M25
Molinia caerulea-Potentilla erecta mire

Synonymy
Molinietum caeruleae Moss 1911, Rankin 1911*a*, *b*, Smith 1911, Crampton 1911, Stapledon 1914, Jefferies 1915, Fraser 1933, Tansley 1939, all *p.p.*; *Molinia-Myrica* nodum McVean & Ratcliffe 1962, Adam *et al.* 1977; *Molinia caerulea* grassland McVean & Ratcliffe 1962, Edgell 1969, Meek 1976, Meade 1981 *p.p.*; *Junco acutiflori-Molinietum* O'Sullivan 1968, Hill & Evans 1978, Ratcliffe & Hattey 1982 *p.p.*; *Festuco-Molinietum anthoxanthosum* Evans *et al.* 1977; *Molinia* flushes Ferreira 1978; Wet Grassy *Juncus* Heath NCC Devon Heathland Report 1980; *Myricetum galis* Birse 1980; *Molinia caerulea-Myrica gale* community Wheeler 1980*c p.p.*; *Molinia-Potentilla erecta* nodum Bignal & Curtis 1981; *Erica vagans-Schoenus nigricans* heath Hopkins 1983 *p.p.*

Constant species
Molinia caerulea, *Potentilla erecta*.

Rare species
Agrostis curtisii, *Erica vagans*, *Lobelia urens*.

Physiognomy
The *Molinia caerulea-Potentilla erecta* mire encompasses vegetation of quite widely differing floristics and physiognomy, but characterised throughout by the overwhelming abundance of *Molinia*. This is a feature which helps distinguish the community from rather similar vegetation types of the Juncion acutiflori and Caricion nigrae, where *Molinia* can occur occasionally but where dominance is usually held by rushes or small sedges, themselves quite frequent here, though typically of subsidiary cover. *Molinia*-dominance is not, however, confined to this community in western Britain: throughout the range of the *Molinia-Potentilla* mire, this grass is a very common element in lowland Erico-Sphagnion blanket mires and Ericion tetralicis wet heaths and it shows a distressing tendency to increase its abundance in these vegetation types in certain circumstances, bringing them very close in composition and structure to this community. Indeed, many references to a *Molinietum* or to '*Molinia* grassland' in the British literature (e.g. Moss 1911, Rankin 1911*a*, *b*, Smith 1911*a*, Crampton 1911, Stapledon 1914, Jefferies 1915, Fraser 1933, Tansley 1939, McVean & Ratcliffe 1962, Meade 1981) and to other more precisely-defined units, like the *Festuco-Molinietum* of Evans *et al.* (1977) and the *Molinia-Potentilla* nodum of Bignal & Curtis (1981), include vegetation of this kind together with what is here termed *Molinia-Potentilla* mire, and bear ample testimony to the problems of separation of these different communities in the more oceanic parts of the country.

Although sharing a general abundance of *Molinia* with these modified vegetation types, the *Molinia-Potentilla* mire does seem to offer particularly favourable conditions for this grass, and the community includes many of the more extensive and vigorous stands of *Molinia* vegetation in western Britain. Its cover here is often virtually complete, though its growth form can vary from an almost even or gently-undulating sward to a formidably tussocky cover in which individual stools can attain diameters of half a metre or more and even greater heights, with systems of deep litter-lined runnels between. With the emergence of the annual crop of leaves in spring and early summer, the vegetation acquires a fresh-green colour which can mark out stands from a great distance and, in winter, with the dead brown foliage often laid in one direction by the winds, the tussocks give a distinctive wave-like appearance, features well caught in Jefferies' (1915) classic study.

Amongst this dense cover, the associated flora is noticeably poor in species and generally of low total abundance, though it is quite variable. Most common throughout are rushes and a few dicotyledons which help confirm the affinities of the vegetation with the Molinietalia. Among the former, *Juncus acutiflorus* is the most frequent, with *J. effusus* quite well represented too, except in the more acidic situations into which the community penetrates. Each of these can be patchily

https://doi.org/10.1017/9780521391658.029 Published online by Cambridge University Press

prominent among the *Molinia*, though typically they do not exceed it in cover and are often represented by just a few scattered shoots, one feature which helps separate the *Molinia-Potentilla* mire from rush-dominated stands of the *Carex echinata-Sphagnum* mire and from the *Juncus-Galium* rush-pasture, in which some of O'Sullivan's (1968*a*) *Junco acutiflori-Molinietum* is probably best placed. *J. articulatus* also occurs very occasionally but *J. conglomeratus* is very scarce, being more characteristic of heathy Molinietalia vegetation. In the very few eastern English localities where the *Molinia-Potentilla* mire occurs, *J. subnodulosus* is sometimes to be found, as at Roydon Common in Norfolk.

Among the few common dicotyledons of the community, only *Potentilla erecta* is frequent enough to qualify as a constant, and it is the only small herb that occurs more than occasionally throughout this vegetation, being able to survive growing among the dense herbage of the dry hummock tops. More sparsely represented, particularly in wetter, more base-poor situations, where there is heavy grazing or where the dominance of *Molinia* is very uncompromising, are *Lotus uliginosus*, *Succisa pratensis*, *Cirsium palustre* and *Angelica sylvestris*. Rooted between the tussocks, the taller among these hemicryptophytes have flowering shoots which, by mid-summer, can project above the *Molinia* and, where numbers of these plants occur more frequently, along with occasional *Eupatorium cannabinum* or *Filipendula ulmaria*, the community becomes more colourful and structurally varied, sometimes approaching poorer Filipendulion vegetation in its general appearance. In south-western England and south Wales, this kind of *Molinia-Potentilla* mire can also come close to the *Cirsio-Molinietum*, although *Cirsium dissectum* is only very rarely to be found among the taller herbs here, and these two vegetation types are, by and large, geographical replacements of one another.

A further structural element which gains occasional prominence in the *Molinia-Potentilla* mire comprises shrubs and sub-shrubs. *Calluna vulgaris* and, particularly on wetter ground, *Erica tetralix*, can both be quite common, though they are seldom very abundant and usually not very conspicuous, being rather attenuated in growth. Nonetheless, in south-western England in particular, it can sometimes be difficult to separate such vegetation from the *Ericetum tetralicis* wet heath from which expansion of *Molinia* has all but eliminated any distinctive associates. Elsewhere, throughout western Britain, the presence of these ericoids provides a link with the *Scirpus-Erica* wet heath in which *Molinia* can likewise increase its cover, but *Scirpus cespitosus* is only rarely recorded in the *Molinia-Potentilla* mire and such sub-shrubs as *Erica cinerea* and *Vaccinium myrtillus*, which can be commonly found in small amounts in the *Scirpus-Erica* wet heath, hardly ever occur here.

Sometimes, too, in Wales and south-west England, *Ulex gallii* is an occasional in the *Molinia-Potentilla* mire, the bushes scattered but very noticeable in summer when the plant is flowering. *U. europaeus* also occurs in some stands, and it can be locally prominent in this kind of vegetation, as on the Lizard in Cornwall, where both gorses occur, together with small quantities of *Erica vagans*, in a very striking kind of *Molinia-Potentilla* mire transitional to *Erica vagans-Schoenus* heath (and included in that community by Hopkins 1983).

More frequently noted in previous descriptions is the local, but very conspicuous, occurrence here of *Myrica gale*, forming a patchy or sometimes quite extensive and dense over-canopy. The combination of *Molinia* and *Myrica* is very eye-catching and several authors have characterised a vegetation type defined by the constancy of these species. But both have rather wide ecological amplitudes and can be found together with quite diverse suites of associates. In this scheme, therefore, assemblages with abundant *Molinia* and *Myrica* are treated as components of a number of communities: the *Molinia-Potentilla* mire can incorporate most of the *Molinia-Myrica* vegetation of McVean & Ratcliffe (1962) and Wheeler (1980*c*) and of Birse's (1980) *Myricetum galis*, but it excludes more base-rich vegetation like the *Molinia-Myrica* Association of Birks (1973) and much of that encompassed by Wheeler's (1980*c*) *Myricetum gale*.

The general absence of more calcicolous herbs among the often impoverished associated flora of the *Molinia-Potentilla* mire provides a further distinction from the *Cirsio-Molinietum* where such plants are few but quite frequent and from grassier stands of the *Schoenetum*, where they are more numerous. *Schoenus nigricans* itself, in fact, is sometimes found here and its local prominence can create a structural resemblance between the community and the *Schoenetum*, but other, more basiphilous cyperaceous plants are poorly represented. Indeed, among denser growths of *Molinia*, smaller sedges of any kind are of only sparse occurrence in the litter-choked runnels and through the community as a whole *Carex panicea*, *C. echinata* and *C. nigra* attain but occasional frequency and usually low cover, with such species as *C. hostiana*, *C. pulicaris*, *C. dioica* and *C. flacca* all rare.

Grasses too, other than *Molinia*, are of limited importance. *Agrostis canina* (presumably mostly ssp. *canina*) and *A. stolonifera* can be found at low frequency throughout and, in more open runnels, can form quite extensive mats. *Holcus lanatus* is also fairly common but it is only in the *Anthoxanthum* sub-community that other species figure prominently: there, *Anthoxanthum odoratum*, *Agrostis capillaris*, *Festuca rubra* and *Danthonia decumbens* all become preferentially common, though rarely very abundant, in swards transitional to Nardo-Galion vegetation. Among this kind of *Molinia*-

Potentilla vegetation, too, can be included some of the grassy herbage in which *Agrostis curtisii* and *Molinia* become frequent on heaths in south-western Britain.

Smaller dicotyledons only exceptionally make more than a scattered appearance in the community. *Viola palustris*, *Hydrocotyle vulgaris*, *Dactylorhiza maculata*, *Ranunculus acris* and *Achillea ptarmica* all occur occasionally and *Mentha aquatica*, *Cardamine pratensis*, *Epilobium palustre*, *Pulicaria dysenterica* and *Narthecium ossifragum* are preferential for particular sub-communities. The *Molinia-Potentilla* mire also provides an occasional locus for such Oceanic West European plants as *Scutellaria minor* and the more local *Carum verticillatum* and is an important context for the nationally rare *Lobelia urens* (Brightmore 1968).

Among the dense herbage, bryophytes are also often sparse, mainly confined to more open areas in the runnels or finding a place on decaying tussocks. *Rhytidiadelphus squarrosus*, *Pleurozium schreberi*, *Pohlia nutans* and *Calliergon cuspidatum* are found occasionally throughout but only in the *Erica* sub-community, where the ground between the tussocks remains wet for much of the year, is this cover enriched. There, a variety of other species, including some Sphagna, become preferentially frequent and abundant.

Sub-communities

***Erica tetralix* sub-community:** *Molinietum caeruleae* Moss 1911, Rankin 1911*a*, *b*, Smith 1911, Crampton 1911, Stapledon 1914, Jefferies 1915, Fraser 1933, Tansley 1939; *Molinia caerulea* grassland McVean & Ratcliffe 1962 *p.p.*, Edgell 1969, Meade 1981 *p.p.*; *Molinia-Myrica* nodum McVean & Ratcliffe 1962, Adam *et al.* 1977, Ratcliffe & Hattey 1982 *p.p.*; *Junco acutiflori-Molinietum*, heathy facies Hill & Evans 1978; *Myricetum galis* Birse 1980; *Molinia caerulea-Myrica gale* community Wheeler 1980*c p.p.*; *Myricetum gale ericetosum* Fischer 1967 *sensu* Wheeler 1980*c*; *Molinia-Potentilla erecta* nodum Bignal & Curtis 1981 *p.p.*; *Molinia caerulea-Juncus squarrosus* nodum Ratcliffe & Hattey 1982 *p.p.* In this, the most widely distributed and commonly described kind of *Molinia-Potentilla* mire, *Molinia* is still very much the dominant but there is a distinct shift in the associated flora towards Ericion tetralicis wet heath. In the first place, *Erica tetralix* is strongly preferential and, though rarely abundant, with frequent *Calluna* it brings a modest variegation to the vascular canopy. Then, although *J. acutiflorus* (only rarely here *J. effusus*) remains common and can be locally abundant, it is often rivalled in frequency by *Eriophorum angustifolium*. Among the sedges, *C. panicea*, *C. echinata* and *C. nigra* all occur occasionally and they sometimes thicken up their cover a little in more open runnels. But, apart from sparse *Holcus lanatus*, *Anthoxanthum*, *Festuca rubra* and *Agrostis canina*, grasses are noticeably thin and, though there can be scattered plants of *Succisa*, *Cirsium palustre* and *Lotus uliginosus*, such taller herbs are poorly represented. Among smaller plants, *Viola palustris* and *Hydrocotyle* are sometimes found but more striking here is the occasional presence of such species as *Narthecium*, *Drosera rotundifolia* and *Vaccinium oxycoccos*.

The bryophyte cover, too, shows some distinctive features. *Aulacomnium palustre*, *Polytrichum commune*, *Hypnum jutlandicum* and *Calypogeia fissa* are all preferential at low frequencies but more noticeable is the variety and patchy abundance of Sphagna. *Sphagnum recurvum* and *S. auriculatum* are the commonest species but *S. papillosum*, *S. palustre*, *S. capillifolium* and *S. subnitens* also occur occasionally.

Superimposed on this basic pattern is a variety of local or regional differences. On Roydon Common in Norfolk, for example, one of the few eastern localities for the *Molinia-Potentilla* mire, *J. subnodulosus* replaces *J. acutiflorus* as the charateristic rush in this vegetation. Then, in south-western Britain, *Ulex gallii* extends out of the drier heaths to find an occasional place in this sub-community. More widely distributed are those stands where *Myrica* has attained local abundance over a field layer which is essentially an impoverished version of this kind of *Molinia-Potentilla* mire.

***Anthoxanthum odoratum* sub-community:** *Molinia caerulea* grassland Meek 1976 *p.p.*, Meade 1981 *p.p.*; *Festuco-Molinietum anthoxanthosum* Evans *et al.* 1977; *Molinia* flushes Ferreira 1978 *p.p.*; *Junco-Molinietum caeruleae*, non-heathy facies Hill & Evans 1978; *Junco acutiflori-Molinietum*, *Molinia caerulea* mire variant Ratcliffe & Hattey 1982 *p.p.* Although *Molinia* is still very much the dominant in this sub-community, the sward here tends to be shorter than in other kinds of *Molinia-Potentilla* mire and more varied in its major components. *J. acutiflorus* remains frequent and *J. effusus* reaches occasional frequency but it is grasses which contribute the most distinctive element. *Anthoxanthum* is the best preferential but *Holcus lanatus*, *Agrostis capillaris*, *Danthonia decumbens* and *Festuca rubra* all occur more commonly than usual and *F. ovina*, *Agrostis canina*, *A. stolonifera*, *Nardus stricta*, *Deschampsia cespitosa* and, in the south-west, *A. curtisii* can also be found occasionally. *Luzula campestris* and *L. multiflora* are somewhat commoner than usual, too, and *Carex panicea* and *C. echinata* occur at low frequency.

In this generally grassy ground, other associates can be quite sparse. *Calluna* and *U. gallii* occur occasionally, and *U. europaeus* and *Rubus fruticosus* agg. can also figure, particularly where there has been some disturbance, but *E. tetralix* and *Myrica* are both very uncommon. Then, though *Succisa*, *Lotus uliginosus* and *Cir-*

https://doi.org/10.1017/9780521391658.029 Published online by Cambridge University Press

sium palustre are all more frequent than in the *Erica* sub-community and *Serratula tinctoria* and *Rumex acetosa* weakly preferential, such taller herbs are rarely very abundant and, in grazed stands, the more palatable are often nibbled down to non-flowering rosettes. At scattered localities towards the southern coast of England, *Lobelia urens* is sometimes to be found among this element of the vegetation and in more open but ungrazed stands, where it has a chance to flower, it can provide a striking splash of purplish-blue right through the summer (Brightmore 1968).

Among the dense grassy cover, smaller herbs are poorly represented and, apart from *Potentilla erecta*, only *Viola palustris* and *Hydrocotyle* approach occasional frequency. Bryophytes, too, are sparse with *Pseudoscleropodium purum* and *Rhytidiadelphus squarrosus* the commonest species but even those typically occurring only as scattered small patches. Sphagna are rarely found.

***Angelica sylvestris* sub-community:** *Molinia* flushes Ferreira 1978 *p.p.*; Wet Grassy *Juncus* Heath NCC Devon Heathland Report 1980; *Molinia* grasslands Group 10 Meade 1981 *p.p.*; *Molinia-Eupatorium* community Ratcliffe & Hattey 1982; *Erica vagans-Schoenus nigricans* heath, *Ulex europaeus* variant Hopkins 1983. This is the most local but striking kind of *Molinia-Potentilla* mire because, though *Molinia* often grows very vigorously and frequently occurs as substantial tussocks, the cover is often variegated by small clumps of *J. acutiflorus* and *J. effusus* and, in mid-summer, is generally punctuated by the tall flowering shoots of numbers of dicotyledons, notably *Succisa* and *Lotus uliginosus* and then, more preferential to this sub-community, *Angelica* and *Cirsium palustre* with, more occasionally, *Epilobium palustre*, *Filipendula ulmaria*, *Pulicaria dysenterica*, *Valeriana officinalis* and *Centaurea nigra*. Somewhat shorter are *Mentha aquatica*, *Scutellaria minor*, *Cardamine pratensis* and *Equisetum palustre* and then, sprawling among the herbage, there is frequently some *Galium palustre*. *Agrostis stolonifera* and *A. canina* occasionally form spreading mats and scattered tufts of *Holcus lanatus* can also be found but other grasses, and sedges and ground-growing dicotyledons, are scarce.

Some notable local components of this kind of *Molinia-Potentilla* mire are *Carum verticillatum*, which in Britain occurs largely in this vegetation and in the closely-related *Juncus-Galium* rush-pasture, and that more obvious oceanic plant, *Osmunda regalis*, which can reach a substantial size here. *Schoenus nigricans* can also be found and its tussocks are numerous on occasion, though they are not accompanied by the kind of rich basiphilous flora characteristic of the *Schoenetum*. On the Lizard, however, there is some rather different vegetation with *Molinia* and *Schoenus* that is probably best included here. Hopkins (1983) saw it as part of his *Erica-Schoenus* heath and, along with the two bulky monocotyledons and such species as *Potentilla erecta*, *Angelica*, *Eupatorium* and *Succisa*, it also had bushes of *Ulex europaeus*, *U. gallii* and that distinctive heath of the headland, *Erica vagans*, and frequent *Sanguisorba officinalis*.

Throughout the *Angelica* sub-community bryophytes are again sparse but *Calliergon cuspidatum* and *C. giganteum* can be found as scattered patches.

Habitat

The *Molinia-Potentilla* 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 the flushed margins of sluggish streams, water-tracks and topogenous mires, but also extending on to the fringes of ombrogenous bogs. Although both climate and soils influence the composition of the vegetation, treatments, particularly burning and grazing, have probably affected many stands and contributed to the general abundance of *Molinia* in the community, especially where it extends on to less typical habitats. In the upland fringes of the north and west, this kind of vegetation often marks out situations which, with draining, are much prized for coniferous forestry, so much has been lost to this land use.

Geographically, the *Molinia-Potentilla* mire can be seen as a north-western replacement of the *Cirsio-Molinietum*, and some of the floristic differences between the communities can be related to the cooler but relatively mild climate of this part of Britain. Almost all the stands of the *Molinia-Potentilla* mire experience mean annual maximum temperatures of less than 26 °C (Conolly & Dahl 1970), but within this zone, the community is largely confined to the milder lowlands, occurring mostly below 200 m where February minima are generally a degree or so above freezing (*Climatological Atlas* 1952) and thus becoming increasingly local in the less equable reaches of the mountainous west of Scotland. In the warmer, oceanic climate of south-west Britain, there is, in fact, some geographical overlap, and, on circumneutral soils, a close floristic similarity, between the two communities. But much of the *Molinia-Potentilla* mire lies beyond the range of *Cirsium dissectum*, the major preferential of the *Cirsio-Molinietum*, and the more generally oceanic conditions are further reflected in the occurrence, along with abundant and vigorous *Molinia*, of *J. acutiflorus* and, in certain circumstances, *E. tetralix*, *Myrica* and *U. gallii*, together with the more local *Carum verticillatum*, *Scutellaria minor* and *Lobelia urens*, all Oceanic West European plants. Sadly, the easier it becomes to make this separation between our two Junco-Molinion communities, the harder it is to distinguish the *Molinia-Potentilla* mire from the Juncion acutiflori vegetation of north-west Britain, the *Juncus-Galium* rush-pasture.

However, much more obvious and specific than the direct influence of temperature on the *Molinia-Potentilla* mire are the indirect effects of rainfall felt through the soils, which help distinguish the community from these closely-related vegetation types, both in its floristics and in the particular kinds of habitats it characterises. Like both the *Cirsio-Molinietum* and the *Juncus-Galium* rush-pasture, this is a community of generally moist soils, intermediate between the permanently waterlogged on the one hand and the excessively draining on the other. In all three vegetation types, therefore, much of the floristic character is supplied by Molinietalia species such as *Succisa*, *Cirsium palustre*, *Angelica* and *Lotus uliginosus*, and grasses of damp mesotrophic swards like *Holcus lanatus* and *Anthoxanthum*. However, although the soils beneath the *Molinia-Potentilla* mire are frequently just as saturated as those under the *Juncus-Galium* rush-pasture (indeed, quite often they are wetter), they are typically well aerated, with relatively free movement of water through the upper horizons, whereas the latter vegetation is very much associated with a strong measure of impedence in the profile. As far as the floristics of the two communities are concerned, this difference is probably of major importance in affecting the balance between the abundance of *Molinia* and the Junci. Their proportions vary in a virtually continuous gradation from one vegetation type to the other, and the prominence of each can be influenced by factors other than drainage conditions, but *Molinia* is strongly favoured by a wet but not waterlogged environment (Jefferies 1915, Rutter 1955, Loach 1966), while the Junci thrive on markedly gleyed soils. In fact, judging by the frequently very vigorous growth of *Molinia* in this community, the soil moisture regime seems to be well-nigh ideal for this grass, and its resulting abundance has a marked effect on the frequency and disposition of equally well-suited but less bulky and competitive associates.

In the dry climate of south-east England, such strong representation of *Molinia* in the *Cirsio-Molinietum* is of rather local occurrence, marking out the sloping fringes of topogenous hollows and flood-plain mires, and the margins of springs and flushes, where thin peats and peaty mineral soils are protected from summer drought but kept free from continuous waterlogging. In the wetter west of Britain, however, beyond the 1000 mm annual isohyet (*Climatological Atlas* 1952), where there are at least 140 wet days yr^{-1} (Ratcliffe 1968), such edaphic conditions are met much more widely, so *Molinia*-dominance can be maintained there over a broader range of physiographies and soils. The beginning of this extension can be seen in south-western stands of the *Cirsio-Molinietum*, which occur a little beyond the usual strict confines of that community, but it is in the *Molinia-Potentilla* mire that this development reaches its full expression.

Throughout western Britain, the community can thus be found over moist slopes in a variety of landscape settings. Many of the more clearly-defined stands continue to mark out tracts of obvious soligenous influence or quickening drainage due to variations in relief or in the permeability of underlying bedrocks or drift, around the heads and sides of moorland streams for example (Jefferies 1915, NCC Devon Heathland Report 1980), or around the margins of valley or basin mires (Ratcliffe & Hattey 1982) or on the periodically-flooded margins of lake sides or small rivers (McVean & Ratcliffe 1962). In such situations, it is usually shallow, well-humified peats that underlie the community, very much as beneath the *Cirsio-Molinietum*, but becoming much more common in the gently-undulating scenery of the Silurian, Ordovician and Carboniferous shales and grits, and their drift mantle, through the upland fringes of south-west England, Wales and southern Scotland. But, with the higher rainfall the *Molinia-Potentilla* mire is often found over open slopes which channel seepage waters in a rather ill-defined fashion and it frequently extends on to somewhat steeper ground, cut into more pervious substrates and carrying brown podzolic soils or even podzols proper, profiles which are free-draining but which have a more or less permanently moist humic top. And, where precipitation has been such as to favour the accumulation of ombrogenous peats, now independent of a ground water-table, the community can extend on to the margins of blanket and raised mires, providing the slope of the ground or flushing ameliorate the stagnant conditions.

However, even in the very wettest situations in which it is found, where the ground between the *Molinia* can be under water for much of the winter and spring, continuing good aeration helps mark off the community from the vegetation of the Caricion nigrae or Oxycocco-Sphagnetea. It is in the *Erica* sub-community that the *Molinia-Potentilla* mire makes its nearest approach to such assemblages, with *Eriophorum angustifolium*, *Narthecium*, various Sphagna and some other poor-fen bryophytes marking the floristic transition, but such associates are generally scattered and patchy in their occurrence, even where the shade from the *Molinia* is not too dense, and such species as *Scirpus cespitosus* and *Eriophorum vaginatum* and extensive carpets of peat-building Sphagna are not typical here. At the opposite extreme, where the *Molinia-Potentilla* mire extends on to moist peaty mineral soils, it is usually represented by the *Anthoxanthum* sub-community which lacks the above preferentials and, with its distinctive suite of

https://doi.org/10.1017/9780521391658.029 Published online by Cambridge University Press

grasses, come close to damp Nardo-Galion grasslands.

One other important diagnostic feature of the habitat of the western *Molinia* vegetation included here is that the soils are somewhat more base-poor than those of the *Cirsio-Molinietum*. Both communities can be found over circumneutral profiles, which is part of the reason why Molinietalia herbs flourish so well in each, but, in eastern Britain at least, the *Cirsio-Molinietum* is very much a vegetation type of more base-rich and calcareous fens. To the south-west, where the climate is still warm, but where rainfall is higher, it extends in the *Juncus-Erica* sub-community on to argillaceous bedrocks of somewhat lower pH but, for the most part, through western Britain, where siliceous substrates prevail and the tendency to surface-leaching is high, *Molinia*-dominance is seen in the *Molinia-Potentilla* mire over soils of pH 4–5.5. Such plants as *Carex hostiana*, *C. pulicaris* and *Briza media* which can make a frequent contribution to the *Cirsio-Molinietum* are therefore of very limited occurrence here: even in the *Anthoxanthum* and *Angelica* sub-communities which can mark out soils where the base-richness approaches or exceeds pH 6, yet a mildly calcicolous aspect to the vegetation is exceptional. At the opposite extreme, where the *Anthoxanthum* sub-community extends a little way on to drier podzols or where, more commonly, the *Erica* sub-community is found in flushes with more markedly base-poor waters, of pH well below 4, the general appearance of the associated flora is quite strongly calcifuge. Even where the substrate is nearer to neutral in its reaction, the acidophile character of the vegetation can be pronounced if plants are able to get a hold in the leached tops of the *Molinia* tussocks.

The irrigation which often marks off the habitat of the *Molinia-Potentilla* mire from the grassland, heath or bog which surrounds it probably also brings modest nutrient enrichment and, compared with the Caricion nigrae vegetation, too, which can occupy similar flushes and water-tracks, the waters and peats here are less impoverished. Among wet heaths in Hampshire, for example, Loach (1966, 1968*a*, *b*) found that, compared with *Calluna* and *Erica tetralix*, *Molinia* occupied the soils with the greatest nutrient supply and the lowest carbon:nitrogen ratio. Nutrients were concentrated in the surface horizons, perhaps because of the activity of the deep-rooted grass itself (e.g. Jefferies 1915) and seasonal turnover was rapid. On the Lizard, Hopkins (1983) also noted that increase of *Molinia* among *Erica-Schoenus* heath was related to larger amounts of potassium and phosphorus than usual.

In this respect, the quite common coupling of *Molinia* with *Myrica* here is noteworthy for this shrub has symbiotic root-nodule bacteria which can annually fix nitrogen equivalent to roughly half that in the current year's shoots (Sprent *et al.* 1978). The additional shade of the *Myrica*, together with the luxuriant cover of the *Molinia* encouraged by enrichment, can make such vegetation particularly species-poor.

Although edaphic conditions in the community seem generally very favourable for the vigour of *Molinia* and though, once established in abundance, the grass may be able to maintain itself as a well-entrenched dominant, treatments probably play some part in its widespread ascendancy and persistence over suitable soils in western Britain, and are perhaps largely responsible for the development of the *Molinia-Potentilla* mire over ground that would naturally carry some other kind of mire or wet-heath vegetation, quite a common occurrence. Burning and grazing have probably been of especial importance since these can both leave *Molinia* largely unaffected while destroying or keeping in check less robust perennial associates or more vulnerable palatable plants, such as the tall hemicryptophyte dicotyledons and the sub-shrubs. Such effects reinforce the impoverished character of the community in many cases and help maintain it against colonisation by ericoids, gorse and probably also, in suitable situations, by *Myrica* which, though not quickly eliminated by such treatments, grows with reduced stature and is perhaps eventually lost (McVean & Ratcliffe 1962). And ultimately, burning and grazing probably hold many stands as plagioclimax vegetation when they would otherwise be directly invaded by trees and progress to woodland (see below). Draining, too, may be important in the establishment of the community from mire vegetation of previously waterlogged peats, either on the fringes of blanket mire or over the rand of raised mires, where it can augment the effects of a drying climate on the lowering of the water-table (Godwin & Conway 1939). In such circumstances, the survival of the *Molinia-Potentilla* mire may be more precarious, further drainage precipitating the degeneration of the *Molinia* and colonisation by trees. The potentially favourable soil conditions produced by surface drying and peat oxidation means that the ground under the community has often attracted the attention of foresters and many stands have been drained and ploughed for the establishment of conifers.

Within the community, burning and, particularly, grazing are of some importance in maintaining the floristic differences seen in the *Anthoxanthum* and *Angelica* sub-communities. The former, with its more mixed grassy herbage is typically found where *Molinia-Potentilla* mire on drier ground has been open to grazing. Continuing predation by stock can keep such swards fairly short and diverse, though where grazing is relaxed the more robust grasses can grow up with the *Molinia* to produce a rank, more species-poor sward retaining this general floristic character. Freedom from grazing on somewhat moister ground favours the development of

https://doi.org/10.1017/9780521391658.029 Published online by Cambridge University Press

the *Angelica* sub-community with its more prominent contingent of tall dicotyledons among the *Molinia* tussocks, though some of these will persist as non-flowering rosettes with the introduction of stock.

Zonation and succession

The *Molinia-Potentilla* mire is a common and widespread element in the heath and moorland scenery of western Britain, occurring with other mire communities, heaths and grasslands in zonations and mosaics under the primary influence of edaphic conditions, though much affected by treatments. At lower altitudes, improvement has often grossly altered or truncated such sequences, leaving them isolated within intensive agricultural landscapes. On somewhat higher ground, afforestation has often been centred on slopes previously occupied by the community, though many tracts remain in more intact zonations and have extended their cover on to much-burned and grazed ground. Such treatments play an important part in preventing seral progression to scrub woodland.

The simplest patterns are to be seen where the *Molinia-Potentilla* mire marks out tracts of moist but well-aerated ground within sequences from grassland or dry heath to bog over ground which becomes increasingly ill-drained and eventually permanently waterlogged. In the less humid parts of its range, in south Wales and through south-west England, where such zonations are strongly dependent on topography, it is thus commonly found on the slopes around valley bogs, its exact position in the sequence of vegetation types depending on the conformation of the ground and the way in which seepage is affected by the permeability of the underlying deposits. Generally speaking, it occurs in such zonations at or around the level of the wet heath, interposed between the drier heaths on the podzols of the interfluves and the bog vegetation of the waterlogged peats in the valley bottoms. Where the ground drops away fairly quickly from among the former, gathering substantial amounts of seepage and channelling it down the slope, then there can be a direct switch to the *Molinia-Potentilla* mire over the flushed zones. In south-west Britain, *Molinia* finds strong representation among communities like the *Ulex minor-Agrostis* and *Ulex gallii-Agrostis* heaths, but transitions from these vegetation types are usually fairly well marked in a decisive shift in dominance to the grass, with a much reduced cover of sub-shrubs. Quite often, however, where there are extensive tracts of flatter and ill-drained ground around the drier heaths, the *Ericetum tetralicis* wet heath supervenes between them and the *Molinia-Potentilla* mire, and then boundaries can be much less well defined, particularly if there is some extension of the soligenous influence back into the wet heath. Then, the *Angelica* sub-community of the *Molinia-Potentilla* mire can grade imperceptibly to the *Succisa-Carex* sub-community of the *Ericetum*, taller herbs, clumps of rushes and an over-canopy of *Myrica* sometimes providing a strong visual continuity throughout and masking the gradual move in dominance from the grass to a more mixed cover of *Molinia* and ericoids.

Downslope, where the levelling of the ground in such terrain leads to permanent waterlogging and the accumulation of deeper acid peats, the *Molinia-Potentilla* mire is typically replaced by the *Narthecio-Sphagnetum* valley bog. To such vegetation, the *Erica* sub-community can form a gradual transition and *Molinia* itself persists with high frequency into the bog, but it becomes non-tussocky and grows ever more weakly in the stagnant conditions and the *Sphagnum* cover, dotted with abundant *Narthecium* and *Drosera rotundifolia*, extends to form a luxuriant carpet. In many larger valley mires of this kind, there is also a longitudinal zonation between these two communities, the *Narthecio-Sphagnetum* being concentrated towards the stagnant head of the valley and giving way downstream, with increasing channelling of the waters, to the *Molinia-Potentilla* mire, though sometimes persisting over a marginal zone of stagnation between it and the surrounding *Ericetum tetralicis*.

Further complexities arise in such patterns where there is some variation in the base-richness of the seepage waters because of geological heterogeneity. A slight rise in pH within such flushed ground in south-west Britain is generally marked by the occurrence of the *Cirsio-Molinietum* which, in its distinctive *Juncus-Erica* sub-community, comes very close in its composition to the *Molinia-Potentilla* mire and which can occur adjacent to it or replace it in neighbouring, but more base-rich, seepage zones. *Schoenus* can figure patchily in such situations and sometimes thickens its cover in strongly irrigated mires as the dominant in the distinctive *Schoenus-Narthecium* community or, where the waters are more base-rich, in vegetation resembling the *Schoenetum* though usually without *J. subnodulosus*.

Sequences of this kind, occasionally complete, often in part and sometimes disposed in complex mosaics over gently undulating terrain with complex hydrology, are a very characteristic feature of the heathlands of south-west Britain. The *Molinia-Potentilla* mire can be seen, represented to a greater or lesser degree, where such patterns have developed over the Eocene clays, sands and gravels of the New Forest and Dorset (Ratcliffe 1977), the Triassic deposits of the Devon Pebble-Bed Commons (well shown in Ivimey-Cook *et al.* 1975), the Carboniferous rocks of north-west Devon (NCC Devon Heathland Report 1980) and Gower, and on Silurian and Ordovician rocks, variously smeared with drift, through west Wales (Meade 1981). And analogous, though rather striking, zonations are to be found over the serpentine and gabbro of the Lizard (Hopkins 1983), where the community occurs among dry and wet heaths in both of which *Erica vagans* figures prominently.

Northwards in this western part of Britain, the basic pattern of vegetation types in such sequences is preserved but, with the increasing rainfall, there is an extension of the wetter components of the zonation out of the narrow topographic confines characteristic of the south-west, and a switch to the sub-montane analogues of many of the communities. Even on Gower, much of the wet heath begins to resemble the *Scirpus-Erica* community, which replaces the *Ericetum tetralicis* in north-west Britain and which mantles many of the thinner peat soils through the upland fringes, forming an intergrade between a variety of sub-montane heaths and grasslands on podzolic profiles to blanket bog, usually the *Scirpus-Eriophorum* mire, on deep ombrogenous peats. Typically, in this kind of landscape, the *Molinia-Potentilla* mire marks out water-tracks running through this zonation, channelling seepage from the bog or wet heath and carrying it downslope through the drier heaths and grasslands, or gathering it from shedding slopes above the bog and debouching it on to its surface (e.g. McVean & Ratcliffe 1962, Edgell 1969). Again, though *Molinia* occurs frequently in the bog and wet-heath vegetation in such zonations, its abundance usually increases very markedly over the soligenous zones, so the boundary of the community is often clear. However, as before, where seepage extends back into the wet heath, transitions can be less well defined, with the *Molinia-Potentilla* mire grading to the *Carex* sub-community of the *Scirpus-Erica* wet heath: as in southern valley bogs, *Myrica* can form a canopy over both these vegetation types. And, there can be analogous complications along the length of seepage tracts, with the *Carex echinata-Sphagnum* mire and the *Juncus-Galium* rush-pasture replacing the *Molinia-Potentilla* mire according to the base-poverty of the soils and flushing waters and the extent of waterlogging as the ground levels and falls away over the hillsides.

Similar kinds of vegetation, though disposed in rather different fashion, can be seen where the *Molinia-Potentilla* mire occurs on raised bogs in western Britain. Here, it again marks out the better-drained tracts of the mire surface, typically dominating the rand which surrounds the active plane, itself generally carrying some form of the *Erica-Sphagnum papillosum* mire, sometimes fringed by a zone of *Scirpus-Erica* wet heath, a pattern seen in classic form at Cors Goch glan Teifi (Godwin & Conway 1939) and on a smaller scale at Malham (Proctor 1974, Adam *et al.* 1975). Where well-aerated conditions are maintained in the marginal lagg of such bogs, the *Molinia-Potentilla* mire can extend its cover into this, but more consistent waterlogging there is often marked by the occurrence of some kind of *Carex echinata-Sphagnum* mire or rush-pasture.

Patterns of this kind are often further complicated by treatments, particularly by burning and grazing, which have been a traditional element in the management of both the lowland heath and the upland fringes in which this community is found. Practised with care, these treatments, either alone or in concert, do little damage to the *Molinia-Potentilla* mire: indeed, they probably often ultimately prevent seral progression and, on moister soils, can reinforce the uncompromising dominance of *Molinia* by helping eliminate its associates or competitors. And it is this latter effect that is seen most frequently in the kinds of zonations discussed above because, where the surrounding wet heaths are subject to burning and then grazed, they show a strong tendency to develop into the *Molinia-Potentilla* mire, extending its cover outside what would be its normal edaphic bounds. Such a succession can extend on to the deeper peats of the bog themselves and is especially likely where artificial drainage has sharpened up the loss of water from the mire plane. This was already visible at Cors Goch glan Teifi at the time of Godwin & Conway's (1939) study, markedly enhancing what was perhaps a natural tendency with the drying climate, and it is now very evident on, for example, the raised and blanket mires surveyed through Strathclyde by Bignal & Curtis (1981). It can be seen, too, where longitudinal drains have been put through some of the valley mires in the New Forest.

Over drier ground, where the *Molinia* tends to be not quite so abundant and not so strongly hummocky, grazing can perhaps effect more obvious changes in the community itself. The *Anthoxanthum* sub-community, for example, characteristic of grazed sites, has much in common with moist Nardo-Galion swards and continued pasturing could perhaps effect a transition to that kind of grassland and, combined with draining and the application of fertiliser, convert the *Molinia-Potentilla* mire into a Cynosurion sward. However, where there is a tendency towards poaching of the ground here, particularly likely where moist mineral soils are heavily grazed with cattle, there is a strong likelihood of rushes spreading with the eventual development of the *Juncus-Galium* rush-pasture. Mosaics of these two vegetation types are very common on some of the heavily-grazed Gower commons on soils derived from Carboniferous shales.

The common occurrence of scattered shrubs and trees in association with the *Molinia-Potentilla* mire, particularly on lowland commons where seed-parents are often close at hand, suggests that, where treatments are relaxed and where the herbage has not grown too rank, succession to scrub and woodland could be quite rapid. *Salix cinerea* and *Betula pubescens* are the commonest woody species found in such situations though, further north, *S. aurita* becomes more frequent (McVean & Ratcliffe 1962, Prentice & Prentice 1975). The likely development in such seres would be the *Betula-Molinia* woodland, in the more open flushed stands of which many of the characteristic herbs here survive.

The potential suitability for forestry of the soils under the *Molinia-Potentilla* mire, often better-drained and somewhat richer than the surrounding ground, means that tracts of the community have often been replaced, in whole or part, by coniferous plantations. This is particularly widespread in the upland fringes of the north-west where such forests have been established, often with little care for the natural configuration of the ground, cutting across sequences of wet heath and mire, but it can also be seen on certain lowland heaths, notably over some New Forest zonations. Elsewhere in the lowlands, other tracts of the community, together with neighbouring vegetation, have been lost to agricultural improvement or left as isolated fragments in intensively pastoral landscapes.

Distribution

The community occurs throughout western Britain, and is especially frequent in south-west England, Wales and southern Scotland. The *Erica* sub-community has been recorded most widely and its stands can be extensive; the facies with *Myrica* is local, though it can be very common, as in the New Forest and in parts of Wales and the west Highlands. The *Anthoxanthum* sub-community occurs scattered throughout the range but is particularly well represented in Wales. The *Angelica* sub-community is more concentrated in south-west England and south and west Wales.

Affinities

Defining the *Molinia-Potentilla* mire from among the variety of British vegetation types in which *Molinia* figures prominently is a troublesome job. Separation from the *Cirsio-Molinietum* is the first problem, though an easier one because, although the two communities come very close in their floristics and habitat in the south-west, and have both been described as Molinieta (Ivimey-Cook *et al.* 1975), some fairly consistent differences can be seen throughout. In moving from the warmer and drier south-east of Britain, where suitably moist but aerated soils are of local occurrence and often tending towards base-richness, to the cooler and wetter west, where they are more widespread but often rather acidic, the shift from the one community to the other is marked by the loss of species such as *Cirsium dissectum*, *Carex hostiana*, *C. pulicaris* and *Briza media*, together with Caricion davallianae and Mesobromion occasionals, and the more frequent occurrence of plants of Ericion wet heaths, Caricion nigrae poor fens and Nardo-Galion grasslands in what are often larger stands within a broader landscape context.

The change in climatic and soil conditions between these two kinds of *Molinia* vegetation is also accompanied by a switch from *Juncus subnodulosus* to *J. acutiflorus* as the commonest associated rush. And just as there can be problems in the east of Britain separating the *Cirsio-Molinietum* from Calthion fen-meadow, so there is a continuous gradation in the west between the *Molinia-Potentilla* mire and the *Juncus-Galium* rush-pasture. The two vegetation types have many associates in common and are often found in close proximity on heaths and around the upland fringes but, although *Molinia* and *J. acutiflorus* each transgress far into swards dominated by the other, the balance between them is a reasonably good guide to the separation of the communities, strongly reflecting the drainage conditions favoured by each. The frequent association of *Molinia* with *J. acutiflorus* in the *Molinia-Potentilla* mire has sometimes led to the community being termed a *Junco-Molinietum* (Hill & Evans 1978, Ratcliffe & Hattey 1982), though, as applied by O'Sullivan (1982), who originally coined the epithet (Tüxen & O'Sullivan 1964 in O'Sullivan 1968*a*), this vegetation type includes mainly rush-dominated swards.

Reliance on the dominance of *Molinia* to help delimit the *Molinia-Potentilla* mire brings problems of its own because, in the more oceanic parts of Britain, this grass becomes increasingly frequent and abundant in a wide variety of vegetation types which thus show floristic convergence into impoverished kinds of herbage whose most obvious shared characteristic is simply *Molinia*-dominance. Although the *Molinia-Potentilla* mire does take in much of the species-poor *Molinia* vegetation of western Britain, including some which, under the combined influence of climate and various treatments, has been derived from other communities, its bounds are drawn more tightly and precisely than those of most of the Molinieta and '*Molinia* grasslands' erected to include such a compendious assemblage. Such communities, gathered together in Tansley (1911, 1939), often took in almost any kind of vegetation in which *Molinia* played a leading role, irrespective of the associates represented with it and, in some later studies too, fairly diverse vegetation types are gathered together under such general headings (Edgell 1969, Meek 1976, Meade 1981, Ratcliffe & Hattey 1982). In this scheme, as on a smaller scale in McVean & Ratcliffe (1962), some *Molinia*-dominated vegetation is retained within such communities as the *Scirpus-Erica* wet heath and, towards the east, the *Ericetum tetralicis*, with the *Molinia-Potentilla* mire being centred on assemblages in which such plants as *Succisa*, *Lotus uliginosus*, *Cirsium palustre* and *Ange-*

lica play a consistent if sometimes sparse role. Despite the still fairly broad character of the community, with its clear floristic links with Ericion wet heath, Caricion nigrae poor fens and Nardo-Galion grasslands, this group of plants, and the absence of more than locally important *Sphagnum* carpets, ericoid canopies and small-sedge or short calcifugous swards, provides a reasonably good definition and can even help integrate such superficially distinct assemblages as some *Myrica* vegetation (McVean & Ratcliffe 1962, Adam *et al.* 1977, Birse 1980, Wheeler 1980*c*).

At a higher phytosociological level, where precise distinctions have been the subject of long debate (e.g. Duvigneaud 1949, Westhoff & den Held 1969), the status of this community is more difficult to assess. Although it is somewhat paradoxical that the vegetation in which *Molinia* is most generally abundant in Britain is the kind which often least clearly belongs to the Molinietalia, the preferential occurrence of the assemblage noted above helps locate this impoverished community in that order. And, within it, it is probably best placed, with the *Cirsio-Molinietum*, in the Junco-Molinion. But, certainly, looking towards Europe from western Britain, the perspective on these vegetation types is very different from that which has grown up on the Continent.

Floristic table M25

	a	b	c	25
Molinia caerulea	V (4–10)	V (2–9)	V (6–10)	V (2–10)
Potentilla erecta	IV (1–4)	V (2–6)	V (1–5)	V (1–6)
Erica tetralix	IV (1–7)	I (2–5)	I (4)	II (1–7)
Eriophorum angustifolium	III (1–5)		I (3)	I (1–5)
Myrica gale	II (2–9)	I (8)	I (8)	II (2–9)
Sphagnum recurvum	II (1–9)		I (4)	I (1–9)
Narthecium ossifragum	II (1–7)		I (5)	I (1–7)
Sphagnum auriculatum	II (1–6)	I (2–4)		I (1–6)
Calypogeia fissa	II (1–3)	I (1)	I (4)	I (1–3)
Polytrichum commune	II (1–7)			I (1–7)
Aulacomnium palustre	II (1–5)			I (1–5)
Hypnum jutlandicum	II (1–9)			I (1–9)
Sphagnum papillosum	II (2–6)			I (2–6)
Sphagnum palustre	I (1–6)			I (1–6)
Sphagnum capillifolium	I (1–6)			I (1–6)
Vaccinium oxycoccos	I (1–4)			I (1–4)
Juncus subnodulosus	I (2–5)			I (2–5)
Anthoxanthum odoratum	I (2–4)	IV (1–5)	I (1–3)	II (1–5)
Holcus lanatus	I (1–6)	III (1–6)	II (1–4)	II (1–6)
Agrostis capillaris		III (1–5)		II (1–5)
Festuca rubra	I (2–4)	II (2–5)	I (1–4)	I (1–5)
Luzula multiflora	I (1–3)	II (1–3)	I (2)	I (1–3)
Viola palustris	I (2–4)	II (1–5)	I (1–4)	I (1–5)
Rumex acetosa		II (3–4)	I (3–4)	I (3–4)
Danthonia decumbens		II (1–3)	I (1–3)	I (1–3)
Pseudoscleropodium purum		II (1–4)		I (1–4)
Serratula tinctoria		II (1–2)		I (1–2)
Luzula campestris		II (1–4)		I (1–4)
Carex flacca		I (2–5)		I (2–5)
Agrostis curtisii		I (1–6)		I (1–6)
Lobelia urens		I (1–3)		I (1–3)
Angelica sylvestris		I (1–2)	V (1–6)	II (1–6)

https://doi.org/10.1017/9780521391658.029 Published online by Cambridge University Press

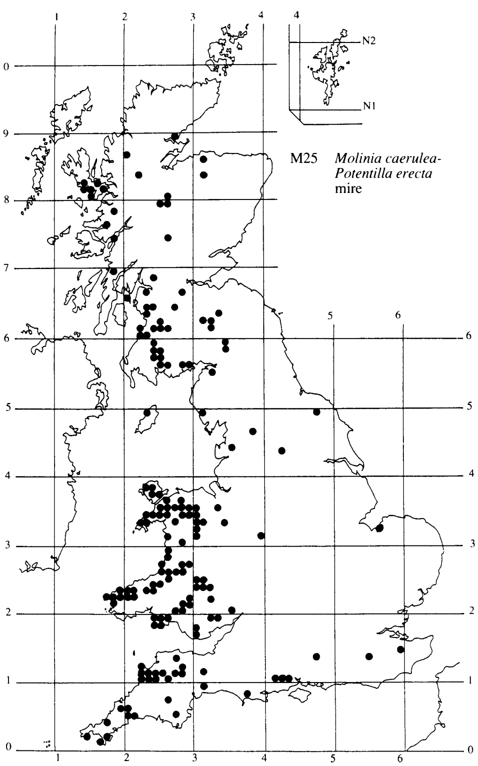
Floristic table M25 *(cont.)*

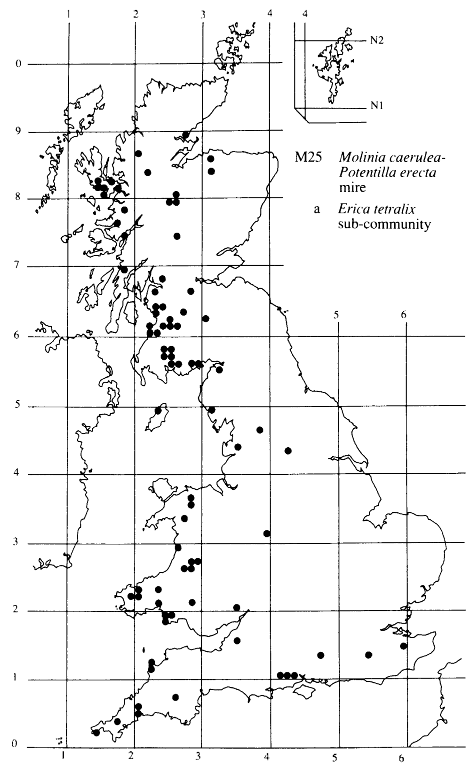
	a	b	c	25
Cirsium palustre	I (1–4)	II (1–4)	IV (1–4)	II (1–4)
Juncus effusus	I (1–3)	II (1–4)	III (3–5)	II (1–5)
Galium palustre			III (1–4)	II (1–4)
Epilobium palustre			II (1–3)	I (1–3)
Mentha aquatica			II (1–4)	I (1–4)
Eupatorium cannabinum			II (1–5)	I (1–5)
Filipendula ulmaria			II (3–5)	I (3–5)
Scutellaria minor			II (1–3)	I (1–3)
Pulicaria dysenterica			I (4)	I (4)
Cardamine pratensis			I (1–3)	I (1–3)
Schoenus nigricans			I (5–7)	I (5–7)
Calliergon giganteum			I (3–4)	I (3–4)
Equisetum palustre			I (1–3)	I (1–3)
Osmunda regalis			I (4–6)	I (4–6)
Carum verticillatum			I (1–3)	I (1–3)
Dryopteris carthusiana			I (3–6)	I (3–6)
Juncus acutiflorus	III (1–6)	III (3–7)	III (1–5)	III (1–6)
Succisa pratensis	II (1–4)	III (1–6)	III (1–5)	III (1–6)
Lotus uliginosus	I (2–4)	III (1–4)	III (1–4)	III (1–4)
Ulex gallii	II (1–4)	II (4–5)	I (1–4)	II (1–5)
Carex echinata	II (1–4)	II (2–3)	I (3)	II (1–4)
Carex panicea	II (1–6)	II (3)	I (3)	II (1–6)
Calluna vulgaris	II (1–7)	II (2–6)		II (1–7)
Agrostis canina	I (1–7)	II (2–5)	II (1–6)	II (1–7)
Agrostis stolonifera		II (1–4)	II (3–5)	II (1–5)
Carex nigra	I (1–5)	I (1–3)	I (2)	I (1–5)
Rhytidiadelphus squarrosus	I (1–4)	I (2–4)	I (3)	I (1–4)
Hydrocotyle vulgaris	I (3–6)	I (3–7)	I (3)	I (3–7)
Dactylorhiza maculata	I (1–3)	I (1–2)	I (2)	I (1–3)
Festuca ovina	I (1–3)	I (1–4)	I (3)	I (1–4)
Pleurozium schreberi	I (1–4)	I (3)		I (1–4)
Juncus articulatus	I (2–3)	I (4–5)		I (2–5)
Nardus stricta	I (1–4)	I (2)		I (1–4)
Pohlia nutans	I (1–4)	I (3)		I (1–4)
Ranunculus acris	I (2–3)	I (3)		I (2–3)
Sphagnum subnitens	I (1–6)		I (3)	I (1–6)
Cephalozia bicuspidata	I (1–3)		I (3)	I (1–3)
Phragmites australis	I (2–5)		I (6)	I (2–6)
Menyanthes trifoliata	I (1–4)		I (4)	I (1–4)
Lophozia ventricosa	I (1–4)		I (1)	I (1–4)
Ranunculus flammula		I (3)	I (3)	I (3)
Calliergon cuspidatum		I (1–7)	I (4–5)	I (1–7)
Ulex europaeus		I (2–3)	I (1–6)	I (1–6)
Rubus fruticosus agg.		I (2–4)	I (1–4)	I (1–4)
Eurhynchium praelongum		I (2)	I (3)	I (2–3)

https://doi.org/10.1017/9780521391658.029 Published online by Cambridge University Press

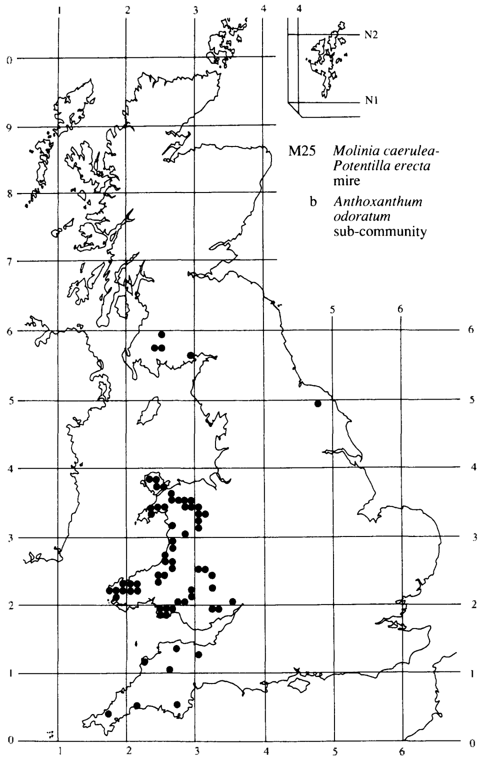
	a	b	c	25
Centaurea nigra		I (2–3)	I (1–5)	I (1–5)
Valeriana officinalis		I (2–4)	I (3–5)	I (2–5)
Hypericum pulchrum		I (3)	I (1–3)	I (1–3)
Deschampsia cespitosa		I (2–4)	I (5)	I (2–5)
Salix cinerea		I (3)	I (2–6)	I (2–6)
Achillea ptarmica		I (4)	I (4)	I (4)
Hypericum tetrapterum		I (2)	I (1–3)	I (1–3)
Lophocolea bidentata s.l.		I (3)	I (2–3)	I (2–3)
Number of samples	59	159	69	287

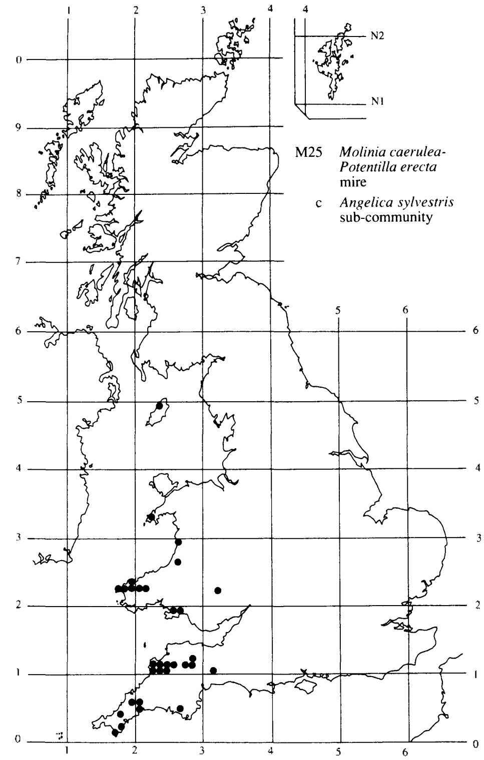
a *Erica tetralix* sub-community
b *Anthoxanthum odoratum* sub-community
c *Angelica sylvestris* sub-community
25 *Molinia caerulea-Potentilla erecta* mire (total)





https://doi.org/10.1017/9780521391658.029 Published online by Cambridge University Press





https://doi.org/10.1017/9780521391658.029 Published online by Cambridge University Press