NATIONAL VEGETATION CLASSIFICATION

field guide to mires and heaths
National Vegetation Classification: 
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National Vegetation Classification: Field guide to mires and heaths

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1 Introduction

National Vegetation Classification

Since its development in the 1980s, the National Vegetation Classification (NVC) has become the standard classification used for describing vegetation in Britain. Whereas many other classifications are restricted to particular types of vegetation, the NVC aims to describe all the vegetation of Great Britain. This means that it is possible to analyse, and map, a complex site, composed of several habitat types (e.g. woodland, scrub, heathland and bog) using the same classification system.

The NVC is a 'phytosociological' classification, classifying vegetation solely on the basis of the plant species of which it is composed. The resulting communities can usually be correlated to other factors, such as geology and soils, climate, water chemistry and management; but the plant species alone are used to assign the vegetation to a community.

The NVC breaks down each broad vegetation type (e.g. heath, mire, woodland) into communities, designated by a number and name (e.g. H4 Ulex gallicii – Agrostis curtisii heath, M10 Carex dioica – Pinguicula vulgaris mire, W4 Betula pubescens – Molinia caerulea woodland). Many (but not all) of these communities contain two or more sub-communities, designated by a letter (e.g. H4b Ulex gallicii – Agrostis curtisii heath, Festuca ovina sub-community). Sub-communities in a few cases are further divided into variants (e.g. M10bi and ii).

Mires and heaths: scope of this guide

The second volume of British Plant Communities was published in 1991 (Rodwell 1991a). It provides a detailed account of 38 mire communities and 22 heath communities, giving information on their composition, structure and distribution, their affinities to other types of vegetation, both in Britain and on the Continent, and the relation of the communities described within the NVC to those previously described by other authors. The scope of this field guide is identical to that of Volume 2.

A number of vegetation types which might also be considered as ‘mires’ or ‘heaths’ are described in other volumes of British Plant Communities, and so are not included here. Aquatic, swamp and tall-herb fen communities can be found in Volume 4 (Rodwell 1995), whilst inundation communities, dune slack communities and Epilobium hirsutum stands are described in Volume 5 (Rodwell 2000). ‘Grass heaths’, Dryas heaths and related lichen and bryophyte dominated vegetation are included in Volume 3 (Rodwell 1992), as are certain wet grasslands. Volume 1 (Rodwell 1991b) encompasses wet woodland and scrub vegetation. Companion guides to volumes 1 and 3 have also been published by JNCC (Hall et al. 2001; Cooper 1997).

Users of this guide should also note that most ‘wet heath’ vegetation is described in the NVC with the mires rather than the heaths (as M15 Scirpus cespitosus – Erica tetralix wet heath and M16 Erica tetralix – Sphagnum compactum wet heath), because of its floristic affinities. Helpful insight into the floristic relationships of NVC types can be gained from the Phytosociological Conspectus in Volume 5 of British Plant Communities. This places all NVC communities within a hierarchical framework of European vegetation.

Various gaps in coverage of the NVC have been identified at community and sub-community level subsequent to the publication of British Plant Communities. These include several mire and heath types, as outlined in JNCC Report No. 302 Review of coverage of the National Vegetation Classification (Rodwell et al. 2000). No attempt has been made to incorporate these here, pending further analysis and formal description.

The summary descriptions provided here are derived directly from the full accounts prepared by John Rodwell, but are in no way a substitute for them. Rather they are intended as an aide-memoire to assist surveyors in the field or for anyone else wishing to familiarise themselves with the overall scheme of classification for mires and heaths. Anyone who uses this book should always check their results against the frequency tables and full descriptions for each community in Volume 2 of British Plant Communities. The descriptions are not intended to take account of the results of recent survey work undertaken by the three country agencies (Countryside Council for Wales, English Nature, Scottish Natural Heritage) which may help circumscribe some of the communities more tightly and improve our understanding of community distributions.
A series of dendrograms have been produced to show the broad floristic relationships between the main communities and between the sub-communities for each community where these exist. These dendrograms are only intended as guides and should not be followed slavishly. Details of variants, if indicated, can be found in Volume 2 of British Plant Communities.

The amount of any particular species is referred to both in terms of its frequency and abundance. ‘Frequency’ refers to how often a plant is found in moving from one sample or vegetation to the next, irrespective of how much of that species is present in each sample. This is summarised in the published tables as classes denoted by the Roman numerals I to V: 1-20% frequency (that is, up to one sample in five) = I, 21-40% = II, 41-60% = III, 61-80% = IV, and 81-100% = V. The summary descriptions follow the usual convention of referring to species of frequency classes IV and V in a particular community as its constants, with those species of class III as common or frequent, of class II as occasional and of class I as scarce or rare. The term ‘abundance’, on the other hand, is used to describe how much of a plant is present in a sample, irrespective of how frequent or rare it is among the samples. It is summarised in the published tables as bracketed numbers for the Domin ranges, and is referred to in the text here, as in the published descriptions, using such terms as dominant, abundant, frequent and sparse.

The nomenclature for plant species used in British Plant Communities has been followed in this publication for consistency. Botanists more familiar with Stace’s New flora of the British Isles (Stace 1997) may not recognise names such as (Stace equivalent in brackets): Scirpus cespitosus (Trichophorum cespitosum), Carex demissa (C. viridula ssp. oedocarpa), C. lepidocarpa (C. viridula ssp. brachyrhyncha) and Silene vulgaris maritima (S. uniflora). Amongst cryptogams, the common lichen of heaths and bogs referred to here as Cladonia impexa is now generally known as C. portentosa.

References


A Key to mires

1. Sphagnum spp. constant or very frequent in the vegetation, either continuous or patchy.
   1a. Sphagnum spp. not constant in the vegetation. Occasional small patches may be present but these are never prominent.

2. Calluna vulgaris and/or Erica tetralix constant. Usually quite extensive mires over peat.
   2a. Sub-shrubs not constant; though Calluna vulgaris and/or Erica tetralix may be present at low abundance.

3. Dominated by sedges Eriophorum, Carex spp., or tall rushes, Juncus spp.
   3a. Sedges may be present but are subordinate to bryophytes or to other vascular species.

4. Vegetation dominated by Eriophorum angustifolium and/or E. vaginatum.
   4a. Vegetation dominated by other sedges or tall rushes.

   5a. Open springs or rills with constant, but patchy Sphagnum auriculatum.

6. Semi-aquatic rills and flushes dominated by Potamogeton polygonifolius and/or Montia fontana.
   6a. Open bryophyte mats around springs. Sphagnum auriculatum can be constant.

7. Spring or flush vegetation; an open bryophyte-rich mat in which any of: Cratoneuron comatum, Philonotis fontana, Anthelia julacea, Pohlia wahlenbergii or Koenigia islandica can be prominent.
   7a. More bulky vegetation in which sedges, rushes, grasses or tall herbs are prominent.

8. Vegetation dominated by sedges, Carex or Eriophorum spp., either in low, open mats or taller, more dense mires.
   8a. Sedges may be frequent in the sward but not dominant and never structurally important.

9. Molinia caerulea constant and usually structurally important in the vegetation; with or without Schoenus nigricans.
   9a. Tall rushes, Juncus spp., and/or tall fen herbs dominant. Molinia caerulea rare but may be locally abundant in western mires.

See Fig 1. See Fig 2. See Fig 3. See Fig 4. See Fig 5. See Fig 6. See Fig 7. See Fig 8. See Fig 9.
Mires Figure 1

Fig 1. Key to vegetation with constant Sphagnum spp. and constant ericoid sub-shrubs

1. Eriophorum vaginatum (either as prominent tussocks or sparse fronds) and/or Sphagnum papillosum and/or S. magellanicum constant. Deep peat > 1 m. Blanket and raised mires.

2. Molinia caerulea and/or Scirpus cespitosus constant with at least some Narthecium ossifragum, Eriophorum angustifolium, Potentilla erecta, Sphagnum papillosum and S. capillifolium.

2a. Scirpus cespitosus not constant and rarely prominent, though can be frequent in patches. Molinia caerulea generally absent (can form mosaics with tussocky Eriophorum vaginatum in degraded forms of M19.)

3. Sphagnum spp. prominent, especially S. papillosum, S. capillifolium and S. tenellum, often S. magellanicum. Associates include at least some of Vaccinium oxycoccos, Drosera rotundifolia and Odontoschisma sphagni.

3a. Sphagnum spp. patchy, though S. capillifolium constant. S. tenellum, S. magellanicum and Odontoschisma sphagni generally absent or very rare.

3b. Sphagnum spp. patchy, though S. capillifolium constant. S. tenellum, S. magellanicum and Odontoschisma sphagni generally absent or very rare.

4. Calluna vulgaris and Eriophorum vaginatum form the bulk of the vegetation, E. vaginatum usually tussocky, with Sphagnum capillifolium, E. angustifolium and pleurocarpous mosses: Pleurozium schreberi, Hylocomium splendens and Hypnum jutlandicum.

4a. Vegetation dominated by tussocks of Eriophorum vaginatum with Calluna vulgaris and Sphagnum spp. at best infrequent and patchy. Mounds of Empetrum nigrum and/or Vaccinium myrtillus with constant Eriophorum angustifolium and Deschampsia flexuosa.

M17 Scirpus cespitosus – Eriophorum vaginatum blanket mire

M18 Erica tetralix – Sphagnum papillosum raised and blanket mire

M19 Calluna vulgaris – Eriophorum vaginatum blanket mire

M20b Eriophorum vaginatum blanket and raised mire, Calluna vulgaris – Cladonia spp. sub-community

Burning can increase the proportion of Calluna vulgaris or Deschampsia flexuosa and Vaccinium myrtillus. Grazing usually decreases the abundance of C. vulgaris, ultimately to its disappearance, especially if combined with large-scale burns. Such disturbance can shift the floristics of this community towards the impoverished M20 mire. Lower altitude stands (<400 m) to the west usually include constant Erica tetralix which is replaced in higher and more eastern stands by Empetrum nigrum and Rubus chamaemorus.

The Eriophorum mire is apparently biotically derived from M19 blanket bog or M18 raised mire, the degree of floristic impoverishment depending on the intensity and duration of destructive management practice. There is therefore a continuous gradation between richer and poorer stands. In the wet north-west some Sphagnum spp. can persist even in highly degraded stands, especially S. recurvum which is relatively tolerant to some disturbance.
5. Calluna vulgaris and Erica tetralix both prominent with Eriophorum angustifolium and Molinia caerulea constant.

6. Narthecium ossifragum constant and abundant with Drosera rotundifolia, Eriophorum angustifolium, Sphagnum papillosum, plus S. auriculatum and/or S. recurvum. Schoenus nigricans absent or very rare.

7. Erica tetralix usually the most prominent sub-shrub. Sphagnum layer dominated by S. compactum and S. tenellum. Molinia caerulea usually dominant amongst the vascular monotoc associates.

8. Schoenus nigricans constant with prominent Narthecium ossifragum and Sphagnum subnitens.

M21 Narthecium ossifragum – Sphagnum papillosum valley mire

M16 Erica tetralix – Sphagnum compactum wet heath

Wet heath primarily of the south and east of Britain, this community provides the major focus for Scirpus cespitosus and Eriophorum vaginatum (though rare) in this part of the country.

M15 Scirpus cespitosus – Erica tetralix wet heath

This is a very variable vegetation type and, of the major components, any can be dominant with up to two of the others missing. A community primarily of north-west Britain, it includes most of the heather-dominated vegetation intermediate in character between the dry heath and blanket mire types. Where heavily grazed and/or burnt, the ericoids can become very sparse and these stands are often transitional to the Molinia-dominated community M25, or drier stands to the Juncus squarrosus grassland U6.

M14 Schoenus nigricans – Narthecium ossifragum mire

M25a Molinia caerulea – Potentilla erecta mire, Erica tetralix sub-community

Burning and grazing of M15 wet heath can favour an increase in Molinia which shifts the vegetation towards that of the Erica tetralix sub-community of M25. The similarities between M25a and Molinia-rich M15 show the transition between these two communities through disturbance.
Fig 2. Key to vegetation with constant Sphagnum spp. and dominated by Eriophorum vaginatum and/or E. angustifolium

1. Vegetation dominated by Eriophorum angustifolium in which Sphagnum cuspidatum and/or Drepanocladus fluitans can be prominent. Bog pools and erosion hagg runnels within blanket peat.

2. Tussocky E. vaginatum with very patchy Sphagnum capillifolium, constant Deschampsia flexuosa and mounds of Vaccinium myrtillus and/or Empetrum nigrum nigrum. Calluna vulgaris usually absent but can be present as scattered sprigs at low frequency. North-western stands also feature prominent Polytrichum commune.

M3 Eriophorum angustifolium bog pool

This community is typical of recent or disturbed bog pools or forms an early seral stage in the transition from exposed peat back to mire vegetation. Poorer stands of the M2b Sphagnum recurvum bog pool can be very similar to Sphagnum-rich M3 stands, reflecting the transitional continuum between these communities.

1a. Vegetation dominated by Eriophorum vaginatum in which E. angustifolium can be constant but is always subordinate to E. vaginatum.

2a. It can be difficult to separate richer forms of the M20b sub-community from poor and degraded stands of the M19 blanket mire, since there is a continuum of vegetation types between these two communities with increasing disturbance to the latter. Generally, if C. vulgaris is constant with a reasonably intact Sphagnum flora this community can be categorised with the M19 mires, though E. vaginatum may be visually dominant.

M19 Calluna vulgaris – Eriophorum vaginatum blanket mire

M20b Eriophorum vaginatum blanket and raised mire, Calluna vulgaris – Cladonia spp. sub-community
2. Moss layer dominated by Sphagnum recurvum, S. cuspidatum and Polytrichum commune, never S. squarrosum. Carex curta can be abundant in some stands (DOMIN 2-9) but S. warnstorfii never present.

3. Sphagnum squarrosum constant with at least three of: Potentilla palustris, Carex nigra, Eriophorum angustifolium, Succisa pratensis, Aulacomnium palustre.

4. Vegetation dominated by tall rushes; Juncus effusus and/or Juncus acutiflorus usually with Carex echinata but this sometimes very sparse. Associates include: Polytrichum commune, Potentilla erecta, Viola palustris over a moss layer dominated by Sphagnum palustre and either S. recurvum or S. auriculatum.

5. Vegetation dominated by Carex curta with constant Sphagnum russowii and at least two of Carex echinata, Eriophorum angustifolium, Viola palustris, S. papillosum.

6. Carex echinata – Sphagnum recurvum/auriculatum mire, M6a Carex echinata sub-community and M6b Carex nigra – Nardus stricta sub-community

7. Carex curta – Sphagnum russowii mire

8. Montane flush vegetation, almost always between 650 m and 1100 m asl in central Scotland.

9. Flush or floating raft over liquid peat. Often forms stage in the transition to open water or as part of a complex mosaic with other C. rostrata dominated communities (M9, S9, S27).

Fig 3. Key to communities with constant Sphagnum spp. and dominated by sedges or tall rushes.
Mires Figure 4

**Fig 4. Key to bog pools dominated by open Sphagnum carpets**

1. Bog pool dominated by Sphagnum auriculatum and S. cuspidatum, usually with some Menyanthes trifoliata and Eriophorum angustifolium.

1a. Bog pool dominated by Sphagnum cuspidatum and/or S. recurvum. S. auriculatum never present. Scattered Eriophorum angustifolium throughout pool; Erica tetralix, Drosera rotundifolia and other vascular species around margins.

M1 Sphagnum auriculatum bog pool

M2 Sphagnum cuspidatum /recurvum bog pool

As temporary pools infill, Eriophorum angustifolium increases in prominence. Such pools can exist in all transitional stages between M2 and M3 bog pool floristics.

Mires Figure 5

**Fig 5. Key to semi-aquatic rills and flushes dominated by Potamogeton polygonifolius and/or Montia fontana**

1. Flush vegetation dominated by Potamogeton polygonifolius with Hypericum elodes, Ranunculus flammula and Juncus bulbosus.

1a. Rills and spring-head vegetation dominated by Montia fontana and Ranunculus omiophyllus, usually with Ranunculus flammula and some of: Juncus bulbosus, J. articulatus, Potamogeton polygonifolius, Myosotis secunda and Agrostis stolonifera.

M29 Hypericum elodes – Potamogeton polygonifolius soakway

M35 Ranunculus omiophyllus – Montia fontana rill

This community has been poorly sampled from the north. Hypericum elodes is abundant in this community across southwest Britain but declines to the north and is absent from most stands north of the Scottish Borders except for occasional outliers in the Western Isles.

This community has been poorly sampled from the north of Britain. Stands similar in floristics to the M35 rills but lacking R. omiophyllus are occasional along ditch-lines at the margins of improved land in lowland areas.
1. Montane or sub-montane bryophyte-rich spring-heads dominated by Cratoneuron commutatum and/or Philonotis fontana.

2. Moss carpet dominated by Cratoneuron commutatum or occasionally by C. filicinum.

2a. Cratoneuron commutatum absent or only present at low frequency. Philonotis fontana constant with two or more of: Saxifraga stellaris, Scapania undulata, Deschampsia cespitosa, Dicranella palustris, Stellaria alpina, Sphagnum auriculatum.

3. Species-rich springs in which Carex spp. are frequent, though sparse, especially C. nigra, C. panicea and C. demissa. Diverse herbs including some of: Cardamine pratensis, Leontodon autumnalis, Trifolium repens and Polygonum viviparum. Philonotis fontana can be frequent in the moss carpet.

3a. Springs overwhelmingly dominated by Cratoneuron commutatum with Philonotis fontana rare to occasional. Small sedges are scarce and the diversity of vascular plants quite poor, usually including Cardamine pratensis, Festuca rubra and Agrostis stolonifera.

3b. Open mat dominated by Anthelia julacea with constant Sphagnum auriculatum, Marsupella emarginata, Scapania undulata and Deschampsia cespitosa.

3b. Not Anthonyb julacea.

3c. Spongy bryophyte carpets dominated by Pohlia wahlenbergii var. glacialis. Constants include: Saxifraga stellaris, Deschampsia cespitosa and Pohlia ludwigi. Cerastium erato misd can be frequent.

4. Open mat dominated by Anthelia julacea with constant Sphagnum auriculatum, Marsupella emarginata, Scapania undulata and Deschampsia cespitosa.

4a. Montane springs or rills in which Cratoneuron commutatum and Philonotis fontana are absent or very sparse.

5. Spongy bryophyte carpets dominated by Pohlia wahlenbergii var. glacialis. Constants include: Saxifraga stellaris, Deschampsia cespitosa and Pohlia ludwigi. Cerastium erato misd can be frequent.

5a. Bryophyte mat with open areas of stony ground. Carex demissa and Koenigia islandica constant with Deschampsia cespitosa, Saxifraga stellaris and Scapania undulata.

Light grazing is important in keeping the mat open and maintaining diversity.
1. Vegetation overwhelmingly dominated by Eriophorum spp; Carex spp. never prominent.

2. Eriophorum angustifolium dominant on open eroded peat, especially around hags.

3. Carex rostrata prominent in herb-rich swards over bulky mosses, often forming floating rafts. Constants include Eriophorum angustifolium, Galium palustre, Menyanthes trifoliata, Potentilla palustris and Calliergon cuspidatum.

4. Carex saxatilis dominant, other sedges subordinate. Constants include: Thalictrum alpinum, Hylocomium splendens, Polygonum viviparum and Aneura pinguis.

5. Saxifraga aizoides and Carex demissa constant.

M3 Eriophorum angustifolium bog pool

M20 Eriophorum vaginatum blanket and raised mire

M9 Carex rostrata - Calliergon cuspidatum/giganteum mire

M12 Carex saxatilis mire

M10 Carex dioica - Saxifraga aizoides mire

M11 Carex demissa - Saxifraga aizoides mire

Montane flushes over 700 m asl.

This community usually results from degraded blanket mire, M19. Species-poor, but a range of transitional M20-M19 stands occurs.

Often occurs in complex mosaics with M5 and the S27 swamp in which the diagnostic herbs are very similar, though lacking the moss carpet of M9.

Carex dioica may be absent or difficult to find in poorer stands. C. demissa may replace C. lepidocarpa in higher altitude/less base-rich stands.
Fig 8. Key to vegetation in which Molinia caerulea is constant and structurally important but Sphagnum spp. are generally lacking

1. Schoenus nigricans constant and abundant.

2. Juncus subnodulosus constant, usually with other Juncus spp., Succisa pratensis, Potentilla erecta, Carex panicea and Calliergon cuspidatum.

2a. Schoenus nigricans usually abundant with some of: Erica tetralix, Narthecium ossifragum, Anagallis tenella, Drosera rotundifolia and generally some Sphagnum auriculatum and/or S. subnitens. J. subnodulosus absent.

3. Calluna vulgaris and Erica tetralix constant and usually abundant with Scirpus cespitosus and Potentilla erecta.

3a. Calluna vulgaris absent or present at low frequency. Erica tetralix may be frequent in the M25a sub-community.

4. Molinia caerulea - dominated fen with constant Cirsium dissectum, usually with Juncus subnodulosus, sometimes J. articulatus or J. inflexus. Associates include poor fen herbs, particularly Valeriana dioica and Succisa pratensis.

4a. Cirsium dissectum and Juncus subnodulosus absent or rare.

5. Rich Molinia caerulea fen with Carex nigra and at least three of: Crepis paludosa, Carex panicea, C. pulicaris, Valeriana dioica, Succisa pratensis, Filipendula ulmaria and Ranunculus acris.

5a. Molinia caerulea and Potentilla erecta only constants in generally quite poor vegetation. Associated include frequent Juncus acutiflorus and sparse herbs such as Succisa pratensis, Cirsium palustre and/or Erica tetralix.

M13 Schoenus nigricans - Juncus subnodulosus mire
M14 Schoenus nigricans - Narthecium ossifragum mire
M15 Scirpus cespitosus - Erica tetralix wet heath
M16 Molinia caerulea - Cirsium dissectum fen-meadow
M24 Molinia caerulea - Cirsium dissectum fen-meadow
M25 Molinia caerulea - Potentilla erecta mire
M26 Molinia caerulea - Crepis paludosa mire

This community is mainly in south and east Britain, though sedge-rich stands of M25 found in south-west Scotland and the Western Isles may resemble the Juncus acutiflorus - Erica tetralix sub-community M24c.

Existing records limit this community to the North Pennines and Lake District, though it may extend into the Southern Uplands.
Oenanthe crocata is often absent from stands of this community in the north and west of Scotland.

1. Iris pseudacorus constant and generally dominant, usually with constant Oenanthe crocata, Filipendula ulmaria and Poa trivialis.

1a. Iris pseudacorus absent or at low frequency in the sward.

2. Filipendula ulmaria constant and prominent with tall fen herbs including Angelica sylvestris, Valeriana officinalis and Rumex acetosa.

2a. Filipendula ulmaria can be occasional to frequent but never prominent. Vegetation dominated by tall rushes usually with constant Holcus lanatus and Lotus uliginosus.

3. Fen-meadow dominated by Juncus subnodulosus often with frequent J. inflexus and/or J. articulatus. Constants include: Mentha aquatica, Cirsium palustre and Calliergon cuspidatum.

3a. Vegetation dominated by Juncus effusus and/or J. acutiflorus with constant Galium palustre and other poor-fen associates, most usually Cirsium palustre, Rumex acetosa, Epilobium palustre, Mentha aquatica and Ranunculus flammula.

M 28 Iris pseudacorus – Filipendula ulmaria mire

M 27 Filipendula ulmaria – Angelica sylvestris mire

M 22 Juncus subnodulosus – Cirsium palustre fen-meadow

M 23 Juncus effusus/ acutiflorus – Galium palustre rush-pasture

In western Britain Molinia caerulea can be locally abundant in this community.
3 Mire community descriptions and sub-community keys

M1 Sphagnum auriculatum bog pool community

This bog pool community typically consists of floating masses or soft wet carpets of Sphagnum spp., mainly Sphagnum auriculatum (including var. inundatum) and S. cuspidatum, with scattered vascular plants growing on or through them or in areas of open water between. Locally, the bright orange-yellow S. pulchrum is conspicuous. S. recurvum is rare in contrast with the Sphagnum cuspidatum/recurvum bog pool community (M2). Other bryophytes are generally scarce, but Cladopodiella fluitans is characteristic at low frequencies and Gymnocolea inflata can also be present.

The commonest vascular plants are Menyanthes trifoliata and Eriophorum angustifolium which together make up a cover of less than 30%. In open water Sphagnum cover is reduced and Utricularia species, usually U. minor or locally U. intermedia, are sometimes present. In shallow water Rhynchospora alba is characteristic, and R. fusca is found occasionally in this community. Narthecium ossifragum and Drosera spp., particularly D. rotundifolia, are also occasionally present. In some areas Carex limosa is frequent, but is shy in flowering. Around the pool margins Molinia caerulea can extend down from the mire surface although its cover is generally low.

This community is confined to pools and wetter hollows on ombrogenous and topogenous mires with base-poor and oligotrophic raw peat soils in the more oceanic parts of Britain. It is a widespread component in the Scirpus cespitosus – Eriophorum vaginatum blanket mire (M17) in the far west of Britain including western Scotland, parts of the Lake District, Wales, and the South-West Peninsula, and the Narthecium ossifragum – Sphagnum papillosum valley mire (M21) in south-western valley mires with a high water table, particularly in the New Forest and Dorset.

The wetness gives some protection to this vegetation where mires are grazed or burned, but it has been reduced on many sites by draining and cutting of the peat. It has been widely lost where Erico-Sphagnion communities have been converted to Ericion heaths or their degraded derivatives. Shallow peat-digging can create flooded hollows which become suitable for recolonisation by Sphagnum spp., Rhynchospora alba and Drosera spp., but such locally reconstituted stands often lie in much-modified mire contexts.

No sub-communities.
M2 Sphagnum cuspidatum/recurvum bog pool community

This community is typically dominated by soft wet carpets of Sphagnum cuspidatum or S. recurvum, or both. S. pulchrum occurs very locally, occasionally with S. tenellum, S. magellanicum or S. papillosum. Sphagnum auriculatum is rare in contrast with the Sphagnum auriculum bog pool community (M1). Other bryophytes are scarce but Polytrichum commune or Aulacomnium palustre can form occasional patches and there may be scattered leafy hepatics. Vascular plants occur as scattered individuals with Eriophorum angustifolium and Erica tetralix both constant; the former often extending into deeper pools and the latter confined to drier areas. Drosera rotundifolia is frequent and Narthecium ossifragum occasional. Andromeda polifolia, where present, is distinctive of this vegetation type particularly around pool margins, and together with Rhynchospora alba it forms a clear sub-community. There may be some sedges including Carex limosa, C. curta and C. magellanica.

The community is typically found in pools and lawns on very wet and base-poor raw peats on ombrogenous and topogenous mires in the less oceanic parts of Britain. Its range coincides closely with that of the Erica tetralix – Sphagnum papillosum mire (M18) and it typically forms the pool, wet hollow and lawn elements in that community (and its degraded derivatives) on lowland raised bogs, on locally raised areas within low altitude blanket mires and in base-poor basin mires. It occurs from Wales up through the Scottish Borders and south-west Scotland with some localities in north-east Scotland.

This community has been reduced by widespread drainage and cutting of mires, so that often just small and modified fragments remain within predominantly agriculture landscapes. However this community readily colonises shallow flooded workings and appears to have expanded its coverage in sites where there has been some agricultural enrichment of the water.

M2a

Rhynchospora alba sub-community

Sphagnum cuspidatum is the typical dominant in the Sphagnum carpet. Eriophorum angustifolium and Erica tetralix join Rhynchospora alba and Andromeda polifolia as constants, Drosera rotundifolia is frequent and D. anglica or D. intermedia occasional.

This sub-community is more widely distributed on active, undisturbed raised mires.

M2b

Sphagnum recurvum/Sub-community

Sphagnum recurvum is constant with S. cuspidatum and often the more abundant of the two. Eriophorum angustifolium, Erica tetralix and Drosera rotundifolia maintain their high frequency and Vaccinium oxyccocos is a good preferential. Polytrichum commune and Aulacomnium palustre can occur sporadically in slightly drier areas with some Calluna vulgaris and Eriophorum vaginatum. Molinia caerulea may be locally prominent.

This sub-community is more restricted to soligenous areas and disturbed basin mires.
Eriophorum angustifolium is dominant here in swards where other vascular species and Sphagnum spp. play a relatively minor role. Its shoot density is very variable, as is the sward height which may be very short or up to half a metre or more. Usually shoots reach approximately 30 cm.

Other vascular plants attain only occasional frequency but there can be scattered small tussocks of Eriophorum vaginatum or Molinia caerulea or sparse individuals of Drosera rotundifolia, Erica tetralix or Empetrum nigrum ssp. nigrum. Bryophyte cover is also very variable and there are no constant species but Drepanocladus fluitans may be frequent, often growing submerged. Sparse shoots or small tufts of Sphagnum spp. may be present, usually S. cuspidatum but sometimes S. recurvum or S. papillosum.

This community is typically found as small stands on barer exposures of acid raw peat soils in depressions, erosion channels or shallow peat cuttings on a wide range of mire types. It can be found in natural hollows on surfaces of more or less intact mires but is more common among erosion features where the peat has been worn down in gullies or redistributed. It is also sometimes associated with abandoned peat workings on lowland mires. The community is particularly associated with the eroded blanket mire in the north-west of Britain, being a common feature in tracts of the Calluna vulgaris – Eriophorum vaginatum and Eriophorum vaginatum mires (M19 and M20), and it is widespread but local in lowland Erico-Sphagnion mires (M18, M21) and Ericion wet heaths (M15, M16). This community may represent a seral stage in the redevelopment of active mire vegetation following disruption.

No sub-communities.
M4 Carex rostrata – Sphagnum recurvum mire

This mire typically has a cover of sedges over a carpet of semi-aquatic Sphagnum spp. Carex rostrata is the commonest sedge, usually forming a rather open cover of shoots, but it can be accompanied by C. curta, C. lasiocarpa, C. limosa or C. nigra (the first two especially can be locally prominent). Carex chordorrhiza is a rare associate. Occasionally the taller element of the vegetation also has Eriophorum angustifolium, Juncus effusus or J. acutiflorus. There is generally an extensive wet carpet of Sphagnum spp. S. recurvum and S. cuspidatum are usually the most frequent and abundant species and S. auriculatum is also common. Sphagnum palustre is occasional, with sparse records for Sphagnum subnitens and S. papillosum. S. squarrosum and S. teres are characteristically rare, which provides a good contrast with Carex rostrata – Sphagnum squarrosum mire (M5). Other bryophytes are few, but Polytrichum commune is very frequent forming scattered patches. Aulacomnium palustre and Calliergon stramineum are very sparse.

Scattered through the ground cover are individuals of an impoverished poor-fen herb flora. The commonest species are Agrostis canina ssp. canina and A. stolonifera (which may be locally abundant as stoloniferous mats), Molinia caerulea, Potentilla erecta, Galium palustre, Rumex acetosa, Viola palustris, Succisa pratensis and Stellaria alsine. Usually only one or two of these are present in any one stand. Potentilla palustris, Menyanthes trifoliata and Equisetum fluviatile also may occur occasionally.

This community is characteristic of pools and seepage areas on raw peat soils of topogenous and soligenous mires where the waters are fairly acid and only slightly enriched. It can occur in bog pools on the surface of basin (and sometimes raised) mires, but is more common in obviously soligenous areas as in mire lags and the wettest parts of water-tracks. Enrichment is slight and the pH is typically around 4. The community is of widespread but local occurrence throughout the north-west of Britain and probably remains as remnants in drained mire systems in the lowlands.

The place of this community in the terrestrialising succession is not clear and the vegetation may be very stable provided the high water table and modest irrigation are maintained. Drainage results in the demise of the more aquatic Sphagnum spp. and perhaps a transition to the Carex echinata – Sphagnum recurvum/ auriculatum mire (M6), and with grazing, may result in a spread of Juncus dominance.

No sub-communities.
This mire is fairly heterogeneous and is characterised overall by the dominance of sedges with scattered poor-fen herbs over a patchy carpet of moderately base-tolerant Sphagnum spp. The commonest species throughout are Carex rostrata and C. nigra, with the former generally more extensive. Carex lasiocarpa can be locally prominent and C. curta is occasionally found. Carex limosa and C. diandra are typically absent in contrast with the Carex rostrata - Calliergon cuspidatum/giganteum mire (M9).

Other vascular plants are often limited to scattered individuals, but the most frequent overall are Potentilla palustris, Eriophorum angustifolium, Menyanthes trifoliata, Galium palustre and such typical poor-fen herbs as Succisa pratensis, Viola palustris, Ranunculus flammula, Epilobium palustre and Lychnis flos-cuculi. Juncus effusus can be frequent, as can Molinia caerulea and Myrica gale.

The bryophyte carpet helps define the Carex - Sphagnum squarrosum mire against closely related vegetation types. Sphagnum spp. are at least patchily prominent. Especially distinctive is the presence of Sphagnum squarrosum and S. teres. In addition S. recurvum and S. palustre are frequently encountered and S. cuspidatum and S. auriculatum are occasionally found. Sphagnum contortum is rare in contrast with the Carex rostrata - Calliergon cuspidatum/giganteum mire (M9). Other common bryophytes are Aulacomnium palustre and Calliergon stramineum.

This mire is typically found as a floating raft or on soft, spongy peats in topogenous mires and in soligenous sites with mildly acid, only moderately calcareous and rather nutrient-poor waters; the pH range is from about 4 to above 6. It is characteristically found in zonations and mosaics, the simplest being open water transitions around lakes. It can also be found around springs, seepage lines and streams where it can form part of a mixture of poor- and rich-fen communities. The community has a widespread but fairly local distribution in north-western parts of Britain. It was probably once much more widespread in the lowland south and east where relic stands may still occur.

The peat under this community is often very soft which gives the vegetation a measure of protection against the trampling and grazing effects of larger herbivores, although damage may occur during periodic dry spells. Where the community runs onto firmer peats around the margins of lakes or basins, the vegetation tends to pass to the Carex echinata - Sphagnum recurvum/auriculatum mire (M6). The effect of grazing on these transitions may favour the spread of Juncus effusus.

No sub-communities.
This community has a distinct general character but includes a wide variation in composition, expressed here in four sub-communities. Essentially it is a poor-fen with small sedges or rushes dominating over a carpet of oligotrophic and base-intolerant Sphagnum spp. The constants are very few. Among vascular plants only Carex echinata has a uniformly high frequency, but C. nigra and C. panicea are common, and C. demissa occasional. There are two negative characters which aid definition of this community. Firstly, the general absence of more calcicolous Carex species, e.g. C. dioica, C. pulicaris, C. lepidocarpa and C. flacca, helps to separate this community from the Caricion davallianae rich fens (M9 to M12), and secondly, only local occurrence of species like C. rostrata and C. curta marks the vegetation off from communities like the Carex rostrata – Sphagnum recurvum mire (M4).

The most common vascular associates are grasses and poor-fen dicotyledons. Among the grasses, Agrostis canina ssp. canina and Molinia caerulea are the most common but Anthoxanthum odoratum is also frequent. Commonly occurring poor-fen dicotyledons include Viola palustris and Potentilla erecta, and occasionally one or more of Galium saxatile, G. palustre, Cirsium palustre, Epilobium palustre, Succisa pratensis, Ranunculus flammula or Cardamine pratensis may be present. Sometimes species such as Narthecium ossifragum, Drosera rotundifolia and Erica tetralix are found. The rushes Juncus acutiflorus and J. effusus may each be dominant in particular sub-communities.

A ground carpet of Sphagnum spp. is prominent and it is most frequently composed of S. recurvum and S. auriculatum, with occasional occurrence of S. subnitens and S. papillosum. There are only a few other commonly occurring bryophyte species. Polytrichum commune is very frequent, Rhytidiadelphus squarrosus is occasional and Calliergon stramineum and Aulacomnium palustre are patchy throughout. Calliergon cuspidatum and Plagiothecium undulatum are conspicuously rare.

This mire is the major soligenous community of peats and peaty gleys irrigated by rather base-poor waters in the sub-montane zone of northern and western Britain. The soils and water are quite acidic with a superficial pH usually between 4.5 and 5. It typically occurs as small stands among other mire communities, grassland and heaths and sometimes with swamp and spring vegetation. It is commonly found in tracts of unenclosed pasture on upland fringes, particularly between 200 m and 400 m (although it may be found much higher) and is ubiquitous in the upland fringes of Britain. The community is frequently grazed. This, especially where combined with drainage, can convert the community to grassland. The exclusion of herbivores would be expected to permit progress to wet scrub and woodland, although in many cases this would probably be slow and patchy.
Mixtures of Carex echinata, C. nigra and C. panicea usually dominate with Eriophorum angustifolium sometimes abundant but Juncus spp. at most sparse.

Sedge cover less varied and extensive and Eriophorum angustifolium usually sparse; Juncus effusus or J. acutiflorus dominant.

Carex echinata usually the most abundant sedge, C. panicea and C. nigra subordinate and Nardus stricta and Juncus squarrosus occasional in an extensive Sphagnum carpet.

Carex nigra, C. panicea and C. echinata equally frequent and mixtures of these usually dominate. Nardus stricta and Juncus squarrosus very common among a sometimes patchy Sphagnum cover.

Juncus effusus is the most abundant rush among an extensive Sphagnum carpet usually dominated by S. recurvum with S. palustre.

Carex echinata sub-community

The vegetation is generally dominated by mixtures of sedges with Carex echinata generally most common; grasses are rather scarce except for Molinia caerulea and Agrostis canina ssp. canina which are very common. Eriophorum angustifolium is frequent and may dominate. Rushes are typically scarce and of low cover. The Sphagnum carpet is typically extensive and luxuriant. S. palustre is common but S. recurvum and S. auriculatum show a pattern of replacement, the latter becoming more prominent in the oceanic far west of Britain. Drosera rotundifolia, Narthecium ossifragum, Erica tetralix, Juncus bulbosus/kochii and Menyanthes trifoliata show some preference for the S. auriculatum type of flush.

This sub-community is found throughout the range of M6.

Two variants.

Carex nigra - Nardus stricta sub-community

Together with the Carex spp. and other species mentioned above, Eriophorum angustifolium is very common and Anthoxanthum odoratum frequent. Juncus squarrosus is a good preferential, but J. effusus is scarce and J. acutiflorus absent. In some stands Sphagnum recurvum and S. palustre are the commonest Sphagnum species with poor fen herbs such Ranunculus flammula, Epilobium palustre and Cirsium palustre. In contrast other stands have a greater abundance of Sphagnum spp., with S. auriculatum, S. subnitens and S. papillosum being preferential and often some Molinia caerulea present among the other grasses.

This sub-community is found throughout the range of M6.

Two variants.

Juncus effusus sub-community

Sedges are less frequent and abundant and the vegetation is dominated by Juncus effusus. Frequent vascular associates are few but there is often some Agrostis canina ssp. canina, Potentilla erecta, and (rather diagnostic here) Galium saxatile. Carex echinata, Molinia caerulea and Viola palustris are also fairly common. The Sphagnum carpet is generally extensive and luxuriant and S. recurvum is almost always dominant. Polytrichum commune remains frequent and sometimes abundant.

This sub-community is found throughout the range of M6.

Two variants.

Juncus acutiflorus sub-community

Juncus acutiflorus is dominant over an extensive Sphagnum carpet and Molinia caerulea becomes more consistently frequent. Most of the same poor-fen herbs as listed in M6c are frequent. Sphagnum spp. are generally abundant with S. palustre common throughout and S. recurvum or S. auriculatum with S. subnitens, S. papillosum and S. capillifolium having dominance in the carpet.

This sub-community is found throughout the range of M6.

Two variants.
M7 Carex curta - Sphagnum russowii mire

This mire community has prominent cyperaceous and Sphagnum components with a distinct northern and montane character. Eriophorum angustifolium and Carex echinata are very frequent and provide a floristic link with the Carex echinata - Sphagnum recurvum/auriculatum mire (M6) community which occurs at lower altitudes, but in contrast, C. curta is a constant often with high cover. It is often accompanied by C. bigelowii or C. aquatilis and C. rariflora. Carex nigra can also occur, sometimes abundantly. Larger Juncus spp., e.g. Juncus effusus and J. acutiflorus, are very scarce, again in contrast to M6.

The Sphagnum carpet is typically extensive. Sphagnum papillosum is common and often abundant, and S. subnitens, S. auriculatum, S. capillifolium or S. recurvum may be frequent. The high altitude species S. russowii is constant as is S. lindbergii in one of the sub-communities. The rare S. riparium also grows in this community. Other frequent bryophytes are Polytrichum commune, Calliergon stramineum or C. sarmentosum.

Grasses play a minor role, although Nardus stricta is very common and Agrostis canina ssp. canina frequent. Among dicotyledons Viola palustris and Galium saxatile are most common, but are typically of low cover.

This community is confined to high altitude sites, usually above 650 m, forming small stands where peaty soils are irrigated by oligotrophic and base-poor waters. It is characteristic of hollows and drainage channels in blanket mires or flushes and seepage areas in tracts of montane moss heaths. It is an altitudinal replacement for Carex echinata - Sphagnum recurvum/auriculatum mire (M6) with a preponderance of montane plants. The community is mainly confined to the central Highlands of Scotland, but extends south into the Pennines and perhaps also into Wales.

Most of the occurrences of the Carex curta - Sphagnum russowii mire are close to or above the potential forest limit in the Scottish Highlands and the community is probably an essentially stable component of the vegetation pattern under present-day conditions.
This community has a dominant cover of sedges over an extensive carpet of Sphagnum spp. and a fairly numerous and diverse assemblage of herbs. Carex rostrata and C. nigra are the commonest sedges, the former usually more abundant and of high cover. Other poor-fen sedges, C. panicea, C. echinata and C. demissa occur frequently and sometimes abundantly and C. pulicaris is occasional.

The Sphagnum carpet is typically extensive, and the prominence of the base-tolerant Sphagnum teres and S. warnstorfii is quite distinctive. Sphagnum recurvum occurs frequently and S. subsecundum sensu stricto, although only occurring occasionally, is also very characteristic of this community.

Other bryophytes are numerous and in particular Aulacomnium palustre and Rhizomnium pseudopunctatum are frequent. Also distinctive are Calliergon cuspidatum, C. stramineum and less frequently C. sarmentosum. Homalothecium nitens is quite common and a good diagnostic species. Hylocomium splendens and Rhytidadelphus squarrosus are frequently recorded.

Herbaceous associates are common but typically of low total cover. Constant species are Epilobium palustre, Potentilla erecta, Viola palustris and Selaginella selaginoides. Common grasses are Festuca ovina (and F. vivipara), Nardus stricta, Anthoxanthum odoratum and Agrostis stolonifera, all of which are generally present as scattered shoots or small tussocks.

This community typically occurs as small stands and is strictly confined to raw peat soils in waterlogged hollows in the montane zone of Britain where there is moderate base-enrichment by drainage from calcareous rocks. These conditions are not common. The peat deposits on which the community is found are typically quite deep, usually more than 1 m, with a high and stagnant water table. The pH of the waters and the peat is usually between 5.5 and 6. The small but distinct montane element in the flora of this community helps separate it from the Carex rostrata – Sphagnum squarrosum mire (M5) which is found in analogous situations in the lowlands. The community is generally confined to altitudes between 400 m and 800 m in the central Highlands except for a few examples in southern Scotland and northern England.

The frequent presence of seedlings of Salix aurita in stands of the community may indicate a tendency towards the development of montane willow scrub but such successions have never been seen to progress further.

No sub-communities.
This community has a diverse composition and physiognomy, even within individual stands, but is generally characterised by a fairly rich assemblage of sedges and vascular plants over a carpet of bulky mosses and localised patches of Sphagnum spp. The commonest large sedge is Carex rostrata, which is often abundant and sometimes dominant. Carex diandra is frequent, and C. lasiocarpa may accompany one or both of these species. Carex paniculata or C. appropinquata is present in some localities. Small sedges which commonly occur in this community include C. panicea and C. nigra.

Intermixed with these species, or fringing patches of them, are a variety of associates. Potentilla palustris and Menyanthes trifoliata are common and are particularly important when the vegetation forms floating rafts. Also common are Eriophorum angustifolium, Equisetum fluviatile, E. palustre, Succisa pratensis, Pedicularis palustris, Cirsium palustre and Ranunculus flammula often with Galium palustre. Less evenly distributed and usually present as scattered individuals are Mentha aquatica, Caltha palustris, Valeriana dioica, Angelica sylvestris, Epilobium palustre and Lychnis flos-cuculi. The commonest grass to occur in this community is Molinia caerulea, particularly in drier stands.

Bryophytes are almost always conspicuous. Calliergon cuspidatum is constant and C. giganteum and C. cordifolium frequent. One or more of the larger Mniumae are also common. Campylium stellatum is a distinctive species of this community together with Scorpidium scorpioides and Drepanoclados revolvens.

This community is characteristic of soft, spongy peats kept permanently moist by at least moderately base-rich and calcareous waters. Waters and substrates always have a pH above 5 and usually above 6. It is commonest in wetter parts of topogenous mires in hollows or old peatworkings, but also around springs, lags of raised mires and mowing marshes. The community is widespread but local, ranging from south-east England, particularly in Broadland, to Wales and northern England and through most of Scotland.

The community is limited by the fairly sparse occurrence of suitable natural situations and in the lowland south-east by wetland drainage and the cessation of shallow peat-digging. It is typically too wet to be grazed but in some areas it occurs within mowing marsh that is periodically cropped. Throughout its range, at least at the lower altitudes and in less remote sites, the Carex rostrata - Calliergon cuspidatum/giganteum mire is probably a successional stage to Salix pentandra - Carex rostrata woodland (W3) in the north and Salix cinerea - Betula pubescens - Phragmites australis woodland (W2) in the south-east, although development to woodland may be hindered by a high water table or by the periodic mowing of the vegetation. There is also the possibility that under certain conditions this mire type is seral to the development of poor-fen and ombrogenous mire through the local formation of Sphagnum nuclei.
**M9**

**Carex rostrata usually dominant, sometimes with C. lasiocarpa or more locally C. diandra or Schoenus nigricans. Calliergon cuspidatum common but other Calliergon species and larger Mniaceae at most local. Ground carpet usually dominated by mixtures of Campylium stellatum, Scorpidium scorpioides and Drepanocladus revolvens.**

**M9a**

**Campylium stellatum - Scorpidium scorpioides sub-community**

Smaller sedges are more numerous than in M9b; Carex panicea and C. nigra retain their high frequency and C. limosa and C. echinata are strongly preferential. Herbaceous associates are variable and not very rich, and total cover is low, giving an open community. Menyanthes trifoliata and Potentilla palustris can be prominent, but most species occur as scattered plants. Bryophytes are usually prominent as indicated above. Clumps of Sphagnum spp. are occasional, notably so for the base-tolerant Sphagnum contortum. This sub-community is largely north-western in range.

**M9b**

**Carex diandra - Calliergon giganteum sub-community**

The pattern of dominance is more variable here as indicated above. Juncus subnodulosus is locally abundant in eastern England. Herbaceous associates are more numerous; Potentilla palustris, Menyanthes trifoliata and Filipendula ulmaria can be prominent with Angelica sylvestris, Epilobium palustre, Lychnis flos-cuculi, Valeriana dioica, Caltha palustris, Cardamine pratensis and Mentha aquatica all frequent. Bryophytes are often extensive with Calliergon giganteum, C. cordifolium, Plagiomnium rostratum and P. affine showing their maximum development in this sub-community.

This sub-community occurs throughout the range mostly in topogenous mires.
M10 Carex dioica – Pinguicula vulgaris mire

The community includes a range of distinctive calcicolous flush vegetation in which the bulk of the sward is composed of small sedges, dicotyledons and bryophytes. There are marked variations in proportions of frequent species, as indicated in the three sub-communities and their variants. Essentially this is a small sedge mire with Carex dioica, C. hostiana, C. lepidocarpa, C. panicea and C. pulicaris as constants which are also often abundant. Carex nigra is frequent and C. echinata and C. flacca common. Other prominent Cyperaceae are Eriophorum angustifolium, a constant, and Eleocharis quinqueflora.

Some rushes and grasses occur frequently. Juncus articulatus is a constant and J. bulbosus/kochii is typical of less base-rich sites. Molinia caerulea is the commonest grass with Festuca ovina more variable in occurrence. Other herbs generally occur as scattered plants. The frequent occurrences of Pinguicula vulgaris and Selaginella selaginoides are very distinctive of this community. Potentilla erecta and Succisa pratensis are also common species in this community but Equisetum palustre and Euphrasia officinalis agg. are more variable in occurrence. Other species are characteristic of particular sub-communities.

Bryophytes are always obvious, often comprising 50% or more of the ground cover. Calcicolous species such as Campylium stellatum, Aneura pinguis, Drepanocladus revolvens, Ctenidium molluscum, Fissidens adiantoides and Cratoneuron commutatum are frequent, together with Bryum pseudotriquetrum. Such assemblages of calcicolous species provide a strong definition for the community against its counterparts in the Caricion nigrae (M5-M7) and in flushed Oxycocco – Sphagnetea mires (M14-M21) which occupy similar but more base-poor situations.

This community is typically a soligenous mire of mineral soils and shallow peats kept very wet by base-rich, calcareous and oligotrophic waters. The pH of flushing waters is high, usually between 5.5 and 7.0 or sometimes higher, and the composition of this community is one of the most calcicolous of British mires. It is found in small stands, often associated with spring and rill vegetation, within grasslands and more occasionally in ombrogenous mires and around topogenous mires. Typically the in situ formation of peat is limited, a feature which helps to distinguish the habitat of the community from that of base-rich basins where it is replaced by vegetation like the Carex rostrata – Calliergon cuspidatum/giganteum mire (M9) and the Carex rostrata – Sphagnum warnstorfii mire (M8). It is predominantly a community of north-west Britain from Wales and the Pennines northwards, developed in the cool, wet climate.

The community typically occurs in unenclosed uplands and most of the stands are grazed and trampled by large herbivores. It is probably these factors, combined with nutrient impoverishment and the often strong and scouring effect of the irrigation, which play a major part in maintaining the community in its generally rich, varied and open state. Most stands would probably progress to Alno – Ulmion scrub or woodland (W7, W9) if grazing were withdrawn. However, at higher altitudes the vegetation may be a climatic climax.
Species listed opposite scarce or absent. Gymnostomum recurvirostrum or less commonly Catascopium nigritum forming hummocks with Drepanocladus revolvens and Cratoneuron commutatum often abundant.

Carex hostiana, C. pulicaris and C. nigra all frequent with Eriophorum angustifolium and Molinia caerulea. Potentilla erecta and Succisa pratensis common with Ctenidium molluscum and Fissidens adianthoides frequent.

Gymnostomum recurvirostrum sub-community
Vascular plants have low individual and total cover; much more prominent are the conspicuous moss hummocks, particularly of Gymnostomum recurvirostrum which are up to 30 cm high and 60 cm across. There is much bare ground with a fragmentary cover of vascular plants; good preferentials are Plantago maritima, Sagina nodosa and Minuartia verna. M. stricta is restricted to this sub-community in its only British locus.

This striking vegetation is only recorded from Upper Teesdale.

Carex hostiana and C. pulicaris to frequent; C. lepidocarpa and C. flacca scarce and C. pulicaris patchy. Juncus bulbosus and Erica tetralix quite common.

Carex demissa and C. echinata occasional to frequent; C. lepidocarpa and C. flacca scarce and C. pulicaris patchy. Juncus bulbosus and Erica tetralix only of local significance.


M10a
Carex demissa - Juncus bulbosus/kochii sub-community
This comprises the less calcicolous types of M10 with vascular plants predominant. Carex panicea, C. dioica, C. hostiana and C. nigra remain very frequent with the species listed above. More calcicolous herbs such as Briza media, Primula farinosa, Linum catharticum and Sesleria albicans are usually poorly represented. Bryophytes are generally less prominent in the turf; Bryum pseudotriquetrum, Fissidens adianthoides and Ctenidium molluscum are rather uncommon and Campylium stellatum and Scrophularia scorpioides rather more prominent.

This sub-community is largely restricted to Scotland and the Lake District with outlying occurrences in north-west Wales and Upper Teesdale.

Three variants.

M10b
Briza media - Primula farinosa sub-community
Vascular plants are also prominent but many swards are open with extensive bare ground. Calcicoles and more mesophytic herbs well represented. Carex lepidocarpa, C. hostiana and C. pulicaris are consistently frequent and commonly accompanied by C. flacca. Among the preferentials Briza media, Primula farinosa, Linum catharticum, Sesleria albicans and Equisetum variegatum are frequent. Juncus bulbosus/kochii, Erica tetralix, Narthecium ossifragum and Drosera rotundifolia are reduced in their occurrence. Among the bryophytes Annea pinguis, Ctenidium molluscum and Fissidens adianthoides are consistently frequent.

This sub-community is predominantly found in northern England.

Three variants.

M10c
Gymnostomum recurvirostrum sub-community
Vascular plants have low individual and total cover; much more prominent are the conspicuous moss hummocks, particularly of Gymnostomum recurvirostrum which are up to 30 cm high and 60 cm across. There is much bare ground with a fragmentary cover of vascular plants; good preferentials are Plantago maritima, Sagina nodosa and Minuartia verna. M. stricta is restricted to this sub-community in its only British locus.

This striking vegetation is only recorded from Upper Teesdale.

Three variants.
M11 Carex demissa – Saxifraga aizoides mire

This vegetation is typically open with rich mixtures of small sedges, other herbs and bryophytes among water-scoured runnels and with much exposed silt and rock debris. There is a strong floristic link with Carex dioica – Pinguiscula vulgaris mire (M10) but the Arctic-Alpine element of the vegetation is much more pronounced in this community than it is in M10. Typically there is no single dominant. Carex demissa, C. panicea and C. pulicaris are very frequent throughout and C. flacca and C. dioica are common in some variants. Juncus articulatus is a constant, Eriophorum angustifolium is frequent as is Eleocharis quinqueflora at lower altitudes. At higher altitudes Juncus triglumis is constant and Tofieldia pusilla becomes frequent. By comparison with M10, C. lepidocarpa and C. hostiana are much less common and C. nigra and C. echinata also rather scarce. At higher altitudes there is an Arctic-Alpine element with Juncus triglumis being constant and Tofieldia pusilla becoming more frequent. Grasses are typically low in cover. Festuca ovina/vivipara is common and Agrostis stolonifera occasional. At higher altitudes Deschampsia cespitosa (including D. alpina), Nardus stricta, Anthoxanthum odoratum, Agrostis canina ssp. canina and Festuca rubra may be present.

Other herbs found in this community include Pinguiscula vulgaris and Saxifraga aizoides which are both constant and Selaginella selaginoides which is very frequent. The montane element of this community includes Thalictrum alpinum, which is very common at higher altitudes, and occasionally Saxifraga stellaris, S. oppositifolia and Alchemilla filicaulis ssp. filicaulis. Typically all these species occur in an uneven and broken sward.

Bryophytes are frequent and varied. Aneura pinguis, Campylium stellatum, Drepanocladus revolvens, Bryum pseudotriquetrum, and at lower altitudes, Cratoneuron commutatum, Fissidens adiantoides, Ctenidium molluscum and Scorpidium scorpioides are all common. The montane moss Blindia acuta can be prominent at higher altitudes and is a good preferential for this community.

This community is characteristic of open, stony flushes, strongly irrigated with moderately base-rich waters, on generally steep slopes in submontane and montane parts of Britain. Although the community can occur almost at sea level in the far north-west of Scotland, it is generally confined to high altitudes. It is always associated with calcareous bedrocks having a soil pH range of 5.5 to 7.0. Flushing is vigorous and erosion of the surface is therefore often pronounced and the soil cover little more than scoured accumulations of silt and organic matter with exposed rock debris. It is largely confined to Scotland, but also present in the Lake District, and more locally in the Southern Uplands, the northern Pennines and north Wales.

The community is normally grazed and this grazing may help maintain the open structure and help prevent the development of a woody cover. However, colonisation of trees and scrubs would be slow due to the climatic conditions in which the community occurs and at higher altitudes the mire is probably a climatic climax.

<table>
<thead>
<tr>
<th>Juncus triglumis and Thalictrum alpinum constant, but Eleocharis quinqueflora uncommon. Deschampsia cespitosa, Nardus stricta and Anthoxanthum odoratum frequent and Alchemilla alpina occasional. Cratoneuron commutatum, Scorpidium scorpioides and Fissidens adiantoides all scarce.</th>
<th>Eleocharis quinqueflora constant with Juncus triglumis and Thalictrum alpinum becoming more frequent at higher altitudes. The grasses found in M11a at most occasional. Cratoneuron commutatum and Scorpidium scorpioides very common and abundant, often with Fissidens adiantoides.</th>
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<tbody>
<tr>
<td><strong>M11a</strong> Thalictrum alpinum - Juncus triglumis sub-community</td>
<td><strong>M11b</strong> Cratoneuron commutatum - Eleocharis quinqueflora sub-community</td>
</tr>
<tr>
<td>There is an obvious montane element in the vegetation as indicated in the species above. Saxifraga aizoides. Carex demissa and C. panicea are usually the most abundant vascular plants with Blindia acuta, Campylium stellatum or Drepanocladus revolvens predominating among the mosses. This is the typical form of M11 at higher altitudes and is virtually confined to Scotland. Two variants.</td>
<td>In this sub-community M11 grades into M10 with more extreme montane plants, except Saxifraga aizoides and Blindia acuta, much more poorly represented; and in more southerly stands even these become rare. Eleocharis quinqueflora is constant and sometimes abundant, rivalling the sedges, among which Carex hostiana and, in wetter stands, C. rostrata are sometimes found. Vascular plant cover typically more extensive than in M11a. This sub-community is also frequent in Scotland at lower altitudes and in most of the English and Welsh stands.</td>
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</table>
Carex saxatilis is typically dominant in this montane mire with a distinctive assemblage of associates. The sward is generally less than 20 cm high and rather open with patches of soil. Carex demissa, C. echinata and C. nigra are very frequent and can be abundant. Carex bigelowii is fairly consistent, especially in grassy transitions to surrounding swards.

Eriophorum angustifolium is also frequent attaining a cover of more than 10%. Almost all other herbs occur as scattered individuals. Selaginella selaginoides and Pinguicula vulgaris are both very common as in other calcicolous flushes, but more distinctive are Thalictrum alpinum, Polygonum viviparum, and Juncus triglumis. Saxifraga aizoides is infrequent, in contrast to Carex demissa - Saxifraga aizoides mire (M11). Also common are the poor-fen herbs Viola palustris, Caltha palustris and Agrostis canina ssp. canina.

Bryophytes are an important element of the vegetation although apart from the constant Drepanocladus revolvens, cover of individual species is low. Aneura pinguis is frequent and Bryum pseudotriquetrum, Blindia acuta, Campylium stellatum and Calliergon trifarium are occasional. Hylocomium splendens is also a constant as is Scapania undulata. There can also be some small patches of Sphagnum spp.

This mire type is strictly confined to margins of high-montane flushes irrigated with base-rich and calcareous waters perhaps influenced by long snow-lie. It typically occurs as small stands bordering rills or more strongly irrigated soligenous mires. The soils that this community is found on, though continuously irrigated, are not of especially high pH, ranging from 4.6 to 6.3. The community is fairly widespread but local on peaks above 750 m through the southern and central Scottish Highlands with scattered localities in north-west Scotland.

The physical effects of flushing, snow-melt, cryoturbation, and solifluctional flow result in the continual instability of the substrate on which this community is found and this is important in maintaining open stony areas where rare Arctic-Alpine sedges and rushes find a niche. It is possible that grazing prevents colonisation by Arctic-Alpine willows; however, in the extreme environment in which it occurs the community is probably a climatic climax.

No sub-communities.
M13 Schoenus nigricans – Juncus subnodulosus mire

In this community Schoenus nigricans is typically very frequent and consistently associated with other distinctive floristic features. It is generally dominant (although it may be absent from fragmentary stands) giving a grey-green appearance to the vegetation. Commonly it is intermixed with Juncus subnodulosus, and where this predominates the vegetation is olive-green in spring and reddish brown in winter. Molinia caerulea is also constant. These species form a rough sward about 50 cm in height with smaller herbs growing in between. Sedges are often important, particularly Carex panicea, C. lepidocarpa and C. flacca. Where the summer water table is close to the surface, species such as Schoenus nigricans, Pedicularis palustris, Mentha aquatica, Valeriana dioica and Cardamine pratensis occur, sometimes with Parnassia palustris, Pinguicula vulgaris and Eriophorum latifolium. A variety of orchids are found, particularly Epipactis palustris. Taller herbs can be locally abundant with Succisa pratensis being most common. Phragmites australis is also frequent, particularly in ungrazed stands. On drier areas and particularly tops of Schoenus tussocks less calcicolous plants are found, most frequently the constant Potentilla erecta and Erica tetralix.

Bryophytes vary in cover and species but can be very extensive. The commonest throughout are Campylium stellatum and Calliergon cuspidatum. Other frequent species include Drepanocladus revolvens, Aneura pinguis, Cratoneuron communatum and C. filicinum.

This community is confined to peat or mineral soils, in and around lowland mires irrigated by base-rich, highly calcareous, and oligotrophic waters. It is often found below springs and seepage lines and on flushed margins of valley mires, but also extends into topogenous basins provided there is close contact with waters draining from lime-rich substrates. The flushing waters typically have pH between 6.5 and 8. It is widespread but local throughout lowland England and Wales, but is restricted by natural scarcity of suitable habitat and its extensive destruction.

The structure and floristics of this community are often influenced by grazing and some stands have been affected by mowing and burning. Shallow peat-digging has been locally important in providing a suitable habitat for the community but more drastic treatment of mires, particularly draining and eutrophication, have reduced its extent and eliminated it from some areas.
Carex hostiana and C. pulicaris very frequent among an abundant and diverse small herb flora in runnels with Briza media, Pinguicula vulgaris, Linum catharticum, and Juncus articulatus common. Many smaller runnel herbs sporadic, but Caltha palustris and Valeriana dioica become common and taller dicotyledons are often prominent with Filipendula ulmaria, Eupatorium cannabinum and Lychnis flos-cuculi frequent.

M13

General floristic and structural features well preserved, with at least some of Anagallis tenella, Pedicularis palustris, Angelica sylvestris, Cirsium palustre, Mentha aquatica, Equisetum palustre and Phragmites australis frequent.

M13a

Festuca rubra - Juncus acutiflorus sub-community
This comprises the more impoverished stands of M13. Apart from the reduction or even absence of Schoenus nigricans and presence of the species mentioned above, Carex panicea, C. lepidocarpa, and C. flacca are also important in runnels. Anagallis tenella is totally absent and Pedicularis palustris, Epipactis palustris and other orchids are very scarce. The commonest herbs are Succisa pratensis and Hydrocotyle vulgaris. Bryophytes are generally sparse and low in number with Calliergon cuspidatum the commonest species. This sub-community occurs through the range of M13.

M13b

Briza media - Pinguicula vulgaris sub-community
This kind of Schoenetum is strikingly rich. Mixtures of Schoenus nigricans, Juncus subnodulosus and Molinia caerulea usually share dominance but the small herbs of runnels are especially distinctive. Apart from the species mentioned above, Parnassia palustris is frequent often with mixtures of orchids including Gymnadenia conopsea var. densiflora, Dactylorhiza fuchsii, D. majalis ssp. purpurella and Epipactis palustris. Along with Succisa pratensis and Serratula tinctoria, taller herbs are represented by frequent Angelica sylvestris, Cirsium palustre, Eupatorium cannabinum and Oenanthe lachenalii. Bryophytes are quite numerous and sometimes of high cover. This sub-community occurs in Anglesey and East Anglia.

M13c

Caltha palustris - Galium uliginosum sub-community
Schoenus nigricans, Juncus subnodulosus and Molinia caerulea remain of structural importance but are variously augmented by Carex rostrata, C. diandra, C. elata, Cladium mariscus and sometimes Phragmites australis. Runnels are well developed but smaller preferentials of M13b are only occasional. The commonest species are Carex panicea, C. lepidocarpa, Mentha aquatica, Hydrocotyle vulgaris together with the preferentials Caltha palustris and Valeriana dioica. In addition to Epipactis palustris there is often Dactylorhiza incarnata, D. majalis ssp. praetermissa and sometimes D. traunsteineri. Taller herbs are common, as listed above, with sprawling Galium uliginosum and less commonly G. palustre. A pool element is sometimes present, with Carex rostrata and C. diandra together with Menyanthes trifoliata, Equisetum fluviatile and Utricularia species. This sub-community is concentrated in East Anglia.

Juncus subnodulosus and Molinia caerulea often very abundant with Schoenus nigricans markedly reduced in vigour. Festuca rubra, Holcus lanatus, Agrostis canina and A. stolonifera frequent and tall herbs, orchids and bryophytes patchy.
M14 Schoenus nigricans – Narthecium ossifragum mire

This mire type includes mildly calcicolous Schoenus vegetation of south-west England that is not readily integrated into Schoenus nigricans – Juncus subnodulosus mire (M13) and with a less varied flora. Schoenus nigricans is usually dominant and Molinia caerulea is generally abundant. A mixture of these two species usually cover the ground. Juncus subnodulosus is absent in contrast to M13. Small calcicolous herbs are generally absent. Narthecium ossifragum and Anagallis tenella are constants while Drosera rotundifolia, growing on cushions of Sphagnum, is less common. Erica tetralix, or occasionally Calluna vulgaris, grows on Schoenus or Molinia tussocks. Some stands have a local abundance of Myrica gale.

Bryophytes are variable and also less calcicolous in character than in M13. Campylium stellatum and Aneura pinguis are frequent and together with Scorpidium scorpioides and, less commonly, Drepanocladus revolvens, can form extensive mats in runnels. Sphagnum spp. are a consistent feature, particularly on tussocks. Sphagnum subnitens is most common and S. auriculatum is frequent. Hypnum jutandicum is preferential and there may be patches of hepatics including Kurzia pauciflora and Calypogeia species.

This community is characteristic of peats and mineral soils irrigated by moderately base-rich and calcareous ground waters of a pH range between 5 and 7. It characteristically occurs as isolated flushes among wet heath and moorland vegetation, but it is also associated with soligenous zones within valley mires. The community occurs very locally in Cornwall, east Devon, south-east Dorset and the New Forest. It may also be found in Wales but it is replaced in comparable situations on north-western blanket bogs by Schoenus-dominant stands of Scirpus cespitosus – Erica tetralix wet heath (M15).

The community only occurs very locally. This is partly because of the natural scarcity of suitable habitats, but also because of the reduction in its extent by human activities such as drainage and agricultural improvement. Occasional burning and light grazing are also of common occurrence over the tracts of heath in which this kind of mire usually occurs, although these activities are probably not very damaging. In the absence of grazing or burning it is expected that some stands of this community would progress towards wet woodland.

No sub-communities.

M15 Scirpus cespitosus – Erica tetralix wet heath

This is a vegetation type with few constants and a wide variation in the pattern of dominance and in associated flora. Molinia caerulea, Scirpus cespitosus, Erica tetralix and Calluna vulgaris are all of high frequency and it is mixtures of these species that give the vegetation its general character. However, sometimes one or two of them may be missing and their relative proportions are very diverse. Molinia is the most consistent overall and often abundant; in other stands Scirpus is very prominent and both may share dominance with Calluna. Molinia may also dominate with Scirpus or with Erica tetralix. The shrubby species Erica cinerea, Vaccinium myrtillus and Myrica gale are important in particular sub-communities. Other common species are Potentilla erecta, and in moister stands, Polygala serpyllifolia, Narthecium ossifragum and Eriophorum angustifolium. By contrast E. vaginatum is notably scarce.

There are few bryophytes common throughout. There are usually some Sphagnum spp. but they do not form the luxuriant carpets of the Sphagnetales mires (M17-M21). The most frequent species overall are Sphagnum capillifolium and S. subnitens. Sphagnum palustre, S. recurvum and S. auriculatum can become common in wetter stands. Lichens do not appear consistently but Cladonia spp. can be locally prominent.

This wet heath community is characteristic of moist and generally acid and oligotrophic peats and peaty mineral soils in the wetter western and northern parts of Britain. It is associated with thinner or better drained areas of ombrogenous peat with a surface pH typically between 4 and 5. The community is particularly well represented in the west and south-west of Scotland, through Wales and less extensively in the Lake District, Dartmoor and Exmoor.

Grazing and burning have important effects on the floristics and structure of this community, and draining and peat-cutting have extended its coverage to formerly deeper and wetter peats. Without burning or grazing, less damaged stands may be able to revert to blanket mire. However, cessation of burning, especially on peat that is well aerated or where there has been drainage, may precipitate a vigorous expansion of Molinia. Although progression to woodland is theoretically possible over most, if not all, of its altitudinal range, widespread deforestation has often removed potential seed-parents, and continued grazing by livestock and deer and sporadic burning may be enough to set back succession continually. However, extensive tracts of this kind of vegetation have been replaced by coniferous forest after the ground has been drained.
M15

Narthecium ossifragum and Eriophorum angustifolium frequent with Sphagnum palustre common. Myrica gale often found.

Usually small stands, often in soakways. Sphagnum carpet extensive with frequent Sphagnum recurvum and S. subintens. Drosera rotundifolia common and scattered small sedges such as Carex echinata, C. panicea and C. nigra.

Drosera rotundifolia and small sedges at most occasional. Sphagnum carpet patchy, but S. papillosum quite frequent.

Erica cinerea frequent, sometimes abundant, but Vaccinium myrtillus rare. Racomitrium lanuginosum common and Cladonia spp. often abundant.

Erica cinerea rare but Vaccinium myrtillus frequent, commonly with Nardus stricta, Juncus squarrosus and Deschampsia flexuosa. Racomitrium lanuginosum and Cladonia spp. scarce.

Typical sub-community

The dominants here are very variable. Scirpus cespitosus and Calluna vulgaris may share dominance, or Calluna and Molinia caerulea may predominate. Molinia and Erica tetralix or Molinia alone may be dominant. Myrica gale is quite common but not abundant. Narthecium ossifragum and Eriophorum angustifolium are frequent as in M15a, but small sedges are generally sparse, with only Carex panicea and C. echinata occasional and fen associates very uncommon. Nardus stricta and Juncus squarrosus may show local prominence. Eriophorum vaginatum is a low-cover occasional. Sphagnum papillosum is frequent and locally abundant and Odontoschisma sphagni often present. In some stands Sphagnum spp. are sparse and mosses such as Racomitrium lanuginosum, Dicranum scoparium, Hypnum cupressiforme/jutlandicum and Phyllodoce lanuginosa cover most of the cover.

This sub-community is especially common in the drier regions of the distribution of M15.

Carex panicea sub-community

This is the richest and most floristically distinct sub-community. Molinia caerulea and Erica tetralix retain high frequency; Scirpus cespitosus and Calluna vulgaris are more sparse. Myrica gale sometimes has local abundance, but E. cinerea and Vaccinium myrtillus almost totally absent. Potentilla erecta and Polygala serpyllifolia are very commonly found with Narthecium ossifragum and Erica angustifolium. Drosera rotundifolia is preferential with a variety of species such as Carex panicea, C. echinata, C. nigra, C. pulicaris, C. demissa, C. dioica, Selaginella selaginoides, Pinguicula vulgaris, Succisa pratensis, Viola palustris, Juncus bulbosus and Dactylorhiza maculata spp. maculata. The Sphagnum carpet is also distinctive, as indicated above, with Sphagnum palustre also often abundant and with S. capillifolium patchy.

This and the Typical sub-community are particularly common in the west of Scotland.

Cladonia spp. sub-community

All four possible dominants have high frequency but Calluna vulgaris usually predominates. Potentilla erecta remains constant, but Polygala serpyllifolia and Narthecium ossifragum are less common and Eriophorum angustifolium and Myrica gale very scarce. Sphagnum spp. are only poorly represented and Hypnum cupressiforme/jutlandicum and Racomitrium lanuginosum become frequent. Cladonia spp. are abundant, particularly Cladonia impexa and C. uncialis together with C. arbuscula, C. pyxidata, C. coccifera and C. gracilis. This sub-community is especially common in the drier regions of the distribution of M15.

Vaccinium myrtillus sub-community

M15a

M15b

M15c

M15d

Mixtures of Molinia caerulea and Calluna vulgaris generally dominate with Scirpus cespitosus and Erica tetralix both rather uneven, often with some Vaccinium myrtillus. Commonly there are small tussocks of Nardus stricta, Juncus squarrosus, Deschampsia flexuosa and more occasionally some Anthoxanthum odoratum, Festuca ovina/vivipara, F. rubra, Luzula multiflora and Carex pilulifera. Sphagnum spp. are infrequent, their place being taken by Hypnum cupressiforme/jutlandicum, Dicranum scoparium, Pleurozium schreberi, Plagiothecium undulatum, Polytrichum commune and Rhytidium loreus. Racomitrium lanuginosum and Cladonia spp. are scarce. This sub-community is especially common in the drier regions of the distribution of M15.
This community is characteristically dominated by mixtures of Erica tetralix, Calluna vulgaris and Molinia caerulea, but their proportions are very variable, being influenced by differences in the water regime and trophic state of the soils, and also by grazing and burning. Erica tetralix is often vigorous, particularly on wetter soils, while Calluna is often subordinate and weak (although it may be abundant in drier stands or where controlled burning is carried out). No other sub-shrubs attain a high frequency, although Erica cinerea and Ulex gallii may be abundant in transitions to drier heaths in south-west England and E. cinerea and U. minor can occur in similar situations further east. In some situations Molinia may be dominant.

This community may have no other, or only sporadic, vascular associates. The commonest vascular associate, where present, is Scirpus cespitosus. Eriophorum angustifolium and Narthecium ossifragum are quite frequent, as is Drosera rotundifolia in wetter hollows. Myrica gale occurs occasionally, sometimes with local abundance.

Most characteristic of the bryophyte layer in drier situations is Sphagnum compactum, a constant and strong preferential for the community. In wetter places S. tenellum may be present. These species may occur as scattered cushions or form a continuous carpet, sometimes with several other Sphagnum spp. as well as a number of other bryophytes, between the dominants. Lichens may also be present, especially larger Cladonia species such as C. impexa and C. uncialis.

This wet heath community is found on acid and oligotrophic mineral soils or shallow peats that generally have a surface pH of between 3.5 and 4.5 and that are at least seasonally waterlogged. It is characteristic of the south of lowland England, being particularly associated with the surrounds of valley mires maintained by a locally high water table. It is also found through Wales, and in northern England and Scotland, where it extends on to thin ombrogenous peats at higher altitudes.

Grazing and burning are important in maintaining the vegetation, and burning is able to transform the appearance of particular stands over short periods of time, producing considerable structural diversity within a small area. Without any grazing or burning most stands would probably progress to woodland, and this has happened to some stands lying within tracts of heath on commons in south-east England where traditional management has fallen into disuse. The combination of frequent burning, draining, and damage due to other operations such as military manoeuvres and mineral extraction, have led to an irretrievable loss of this community in many areas and its distribution has been considerably fragmented with remaining stands closely hemmed in by coniferous plantations or intensive agricultural land.
Molinia caerulea usually dominant with Scirpus cespitosus and Narthecium ossifragum less common than usual, scattered plants of Potentilla erecta and Succisa pratensis frequent, with occasional Polygala serpyllifolia, Carex panicea, Salix repens, Cirsium dissectum and Serratula tinctoria. Bryophytes usually sparse.

Subshrub cover generally patchy, but Sphagnum carpet quite extensive with frequent Kurzia pauciflora. Wetter hollows and runnels have Drosera rotundifolia and often D. intermedia, Rhynchospora alba and locally R. fusca as sub-community preferentials.

Sphagnum carpet often very patchy and sometimes absent and M16c associates hardly ever found.

Very variable mixtures of Calluna vulgaris, Erica tetralix and Molinia caerulea generally dominate with occasional Scirpus cespitosus and Juncus squarrosus. Other associates listed for M16d rare.

Typical sub-community

All variations in the proportions of Molinia caerulea, Erica tetralix and Calluna vulgaris can be found in this sub-community so the appearance is very diverse. Where their cover is open, Sphagnum compactum and S. tenellum can be very frequent and often abundant. A mong other bryophytes Hypnum cupressiforme, Dicranum scoparium, Racomitrium lanuginosum and Diplophyllum albicans all common. Cladonia species often present.

This is the usual sub-community in the north and east of Britain.
This community is dominated by mixtures of monocotyledons, ericoid sub-shrubs and Sphagnum spp. It can occur as extensive, relatively uniform tracts, or as hummock and hollow complexes, with this community giving way to bog pool vegetation in the hollows. Among the bulkier vascular species, the most common are Scirpus cespitosus, Eriophorum vaginatum, Molinia caerulea, Calluna vulgaris and Erica tetralix; mixtures of which form a rather open uneven-topped tier which is 20-30 cm tall. Myrica gale also has occasional local abundance in this stratum.

Eriophorum angustifolium and Narthecium ossifragum are both very frequent and Drosera rotundifolia is very common in wetter areas. Potentilla erecta is a constant which helps to distinguish this community from other Sphagnetalia mires (M18-M21). Other species found at low frequencies throughout are Pedicularis sylvatica, Huperzia selago, Juncus acutiflorus, Festuca ovina and Carex echinata. Vaccinium myrtillus, Empetrum nigrum ssp. nigrum and Rubus chamaemorus are all scarce, in contrast to Calluna vulgaris-Eriophorum vaginatum blanket mire (M19).

Sphagnum spp. are an important component of the ground layer. Sphagnum capillifolium and S. papillosum are constants and may be accompanied by S. tenellum, S. subnitens and other species, forming luxuriant carpets. Such carpets typically have a variety of leafy hepatics including Odontoschisma sphagni, Mylia anomala, M. taylori and Pleurozia purpurea. Racomitrium lanuginosum is a common moss throughout, but becomes abundant on hummock tops and in degraded mires. Lichens, particularly larger Cladonia species, can be prominent and tend to be associated with R. lanuginosum.

This community is the characteristic blanket bog vegetation of the more oceanic parts of Britain, occurring extensively on waterlogged ombrogenous peat. The peats show varying humification but are typically highly acidic, with a surface pH usually not above 4 and often less. It is a community of lower altitudes where extreme humidity is combined with a relatively mild winter climate. It is largely confined to western Britain from the western Highlands of Scotland and the Western Isles, to south-west Scotland, the Lake District, Wales and south-west England.

Burning, marginal peat-cutting, and drainage have often resulted in surface drying of the peat and hence a modification of the vegetation. It is also possible that natural climatic change too has played a part in the degeneration of the blanket bogs occupied by this type of community. However, this community still remains as climax vegetation in the more oceanic parts of Britain.
The usual vascular dominants are Calluna vulgaris and Scirpus cespitosus, with Erica tetralix and Molinia caerulea of reduced importance and Myrica gale rare. Drosera rotundifolia at most occasional. Sphagnum cover rather impoverished and leafy hepatics infrequent.

Racomitrium lanuginosum very common with several Cladonia species. Erica cinerea occasional and locally abundant. Vaccinium myrtillus and Empetrum nigrum very scarce. Nardus stricta and Juncus squarrosus occasional. Myrica gale is absent and Erica cinerea very scarce. There is a marked increase in Juncus squarrosus, Nardus stricta, Deschampsia flexuosa and Carex nigra, and with them Agrostis canina ssp. canina, Anthoxanthum odoratum and Luzula multiflora can be found. Of the Sphagnum spp., Sphagnum papillosum is usually the most abundant. There is a distinctive contingent of mosses: Hyphnum cupressiforme/jutlandicum, Rhytiadiadelphus loreus and Dicranum scoparium are all very frequent, while Polytrichum commune, P. alpestris, Plagiothecium undulatum, Aulacomnium palustre, Ptilidium ciliare, Pohlia nutans and Campylopus paradoxus are more occasional but preferential.

This sub-community along with the Cladonia sub-community occurs in the west but they extend the range of the community on to drier peats, most notably in south-west and eastern Scotland.
This community is generally dominated by Sphagnum spp. Ericoid sub-shrubs and monocotyledons are often subordinate. It can be found as undulating carpets or can comprise lawn and hummock components. The bulkier vascular plants typically form a low, patchy canopy with Calluna vulgaris, Erica tetralix and Eriophorum vaginatum being the commonest species and Scirpus cespitosus slightly less frequent. Erica tetralix tends to predominate on wetter ground where shoots of Eriophorum angustifolium can also be abundant. Calluna, Scirpus and E. vaginatum are found more typically on the drier areas.

Sphagnum spp. make up the most important component of the vegetation. Both Sphagnum papillosum and S. capillifolium are very common and S. tenellum is also a constant but less abundant. Sphagnum magellanicum is a preferential species and a major peat-builder. S. imbricatum is a distinctive species where present. Over gently-undulating surfaces the Sphagnum spp. form an irregular patchwork, but with increasing differentiation of hummocks and hollows they show a vertical stratification. On hummock tops and sides S. capillifolium is abundant, and S. papillosum, S. magellanicum, and a little S. tenellum predominate on the surrounds to wetter depressions.

Other bryophytes are generally subordinate but can be frequent and locally abundant. The leafy hepatics Odontoschisma sphagni and Mylia anomala are both common, but Pleurozia purpurea is generally absent. Aulacomnium palustre and Hypnum cupressiforme/jutlandicum are frequent mosses.

This vegetation is characteristic of waterlogged ombrogenous peats, typically at low altitudes in moderately oceanic parts of Britain. It is characteristic of raised bogs where it is the main community of the active plane, but is also found within blanket mires and in some basin mires on acid peat. The peats it covers are usually deep with a uniformly acid surface with a pH of about 4, and oligotrophic. It is widespread but local through the lowlands of Wales, up to the Scottish Borders and in south-west Scotland. There are also localities in southern England and east Scotland.

Erica tetralix – Sphagnum papillosum raised and blanket mire vegetation is a climax of a hydroseral succession. However, the typical habitat of this community has been widely affected by various treatments, notably peat-cutting, burning and grazing, and these have often modified the vegetation or reduced it to fragmentary stands.
M18

Sphagnum spp. luxuriant, with Sphagnum magellanicum frequent and abundant, along with S. papillosum in wetter lawns. Narthecium ossifragum and Drosera rotundifolia common and Vaccinium oxycoccos and Andromeda polifolia especially distinctive.

M18a

Sphagnum magellanicum - Andromeda polifolia sub-community

All the community vascular constants are of high frequency but very often none is dominant. Sphagnum spp. form an obvious and extensive carpet in which Sphagnum papillosum, often with abundant S. magellanicum, predominates along with the constants S. tenellum and S. capillifolium. Scattered through are frequent individuals of Drosera rotundifolia and Narthecium ossifragum with the preferentials Vaccinium oxycoccos and Andromeda polifolia. Cladonia spp. and Pleurozium schreberi are typically of low frequency. This sub-community occurs throughout the range of M18.

M18b

Empetrum nigrum ssp. nigrum - Cladonia spp. sub-community

Calluna vulgaris, Scirpus cespitosus and Eriophorum vaginatum tend to have higher covers here, Calluna vulgaris in particular becoming more vigorous and abundant. Empetrum nigrum is also frequent among them. Among the Sphagnum spp., S. capillifolium is strongly dominant, although S. papillosum is still frequent. S. tenellum is patchy and S. magellanicum only occasional. Other mosses become frequent, with Pleurozium schreberi and Rhytididiadelphus luteus being good preferentials; a range of hepatics is also common. There is a marked increase in Cladonia spp., notably Cladonia impexa, C. uncialis and C. arbuscula, each of which can be locally abundant. This sub-community occurs throughout the range of M18.
This vegetation is generally dominated by mixtures of Eriophorum vaginatum and ericoid sub-shrubs. Sphagnum spp. can be prominent over wetter ground but are not as luxuriant or rich as in Scirpus cespitosus – Eriophorum vaginatum blanket mire (M17) or Erica tetralix – Sphagnum papillosum raised and blanket mire (M18). The ground surface is often uneven, but does not show true hummock and hollow relief. Eriophorum vaginatum is abundant and at least co-dominant. Normally this community has very frequent occurrences of Calluna vulgaris, Vaccinium myrtillus and Empetrum nigrum ssp. nigrum and, at higher altitudes, V. vitis-idaea, V. uliginosum and E. nigrum ssp. hermaphroditum. Overall Calluna is the most common co-dominant along with Eriophorum vaginatum, but diverse mixtures of these sub-shrubs are very frequent. Vascular associates are few, the commonest being Eriophorum angustifolium, and Rubus chamaemorus, a species which is distinctive for this community. Deschampsia flexuosa and Juncus squarrosus occur occasionally throughout, and at higher altitudes Carex bigelovii becomes frequent.

In contrast to the vascular plants, the bryophyte flora is rich, often with a cover exceeding 50%. The most frequent Sphagnum species is S. capillifolium, which forms patches rather than carpets. Hypnaceous mosses are consistently present and Pleurozium schreberi, Rhytidiodaphus loreus, Hypnum cupressiforme/jutlandicum and Plagiothecium undulatum are all very frequent. Hylocomium splendens is common at higher altitudes.

A variety of leafy hepatics occur in this community and lichens are frequent. Larger Cladonia spp. can be abundant on old Eriophorum hummocks.

This mire is the typical blanket bog vegetation of high-altitude ombrogenous peats present in the wet and cold climate of the uplands of northern Britain. In particular, it occurs on high-level plateaux and broad watersheds, usually above 300 m, and is confined to deeper peats, usually more than 2 m thick, on flat or gently-sloping ground. The peats are usually well-humified, highly acidic with a surface pH often less than 4. They are not consistently waterlogged and may become surface oxidised in summer. Erosion of the peat is common. This community is found on the higher ground in the Pennines, the central Highlands of Scotland, and Wales.

Treatments such as burning and grazing are important in influencing the composition and structure of the vegetation throughout the range of this community, in particular where stands form part of unenclosed hill grazing or grouse moors. A stable diversity of bog vegetation can be maintained by careful burning on a rotation of around 10 years, or by moderate levels of grazing. However, frequent burning or heavy grazing contribute to the conversion of the Calluna vulgaris – Eriophorum vaginatum blanket mire to Eriophorum vaginatum blanket mire (M20). In other cases drainage can convert this community into heathland or grassland, and this type of blanket mire has been reclaimed for agriculture or forestry in many areas.
Eriophorum vaginatum usually abundant and Rubus chamaemorus frequent. Scirpus cespitosus rare and Sphagnum cover patchy.

Empetrum nigrum ssp. nigrum occasional at most and often with ssp. nigrum as a replacement. Vaccinium vitis-idaea also occasional and V. uliginosum, Juncus squarrosus and Carex bigelowii rare. Bryophytes in M19c rare.

Vaccinium vitis-idaea – Hylocomium splendens sub-community
This embraces all the high-montane blanket mire. It preserves all the general floristic features but is distinctive in the frequent and consistent presence of Vaccinium vitis-idaea and Empetrum nigrum ssp. hermaphroditum and the more restricted presence of V. uliginosum. These are mixed with other subshrubs and usually with abundant Calluna vulgaris. Eriophorum angustifolium is less common, but Rubus chamaemorus is very frequent. Juncus squarrosus occurs quite often, as do Carex bigelowii and Scirpus cespitosus. Sphagnum spp. can be quite prominent, with a range of other bryophytes including the hepatic Ptilidium ciliare. The lichen flora is usually well developed.
This sub-community extends to the altitudinal limit of this kind of blanket bog in central Scotland.
Three variants.
Eriophorum vaginatum mire comprises species-poor ombrogenous bog vegetation dominated by E. vaginatum, the tussocks of which form an open or closed canopy 10-30 cm high. The only other constant plant is E. angustifolium, which is usually found as scattered shoots. Ericoid sub-shrubs are patchy; Calluna vulgaris, Empetrum nigrum ssp. nigrum and Vaccinium myrtillus can each be found quite frequently and the last two may be locally abundant. Alternatively these species may be reduced to sparse shoots. Deschampsia flexuosa is fairly common while Festuca ovina, Juncus squarrosus, Scirpus cespitosus and Carex bigelowii are all infrequent.

Bryophytes are sparse and patchy. Sphagnum spp. are scarce with Sphagnum capillifolium and S. papillosum the most usual species. Hypnaceous mosses are poorly represented; the only moss of any frequency being Campylopus paradoxus which can be accompanied by Dicranum scoparium. There may be occasional shoots of Orthodontium lineare, Pohlia nutans and Drepanocladius fluitans. A variety of leafy hepatics may be present. Lichens are typically few in number.

This community is characteristic of ombrogenous peats on bogs where certain treatments have greatly affected the vegetation; grazing and burning have been of greatest significance, but draining and aerial pollution have also played a part. It is commonest on blanket mires, where these factors have contributed both to floristic impoverishment and to gross erosion of the peats, but is also found locally on run-down raised bogs. The Eriophorum mire is present mainly between 500 m and 700 m where the climate is cold and wet. The peats are generally dry, often showing surface oxidation and with a pH frequently as low as 3. This community can be found locally through northern Britain, and is especially extensive in the southern Pennines. This community has been seen to revert to the vegetation characteristic of the richer blanket bog community Calluna vulgaris - Eriophorum vaginatum mire (M19) within 25 years of enclosure and freedom from burning, but in many instances, particularly if intensive grazing or frequent burning have been accompanied by drainage, the degeneration of the vegetation is perhaps irreversible.
This mire vegetation is dominated by carpets of Sphagnum spp. with scattered herbs and sub-shrubs forming extensive lawns or the drier parts of hummock and hollow complexes. The dominant Sphagnum is usually S. papillosum. Sphagnum auriculatum or S. recurvum (and occasionally both) are frequently encountered and less often S. cuspidatum. Locally, S. magellanicum and S. pulchrum may be present. Sphagnum compactum is almost always absent in contrast with Erica tetralix – Sphagnum compactum wet heath (M16). Only a few other mosses occur and they are generally of low cover, but leafy hepatics are common. Odontoschisma sphagni and Kurzia pauciflora are most common, but Cladopodiella fluitans, Cephalozia macrostachya, C. connivens, C. bicuspidata and Calypogeia fissa have also been recorded. Lichens are typically sparse, but hummock tops can be a habitat for Cladonia impexa, C. arbuscula and C. uncialis.

The vascular plant species present provide the major distinction between this community and other types of Erica – Sphagnum bogs (M17-M20). Eriophorum vaginatum and Scirpus cespitosus are rare, but Eriophorum angustifolium and Narthecium ossifragum are constant and often abundant. Molinia caerulea is typical, but is often weak and not tussock-forming, and Rhynchospora alba is characteristic of one sub-community, being most prominent around hollows and pools. The sub-shrubs Erica tetralix and Calluna vulgaris are very frequent, forming an open canopy. More restricted but conspicuous when present is Myrica gale. Other plants are generally present as scattered individuals, Drosera rotundifolia being the most frequent.

This is a community of permanently waterlogged, acid and oligotrophic peats, especially characteristic of valley mires maintained by a locally high water table. The peat on which this community is found is usually not very deep (20-150 cm) with a surface pH mostly in the range of 3.5-4.5, and a water table at or very close to the surface. It is found locally in the southern lowlands of Britain.

Neither burning nor grazing are important in maintaining this community, as the wetness of the vegetation gives it some protection from these treatments, but both can cause damage if combined with drainage. With continued autogenic accumulation of peat, it would probably progress naturally to some kind of woodland but this process is likely to be very slow in the absence of drainage.
M22 Juncus subnodulosus – Cirsium palustre fen-meadow

This community shows considerable variation in its floristic composition which often reflects a unique and complex history of mowing and grazing management. The most prominent structural element typically consists of rushes and sedges of moderate stature, appearing as a rank sward if it is not grazed. Juncus subnodulosus is the most important of the bulkier species and the most usual dominant. Juncus inflexus and J. articulatus are the commonest accompanying rushes. Of the sedges, the most striking are Carex acutiformis and C. disticha, either of which can be frequent or occasionally dominant. Much more occasionally C. elata or C. paniculata can occur. In summer this rush and sedge layer can be overtopped by flowering dicotyledons. The most frequent of these throughout the community are Cirsium palustre, Filipendula ulmaria, Angelica sylvestris, Eupatorium cannabinum and Scrophularia aquatica. More locally Lythrum salicaria, Lysimachia vulgaris, Valeriana officinalis, Thalictrum flavum and Symphytum officinale can be found, and, in Broadland, the nationally rare Peucedanum palustre. However, grazing may keep these species severely in check.

Among smaller species, grasses are important, and species found include Holcus lanatus, Festuca rubra and, less commonly, Arrhenatherum elatius, together with Poa trivialis, Agrostis stolonifera, Anthoxanthum odoratum and Briza media. Smaller herbs are those characteristic of moist grasslands, the commonest being Mentha aquatica, Caltha palustris, Equisetum palustre, Carex panicea, Valeriana dioica, Hypericum tetragonum, Hydrocotyle vulgaris, Lotus uliginosus, Lychnis flos-cuculi, Cardamine pratensis, Ranunculus acris, Potentilla erecta, Cerastium fontanum, and Rumex acetosa, with several scrambling plants including Galium uliginosum, G. palustre, Vicia cracca and Lathyris pratensis. Bryophytes play a reduced role with only Calliergon cuspidatum and Brachythecium rutabulum being common throughout.

This community brings together secondary herbaceous vegetation developed over a variety of moist, base-rich and moderately mesotrophic peats in southern lowland Britain. It can be found either in, or around, well-developed springs, flushes and mires, or marking out more ill-defined areas of influence of surface or ground waters. This community marks out soils which are kept moist for most of the year and have a moderate to high base-status, and usually a pH range of 6.5-7.5. The community has a wide distribution through the southern British lowlands with particular concentrations of stands in East Anglia, north Buckinghamshire and Anglesey.

This community is always dependent on various kinds of treatment for its maintenance, as it is derived from other wetland vegetation types by mowing or grazing, or both. The reduction in grazing results in the expansion of bulky dominants and ranker grasses and the overwhelming of the smaller herbs. Its overall distribution and the extent of the stands has become much less than formerly because of intensive land improvement and abandonment of traditional agricultural practices.
Phragmites australis and Hydrocotyle vulgaris frequent, with Carex acutiformis or C. elata common, sometimes abundant.

M22c

Carex elata constant and sometimes abundant among Juncus subnodulosus, with frequent Potentilla palustris, Eriophorum palustre, Equisetum fluviatile and Dactylorhiza incarnata.

Juncus subnodulosus usually dominant with little or no Carex elata, but with frequent and sometimes abundant C. acutiformis. Galium palustre common but other associates listed opposite rare.

M22d

Iris pseudacorus sub-community

Juncus subnodulosus usually dominant in rather rank and impoverished vegetation with bulkier grasses abundant. Molinia caerulea and dicotyledons listed opposite infrequent at most.

M22a

Typical sub-community

In this, the most common kind of fen-meadow, there are no preferential floristic features and the general impression is of rank structure and impoverishment. Juncus subnodulosus is frequent and the commonest dominant. The commonest associates are bulkier grasses such as Holcus lanatus, Festuca rubra, sometimes Molinia caerulea, mat-formers such as Agrostis stolonifera and Poa trivialis, and tall er dicotyledons such as Cirsium palustre, Filipendula ulmaria, Angelica sylvestris and Succisa pratensis are all common and Iris pseudacorus, Ranunculus flammula, Valeriana officinalis, Lysimachia vulgaris and Thalictrum flavum are all frequent. This and the Carex sub-community are especially well-represented on topogenous mires in East Anglia.

M22b

Briza media - Trifolium spp. sub-community

In comparison to M22a, in this sub-community the rush and sedge tier has a lower cover and density and there is a richer associated flora. Taller dicotyledons such as Cirsium palustre, Filipendula ulmaria, Angelica sylvestris, Eupatorium cannabinum and Succisa pratensis show an increased frequency and often occur with Centaurea nigra and Rumex acetosa. The lower sward is particularly rich. There is a range of grasses, often with Carex panicea and occasionally C. nigra and C. flacca. There is a variety of other herbs; most frequent are Lotus uliginosus, Lychnis flos-cuculi, Caltha palustris, Ranunculus acris, Valeriana dioica, Potentilla erecta, P. anserina and Hypericum tetrapterum which are characteristic of M22 as a whole. Strongly preferential are the species listed above together with Prunella vulgaris, Ranunculus repens, Triglochin palustris, Rhinanthus minor and Dactylorhiza fuchsii. Phragmites australis is generally scarce. This sub-community is most frequently developed around grazed spring-fens and wet field hollows and occurs through the range of M22.
This vegetation is ill-defined and characterised by the abundance of either Juncus effusus or J. acutiflorus, sometimes both, in a ground of mesophytic herbs common in moist agricultural grassland. The rushes often have a high cover but they may also be more sparse. Juncus effusus is more abundant in the east, while J. acutiflorus has a distinctly western distribution. Diversity in dominants is not great but the associates are quite diverse, making the bounds of this vegetation type hard to fix. Sometimes J. articulatus may be locally frequent and abundant. Holcus lanatus is the most frequent grass, but Agrostis canina ssp. canina, A. stolonifera, Anthoxanthum odoratum and Poa trivialis are also common in drier stands. Festuca rubra and Agrostis capillaris may also become frequent. Molinia caerulea is increasingly common and abundant towards the west and there may be some sedges in the sward. There is a variety of common herbs. Among the taller species Cirsium palustre is the commonest, Rumex acetosa, Angelica sylvestris and Epilobium palustre are frequent, and two sprawling species Galium palustre and Lotus uliginosus are constant. Frequent smaller species are Mentha aquatica, Ranunculus flammula, R. repens, R. acris, Cardamine pratensis, Hydrocotyle vulgaris, Viola palustris, and Stellaria alsine.

Bryophytes are variable in their cover. Where the vegetation is open they may be abundant. Calliergon cuspidatum is the most frequent, often occurring with Brachythecium rutabulum and Rhytidium squarrosus.

This rush-pasture occurs over a variety of moist, moderately acid to neutral, peaty and mineral soils in the cool and rainy lowlands of western Britain. It is a community of gently-sloping ground around the margins of soligenous flushes, as a zone around topogenous mires and wet heaths, and especially widespread in ill-drained, comparatively unimproved or reverted pasture. It can be found on a variety of moderately acid to neutral soils that are kept moist to wet for most of the year with a pH in the range of 4-6. It is found at the opposite climatic and edaphic extreme to the Juncus subnodulosus – Cirsium palustre fen meadow (M22) with a distinctly oceanic distribution. The community is wide-spread through the west of Britain from Devon and Cornwall to Skye and Caithness.

This community is maintained mainly by grazing and more occasionally mowing which prevents the succession of the community to woodland. Draining and other kinds of soil improvements such as fertilising and reseeding have reduced its former extent.
M23

Juncus effusus very common, but exceeded by J. acutiflorus, with Molinia caerulea and Holcus lanatus frequent and sometimes abundant. Filipendula ulmaria occasional, also some of Ranunculus acris, Potentilla erecta, Achillea ptarmica and Equisetum palustre and locally prominent tall-fen herbs such as Lythrum salicaria and Iris pseudacorus.

M23a

Juncus acutiflorus sub-community

Juncus acutiflorus and J. effusus are both constant, J. articulatus is locally prominent and J. conglomeratus is occasional. The commonest grasses are Holcus lanatus and, preferential here, Molinia caerulea. Community herbs such as Cirsium palustre, Rumex acetosa and Angelica sylvestris remain frequent with Galium palustre and Lotus uliginosus. Filipendula ulmaria is more common than in M23b and there may be an abundance of taller herbs. In the lower tier of vegetation, Mentha aquatica, Cardamine pratensis, Ranunculus flammula and R. repens are frequent with at least some of the herbs listed above. This, the more sharply-defined sub-community, prevails in Scotland and is common in Wales.

M23b

Juncus effusus sub-community

Juncus effusus constant and usually dominant, with J. acutiflorus scarce. Holcus lanatus common, but Molinia caerulea and dicotyledons listed opposite all scarce.

This sub-community is less well-defined and is essentially a transition between M23a and the Holcus lanatus - Juncus effusus rush-pasture (MG10). Other rushes comprise Juncus articulatus and J. conglomeratus, but J. inflexus, common in MG10, is absent. Molinia caerulea is infrequent, but grasses are important in the sward. Where the community is surrounded by improved pasture, as is common, Cynosurus cristatus and Lolium perenne can be present at low cover. Good distinguishing features are the high frequencies of Galium palustre, Cirsium palustre, Ranunculus flammula and Mentha aquatica.

This is the typical sub-community of the South-West Peninsula, but is also found through the range of M23.
This community includes the bulk of the Molinia caerulea vegetation in the lowland south-east of Britain. Molinia is always the dominant to the extent that associates may be reduced to scattered individuals of only a few species. Often however there are a considerable number of associates. In structural terms the most important species are other monocotyledons. Through most of the central and eastern part of the range where this community is often found in association with fens, Juncus subnodulosus is the characteristic rush with J. articulatus and J. inflexus sometimes also present. To the south and west where the community often develops among heath vegetation, J. acutiflorus and J. conglomeratus become frequent.

The associated flora of dicotyledons helps to distinguish this community, although it is often difficult to separate it from Juncus subnodulosus – Cirsium palustre fen meadow (M22) and Juncus effusus/acutiflorus - Galium palustre rush pasture (M23) when these contain Molinia. Cirsium palustre and Angelica sylvestris are both very frequent and Filipendula ulmaria and Centaurea nigra can also be common. More strictly limited are Valeriana dioica, Succisa pratensis, and Cirsium dissectum, although only the last species is preferential. Other common species of wide occurrence are Potentilla erecta, Lotus uliginosus, Mentha aquatica, Prunella vulgaris, Ranunculus acris, Hydrocotyle vulgaris, and the scramblers Vicia cracca and Lathyrus pratensis.

Coarser grasses are often prominent, with Holcus lanatus and Anthoxanthum odoratum most frequent and Festuca rubra, Deschampsia cespitosa and Agrostis stolonifera less common, though sometimes abundant. There can also be some sedges present, the most common being smaller species such as Carex panicea, which is a community constant, and less frequent C. hostiana and C. pubescens. Bryophytes are generally few and of low cover.

This is a community of moist to fairly dry peats and peaty mineral soils which are circumneutral, generally having a pH within the range 5-6.5. It can be found in association with both soligenous and topogenous mires, typically marking out the better-drained fringes of bogs and fens, or the margins of wet hollows and flushes. This community is widespread through the lowland south of Britain but has become increasingly local with changes in agricultural practice.

Although climate and soil together both influence the floristics of this community it is essentially a secondary vegetation type, derived from a variety of wetland vegetation types and maintained by mowing or grazing. In the absence of any kind of treatment all the stands of the community would probably progress to scrub or woodland. It has been reduced in extent by agricultural reclamation. Other stands have become rank and scrubby with neglect.
M24

Molinia caerulea generally dominant with Juncus subnodulosus common and frequent records for some of Valeriana dioica, Galium uliginosum, Centaurea nigra, Vicia cracca, Filipendula ulmaria and Equisetum palustre.

Phragmites australis constant, Cladium mariscus quite common, both typically subordinate in cover to Molinia caerulea. Eupatorium cannabinum and Lythrum salicaria frequent.

Eupatorium cannabinum sub-community

One of the most conspicuous species here, even when sparse, is Phragmites australis. The best single preferential is Eupatorium cannabinum which provides continuity with tall-herb fen; less common are Lythrum salicaria and Lysimachia vulgaris. Cirsium palustre, Angelica sylvestris and Filipendula ulmaria are also common and, as reed or sedge cover becomes thinner, plants such as Succisa pratensis, Cirsium dissectum, Centaurea nigra and Equisetum palustre increase in frequency. Bryophytes can be more conspicuous in this sub-community, but species are only few, with Campylium stellatum joining Calliergon cuspidatum and Brachythecium rutabulum as a distinctive preferential. This sub-community is mainly confined to East Anglia.

M24a

Eupatorium cannabinum and Phragmites australis only occasional. Cladium mariscus and Lythrum salicaria usually absent.

Typical sub-community

Molinia caerulea is often found with smaller amounts of Juncus subnodulosus or J. articulatus. Smaller grasses are well represented; Holcus lanatus and Anthoxanthum odoratum are frequent and Briza media is strongly preferential. Sedges are common with Carex panicea and C. hostiana showing a peak of occurrence, C. palustris being especially frequent and C. nigra preferential and sometimes in abundance. Succisa pratensis, Cirsium dissectum, C. palustris and Angelica sylvestris are all very common together with the species listed above. Sub-shrubs are typically sparse and bryophytes are poorly represented. This is the most common sub-community in central and eastern England.

M24b

M24c

Juncus acutiflorus absent, but J. conglomeratus common, J. effusus occasional. Species listed opposite all scarce but Erica tetralix, Calluna vulgaris, Galium palustre and Dactylorhiza maculata frequent.

Molinia caerulea generally dominant with Juncus subnodulosus common and frequent records for some of Valeriana dioica, Galium uliginosum, Centaurea nigra, Vicia cracca, Filipendula ulmaria and Equisetum palustre.

Juncus acutiflorus – Erica tetralix sub-community

Rushes are a common feature, most usually Juncus acutiflorus and J. conglomeratus. There is frequently some Erica tetralix, less often Calluna vulgaris and Ulex gallii, so that the vegetation looks more like a heath. However Holcus lanatus, Anthoxanthum odorum, less often Festuca rubra and Agrostis stolonifera are intermixed with Molinia caerulea with frequent Carex panicea and a range of small herbs. Valeriana dioica, Centaurea nigra and Filipendula ulmaria and the tall-fen herbs of M24a are not represented. Bryophytes are not conspicuous, though a number of species have been recorded. This is the most usual type of M24 in south-western Britain.

M24b

Typical sub-community

Molinia caerulea is often found with smaller amounts of Juncus subnodulosus or J. articulatus. Smaller grasses are well represented; Holcus lanatus and Anthoxanthum odoratum are frequent and Briza media is strongly preferential. Sedges are common with Carex panicea and C. hostiana showing a peak of occurrence, C. palustris being especially frequent and C. nigra preferential and sometimes in abundance. Succisa pratensis, Cirsium dissectum, C. palustris and Angelica sylvestris are all very common together with the species listed above. Sub-shrubs are typically sparse and bryophytes are poorly represented. This is the most common sub-community in central and eastern England.
M.25 Molinia caerulea – Potentilla erecta mire

Molinia caerulea is the most abundant species found in this community. The associated flora is poor, and most common are rushes and a few dicotyledons. Among the former, Juncus acutiflorus and J. effusus are the most frequent. Juncus articulatus and J. subnodulosus are both occasional, and J. conglomeratus is very scarce. The only constant dicotyledon is Potentilla erecta. Lotus uliginosus, Succisa pratensis, Cirsium palustre and Angelica sylvestris are sparse and occasionally there can be some Eupatorium cannabinum or Filipendula ulmaria. Cirsium dissectum is very rare and its presence separates the Molinia caerulea – Cirsium dissectum mire (M24) from this community. Also, since the soil pH is generally acidic, plants such as Carex hostiana, C. pulicaris and Briza media, frequent in M24, are of very limited occurrence here. Occasionally subshrubs can be quite common, particularly Calluna vulgaris and Erica tetralix. Ulex gallii can also be occasional in Wales and south-west England, and U. europaea occurs in some stands. Myrica gale is local but can be quite extensive and dense. Grasses are limited in importance but Agrostis canina and A. stolonifera can be found at low frequency throughout and Holcus lanatus is fairly common. Among the dense herbage, bryophytes are sparse.

This mire is a community of moist, but well-aerated, acid to neutral peats and peaty mineral soils in the wet and cool western lowlands of Britain. It occurs over gently-sloping ground, marking out seepage zones and flushed margins of sluggish streams, water-tracks and topogenous mires, but also extends onto the fringes of ombrogenous mires. Soil and drainage conditions of this community have similarities to those of M23 and M24 and geographically this community can be seen as a northern/western replacement of M24. It is especially frequent in south-west England, Wales, and southern Scotland.

Although both climate and soils influence the composition of the vegetation, treatments such as burning, grazing and drainage are likely to be largely responsible for the development of this community over ground that would naturally carry some other kind of mire or wet heath vegetation. Tracts of this community have been replaced by coniferous plantations, particularly in the upland fringes of the north-west. Elsewhere in the lowlands, other tracts of the community together with neighbouring vegetation have been lost to agricultural improvements.
**M25c**

*Angelica sylvestris sub-community*

This is the most local sub-community, but also the most striking sub-community, developed on moist ground with freedom from grazing. Molinia caerulea is vigorous, but variegated by clumps of *Juncus acutiflorus* and *J. effusus*. Taller dicotyledons are common: *Succisa pratensis* and *Lotus uliginosus* are notable together with the preferential species listed above and also *Pulicaria dysenterica*, *Valeriana officinalis* and *Centaurea nigra*. Shorter species include *Mentha aquatica*, *Cardamine pratensis* and *Equisetum palustre* with frequent *Galium palustre*. Bryophytes are again sparse but *Calliergon cuspidatum* and *C. giganteum* form scattered patches. This sub-community is found mainly in south-west England and south-west Wales.

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**M25a**

*Erica tetralix sub-community*

This is the widely distributed type of M25. *Molinia caerulea* is the dominant but the associated flora is shifted towards that of *Erica tetralix* wet heaths (M15-16). *Erica tetralix* is strongly preferential, with frequent *Calluna vulgaris*, *Juncus acutiflorus* remains common but is joined by *Eriophorum angustifolium*. Apart from sparse *Anthoxanthum odoratum*, *Festuca rubra* and *Agrostis canina*, grasses are thin and taller herbs are poorly represented. Among smaller plants, *Viola palustris* and *Hydrocotyle vulgaris* are sometimes present, but with occasional *Narthecium ossifragum*, *Drosera rotundifolia* and *Vaccinium oxyccos*. *Sphagnum spp.* are noticeable, forming patches; *Sphagnum recurvum* and *S. auri culatum* are the commonest species. This sub-community can be found throughout the range of M25.

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**M25b**

*Anthoxanthum odoratum sub-community*

Although *Molinia caerulea* is still dominant, the sward is shorter and more varied. Apart from the rushes and grasses mentioned above other associates can be sparse. *Calluna vulgaris* and *Ulex gallii*are occasional, as are *U. europaeus* and *Rubus fruticosus*. *Erica tetralix* and *Myrica gale* are very uncommon. *Succisa pratensis*, *Lotus uliginosus* and *Cirsium palustre* are all more frequent than in M25a and *Serratula tinctoria* and *Rumex acetosa* are weakly preferential, but all tend to be grazed to rosettes. Smaller herbs and bryophytes are poorly represented. This sub-community is scattered throughout the range of M25 but is particularly frequent in Wales.

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**M25**

*Species listed opposite usually all occasional but tall herbs prominent among Molinia caerulea and rush dumps, with frequent Angelica sylvestris and Cirsium palustre. Epilobium palustre, Eupatorium cannabinum, Filipendula ulmaria, Galium palustre and Mentha aquatica are occasional. Schoenus nigricans can be locally abundant.*
This community is well-defined by a block of constants and frequent companions but also shows considerable variation in associated flora. Stands range from swamp to those having a rank, grassy character. Molinia caerulea is almost always present, being the commonest dominant. Carex nigra is also a constant, often as prominent tufts which can exceed Molinia in cover. Carex panicea can be abundant and C. pulicaris is common. In stands transitional to swamp, C. appropinquata or C. rostrata are present. In the Festuca sub-community, by contrast, it is taller rushes and grasses which, with Molinia, form the bulk of the cover. Juncus acutiflorus may form dense patches and J. conglomeratus and J. articulatus both occur occasionally.

Hemicryptophyte dicotyledons are an important structural element among the Molinia, sedges and rushes. Most frequent are Succisa pratensis, Filipendula ulmaria, Valeriana dioica, Cirsium palustre and Caltha palustris together with the northern species Crepis paludosa and Trollius europaeus. Also common are Sanguisorba officinalis, Angelica sylvestris, Centaurea nigra, Leonotodon hispidus, Geum rivale and Lychnis flos-cuculi. Less conspicuous, but also frequent, is Equisetum palustre. Potentilla erecta, Ranunculus acris, and Anemone nemorosa are common. Bryophytes are only prominent in exceptional cases, with Calliergon cuspidatum most frequent.

This is a very local community of moist, moderately base-rich and calcareous peats and peaty mineral soils in the sub-montane northern Pennines. It represents a northern and altitudinal extreme of the richer kind of Molinia – tall herb vegetation. Stands are rare but all occur around the northern Pennine uplands and the Lake District between 250 m and 450 m altitude.

This community is an apparently stable component of topogenous sequences around open waters and mires, but where it occurs on flushed slopes, grazing often maintains the community and prevents progression of the community to scrub or woodland. Drainage and sward improvement have probably destroyed many smaller stands of this community and contributed to its very local distribution.
Molinia caerulea and Carex nigra both abundant, with locally prominent C. appropinquata or C. rostrata. Sanguisorba officinalis, Angelica sylvestris, Serratula tinctoria, Galium palustre and G. uliginosum all frequent; bryophytes patchy.

Sanguisorba officinalis sub-community
This is generally the less species-rich sub-community. Molinia caerulea and Carex nigra are usually the most abundant plants, with one or both dominant in a swamp vegetation with large sedges as above. Smaller sedges can also occur, Carex panicea and C. pulicaris being common. Apart from Agrostis stolonifera, grasses are poorly represented and among small herbs only Potentilla erecta, Ranunculus acris and Anemone nemorosa occur with any frequency. The most common tall herbs are listed above. Bryophytes are patchy but better-developed than in M26b. Calliergon cuspidatum, Lophocolea bidentata s.l., Thuidium tamariscinum and Campylium stellatum are frequent, with Ctenidium molluscum, Plagiocoma asplenioides, Campylium elodes and Aulacomnium palustre being preferential.
This sub-community is found most extensively at Sunbiggin and Malham Tarns.

Carex nigra often subordinate to Molinia caerulea in more grassy or rushy vegetation, with frequent and abundant Festuca rubra, F. ovina, Holcus lanatus, Briza media, Deschampsia cespitosa, Anthoxanthum odoratum, Juncus acutiflorus and J. conglomeratus; associates listed opposite all occasional.

Festuca rubra sub-community
This sub-community appears more grassy and is usually developed on drier soils. Molinia caerulea is the usual dominant, forming the bulk of a rough sward together with the grasses listed above. Sedges are also common; Carex nigra and C. panicea can both show high cover and C. flacca and C. pulicaris can be frequent. Rushes are also common; Juncus acutiflorus and J. conglomeratus are preferential and J. articulatus also occurs. Taller dicotyledons remain frequent, although Sanguisorba officinalis, Angelica sylvestris and Serratula tinctoria are all scarce. Geum rivale, Centaurea nigra and Leontodon hispidus are more common than in M26a. In shorter swards, Prunella vulgaris, Plantago lanceolata and Trifolium repens can be found. Bryophytes are often poorly represented, but Calliergon cuspidatum, Pseudoscleropodium purum and Lophocolea bidentata remain frequent.
This sub-community has a scattered distribution through the dales along the upland fringes.
Although Filipendula ulmaria is frequent and locally abundant in a variety of vegetation types, in this community it forms the overwhelming dominant and the only constant. The dominants of other communities in which it occurs, tall helophytes, bulky sedges, rushes and rank grasses are, if present, all subordinate in this community. In the deep shade cast by Filipendula only scattered individuals or dispersed clumps of other species are found. The commonest accompanying tall herbs are Angelica sylvestris, Valeriana officinalis and Rumex acetosa. In the Valeriana - Rumex sub-community they are often accompanied by Lychnis flos-cuculi, Succisa pratensis, Geum rivale and sprawling Galium palustre. In the Urtica - Vicia sub-community these species are more scarce and Urtica dioica is very common with Cirsium arvense, Epilobium hirsutum, Eupatorium cannabinum and Vicia cracca. At low frequency throughout there can be scattered Lythrum salicaria, Rumex crispus, R. sanguineus, Epilobium palustre, E. arvense and E. fluviatile. There are few bulky monocotyledons; Phragmites australis can be common and Phalaris arundinacea is found occasionally. Rushes are few with Juncus effusus the most common. Molinia caerulea can also be found occasionally. Among smaller dicotyledons there can be Ranunculus repens, Mentha aquatica, Lotus uliginosus, and Caltha palustris with more occasional Ranunculus acris, Cardamine pratensis, C. flexuosa, Potentilla anserina, and Polygonum hydropiper. Bryophytes are few in number and of low cover.

This community is typically found where moist, reasonably rich, circumneutral soils occur in situations protected from grazing. It can be found in both topogenous and soligenous mires and is especially typical of silted margins of slow-moving streams and soakways, the edges of flushes and damp hollows, and also of artificial habitats such as along dykes and roadside ditches and around ponds. This community occurs throughout lowland Britain.

Both draining and grazing have reduced the extent of this community to small remnants in many places. The community cannot tolerate any other than very light or sporadic grazing and so stands often only persist outside enclosures, and around unreclaimed mires and flushes. For example, this community can be found in wet field bottoms and edges that have been fenced off, and alongside streams and ditches between pasture and boundaries. Progression to woodland, even in the absence of treatments such as grazing or mowing, appears to be slow.
Associates listed opposite at most occasional but Juncus effusus and Holcus lanatus are constant, and Juncus acutiflorus and Molinia caerulea occasional in ranker swards with Anthoxanthum odoratum, Agrostis stolonifera, Mentha aquatica and Lotus uliginosus quite common.

M27

**Valeriana officinalis - Rumex acetosa sub-community**

Filipendula ulmaria is abundant and dominant. The vegetation may be species-poor, but overall it is characterised by a variety of associates. Most common are Angelica sylvestris and Valeriana officinalis, both sometimes locally abundant, with Rumex acetosa, Lychnis flos-cuculi, Succisa pratensis and Geum rivale are less common. Among smaller herbs can be the species listed above with Stellaria aline and Ajuga reptans and Galium palustre as the most common sprawling plant. Apart from Poa trivialis, preferential here, grasses and rushes are infrequent. Carex rostrata is quite common and can occur with Menyanthes trifoliata and Potentilla palustris. Bryophytes are better developed in this sub-community, with Brachythecium rutabulum the most common species.

This sub-community is the usual form in northern England and in southern and eastern Scotland.

**M27a**

**M27b**

**Urtica dioica - Vicia cracca sub-community**

Filipendula ulmaria and a variety of tall herbs again provide the main structural element. Angelica sylvestris, Cirsium palustre and Lythrum salicaria are occasional, but others present in M27a, e.g. Valeriana officinalis and Rumex acetosa, become scarce or absent. Urtica dioica, however, is very common and is found with occasional Eupatorium cannabinum and Epilobium hirsutum forming patches. Scattered throughout can be Cirsium arvense and Centaurea nigra. Phragmites australis can be common; alternatively there may be tussocks of Arrhenatherum elatius and some Holcus lanatus or scattered clumps of rushes. Smaller herbs and bryophytes are few and sparse.

This sub-community is found in central, southern and eastern Britain.

**M27c**

**Juncus effusus - Holcus lanatus sub-community**

Filipendula ulmaria is still the most abundant species, but other tall herbs such as Angelica sylvestris, Valeriana officinalis, Cirsium palustre and Rumex acetosa occur occasionally. Of greater importance, rushes and grasses may have moderate abundance. Juncus effusus and Holcus lanatus are both constant and J. acutiflorus and Molinia caerulea occasional, with a range of other grasses. In some stands Mentha aquatica and Lotus uliginosus are frequent. In others Iris pseudacorus and/or Oenanthe crocata can be prominent.

The sub-community is western in distribution.
M28 Iris pseudacorus – Filipendula ulmaria mire

In its typical form this is a luxuriant and species-rich community with Iris pseudacorus more abundant than Oenanthe crocata, although both are constants, except in the far north of Scotland where O. crocata is not found. Other tall herbs are nearly always present, though only Iris pseudacorus, Rumex crispus and Scutellaria galericulata are frequent throughout the community. Other species such as Rumex acetosa, Lycopus europaeus, Angelica sylvestris, Valeriana officinalis, Cirsium palustre, C. arvense and Urtica dioica are often common and conspicuous but preferential to particular sub-communities.

Rushes and grasses are frequently important. Juncus effusus and J. acutiflorus are common, as are Poa trivialis and Agrostis stolonifera. There are a variety of smaller dicotyledons. Some typically occur as scattered plants, for example Ranunculus acris, Caltha palustris, Stellaria alsine, Mentha aquatica and Hydrocotyle vulgaris, while Ranunculus repens and Potentilla anserina form mats with high local cover. On patches of wet and open ground, annuals may be prolific, such as Polygonum hydropiper, Montia fontana, and on cattle-poached mud, Ranunculus sceleratus. On salt-marsh transitions Atriplex prostrata and Matricaria maritima may be frequent with Samolus valerandi, Oenanthe lachenalii and halophytic herbs. Bryophytes are few, with Eurhynchium paeonii being the commonest throughout.

This community is confined to moist, more nutrient-rich soils along the oceanic seacoast of Britain. It is especially characteristic of the fresh-water seepage zone along the upper edge of salt-marshes in the sheltered sea-lochs of western Scotland. Other situations in which it occurs are over stabilised shingle down the west coast and in wetter hollows and flushes on raised beach platforms and gentle cliff slopes. The community is the oceanic counterpart of the Filipendula ulmaria – Angelica sylvestris mire (M27) and is largely confined to the west coast of Britain. In particular it is found in west Scotland from Orkney and Shetland southwards, with scattered stands in south-west England and west Wales.

The community was probably once much more widespread in south-west England and west Wales but it may have been largely destroyed in its salt-marsh habitat by human interference with the transitional upper zones. The community, where it does occur, is often not heavily grazed and it appears to be a relatively stable vegetation type with only a slow progression to scrub or woodland.
Groups of species opposite, and even Filipendula ulmaria, infrequent in rather open vegetation with Atriplex prostrata and Samolus valerandi common and sporadic records for maritime plants.

M28a
Juncus spp. sub-community
This is the richest sub-community in which other dicotyledons, rushes and grasses form a consistent associated flora. Iris pseudacorus is generally a clear dominant although both Oenanthe crocata and Filipendula ulmaria can be patchily abundant with the above Juncus spp. Among the taller herbs, Lycopus europaeus, Rumex crispus, Scutellaria galericulata, Angelica sylvestris and Valeriana officinalis, with the species listed above, all occur frequently to occasionally. Common grasses are Festuca rubra, Holcus lanatus, Anthoxanthum odoratum, Poa pratensis and Elymus repens forming scattered tussocks, and with Carex otrubae and trailing Galium palustre.

M28b
Urtica dioica – Galium aparine sub-community
The vegetation here, although as tall and luxuriant as in M28a is less species-rich. Iris pseudacorus is still dominant and both Oenanthe crocata and Filipendula ulmaria remain frequent, but apart from Lycopus europaeus and Scutellaria galericulata, the only other common taller dicotyledons are Urtica dioica and Cirsiun arvense which can be abundant. Other taller species of M28a are occasional or scarce and Galium aparine replaces G. palustre. Grasses are often conspicuous with Poa trivialis and Agrostis stolonifera very common as patchy carpets interspersed with the other species listed above.

M28c
Atriplex prostrata – Samolus valerandi sub-community
Although Iris pseudacorus and Oenanthe crocata can be abundant, taller associates are generally lacking even Filipendula ulmaria is scarce and Lycopus europaeus and Rumex crispus are only present as scattered plants. Among smaller plants the commonest grasses are Agrostis stolonifera and Festuca rubra. The most common preferences are plants tolerant of saline habitats, including Atriplex prostrata, the most common, with Samolus valerandi, Oenanthe lachenalii, Matricaria maritima, Triglochin maritima and Glaux maritima.
M29 Hypericum elodes - Potamogeton polygonifolius soakway

This community has a very distinctive appearance, typically consisting of low creeping or floating mats of Hypericum elodes and Potamogeton polygonifolius. Very often, unless the ground has been badly trampled by grazing animals, these two constants are set in a carpet of submerged Sphagnum auriculatum, sometimes with S. cuspidatum, S. palustre or S. recurvum. Other bryophytes are sparse but Polytrichum commune or Aulacomnium palustre, and Drepanocladus exannulatus, D. revolvens, and Calliergon cuspidatum, may be locally abundant.

Other vascular plants are scattered. Juncus bulbosus and Ranunculus flammula are the only constants but Hydrocotyle vulgaris, Anagallis tenella, Drosera rotundifolia, Narthecium ossifragum, and Galium palustre can all be moderately frequent, along with sedges such as Carex demissa, C. echinata, C. panicacea and C. nigra. There can also be sparse shoots or small patches of Molinia caerulea, Agrostis canina ssp. canina, Juncus articulatus, J. effusus, J. acutiflorus, Eleocharis multicaulis, Erigeron angustifolium and Rhynchospora alba. Carex rostrata can also be found in some stands. Two rare species associated with this community are Galium debile, in the New Forest, and the fern Pilularia globulifera.

This community is characteristic of shallow soakways and pools in peats and peaty mineral soils with fluctuating water levels, such as seepages and runnels around mires and in heathland pools, at moderate altitudes. The water is typically clear, still or gently-flowing, moderately acid to neutral, with a pH between 4 and 5.5, and probably quite oligotrophic. This vegetation is confined to the warm oceanic parts of Britain and extends in a well-defined zone from west Surrey through the New Forest to the South-West Peninsula and north through Wales to Galloway. It may well be found further north, following the distribution of Hypericum elodes.

This soakway appears to be a stable vegetation type in the absence of nutrient enrichment. In situations where there is some nutrient enrichment, grazing and trampling may help continually set back any tendency to succession. Trampling by grazing animals can also play a part in keeping the vegetation open and varied, although heavy poaching can be deleterious to the Sphagnum carpet.

No sub-communities.

M30 Related vegetation of seasonally-inundated habitats

Other vegetation of the same type as Hypericum elodes - Potamogeton polygonifolius soakway (M29), and characteristic of similar, seasonally inundated habitats, with rather base-poor and only moderately enriched waters, has only been poorly sampled. Some examples, lacking Hypericum elodes but otherwise the same as M29, may be regarded as impoverished stands of that community, though it must be noted that species such as Potamogeton polygonifolius, Erigeron angustifolium, Juncus bulbosus/kochii and Sphagnum auriculatum also occur with some frequency in bog-pool and poor-fen vegetation.

There are also stands in which Eleocharis multicaulis is strongly dominant with little or no Hypericum elodes or Potamogeton polygonifolius; these look similar to the Eleocharitetum multicaulis recorded from Eire and elsewhere in western Europe. Deschampsia setacea is listed as a characteristic species of such vegetation, and in Britain this rare species is typical of this type of habitat. Scirpus fluitans can also be found dominating in swards which lack some of the typical plants of M29, and in the New Forest and Cornwall, Baldellia ranunculoides is a frequent and conspicuous component of low-growing vegetation in seasonally wet pools.

All these vegetation types, along with M29, have been grouped in the Hydrocotylo-Baldellion alliance, comprising assemblages of mesotrophic to oligotrophic, and periodically fluctuating waters.

No sub-communities.
In this community Anthelia julacea forms cushions up to a metre or more in thickness and several square metres in extent. Its associated flora is species-poor and vascular plants are sparse. Among other bryophytes, Sphagnum auriculatum, Marsupella marginata and Scapania undulata are all constant, the first of which can form prominent patches. Racomitrium lanuginosum and Philonotis fontana are also frequent with occasional Calliergon sarmentosum, Campylopus atrovirens, Polytrichum commune and Racomitrium fasciculare. Rare bryophytes which have been recorded in this community include Anthelia juratzkana, which almost totally replaces A. julacea in some stands, and Pohlia ludwigii.

The commonest vascular plant is Deschampsia cespitosa. Scattered plants of Nardus stricta occur quite often with occasional Narthecium ossifragum, Pinguicula vulgaris, Carex demissa, and Saxifraga stellaris. Less frequent are Eriophorum angustifolium, Carex bigelowii, C. nigra, Festuca vivipara, Agrostis canina, A. stolonifera, Juncus bulbosus, Thalictrum alpinum, and Viola palustris.

This is a montane community typical of often skeletal mineral and organic soils kept more or less permanently wet by the trickling of acid and oligotrophic waters, of pH 4.5-5.0, frequently derived at higher altitudes from snow-melt. It occurs at moderate to high altitudes, from about 400 m to over 1000 m, marking out areas of less vigorous seepage among tracts of montane grasslands and grass-heaths or among snow-bed vegetation. It is a local but widespread community found through much of Scotland, the Lake District and Snowdonia.

Anthelia julacea – Sphagnum auriculatum spring is an essentially stable community in the harsh environment in which it characteristically occurs.

No sub-communities.
M 32 Philonotis fontana – Saxifraga stellaris spring

These bryophyte-dominated springs, flushes and rills are striking in appearance. Philonotis fontana is usually dominant and obvious by its fresh-green colour. The golden-green Dicranella palustris and Scapania undulata are often also abundant. These species together often form cushions or plush mats. Less consistent but sometimes prominent are Sphagnum auriculatum, Scapania uliginosa, Calliergon sarmentosum, Drepanocladus exannulatus, D. fluitans and the characteristic, but not very frequent, Jungermannia exsertifolia. Bryum pseudotriquetrum is also common, but not as consistent as in more base-rich springs, and Cratoneuron commutatum and C. filicinum are scarce.

The associated vascular flora is rather varied in composition and cover and typically species-poor. The only constant is Saxifraga stellaris, but Deschampsia cespitosa (with ssp. alpina at higher altitudes) is often found in small quantities with scattered Stellaria alsine. More occasional are Festuca rubra, Anthoxanthum odoratum, Agrostis stolonifera and A. canina, all usually at low cover, with sparse Viola palustris, Nardus stricta, Carex bigelovii and C. panicea. In stands which are perhaps less base-poor, Montia fontana and Chrysosplenium oppositifolium become frequent and abundant, along with Caltha palustris, Cardamine pratensis and a number of other associated species.

This is a community of springs and rills at moderate to high altitudes, above 450 m to over 1000 m, where there is irrigation with circumneutral and oligotrophic waters with a pH of around 4.5-6. This is one of the most common and widespread types of spring vegetation in the uplands of north-west Britain and is dependent on sustained and vigorous irrigation by groundwaters, common in the wetter parts of the country. It marks out permanent springs of a well-defined character, also diffuse flushes and seepage lines, rills and small streams and occasionally steep, dripping ground. In some places snowmelt may be an important water source. It is found on a variety of waterlogged soils from fragmentary accumulation of silt among stones to flushed peats and gleys. The community is common through the Scottish Highlands, the Southern Uplands, the Lake District and north Wales and over the non-calcareous parts of the Pennines. It can also be found as fragmentary stands at lower altitudes without the montane element in the vegetation, particularly at the southern limit of the range of this community.

The harsh montane environment has a striking influence on the composition of the community and though stands can be grazed and trampled, climatic and soil conditions probably play the major part in maintaining the vegetation as an effective climax. At lower altitudes, it could perhaps show some successional development in ungrazed situations.
Sphagnum auriculatum and other bryophytes listed opposite very scarce but Bryum pseudotriquetrum frequent. Montia fontana and Chrysosplenium oppositifolium constant and sometimes abundant.

M32a

**Sphagnum auriculatum sub-community**

In this species-poor sub-community the bryophyte mat consists of mixtures of Philonotis fontana, Scapania undulata and Dicranella palustris with Sphagnum auriculatum strongly preferred and often abundant. Calliergon sarmentosum and Scapania uliginosa are occasional and Polytrichum commune and Hygrohypnum ochraceum occur at low frequencies. Among the vascular plants only Saxifraga stellaris and Deschampsia cespitosa are constant but other grasses such as Agrostis stolonifera, A. capillaris, Anthoxanthum odoratum and Festuca rubra are quite frequent as scattered tufts.

This sub-community occurs mainly on the harder acidic quartzites and sandstones of the north-west Highlands.

M32b

**Montia fontana - Chrysosplenium oppositifolium sub-community**

Vascular plants are more numerous and varied, although bryophytes still generally have dominance. Philonotis fontana, Dicranella palustris and Scapania undulata are all very common and each, especially the first, can be abundant. Bryum pseudotriquetrum is frequent and Jungermannia exsertifolia occasional. Among the vascular plants, Montia fontana and Chrysosplenium oppositifolium have high frequencies with Saxifraga stellaris, and are sometimes abundant. Along with Stellaria alsine there are often very small plants of Caltha palustris (ssp. minor) and Cardamine pratensis. Epilobium palustre can sometimes be found but more distinctive are the frequent occurrence of E. alpinifolium and E. anagallidifolium. Grasses can be quite common; Deschampsia cespitosa is often joined by Anthoxanthum odoratum, Agrostis canina and several other grasses together with some sedges.

This community is associated with a range of substrates slightly more base-rich than those of M32a.
In this community Pohlia wahlenbergii var. glacialis dominates in spongy carpets of a bright apple-green colour, often of small extent, but exceptionally up to 200 m². Few other bryophytes occur with any frequency although P. ludwigii is a constant. Philonotis fontana can be prominent, although not with the high cover found in Philonotis fontana – Saxifraga stellaris spring (M32). Other bryophytes recorded occasionally are Hygrohypnum luridum, Bryum weigelii, Calliergon stramineum, Scapania undulata, S. uliginosa, Dicranella palustris and Marchantia alpestris.

In this carpet there are only a few vascular plants. Deschampsia cespitosa (presumably ssp. alpina) and Saxifraga stellaris are constant, but Cerastium cerastoides is quite often found and there can be Stellaria alpinae, Chrysosplenium oppositifolium, Epilobium anagallidifolium, Veronica serpyllifolia var. humifusa, and Rumex acetosa. Other rare plants found occasionally are Epilobium alpinum, Alopecurus alpinus and Phleum alpinum.

This community is strictly confined to spring-heads associated with late snow-beds where there is vigorous irrigation by cold waters. The flushing waters, and often sloppy, ill-structured mixtures of mineral and organic matter beneath the moss carpet, are base-poor and oligotrophic. Although Pohlia wahlenbergii var. glacialis occurs over quite a range of altitudes through the uplands of Wales, Cumbria and Scotland, it is only found with the kind of dominance characteristic here within the high montane zone at altitudes generally above 850 m. Within this area, which includes the central and northwestern Highlands of Scotland, the community is further restricted to situations where the snow lies longest, especially on north- and east-facing slopes.

The general climatic and edaphic features determine the overall character of this community with its cold-tolerant plants and montane species.

No sub-communities.
M 35 Ranunculus omiophyllus – Montia fontana rill

These rills typically have a rather crowded, though not always continuous, cover of vascular plants and bryophytes. Much of the growth is often submerged in the shallow waters, with a floating or shortly emergent canopy. Ranunculus omiophyllus is often abundant, frequently with Montia fontana. Floating leaves of Potamogeton polygonifolius are commonly prominent and there can be local patches of Agrostis stolonifera, Glyceria fluitans, Juncus bulbosus, J. articulatus and Callitriche stagnalis, with scattered plants of Ranunculus flammula, a constant, Myosotis secunda and Stellaria alsine. More occasional are Ranunculus repens, Equisetum palustre, Hydrocotyle vulgaris, Galium palustre and Lotus uliginosus. Juncus bufonius and Scirpus setaceus can sometimes be seen on open mud.

Bryophytes can contribute substantially to the cover although there are only a few frequent species. Sphagnum auriculatum is a constant and often grows semi-submerged with patches of Philonotis fontana but, apart from occasional Polytrichum commune, other species are sparse, with only occasional records of Calliergon cuspidatum, C. stramineum, Drepanocladius exan- nulatus, D. vernicosus, Scapania irrigua and Rhytidiadelphus squarrosus.

This community is typical of spring-heads and rills at moderate altitudes in south-western Britain, where there is irrigation by circumneutral and probably quite oligotrophic waters. These are typically rather base- and nutrient-poor with pH values ranging from 4.5 to 6.5 over acidic rocks. It has been recorded only from south-western England, Wales, and around the Lake District. It may occur throughout the range of R. omiophyllus in Britain.

No sub-communities.

M 36 Lowland springs and streambanks of shaded situations

There is a clear contrast, among the Cardamino – Montion springs and flushes of acid to circumneutral habitats, between the upland communities which have been described, where Montia fontana, Saxifraga stellaris and Philonotis fontana are conspicuous, and the vegetation of lowland and often shaded situations. In these, Chrysosplenium oppositifolium occurs with bryophytes such as Hookeria lucens, Rhizomnium punctatum, Trichocolea tomentella, Pellia epiphylla and Conocephalum conicum. This type of vegetation has not been separately sampled here but it figures in the field and ground layers of various wet woodlands, notably the Alnus – Carex, Alnus – Urtica and Alnus – Fraxinus – Lysimachia types, where it is distinctive of seepage lines and damp stream banks, quite often with Cardamine flexuosa, C. amara and Chrysosplenium alternifolium. Similar mixtures of plants can be found widely through lowland Britain, especially in the wetter west and around the upland fringes, along stream-sides and wet banks, probably once wooded, but where shade is now provided by tall herbs or by the aspect of the site. These need further sampling.

No sub-communities.
Cratoneuron commutatum occurs frequently in a variety of calcareous mires, but here it is consistently dominant in large masses, often forming prominent mounds or banks. In some stands of the same general floristic composition, C. filicinum accompanies or totally replaces it. Other bryophytes can make a contribution, but typically a minor one. However, the constant Bryum pseudotriquetrum is very common. Occasional species include Philonotis fontana, P. calcarea, Aneura pinguis, Pellia endiviifolia, Drepanoclados revolvens, Gymnostomum recurvirostrum, G. aeruginosum, Brachythecium rivulare and Dicranella palustris. Very typically there is some tufa deposition allowing the mat to build into mounds. The vascular element is typically species-poor and of low total cover. There may be considerable variation in associated flora and, particularly where stands are developed on gently-sloping ground, a richer and more extensive layer can be found, coming close to the Cratoneuron commutatum – Carex nigra spring (M38). Often, however the only species present are Festuca rubra, Cardamine pratensis and Saxifraga aizoides, the last of which is absent from southern Scotland and Wales. Occasional herbs include Agrostis stolonifera, Deschampsia cespitosa, Equisetum palustre, Chrysosplenium oppositifolium, Poa trivialis, Carex panicea, C. nigra and C. dioica.

This is a community of ground kept permanently moist by irrigation with base-rich, calcareous and generally oligotrophic waters. It is dependent on sustained irrigation common in areas of higher rainfall. Here it can be found marking out spring-heads, seepage lines and drip zones in areas of lime-rich bedrocks, where waters emerge along bedding planes or at junctions with impervious substrates. Provided the ground is permanently wet, the community can even occur on vertical surfaces and bare rock, forming curtain-like masses. The community can be found throughout the north-western uplands of Britain with its more Arctic-Alpine element best developed in the Scottish Highlands, with outliers in the Lake District and Upper Teesdale. Springs dominated by Cratoneuron species also occur widely, but locally, in the British lowlands, and further sampling of these is needed.

In most circumstances it is a permanent community maintained by edaphic and climatic conditions of the environment. On gentle slopes, trampling by grazing stock or deer often plays an important part in maintaining the characteristically open conditions of flushed soils, but trampling and grazing can have an adverse effect on the bryophyte carpet.

No sub-communities.
This type of spring preserves the same pattern of dominance by *Cratoneuron commutatum* (again occasionally supplemented or replaced by *C. filicinum*) as in *Cratoneuron commutatum* – *Festuca rubra* spring (M37), but the associated flora is much richer. This is partly seen among the bryophytes. *Bryum pseudotriquetrum* and *Philonotis fontana* are the commonest and can have moderately high cover, and there are many others which can occur locally as prominent patches. These include calcicolous species such as *Aneura pinguis*, *Fissidens adianthoides*, *Philonotis calcarea*, *Ctenidium molluscum*, *Cinclidium stygium*, *Drepanocladius revolvens* and *Campylium stellatum*.

The increased richness is most seen among the vascular plants. Small sedges are noticeable. *Carex demissa*, *C. nigra* and *C. panicea* are constant and often abundant, and *C. pulicaris*, *C. flacca* and *C. dioica* are common. There are frequent scattered plants of *Cardamine pratensis*, *Selaginella selaginoides*, *Leontodon autumnalis*, *Polygonum viviparum*, *Trifolium repens*, *Cirsium palustre*, *Ranunculus flammula*, *Sagina nodosa*, *Juncus triglumis*, *J. articulatus*, *J. bulbosus*, *Cerastium fontanum*, *Prunella vulgaris*, *Caltha palustris*, *Galium palustre*, *Equisetum palustre*, *Achillea ptarmica*, *Cochlearia officinalis* (often ssp. alpina), *Triglochin palustris*, *Ranunculus acris*, *Anthoxanthum odoratum*, *Festuca ovina*, *Epilobium anagallidifolium* and, in north England, the introduced *E. nerteroides*. In Teesdale this community is the locus for *Saxifraga hirculus*.

This vegetation is confined to montane springs and flushes strongly irrigated by base-rich, calcareous and oligotrophic waters. As in M37, sites of sustained irrigation with waters draining from lime-rich bedrock are marked out and tufa encrustation is often seen. It is very local around Upper Teesdale in the north Pennines and in the central Highlands of Scotland, mostly above 650 m altitude.

Although the harsh climatic and edaphic conditions exert a strong influence on the structure and composition of the vegetation, heavy grazing plays a major role in maintaining the distinctive richness of the community, and it is this trampling and cropping by sheep and deer which is responsible for the most obvious floristic differences between this community and M37.

No sub-communities.
1. Calluna vulgaris may be present but is not constant or prominent in the vegetation.

1a. Calluna vulgaris constant and usually dominant in the vegetation.

2. Ulex spp. constant in the sward and usually prominent.

2a. Ulex spp. absent or, if present, then not constant and subordinate in the vegetation.

3. Sphagnum capillifolium constant within a luxuriant moss-carpet, usually over steep slopes with a thin mineral soil.

3a. Sphagnum capillifolium absent or, if present, sparse and infrequent.

4. At least two of Racomitrium lanuginosum, Cladonia arbuscula, C. uncialis, Huperzia selago, Empetrum nigrum hemaphroditum and Cetraria islandica constant in the vegetation. **Sub-montane and montane heaths.**

5. Racomitrium lanuginosum and the above species not constant. At least one of: Erica cinerea, Galium saxatile, Vaccinium myrtillus, Festuca ovina, Deschampsia flexuosa and/or Hypnum spp. constant in the vegetation. **Lowland and sub-montane heaths.**

See Fig 1.  
See Fig 2.  
See Fig 3.  
See Fig 4.  
See Fig 5.
1. Erica vagans present and usually co-dominant with other species.

2. Erica vagans co-dominant with Schoenus nigricans, Molinia caerulea, Erica cinerea and E. tetralix; Ulex gallii and Genista anglica sometimes frequent.

2a. Erica vagans co-dominant with Ulex europeaeus. Ulex gallii and Erica cinerea constant and frequent often with Carex flacca, Potentilla erecta and Polygala vulgaris. Erica tetralix never prominent.

3. Carex bigelowii constant and frequent.

3a. Carex bigelowii absent or infrequent, occasionally locally abundant. Vegetation usually dominated by Vaccinium myrtillus with constant Galium saxatile, Deschampsia flexuosa, Dicranum scoparium and Pleurozium schreberi.


4a. Cladonia arbuscula not constant but may be frequent. Empetrum nigrum hemaphroditum and mats of bulky pleurocarpous mosses: Pleurozium schreberi, Rhytidiadelphus loreus Racomitrium lanuginosum and Hylocomium splendens constant and abundant.

H5 Erica vagans – Schoenus nigricans heath

H6 Erica vagans – Ulex europeaeus heath

H19 Vaccinium myrtillus – Cladonia arbuscula heath

H20 Vaccinium myrtillus – Racomitrium lanuginosum heath

H18 Vaccinium myrtillus – Deschampsia flexuosa heath

These communities are almost entirely restricted to the Lizard Peninsula in Cornwall.
1. Ulex minor constant and usually prominent.

2. Agrostis curtisi, Molinia caerulea, Erica cinerea and E. tetralix constant.

H3 Ulex minor - Agrostis curtisi heath

Restricted in its occurrence to Dorset and Hampshire.

3. Agrostis curtisi, Molinia caerulea, Erica cinerea and E. tetralix constant.

H4 Ulex gallii - Agrostis curtisi heath

Found mainly in south-west Britain.

4. Agrostis curtisi generally absent; Erica tetralix never frequent. Ulex europaeus may be abundant.

H8 Calluna vulgaris - Ulex gallii heath

1a. Ulex minor generally absent. Ulex gallii constant and prominent.

2a. Agrostis curtisi absent or present only at low frequency. Erica tetralix never frequent.

H2 Calluna vulgaris - Ulex minor heath

2. Fig 2. Key to heaths with constant Calluna vulgaris and in which Ulex spp. are constant and prominent
1. Vaccinium vitis-idaea and Cladonia arbuscula constant in the vegetation. Rubus chamaemorus frequent and may be prominent.

H22 Vaccinium myrtillus-Rubus chamaemorus heath

Almost entirely confined in its distribution to the central and north-west Highlands.

H21 Calluna vulgaris - Vaccinium myrtillus - Sphagnum capillifolium heath

Usually located on steep, north-east to north-west facing slopes on thin mineral soils, often with rock outcrops.

1a. Vaccinium vitis-idaea and Cladonia arbuscula absent or at very low frequency. Constant Potentilla erecta. The bryophyte carpet includes Dicranum majus and Plagiothecium undulatum.

Fig 3. Key to heaths with constant Calluna vulgaris and Sphagnum capillifolium over a luxuriant bryophyte-rich carpet. Constants include: Vaccinium myrtillus, Empetrum nigrum nigrum, Deschampsia flexuosa, Rhytidium loreus, Pleurozium schreberi, Dicranum scoparium and Hylocomium splendens.
Fig. 4. Key to sub-montane and montane heaths with constant Calluna vulgaris and at least two constants from Racomitrium lanuginosum, Cladonia arbuscula, C. uncialis, Huperzia selago, Empetrum nigrum hermaphroditum and Cetraria islandica.

1. Juniperus communis
ssp. nana or Arctostaphylos alpinus
constant, usually with some Erica cinerea.

2. Vegetation dominated by Juniperus communis
ssp. nana with constant Scirpus cespitosus,
Deschampsia flexuosa, Potentilla erecta, Erica
cinerea, Racomitrium lanuginosum, Cladonia
uncialis, Pleurozia purpurea.

2a. Juniperus communis
ssp. nana usually absent.
Arctostaphylos alpinus constant in a low open
mat. Also constant: Huperzia selago,
Deschampsia flexuosa, Racomitrium lanugi-
osum, Cladonia arbuscula and C. uncialis.

2. Vegetation dominated by Juniperus communis
ssp. nana with constant Scirpus cespitosus,
Deschampsia flexuosa, Potentilla erecta, Erica
cinerea, Racomitrium lanuginosum, Cladonia
uncialis, Pleurozia purpurea.

2a. Juniperus communis
ssp. nana usually absent.
Arctostaphylos alpinus constant in a low open
mat. Also constant: Huperzia selago,
Deschampsia flexuosa, Racomitrium lanugi-
osum, Cladonia arbuscula and C. uncialis.

1a. Juniperus communis
and Arctostaphylos alpi-
nus absent or at very low
frequency. Racomitrium lanuginosum and/or
Cladonia spp. prominent.

3. Racomitrium lanuginosum dominant,
usually with constant Cladonia uncialis.
Empetrum nigrum (either sub-species),
Deschampsia flexuosa and Hypnum cupressi-
forme can be frequent.

3a. Racomitrium lanuginosum can be
frequent but is rarely abundant. Cladonia
spp. usually prominent including constant
C. arbuscula, C. uncialis and C. rangiferina.
Empetrum nigrum hermaphroditum also
constant. Deschampsia flexuosa and Hypnum
cupressiforme occasional and sparse.

4. Racomitrium lanuginosum forms
a dense woolly mat
5-10 cm thick. Cladonia arbuscula constant, Erica
cinerea may be frequent
but not constant.

4a. Racomitrium lanuginosum abundant
but not forming a dense
mat. Cladonia arbuscula
absent. Erica cinerea
constant.

H15 Calluna vulgaris –
Juniperus communis
ssp. nana heath

H17 Calluna vulgaris –
Arctostaphylos alpinus
heath

H14 Calluna vulgaris –
Racomitrium lanugi-
osum heath

H10b Calluna vulgaris –
Erica cinerea heath,
Racomitrium lanuginosum
sub-community

H13 Calluna vulgaris –
Cladonia arbuscula
heath
Fig 5. Key to lowland and sub-montane heaths with constant, usually dominant Calluna vulgaris and at least one of Erica cinerea, Vaccinium myrtillus, Empetrum nigrum nigrum, Festuca ovina, Deschampsia flexuosa, Galium saxatile and Hypnum cupressiforme constant in the vegetation.
Heath community descriptions and sub-community keys

H.1 Calluna vulgaris – Festuca ovina heath

This is a heather-dominated community which is very poor in vascular associates, although sometimes showing a modest diversity among the bryophytes and, more especially, the lichens. Calluna vulgaris is usually the only woody species and the most abundant. The height and cover of the canopy are very variable depending on the age of the heather and the consequent phase of development, and also on grazing intensity. Erica cinerea, Ulex minor and U. gallii, important in dry heaths further south and west, are largely excluded as is Erica tetralix. Ulex europaeus is uncommon, except where there has been disturbance.

Typically there are no grassy areas but Festuca ovina is very common throughout, usually as scattered tussocks, often with less than 30% total cover. Other grasses are few. Agrostis capillaris is occasional and there may be a little Deschampsia flexuosa. Associated dicotyledons are also few and patchy. Occasionally Senecio jacobaea, Galium saxatile, Cerastium fontanum, Campanula rotundifolia and Luzula campestris may be present. Two species locally important in particular situations are Pteridium aquilinum and Carex arenaria. In bare areas Rumex acetosella together with ephemerals such as Apahenes arvensis, Teesdalina nudicaulis, Myosotis ramosissima and the annual Aira praecox may be found.

Only a few bryophyte species occur throughout the community. Hypnum cupressiforme and Dicranum scoparium are both constant. These two usually form the bulk of the bryophyte cover in both pioneer and degenerate Calluna. In such situations Hylocomium splendens, Pleurozium schreberi, Ptilidium ciliare and Dicranella heteromalla are occasional. Lichens may exceed mosses in cover. Cladonia species are prominent with encrusting species such as Cladonia pyxidata, C. squamosa and C. fimbriata on bare ground. Species like C. impexa, C. furcata and C. arbuscula are especially abundant on old Calluna together with Hypogymnia physodes.

This community is confined to acid, base-poor and oligotrophic sandy soils in the more continental lowlands of eastern England. The profiles under the community are usually brown sands which are free to excessive-draining and have a low surface pH. In some localities, such as in Lincolnshire and around the Weald, the impoverished soils are derived from arenaceous bedrock, but they have mostly developed from sandy glacio-fluvial drift, sometimes supplemented by aeolian sand. The community occurs through the eastern lowlands of England, although it is now very local.

This heath has been traditionally managed with burning and grazing (both domestic livestock and wild herbivores such as rabbits and deer). However in many areas the abandonment of this traditional management has been followed by agricultural improvement or afforestation which has reduced and fragmented tracts of this community. In other areas the lack of grazing and burning has often permitted seral progression to scrub and woodland. The most common woody invaders are Betula pendula and Pinus spp., and more occasionally, Quercus robur if mature trees are fairly close by.
Lichens poorly represented.

Hypnum cupressiforme very common among collapsed Calluna vulgaris and in grassy patches.

H1a

Hypnum cupressiforme
sub-community

Cover of Calluna vulgaris is often less than complete and only moderately tall. The most prominent associates are Festuca ovina and the cryptogams which often exceed 50% cover. Among the mosses Hypnum cupressiforme and Dicranum scoparium are very frequent. Lichens are also abundant, Cladonia pyxidata, C. squamosa, C. fimbriata and C. gracilis usually predominate, bulkier species like C. impexa, C. uncials and C. arbuscula being less frequent and Hypogymnia physodes occasional.

H1b

Hypogymnia physodes - Cladonia impexa
sub-community

The heather cover is the same as in H1a but degenerate bushes predominate. The contribution of Festuca ovina, Hypnum cupressiforme and Dicranum scoparium is more uneven, the mosses occurring as small patches among collapsed stems. Lichens by contrast are abundant in these areas, encrusting species being joined or exceeded by Cladonia impexa, C. furcata and C. macilenta. Hypogymnia physodes is most frequent here.

H1c

Teucrium scorodonia frequent with Senecio jacobaea, Agrostis capillaris and Galium saxatile occasional.

H1d

Carex arenaria constant, sometimes abundant.

H1e

Very impoverished rank canopies of Calluna vulgaris.

Species-poor sub-community

Unbroken canopies of dense and often tall heather, up to 50 cm or more high, are characteristic here, among which virtually no associates can survive, apart from occasional sparse plants of Hypnum cupressiforme. This sub-community is typically of building and mature heather.
This community is generally dominated by Calluna vulgaris, but with both Erica cinerea and Ulex minor playing a very frequent and sometimes prominent role in the sub-shrub layer. The constancy of the latter two species provides the most obvious floristic distinction between this community and the Calluna vulgaris – Festuca ovina heath (H1). The canopy is very variable in height, from 10 cm to 80 cm or more, and the structure depends greatly on the growth phase of the Calluna and whether the individuals are of even or uneven age. Where burning occurs (for example, in the New Forest) a characteristic patchwork of swales is formed. After fire E. cinerea often increases in frequency because of its prolific seeding. Ulex minor normally plays a subsidiary role, forming a patchy understorey below the Calluna. No other sub-shrubs are found throughout the community. Ulex europaeus is occasional, but may be locally abundant after disturbance. Erica tetralix and Vaccinium myrtillus are found in particular sub-communities.

Other consistent associates are very few. Deschampsia flexuosa is constant but patchy, though it may be more common in grazed areas. On wetter soils it tends to be replaced by Molinia caerulea. Pteridium aquilinum is occasional overall and preferential for one sub-community. Scattered plants of Potentilla erecta or Galium saxatile may also be found in more open areas. In some stands invading seedling and sapling trees may occur, particularly Quercus spp., Betula spp. and Pinus sylvestris.

In the absence of burning, mosses and lichens can become common. Dicranum scoparium and Hypnum jutlandicum are the most frequent bryophytes, with peat-encrusting Cladonia species and larger species such as Cladonia furcata and C. arbuscula. Hypogymnia physodes can sometimes be found on old heather stems.

This community is characteristic of impoverished acid soils, predominantly free-draining in south-east and central southern England. It is characteristic of free-draining profiles developed from pervious arenaceous or pebbly parent materials. Typically, these parent materials have given rise to some kind of podzolic profile under this community which is highly acidic, often with a superficial pH between 3.5 and 4.5, and generally impoverished. The community occurs from the Poole Harbour area in the west through the New Forest, where stands are particularly numerous and extensive, to Surrey and the High Weald in the east, where it occurs as more local and fragmented tracts of heathland.

The vegetation takes much of its structural, and some of its floristic, character from traditional grazing and burning treatments. However, when released from these treatments a progression to woodland can be expected. Agricultural improvements and forestry have caused fragmentation and isolation of small remnants of this community in many places.
Pteridium aquilinum can be quite common, but Vaccinium myrtillus and young trees very scarce.

Vaccinium myrtillus constant and locally abundant, Pteridium aquilinum frequent and with scattered tree seedlings and saplings.

Molinia caerulea very common, often almost totally displacing Deschampsia flexuosa. Erica tetralix frequent and sometimes exceeding E. cinerea.

H2b

Vaccinium myrtillus sub-community

The sub-shrub canopy usually consists of mixtures of heather with sometimes substantial amounts of Ulex minor, Erica cinerea and, strongly preferential, Vaccinium myrtillus. Pteridium aquilinum is more frequent, and in open areas there is usually some Deschampsia flexuosa and occasionally a little Molinia caerulea. Young trees are also strongly preferential, with oak and birch seedlings and saplings frequent, and small pines locally prominent. Hypnum jutlandicum and Dicranum scoparium are occasional but lichens are sparse. This sub-community tends to be found at the higher altitudes in the range of H2.

H2c

Molinia caerulea sub-community

Calluna vulgaris is abundant, usually with smaller amounts of Ulex minor and particularly of Erica cinerea which may be joined with or replaced by Erica tetralix. More obviously preferential is Molinia caerulea. Pteridium aquilinum is uncommon and young trees are rarely found. The ground layer is also sparse. This sub-community is predominantly found on soils with impeded drainage.

Molinia caerulea occasional at most with Deschampsia flexuosa very common. Dicranum scoparium and Hypnum ericetorum with Cladonia spp. patchily prominent in more open areas.

H2a

Typical sub-community

Calluna vulgaris is generally strongly dominant with subsidiary amounts of Ulex minor and Erica cinerea, the latter very variable and sometimes absent. Neither Vaccinium myrtillus nor Erica tetralix occur and Molinia caerulea is scarce. Deschampsia flexuosa is common and sometimes with or replaced by Festuca rubra. Pteridium aquilinum and tree seedlings are infrequent. Bryophytes and lichens can be conspicuous among older heather or after burning, with Cladonia fimbriata, C. coccifera, C. chlorophoea and C. arbuscula all slightly preferential.
This community contains nearly all the sub-shrub vegetation in which Ulex minor and Agrostis curtisii occur together as important components, although A. curtisii can also occur occasionally in Calluna vulgaris – Ulex minor heath (H2). The canopy is usually fairly low, 20-30 cm high, and Calluna frequently dominates, especially when it has not been burned for some time. Compared with less oceanic heaths the most unusual feature of the woody cover is the occurrence together of Erica cinerea and E. tetralix, both of which are constants. Both can grow vigorously, although E. cinerea is likely to be more prominent especially after burning. Erica tetralix can have high cover locally, especially on more strongly gleyed soils. Ulex minor maintains its high frequency throughout, although its abundance is very variable. In stands which have not been burnt for some time A. curtisii and Molinia caerulea, the two characteristic and constant grasses, are generally scattered, but after burning A. curtisii and to a lesser degree Molinia can become prominent. In contrast to H2 Deschampsia flexuosa is very scarce. Pteridium aquilinum occurs occasionally and other herbs are found as scattered individuals. Potentilla erecta, Polygala serpyllifolia, Carex pilulifera and the parasitic Cuscuta epithymum can all be found occasionally. In disturbed or burned situations Viola lactea is very characteristic.

Burning has the effect of opening the canopy, and mosses and lichens become prominent. Among the bryophytes Campylopus brevifolius is most distinctive and can be accompanied by C. paradoxus, Polytrichum juniperinum, Dicranum scoparium, Hypnum jutlandicum and Leucobryum glaucum. Cladonia impexa is one of the most common and conspicuous lichens with peat-encrusting species such as C. floerkeana, C. coccifera and C. pyxidata. Hypogymnia physodes often colonizes old heather stems.

This community is the characteristic sub-shrub community of impoverished acid soils which are protected against parching by a measure of drainage impedance and a moderately oceanic climate. It occupies a distinct position on soils that are too dry for the Erica tetralix – Sphagnum compactum wet heath (M16) and too moist for the Calluna vulgaris – Ulex minor heath (H2). It is largely confined to south Dorset and Hampshire.

The combination of drainage impedance and climate is the major influence on the floristics of this community, although grazing and burning still often exert an important measure of control on its composition and structure. The general effect of the combination of these treatments is to curtail the mature and degenerate phase of Calluna and to set back repeatedly any invasion of trees and seral progression to woodland. The abandonment of traditional land use and soil improvement for agriculture in many stands of this type of vegetation has meant that surviving tracts can be fragmented, and are often sharply delineated from their surrounds.
Calluna vulgaris and Erica tetralix reduced in frequency and cover and Molinia caerulea and Ulex minor somewhat patchy. Agrostis curtisi is very abundant and Ulex europaeus common and Viola lactea often persistent.

H3c

Agrostis curtisi sub-community

Agrostis curtisi very frequent, but not extensive, and Ulex europaeus occasional at most among mixed or Calluna vulgaris-dominated canopies.

H3

Polygala serpyllifolia common with a patchy cover of bryophytes and lichens on more open areas. Species present include Campylopus brevipilus, Polytrichum juniperinum, Cladonia impexa, C. floerkæna and C. coccifera.

H3b

Cladonia spp. sub-community

Species opposite very sparse among usually dense sub-shrub canopies.

H3a

Typical sub-community

The sub-shrubs typically form an extensive canopy, often with Calluna vulgaris as the main dominant, although, sometimes more mixed. Grasses are usually subordinate. Ulex europaeus is occasional and Erica ciliaris is found in south Dorset vegetation. Other species are few, although Potentilla erecta is preferential at low frequency, and there is sometimes a little Pteridium aquilinum, Carex pilulifera, Polygala serpyllifolia or Cuscuta epithymum. Bryophytes and lichens are sparse.
H4 Ulex gallii – Agrostis curtisii heath

This community is very similar to Ulex minor – Agrostis curtisii heath (H3), with the replacement of one gorse by another. The western limit of U. minor in east Dorset forms the boundary between these two heath types. Apart from this difference they share five constants, namely, Calluna vulgaris, Erica cinerea, E. tetralix, Molinia caerulea and Agrostis curtisii, and these species, together with U. gallii, generally account for the bulk of the vascular cover. Their proportions and structure, however, vary considerably so that the appearance of stands differs markedly. The vegetation can vary from a short mixed canopy of grasses and sub-shrubs no more than 10 cm high (grass heath), to a canopy of woody plants 50 cm or more high. There may also be quite extensive areas of barer ground. Calluna and U. gallii are the most common species and are often abundant. Calluna often dominates. The frequent occurrence of E. cinerea and E. tetralix together distinguishes this vegetation from the corresponding dry heath Calluna vulgaris – Ulex gallii heath (H8). Four other sub-shrubs are more restricted. Vaccinium myrtillus is commoner at higher altitudes with increased rainfall. The others, Salix repens, Erica ciliaris and E. vagans (a species restricted to the Lizard in Cornwall) are found in the wetter E. tetralix sub-community.

Two grasses are constant, Agrostis curtisii and Molinia caerulea, which always make some contribution to the cover. Among the grassier heaths, Festuca ovina and Danthonia decumbens are particularly important, with the sedges Carex binervis and C. pilulifera also characteristic. On cooler, moister slopes Scirpus cespitosus can be prominent. The only dicotyledonous herb which is a constant of this community is Potentilla erecta, which occurs as scattered individuals. Other occasional herbs are Polygala serpyllifolia and Pedicularis sylvatica, with Viola lactea in disturbed situations. There are a variety of bryophytes and lichens, but none occur with any frequency.

This community is confined to the warm oceanic parts of south-west Britain where it occurs on a variety of moist, acid soils. Like its eastern counterpart, H3, this is a vegetation type of acid soils that are too moist for dry heath but not so consistently waterlogged as to be able to sustain wet heath. The community is confined to southwest Britain, beyond a line from mid-Dorset to the Quantocks, and including parts of the south Wales seaboard up to altitudes of 500 m.

Both climatic and edaphic conditions combine to influence the general character of this vegetation. However, in most situations burning and grazing have a marked effect on the floristics and physiognomy of the vegetation and, with the exception of situations such as the Lizard where exposure to high and frequent winds is combined with a scarcity of seed parents, these treatments are important for maintaining the community against succession to woodland. As with many lowland heath communities intensive improvement for agriculture and afforestation has reduced and fragmented its extent.
Erica tetralix very infrequent in vegetation usually dominated by Agrostis curtisii or E. cinerea.

Erica cinerea rather patchy but Vaccinium myrtillus common in a grassy heath with Festuca ovina, Danthonia decumbens, Agrostis capillaris, Galium saxatile and occasional Carex pilulifera and C. binervis.

H4a

Agrostis curtisii - Erica cinerea sub-community

Unusually there is an almost total absence of Erica tetralix. Otherwise all the constants remain frequent except for Agrostis curtisii which is often dominant, forming a virtually pure and tussocky sward. Other grasses do not generally increase in cover. Other vascular and cryptogam associates are few in number.

This sub-community occurs throughout the range of H4 and is often present as regenerating vegetation after burning.

H4b

Festuca ovina sub-community

Agrostis curtisii is often the most abundant species, most commonly with a fairly rich mixture of sub-shrubs and herbs forming a grass heath. Both Ulex gallii and Calluna vulgaris have high frequencies; Erica cinerea is more patchy and Erica tetralix common but not constant. Vaccinium myrtillus is most common in this sub-community, often as sparse shoots. The associates listed above are more abundant and preferential.

Potentilla erecta is very common, often with Galium saxatile. Bryophytes and lichens are very sparse in ungrazed stands but occasional in grazed vegetation.

This sub-community, along with the Scirpus sub-community, can be found at higher altitudes on Dartmoor and Exmoor and also throughout the range on free-draining soils with grazing.

H4c

Erica tetralix sub-community

Both grasses and sub-shrubs have very high frequency, including Erica tetralix, and each can be abundant. Potentilla erecta is frequent and Danthonia decumbens, Polygala serpyllifolia and Carex paniculata occasional. This vegetation is best known on the Lizard where Erica ciliaris or E. vagans occur in this type of heath. Bryophytes and lichens show a varying representation.

This sub-community is especially characteristic of lower altitudes and is well represented on the Devon Pebble-Bed commons, the lower fringes of Dartmoor and Bodmin Moor and on the Lizard.

H4d

Scirpus cespitosus sub-community

Scirpus cespitosus is constant in vegetation usually dominated by Calluna vulgaris, but with other sub-shrubs and grasses locally abundant.

Scirpus cespitosus constant in vegetation usually dominated by Calluna vulgaris, but with other sub-shrubs and grasses locally abundant.

Scirpus cespitosus absent from vegetation variously dominated by one or more sub-shrubs and grasses and with Erica vagans or E. ciliaris locally abundant.
H5 Erica vagans - Schoenus nigricans heath

This heath is one of two sub-shrub communities in which the nationally-rare Erica vagans makes a constant and prominent contribution. Schoenus nigricans is also constant and usually abundant as strongly-developed tussocks. Molinia caerulea and Erica tetralix are also constant, often with high cover, and together these four species dominate in mixtures. Between these species there is a well-defined system of runnels giving a distinct microhabitat. Among other sub-shrubs only Ulex gallii occurs with any frequency and may be co-dominant. Calluna is only occasional and E. cinerea scarce. Genista anglica, however, can occur frequently and is preferential to this community.

In undisturbed stands which have not been burnt or grazed recently, Schoenus and E. vagans tend to be dominant and the vegetation is choked with their litter. Then, even common associates like Potentilla erecta and Festuca ovina can be crowded out. After burning or grazing, or both, the associated flora is much richer. In the wetter runnels sedges are often important with Carex pumila, C. panicea and C. flacca frequent and, on gabbro, C. hostiana. Anagallis tenella, also constant, may form extensive mats. Among taller herbs Serratula tinctoria and Succisa pratensis are constant and Sanguisorba officinalis frequent. There are a number of occasional associates. On wetter ground Phragmites australis can be present as conspicuous but scattered shoots.

Bryophytes vary considerably among stands but Campylium stellatum is constant and very frequent in runnels and may be abundant, often with Riccardia multifida, R. sinuata and, over gabbro, Scorpidium scorpioides. After wet weather runnels often have swollen gelatinous globules of blue-green algae.

This community is confined to wet, base-rich but calcium-poor mineral soils and shallow peats on the Lizard in Cornwall. Here the distinctive parent materials of serpentine and gabbro found in this area have given rise to soils that have a superficial pH of between 5.5 and 7.5 but in which magnesium predominates over calcium. The community makes the major proportion of the open and enclosed heaths of the hinterland of the peninsula.

The floristics of this community are influenced both by the mild oceanic climate and underlying bedrocks of serpentine and gabbro, but the composition and physiognomy of particular stands are affected by burning and sometimes also by grazing. Other past treatments like the cutting of turf have also probably influenced the appearance and distribution of this community. There have been losses of this vegetation type to modern techniques of land improvement and much of the remaining extent has statutory or voluntary protection.
Vegetation variable in composition and structure, but species listed opposite rare.

Frequent *Eleocharis multicaulis*, *Eriophorum angustifolium*, *Drosera rotundifolia*, *Pinguicula lusitanica*, and *Dactylorhiza incarnata incarnata* growing in runnels that are usually flooded for much of the year. In ungrazed stands, *Phragmites australis* may be locally abundant.

**H5b**

*Eleocharis multicaulis* sub-community

*Schoenus nigricans* dominant with *Molinia caerulea* and *Erica vagans*. *Erica tetralix* is somewhat less abundant. *Calluna vulgaris* and *Erica tetralix* usually absent and *Carex panicea* is also typically missing.

**H5a**

Typical sub-community

This vegetation has all the general features of the community with no additional preferential species. The tussock/runnel structure is often well-defined, but species-richness depends greatly on treatment and especially time since burning.
This community is a distinctive type of sub-shrub vegetation, but rather variable in floristics and structure. The most obvious feature is a mixed canopy of sub-shrubs in which Erica vagans and Ulex europaeus are the usual co-dominants. The canopy is generally 30-60 cm high but in exposed situations may be not more than 10 cm high. Two other constant sub-shrubs, Ulex gallii and E. cinerea, can also be abundant although the former may be suppressed in dense stands. Calluna vulgaris is not frequent and has generally low cover.

In contrast to the Erica vagans – Schoenus nigricans heath (H5) community, E. tetralix is only occasional and confined to wetter soils (see sub-community H6d) with several preferential associates. The only herbaceous associates common throughout are Carex flacca, Potentilla erecta and Polygala vulgaris. The most common and distinctive herbs of this community are Viola riviniana, Filipendula vulgaris, Stachys betonica, Hypochoeris radicata, Agrostis canina ssp. montana, Dactylis glomerata and Scilla verna. Most of these species are found in recently burned stands but become more scattered and reduced in number as the vegetation and litter increase.

On shallower soils, especially when grazed, a rich short herb layer is maintained with several additional species including Festuca ovina, Thymus praecox, Lotus corniculatus, Galium verum, Jasione montana, Danthonia decumbens and Brachypodium sylvaticum. Immediately after burning, diversity is increased, with ephemerals including Aira caryophyllaea and Centaurea erythraea. Continued burning and the dense shade and litter of older stands inhibit bryophytes and lichens, which as a result are uncommon.

This community is confined to the Lizard in Cornwall where it is characteristic of free-draining brown earths that are usually quite base-rich but calcium-poor and fairly oligotrophic. It is found on soils similar to that of H5 with a pH of generally between 5 and 7, but which are more free-draining. Therefore it is typically found on the steeper, shedding slopes around coves and on the cliff tops of the headlands. Although it is mainly coastal in distribution it is not strictly speaking a maritime heath and is replaced on slopes which are exposed to salt spray by Calluna vulgaris – Scilla verna heath (H7).

Edaphic variation and local differences in the warm oceanic climate strongly influence floristic diversity, but treatments, especially burning, and to a lesser extent grazing, also have a marked effect on composition and physiognomy of the vegetation. However, the progression to scrub and woodland in the absence of these treatments would probably be slow due to the lack of seed parents and the poor quality of the soil. Preferential cultivation of the more fertile soils developed over gabbro and schists means that the community survives most extensively over serpentine.
**Agrostis curtisi sub-community**

Apart from occasional occurrences in H6a, Agrostis curtisi is largely confined to this sub-community where it can be very abundant especially after burning. Molinia caerulea is also frequent and the two grasses sometimes dominate under an open canopy of Erica vagans, E. cinerea, Ulex gallii and U. europaeus. Among the herbs Viola riviniana is absent and Filipendula vulgaris scarce. Danthonia decumbens and Potentilla erecta are very frequent and Stachys betonica and Serratula tinctoria are common, as are the preferential species listed above.

**Molinia caerulea sub-community**

Erica vagans and Ulex europaeus retain high frequency and abundance with smaller amounts of Ulex gallii. Both Erica cinerea and Calluna vulgaris are reduced in frequency but Erica tetrax is constant in small amounts. In stands not recently burned Molinia caerulea is distinctive. Its litter depresses herbs and generally only Carex flacca, Viola riviniana, Potentilla erecta and Stachys betonica occur with any frequency, with small amounts of the preferential species listed above.

**Festuca ovina sub-community**

Here the abundance and height of the sub-shrub canopy is less than in the typical form with a total cover of often less than 50%. Apart from Potentilla erecta the common herbs are all well represented in this sub-community. In the more open conditions there are more cryptogams than usual, Hypnum cupressiforme s.l. is frequent and various Cladonia spp. common.

**Typical sub-community**

Typical heath with a complete range of floristic and structural vegetation related to burning. A few years into the cycle there is a well-developed sub-shrub canopy with most of the community constants. Richer stands have occasional Teucrium scorodonia and Geranium sanguineum, but associates listed opposite very sparse in more recently regenerating stands.
In this heath, sub-shrubs are a consistent feature, though they are not always obvious. The canopy is typically very short, rarely over 20 cm, and sometimes when grazed forming a mat only 2-3 cm high. The cover of woody plants is rarely continuous. Even where sub-shrubs are more extensive, they are commonly penetrated by herbs. Calluna vulgaris is the most frequent sub-shrub and the commonest dominant, though on dry soils it is accompanied by Erica cinerea. On wetter soils the latter is much reduced and E. tetralix and/or Empetrum nigrum ssp. nigrum are the usual associates. No other woody species occurs frequently throughout, although Ulex gallii is occasional.

Among herbaceous associates grasses are often important. Festuca ovina is the most frequent grass species, though F. rubra is also common. Also common and a constant is Holcus lanatus, often with Dactylis glomerata on drier soils or Danthonia decumbens on moister ground. In wetter, northern heaths Agrostis capillaris and Anthoxanthum odoratum can become very common, but Molinia caerulea is infrequent. There are a variety of other herbs. Most distinctive among the constants are Plantago maritima and Scilla verna. Other common and constant species are Plantago lanceolata, Potentilla erecta, Lotus corniculatus, Thymus praecox and Hypochoeris radicata, the latter of which tends to favour drier soils. Anthyllis vulneraria also favours drier soils as do Euphrasia species. Other species are more characteristic of particular sub-communities.

In contrast cryptogams are few and never show high cover. Among the mosses only Hypnum cupressiforme s.l. is moderately frequent and Frullania tamarisci, the commonest hepatic, is infrequent. Several Cladonia species are occasional.

This community occurs over a wide variety of moderately base-poor soils on the less exposed parts of maritime cliffs all around the coast of Britain except to the east and south between Durham and Dorset. The single most distinctive difference between the habitat of this kind of heath and the habitats of other sub-shrub communities is the input of salt spray generated by breaking waves and carried inland by the wind.

The floristic and structural variation in this community is influenced by the climatic and edaphic differences both throughout the considerable geographic range of the community and over particular stretches of cliff. Grazing also affects the composition and appearance of the vegetation and probably contributes to maintaining it against successional change. However, over much of its range this vegetation can be considered a climatic climax as exposure to even small amounts of salt spray hinders the invasion of woody invaders.
Agrostis capillaris and Anthoxanthum odoratum occasional but Erica cinerea and Hypochoeris radicata remain very frequent and E. tetralix, Empetrum nigrum, Carex panicea and C. nigra are rare.

Empetrum nigrum constant with occasional Empetrum nigrum and frequent Danthonia decumbens and Succisa pratensis. Molinia caerulea, Nardus stricta and Salix repens locally prominent.

Plantago maritima and frequent and Empetrum nigrum very conspicuous. Anthoxanthum odoratum and Hypochoeris radicata frequent and Carex panicea and Carex nigra occasional.

Armeria maritima and Sedum anglicum constant and often abundant with frequent Dactylis glomerata, Anthyllis vulneraria and Jasione montana, and occasional Plantago coronopus and Silene vulgaris maritima.

Dactylis glomerata and Anthyllis vulneraria occasional but other listed associates rare.

Viola riviniana occasional but other listed associates rare among an often impoverished Calluna vulgaris-dominated cover.

This sub-community, along with the Armeria sub-community, occurs throughout the range of H7 but is better developed south of Galloway with only local stations beyond this.
Floristically this is a diverse community with only three constants overall, namely Calluna vulgaris, Erica cinerea and Ulex gallii. Erica tetralix, Molinia caerulea and Agrostis curtisi are typically lacking from this community. Often the three constant sub-shrubs are co-dominant, but proportions are variable and where E. cinerea is reduced Vaccinium myrtillus can appear. On disturbed ground U. europaeus may be abundant and both Pteridium aquilinum and Rubus fruticosus agg. may appear in the heath.

Typically sub-shrub cover is high and herbs are sparse, but often the bushes are separated by grassy runnels, a feature accentuated by grazing. The most frequent grasses are Agrostis capillaris and Festuca ovina with A. canina ssp. montana, F. rubra, Anthoxanthum odoratum and Danthonia decumbens occasional to frequent. Deschampsia flexuosa and Nardus stricta are much more patchy in their occurrence. There is often some Potentilla erecta and Galium saxatile, and much more occasionally Teucrium scorodonia and Polygala serpyllifolia. Additional herbs are characteristic of particular sub-communities.

In general bryophytes and lichens are not numerous or diverse. There may be some Hypnum cupressiforme and Dicranum scoparium, and Rhytidiadelphus squarrosus and Pleurozium schreberi are more occasional. In more open situations, or on burned or disturbed bare ground, mosses such as Campylopus paradoxus, Polytrichum piliferum or P. juniperinum can become abundant along with lichens species such as Cladonia impexa and C. squamosa.

This community is found on free-draining, generally acid to circumneutral soils, in the warm oceanic regions of lowland Britain. It can be found over a wide range of arenaceous sediments and acid igneous and metamorphic rocks as well as on silty and sandy superficials like loess and aeolian sands. The superficial pH underneath this community is usually from 3.5 to 4.5. It occurs throughout south-western England and Wales, on the Isle of Man and, more sporadically, in the southern Pennine fringes and the East Anglian coast.

Local climatic and edaphic conditions influence floristic variation; grazing by rabbits, sheep or cattle, and sometimes burning (which is normally an accidental occurrence), affect physiognomy and composition. The community is maintained against succession to woodland in most situations by grazing and burning, although in some situations exposure to the wind prevents the establishment of woody invaders such as Betula spp. and Quercus spp. Much former heath has been improved for agriculture and it now often survives as patches on marginal grazing land.
Potentilla erecta can be quite common, but other species listed opposite are scarce.

Danthonia decumbens, Anthoxanthum odoratum, Festuca rubra and Potentilla erecta frequent.

Species listed opposite usually very scarce.

Combination of species listed opposite not present.

Erica cinerea reduced in frequency but Vaccinium myrtillus constant in small amounts with Deschampsia flexuosa frequent and Nardus stricta, Pleurozium schreberi and Rhytidiadelphus squarrosum occasional.

Erica cinerea remains common but Vaccinium myrtillus and other species listed opposite scarce.

Danthonia decumbens sub-community

The canopy is well-developed here with Ulex gallii and Erica cinerea especially abundant, but not as dense as in H8a and typically there is a system of grassy runnels. In these Agrostis capillaris and Festuca ovina are quite frequent but more characteristic is Danthonia decumbens and less commonly Anthoxanthum odoratum, Festuca rubra and Agrostis canina montana. Mixtures of these species typically form the bulk of a rough cover between the bushes. Carex pilulifera is also typical but patchy, though particularly abundant in open places after burning, and Viola lactea can also become prominent in such places. This sub-community occurs confined to the coastal fringe in western Britain.

This sub-community is found in areas with calcareous bedrock mantled with drift.

Vaccinium myrtillus sub-community

Erica cinerea is present with reduced frequency, though it can remain locally abundant in this upland sub-community. The most prominent sub-shrub is usually Ulex gallii with smaller amounts of Calluna vulgaris and, strongly diagnostic, Vaccinium myrtillus. Grasses can have a high cover, with Agrostis capillaris, Festuca ovina and Anthoxanthum odoratum all frequent, but Deschampsia flexuosa is preferential. Nardus stricta can also occur with local abundance but dicotyledonous associates are few. Galium saxatile and Digitalis purpurea are occasional. In more open situations bryophytes can form a lush but patchy cover. This sub-community is found mainly in the upland fringes.

Species-poor sub-community

There is an extensive and dense sub-shrub canopy. The canopy can be quite tall, thicker stands being less penetrable to livestock. The associated flora is very sparse with grasses such as Agrostis capillaris, Festuca ovina and F. rubra reduced to small tufts with occasional and weak Potentilla erecta and Galium saxatile. Where the canopy is opened by disturbance or burning Ulex europaeus or Pteridium aquilinum may expand. Cryptogams are generally infrequent with a few patches of Hypnum cupressiforme. This sub-community occurs throughout the range of H8.

Sanguisorba minor sub-community

This is the most striking of the sub-communities, developing on more calcareous soils. The sub-shrubs and structural variation are similar to those of H8b. With them, however, is a group of strongly preferential herbs, listed above. Where numbers of these are present in grazed stands the vegetation can look like Mesobromion grassland growing among islands of the heath sub-shrubs. This sub-community is found in areas with calcareous bedrock mantled with drift.

Scilla verna sub-community

The three constant sub-shrubs are typically extensive as co-dominants. There is a rather species-poor herbaceous element with Festuca ovina the most frequent, and often the only grass. Potentilla erecta remains common while Hypochoeris radicata is more distinctive and preferential with Scilla verna. Plantago maritima can occur frequently and may be abundant in a grazed sward.

This sub-community occurs throughout the range of H8 but is better represented in the west.
Calluna vulgaris is almost always the most abundant plant in this community, often forming a fairly low and open canopy. Where burning is frequent, the individuals are immature and stands are uniform in age. No other sub-shrubs are consistently frequent throughout, although some can be quite common and locally abundant. Vaccinium myrtillus is the most important, particularly at higher altitudes. More locally V. vitis-idaea and Empetrum nigrum ssp. nigrum can be found. Erica cinerea, E. tetralix and Ulex gallii by contrast are very scarce.

The only other vascular constant is Deschampsia flexuosa, although even in open heather it often occurs only as sparse tufts, and under dense canopies it can almost disappear. Molinia caerulea can become frequent on moister ground, but Agrostis capillaris, Holcus lanatus, H. mollis and Festuca rubra only occur occasionally. Other herbs are also few and are of low cover. Galium saxatile and Potentilla erecta are frequent in grazed stands and Juncus squarrosus and Pteridium aquilinum occasionally occur. Seedlings of Quercus spp., Betula spp. and Pinus sylvestris may be seen but rarely survive to the sapling stage due to frequent burning and grazing.

The bryophyte and lichen flora is characteristic, although poor in species. Hypnum cupressiforme s.l. is restricted, but Pohlia nutans is constant and very common with occasional Campylopus paradoxus and Dicranum scoparium. Orthodontium lineare may be frequent. On exposed soil there can be locally abundant Polytrichum juniperinum, P. piliferum and P. commune. Among leafy hepatics Gymnogonium inflatum is particularly characteristic. The commonest lichens are Cladonia chlorophaea, C. floerkeana, C. squamosa, C. coniocrea and C. fimbriata.

This heath is the characteristic sub-shrub vegetation of acid and impoverished soils at low to moderate altitudes through the Midlands and northern England. It is normally found on very base-poor soils with a surface acidity generally of pH 3-4, highly oligotrophic and at least moderately free-draining, often excessively so, which have been derived from a wide variety of parent materials. It is found mainly in the southern Pennines and North York Moors with more local occurrences scattered through the Midland plain.

The cool and wet climate has some influence on the floristics of this community, but much of its character derives from a combination of frequent burning and grazing. Also the heavy atmospheric pollution in the areas in which this heath occurs is thought to inhibit bryophyte and lichen diversity of the community. The community has been reduced considerably in extent. In the lowlands large tracts of heath have been reclaimed for agriculture whilst other areas have been lost to invasion by trees after the neglect of traditional treatments. Furthermore, both in the lowlands and around the upland fringes, the community has been replaced with coniferous plantations, or land use changes have led to the spread of U20 Pteridium aquilinum – Galium saxatile community.
Vaccinium myrtillus or, more locally, V. vitis-idaea, V. intermedium or Empetrum nigrum common or locally abundant with occasional to frequent Campylopus paradoxus, Gymnogalea inflata, Barbilophozia floerkeii, Cladonia chlorophaea, C. floerkeana and C. squamosa.

Molinia caerulea absent.

Deschampsia flexuosa may be abundant but not with associates listed opposite.

Hypnum cupressiforme and Dicranum scoparium common and sometimes abundant.

Calluna vulgaris and Deschampsia flexuosa often the only plants, with occasional Pohlia nutans.

H9b
Vaccinium myrtillus - Cladonia spp. sub-community

This is the richest sub-community characterised by younger canopies of heather, often recovering from burning. There are frequently one or more of the sub-shrubs listed above. Often Deschampsia flexuosa has a rather low cover. Among the sub-shrubs, bryophytes are more varied than in any other type of this heath. Pohlia nutans, Campylopus paradoxus and Orthodontium lineare all occur frequently and the leafy hepatics and lichens listed above are occasional to frequent.

This and the species-poor sub-community are the usual forms in the southern Pennines and the North York Moors, and are widespread and sometimes extensive over heathlands that are still frequently burned.

Molinia caerulea constant at low cover.

Deschampsia flexuosa often especially abundant with occasional Holcus mollis and Festuca rubra; Galium saxatile and Potentilla erecta frequent with occasional Rumex acetosella.

Hypnum cupressiforme and Dicranum scoparium common and sometimes frequent.

This and the Vaccinium sub-community are the usual forms in the southern Pennines and the North York Moors and are widespread and sometimes extensive over heathlands that are still frequently burned.

H9c
Species-poor sub-community

In this, the most impoverished form, Calluna vulgaris and Deschampsia flexuosa are the only constants, and in frequently burned heather even the Calluna can almost disappear. Vaccinium myrtillus is occasional. Pohlia nutans, Campylopus paradoxus and Orthodontium lineare all show reduced frequencies compared with H9b.

This and the Vaccinium sub-community are the usual forms in the southern Pennines and the North York Moors, and are widespread and sometimes extensive over heathlands that are still frequently burned.
H10 Calluna vulgaris - Erica cinerea heath

This community is typically dominated by Calluna vulgaris, but the cover, height and structure of the sub-shrub canopy vary markedly depending on the intensity and timing of burning and grazing. Erica cinerea, a constant, is frequent but generally subordinate to heather and persists below taller Calluna canopies. Vaccinium myrtillus, by contrast, is at most occasional and V. vitis-idaea is scarce. Empetrum nigrum ssp. nigrum can occur, but mainly in sub-community H10b. The restricted occurrence of these sub-shrubs is a contrast with Calluna vulgaris – Vaccinium myrtillus heath (H12).

Apart from the abundance of the two constant sub-shrubs there are two other distinctive floristic features of this type of heath. These are firstly the high frequency of grasses and to a lesser extent sedges and dicotyledons, and secondly the striking contribution that the ground layer makes to this community. Deschampsia flexuosa is the most consistent grass throughout, with Agrostis canina and Nardus stricta occasional to frequent. In certain sub-communities Festuca ovina, Anthoxanthum odoratum, Agrostis capillaris and Molinia caerulea become very common. Carex binevis and C. pilulifera are very characteristic of this community. After burning, mixtures of these plants can become patchily abundant and Deschampsia flexuosa and C. pilulifera temporarily dominant. There are typically only a few dicotyledons, but Potentilla erecta is a constant and Galium saxatile is fairly common.

After burning, a local abundance of Polytrichum piliferum, P. juniperinum and encrusting Cladonia species can develop. In exposed stands there is often a patchy carpet of Racomitrium lanuginosum and fruticose lichens. However, more important than these species in the community as a whole are bulky pleurocarpous mosses such as Hypnum cupressiforme s.l., Pleurozium schreberi and Hylocomium splendens, with Rhytididiaphalus triquetrus and R. loreus also occurring occasionally. These species, with Dicranum scoparium, become abundant with the maturing and opening up of the Calluna bushes.

This heath is characteristic of acid to circum-neutral and generally free-draining soils in the cool oceanic lowlands and upland fringes of northern and western Britain. The soils on which this community is found can be quite moist as a result of the climate and the superficial pH beneath the community can be anywhere between 3.5 and 6. It occurs widely through the more oceanic parts of Scotland, with outlying stands in Wales, western England and around the east-central Highlands.

In more exposed situations it may be considered as an edaphic or climatic climax, but often burning and grazing are important in controlling its composition and structure. Steady grazing pressure pushes the vegetation towards the Festuca ovina – Agrostis capillaris – Galium saxatile grassland (U4) or, over more base-rich soils, the Festuca ovina – Agrostis capillaris – Thymus praecox grassland (CG10). After fire, heavy grazing can precipitate a run-down of the heath to swards in which Nardus stricta or Juncus squarrosus play an important part or permit the spread of Pteridium aquilinum. Release from grazing and burning, in all but the most exposed sites, would theoretically permit progression to scrub and woodland, although in many areas natural seed parents are now scarce.
Combinations of such species rare.

Sub-shrub canopy often short in a grassy heath with frequent Festuca ovina, F. rubra, Agrostis capillaris, Anthoxanthum odoratum and Galium saxatile and occasional Campanula rotundifolia, Succisa pratensis and Hypericum pulchrum. Dicranum scoparium, Pleurozium schreberi and Hylcomium splendens patchy.

Danthonia decumbens very common with occasional to frequent Carex pullicaris, Viola riviniana, Linum catharticum, Prunella vulgaris and Primula vulgaris.

Thymus praecox - Carex pullicaris sub-community

This heath is found on relatively base-rich brown earth soils and is very similar to H10c with Calluna vulgaris and Erica cinerea both able to show prominence and with herbs and bryophytes both being of structural importance. Here there are additional preferentials, making this the most species-rich sub-community. The species listed above are most frequent together with Carex panicea and Thymus praecox. Among the bryophytes Dicranum scoparium and Racomitrium lanuginosum are frequent. This sub-community is local in occurrence but can be found on Skye, Rum and Uist and scattered localities through the Highlands and Southern Uplands.

H10d

Festuca ovina - Anthoxanthum odoratum sub-community

Calluna vulgaris is still abundant but Erica cinerea may often be co-dominant. The sub-shrubs are usually short, commonly forming a mosaic with a grassy turf. Most frequent here are the grasses and other species listed above. Carex bineversis and C. pilulifera are also common. Dicotyledonous herbs are more numerous than in 10a and 10b. Potentilla erecta and Carex pilulifera are both very common with occasional records for several species. Bulky pleurocarpous mosses are consistent and distinctive here with frequent Hypnum cupressiforme s.l., Pleurozium schreberi, Hylcomium splendens and also Dicranum scoparium. This sub-community is common in south-west Scotland.

H10c

Racomitrium lanuginosum sub-community

This is found on exposed sites where the sub-shrub canopy is more open and Calluna vulgaris is the usual dominant. Erica cinerea is frequent, Vaccinium myrtillus occasional and Empetrum nigrum ssp. nigrum is preferential and quite common. Grasses are sparse with scattered tufts of Deschampsia flexuosa other grasses very occasional. Carex bineversis is rare, its place being taken by Carex pilulifera and C. panicea. Scirpus cespitosus is also frequent. Potentilla erecta is the only frequent dicotyledon. Hypeveria selago is preferentially common. There are substantial areas of the ground layer with Racomitrium lanuginosum the most abundant moss, and frequent Hyphnum cupressiforme s.l. Lichens are well represented. This sub-community is typical of the Western Isles and Shetland.

H10b

Empetrum nigrum ssp. nigrum and Scirpus cespitosus occasional at most and Molinia caerulea very common at low covers with frequent Carex bineversis and occasional Juncus squarrosus. Campylopus paradoxus, Sphagnum capillifolium and Diplophyllum albicans occasional to frequent.

Emetrum nigrum ssp. nigrum

This is found on exposed sites where the sub-shrub canopy is more open and Calluna vulgaris is the usual dominant. Erica cinerea is frequent, Vaccinium myrtillus occasional and Empetrum nigrum ssp. nigrum is preferential and quite common. Grasses are sparse with scattered tufts of Deschampsia flexuosa other grasses very occasional. Carex bineversis is rare, its place being taken by Carex pilulifera and C. panicea. Scirpus cespitosus is also frequent. Potentilla erecta is the only frequent dicotyledon. Hypeveria selago is preferentially common. There are substantial areas of the ground layer with Racomitrium lanuginosum the most abundant moss, and frequent Hyphnum cupressiforme s.l. Lichens are well represented. This sub-community is typical of the Western Isles and Shetland.

H10a

Typical sub-community

In this, the most species-poor sub-community, Calluna is typically dominant and abundant in pioneer and building regrowth after burning. Erica cinerea is very frequent and can be prominent. Vaccinium myrtillus is occasional and Empetrum nigrum nigrum and Erica tetralix scarce. Monocotyledons are few with Deschampsia flexuosa very frequent and sometimes prominent. Molinia caerulea is preferential and patchily abundant with occasional Scirpus cespitosus and Juncus squarrosus. Carex bineversis is well represented. Apart from Potentilla erecta and Galium saxatile, dicotyledons are very sparse. The ground layer is also poor in species and of low cover. This sub-community is found throughout the range of H10.
Calluna vulgaris is the only constant sub-shrub found in this community and is often abundant, although cover may be discontinuous and patchy in younger or grazed stands. Other frequent sub-shrubs are Erica cinerea and Empetrum nigrum ssp. nigrum, and each can be locally abundant, to the exclusion of Calluna itself. Sometimes Rosa pimpinellifolia is plentiful, and together with Erica tetralix and Salix repens is found in transitions to wetter heath. Carex arenaria is constant, but no more than moderately abundant and often senile, except where the sand is locally mobile. Ammophila arenaria is also frequent throughout, though usually sparse. In more species-poor stands these may be the only species, but often there is some Festuca rubra (or F. ovina) with Agrostis capillaris and Anthoxanthum odoratum and less commonly Poa pratensis. Variation among dicotyledons is modest, but Galium verum, Lotus corniculatus, Viola riviniana and Thymus praecox all occur quite frequently with several other herbs.

There may be hypnoid mosses such as Hypnum cupressiforme s.l., Pleurozium schreberi, Hylocomium splendens and Rhytidium rugosum in the turf. On areas of bare ground acrocarps such as Polytrichum juniperinum, P. piliferum and Ceratodon purpureus may be patchily abundant.

This is the characteristic sub-shrub vegetation of stabilised, base-poor sands on dunes and plains around the coasts of Britain. The heath is largely confined to sands with a pH of less than 5 and can only establish on sediments with surface stability such as found on older dunes and on consolidated sand plains. It is very local along the coasts of western England and Wales, becoming commoner in Scotland.

The community develops in primary succession by colonising fixed dune grasslands on acid sands or where more lime-rich sands have become leached. Relief from grazing is probably important for its establishment but once established predation by herbivores, along with variation in regional climate and substrate, influences its composition and structure, and ultimately, grazing maintains the community against reversion to grassland or progression to scrub and woodland.
Erica cinerea and Aira praecox frequent but Empetrum nigrum, Agrostis capillaris and Galium saxatile are rare. Dicranum scoparium common and some of Cladonia furcata, C. floerckiana, C. pyxidata, C. gracilis and C. foliacea in an often extensive carpet of lichens.

H11a

**Erica cinerea sub-community**

This sub-community is prominent in southern areas where rainfall is relatively low. Calluna vulgaris and Erica cinerea are generally co-dominant with Erica cinerea sometimes colonising first. Rosa pimpinellifolia is a distinctive invader. Festuca rubra/ovina is very common with scattered shoots of Carex arenaria and Luzula campestris. Other herbs are occasional. The distinctive element is the cryptogams, often occupying the bulk of the ground. Hypnoid mosses are scarce and most obvious are the lichens, particularly Cladonia spp., including those listed above. Cornicularia aculeata and Hypogymnia physodes are also common, sometimes with Peltigera canina and low-growing Usnea species.

This is the most widespread sub-community but it is replaced locally by the Empetrum sub-community in north and east Scotland.

H11b

**Empetrum nigrum ssp. nigrum sub-community**

Calluna vulgaris and Empetrum nigrum, which forms large patches, are the co-dominants here, especially in the cooler wetter north of Britain. Festuca rubra/ovina remains common among frequent Carex arenaria and Luzula campestris with other species as listed above. Hypnoid mosses are more prominent with Hypnum cupressiforme, Pleurozium schreberi, Rhytiadiadelphus triquetrus and Hyplocarpos plagiobothrus. This is the most species-rich sub-community.

H11c

**Species-poor sub-community**

Calluna vulgaris is overwhelmingly dominant with only occasional or even no bushes of other species. Carex arenaria remains constant but grasses may only be represented by a few tufts of Anthoxanthum odoratum or Deschampsia flexuosa. Other herbs are also sparse. Bryophytes may include hypnoid spp. and Dicranum scoparium.

This sub-community can be found throughout the range of H11.
This heath is generally dominated by Calluna vulgaris and includes most of the Calluneta from less oceanic sub-montane areas where burning is commonly practised, including many grouse moors. Here a predominance of building-phase Calluna is found, but a more open cover of degenerate Calluna can often also be present. Vaccinium myrtillus is constant though it is usually subordinate to Calluna and is most vigorous out of reach of grazing animals. Vaccinium vitis-idaea is also found, sometimes with local prominence, and Erica cinerea may also be present on drier slopes. Empetrum nigrum ssp. nigrum is frequent, forming mats after burning, but then becomes reduced after the Calluna has regrown.

In many stands herbs are rare. Only Deschampsia flexuosa is frequent throughout. When grazing is regular there may be additional herbs including Festuca ovina, Agrostis capillaris, A. canina, Nardus stricta, Potentilla erecta and Galium saxatile.

The ground-layer is often prominent with bulky mosses characteristic, such as Dicranum scoparium, Pleurozium schreberi, Hypnum cupressiforme s.l. and Hylocomium splendens, together with larger Cladonia species. Encrusting lichens and Polytrichum species can be abundant in the years following burning.

This community is the typical sub-shrub community of acidic to circumneutral, free-draining mineral soils throughout the cold and wet sub-montane zone generally between 200 m and 600 m. The soils on which it occurs are widespread throughout this zone, developing from a variety of siliceous parent materials, intrusive igneous rock or coarse glacio-fluvial gravels. Despite being free-draining the soils are normally moist for the majority of the year because of the climate and the superficial pH is usually between 3.5 and 4.5. It is extensive in the east-central Highlands but also important in south-east Scotland, the Lake District, parts of Wales and the South-West Peninsula and the North York Moors. In places like the southern Pennines, where air pollution is severe, it is largely replaced by Calluna vulgaris – Deschampsia flexuosa heath (H9).

Burning and grazing are the major influences on floristics and structure, although climatic and edaphic difference play some part in determining variation within the community. Successional developments are usually held in check by burning and grazing and without these most stands would probably progress to scrub and woodland. Continuous heavy grazing favours the loss of sub-shrub vegetation to grassland and in some instances, particularly after burning, may result in the spread of Pteridium aquilinum.
Vaccinium vitis-idaea and Empetrum nigrum nigrum frequent, with occasional Juncus squarrosus and Blechnum spicant.

Calluna vulgaris not so abundant as usual, and other sub-shrubs of generally moderate cover in a grassy heath, with frequent Festuca ovina, Agrostis capillaris, Nardus stricta, Galium saxatile and Potentilla erecta and occasional Carex pilulifera, Campanula rotundifolia and Polygala serpyllifolia. Lichens not extensive, often patchy.

Sub-shrub cover extensive and varied with Vaccinium vitis-idaea especially frequent and species listed opposite typically scarce. Cryptogam flora varied and often abundant, with bulky pleurocarps prominent, Hymnoium splendens often joining Pleurozium schreberi and Hypnum jutlandicum. Cladonia impexa, C. uncialis and C. pyxidata common.

Galium saxatile - Festuca ovina sub-community

This sub-community is found on better soils and after burning, often followed by grazing. Calluna vulgaris is less dominant and with other sub-shrubs forms an open growth within a grassy sward. Deschampsia flexuosa is joined by a variety of herbs including those listed above. Where the soils are less base-poor, species such as Lotus corniculatus, Lathryus montanus, Succisa pratensis, Viola riviniana and Anemone nemorosa can be locally abundant. Bryophytes remain quite varied, but lichens are few and of low cover.

Vaccinium vitis-idaea - Cladonia impexa sub-community

This includes most of the richer stands of this heath, which develop a number of years after burning. Although Calluna vulgaris is still the general dominant it is frequently accompanied by Vaccinium myrtillus, V. vitis-idaea and Empetrum nigrum nigrum and occasionally with Erica cinerea. Herbs are generally sparse with only scattered plants of Deschampsia flexuosa, and occasional Potentilla erecta, Juncus squarrosus and Blechnum spicant. Bryophytes and lichens are more numerous including the species listed above.

Calluna vulgaris sub-community

Vegetation is typically species-poor with Calluna vulgaris overwhelmingly dominant and other sub-shrubs of low cover. Vaccinium myrtillus is very frequent and Erica cinerea common, but both only as scattered shoots. Other vascular associates are few. Deschampsia flexuosa is frequent as scattered shoots and sparse plants of Potentilla erecta and Pteridium aquilinum are quite common. The ground cover is not extensive and only Dicranum scoparium, Hypnum jutlandicum and Pleurozium schreberi occur frequently as scattered shoots.
H13 Calluna vulgaris – Cladonia arbuscula heath

This heath has a dwarfed mat of sub-shrubs with few vascular associates, but with a prominent lichen flora. Calluna vulgaris is the most frequent species, generally prostrate and forming a carpet or in wave-like bands or on solifluction terraces. Among other sub-shrubs Empetrum nigrum is most important, usually as ssp. hermaphroditum, but with ssp. nigrum at lower altitudes. It may be intermixed in the mat or forming clumps. Loiseleuria procumbens is quite frequent and abundant, but Arctostaphylos uva-ursi is at most occasional. Both Vaccinium myrtillus and V. vitis-idaea are common, but always subordinate in cover.

The other vascular associates are few and sparse. Deschampsia flexuosa and Carex bigelowii are most frequent with species such as Scirpus cespitosus, Agrostis canina and Molinia caerulea at lower altitudes and Juncus trifidus becoming occasional at higher levels. Huperzia selago is also frequent in higher altitude stands.

Lichens are important structurally. Cladonia arbuscula is especially common and, where there is some shelter, may be abundant. It is usually mixed with C. rangiferina which locally may be co-dominant. Also constant are C. uncialis, Cetraria islandica, Alectoria nigricans and Cornicularia aculeata. Among these, bryophytes are generally few and rarely of any abundance. Racomitrium lanuginosum is constant and can form locally conspicuous patches.

This heath is the characteristic sub-shrub vegetation of base-poor soils, over exposed ridges and summits of mountains, in parts of Britain with a cold continental climate. It is found on soils with a superficial pH of between 4 and 5, and frequently a humic surface above pervious acidic bedrocks and superficials. It is most widespread through the east-central Highlands of Scotland, thinning out westwards into the central Grampians and north-west Highlands where it is progressively replaced by its oceanic counterpart Calluna vulgaris – Racomitrium lanuginosum heath (H14). There are a few fragmentary localities in northern England and Wales.

It is a vegetation type of unsheltered slopes generally between 600 m and 900 m where there are almost constant strong winds which frequently clear the ground of snow and subject the vegetation not only to reduced precipitation but also to the effects of frequent and severe frosts and subsequent thaws. Burning and grazing may have curtailed its range in suitable localities in the more southerly uplands, but in the eastern Highlands the vegetation seems to be largely unaffected by treatments and the community can be considered a climax.
Vaccinium species common and Loiseleuria procumbens frequent in a nearly prostrate mat, with Cladonia crispata, C. coccleifera, Ochrolechia frigida and Thamnolia vermicularis often found.

H13a
Vaccinium species less frequent and Loiseleuria procumbens and listed lichens occasional at most.

H13b
Empetrum nigrum ssp. hermaphroditum - Cetraria nivalis sub-community
On bleak exposed sites at higher altitudes lichens remain abundant, but Calluna vulgaris or occasionally Empetrum nigrum hermaphroditum is dominant. Both Vaccinium myrtillus and V. vitis-idaea are more frequent than in H13a but usually have low cover. Loiseleuria procumbens is occasional. Cladonia arbescula is still the most frequent lichen but is commonly joined by the species listed above. Mosses only make a minor contribution and the few vascular associates are present as scattered individuals.

H13c
Cladonia crispata - Loiseleuria procumbens sub-community
Calluna vulgaris is again the usual dominant, but one or both subspecies of Empetrum nigrum are common and can be abundant. In the flattened sub-shrub mat there is a mixed carpet of lichens including the species listed above. The herbs comprise scattered shoots of Carex bigelowii, Huperzia selago and Deschampsia flexuosa.

Deschampsia flexuosa very common with occasional Diphasium alpinum and Juncus trifidus. Cetraria nivalis frequent and Cladonia gracilis and C. bellidiflora occasional.

Deschampsia flexuosa only occasional and Carex bigelowii scarce but Erica cinerea and E. tetralix occasional among the sub-shrubs, sometimes with Scirpus cespitosus and Molinia caerulea. Cetraria nivalis and Cladonia gracilis uncommon, but C. arbuscula and C. rangiferina especially abundant.

Cladonia arbuscula - Cladonia rangiferina sub-community
This sub-community is found at lower altitudes or more sheltered sites where larger Cladonia species, as above, are especially abundant, often exceeding the sub-shrubs in cover. Cladonia implexa can also be found, but C. gracilis and C. crispata are scarce. The most common sub-shrub is Calluna vulgaris but Empetrum nigrum is very common, often as ssp. nigrum. Vaccinium species are only occasional.
This heath consists essentially of a dwarfed sub-shrub mat with Calluna vulgaris usually predominant, together with Racomitrium lanuginosum. Other sub-shrubs play a subordinate role, but may be common. Most frequent is Empetrum nigrum, with the two subspecies characterising opposite ends of the altitudinal range (ssp. nigrum preferentially common towards lower levels and ssp. hermaphroditum largely confined to higher altitudes). Erica cinerea is also frequent.

Other vascular associates are few and usually scattered. Deschampsia flexuosa, Huperzia selago, Carex pilulifera, Potentilla erecta and Scirpus cespitosus are all frequent, and Carex bigelowii becomes common at higher altitudes.

The extensive woolly carpet of Racomitrium lanuginosum which can be up to 5-10 cm thick is the most noticeable feature of this community. Hypnum cupressiforme s.l. is also very frequent in some stands, often with several other mosses and occasional hepatics. Lichens are common and varied but not abundant, and species like Cetraria nivalis and Alectoria ochroleuca are absent. Cladonia arbuscula and C. uncialis are the most frequent, and Sphaerophorus globosus and Cornicularia aculeata are also common throughout. Cladonia impexa is frequent at lower altitudes and Cladonia gracilis, C. bellidiflora, Cetraria islandica and Ochrolechia frigida occur often at higher altitudes.

This community is the typical sub-shrub community of base-poor soils on windswept plateaux and ridges at moderate to fairly high altitudes in the cool oceanic climate of the mountains of north-west Scotland. It can be found up to 750 m, although this can extend up to 1000 m in the east; to the west and north, on islands like Skye, Orkney and Shetland, it can extend down to below 250 m. The community is found on the base-poor rankers and podzolic soils which are widespread in this region, with a superficial pH between 4 and 5 and a humic surface. It is very much a community of the north-west Highlands with scattered occurrences in the central Grampians.

Like its eastern counterpart Calluna vulgaris – Cladonia arbuscula heath (H13) it is found over gentle to moderately steep slopes which are exposed to fairly constant strong winds that clear the snow which might otherwise provide shelter in the coldest months. Although it is sometimes grazed by sheep and deer, it is unlikely that this factor is important in maintaining the characteristic composition and physiognomy, and this vegetation can be regarded as the natural climax in such exposed situations in its range.
<table>
<thead>
<tr>
<th>H14a</th>
<th>Empetrum nigrum nigrum and Erica cinerea at most occasional. Arctostaphylos species and the herbs and bryophytes listed opposite very scarce.</th>
</tr>
</thead>
<tbody>
<tr>
<td>H14b</td>
<td>Empetrum nigrum hermaphroditum constant with frequent Nardus stricta and Diphasium alpinum and sometimes with an extensive lichen cover, including Cetraria islandica, Cladonia gracilis and Ochrolechia frigida.</td>
</tr>
<tr>
<td>H14c</td>
<td>Arctostaphylos uva-ursi constant with frequent A. alpinus, Empetrum nigrum nigrum and Erica cinerea. Scirpus cespitosus common with Molinia caerulea and Carex binervis occasional. Dicranum scoparium, Diplophyllum albicans and Pleurozium schreberi frequent.</td>
</tr>
<tr>
<td>H14d</td>
<td>Festuca ovina sub-community Calluna vulgaris and Racomitrium lanuginosum retain the representation of H14b but the sub-shrubs are more varied with Erica cinerea and Empetrum nigrum ssp. nigrum at their peak of frequency, and locally abundant Arctostaphylos uva-ursi and A. alpinus. Among the vascular associates Carex bigelowii is very scarce. In the bryophyte mat Dicranum scoparium and larger pleurocarps such as Hypnum cupressiforme s.l. and Pleurozium schreberi make their biggest contribution. In the lichen flora Cladonia impexa is common together with the community species. This and the Festuca sub-community are found at the lowest altitudes and most sheltered sites occupied by the community.</td>
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</tbody>
</table>

**H14**

- **Arctostaphylos uva-ursi sub-community**
  - Calluna vulgaris and Racomitrium lanuginosum retain the representation of H14b but the sub-shrubs are more varied with Erica cinerea and Empetrum nigrum ssp. nigrum at their peak of frequency, and locally abundant Arctostaphylos uva-ursi and A. alpinus. Among the vascular associates Carex bigelowii is very scarce. In the bryophyte mat Dicranum scoparium and larger pleurocarps such as Hypnum cupressiforme s.l. and Pleurozium schreberi make their biggest contribution. In the lichen flora Cladonia impexa is common together with the community species.
  - This and the Festuca sub-community are found at the lowest altitudes and most sheltered sites occupied by the community.
**H 15 Calluna vulgaris – Juniperus communis ssp. nana heath**

Prostrate juniper, referable to Juniperus communis ssp. nana, is occasional in a wide variety of sub-shrub heaths. Here, however, it is consistently dominant in the sub-shrub mat, accompanied by a small but distinctive group of oceanic hepatics. The mat is generally less than 10 cm high, fairly continuous in the best stands, but it may form a mosaic with islands of vegetation on tracts of bare rock and debris. Several other sub-shrubs are well represented: Calluna vulgaris and Erica cinerea are especially frequent and the former often fairly abundant. Arctostaphylos uva-ursi and A. alpinus are less common, and Empetrum nigrum ssp. hermaphroditum is occasional.

Vascular associates are typically few and are usually scattered in the mat. Deschampsia flexuosa, Scirpus cepitosus and Potentilla erecta are constant, with Hupehia selago, Solidago virgaurea, Dactylorhiza maculata, Polygala serpyllifolia, Succisa pratensis, and Antennaria dioica more occasional.

In some stands the cryptogam flora is similar to other kinds of dwarfed sub-shrub heath. In typical examples of this community, however, the species Racemitrium lanuginosum, Cladonia uncialis, C. impexa, Sphaerophorus globosus and Cornicularia aculeata, which are common in all these other kinds of heath, are joined by Pleurozia purpurea, Frullania tamarisci and Diplolphyllum albicans which are not. Where the sub-shrub canopy is well-developed the total cover of the cryptogams is much less than in the typical moss-heaths of the region.

This heath is confined to humic rankers at moderate altitudes in the cool oceanic climate along the western seaboard of the north-west Highlands and some of the Western Isles. Soil development under this community is typically rudimentary with just shallow accumulations of decaying juniper and bryophyte litter on Cambrian quartzite screes. Although perhaps once more widespread throughout the north-west Highlands, the community is now of rather patchy occurrence along the western side of the more northerly mountains with especially good stands on Beinn Eighe and Foinaven. The community is replaced in the continental climate of the east-central Highlands by the juniperus communis ssp. communis – Oxalis acetosella woodland (W19).

It is confined to the lower portion of the altitudinal ranges of the other dwarf sub-shrub heaths and, although the vegetation mat is typically blown clear of snow, is not usually found in the kind of severely exposed situations of which the other communities are so characteristic. This community is given some protection against the effects of grazing by the rocky ground on which it is typically found, but it is readily damaged by burning.

No sub-communities.

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**H 16 Calluna vulgaris – Arctostaphylos uva-ursi heath**

Although Arctostaphylos uva-ursi is found as an occasional in a variety of heath types, it is most often found in this community, which has a distinct boreal character. Calluna vulgaris is always present and is the most usual dominant, forming a canopy 20-40 cm high and having a substantial total cover. Arctostaphylos uva-ursi is constant and can become modestly abundant in gaps within the heather cover. Erica cinerea is also very common but of low cover. In many stands there is some Vaccinium myrtillus and V. vitis-idaea.

Quite commonly there are small amounts of Genista anglica, but herbaceous associates are few except in the Pyrola media – Lathyrus montanus sub-community. The only constant grass is Deschampsia flexuosa and this can be joined by Luzula multiflora and L. pilosa.

Bryophytes are variable, with the bulkier mosses often strongly associated with particular stages in the heather regeneration cycle. Hypnum jutlandicum, Pleurozia schreberi and Dicranum scoparium, however, are very common overall and Hylcomium splendens is also a constant through much of the community.

Lichens also differ in their representation, with only Cladonia impexa constant and, in many stands, of low cover. Fruticose species such as C. arbuscula and C. rangiferina tend to follow the larger pleurocarps in developing among the more shady and humid conditions of older heather canopies. Hypogymnia physodes and, less commonly, Cetraria glauca can be seen on decaying woody stems.

This heath is characteristic of base-poor to circumneutral soils at moderate altitudes, generally between 250 m and 600 m altitude, in the cold continental climate of the east-central Highlands of Scotland. It is found on a variety of acid soils developed from lime-poor parent material. It occurs widely but fairly locally through the east-central Highlands with especially good representation in Speyside.

The community forms an important part of grouse-moor in the central Highlands and although edaphic differences play some part in determining floristic variation in the community, their effects are often overlain and modified by the influence of burning which ultimately maintains this vegetation as a plagioclimax. Stretches of moorland including stands of the community are often open to livestock but there is little information on the impact of grazing on this vegetation.
Arctostaphylos uva-ursi often extensive with Calluna vulgaris, Erica cinerea and Vaccinium species. Festuca ovina common with occasional Agrostis capillaris and Anthoxanthum odoratum. The rich herb flora includes frequent Potentilla erecta, Pyrola media, Viola riviniana, Lathyrus montanus, Hypericum pulchrum, A nemone nemorosa, Trientalis europaea, Galium saxatile and Lotus corniculatus.

Calluna vulgaris usually a strong dominant with Arctostaphylos uva-ursi subordinate and associates listed opposite occasional at most.

Vaccinium myrtillus commonly accompanies V. vitis-idaea in a sparse understorey with Empetrum nigrum nigrum intermingled. Hypnoid mosses often extensive with Cladonia arbuscula and C. rangiferina also frequent.

Vaccinium myrtillus absent, V. vitis-idaea and Empetrum nigrum nigrum scarce, and hypnoid mosses patchy. Scirpus cespitosus and Carex pilulifera common and lichens extensive on areas of bare ground with frequent Cladonia uncialis, C. impexa, C. floreika, C. coccifera and C. squamosa.

Cladonia spp. sub-community
Although Arctostaphylos uva-ursi is sometimes quite abundant, Calluna vulgaris is more often overwhelmingly dominant. Both Erica cinerea and Genista anglica occur frequently. The herbs of sub-community H16a are hardly ever found. Among the bryophytes the characteristic mosses Hylocomium splendens and Pleurozi um schreberi and Hylotrichum splendens are often abundant. Larger lichens are also more apparent including several Cladonia species.
Arctostaphylos alpinus occurs with some frequency in various kinds of dwarfed sub-shrub heath, but is most typical of this community where it is a constant, although usually a subordinate one, in the woody mat which is normally less than 10 cm tall. It is usually dominated by stunted bushes of Calluna vulgaris with stretches of bare stones between. Empetrum nigrum ssp. hermaphroditum is strongly preferential to higher altitudes and ssp. nigrum is largely confined to lower situations. Loiseleuria procumbens is characteristically found with E. nigrum ssp. hermaphroditum, and Erica cinerea with E. nigrum ssp. nigrum. Vaccinium myrtillus is common throughout but other Vaccinium species are scarce.

There are few herbs. Huperzia selago is the commonest and a constant, and is often accompanied, at higher altitudes, by Diapensia alpina, Carex bigelowii and Antennaria dioica. Deschampsia flexuosa is also frequent throughout, though more so at lower altitudes where Potentilla erecta, Scirpus cespitosus and Carex pilulifera occur most commonly.

More conspicuous are the lichens which form a patchy mosaic. Cladonia arbuscula and C. uncilis are constant. Preferential to higher altitudes are Cetraria glauca, C. islandica, Cornicularia aculeata, Alectoria nigricans and Sphaerophorus globosus. Mosses are not abundant. Racomitrium lanuginosum is constant, though in small amounts, and Hypnum jutlandicum becomes frequent at lower altitudes.

This heath is the typical climax sub-shrub vegetation of rather base-poor moder soils over very exposed ridges and crests at moderate to fairly high altitudes in the cold and humid climate of the mountains of north-west Scotland. It is found at higher altitudes than the Calluna vulgaris – Racomitrium lanuginosum heath (H14) which has a similar distribution, and its normal range is between 500 m and 750 m, although it can exceptionally be found up to 900 m, and down to 250 m along the north Scottish coast and on Orkney. It is typically found on humic poor rankers and more occasionally mature podzolised soil that have been derived from a variety of lime-poor parent materials. This community is confined to the north-west Highlands, the north Scottish coast and Orkney.

The community may be lightly grazed by sheep and deer but this probably has little effect on its floristics or physiognomy. The inhospitable environment and the harsh conditions maintain the vegetation as a climax. Burning is very deleterious and may cause damage from which recovery is extremely slow if not impossible. Burning may have eliminated this community from many sites throughout its range.
Empetrum nigrum ssp. hermaphroditum and Loiseleuria procumbens constant with frequent Carex bigelowii, Diapensia alpina, Antennaria dioica, Cladonia uncialis, C. arbuscula, C. gracilis, C. pyxidata, C. belidiflora, Cetraria glauca, C. Islandica, Alectorion nigricans and Sphaerophorus globosus.

Loiseleuria procumbens occasional, but Empetrum nigrum ssp. hermaphroditum replaced by ssp. nigrum and with Erica cinerea becoming common. Potentilla erecta very frequent with Scirpus cespitosus and stricla often present. Cladonia uncialis and C. arbuscula remain common but lichen flora not so varied or abundant.

Loiseleuria procumbens – Cetraria glauca sub-community

In this distinctive sub-community mixtures of Calluna vulgaris with subordinate Arctostaphylos alpinus, Loiseleuria procumbens and Empetrum nigrum ssp. hermaphroditum make up the bulk of the mat with scattered Vaccinium myrtillus and occasional V. vitis-idaea, Arctostaphylos uva-ursi, Juniperus communis nana and Salix herbacea. Deschampsia flexuosa occurs sparsely with the above herbs and other more occasional species. Small patches of Racomitrium lanuginosum are frequent and there is a rich and extensive lichen flora including the species listed above.

Empetrum nigrum ssp. nigrum sub-community

Calluna vulgaris dominates the sub-shrub mat with Arctostaphylos alpinus constant and Empetrum nigrum ssp. nigrum and Erica cinerea as common associates. Vaccinium myrtillus is again sparse with occasional Arctostaphylos uva-ursi. Carex bigelowii is less common and Deschampsia flexuosa more frequent than in H17a, with the other associates listed above. Among bryophytes Hypnum jutlandicum frequently joins Racomitrium lanuginosum. Lichens are not so varied or abundant as in H17a, but Cladonia uncialis and C. arbuscula remain very common.
This community includes a variety of moss-rich and grassy sub-shrub vegetation, in which Vaccinium myrtillus is the most frequent ericoid, with Calluna vulgaris only occasional and often lacking in vigour. Other sub-shrubs can make a sizeable contribution to the canopy; in particular Empetrum nigrum, usually ssp. hermaphroditum, is most frequent, often forming patches. Vaccinium vitis-idaea is also common.

Among vascular associates Deschampsia flexuosa and Galium saxatile are constant throughout, with Nardus stricta, Agrostis canina ssp. montana and Potentilla erecta all very frequent. In some stands these species account for virtually all the herbaceous cover. The grasses Festuca ovina, Agrostis capillaris and Anthoxanthum odoratum occur at least occasionally and increase in frequency and abundance in some sub-communities.

The other element, which is usually prominent, comprises bulky mosses. Dicranum scoparium, Pleurozium schreberi and Hypnum cupressiforme s.l. are very common throughout, Hylocomium splendens is also conspicuous and there can be frequent Rhytidiodelphus loreus, R. squarrosus, Plagiothecium undulatum, Dicranum majus and Racomitrium lanuginosum. Some lichens occur frequently although an extensive carpet is never found. The most common species are Cladonia arbuscula, C. impexa and C. uncialis.

This community is typical of moist but free-draining, base-poor to circumneutral soils over steeper slopes at moderate to high altitudes through the uplands of northern Britain. It is largely confined to altitudes above 400 m and can extend up to 800 m. It occurs over a wide variety of bedrocks on a variety of soil profiles which have a superficial pH of 3.5-5.5. Typically, however, the soils have a well-developed humic layer. This community is widespread through the uplands of Britain but is particular common in northern Scotland, where the heart of its range occurs in the central and eastern Highlands, with more sporadic occurrences to the north-west.

At higher levels this vegetation is probably a natural climax with the floristics and distribution of the community being influenced by snow-lie, but towards the sub-montane zone quite extensive stands of the vegetation have been biotically derived as a result of woodland clearance and pasturing. In other places treatments such as burning and grazing have precipitated its spread on to blanket peats.
Sub-shrubs often co-dominant with Alchemilla alpina and/or grasses among which Festuca ovina, Agrostis capillaris and Anthoxanthum odoratum are especially common. Luzula campestris, Carex pilulifera and C. binevis also common with Potentilla erecta and occasional Campanula rotundifolia, Viola riviniana and Ranunculus acris.

Luzula campestris, Carex pilulifera and C. bigelowii are infrequent but locally abundant. Apart from Galium saxatile herbaceous dicotyledons are uncommon. The only common pleurocarps are Pleurozium schreberi and Hypnum cupressiforme s.l. Lichens, however, are best represented in this sub-community, particularly the species listed above. This sub-community is found throughout the range of H18.

Alchemilla alpina – Carex pilulifera sub-community
This sub-community is found at lower altitudes and favours sunnier aspects with less humic and sometimes less base-poor soils. Grazing often plays an important part in its development. Vaccinium myrtillus can be quite abundant but Emptem nigrum is scarcer than in H18a. Ericoids as a whole are often co-dominant with Alchemilla alpina in the canopy and/or with grasses which are best represented here. There is a variety of dicotyledonous herbs including the species listed above. Bulbifer mosses can be quite frequent but not with the same abundance and variety as in H18a. Lichens are sparse. This sub-community is especially characteristic of the Breadalbane-Clova region.

Hylocomium splendens – Rhytidiadelphus loreus sub-community
This sub-community is generally found in and around snow-beds on acidic soils. Sub-shrubs are generally dominant with Vaccinium myrtillus usually most abundant, but Emptem nigrum is occasionally co-dominant and in some stands with Vaccinium vitiss-idea or V. uliginosum. Deschampsia flexuosa is very common and sometimes abundant, but grasses are not as abundant as in H18b. A high frequency of Blechnum spicant is diagnostic. Bryophytes attain their most diverse and extensive cover here, particularly the species listed above. Lichens are generally much less obvious, the only frequent species being Cladonia arbuscula. This sub-community is found throughout the range of H18.

Calluna vulgaris quite common among the sub-shrubs with Blechnum spicant frequent. Mosses forming an extensive ground carpet with Hylocomium splendens and Rhytidiadelphus loreus joining Pleurozium schreberi and Dicranum scoparium.

Calluna vulgaris sparse, and Blechnum spicant absent and pleurocarps rather patchy. Racomintrium lanuginosum common and lichens quite conspicuous, Cladonia arbuscula being locally abundant and C. impea and C. uncialis occasional.

This sub-community is especially developed where peaty soils have been burned or on degraded blanket peats. Vaccinium myrtillus or mixtures of this with Emptem nigrum are usually domi-nant, with sparse plants of Calluna vulga-ris and Vaccinium vitis-idea. Deschampsia flexuosa and Festuca ovina are very frequent and can be abundant, with other grasses only occa-sional. Carex bigelowii is infre-quent but locally abundant. Apart from Galium saxatile herbaceous di-cotyledons are uncommon. The only common pleurocarps are Pleurozium schreberi and Hypnum cupressiforme s.l. Lichens, however, are best represented in this sub-community, particularly the species listed above. This sub-community is found throughout the range of H18.
H19 Vaccinium myrtillus - Cladonia arbuscula heath

This community consists essentially of a very low mat, 5-10 cm high, of sub-shrubs with an abundance of lichens, often marking stands with a yellowish tinge. Lichens are more extensive and dominant than in the Calluna vulgaris - Cladonia arbuscula heath (H13). Calluna vulgaris is uncommon overall and Vaccinium myrtillus is the most consistent sub-shrub, being co-dominant in more sheltered situations, although sparse in exposed sites. Vaccinium vitis-idaea is less common, but constant, and V. uliginosum scarce overall. Empetrum nigrum, almost always ssp. hermaphroditum, is frequent and can exceed Vaccinium species in its cover.

Vascular associates are few but Carex bigelowii, a constant, is frequent and often abundant and may be co-dominant with the ericoids and lichens. The other common and constant plant is Deschampsia flexuosa. Festuca ovina is also fairly frequent together with several herbs, such as Galium saxatile, in sub-community H19a.

Bryophytes are generally not important and Racomitrium lanuginosum is only abundant in one sub-community. Dicranum fuscescens is quite frequent or there may only be sparse shoots of Polytrichum alpestre and P. piliferum.

Much more important are the lichens, particularly larger fruticose species such as Cladonia arbuscula and C. uncialis, both constants, and less commonly C. rangiferina and C. gracilis, mixtures of which can exceed the sub-shrubs in total cover. Cetraria islandica and Cornicularia aculeata are also very common, often with a variety of other species.

This heath is typical of base-poor soils on moderately sheltered and snow-bound slopes at high altitudes, particularly in the more continental mountains of northern Britain. The vegetation is strongly montane, being found mainly above 650 m up to 1000 m or even beyond, and usually stands are found in sites with some shelter so that there is winter protection from lying snow. It is characteristic of acid soils with a superficial pH of about 4. It has a similar range to that of H13, being strongly concentrated in the central and eastern Highlands of Scotland, particularly the Grampians, but also in the mountains of the north-west and the Southern Uplands and with scattered localities in northern England.

Floristic variation reflects differences in exposure and soil type, but overall the vegetation is a climatic climax.
**H19**

**Vaccinium myrtillus** and **Carex bigelowii** usually co-dominant among the vascular plants, with **Festuca ovina**/**Vi vipara**. **Galium saxatile** frequent and **Potentilla erecta** occasional.

**Racomitrium lanuginosum** sometimes quite abundant in a rather patchy lichen cover. **Alchemilla alpina** frequent in small amounts, with occasional **Salix herbacea** and **Juncus trifidus**.

**Empetrum nigrum ssp. hermaphroditum** very common with lichens very abundant in the mat. **Cladonia rangiferina**, **C. gracilis** and **Ochrolechia frigida** are preferentially frequent and **C. bellidiflora**, **C. pyxidata** and **Cetraria nivalis** more occasional. **Racomitrium lanuginosum** frequent but not abundant.

**H19a**

**Festuca ovina** – **Galium saxatile** sub-community

**Vaccinium myrtillus** is often abundant and co-dominant with **Carex bigelowii**. **Empetrum nigrum** is sometimes found and **Vaccinium vitis-idaea** is most frequent and abundant here. **Deschampsia flexuosa** is moderately abundant and **Galium saxatile** is a good diagnostic species. The lichen element is prominent although not so extensive as in sub-community H19c. **Cladonia arbuscula** is sometimes co-dominant with the vascular plants and **C. uncialis** is moderately abundant.

This sub-community is more characteristic of the lime-rich rocks between Breadalbane and Clova, although the pH of the soil surface is still strongly acid.

**H19b**

**Racomitrium lanuginosum** sub-community

The mat is dominated by various mixtures of **Vaccinium myrtillus**, **Carex bigelowii**, lichens and abundant **Racomitrium lanuginosum**. **Empetrum nigrum**, mostly ssp. **hermaphroditum**, is fairly common, but **Vaccinium vitis-idaea** is very patchy. **Salix herbacea** is occasional as is the rare moss **Kiaeria starkei** but both can be locally abundant. Other vascular associates are either occasional, as above, or very occasional. The lichen cover is varied; **Cladonia arbuscula** can be abundant but may be patchy and mixed carpets are more usual with **C. uncialis**, **Cetraria islandica**, **Cornicularia aculeata** and **Sphaerophorus globosus**. This sub-community is found both in central and north-west Scotland.

**H19c**

**Empetrum nigrum ssp. hermaphroditum** – **Cladonia spp.** sub-community

Mixed mats of **Vaccinium myrtillus** and **Empetrum nigrum hermaphroditum** provide the bulk of the vascular cover, but are often exceeded by the lichen cover. **Vaccinium vitis-idaea** can be moderately abundant and there is often a little **Calluna vulgaris**. **Deschampsia flexuosa** is the only common grass and species like **Carex pilulifera** and **Galium saxatile** are at their most infrequent. **Racomitrium lanuginosum** is accompanied by preferentially common **Pleurozium schreberi**, **Dicranum scoparium** and **Ptilidium ciliare**. Lichens are very extensive, with the most common species listed above. This sub-community is widespread on granitic and quartzitic mountains.
This community brings together a variety of vegetation types in which Vaccinium myrtillus and/or Empetrum nigrum ssp. hermaphroditum occur, occasionally with other sub-shrubs such as V. vitis-idaea, and are co-dominant with Racomitrium lanuginosum or hypnaceous mosses. Vaccinium myrtillus and E. nigrum form a low mat, usually less than 10 cm high, appearing as a patchy mosaic of bushes among the moss carpet. At lower altitudes Juniperus communis ssp. nana and Erica cinerea can show local prominence.

Among vascular associates Carex bigelowii, Festuca ovina/vivipara, Deschampsia flexuosa and Galium saxatile are all constant and frequent. There are few other common herbs, although the grasses may include frequent Nardus stricta. Huperzia selago and Potentilla erecta are frequent in some stands and may be accompanied by Thymus praecox, Viola riviniana and Carex pilulifera.

Much of the distinctive character of this vegetation type depends on the cryptogams.

Racomitrium lanuginosum is very important, forming a woolly carpet, and it is found with a variety of other bulky mosses. Hypnum cupressiforme s.l., Hylocomium splendens, Rhytidiodelphus loreus and Pleurozium schreberi are all constant and can be prominent. Additionally, Polytrichum alpinum and Dicranum scoparium are found in many stands. Common hepatics are Ptilidium ciliare and Diplophyllum albicans, but their greatest variety is found in the Bazzania - Mylia sub-community. Lichens are less important, but Cladonia uncialis and C. arbuscula are most frequent throughout and may be modestly abundant, with C. gracilis and Cetraria islandica also common.

This heath is characteristic of humic, base-poor soils on fairly exposed slopes and summits at moderate to high altitudes, in the cool oceanic mountains of north-west Scotland, extending to Skye, and scattered through the Grampians. Almost always, the bedrocks underlying this heath are siliceous in character.

Climatic differences and some modest variation in edaphic conditions influence the floristics, but this is essentially climax vegetation.
Vaccinium vitis-idaea very scarce, but Calluna vulgaris, Erica cinerea and Juniperus communis nana occasional with Alchemilla alpina sometimes co-dominant. Potentilla erecta, Thymus praecox, Viola riviniana and Carex pilulifera frequent.

Diplophyllum albicans and Anastrepta orcadensis sometimes found but combinations of these other bryophytes rare.

Rich and luxuriant patchwork of bryophytes present among the Racomitrium lanuginosum carpet with Dicranum scoparium, Plagiothecium undulatum, Sphagnum capillifolium, Mylia taylori, Diplophyllum albicans, Pleurozia purpurea, Bazzania tricrenata, Scapania gracilis, S. ornithopodioides, Anastrepta orcadensis and Anthelia julacea frequent.

Vaccinium vitis-idaea very common and all other listed associates scarce. Rich and luxuriant patchwork of bryophytes present among the Racomitrium lanuginosum carpet with Dicranum scoparium, Plagiothecium undulatum, Sphagnum capillifolium, Mylia taylori, Diplophyllum albicans, Pleurozia purpurea, Bazzania tricrenata, Scapania gracilis, S. ornithopodioides, Anastrepta orcadensis and Anthelia julacea frequent.

Vaccinium vitis-idaea very common and all other listed associates scarce.

Bazzania tricrenata – Mylia taylori sub-community
The sub-shrub mat is more varied than usual in the community. Empetrum nigrum hermaphroditum and Vaccinium myrtillus can both be abundant, but Alchemilla alpina can be co-dominant and more locally Juncus communis ssp. nana or Erica cinerea may occur with sparse shoots of Calluna vulgaris. Herbs characteristic of H20, such as Festuca ovina/vivipara, Deschampsia flexuosa and Galium saxatile, remain very frequent and are joined preferentially by the herbs listed above. The cryptogam flora is poor, with Racomitrium lanuginosum as the typical dominant, but other pleurocarps are less frequent and Diplophyllum albicans is the only common hepatic. This sub-community extends the range of H20 into the milder foothills of the western seaboard and Skye.

Racomitrium lanuginosum reduced in cover with dominance often passing to mixtures of Pleurozium schreberi, Hylocomium splendens and Rhytidiodalphyllum loreus.

Cetraria islandica sub-community
Mixtures of Empetrum nigrum ssp. hermaphroditum and Vaccinium myrtillus with abundant Racomitrium lanuginosum are usually dominant. Grasses like Festuca ovina/vivipara, Deschampsia flexuosa, Nardus stricta, Agrostis canina and Anthoxanthum odoratum tend to be prominent, but the richness of vascular plants in H20a is absent. Bryophytes are not numerous although community constants are all common with frequent Hypnum cupressiforme s.l. and Polytrichum alpinum. The lichen flora is a little richer than usual with the species listed above present. This is the most widespread and common sub-community overall.
This community has a mixed canopy of subshrubs, usually 30-50 cm high, with a damp layer of luxuriant bryophytes. Calluna vulgaris is usually the dominant ericoid, although Vaccinium myrtillus is constant and Empetrum nigrum, almost always ssp. hermaphroditum, very frequent. Erica cinerea is also frequent, but patchy. Other subshrubs are only occasional.

Deschampsia flexuosa and Potentilla erecta are constant and very common though usually present as sparse, scattered individuals. More distinctiveley Blechnum spicant is constant and Solidago virgaurea and Listera cordata frequent. There are only occasional records for other vascular associates.

The bryophytes form an extensive and lush carpet. Constant throughout are bulky hypnaceous mosses such as Hypnum cupressiforme s.l., Rhytidiadelphus loreus, Pleurozium schreberi and Hylocomium splendens, with Plagiothecium undulatum, Dicranum scoparium and D. majus also very common. Particularly distinctive is the high frequency and local abundance of Sphagnum capillifolium. Racomitrium lanuginosum becomes more frequent at higher altitudes. The most spectacular enrichment in this element comes from oceanic hepatics and this community is a major locus for the 'mixed northern hepatic mat'. Species such as Scapania gracilis, Mylia taylori and Diplophyllum albicans can be found throughout, but the Mastigophora – Herbertus sub-community has an additional range of Atlantic species, forming a unique vegetation found at higher altitudes in north-west Scotland where summer temperatures are lower and rainfall higher. Lichens are fairly insignificant, Cladonia impexa being the only species occurring commonly throughout.

This heath is highly characteristic of fragmentary humic soils, developed in situations with a cool but equable climate and a consistently shady and extremely humid atmosphere. It is almost wholly confined to low to moderate altitudes through the oceanic mountains of north-west Scotland and on Skye, with outliers on Orkney, in south-west Scotland and the Lake District.

It is largely restricted to steep, sunless slopes of north-west to easterly aspect, often with rock outcrops and blocky talus, among which crevices provide additional shade. In some situations this may not be a climax community but a result of woodland clearance, but towards the upper end of its altitudinal limits this heath appears to form a natural component of vegetation patterns controlled largely by variations in local climates and soils. It is sometimes lightly grazed, but burning is very damaging and recovery is probably extremely slow. It seems certain that the extent of this community has been reduced by burning.
Empetrum nigrum hermaphroditum frequent and locally abundant among the sub-shrubs with especially rich and luxuriant cryptogam carpets among which there is frequent Racomitrium lanuginosum, Mylia taylori, Scapania gracilis, Bazzania tricrenata, Pleurozia purpurea, Diplophyllum albicans, Anastrepta orcadensis, Mastigophora woodsii, Herbertus aduncus hutchinsiae, Cladonia uncialis and C. arbuscula.

Empetrum nigrum hermaphroditum local and combinations of listed cryptogams rare, but Dicranum scoparium common with frequent fronds of Pteridium aquilinum.

Mastigophora woodsii - Herbertus aduncus ssp. hutchinsiae sub-community

Calluna vulgaris is usually the most abundant sub-shrub, but the canopy is short and more mixed than in H21a. The bryophytes are extremely well developed. Among the mosses all the community constants occur frequently. The hepatics, however, are most abundant, tingeing the vegetation with a variety of colours. They include the species listed above with other rarer Atlantic hepatics.

This sub-community is restricted in range, being confined to the more shaded and humid habitats in north-west Scotland.

Calluna vulgaris - Pteridium aquilinum sub-community

This sub-community occurs in sites which cannot support the full range of hepatics. Calluna vulgaris is generally a strong dominant in this taller and more species-poor heath. Vaccinium myrtillus is very common with Erica cinerea and Vaccinium vitis-idaea occasional. Other vascular plants are sparse, but distinctive is Pteridium aquilinum with occasional Oxalis acetosella, Viola riviniana and Luzula sylvatica. Bryophytes can have fairly high cover, but comprise almost entirely the community constants.

This sub-community is found throughout the range of H21.
This heath has a mixed cover of sub-shrubs over a moist cover of bryophytes similar to that of Calluna vulgaris – Vaccinium myrtillus – Sphagnum capillifolium heath (H21). However, here the canopy is not as tall, being mostly between 10 and 30 cm high, and Calluna vulgaris is not invariable in its dominance (Vaccinium myrtillus is dominant in the Polytrichum – Galium sub-community). Empetrum nigrum ssp. hermaphroditum is constant, as is V. vitis-idaea (although less frequent), and V. uliginosum is rare. Erica cinerea is absent.

The vascular associates are distinctive because, with constant Deschampsia flexuosa, there is frequently a little Rubus chamaemorus and Cornus suecica. Eriophorum vaginatum can be locally abundant and there are records for Potentilla erecta, Melampyrum pratense, Listera cordata, Juncus squarrosus and Nardus stricta.

Bryophytes are always conspicuous and sometimes very abundant. Dicranum scoparium and the hypnaceous mosses Pleurozium schreberi, Hylocomium splendens and Rhytidiadelphus loreus are the most consistent and constant, although Sphagnum spp. can also have a high cover, with the constant S. capillifolium being especially common and several other species locally abundant. A variety of other mosses and hepatics are variable in their occurrence. Lichens are typically less prominent, although Cladonia arbuscula is constant and can show modest abundance.

This heath is characteristic of wet, base-poor peats at moderate to high altitudes (mainly between 500 m and 800 m), where there is protection against extremes of dryness and winter cold by virtue of an oceanic influence or locally prolonged snow-lie. The profiles found beneath this community are typically poorly-developed, often consisting of just a layer of bryophyte or ericoid humus resting directly on blocky talus, derived from a variety of pervious bedrocks. It is almost entirely confined to the central and north-west Highlands of Scotland. In the former region it is typical of early snow-beds where it is mainly present as the Polytrichum – Galium sub-community. In the north-west Highlands, where the climate is ameliorated by the oceanic climate, this heath is generally represented by the Plagiothecium – Anastrepta sub-community.

Climatic and edaphic factors maintain this heath as a climax vegetation in most situations, although at its lowest limits it falls within the altitudinal range of historical pine forest. It is sometimes affected by grazing and burning where these treatments are applied to the surrounding heaths. Burning is deleterious to the floristic richness of the community.
Carex bigelowii frequent in small amounts with a rich and extensive patchwork of cryptograms, among which Racomitrium lanuginosum, Plagiothecium undulatum, Ptilidium ciliare, Anastrepta orcadensis, Barbilophozia floerkii, Cladonia bellidiflora, C. uncialis, C. leucophaea, C. gracilis and C. impexa are very common.

Carex bigelowii and cryptograms listed opposite all very scarce, but Gallium saxatile and Blechnum spicant frequent as scattered individuals and Polytrichum commune very common among usually plentiful hypnaceous mosses.

**H22b**

**Plagiothecium undulatum - Anastrepta orcadensis sub-community**

Calluna vulgaris is often a strong dominant in a taller canopy with Empetrum nigrum ssp. hermaphroditum occasionally abundant. Vaccinium myrtillus usually has low cover and V. vitis-idaea occurs unevenly. Cornus suecica, Rubus chamaemorus and Deschampsia flexuosa are all more patchy than in H22a, though Eriophorum vaginatum is common as scattered shoots. Carex bigelowii and Huperzia selago are preferential at low frequencies. The cryptogams are distinctive with both hypnaceous mosses and Sphagnum spp. prominent together with a number of Atlantic hepatics including the species listed above. Lichens are also more numerous in this sub-community with the above species present and Cladonia arbuscula constant.

This sub-community occurs throughout the range of H22 and is particularly well-developed in the north-west Highlands.

**H22a**

**Polytrichum commune - Galium saxatile sub-community**

Vaccinium myrtillus is generally dominant in a low sub-shrub canopy with Calluna vulgaris and/or Empetrum nigrum ssp. hermaphroditum sub-dominant. Vaccinium vitis-idaea is fairly common but of low cover. Cornus suecica and Rubus chamaemorus are most consistently frequent here though not abundant. Deschampsia flexuosa is rather patchy and Blechnum spicant and Gallium saxatile are preferentially common. Hypnaceous mosses, especially Hylocomium splendens and Rhytidiadelphus loreus, are plentiful with Sphagnum capitilliforme patchily abundant. Lichens are rare apart from scattered Cladonia arbuscula.

This sub-community is largely restricted to the central Highlands.
The Joint Nature Conservation Committee is the forum through which the three country nature conservation agencies – the Countryside Council for Wales (CCW), English Nature (EN) and Scottish Natural Heritage (SNH) – deliver their statutory responsibilities for Great Britain as a whole and internationally. These responsibilities, known as the special functions, contribute to sustaining and enriching biological diversity, enhancing geological features and sustaining natural systems.

The special functions are principally:

- to advise ministers on the development of policies for, or affecting, nature conservation in Great Britain and internationally;
- to provide advice and knowledge to anyone on nature conservation issues affecting Great Britain and internationally;
- to establish common standards throughout Great Britain for the monitoring of nature conservation and for research into nature conservation and the analysis of the results; and
- to commission or support research which the Committee deems relevant to the special functions.

This Guide is one of a new series of interpretative publications intended to support users of the National Vegetation Classification. These publications will focus on providing further guidance on practical aspects of the NVC.