Summary

This priority habitat includes all the vegetation on ground above the altitudinal limit of woodland – an altitude that varies from over 600 m in the south and east to under 300 m in the north and west. As such it takes in a vast assortment of plant communities from willow scrub on ungrazed ledges to the moss-dominated heaths and snowbeds of our highest slopes and summits.

Willow scrub with montane shrubs such as bog bilberry *Vaccinium uliginosum* or tall base-tolerant herbs represents the upper limit of woodland on base-rich soils in the British uplands. Montane heaths, with their swards of ling *Calluna vulgaris*, bilberry *Vaccinium myrtillus*, mountain crowberry *Empetrum nigrum* ssp. *hermaphroditum* and dwarf juniper *Juniperus communis* ssp. *nana* flattened to the ground by altitude and exposure, are perhaps the most extensive form of montane vegetation in the Scottish hills. Montane grasslands dominated by mat-grass *Nardus stricta* or tufted hair-grass *Deschampsia cespitosa* mark out the areas of high slopes where snow lies late enough in spring to suppress the growth of dwarf shrubs. The most extreme montane vegetation is dominated by bryophytes, plants that are able to tolerate the low light intensity and high humidity under a blanket of winter snow, and that are able to thrive when the growing season is very short. The moss woolly fringe-moss *Racomitrium lanuginosum* is the most widespread species, forming continuous carpets over plateaux, summits and high ridges.
The low temperatures, high rainfall, copious amounts of snow and strong winds are the most important elements of the montane climate in limiting plant growth, but the species that occur at high elevations must also be able to tolerate high temperatures, drought and intense light during the uncommon but regular periods of dry summer weather. Soils tend to be leached humic rankers lying directly over bedrock, summit detritus or consolidated scree, so the pH is rarely high even if the underlying rocks are base-rich.

Montane heaths and willow scrub occurs throughout the country from the Southern Uplands and Galloway north to Orkney and Shetland, including the Hebrides, but is most extensive and varied on the high hills of the central and eastern Highlands. There are important outliers on the group of high hills around Ben Nevis in Lochaber, and further north on Beinn Dearg in wester Ross.

Many of our most rare, valuable and threatened plant species occur in the montane zone. Places where snow lies late are home to an array of specialised bryophytes able to tolerate an extremely short growing season with some notable rarities. Much montane heath and willow scrub vegetation is near-natural, and a changing climate presents more of a threat than most changes in management. However, light grazing seems not to be damaging, and may even be necessary in the south of the country where a history of grazing, by reducing competition, seems to have lowered the altitudinal limit of the montane zone. A cessation of grazing can result in montane vegetation being outcompeted by more vigorous common plants.

What is it?

This priority habitat includes all the vegetation that lies above the presumed upper altitudinal limit of woodland. It is a large and comprehensive category including a vast range of plant assemblages from bryophyte turfs less than a centimetre tall to lush and luxuriant willow scrub which may be more than a metre tall. A great array of heaths and grasslands are also included. These are grouped into 5 sub-divisions described below:

Willow scrub and herb-rich assemblages

Montane willows are sensitive to browsing and almost all the willow scrub that occurs in the uplands is confined to inaccessible ledges and slopes. This means that many stands are fragmentary, covering barely more than a few square metres and with the willows clinging to the rocks with contorted stems. However, at its best this is a magnificent community, with species such as downy willow Salix lapponum and, more rarely, mountain willow S. arbuscula, whortle-leaved willow S. myrsinites and woolly willow S. lanata growing in a low, silvery canopy on wet ledges streaming with water. The ground flora beneath the willows can vary considerably depending on the base-status of the soil and the irrigating water. Where the substrate is fairly acid the understory consists of Vaccinium myrtillus and V. uliginosum growing through a mat of mosses such as Racomitrium lanuginosum and Hylcomium splendens, dotted with species such as alpine bistort Persicaria vivipara, alpine lady’s mantle Alchemilla alpina, great woodrush Luzula sylvatica and hard fern Blechnum spicant. On base-rich rocks, though, this can be one of our most extravagantly herb-rich communities, with a rich, luxuriant array of tall flowering herbs such as wood crane’s-bill Geranium sylvaticum, globe flower Trollius europaeus, meadow buttercup Ranunculus acris, meadowsweet Filipendula ulmaria, wild angelica Angelica sylvestris, water avens Geum rivale, roseroot Sedum rosea, smooth lady’s mantle Alchemilla glabra, Deschampsia cespitosa and ferns, forming the sort of colourful, exuberant display more usually associated with herbaceous borders than with high mountain cliffs.

A related community is the U15 Saxifraga-Alchemilla bank with vegetation characteristic of steep wet slopes and irrigated cliff faces. It is like a hanging garden, with dripping mats of
yellow saxifrage *Saxifraga aizoides* and purple saxifrage *S. oppositifolia* draped over the substrate and spangled with small plants such as *Persicaria vivipara*, alpine meadow-rue *Thalictrum alpinum*, *Alchemilla alpina*, *A. glabra* and lesser clubmoss *Selaginella selaginoides*.

**Mountain heaths**

The most common and the most visually distinctive mountain heaths are the prostrate *Calluna vulgaris* communities where the heather grows in a purple-brown carpet with stems creeping sinuously over the ground away from the direction of the prevailing wind. Although there are species-poor forms with little other than the heather itself, the shrub generally grows through a mat of either the moss *Racomitrium lanuginosum* (H14) or lichens such as *Cladonia arbuscula*, *C. rangiferina*, *C. portentosa*, *C. uncialis* and *Cetraria islandica* (H13). There are also similarly dwarfed and prostrate stands of *Vaccinium myrtillus* ssp. *hermaphroditum*, again with lichen-rich (H19) and *Racomitrium*-rich (H20) forms. These are colourful communities with their rich green swards of dwarf shrubs golden bryophytes or cream-white lichens.

Two other forms of prostrate *Calluna* heath are equally interesting, although far less common. H15 *Calluna-Juniperus communis* ssp. *nana* heath, a speciality of the north-west Highlands, has vegetation in which the mat of heather is interspersed with patches of dwarf juniper with its conspicuous mats and clumps of waxy, grey-green, sharp-leaved stems. The H17 *Calluna-Arctostaphylos* heath has a much more mixed and varied sward in which the prostrate stems of the heather intermingle with shrubs such as alpine bearberry *Arctostaphyllos alpinus*, bearberry *A. uva-ursi*, *Empetrum nigrum* ssp. *hermaphroditum*, *Juniperus communis* ssp. *nana* and trailing azalea *Loiseleuria procumbens*, forming a richly-coloured tapestry of brown stems and bright green leaves set against a bright background of bryophytes and lichens.

All these are home to an array of small montane species such as stiff sedge *Carex bigelowii*, alpine clubmoss *Diphasiastrum alpinum*, dwarf willow *Salix herbacea* and *Vaccinium uliginosum* as well as other diminutive upland plants such as fir clubmoss *Huperzia selago*, eyebright *Euphrasia officinalis* and tormentil *Potentilla erecta*.

The H22 *Vaccinium-Rubus* community is not a prostrate heath, but has a very short sward of *Calluna vulgaris* or *Vaccinium myrtillus* or both growing with *V. uliginosum*, *V. vitis-idaea*, *Empetrum nigrum* ssp. *hermaphroditum*, *Carex bigelowii* and, in many examples, cloudberry *Rubus chamaemorus* and dwarf cornel *Cornus suecica*. It is a damp heath with much *Sphagnum capillifolium* in the richly-coloured underlay of large mosses.

H12 *Calluna-Vaccinium* heaths, H18 *Vaccinium-Deschampsia* heaths and M15 *Trichophorum-Erica* wet heaths that belong to the Upland heathland priority habitat where they occur below the tree-line are considered to be part of the Mountain heaths and willow scrub priority habitat where they occur in the montane zone and include montane species such as *Carex bigelowii* and the lichen *Cetraria islandica*.

**Montane grasslands**

Most of the grassland in Scotland occurs as a result of management where felling of the original woodland has been followed by grazing by domestic stock. Above the tree-line, however, there are near-natural grasslands that occur where snow lies too late or too deep for dwarf shrubs to survive beneath it.

The most widespread of these are the U7 *Nardus-Carex* snow-bed grasslands and the U13 *Deschampsia-Galium* grasslands. The *Anthoxanthum-Alchemilla* sub-community U13a is a
community of steep shaded slopes at high altitudes that receive the meltwater from patches of snow above them, or that are irrigated by flushing from cliffs. The U7 grasslands are the most extensive, forming pale blond swards with a tawny tinge in spring as the melting snow exposes the dead and decaying remains of last year's leaves. They are conspicuous from a great distance.

In the high north-facing corries of the Cairngorms there are patches of montane snow-bed grasslands completely dominated by the grass wavy hair-grass Deschampsia flexuosa, growing in a dense, dark-green sward.

Sub-communities of the largely sub-montane U4 Festuca-Agrostis-Galium grasslands and U5 Nardus-Galium grasslands, neither of which belongs to any priority habitat, can be included in the Mountain heaths and willow scrub habitat where they occur in the montane zone and include montane species such as Carex bigelowii, Salix herbacea and Dipsacaistrum alpinum. They are generally an anthropogenic replacement for one of the more natural montane communities, in which grasses have increased in cover as a result of grazing, trampling and dunging by deer as well as domestic stock.

Summit heaths

The vegetation of high summits, ridges and plateaux consists of distinctive assemblages of species that can tolerate the extreme environment of this habitat. The most widespread and extensive is the U10 Carex-Racomitrium heath, commonly known simply as Racomitrium heath. It clothes large areas of high montane ground in a deep, soft, even, golden-green carpet of the moss Racomitrium lanuginosum. In a few places the dominant moss is R. ericoides, rather than R. lanuginosum. Stands vary from species-poor swards with little other than R. lanuginosum and C. bigelowii to herb-rich assemblages with species such as moss campion Silene acaulis, thrift Armeria maritima, cyphen Minuartia sedoides, Ranunculus acris, Persicaria vivipara, Alchemilla alpina and, in some localities, scarce species such as alpine saw-wort Saussurea alpina, starwort mouse-ear Cerastium cerastioides and the mosses Hypnum hamulosum and Aulacomnium turgidum.

On the highest hills there is an even more attenuated plant community on the barren wildernesses of stone. It consists of thin swards of three-leaved rush Juncus trifidus (U9) growing in small clumps, tufts or circular patches together with a little Carex bigelowii, Salix herbacea, Racomitrium lanuginosum and lichens. Lichen heaths occur on some of our higher summits. They consist of carpets of species such as Cladonia arbuscula, C. portentosa, C. rangiferina, C. uncialis, Cetraria islandica, Alectoria nigricans and Coelocaulon aculeatum, growing in pale patches dotted with a little Vaccinium myrtillus, Carex bigelowii and Salix herbacea.

The U8 Carex-Polytrichium sedge heath resembles grassland from a distance, but actually consists of a dense blue-green sward of the montane sedge Carex bigelowii with its neat tufts of leaves and distinctive black heads of flowers. It is a community of late-lying snow-beds on high montane plateaux, generally where the soils are damp and drainage slightly impeded.

Swards of heath rush Juncus squarrosus U6 can be classed as mountain heath if they occur in the montane zone and include montane species. They generally occur on thin peat at high altitude where they may be an anthropogenic replacement for montane blanket bog.

Fell-fields are an unusual form of vegetation on wind-exposed ridges, summits and shoulders where the substrate is fine gravel. At first glance they appear unvegetated, but are home to a few species such as viviparous sheep's fescue Festuca vivipara, Alchemilla alpina, wild thyme Thymus polytrichus, starry saxifrage Saxifraga stellaris, Luzula sylvatica
and mosses such as *Oligotrichum hercynicum*, *Polytrichum piliferum* and, on basalt, *Racomitrium ellipticum*.

**Snow-beds**

Snow-bed vegetation is that which is characteristic of places where snow lies throughout the winter and persists at least into spring – or even into late summer. It is an extreme environment that leads to great variation in the vegetation, typically on a small scale. The NVC scheme makes a reasonable approximation at classifying this range of variation, though it doesn’t really do it justice and some common types seem not to have been sampled or described.

There seem to be three basic recognisable types of late snow-bed vegetation: those dominated by mosses, those dominated by liverworts, and those with a more mixed structure including higher plants (of these, the fern-dominated snow-beds U18 belong to the Inland rock outcrop and scree habitats priority habitat).

The moss-dominated snow-beds are partially described by the U11 *Polytrichum-Kiaeria* community. They consist of a short, tufted, green turf of species such as *Polytrichum sexangulare*, *P. alpinum*, *Kiaeria starkei*, *K. falcata*, *K. blyttii* and *Andreaea alpina*, which are montane species more or less confined to this habitat, and others such as *Oligotrichum hercynicum*, *Dicranum fuscens*, *Racomitrium heterostichum*, *R. fasciculare* and *R. lanuginosum*, which are less exacting but still more common in the montane zone than they are elsewhere. Deep golden patches of the moss *Rhytidiadelphus loreus* around the upper rims of corries are classified as a sub-community of U13. Many snow-beds consist of distinctive emerald-green swards of *Pohlia ludwigii*; though not described in the NVC scheme it clearly belongs with the moss snow-bed communities.

The liverwort-dominated snow-beds are reasonably well described by the *Salix-Racomitrium* sub-communities U12b and U12c, although some stands with *Racomitrium heterostichum* could be considered to belong with the moss-dominated snow-beds. Liverworts form a thin crust over the surface of the ground, growing in such intimate diversity that there may be eight different species in a square centimetre. Typical species here are *Gymnomitrion concinnatum*, *Nardia scalaris*, *Anthelia juratzkana*, *Marsupella alpina*, *M. arctica*, *M. brevissima*, *M. sphaelata*, *Lophozia sudetica* and *Barbilophozia floerkei*.

The remaining snow-beds have a richer array of vascular plants growing with mixtures of mosses and liverworts and are encompassed by the *Alchemilla-Sibbaldia* community U14 and by the *Silene-Luzula* sub-community of the *Salix-Racomitrium* snow-bed U12a. Typical species are *Alchemilla alpina*, spiked wood-rush *Luzula spicata*, sibbaldia *Sibbaldia procumbens*, *Persicaria vivipara* and *Silene acaulis*.

There is an array of species common to all the snow beds – *Carex bigelowii*, *Saxifraga stellaris*, *Salix herbacea*, *Diphasiastrum alpinum*, *Huperzia selago*, dwarf cudweed *Gnaphalium supinum*, *Deschampsia flexuosa*, *Blechnum spicant* and heath bedstraw *Galium saxatile* among the vascular plants and *Conostomum tetragonum*, *Polytrichum alpinum*, *Racomitrium ericoides* and *Diplophyllum albicans* among the bryophytes.

It is also common to find snow-bed vegetation covering considerable areas of ground that cannot be referred to any of these distinct types – it consists of assemblages of all the species mentioned here together with the fern parsley fern *Cryptogramma crispa*, the grasses *Festuca vivipara*, *Nardus stricta*, *Deschampsia flexuosa* and *D. cespitosa* and plants such as *Juncus trifidus*, *Blechnum spicant* and marsh violet *Viola palustris*. 
How do I recognise it?

Differentiation from other priority types

Within this priority type the montane heaths and grasslands can be separated from the Upland heathland priority habitat and the non-priority acid grasslands by the presence of montane species such as Carex bigelowii, Diphasiastrum alpinum, Vaccinium uliginosum, Empetrum nigrum ssp. hermaphroditum, the moss Polytrichum alpinum and the lichen Cetraria islandica. Nothing resembling the montane moss and lichen heaths, Carex bigelowii and Juncus trifidus swards or the snow-beds occurs in any of the other priority habitats. The montane willow scrub element of this priority habitat is distinguished from wet woodland, which is also dominated by willows, by the presence of the montane species S. lapponum, S. lanata, net-leaved willow S. reticulata, S. myrsinites and mountain willow S. arbuscula.

Definition in relation to other habitat classifications

<table>
<thead>
<tr>
<th>Classification</th>
<th>Habitat types belonging to this UK BAP priority habitat</th>
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<tbody>
<tr>
<td>NVC</td>
<td>H12 (examples above the tree-line), H13-15, H17 (all examples), H18 (examples above the tree-line), H19-20, H22 (all examples), M15 (montane examples with species such as Vaccinium uliginosum and Empetrum nigrum hermaphroditum), U4d and e, U5e (montane examples), U6 (montane form with Carex bigelowii), U7-15, W20 (all examples), Species-poor prostrate Calluna heath, Pohlia ludwigii snowbed, Mixed bryophyte snowbed, Racomitrium ericoides montane heath, Fell-field and Lichen heath (all examples of these seven ‘non-NVC’ vegetation types). All of these communities except U4, Species-poor prostrate Calluna heath, Pohlia ludwigii snowbed, Mixed bryophyte snowbed and Racomitrium ericoides montane heath are included in the Scottish Biodiversity List.</td>
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<td>This priority habitat includes three Phase 1 habitat types: A2, C2 (montane examples of these two) and D4 (all examples).</td>
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<tr>
<td>UK BAP broad habitat</td>
<td>All examples of the Mountain heaths and willow scrub priority habitat in Britain belongs in the UK BAP broad habitat – Montane Habitats.</td>
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Definition in relation to legislative classifications

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<tr>
<td>Habitats Directive Annex I</td>
<td>This priority habitat includes Annex I types H4060, H4080 and H6150 (all examples).</td>
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<tr>
<td>SNH SSSI habitat features</td>
<td>Alpine heath: NVC H13-15, H17, H19-20 and (above tree-line) H22 (= same as Annex I type Alpine and boreal heaths) Alpine moss heath and associated vegetation: NVC U7-12 and U14 (= same as Annex I type Siliceous alpine and boreal grasslands)</td>
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Montane fell-field: Areas of exposed upland which are naturally stony and sparsely-vegetated because of wind-exposure (= within Annex I type Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)) Snowbed. Within this priority habitat there can be mosaics of two or more SSSI habitat features classed together as the Upland assemblage SSSI habitat feature.

Where is it?

This priority type takes in the vegetation of the montane zone, above the altitudinal limit of woodland. This varies over the country from over 600 m in the south and east to near sea-level in the north.

The montane habitat is defined by the severity of its climate. Winters are long and cold and the summers short and cool, so the growing season is also short. Rainfall is high, much of the annual precipitation falls as snow and wind speeds are high. The montane zone spends much time covered with cloud or mist even when the lower slopes are clear; this reduces insolation and temperature further. However, on clear days in summer the temperature can rise very high and the free-draining soils can dry out. This means that the plants of this habitat must tolerate extremes from heat and drought to bitter winter frosts and winds, long spells of wet weather and a considerable period each year under snow. The most extreme habitats are the wind-exposed ridges where snow never persists, and where the plants are subject to prolonged frost as well as severe winds; and the late snow-beds where many months each year are spent in conditions of high humidity, low (but not extremely low) temperatures and low light intensity. The longest-lying snow might not melt out until August or September in some years, and the growing season can be as short as six weeks before the next snow falls. Very few species apart from the specialised snow-bed bryophytes and a few vascular plants can tolerate this.

The underlying rock can vary from hard and acid granite to basic schists, gneiss and basalt. Soils are thin and skeletal and may be strongly leached. Because of this it is uncommon to find very base-rich soils at high altitudes, and where they do occur the flora tends to be outstanding with many rarities. Much of the high ground consists of block scree or summit detritus with very little soil.

On high slopes and summits the soils are continually disturbed by frost heave, solifluction and soil-creep. These processes break up the surface layer of vegetation, preventing anything more than a thin skin of bryophytes from ever developing. Landslips and rockfalls are common on steep slopes.

Communities belonging this priority habitat grade downslope into the Upland heathland priority habitat. Blanket bog and Upland flushes, fens and swamps priority habitats can extend well into the montane zone and can form mosaics with Mountain heaths and willow scrub, as can the Inland rock outcrop and scree habitat communities such as tall-herb ledge vegetation and fern-dominated snow-beds.

Mountain heaths and willow scrub occurs throughout Scotland, from the summits of the Southern Uplands and Galloway northwards. There is estimated to be about 60,000ha of this priority habitat in Scotland, although some of the component communities such as willow scrub and snow-bed communities account for very little of the total.
Montane vegetation is far more extensive in the higher and larger mountain ranges of mainland Europe, especially the Alps and Scandinavia. With their more reliable snow, including permanent snow in the form of ice-caps and glaciers, snow-bed vegetation is far better represented than it is here. However, Scottish snowbeds are invaluable examples of this very special habitat at a comparatively low altitude and in an unusually maritime climate. Similarly, montane willow scrub is far more common in the Scandinavian hills than it is in Scotland. Indeed, the abundance of willow scrub in western Norway prompted speculation that the community might once have been far more widespread in Scotland before the advent of sheep farming, forming a montane scrub zone at the upper altitudinal limit of woodland. However, the requirements of most of the willows for reasonably base-rich, flushed soils at high altitudes suggests that willow scrub was never as important a part of the uplands in Scotland as it is in Norway, though it would once almost certainly have been more common on open slopes and not largely confined to cliffs, as it is today.

In contrast, our *Racomitrium* heaths, prostrate *Calluna* heaths, *Racomitrium*-rich montane *Vaccinium* heaths and montane *Deschampsia cespitosa* grasslands are distinctively British types of vegetation recorded only in Britain, Ireland and in a few sites in western Norway, the Faroe Islands and Iceland. There is probably more *Racomitrium* heath in Scotland than anywhere else in the world.

**What is special about it?**

Many rare and scarce species are associated with this priority habitat, as it includes so many demanding and specialised habitat niches.

Species of special conservation status recorded in this priority habitat in Scotland are listed below.

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Mountain heaths and willow scrub is important not only because it has rare communities and is home to rare species, but because it has southern and western outliers of communities that are confined to higher altitudes in mainland Europe.

It is also amongst our more natural of habitats. Life in the montane zone today has much in common with the vegetation of late-glacial times in Britain, and indeed the snowbed communities are one of our last remaining links with those times.

**How do we manage it?**

A light touch with management is the best policy in the montane zone. Light grazing is not damaging and in the south of the country may be necessary to prevent more vigorous species becoming dominant. Heavy grazing is a problem, as exemplified in the uplands of England and Wales where there have been many more sheep on the hills for many more years in Scotland, and where the former montane heaths, moss heaths and montane grasslands have largely been converted to species-poor acid grasslands. Trampling, which
initiates soil erosion, and dunging, which changes the nutrient status of the soil and encourages grasses, seem to be the most damaging on montane plateaux and in snowbeds.

Grazing is most directly damaging to the montane willows and the associated tall herbs, which cannot tolerate it. Temporary fencing, stock control and deer management may be necessary to reinstate this type of vegetation on open slopes.

It is important not to allow muirburn fires on the lower slopes to spread into the montane zone, as the prostrate montane heaths are slow to recover from this kind of damage.

Recreation in the hills is increasing, but although footpaths to summits can be unsightly the damage is generally restricted to a narrow strip which most people follow.

References, links and further reading


Common Standards Monitoring guidance http://www.jncc.gov.uk/page-2199

Countryside Survey: http://www.countrysidesurvey.org.uk

National Biodiversity Network (NBN) Gateway https://data.nbn.org.uk/

Scottish Government website – information about agricultural grants, subsidies and services: http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/grants/A-Z/Intro

Scottish Natural Heritage website: http://www.nature.scot

UKBAP information on JNCC website: http://jncc.defra.gov.uk/default.aspx?page=5155