28 <i>Potentilla erecta</i> | 65 <i>Acer pseudoplatanus sapling</i> |
| 29 <i>Pteridium aquilinum</i> | 66 <i>Acer pseudoplatanus seedling</i> |
| 30 <i>Rubus fruticosus</i> | 67 <i>Sorbus aucuparia</i> |
| 31 <i>Rumex acetosa</i> | 68 <i>Cladonia basal squamules</i> |
| 32 <i>Rumex acetosella</i> | 69 <i>Hypnum jutlandicum</i> |
| 33 <i>Danthonia decumbens</i> | 70 <i>Barbula sp.</i> |
| 34 <i>Teucrium scorodonia</i> | 71 <i>Cladonia cervicornis</i> |
| 35 <i>Thymus praecox</i> | 72 <i>Cladonia chlorophaea agg.</i> |
| 36 <i>Ulex gallii</i> | 73 <i>Brachythecium sp.</i> |
| 37 <i>Urtica dioica</i> | 74 <i>Hieracium pilosella</i> |

Species from part of Castlemorton Common

- | | |
|--------------------------------|---------------------------------|
| 1 <i>Achillea millefolium</i> | 10 <i>Alopecurus pratensis</i> |
| 2 <i>Achillea ptarmica</i> | 11 <i>Angelica sylvestris</i> |
| 3 <i>Agrimonia eupatoria</i> | 12 <i>Anthoxanthum odoratum</i> |
| 4 <i>Agrostis canina</i> | 13 <i>Aphanes arvensis</i> |
| 5 <i>Agrostis stolonifera</i> | 14 <i>Apium inundatum</i> |
| 6 <i>Agrostis capillaris</i> | 15 <i>Apium nodiflorum</i> |
| 7 <i>Aira caryophyllea</i> | 16 <i>Arrhenatherum elatius</i> |
| 8 <i>Aira praecox</i> | 17 <i>Bellis perennis</i> |
| 9 <i>Alopecurus geniculata</i> | 18 <i>Briza media</i> |
| 19 <i>Bromus hordeaceus</i> | 21 <i>Cardamine pratensis</i> |
| 20 <i>Calluna vulgaris</i> | 22 <i>Carex demissa</i> |

- 23 *Carex echinata*
 24 *Carex flacca*
 25 *Carex hirta*
 26 *Carex nigra*
 27 *Carex ovalis*
 28 *Carex pilulifera*
 29 *Ceratodon fontinalis*
 30 *Epilobium angustifolium*
 31 *Cirsium arvense*
 32 *Cirsium palustris*
 33 *Cirsium vulgare*
 34 *Cynosurus cristatus*
 35 *Dactylis glomerata*
 36 *Deschampsia cespitosa*
 37 *Digitalis purpurea*
 38 *Eleocharis palustris*
 39 *Epilobium adenocaulon*
 40 *Epilobium hirsutum*
 41 *Epilobium obscurum*
 42 *Epilobium parviflorum*
 43 *Equisetum arvense*
 44 *Equisetum palustre*
 45 *Eupatoria cannabinum*
 46 *Festuca arundinacea*
 47 *Festuca ovina*
 48 *Festuca pratensis*
 49 *Festuca rubra*
 50 *Filipendula ulmaria*
 51 *Galium palustre*
 52 *Galium saxatile*
 53 *Galium verum*
 54 *Geranium dissectum*
 55 *Geranium robertianum*
 56 *Glyceria declinata*
 57 *Filaginella uliginosa*
 58 *Holcus lanatus*
 59 *Hydrocotyle vulgaris*
 60 *Hypericum humisifusum*
 61 *Hypericum pulchrum*
 62 *Hypericum tetrapterum*
 63 *Hypochoeris glabra*
 64 *Hypochoeris radicata*
 65 *Juncus acutiflorus*
 66 *Juncus articulatus*
 67 *Juncus bufonius*
 68 *Juncus conglomeratus*
 69 *Juncus effusus*
 70 *Juncus inflexus*
 71 *Lathyrus pratensis*
 72 *Leontodon autumnalis*
 73 *Leontodon taraxacoides*
 74 *Linum catharticum*
 75 *Lolium perenne*
 129 *Veronica beccabunga*
 130 *Veronica scutellata*
 131 *Veronica serpyllifolia*
 132 *Viola riviniana*
 76 *Lonicera periclymenum*
 77 *Lotus corniculatus*
 78 *Lotus uliginosus*
 79 *Luzula campestris*
 80 *Lysimachia nummularia*
 81 *Mentha aquatica*
 82 *Myosotis laxa*
 83 *Nardus stricta*
 84 *Oenanthe fistula*
 85 *Oenanthe lachenalii*
 86 *Lythrum portula*
 87 *Phleum pratense bartolini*
 88 *Phleum pratense*
 89 *Pimpinella saxifraga*
 90 *Plantago lanceolata*
 91 *Plantago major*
 92 *Poa annua*
 93 *Poa pratensis*
 94 *Polygala serpyllifolia*
 95 *Polygala vulgaris*
 96 *Polygonum aviculare*
 97 *Polygonum hydropiper*
 98 *Potentilla anserina*
 99 *Potentilla erecta*
 100 *Potentilla reptans*
 101 *Prunella vulgaris*
 102 *Pulicaria dysenterica*
 103 *Ranunculus acris*
 104 *Ranunculus flammula*
 105 *Ranunculus repens*
 106 *Rosa arvensis*
 107 *Rubus fruticosus*
 108 *Rumex acetosa*
 109 *Rumex acetosella*
 110 *Rumex conglomeratus*
 111 *Rumex crispus*
 112 *Sagina nodosa*
 113 *Scrophularia auriculata*
 114 *Senecio jacobaea*
 115 *Senecio sylvatica*
 116 *Danthonia decumbens*
 117 *Solanum dulcamara*
 118 *Sonchus asper*
 119 *Stellaria alsine*
 120 *Stellaria graminea*
 121 *Thymus praecox*
 122 *Torilis japonica*
 123 *Trifolium dubium*
 124 *Trifolium pratensis*
 125 *Trifolium repens*
 126 *Trisetum flavescens*
 127 *Ulex gallii*
 128 *Urtica dioica*
 133 *Vulpia bromoides*
 134 *Calliargon cuspidatum*
 135 *Amblystegium serpens*
 136 *Brachythecium rutabulum*

- 137 *Brachythecium velutinum*
- 138 *Campylium stellatum*
- 139 *Ceratodon purpureus*
- 140 *Climacium dendroides*
- 141 *Dicranoweissia cirrata*
- 142 *Dicranum scoparium*
- 143 *Eurhynchium praelongum*
- 144 *Amblystegium riparium*
- 145 *Rhizomnium punctatum*
- 146 *Plagothecium undulatum*
- 147 *Pleurozium schreberi*
- 148 *Pohlia carnea*
- 149 *Pseudoscleropodium purum*
- 150 *Rhytidiadelphus squarrosus*
- 151 *Crataegus monogyna*
- 152 *Quercus robur*
- 153 *Hypnum cupressiforme*
- 154 *Cirsium acaule*
- 155 *Hypnum jutlandicum*
- 156 *Ranunculus peltigera*
- 157 *Cirsium sp.*
- 158 *Pohlia sp.*
- 159 *Taraxacum officinale*
- 160 *Brachythecium sp.*
- 161 *Hieracium pilosella*

Species from Hollybed Common

- | | |
|-----------------------------------|--------------------------------------|
| 1 <i>Achillea millefolium</i> | 19 <i>Carex muricata</i> |
| 2 <i>Agrostis canina</i> | 20 <i>Carex pilularis</i> |
| 3 <i>Agrostis stolonifera</i> | 21 <i>Ceratodon fontinalis</i> |
| 4 <i>Agrostis capillaris</i> | 22 <i>Epilobium angustifolium</i> |
| 5 <i>Aira caryophylla</i> | 23 <i>Cirsium arvense</i> |
| 6 <i>Aira praecox</i> | 24 <i>Cirsium palustre</i> |
| 7 <i>Alisma plantago-aquatica</i> | 25 <i>Cirsium vulgare</i> |
| 8 <i>Alopecurus geniculata</i> | 26 <i>Cynosurus cristatus</i> |
| 9 <i>Alopecurus pratensis</i> | 27 <i>Dactylis glomerata</i> |
| 10 <i>Anthoxanthum odoratum</i> | 28 <i>Deschampsia cespitosa</i> |
| 11 <i>Apium nodiflorum</i> | 29 <i>Digitalis purpurea</i> |
| 12 <i>Arrhenatherum elatius</i> | 30 <i>Eleocharis palustris</i> |
| 13 <i>Bellis perennis</i> | 31 <i>Epilobium palustre</i> |
| 14 <i>Campanula rotundifolium</i> | 32 <i>Festuca ovina</i> |
| 15 <i>Cardamine pratensis</i> | 33 <i>Festuca pratensis</i> |
| 16 <i>Carex echinata</i> | 34 <i>Festuca rubra</i> |
| 17 <i>Carex flacca</i> | 35 <i>Logfia minima</i> |
| 18 <i>Carex hirta</i> | 36 <i>Galium palustre</i> |
| 37 <i>Galium saxatile</i> | 47 <i>Lemna minor</i> |
| 38 <i>Galium verum</i> | 48 <i>Leontodon autumnalis</i> |
| 39 <i>Glyceria declinata</i> | 49 <i>Leontodon taraxacoides</i> |
| 40 <i>Holcus lanatus</i> | 50 <i>Lolium perenne</i> |
| 41 <i>Holcus mollis</i> | 51 <i>Lotus corniculatus</i> |
| 42 <i>Hordeum secalinum</i> | 52 <i>Lotus uliginosus</i> |
| 43 <i>Hypericum humifusum</i> | 53 <i>Luzula campestris</i> |
| 44 <i>Juncus articulatus</i> | 54 <i>Mentha aquatica</i> |
| 45 <i>Juncus effusus</i> | 55 <i>Nardus stricta</i> |
| 46 <i>Juncus inflexus</i> | 56 <i>Phleum pratensis bertolini</i> |

- 57 *Plantago lanceolata*
- 58 *Plantago major*
- 59 *Poa annua*
- 60 *Poa pratensis*
- 61 *Polygala serpyllifolia*
- 62 *Potentilla erecta*
- 63 *Potentilla reptans*
- 64 *Potentilla sterilis*
- 65 *Prunella vulgaris*
- 66 *Pteridium aquilinum*
- 67 *Ranunculus repens*
- 68 *Rosa arvensis*
- 69 *Rubus fruticosus*
- 70 *Rumex acetosa*
- 71 *Rumex acetosella*
- 72 *Rumex obtusifolius*
- 73 *Sagina nodosa*
- 74 *Danthonia decumbens*
- 75 *Sparganium erectum*
- 76 *Stellaria graminea*
- 77 *Torilis japonica*
- 78 *Torilis nodosa*
- 79 *Trifolium dubium*
- 80 *Trifolium pratensis*
- 81 *Trifolium repens*
- 82 *Triglochin palustris*
- 83 *Trisetum flavescens*
- 84 *Ulex gallii*
- 85 *Urtica dioica*
- 86 *Viola riviniana*
- 87 *Vulpia bromoides*
- 88 *Calliargon cuspidatum*
- 89 *Brachythecium rutabulum*
- 90 *Brachythecium velutinum*
- 91 *Ceratodon purpureus*
- 92 *Dicranum scoparium*
- 93 *Eurhynchium praelongum*
- 94 *Plagiomnium rostratum*
- 95 *Rhizomnium punctatum*
- 96 *Polytrichum juniperanum*
- 97 *Pseudoscleropodium purum*
- 98 *Rhytidiadelphus squarrosus*
- 99 *Hypnum cupressifome*
- 100 *Hypnum jutlandicum*
- 101 *Callitriche seedling*
- 102 *Ranunculus peltigera*
- 103 *Cirsium sp.*
- 104 *Taraxacum officinale*
- 105 *Brachythecium sp.*
- 106 *Hieracium pilosella*