
CG4

Brachypodium pinnatum grassland

Synonymy

Chalk grassland *auct. angl. p.p.*; *Brachypodium pinnatum* grassland *auct. angl.*; *Cirsio-Brometum brachypodietosum* Shimwell 1968a.

Constant species

Brachypodium pinnatum, *Carex flacca*, *Festuca ovina*.

Rare species

Astragalus danicus, *Herminium monorchis*.

Physiognomy

This community includes all swards in which *B. pinnatum* exceeds 10% cover in the virtual absence of other bulky tussock grasses such as *Bromus erectus* and *Avenula pubescens*. Like the *Bromus* grassland, it takes in vegetation which is similar to the *Festuca-Avenula* grassland as well as some much ranker swards but it is somewhat poorer overall in *Festuca-Avenula* species than the *Bromus* grassland, its general floristics being shifted somewhat towards more mesotrophic grasslands. Only two associates attain constancy throughout, *Carex flacca* and *Festuca ovina* and, of the frequent species, only *Sanguisorba minor*, *Linum catharticum* and *Briza media* are stricter Mesobromion plants. As well as being often too rank to offer a congenial site for more diminutive rarities, many stands occur outside the range of the Continental element in British calcicolous grasslands.

Sub-communities

Avenula pratensis-*Thymus praecox* sub-community.

Although *B. pinnatum* is almost always the most abundant species here, sometimes growing as conspicuous tussocks, its cover is often patchy and, between the clumps, less coarse grasses, such as *Festuca ovina*, *Avenula pratensis*, *Briza media* and *Koeleria macrantha*, and chamaephytes, notably *Thymus praecox* and *Helianthemum nummularium*, occur frequently and sometimes with local abundance. *Cirsium acaule* and *Asperula*

cynanchica are preferential to this sub-community. Many of the swards included here, especially those from colonised quarry spoil, are also somewhat open and on patches of bare soil there are occasional records for a variety of pauciennials, such as *Euphrasia officinalis* agg., *Carlina vulgaris*, *Blackstonia perfoliata*, *Inula conyza*, *Centaureum erythraea* and annual *Hieracia*, and bryophytes like *Weissia* cf. *microstoma*, *Fissidens cristatus*, *Ctenidium molluscum*, *Campyllum chrysophyllum* and *Pseudoscleropodium purum*. *Anacamptis pyramidalis* is sometimes conspicuous in this kind of vegetation.

Centaurea nigra-*Leontodon hispidus* sub-community.

Some Mesobromion dicotyledons, such as *Helianthemum nummularium*, *Sanguisorba minor* and *Linum catharticum*, remain frequent in this sub-community but the taller and ranker swards are generally more overwhelmingly dominated by *B. pinnatum* and the most obvious features of the vegetation are the frequency of the taller hemicryptophytes *Leontodon hispidus*, *Centaurea nigra* and *Knautia arvensis* and the increasing prominence of more mesophytic species such as *Plantago lanceolata*, *Bellis perennis*, *Trifolium pratense*, *Trisetum flavescens* and *Holcus lanatus*. *Ononis repens* occurs occasionally.

Holcus lanatus sub-community: *Cirsio-Brometum*

brachypodietosum Shimwell 1968a *p.p.* In this sub-community more mesophytic species virtually eclipse Mesobromion associates in usually very rank and grassy swards. *B. pinnatum* is generally dominant but *Trisetum flavescens* and *Holcus lanatus* become constant and there are also occasional records for *Cynosurus cristatus* and *Arrhenatherum elatius*. Among the dicotyledons, *Prunella vulgaris*, *Cruciata laevipes*, *Veronica chamaedrys*, *Cerastium fontanum*, *Lathyrus pratensis*, *Trifolium repens*, *Rumex acetosa* and *Cirsium vulgare* are all preferential at low frequencies.

Habitat

As with *Bromus erectus*, the dominance of *Brachypodium pinnatum* is essentially associated with an

absence of or a relaxation of grazing in predominantly calcicolous swards. However, though it has a roughly similar distributional limit in Britain to that of *B. erectus*, *Brachypodium* does not have so narrow a Continental range through Europe and it seems to attain prominence here under climatic and edaphic conditions somewhat different to those favoured by that species. That being said, and despite the all too familiar occurrence of these grasslands in certain areas, we still know very little about the ecology of *B. pinnatum* or the detailed floristic and physiognomic consequences of its expansion.

Like *B. erectus*, *Brachypodium* does occur as an occasional within calcicolous swards (as in the *Festuca-Avenula* grassland) over shallow and free-draining grey rendzinas on limestones in the warmer and drier south-east. With a reduction in grazing pressure, such swards can develop into the kind of vegetation included here as the *Avenula-Thymus* sub-community. Such grasslands are, however, of much more local occurrence than their *Bromus* counterparts, being largely absent, for example, from much of the Chalk of the Chilterns and East Anglia. It may be that, in these more Continental areas, *B. erectus* is more readily able to invade or expand because it is better fitted to the climatic conditions though even in some of the wetter western areas of the Chalk, *Brachypodium*-dominated grasslands are distinctly local.

In general, however, it seems to be where there is some regional or local topographic amelioration of these more extreme climatic and edaphic conditions that *B. pinnatum* rises to prominence as a dominant in ungrazed or lightly-grazed grasslands. The bulk of the swards included here are characteristic of cooler and damper sites towards the western and northern fringe of the Chalk and over the Oolite. In these regions, the community can occur as the more calcicolous *Avenula-Thymus* sub-community over shallow rendzinas (for example, an Oolite quarry spoil) but, more frequently, it is found as the more mesophytic *Centaurea-Leontodon* and *Holcus* sub-communities over deeper and moister, though still often base-rich, soils which tend towards brown rendzinas or calcareous brown earths.

Although many stands of the community now carry stock and/or rabbits, it is reduction in grazing pressure that is, above all, responsible for the development of these swards. In general, *B. pinnatum* is a highly unpalatable grass: it may be eaten by cattle when there is no alternative herbage (Hope-Simpson 1940b) and sheep and rabbits may nibble younger shoots which appear in spring (Duffey *et al.* 1974), but otherwise it seems hardly to be grazed at all by these species. They may, however, keep it in check by grazing hard and close around established tussocks, by inhibiting litter accumulation and by trampling damage (Hope-Simpson 1940b, Green

1973). If such pressure is lessened, *B. pinnatum* responds vigorously, its tussocks expanding by growth of creeping rhizomes and eventually coalescing (Hall & Russell 1911, Hope-Simpson 1940b, Duffey *et al.* 1974: see especially their plates 13–15) and its coarse litter forming a thick layer which decays but slowly, perhaps because of the high silica content of the herbage (Elton 1966, Duffey *et al.* 1974). As in the *Bromus* grassland, it is the consequent reduction in light penetration to the sward that is perhaps primarily responsible for the decline in competitive ability of many of the typical *Festuca-Avenula* species and their eventual demise here. And again, as there, differences in the grazing history, in the regimes and kind of stock employed, may play some part in determining the floristics of the different sub-communities. For example, there is some evidence in the data for an association, in the period of sampling, between sheep-grazing and the more calcicolous *Avenula-Thymus* sub-community, and cattle-grazing and the more mesophytic *Centaurea-Leontodon* and *Holcus* sub-communities, though this may not, of course, reflect long-established differences in pastoral treatment. Burning also helps maintain the more mixed, species-rich and calcicolous swards of the former vegetation type (see below).

Without detailed site histories, it is impossible to define precisely the balance of such edaphic or treatment influences on the composition of the sub-communities or to assess how much of their floristic character is inherited from the antecedent grasslands and how much is consequent upon the expansion of the dominant. Neither do we know whether any of these swards have developed from ploughed and abandoned ground. Like *B. erectus*, *Brachypodium* can produce prolific crops of large, awned fruits and it will invade open soil and spoil but it, too, may face problems of dispersal and establishment.

Zonation and succession

The various kinds of *Brachypodium* grassland, like those dominated by *Bromus erectus*, commonly occur in zonation which reflect seral changes related to grazing intensity, forming patchworks with *Festuca-Avenula* grassland, other rank swards and scrub as on the Wye and Crundale Downs in Kent (Green 1973), at Castor Hanglands on the Huntingdon/Peterborough Oolite (Duffey *et al.* 1974) and over the Chalk of the Yorkshire Wolds (NCC Yorkshire Chalk Grassland Survey 1985). More locally, the community occurs with more open weed vegetation and scrub on quarry spoil (e.g. Shimwell 1968a).

Because of its unpalatability, the expansion of *B. pinnatum* seems to be reversible only with difficulty. Grazing with sheep alone, especially just in winter, is ineffective and even all year round grazing involving

cattle may do no more than simply restrict further spread and reduce the pronounced tussocky character of the sward (Hope-Simpson 1940*b*, Green 1973). Likewise, burning alone, though cheaper than grazing, destroys accumulated litter but may not reduce the cover of *B. pinnatum*: indeed, it can encourage further expansion, though twice-yearly burns in alternate years may prevent this (Green 1973). More effective seem to be combinations of these treatments, for example a burn in very early spring followed by very hard grazing, preferably by cattle first, then sheep (Hope-Simpson 1940*b*, Green 1973). Sprinkling salt on the tussocks may encourage stock to eat the herbage (Hope-Simpson 1940*b*).

The assiduous care needed in such treatments to avoid deleterious side effects such as poaching of the soil, always a danger where cattle are grazing steeper slopes, or loss of invertebrate populations with burning, and the difficulties of integrating them with recreational use of the grasslands, makes mowing an attractive alternative. Mowing with removal of the cuttings has been shown to be effective in maintaining less tussocky and more varied *Brachypodium* swards and reduction in the height of the herbage may induce rabbits to graze (Green 1973).

The further development of ungrazed *Brachypodium* grasslands has not been monitored in detail. As with *Bromus erectus*, the dense tussocky nature of some of the swards and the high population of voles which this encourages, may hinder scrub invasion. Though *B. pinnatum* is actually palatable to *Microtus agrestis* (Godfrey 1953, 1955, Chitty *et al.* 1968), it is doubtful whether voles make great inroads on the cover of the species.

Distribution

The community occurs locally over the Chalk of the North and South Downs and more commonly in Dorset where it is also found on the Corallian Limestone. It is

more frequent on the Oolite of the Cotswolds and Northamptonshire (where mixed *Bromus-Brachypodium* swards are very common) and very characteristic of the northern Chalk of the Yorkshire Wolds.

Affinities

As defined here, the *Brachypodium* grassland takes in some of the vegetation traditionally included within a compendious 'Chalk grassland' community or its partial phytosociological equivalent, the *Cirsio-Brometum* of Shimwell (1968*a*, 1970*b*), as well as ranker swards which have sometimes been separately treated as some kind of '*Brachypodietum*' (e.g. Wells 1975, Smith 1980). Under *Brachypodium* dominance, it brings together grasslands which show a range of variation roughly analogous to that included within the *Festuca-Avenula* grassland, running from more calcicolous to more mesophytic. Although the representation of Mesobromion calcicoles in the community as a whole is very much weaker than in the *Festuca-Avenula* grassland (and less, too, than in the *Bromus*-dominated counterparts), the general affinities of this vegetation type are with that alliance and, for the most part, the swards seem to originate from mainstream plagioclimax Mesobromion vegetation whose stability has been disrupted by a reduction in grazing pressure.

B. pinnatum plays a major part, often with *Bromus erectus*, in Mesobromion grasslands in mainland Europe and grasslands similar to those included here have been described from France (e.g. Allorge 1921–2), The Netherlands (Westhoff & den Held 1969) and Germany (e.g. Ellenberg 1978, Oberdorfer 1978) where communities sometimes take in more mesophytic kinds of vegetation like those included here. Like *B. erectus*, *Brachypodium pinnatum* is also present on the Continent in the drier, rocky swards of the Xerobromion and in some of the steppe-grasslands of the Festucetalia valesiacae.

Floristic table CG4

	a	b	c	4
<i>Brachypodium pinnatum</i>	V (5–9)	V (5–9)	V (5–9)	V (5–9)
<i>Festuca ovina</i>	IV (1–7)	V (3–8)	V (4–8)	V (1–8)
<i>Carex flacca</i>	IV (2–6)	IV (2–6)	III (2–5)	IV (2–6)
<i>Helianthemum nummularium</i>	IV (1–7)	III (2–5)	I (2–4)	II (1–7)
<i>Thymus praecox</i>	IV (1–6)	II (1–7)	I (2–4)	II (1–7)
<i>Avenula pratensis</i>	IV (1–4)			I (1–4)
<i>Koeleria macrantha</i>	III (1–4)	I (3–5)	I (2–5)	I (1–5)
<i>Cirsium acaule</i>	III (1–8)	I (4)		I (1–8)
<i>Carex caryophylla</i>	III (1–4)	I (3)		I (1–4)
<i>Weissia cf. microstoma</i>	III (1–3)			I (1–3)

<i>Euphrasia officinalis</i> agg.	II (1–2)	I (2–3)	I (1–4)	I (1–4)
<i>Taraxacum officinale</i> agg.	II (1–3)	I (1–3)	I (1–2)	I (1–3)
<i>Carlina vulgaris</i>	II (1–4)	I (1–2)	I (2–3)	I (1–4)
<i>Viola hirta</i>	II (1–4)	I (2–3)		I (1–4)
<i>Blackstonia perfoliata</i>	II (1–3)	I (1)		I (1–3)
<i>Festuca rubra</i>	II (2–6)		I (2–4)	I (2–6)
<i>Anthoxanthum odoratum</i>	II (1–4)		I (1)	I (1–4)
<i>Hieracium</i> sect. <i>Vulgata</i>	II (1–3)		I (1)	I (1–3)
<i>Inula conyza</i>	II (1–3)			I (1–3)
<i>Asperula cynanchica</i>	II (1–3)			I (1–3)
<i>Anacamptis pyramidalis</i>	II (1–3)			I (1–3)
<i>Origanum vulgare</i>	I (4–5)			I (4–5)
<i>Centaureum erythraea</i>	I (1–3)			I (1–3)
<i>Hippocrepis comosa</i>	I (2–4)			I (2–4)
<i>Pimpinella saxifraga</i>	I (1–3)			I (1–3)
<i>Fissidens cristatus</i>	I (1–2)			I (1–2)
<i>Campylidium chrysophyllum</i>	I (1–5)			I (1–5)
<i>Ctenidium molluscum</i>	I (1–5)			I (1–5)
<i>Rosa canina</i> agg.	I (2–3)			I (2–3)
<i>Hypochoeris radicata</i>	I (2–3)			I (2–3)
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<i>Lotus corniculatus</i>	III (2–7)	IV (2–5)	III (2–7)	III (2–7)
<i>Campanula rotundifolia</i>	III (1–3)	IV (1–4)	III (1–3)	III (1–4)
<i>Sanguisorba minor</i>	III (2–6)	IV (2–6)	II (2–6)	III (2–6)
<i>Leontodon hispidus</i>	II (2–7)	IV (2–4)	I (1–3)	II (1–7)
<i>Centaurea nigra</i>	I (3–4)	III (2–5)	II (2–4)	II (2–5)
<i>Knautia arvensis</i>	I (1)	III (1–3)	II (1–3)	II (1–3)
<i>Trifolium pratense</i>	I (1)	II (1–5)	I (1–4)	I (1–5)
<i>Ononis repens</i>		II (2–4)	I (2–4)	I (2–4)
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<i>Trisetum flavescens</i>	I (1)	III (3–5)	IV (2–6)	III (1–6)
<i>Holcus lanatus</i>	I (2–3)	II (2–5)	IV (2–8)	III (2–8)
<i>Prunella vulgaris</i>	I (1–2)	I (2–4)	II (1–4)	II (1–4)
<i>Cynosurus cristatus</i>	I (1–3)	I (3–5)	II (3–5)	II (1–5)
<i>Arrhenatherum elatius</i>	I (4)	I (2–4)	II (2–7)	II (2–7)
<i>Cruciata laevipes</i>	I (2–3)	I (1)	II (1–3)	I (1–3)
<i>Veronica chamaedrys</i>	I (1–3)	I (1–3)	II (1–4)	I (1–4)
<i>Cerastium fontanum</i>	I (1)	I (1)	II (1–3)	I (1–3)
<i>Lathyrus pratensis</i>	I (1)	I (1)	II (1–3)	I (1–3)
<i>Trifolium repens</i>		I (2–3)	II (2–5)	I (2–5)
<i>Rumex acetosa</i>		I (1–2)	II (1–3)	I (1–3)
<i>Cirsium vulgare</i>		I (1)	II (2–4)	I (1–4)
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<i>Linum catharticum</i>	III (1–4)	III (1–3)	II (1–3)	III (1–4)
<i>Briza media</i>	III (1–5)	III (3–6)	II (2–5)	III (1–6)
<i>Hieracium pilosella</i>	III (1–8)	III (1–4)	I (2–3)	II (1–8)
<i>Plantago lanceolata</i>	I (2–6)	III (1–8)	III (1–6)	III (1–8)
<i>Galium verum</i>	II (1–4)	II (1–4)	II (1–4)	II (1–4)
<i>Bellis perennis</i>	I (2)	II (1–3)	II (1–3)	II (1–3)
<i>Crataegus monogyna</i> sapling	I (2–3)	II (1–3)	II (1–5)	II (1–5)
<i>Senecio jacobaea</i>	I (3)	II (1–3)	II (2–3)	II (1–3)
<i>Pseudoscleropodium purum</i>	II (1–4)	II (1–5)	I (1–5)	I (1–5)

Floristic table CG4 (cont.)

	a	b	c	4
<i>Achillea millefolium</i>	II (2–3)	I (1–3)	II (1–4)	I (1–4)
<i>Dactylis glomerata</i>	II (1–4)	I (2–4)	II (2–6)	I (1–6)
<i>Medicago lupulina</i>	I (2)	I (1–4)	I (2–3)	I (1–4)
<i>Centaurea scabiosa</i>	I (3–4)	I (1–4)	I (3)	I (1–4)
<i>Scabiosa columbaria</i>	I (1–4)	I (2–4)	I (2)	I (1–4)
<i>Campanula glomerata</i>	I (3)	I (2–4)	I (3)	I (2–4)
<i>Polygala vulgaris</i>	I (2–4)	I (1–2)	I (2–3)	I (1–4)
<i>Crepis capillaris</i>	I (2)	I (2–3)	I (1–3)	I (1–3)
<i>Primula veris</i>	I (3–4)	I (1–2)	I (2–4)	I (1–4)
<i>Leucanthemum vulgare</i>	I (1)	I (2–3)	I (2–3)	I (1–3)
<i>Fraxinus excelsior</i> sapling	I (1–3)	I (1–3)	I (1)	I (1–3)
<i>Dicranum scoparium</i>	I (1)	I (1–4)	I (3–4)	I (1–4)
<i>Ulex europaeus</i>	I (1–3)	I (1)	I (1)	I (1–3)
<i>Daucus carota</i>	I (2–5)	I (2)	I (2)	I (2–5)
<i>Danthonia decumbens</i>	I (2–4)	I (3–4)	I (4)	I (2–4)
<i>Filipendula vulgaris</i>	I (2–5)	I (2–3)	I (3)	I (2–5)
<i>Succisa pratensis</i>	I (1)	I (2–3)	I (3)	I (1–3)
<i>Urtica dioica</i>	I (1)	I (1)	I (1–4)	I (1–4)
<i>Galium mollugo</i>	I (3)	I (2–3)	I (2–5)	I (2–5)
<i>Ranunculus repens</i>	I (2)	I (1)	I (1–3)	I (1–3)
<i>Phleum pratense bertolonii</i>	I (1)	I (4)	I (2–4)	I (1–4)
<i>Agrostis stolonifera</i>	I (2)	I (4)	I (2–4)	I (2–4)
<i>Vicia cracca</i>	I (1)	I (1)	I (1–3)	I (1–3)
<i>Tragopogon pratensis</i>	I (1)	I (1–3)		I (1–3)
<i>Anthyllis vulneraria</i>	I (2)	I (1)		I (1–2)
<i>Agrostis capillaris</i>	I (4–6)		I (4–5)	I (4–6)
<i>Avenula pubescens</i>	I (2–6)		I (2–4)	I (2–6)
<i>Teucrium scorodonia</i>	I (2–3)		I (2–4)	I (2–4)
<i>Hypericum hirsutum</i>	I (1–3)		I (3)	I (1–3)
<i>Lolium perenne</i>	I (1)		I (1–3)	I (1–3)
<i>Ranunculus bulbosus</i>	I (1–3)		I (1)	I (1–3)
<i>Sambucus nigra</i> sapling	I (1)		I (1)	I (1)
<i>Cirsium arvense</i>	I (2)		I (1–4)	I (1–4)
<i>Luzula campestris</i>		I (1)	I (1–3)	I (1–3)
<i>Rhytidiadelphus squarrosus</i>		I (2–3)	I (2–3)	I (2–3)
<i>Hylocomium splendens</i>		I (1)	I (1)	I (1)
<i>Gentianella amarella</i>		I (1–3)	I (2)	I (1–3)
Number of samples	34	96	101	231
Number of species/sample	21 (12–33)	15 (8–25)	16 (7–28)	17 (7–33)

a *Avenula pratensis*-*Thymus praecox* sub-communityb *Centaurea nigra*-*Leontodon hispidus* sub-communityc *Holcus lanatus* sub-community4 *Brachypodium pinnatum* grassland (total)

