
M26

Molinia caerulea-*Crepis paludosa* mire

Synonymy

Mixed fen Holdgate 1955b p.p.; *Carex nigra*-*Sanguisorba officinalis* nodum Proctor 1974 p.p.; *Carex nigra*-*Sanguisorba officinalis* community Wheeler 1980c; *Crepido-Juncetum* Jones 1984.

Constant species

Carex nigra, *C. panicea*, *Crepis paludosa*, *Equisetum palustre*, *Filipendula ulmaria*, *Molinia caerulea*, *Potentilla erecta*, *Ranunculus acris*, *Succisa pratensis*, *Valeriana dioica*, *Calliargon cuspidatum*.

Rare species

Primula farinosa.

Physiognomy

The *Molinia caerulea*-*Crepis paludosa* mire is a striking vegetation type, well-defined by a substantial block of constants and frequent companions, but showing quite considerable variation in its associated flora and embracing stands which, at one extreme, resemble swamp and, towards the other, are of a rank grassy character. *Molinia caerulea* is almost always present and it is often abundant, being the commonest dominant overall and frequently growing in a strongly-tussocky form, creating an irregular canopy up to 50 cm or so tall, and exerting a marked influence on the character and distribution of the associates. Among these are some other plants which can make a substantial contribution to the herbage. *Carex nigra*, for example, is a constant and it quite frequently occurs as prominent tufts or tussocks (var. *subcaespitosa*), sometimes rivalling or exceeding *Molinia* in its cover, particularly in the *Sanguisorba* sub-community (Proctor 1974). *C. panicea* can also be fairly abundant and *C. pulicaris* occurs commonly, too, though not usually as dense tufts. Then, in stands which are transitional to swamp, there can be some *C. appropinquata*, as at Malham Tarn in North Yorkshire (Proctor 1974), or *C. rostrata*, as at Sunbiggin Tarn in Cumbria (Holdgate 1955b). In the *Festuca* sub-

community, by contrast, it is taller rushes and grasses which, together with *Molinia*, provide the bulk of the cover, *Juncus acutiflorus* forming locally dense patches, *J. conglomeratus* occurring as scattered tussocks. *J. articulatus* is also occasional throughout, though it often grows as a semi-decumbent plant and is rarely abundant.

The other important structural element typical of the community as a whole comprises hemicryptophyte dicotyledons which are capable of moderate to tall growth among the *Molinia*, sedges and rushes, but many of which can also subsist as rosettes in grazed stands. Most frequent among this group are *Succisa pratensis*, *Filipendula ulmaria*, *Valeriana dioica*, *Cirsium palustre*, *Caltha palustris* and, adding a particularly distinct regional look, the Continental Northern *Crepis paludosa* and Northern Montane *Trollius europaeus*. Also common, though preferential to different sub-communities, are *Sanguisorba officinalis* and *Angelica sylvestris*, *Centaurea nigra*, *Leontodon hispidus*, *Geum rivale* and *Lychnis flos-cuculi*. When mixtures of these species are present in some numbers, the vegetation can present a splendid sight by mid-summer, with the inflorescences raised above the herbage and set off against the dull-green and russet background.

Less conspicuous, but also very frequent in the community, is *Equisetum palustre*, and some smaller herbs are quite common too, but beneath the thick herbage of the dominants and tall herbs, these are rather few in number and typically of low cover. The most frequent are *Potentilla erecta*, *Ranunculus acris* and *Anemone nemorosa*, with *Ranunculus auricomus* occasional, and a variety of Cynosurion species more common in grazed stands. The *Molinia*-*Crepis* mire also provides a locus for *Primula farinosa*, another Northern Montane species. Even in its richest expression, however, this vegetation does not have the kinds of varied calcicolous turf included in communities like the *Pinguicula*-*Caricetum*.

In marked contrast to those swards, too, bryophytes

are only exceptionally prominent here. The shade-tolerant *Calliergon cuspidatum* is the most frequent, with *Lophocolea bidentata* s.l., *Thuidium tamariscinum*, *Campyllum stellatum* and *Pseudoscleropodium purum* occasional to common, *Ctenidium molluscum*, *Plagiochila asplenoides*, *Campyllum elodes*, *Climacium dendroides* and *Plagiomnium undulatum* variously represented in the two sub-communities.

Sub-communities

***Sanguisorba officinalis* sub-community:** Mixed fen Holdgate 1955b p.p.; *Carex nigra*-*Sanguisorba officinalis* nodum Proctor 1975 p.p.; *Carex nigra*-*Sanguisorba officinalis* community Wheeler 1980c. Although this kind of *Molinia*-*Crepis* mire is generally less species-rich than the *Festuca* sub-community, it is often much more distinctive to the eye. *Molinia* and *C. nigra* are usually the most abundant plants, one or both of them dominating in what is typically a dense and quite tall cover, though, at some sites, *C. rostrata* or *C. appropinquata* have been recorded in some abundance in this kind of vegetation. At Sunbiggin Tarn, for example (Holdgate 1955b), the prominence of the former, together with frequent *Potentilla palustris* and *Menyanthes trifoliata*, plants which are normally rather scarce in the community, gives the vegetation the appearance of a swampy poor fen; while, at Malham (Proctor 1974), the robust tussocks of the latter are locally dominant in transitions to *Phragmitetalia* fen. *Phragmites australis* itself is very occasionally present, though typically as sparse shoots.

Smaller sedges can also occur, with *C. panicea* and *C. pulicaris* common, *C. flacca* occasional and, in some stands, *C. disticha* and *C. hostiana* have been recorded. *Juncus articulatus* is sometimes found, too, though not at high cover and other rushes are rare. Apart from sparse *Agrostis stolonifera*, grasses are likewise poorly represented and, among the smaller dicotyledons, only *Potentilla erecta*, *Ranunculus acris* and *Anemone nemorosa* occur with any frequency.

Much more prominent are the taller herbs among which, as well as the community species, there is very commonly some *Sanguisorba officinalis* and *Angelica sylvestris* and also, coming close in this vegetation to its northern limit in Britain, the Continental *Serratula tinctoria*. *Galium palustre* and *G. uliginosum* can also occur trailing among the herbage.

Bryophytes show a rather patchy development, but are generally rather more varied and abundant than in the *Festuca* sub-community. *Calliergon cuspidatum*, *Lophocolea bidentata* s.l., *Thuidium tamariscinum* and *Campyllum stellatum* are frequent with, preferential here, *Ctenidium molluscum*, *Plagiochila asplenoides*, *Campyllum elodes* and *Aulacomnium palustre*, usually occurring as small pads or tufts over damp litter and soil.

***Festuca rubra* sub-community:** *Crepido-Juncetum* Jones 1984. The general appearance of this kind of *Molinia*-*Crepis* mire is altogether more grassy. *Molinia* is the usual dominant, forming the bulk of a rough sward, sometimes quite tall and rank, in other cases more shortly-cropped, but along with it there is usually some *Festuca rubra*, *F. ovina*, *Briza media*, *Anthoxanthum odoratum*, *Holcus lanatus* and *Deschampsia cespitosa*, none of them consistently abundant, but each able to attain some measure of local prominence. Sedges are common, too, though these are exclusively the smaller species and generally not so strikingly abundant as in the *Sanguisorba* sub-community. *C. nigra* in particular often plays a subordinate role here, though, along with *C. panicea* it can show moderately high cover. *C. flacca* and *C. pulicaris* also occur quite frequently, generally as scattered tufts. Then, there are quite commonly some rushes: as before, *J. articulatus* can be found here, though strongly preferential are the more conspicuous *J. acutiflorus* and *J. conglomeratus*, the former especially showing local abundance and sometimes being co-dominant with *Molinia*.

Taller dicotyledons remain frequent in this sub-community and though *Sanguisorba*, *Angelica* and *Serratula* are all scarce, *Geum rivale*, *Centaurea nigra* and *Leontodon hispidus* are rather more common than in the *Sanguisorba* type, and, in shorter swards, these and many of the community dicotyledons occur as non-flowering rosettes. In such stands, they are often accompanied by *Prunella vulgaris*, *Plantago lanceolata* and *Trifolium repens*. *Lathyrus pratensis* can be conspicuous in somewhat ranker herbage and there is occasionally some *Rhinanthus minor* and *Lychnis flos-cuculi*.

Bryophytes are often poorly represented in the dense turf here, but *Calliergon cuspidatum*, *Pseudoscleropodium purum* and *Lophocolea bidentata* s.l. remain frequent and are sometimes accompanied by *Plagiomnium undulatum*, *Hylocomium splendens* and *Climacium dendroides*.

Habitat

The *Molinia*-*Crepis* mire is a very local community of moist, moderately base-rich and calcareous peats and peaty mineral soils in the sub-montane northern Pennines. It can be found as an apparently stable component of topogenous sequences around open waters and mires, but it also occurs in soligenous situations on flushed slopes, where it is more often subject to some grazing and able to persist in traditionally-treated pasture. Draining and sward improvement have probably destroyed many smaller stands.

This community represents a northern and altitudinal extreme in Britain of the richer kind of *Molinia*-tall herb vegetation. Beyond the warmer, southern lowlands of England and Wales, the *Cirsio-Molinietum* begins to

lose its floristic integrity, with the disappearance of cold-sensitive species such as *Cirsium dissectum*, *Dactylorhiza majalis* ssp. *praetermissa* and other more exclusively south-western oceanic plants. And, even though many of the frequent associates of that fen-meadow remain common well into Scotland, the edaphic conditions and treatments necessary for their occurrence together in this general kind of vegetation coincide only very locally. Suitably moist, circumneutral to moderately base-rich, organic soils become decidedly scarce in the northern lowlands of Britain and such unimproved fragments as there are rarely support herbaceous vegetation, more often now neglected scrub or woodland. Where congenial situations do occur in the north of the country, most obviously on the drift-smeared surfaces of the Carboniferous Limestone, they are at sufficiently high altitudes for the climate to produce a distinct floristic response of its own.

Stands of the *Molinia-Crepis* mire are few and far between, but they all occur around the fringes of the north Pennine uplands, between about 250 and 450 m, experiencing a climate which is generally cold, wet and cloudy (Manley 1936, 1942). Annual precipitation is, in fact, not much greater than for south-western stations of the *Cirsio-Molinietum*, being around 1600 mm (*Climatological Atlas* 1952), with 160 wet days yr⁻¹ or so (Ratcliffe 1968). But annual accumulated temperatures are sometimes only a half of those in southern Britain, generally less than 800 day-degrees C (Page 1982), with long bitter winters and late springs, brief overcast summers and a stormy end to what is one of the shortest growing seasons in England and Wales (Manley 1940, Pigott 1956a, Smith 1976). Floristically, then, although such general lowland plants as *Molinia*, *Carex panicea* and the Junci can still grow vigorously here, and though the community even provides some northern stations for the Continental *Serratula tinctoria*, it is the frequency of such plants as the Continental Northern *Crepis paludosa* and the Northern Montane *Trollius europaeus* which provides the sharpest phytogeographical distinction from the *Cirsio-Molinietum*. *Sanguisorba officinalis*, too, though not universally common here, and of rather peculiar overall distribution in Britain, is much more characteristic of northern vegetation of this general type than of the southern.

For the rest, however, many of the frequent plants of the *Molinia-Crepis* mire are shared with the *Cirsio-Molinietum* and the prominence among them of Molinietales species is partly a reflection of the edaphic conditions which both communities favour. As in southern Britain, this kind of vegetation is typical of situations intermediate between swamps and wet mires on the one hand and dry grasslands on the other, where soil moisture is such as to favour the accumulation or maintenance of fen peat, or at least a humic top over a

mineral base, but not such as to provide a continually waterlogged edaphic environment. Conditions are thus very favourable for the vigour of plants like *Molinia*, *Succisa*, *Filipendula*, *Equisetum palustre*, *Valeriana dioica*, *Angelica*, *Cirsium palustre*, *Serratula tinctoria* and the Junci as well as the *Molinia-Crepis* preferentials, *Trollius* and *Sanguisorba*, whose general affiliations are also with the Molinietales, and some other distinctive herbs of the community, such as *Anemone nemorosa* and *Ranunculus auricomus*.

In fact, although the *Molinia-Crepis* mire does stop short of soils which are badly aerated for the whole of the year, it does extend a little further into wet situations than the *Cirsio-Molinietum*. The substrate here is always rather firm but is normally kept at least damp to the surface and, in winter, can be decidedly wet above. Such conditions are best seen in the *Sanguisorba* sub-community which is typically a vegetation type of fen peats in topogenous hollows, being found around the margins of open-water transition mires and waterlogged depressions. Here, there can even be some standing water among the *Molinia* and *Carex* in the winter, and fluctuations of the water-table in such situations probably encourage the development of a strongly tussocky structure in these plants, but these movements are not very substantial and the vegetation is probably never deeply flooded. However, it is in this sub-community that the *Molinia-Crepis* mire approaches most closely the kinds of vegetation seen on sloppy peats or as floating rafts over shallow open water, with plants such as *Carex appropinquata*, *C. rostrata*, *Phragmites*, *Potentilla palustris*, *Menyanthes trifoliata* and *Equisetum fluviatile* weakly preferential, together with the fen bedstraws *Galium palustre* and *G. uliginosum*. More open damp surfaces here also offer an opportunity for the development of bryophytes, though this is still very patchy under the dense and tall herbage of the vascular cover.

The *Molinia-Crepis* mire can also be found on quite wet soils where there is flushing over slopes cut into deposits of varying permeability. Typically, however, it occurs on the gently-irrigated fringes of such soligenous areas, where the profiles are some sort of stagnohumic gley, often with a substantial peaty topsoil, but not waterlogged to the surface all the year round. In such situations, the *Festuca* sub-community is the usual form, and this kind of *Molinia-Crepis* mire can extend on to ground that is substantially drier than under the *Sanguisorba* sub-community. Phragmitetalia associates are thus lacking and the vegetation often resembles a rough mesotrophic sward with such plants of damp Molinio-Arrhenatheretea grasslands as *Holcus lanatus*, *Festuca rubra*, *Lathyrus pratensis*, *Deschampsia cespitosa* and *Ranunculus acris* becoming very frequent.

In marginal habitats of this kind, further out of the reach of strong influence by base-rich ground waters,

and particularly where there is some more free-draining component to the soil parent material such as coarse-textured drift, the high rainfall can induce some slight surface leaching in the profiles, such that pH under the *Festuca* sub-community sometimes falls below 6. Indeed, although values approaching pH 7 have been recorded under this vegetation, and, beneath the *Sanguisorba* sub-community, are generally above pH 6.5, extreme base-richness and very high calcium contents of substrates and waters are not the rule here. The floristic contrasts with vegetation types of more calcareous fen peats or stagnohumic gleys are well seen at Sunbiggin Tarn (Holdgate 1955b), Malham Tarn (Proctor 1974) and in the range of flushed sites described from Teesdale by Jones (1984), in all of which there is a shift from Molinietales vegetation of the *Molinia-Crepis* type to Caricion davallianae fens with the increase in base-richness. The communities can have much in common in their background floristics and certain more catholic Molinietales plants are frequent in the Caricion fens, but the general absence of calcicoles, whether vascular plants or bryophytes, within the *Molinia-Crepis* mire is very striking.

One other important edaphic difference is that the soils beneath the *Molinia-Crepis* mire are somewhat more productive than those under Caricion davallianae small-sedge fens, although they are probably not more than moderately rich in major nutrients and any marked increase in trophic state, whether from silt deposition along soligenous tracks or from the application of chemical fertilisers to agricultural swards, results in floristic changes in the vegetation. But potentially quite large amounts of herbage can be produced by the community and, being characteristic of the more accessible parts of mires, it has often been subject to some form of treatment, particularly where it occurs as the *Festuca* sub-community on open slopes. In some places this kind of *Molinia-Crepis* mire developed around flushes within agricultural enclosures is included in a hay-crop harvested under a traditional regime of meadow management, a scarce practice now but one that is still extant in some valleys around the fringes of the north Pennines. Generally, however, and in contrast to the case with the *Cirsio-Molinietum*, at least as it was treated in the past, the *Molinia-Crepis* mire is not now mown (Jones 1984). It is, however, quite often open to some grazing and, being concentrated on drier ground, such treatment accentuates the floristic and structural differences between the two sub-communities. Thus, although potentially tall herbs are still very frequent in the *Festuca* type, some, such as *Sanguisorba*, *Angelica* and *Serratula* are largely extinguished and others, notably *Filipendula*, much reduced in cover. And those which remain constant, or which, like *Geum rivale*, *Leontodon hispidus* and *Centaurea nigra*, show an increase, are plants which can

subsist as non-flowering rosettes even in very short turf. Close nibbling also increases the richness of the sward by favouring smaller grasses and dicotyledons which are unable to compete in the taller herbage.

Two other ancillary effects of grazing influence this vegetation. First, trampling, like the close-cropping of the herbage, can help to keep the sward among the tussocks more open and varied, although on heavier wet soils, as around flushes, there is always the risk of poaching and an increase in drainage-impedance, features which favour the kind of patchy spread of rushes seen in the *Festuca* sub-community, and which may precipitate a run-down to Juncion acutiflori vegetation, particularly if cattle are turned out in wet spring weather (see below). Second, there is the effect of dunging, again especially marked where cattle, rather than sheep, are grazed. The enrichment this produces may play some part in the more mesophytic character of the vegetation of the *Festuca* sub-community and might also encourage floristic changes were nutrients to accumulate over many years.

Where the *Molinia-Crepis* mire occurs around open-water transitions, it is less often accessible to grazing and the taller, more luxuriant herbage of the *Sanguisorba* sub-community probably experiences no more than light cropping. The development of a very rank and hummocky cover in such situations probably hinders the invasion of woody plants (Proctor 1974), such that the community acquires a certain stability. On drier ground, however, sudden withdrawal of grazing would probably allow rapid colonisation by woody plants of the shorter, more open sward, such that the vegetation can here be considered a plagioclimax.

Zonation and succession

The *Molinia-Crepis* mire can be found in zonations and mosaics with other kinds of fen vegetation, with grasslands and woodland, disposed according to variations in the height of the water-table, in the base-richness, calcium content and nutrient status of the waters and soils, and in the pattern of treatment. Around open waters, it may be a natural part of primary hydrarch successions with some stability but, on drier ground, grazing probably plays some part in its maintenance. Pastoral mismanagement or land improvement can both destroy this vegetation, and have probably contributed to its present very local distribution.

The simplest kind of sequence in which the community can be seen relates to differences in the water-regime of underlying soils. At both Sunbiggin (Holdgate 1955b) and Malham (Proctor 1974), for example, the *Molinia-Crepis* mire can be seen in complex mosaics, but part of the floristic variation is controlled by the degree of waterlogging in the peats. On wetter ground in these sites, the *Sanguisorba* sub-community, already with a

modest representation of Phragmitetalia plants, grades to tall-herb fen, typically in these northern basins, of the *Potentillo-Caricetum rostratae*. There, dominance switches to large sedges, notably *C. rostrata* but sometimes also *C. appropinquata* or a tussocky form of *C. nigra*, occasionally with some rushes or an overtopping canopy of *Phragmites*. *Molinia* extends hardly at all into this vegetation and the most common associates are plants like *Potentilla palustris*, *Menyanthes trifoliata* and *Equisetum fluviatile*, but some continuity is maintained through such associates as *Angelica sylvestris*, *Cirsium palustre*, *Caltha palustris* and *Galium palustre*.

In such situations as these, however, where the mire waters are draining from catchments in which calcareous rocks predominate, here Carboniferous Limestone, wetter soils are also often more base-rich and more oligotrophic so that Caricion davallianae vegetation is a characteristic element of the sequences, sometimes replacing the Phragmitetalia fen, or occurring alongside it, where there are fine-scale variations in the quality of the incoming waters. Typically, in sites like Sunbiggin and Malham, and particularly on rather sloppy peats, the community is the *Carex-Calliergon* mire, many of whose plants are shared with the *Potentillo-Caricetum*, but which has a less prominent mesophytic element and a stronger contingent of calcicoles. Continuity with the *Molinia-Crepis* mire can thus be quite substantial, through plants tolerant of the middle range of pH and nutrient status, such as *Molinia* itself, *Carex panicea*, *C. nigra*, *Succisa*, *Angelica*, *Cirsium palustre*, *Valeriana dioica*, *Caltha*, *Equisetum palustre* and *Filipendula*. But with the move on to more base-rich and wetter soils, dominance passes to such sedges as *Carex diandra* with *C. lepidocarpa*, *C. demissa* and *C. dioica* appearing among the associates, and the patchy bryophyte cover of the *Molinia-Crepis* mire is replaced by lush carpets of larger *Calliergon* spp., with *Campyllum stellatum*, *Scorpidium scorpioides*, *Drepanocladus revolvens* and *Bryum pseudotriquetrum*.

On firmer, but still very wet and base-rich, peat and peaty mineral soils, the *Molinia-Crepis* mire grades to a different kind of Caricion davallianae fen. In mires like those at Sunbiggin and Malham, such situations are usually found around the margins, where there is flushing from the surrounding slopes through a stagnohumic gley and down on to the fen peat itself and then the *Sanguisorba* sub-community may extend up from the mire surface to form the flush surrounds. Over more open slopes, such a marginal position around this kind of Caricion davallianae flush is very much the characteristic location of the *Festuca* sub-community. Almost always, the Caricion community is the *Pinguiculo-Caricetum dioicae*, a small-sedge fen which, like flush stands of the *Molinia-Crepis* mire, is often kept short by grazing. Structural and floristic similarities between

these vegetation types are thus often very considerable: tall herbs are rarely a feature of the *Pinguiculo-Caricetum*, but such plants as *Molinia*, *C. panicea*, *C. nigra*, *Succisa*, *Potentilla erecta*, *Equisetum palustre*, *Prunella vulgaris*, together with *Juncus articulatus* and the grasses *Briza media*, *Festuca ovina* and *Anthoxanthum*, occur commonly in both communities. The calcicole contingent in the *Pinguiculo-Caricetum* is, however, generally more striking than in the *Carex-Calliergon* mire, so close inspection will usually reveal that transitions from the *Molinia-Crepis* mire are marked by a general switch to dominance by mixtures of *C. panicea* with *C. dioica*, *C. lepidocarpa*, *C. hostiana*, *C. flacca* and *C. pulicaris*, a variety of smaller herbs such as *Pinguicula vulgaris*, *Selaginella selaginoides*, *Linum catharticum*, *Parnassia palustris*, and extensive patches of bryophytes like *Bryum pseudotriquetrum*, *Drepanocladus revolvens*, *Campyllum stellatum*, *Aneura pinguis* and *Ctenidium molluscum*.

In the opposite direction in such sequences as these, increasing dryness of the ground is often marked by a shift from the *Molinia-Crepis* mire to some kind of Nardo-Galion sward over gently-flushed brown soils developed from the drift cover that typically plasters the surrounding slopes. Through the north Pennines, such vegetation is usually the *Festuca-Agrostis-Thymus* grassland, into which grasses like *Festuca rubra*, *F. ovina*, *Anthoxanthum* and *Briza*, together with *Carex panicea*, *Potentilla erecta*, *Ranunculus acris* and *Prunella vulgaris*, run on with high frequency. Where the drift-cover is thinner and the sward more strongly influenced by the free-draining calcareous bedrock, this is replaced by the *Sesleria-Galium* grassland, with a more marked calcicolous element.

Quite often, transitions of these kinds are further complicated by greater natural variations in the trophic state of the soils. This is clearly seen around the margins of fen complexes like those at Malham where incoming streams winding through the *Molinia-Crepis* mire slacken their flow and drop quantities of rich silt, but it sometimes occurs, too, at the foot of slopes where flushing waters debouch on to the flatter ground below. Then, along the levees or deltas of the deeper mineral material, the community can grade to the *Filipendula-Angelica* mire in which mixtures of tall mesophytic dicotyledons predominate.

Such complexities as these and the way in which even simple transitions can be fragmented into mosaics with variations in water-table and base-status over mire surfaces, can obscure the fact that the *Molinia-Crepis* community may play a part in primary successions around open waters. At Malham, for example, stratigraphy reveals that this kind of vegetation can succeed more calcicolous fen with progressive terrestrialisation (Proctor 1974). Subsequent stages in succession have

not been followed, though where the herbage does not become too rank, it is likely that woody plants, notably *Salix* spp. and *Betula pubescens*, could develop fairly quickly into a scrubby canopy. Towards the limit of the spread of the *Molinia-Crepis* mire on to wetter substrates, such a cover would probably be of the *Salix-Carex rostrata* type, the usual woodland of wetter basin peats in northern Britain, where mesotrophic and moderately base-rich conditions prevail. Over drier ground, which might develop eventually within tracts of the above woodland from ombrotrophic nuclei, the *Betula-Molinia* woodland might succeed this. This vegetation type and, over somewhat more base-rich ground, the *Alnus-Fraxinus-Lysimachia* woodland, can also be found over slope flushes around the Pennine fringes, where otherwise the *Molinia-Crepis* mire might be expected, and these too may represent natural successors to it, showing considerable floristic similarities.

In drier situations, grazing undoubtedly plays some part in arresting these seral progressions and some stands may represent the more or less direct result of past woodland clearance and pasturing. In this respect, the presence of plants like *Anemone nemorosa* and *Ranunculus auricomus* in the community is interesting, and the general similarity to the *Anthoxanthum-Geranium* grassland, essentially a mown derivative of the flush woodlands mentioned above, noteworthy. Under moderate and judicious grazing, the *Molinia-Crepis* mire is probably stable but careless sward management or improvement can produce marked changes. With heavy grazing over impeded soils, there is a strong tendency for rushes to become abundant and dunging may help effect a shift towards the *Juncus-Galium* rush-pasture, the widespread *Juncion acutiflori* vegetation of mesotrophic gleyed soils in north-west Britain. In drier situations, and particularly where there has been some enrichment with manure or chemical fertilisers, the sward may begin to approach a mesotrophic *Nardo-Galion* grassland or a *Cynosurion* community and top-sowing or ploughing and re-seeding can fully effect such a transformation over less intractable ground. In some

places, rougher terrain has given the *Molinia-Crepis* mire enough protection to ensure its isolated survival but destruction with agricultural improvement has probably been widespread.

Distribution

The community is very local in the north Pennines and Lake District, the *Sanguisorba* sub-community surviving most extensively at Sunbiggin and Malham Tarns, the *Festuca* sub-community occurring in a more scattered distribution through the dales along the upland fringes. Similar vegetation has been reported from some other localities, such as certain of the Whitlaw Mosses in the Southern Uplands (Wheeler 1975), and assiduous searching should produce more stations.

Affinities

Although the *Molinia-Crepis* mire has obvious floristic links with various vegetation types, such as *Phragmites*-talia tall-herb fens, *Caricion davallianae* communities, *Nardo-Galion* grasslands and traditional hay-meadows, its general affinities are clearly with the *Molinieta*-lia. This is still true even when the unpublished data of Jones (1984), which forms the basis of the grassier *Festuca* sub-community, are included with that previously described by Holdgate (1955*b*) and first given systematic phytosociological treatment by Proctor (1974), and which here constitutes the more distinctive *Sanguisorba* sub-community. Compared with other British vegetation of this same general kind, however, the particular relationships of the community are less clear. It is obviously rather different from the *Cirsio-Molinietum* and its sub-montane character makes it difficult to incorporate the community in the *Junco-Molinion*, essentially an alliance of more oceanic fen-meadows and rush-pastures. If anything, it is more like some of the central European vegetation placed in the *Calthion* or the *Molinion* (e.g. Oberdorfer 1957, 1983) and some of the calcareous pastures described from southern Sweden by Regnéll (1980).

Floristic table M26

	a	b	26
<i>Molinia caerulea</i>	V (4–8)	V (1–8)	V (1–8)
<i>Crepis paludosa</i>	V (1–3)	V (1–5)	V (1–5)
<i>Carex nigra</i>	V (2–8)	V (1–6)	V (1–8)
<i>Carex panicea</i>	V (2–6)	V (1–5)	V (1–6)
<i>Valeriana dioica</i>	V (2–5)	V (1–5)	V (1–5)
<i>Succisa pratensis</i>	V (3–4)	IV (1–5)	IV (1–5)
<i>Equisetum palustre</i>	V (1–4)	IV (1–5)	IV (1–5)

<i>Potentilla erecta</i>	IV (1–3)	IV (1–3)	IV (1–3)
<i>Filipendula ulmaria</i>	IV (2–4)	IV (1–3)	IV (1–4)
<i>Calliergon cuspidatum</i>	IV (1–3)	IV (1–5)	IV (1–5)
<i>Ranunculus acris</i>	III (1–2)	V (1–4)	IV (1–4)
<i>Sanguisorba officinalis</i>	V (3–6)	II (1–3)	III (1–6)
<i>Angelica sylvestris</i>	V (1–4)	II (1–4)	III (1–4)
<i>Serratula tinctoria</i>	III (2–4)	I (1–2)	II (1–4)
<i>Galium palustre</i>	III (1–3)		II (1–3)
<i>Ctenidium molluscum</i>	III (1–3)		II (1–3)
<i>Plagiochila asplenoides</i>	III (2–4)		II (2–4)
<i>Campylum elodes</i>	III (1–3)		II (1–3)
<i>Aulacomnium palustre</i>	III (1–3)		I (1–3)
<i>Carex disticha</i>	II (1)		I (1)
<i>Agrostis stolonifera</i>	II (2–3)		I (2–3)
<i>Equisetum fluviatile</i>	II (1–2)		I (1–2)
<i>Galium uliginosum</i>	II (1–2)		I (1–2)
<i>Menyanthes trifoliata</i>	II (2–4)		I (2–4)
<i>Phragmites australis</i>	II (1–2)		I (1–2)
<i>Carex hostiana</i>	I (5)		I (5)
<i>Carex appropinquata</i>	I (8)		I (8)
<i>Potentilla palustris</i>	I (1)		I (1)
<i>Festuca rubra</i>	I (2)	V (1–5)	III (1–5)
<i>Briza media</i>		V (1–4)	III (1–4)
<i>Holcus lanatus</i>		V (1–4)	III (1–4)
<i>Lathyrus pratensis</i>		IV (1–4)	III (1–4)
<i>Deschampsia cespitosa</i>		IV (1–2)	III (1–2)
<i>Geum rivale</i>	I (2)	IV (1–4)	III (1–4)
<i>Anthoxanthum odoratum</i>	I (2)	IV (1–3)	III (1–3)
<i>Juncus acutiflorus</i>		IV (1–5)	III (1–5)
<i>Festuca ovina</i>	I (1)	III (1–4)	II (1–4)
<i>Climacium dendroides</i>	I (4)	III (1–4)	II (1–4)
<i>Juncus conglomeratus</i>	I (1)	III (1–2)	II (1–2)
<i>Carex echinata</i>	I (1)	III (1)	II (1)
<i>Prunella vulgaris</i>		III (1–4)	II (1–4)
<i>Plagiomnium undulatum</i>		III (1–3)	II (1–3)
<i>Leontodon hispidus</i>		II (1–3)	I (1–3)
<i>Plantago lanceolata</i>		II (1–2)	I (1–2)
<i>Rhinanthus minor</i>		II (1–2)	I (1–2)
<i>Trifolium repens</i>		II (1–2)	I (1–2)
<i>Lychnis flos-cuculi</i>		II (1)	I (1)
<i>Hylocomium splendens</i>	I (1)	II (1–4)	I (1–4)
<i>Cirsium palustre</i>	III (1)	III (1–2)	III (1–2)
<i>Carex pulicaris</i>	III (2–3)	III (1–2)	III (1–3)
<i>Caltha palustris</i>	III (1–2)	III (1–3)	III (1–3)
<i>Trollius europaeus</i>	III (2–3)	III (1–2)	III (1–3)
<i>Lophocolea bidentata</i> s.l.	III (1–3)	III (1–4)	III (1–4)
<i>Anemone nemorosa</i>	III (2–3)	III (1–2)	III (1–3)
<i>Thuidium tamariscinum</i>	III (1–6)	II (1–4)	III (1–6)
<i>Juncus articulatus</i>	III (1–2)	III (1–4)	III (1–4)

Floristic table M26 (cont.)

	a	b	26
<i>Campylium stellatum</i>	III (3–5)	II (1–6)	III (1–6)
<i>Carex flacca</i>	II (1–2)	III (1–5)	III (1–5)
<i>Rhytidiadelphus squarrosus</i>	II (1–2)	III (1–4)	III (1–4)
<i>Pseudoscleropodium purum</i>	II (2–4)	III (1–2)	III (1–4)
<i>Centaurea nigra</i>	II (1–2)	III (1–5)	III (1–5)
<i>Ranunculus auricomus</i>	II (1–2)	II (1–2)	II (1–2)
<i>Rumex acetosa</i>	II (1)	II (1)	II (1)
<i>Primula farinosa</i>	I (1)	I (1–5)	I (1–5)
Number of samples	7	13	20
Number of species/sample	26 (20–32)	34 (17–52)	31 (17–52)
Herb cover (%)	90 (80–100)		
Bryophyte cover (%)	13 (10–30)		
Altitude (m)	370	344 (260–450)	353 (260–450)
Soil pH	6.5	6.1 (5.6–6.8)	

a *Sanguisorba officinalis* sub-community

b *Festuca rubra* sub-community

26 *Molinia caerulea*-*Crepis paludosa* fen (total)