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Molinia caerulea-Cirsium dissectum fen-meadow *Cirsio-Molinietum caeruleae* Sissingh & De Vries 1942 *emend.*

Synonymy

Litter Godwin & Tansley 1929; *Molinietum* Godwin 1941, Willis & Jefferies 1959, Ivimey-Cook *et al.* 1975 *p.p.*; *Molinia*-edge Haslam 1965; *Cirsio-Molinietum peucedanetosum* (Sissingh & De Vries 1942) Wheeler 1978; *Cirsio-Molinietum* (Sissingh & De Vries 1942) Wheeler 1980*c* *p.p.*; Grassy Heath NCC Devon Heathland Report 1980.

Constant species

Carex panicea, *Cirsium dissectum*, *Lotus uliginosus*, *Molinia caerulea*, *Potentilla erecta*.

Rare species

Hypericum undulatum, *Peucedanum palustre*, *Selinum carvifolia*.

Physiognomy

The *Cirsio-Molinietum caeruleae* includes the bulk of the *Molinia caerulea* vegetation in the lowland south-east of Britain. *Molinia* is almost always the dominant plant in the community and it can be very abundant, forming the basis of a rough sward or occurring as a more strongly-tussocky cover, a kind of structure well shown in the classic early account of this vegetation from Wicken Fen in Cambridgeshire (Godwin & Tansley 1929). And there are stands in which the abundance of *Molinia* is so overwhelming that its dense herbage and thick litter reduce the associated flora to scattered individuals of a very few species. Often, however, the number of companions is considerable: although many of the associates are plants of fairly wide distribution among damper meadows and pastures, the most frequent of them comprise a quite distinctive assemblage, and some of the preferentials attain such local prominence as to mask the major contribution which *Molinia* and the other constants make to the community. Much of this character reflects the origin of this kind of vegetation from rather diverse precursors by the application of particular treatments.

In structural terms, the most important associates of *Molinia* are other monocotyledons of medium stature, particularly rushes, which can make quite a substantial contribution to the dense layer of herbage characteristic of the community. Typically, this is 20–60 cm tall, though its physiognomy is strongly dependent on the style and incidence of treatment: in grazed stands, for example, the cover can be shorter than this, with stretches of close-cropped sward running among clumps of more resistant plants; where there is no grazing, and where the vegetation has not been mown for some time, the herbage can be taller and ranker. The trophic state of the substrate also influences the structure of the vegetation, with shorter and more open swards developing over more calcareous and impoverished soils.

The particular rushes represented show quite a strong pattern of regional distribution, because the *Cirsio-Molinietum* extends across a considerable part of southern Britain and has developed in a variety of climatic and edaphic contexts. Thus, through most of the central and eastern parts of its range, where the community is usually found in association with fens, *Juncus subnodulosus* is the characteristic rush, a non-tussocky species and often represented just as a rather sparse cover of shoots, but able to form patches which are locally dense. *J. articulatus* and, less commonly, *J. inflexus* can also be found in these regions, though generally as minor components and often in swards that are shorter than usual and richer in small herbs. To the south and west, by contrast, where the *Cirsio-Molinietum* often develops among heath vegetation, *J. acutiflorus* and *J. conglomeratus*, which are rather local elsewhere in the community, become frequent, the former another far-creeping rush, though sometimes forming extensive clumps, the latter occurring as scattered, spreading tussocks. *J. effusus* can be found occasionally, too, and, in its var. *compactus*, can be confused with *J. conglomeratus*: typically, the stems of the latter are more obviously striate and tend to be markedly splayed out by the inflorescence. Among the rushes, *J. conglomeratus* is quite a good marker of

this kind of vegetation but the prominence of all the other species here can make diagnosis of the *Cirsio-Molinietum* difficult, with separation from other Molinietalia communities, like the *Juncus-Cirsium* fen-meadow and the *Juncus-Galium* rush-pasture, being especially problematical. In their typical manifestations, strongly dominated by their respective rush species, these are readily distinguishable from the *Cirsio-Molinietum*, but *Molinia* can occur in both of them and, in transitional stands, separation may be a matter of the relative dominance of the various monocotyledons.

Similar difficulties can arise because of the local prominence of *Schoenus nigricans* in the *Cirsio-Molinietum*. This is only an occasional in the community and generally subordinate to *Molinia* when it does occur, but it can attain moderate abundance and it tends to strike the eye where its growth has become markedly tussocky. Then, the vegetation can take on some of the character of the *Schoenetum*, a community whose distribution overlaps that of the *Cirsio-Molinietum*, and which is often found at the same sites (e.g. Bellamy & Rose 1961, Haslam 1965). A more uncommon physiognomic element, but one that can be quite conspicuous, consists of *Phragmites australis* and/or *Cladium mariscus*, even sparse plants of which can protrude above the level of the *Molinia* and rushes, and which can sometimes be found in such local abundance as to give the impression of tall-herb fen vegetation. Indeed, as the renowned experiments of Godwin (1941) showed, every gradation between Phragmitetalia fen and the *Cirsio-Molinietum* can be produced by different frequencies of mowing: as defined here, the community takes in the *Molinia*-dominated half of Godwin's transitions between what is called 'mixed sedge' and 'litter' in which there was a declining, though sometimes substantial, remnant of reed or sedge.

What helps distinguish the community is the prominence among the associated flora of dicotyledons able to maintain themselves with varying degrees of success, under the frequent summer-mowing or grazing which characterise this vegetation. Some of these plants, such as *Cirsium palustre* and *Angelica sylvestris*, both of which are very frequent throughout the community, can persist in this vegetation as non-flowering rosettes, even in quite close-cropped herbage, but they are able to grow very tall and are well supplied with stem leaves, so they find wide representation, too, far into the Phragmitetalia fens. *Filipendula ulmaria* is of similar growth form and wide occurrence among other kinds of fen vegetation and it likewise can be common here, but it is patchier than *C. palustre* or *Angelica*, being very sensitive to grazing and also of restricted occurrence on the more impoverished substrates on which the *Cirsio-Molinietum* is represented. *Centaurea nigra*, another hemicryptophyte, is likewise confined to more mesotrophic situations, though its frequency here is in sharp contrast to tall-herb fens.

Much more strictly limited to the kind of short to moderately tall herbage typical of this community are *Valeriana dioica*, *Succisa pratensis* and *Cirsium dissectum*, three hemicryptophytes the bulk of whose foliage is in basal rosettes. *Succisa*, of course, is of wide occurrence in many vegetation types and *V. dioica*, too, can be found as an important component in other small-sedge fens and fen-meadows, and very occasionally this trio can occur in communities other than this. But *C. dissectum* is strongly preferential here and, although, towards the limits of its British range, stands similar to the *Cirsio-Molinietum* occur without the thistle (B.D. Wheeler, pers. comm.), the distribution of this species and of the community are largely coincidental. In phytogeographic terms, it is an Oceanic West European plant (Matthews 1955) and the community can provide an occasional locus for some other species with this kind of European range, *Scutellaria minor*, *Dactylorhiza maculata* ssp. *praetermissa* and the nationally rare *Hypericum undulatum*.

In stands which have not been heavily grazed in spring or which are not mown early, it is the frequent hemicryptophytes of the community which often provide its most attractive element, putting up their flowering shoots among and above the *Molinia* and rushes. For much of the time, however, they tend to be a rather inconspicuous component of the herbage, growing among a variety of other herbs of small to moderate stature which bulk up the lower tier of the vegetation. In contrast to much tall-herb fen vegetation and the wetter kinds of *Schoenetum*, coarser grasses are often prominent here, with *Holcus lanatus* and *Anthoxanthum odoratum* the most frequent, *Festuca rubra*, *Deschampsia cespitosa* and *Agrostis stolonifera* less common, though sometimes abundant. Then, in transitions to wet heath, there can be some *A. canina* ssp. *canina* or, in grassy base-rich swards, *Briza media*. Where this latter kind of vegetation grades to calcicolous grassland, a quite common feature around some valley and basin mires, *Brachypodium pinnatum* and *Festuca ovina* can transgress some way into the community.

Then, there can be some sedges, though the bulkier species represented in tall-herb fens and/or in the *Juncus-Cirsium* fen-meadow, such as *Carex acutiformis*, *C. disticha*, *C. elata* and *C. paniculata*, are very rare here. Rather, it is smaller species such as *C. panicea* and, somewhat less frequently, *C. hostiana* and *C. pulicaris*, that are most common. Generally, they are of low cover, growing intermixed with the other plants: in contrast with many stands of the *Schoenetum*, they do not typically form the basis of the turf running among the dominants, and the distinctive sedge-lined runnels of that community, in which *C. lepidocarpa* and *C. flacca*

are also very common, together with a variety of other calcicoles, are not found here.

Patches within stands of the *Cirsio-Molinietum* can show a structural similarity to such more open and richer swards but, by and large, the character of much of the remaining flora is mesophytic and its texture rather coarse. Thus, although Caricion davallianae plants such as *Epipactis palustris* and *Dactylorhiza incarnata*, which have their best representation in lowland Britain within the *Schoenetum*, are occasionally to be found, they are less frequent overall than species such as *Lotus uliginosus*, *Mentha aquatica*, *Prunella vulgaris*, *Ranunculus acris*, *Hydrocotyle vulgaris* and the scramblers *Vicia cracca* and *Lathyrus pratensis*, plants which are of wide occurrence through damper Molinio-Arrhenatheretea vegetation in Britain.

Other stands have a distinctly heathy aspect. Indeed, *Potentilla erecta* is a constant of the community and, in contrast to the *Schoenetum*, where it is also very frequent but typically epiphytic, it occurs here throughout the sward, sometimes growing on the *Molinia* tussocks, but often rooted in the ground between. And, towards the south and west of Britain, where such sub-shrubs as *Erica tetralix*, *Calluna vulgaris* and *Ulex gallii* also become quite common in the *Cirsio-Molinietum*, the vegetation can approach the *Ericetum tetralicis* in its floristics and structure. Typically, however, grazing and sometimes, in this kind of landscape, burning, keep the cover of these plants in check. The same is true of those shrubs and trees which occasionally get a hold in the community: small saplings of *Salix cinerea* and *Alnus glutinosa* are sometimes to be found but, in normal circumstances, they do not become abundant.

The bryophyte flora of the *Cirsio-Molinietum* is generally poor and of low cover, the dense herbage and thick litter inhibiting its development. The shade-tolerant *Calliergon cuspidatum* is the commonest species throughout, with *Brachythecium rutabulum* also quite frequent and *Campylium stellatum*, *Hypnum cupressiforme*, *Pseudoscleropodium purum*, *Eurhynchium praelongum* and *Thuidium tamariscinum* occasional in various of the sub-communities. In stands which come close to wet heath, *Aulacomnium palustre* and small patches of Sphagna can be found occasionally.

Sub-communities

***Eupatorium cannabinum* sub-community:** *Cladio-Molinietum/Molinietum* transitions Godwin 1941; *Cirsio-Molinietum peucedanetosum* (Sissingh & De Vries 1942) Wheeler 1978; *Cirsio-Molinietum eupatoretosum* (Sissingh & De Vries 1942) Wheeler 1980*c*. This kind of *Cirsio-Molinietum*, renowned from the mowing experiments performed at Wicken Fen (Godwin 1941), has much in common with the typical form but it shows some distinct floristic and structural differences which, in extreme stands, bring it very close to Phragmitetalia fen. *Molinia* remains generally dominant overall and it is often accompanied by some *J. subnodulosus* and, in certain localities, by small amounts of *Schoenus*. But, often more conspicuous than these at first sight, are *Phragmites*, which, even when sparse, can have overtopping shoots, and *Cladium*, usually more stunted, but sometimes still abundant in bulky clumps. Then, among the associates, it is often species capable of taller growth that predominate. Providing obvious continuity with tall-herb fen are *Eupatorium cannabinum*, the best single preferential for this kind of *Cirsio-Molinietum*, and less commonly *Lythrum salicaria*, sometimes also *Lysimachia vulgaris* and, at certain sites, the nationally rare *Peucedanum palustre* or even more local *Selinum carvifolia* (Walters 1965, Wheeler 1975).

Cirsium palustre, *Angelica* and *Filipendula* are also common throughout but, as the reed or sedge cover becomes progressively thinner, typical *Cirsio-Molinietum* plants such as *Succisa*, *C. dissectum*, *Centaurea nigra* and *Equisetum palustre* increase in frequency, then smaller species like *Valeriana dioica*, *Carex panicea*, *C. hostiana* and *Potentilla erecta*. The more open conditions also allow *Mentha aquatica* and *Hydrocotyle vulgaris* to spread and *Agrostis stolonifera* becomes frequent, though other grasses are rather scarce. *Lotus uliginosus* and *Vicia cracca* are much more common than in most tall-herb fen and *Galium uliginosum* seems to be more frequent than *G. palustre*. Some stands have *Dactylorhiza incarnata* or *Gymnadenia conopsea*.

Bryophytes can be somewhat more conspicuous here than elsewhere in the community but the species are still few, with only *Campylium stellatum* joining *Calliergon* and *Brachythecium* as a distinctive preferential.

Typical sub-community: Litter Godwin & Tansley 1929; *Molinietum* Godwin 1941, Willis & Jefferies 1959; *Cirsio-Molinietum typicum* (Sissingh & De Vries 1942) Wheeler 1980*c*. In this, the typical form of the *Cirsio-Molinietum* in all but the south-west of Britain, *Molinia* is generally strongly dominant, although it is often accompanied by smaller amounts of *J. subnodulosus* or *J. articulatus* (rarely both, it seems), less commonly by some *J. conglomeratus*, *J. inflexus*, *J. acutiflorus* or *J. effusus*. *Schoenus* can be found in some stands and, though it is not usually abundant, when occurring along with *J. subnodulosus*, a quite common event here, it can bring the vegetation close in structure to the *Schoenetum*. *Cladium* is very rare but sparse *Phragmites* sometimes overtops the *Molinia* and rush layer.

Other, smaller grasses are generally well represented with *Holcus lanatus* and *Anthoxanthum* frequent, the former sometimes locally abundant, *Festuca rubra*, *Deschampsia cespitosa* and *Agrostis stolonifera* occasional.

Briza media is also strongly preferential to this sub-community and, in transitions to calcicolous swards, *Brachypodium pinnatum* and *Festuca ovina* can sometimes be found. Sedges are also common, particularly in shorter swards of this general type. *C. panicea* and *C. hostiana* both show a peak of occurrence in this kind of *Cirsio-Molinietum*, but *C. pulicaris* is especially frequent and *C. nigra* is preferential too, sometimes occurring in abundance. When numbers of these species occur with semi-prostrate *J. articulatus*, a quite common coincidence, the sward takes on some of the character of a fine-grained Caricion davallianae fen.

Often, however, the herbage is coarser than this and, in less heavily-grazed stands, decidedly rank. The community hemicryptophytes *Succisa*, *Cirsium dissectum*, *C. palustre* and *Angelica* are all very common, with *Valeriana dioica*, *Centaurea nigra* and *Filipendula ulmaria* also frequent. Then, there is often some *Lotus uliginosus* and *Equisetum palustre* and, scrambling among the sward, *Vicia cracca*, *Lathyrus pratensis* and *Galium uliginosum*. *Rumex acetosa* and *Hypericum tetrapterum* are preferential at low frequencies and occasionally some orchids can be found: *Epipactis palustris* and *Gymnadenia conopsea* are the most widespread of these but *Dactylorhiza fuchsii*, *D. incarnata* and *D. majalis* ssp. *praetermissa* also occur. When these taller plants have an opportunity to flower, they can give this vegetation a very colourful aspect, though, where growth of the bulkier monocotyledons proceeds unchecked, certain of them are easily overwhelmed.

Forming a somewhat lower tier or, in close-grazed or recently-mown stands, bulking up an altogether shorter sward, there are frequent plants of *Potentilla erecta*, *Mentha aquatica*, *Hydrocotyle vulgaris* and *Luzula multiflora*, with occasional *Ranunculus acris*, *Cardamine pratensis*, *Prunella vulgaris*, *Plantago lanceolata*, *Trifolium pratense*, *Linum catharticum*, *Leontodon taraxacoides*, *Cerastium fontanum*, *Potentilla reptans*, *P. anserina* and *Triglochin palustris*.

In contrast with the *Juncus-Erica* sub-community, with which this kind of *Cirsio-Molinietum* shares a general abundance of rushes and grasses, sub-shrubs are typically sparse, though at some localities, transitional vegetation can be found with occasional *E. tetralix* and *Calluna*, and it is such stands which often provide an eastern English locus for plants like *D. maculata* ssp. *maculata* and *Platanthera bifolia* (Wheeler 1975).

Bryophytes are usually poorly represented in the coarse herbage with just *Calliergon cuspidatum*, *Brachythecium rutabulum* and *Pseudoscleropodium purum* often being the only species.

***Juncus acutiflorus-Erica tetralix* sub-community:** *Molinietum* Ivimey-Cook *et al.* 1975 *p.p.*; Grassy Heath NCC Devon Heathland Report 1980. In structural terms, this vegetation, which is the usual kind of *Cirsio-Molinietum* in south-western Britain, does not differ greatly from the Typical sub-community, but it does have some distinctive floristic elements. *Molinia* is again the normal dominant and, even from a distance, it generally determines the overall appearance of the vegetation. Rushes are a common feature of the herbage and a locally abundant one, but this sub-community lies, for the most part, beyond the range of *J. subnodulosus* and it is *J. acutiflorus* and *J. conglomeratus*, less often *J. effusus*, that are represented here. *Schoenus* is rarely found and *Phragmites* and *Cladium* are typically absent, but intermixed with the monocotyledons there is frequently some *Erica tetralix*, less often some *Calluna* and *Ulex gallii*, and where these become a little more abundant in relation to the *Molinia* the vegetation can take on a rather heathy aspect.

Indeed, it is mosaics of heaths which provide the usual context for this sub-community in the south-west, and there can be some difficulty in separating this vegetation from soligenous tracts of the *Ericetum tetralicis* (a problem well seen in the NCC Devon Heathland Report 1980). Generally, though, the continuing abundance of the grasses, sedges and dicotyledons of the community provides a distinction. As in the Typical form, *Holcus lanatus*, *Anthoxanthum*, less often *Festuca rubra* and *Agrostis stolonifera*, occur intermixed with the *Molinia*, and there is frequent *Carex panicea* and occasional *C. pulicaris* and *C. hostiana*. *Lotus uliginosus*, *Mentha aquatica*, *Ranunculus acris*, *Luzula multiflora*, *Cardamine pratensis* and *Hydrocotyle vulgaris* all remain occasional to frequent and, by mid-summer, the flowering shoots of *Succisa*, *Cirsium dissectum*, *C. palustre* and *Angelica* provide splashes of colour. Typically, however, *Valeriana dioica*, *Centaurea nigra* and *Filipendula ulmaria* and the tall-fen herbs of the *Eupatorium* sub-community, are not represented here.

Among the preferential associates, there are occasional records for *Dactylorhiza maculata* ssp. *maculata*, *Serratula tinctoria*, *Ranunculus flammula*, *Achillea ptarmica*, *Pedicularis sylvatica*, *Senecio aquaticus* and the Oceanic West European *Scutellaria minor* and the rare *Hypericum undulatum*. This sub-community also probably provides the commonest locus in south-west Britain for *Platanthera bifolia*. Small amounts of *Galium palustre* can often be found and species such as *Viola palustris*, *Agrostis canina* ssp. *canina* and *Narthecium ossifragum* occurring in wetter patches provide a link with poor-fen and bog vegetation. Some stands also show transitions to soakways with *Hypericum elodes*, *Juncus bulbosus* and *Potamogeton polygonifolius*.

Again, bryophytes are not a very conspicuous element of the vegetation but *Calliergon cuspidatum*, *Brachythecium rutabulum*, *Pseudoscleropodium purum*, *Eurhynthium praelongum*, *Thuidium tamariscinum* and *Hypnum*

cupressiforme have all been recorded with more distinctly occasional *Aulacomnium palustre*, *Sphagnum subnitens* and *S. auriculatum*.

Habitat

The *Cirsio-Molinietum* is a community of moist to fairly dry peats and peaty mineral soils, circumneutral but only moderately mesotrophic, in the warmer lowlands of southern Britain. It can be found in association with both topogenous and soligenous mires, typically marking out the better-drained fringes of fens and bogs proper or the margins of wet hollows and flushes. Climate and soil together both influence the floristics of the community but this is essentially a secondary vegetation type, derived from a variety of precursors and ultimately maintained by mowing or grazing, and these treatments have marked effects on its composition and structure. Increasingly assiduous reclamation of mire fringes has reduced and fragmented the distribution of the community and other stands have become rank and scrubby with neglect.

The *Cirsio-Molinietum* is a vegetation type of the warmer parts of Britain, almost all the known stands falling within the area where annual accumulated temperatures exceed 1200 day-degrees C (*Climatological Atlas* 1952, Page 1982). Such a zone takes in the lowlands of central and southern England, roughly bounded by a Severn–Humber line, and the coastal fringe of Wales, and it coincides closely with the mainland British distribution of *Cirsium dissectum*, the best single preferential of this kind of vegetation, not only in this country, but also in those parts of Ireland (Brock *et al.* 1978, White & Doyle 1982) and of the Continent (e.g. Westhoff & den Held 1969) where similar conditions prevail. Apart from this species, however, there are no other phytogeographic indicators which are so constant in or faithful to the *Cirsio-Molinietum* with us. *Dactylorhiza majalis* ssp. *praetermissa*, another Oceanic West European plant with a similar distribution in Britain, occurs as an occasional but it is only in south-western parts of the country that this kind of fen-meadow acquires a really Atlantic feel. Here, in the *Juncus-Erica* sub-community, the *Cirsio-Molinietum* extends into the more obviously winter-mild zone of southern Britain, running from the New Forest across to north Devon and taking in south Wales, and provides a locus for such oceanic plants as *Scutellaria minor*, *Hypericum undulatum*, *Platanthera bifolia* and also more widespread and common species such as *J. acutiflorus*, *E. tetralix* and *Ulex gallii*.

Overall, however, there are few plants in the community which can be said to be even of a generally lowland and southern character in their British distribution: many of the most frequent are virtually ubiquitous in this country, except at the highest altitudes and, indeed, the *Cirsio-Molinietum* provides some southern localities for species which have a mainly northern distribution, such as *Carex hostiana*, *C. pulicaris* and *Angelica*. In fact, the scarcity of this kind of vegetation beyond the limits of the range of *C. dissectum* is not really due to any reliance by a large number of its species on warmer temperatures. It is mainly an edaphic effect, because soils which are suitable for this particular assemblage become increasingly scarce beyond the range of the thistle. Some stands just outside its distribution remain so generally similar to the *Cirsio-Molinietum* that they can properly be included within it (B.D. Wheeler, pers. comm.). Others are quite close in their composition, but are better placed in the north-western equivalent of this community, the *Molinia-Potentilla* mire, to which the *Juncus-Erica* sub-community can be seen as a transition. Still others share many species with the *Cirsio-Molinietum* but, occurring in distinctly cooler and wetter conditions further north, have particular climatically-related floristic elements of their own: this would be true of the *Molinia-Crepis* mire, for example. The northern and western limits of this fen-meadow are thus neither so precise nor so readily explained as might appear at first sight. And further sampling along its general boundary would be very helpful in fixing the position and character of floristic transitions among these vegetation types: of especial value would be an examination of localities around the Humber, sites which have *C. dissectum* (Perring & Walters 1962), but from where the *Cirsio-Molinietum* has not been recorded.

The kinds of soils which support this particular type of fen-meadow are widespread through the warmer, southern lowlands of Britain, though quite local there, even without the extensive losses of suitable habitats that have occurred with land improvement. Most often, the *Cirsio-Molinietum* is found over organic or strongly humic profiles that are of a generally intermediate character in terms of their moisture regime, base-status and nutrient content. These conditions set some broad but important limits on the composition of the community and generally confine its occurrence to situations that are transitional between mires on the one hand and grasslands and dry heaths on the other, though the particular character of these habitats is actually quite varied.

As far as soil moisture is concerned, the profiles here range from fairly moist to quite dry, and though the community can develop around areas of either topogenous or soligenous influence, there is normally no marked seasonal fluctuation in water-level or throughput. The soils are seldom flooded to the surface, even in the wettest parts of the winter, and they can dry out appreciably above in the summer months. Though protected against drought, even in the drier eastern parts of the country, where the Typical or *Eupatorium* sub-

communities can experience less than 120 wet days yr^{-1} (Ratcliffe 1968), the profiles are thus consistently better-aerated than the permanently waterlogged or winter-flooded peats which support Phragmitetalia swamps and fens or Sphagnetalia bogs, or many of the strongly-gleyed humic soils carrying transitional communities on their surrounds or in flushes. The *Cirsio-Molinietum* can be found in close association with these vegetation types, but the shift on to the better-drained peats or less strongly gleyed mineral soils which typically support it sees a rise to prominence of those Molinietalia species which provide so much of its character, *Succisa*, *Cirsium dissectum*, *C. palustre*, *Angelica*, *Lotus uliginosus*, *Valeriana dioica*, *Equisetum palustre*, *Filipendula ulmaria*, the various Junci and, of course, *Molinia* itself, and of other plants which it shares with a wide range of moister mesotrophic swards, such as *Holcus lanatus*, *Anthoxanthum odoratum*, *Centaurea nigra* and *Vicia cracca*. This kind of assemblage, distinguishing the Typical sub-community, is the most widely distributed form of *Cirsio-Molinietum* around the fringes of more calcareous mire systems through the central and eastern lowlands of England, more especially on the fringes of topogenous hollows, like those seen in the East Anglian superficials, and of flood-plain mires, whether small alluvial terraces along Chalkland rivers (e.g. Haslam 1965), or the very extensive fens of Broadland (Wheeler 1975, 1978, 1980*c*) and the Fenland remnants (Godwin & Tansley 1929, Godwin 1929, 1941).

A number of the important Molinietalia species of the community provide a strong continuity with the tall-herb vegetation of topogenous fens and, in the *Eupatorium* sub-community, with its remnants of reed or sedge canopy, the floristic overlap with the Phragmitetalia is very evident. As Godwin (1929, 1941) showed, such vegetation is sometimes the ultimate forebear of the *Cirsio-Molinietum*, though there is an edaphic limit on how far treatments can convert such precursors into this community. Experimental evidence is lacking but Phragmitetalia fen on wetter ground is probably transformed by regular summer-mowing or grazing into the *Juncus-Cirsium* fen-meadow, rather than the *Cirsio-Molinietum*. These two vegetation types sometimes occur together in zonations around mire fringes and topogenous hollows in eastern England and they have a great deal in common, similar treatments encouraging the prominence of mowing- or grazing-tolerant Molinietalia species throughout. But one major difference between the communities, the switch from dominance by rushes and large sedges in the former to dominance by *Molinia* in the latter, is perhaps a further indicator of the move to soils which are better aerated and more resistant to poaching by stock.

Over suites of somewhat more base-poor soils, on to which the *Cirsio-Molinietum* extends locally in the Typical sub-community and more consistently in the *Juncus-Erica* sub-community (see below), its bounds in relation to soil moisture are a little more tightly drawn and perhaps not quite so susceptible to manipulation by treatments. Some important plants of the community, such as *Succisa*, *Potentilla erecta*, *Carex panicea*, *J. acutiflorus* and even *C. dissectum*, can also be found in Ericetalia wet heath, alongside which this *Juncus-Erica* sub-community often occurs in south-west Britain, and *Molinia*, of course, is a common co-dominant there. Some Ericetalia species, too, such as *E. tetralix*, *Narthecium*, *Aulacomnium palustre* and certain *Sphagna*, transgress a little way in the opposite direction, helping to characterise this kind of *Cirsio-Molinietum*. But the area of floristic overlap is relatively small and, within heath and valley bog landscapes, the community is rather strictly confined to those situations which combine accumulation of at least a shallow layer of organic material with enhanced drainage and aeration. Typically, then, it marks out the gently-sloping surrounds to strongly-gleyed and waterlogged hollows over deposits like the Carboniferous shales of Gower and north-west Devon (NCC Devon Heathland Report 1980), the Triassic deposits of the Devonshire Pebble-Bed Commons (e.g. Ivimey-Cook *et al.* 1975) and the Eocene and Oligocene sands and gravels of the New Forest.

In this wetter south-western part of the range of the *Cirsio-Molinietum*, where there is generally in excess of 1000 mm of rain annually and over 140 wet days yr^{-1} (*Climatological Atlas* 1952, Ratcliffe 1968), suitably moist and humic soils can extend the cover of the community a little way on to steeper slopes underlain by more pervious bedrocks, and *Molinia*, in particular, can provide a strong floristic continuity between the fen-meadow and the heaths and grasslands which eventually replace it on drier ground. But any strong tendency to sharpness of drainage is inimical to many of the other most characteristic species of the community. In the drier east, the upper limit of the *Cirsio-Molinietum* tends to be even more sharply defined, because the occurrence of suitable soils is so much more dependent on local drainage conditions.

The regional contrasts in the interaction of climate and soils across the range of the *Cirsio-Molinietum*, which help to define the south-western *Juncus-Erica* type against the other central and eastern sub-communities, are reinforced by variation in the base-status of the soil parent materials and ground waters and in the tendency of the profiles to show surface-leaching. By and large, this is a community of circumneutral soils, with superficial pH generally within the range 5–6.5, very much the optimum for many of our Molinietalia herbs, but also including the lower and upper limits for many more obviously calcicole or calcifuge plants, such that mixtures of species like *Briza media*, *Carex*

hostiana, *C. pulicaris*, *C. panicea*, *Potentilla erecta* and *Luzula multiflora* often provide part of the distinctive character of the vegetation. Over central and eastern England, however, the profiles tend towards the more base-rich and calcareous and here the *Cirsio-Molinietum* is essentially a community of the margins of fens fed by lime-rich ground waters. Typically, it occupies the middle range of a sequence of soils which runs from deep, waterlogged fen peats on the one hand to excessively-draining rendzinas on the other, and which can be seen, in varying degrees of completeness where ill-draining hollows occur within landscapes of limestones, especially the Chalk, and calcareous superficials. In the Typical sub-community, which is very characteristic of the fringes of base-rich mires, particularly in East Anglia, such conditions are reflected in the common occurrence of *J. subnodulosus* and *Briza media* with, more locally, *Schoenus*, *Epipactis palustris* or *Dactylorhiza incarnata* on wetter ground or, in transitions to drier surrounds, *Festuca ovina*, *Brachypodium pinnatum* or even *Thymus praecox* and *Cirsium acaulon* (Wheeler 1975, 1980*c*). Some of the former species also find an occasional place in the *Eupatorium* sub-community, a more local kind of *Cirsio-Molinietum* more strictly associated with the margins of flood-plain mires, particularly in Broadland and the Fens, but, although this vegetation type can be found on equally base-rich substrates as the Typical sub-community, the tall growth of the herbage often precludes a strong calcicolous expression among smaller plants. In patches, then, the *Cirsio-Molinietum* can approach Caricion davallianae vegetation in its floristics, although the base-richness of the habitat is probably less than under communities like the *Schoenetum*, which replaces this kind of fen-meadow in spring-fens.

Locally in eastern England, the soils under the *Cirsio-Molinietum* show some measure of surface-leaching where they are further removed from any influence of calcareous ground waters, as around gravel islands within fens, for example, or over remnant peat baulks left upstanding by cutting (Wheeler 1975). And it is then that, in this part of Britain, such plants as *E. tetralix*, *Calluna* and *Dactylorhiza maculata* ssp. *maculata* make an occasional appearance. In the main, however, these species are confined to the *Juncus-Erica* sub-community whose soils are throughout of somewhat lower pH, usually 4.5–6, something which reflects both the argillaceous bedrocks which typically underlie the *Cirsio-Molinietum* in the south-west of Britain and the wetter climate there. Compared with the surrounding heaths and grasslands, of course, the fen-meadow can appear distinctly basiphilous with its Molinietalia herbs and mildly calcicolous sedges, and it often marks out the influence of bedrocks or seeping waters which are a little enriched in calcium and thus able to counteract the prevailing tendency to eluviation.

The soils beneath the *Cirsio-Molinietum* are probably less impoverished, too, than those which underlie communities like the *Schoenetum* or the *Ericetum tetralicis* and, where grazing and trampling are not too heavy, the fairly luxuriant character of the sward often impresses itself. Compared with the *Juncus-Cirsium* fen-meadow, however, the profiles are probably poorer in major nutrients, or at least selectively depleted, perhaps as a result of long-continued mowing or grazing, with little return to the sward, apart from dunging by stock: this may be another reason for the dominance of *Molinia* as opposed to rushes in this kind of vegetation. But the effects of treatments on the *Cirsio-Molinietum* are much more thorough going than this, because the community owes its maintenance and essential aspects of its floristics and structure to particular patterns of mowing and/or grazing. In its usual context of mire surrounds in central and eastern England, there is little doubt that many stands of this fen-meadow have been derived from Phragmitetalia fen or less markedly calcicolous tracts of Caricion davallianae fen by annual cutting in the summer months or by grazing. On the most general level, such treatments repeatedly set back progression to scrub and woodland while allowing at least limited further peat accumulation, but more particularly they deflect succession away from vegetation dominated by the typical tall helophytes or bulky cyperaceous plants of mire surrounds. As Godwin (1941) showed in his classic crop-taking experiments, as far as mowing is concerned, it is the frequency and the timing of the treatment that are of crucial importance in determining the extent to which the sere is deflected towards vegetation like the *Cirsio-Molinietum*, because under some cutting regimes, important fen-dominants like *Phragmites* and *Cladium* can maintain themselves: indeed, annual winter-mowing of Phragmitetalia vegetation or three- or four-yearly summer-cutting were the standard treatments for the harvesting of reed or sedge respectively in places like the Norfolk Broads (e.g. Lambert 1951, 1965). The *Cirsio-Molinietum*, on the other hand, formed a major part of the crop known as 'litter', herbaceous vegetation lacking large amounts of the bulkier fen-dominants but with much *Molinia* and *J. subnodulosus*, cut every year between July and October, for fodder and bedding (Godwin & Tansley 1929, Godwin 1929, 1941, 1978, Lambert 1965). And Godwin (1941) demonstrated at Wicken how, over a period of twelve years, treatments which came increasingly close to annual summer mowing in their frequency, were ever more effective in actually converting stands of tall-herb fen, in this particular case *Cladium*-dominated vegetation, into the *Cirsio-Molinietum*; and, further, that some of these floristic and structural changes involved in this transformation could be reversed somewhat when tracts of 'litter' were mown at less frequent intervals or intermediate vegetation simply left uncut. As defined here, the Typical

sub-community approximates to what the early workers knew as 'litter' or *Molinietum*, the more or less stable end-point of this deflected succession, while the *Eupatorium* sub-community includes much of the transitional vegetation, in the process of conversion or at some intermediate point of balance under regimes of summer cutting every two or three years. And the gradual floristic change that can be seen running through the sequence from tall-herb fen, through the *Eupatorium* sub-community to the Typical kind of *Cirsio-Molinietum*, largely reflects the extent to which smaller hemicryptophytes are able to capitalise on the absence of shade from plants like *Phragmites* and *Cladium* and of the smothering effects of their bulky litter.

In fact, nowadays, traditional mowing treatments of this kind are almost wholly confined to fen reserves like Wicken, although fragments of the community persisting in field corners may sometimes be taken in with a hay crop. Most often, it is grazing which maintains the community and, though no parallel experiments to those described above have ever been carried out, there seems little doubt that, around the drier fringes of Phragmitetalia vegetation, this treatment has effected changes similar to those seen at Wicken, particularly where palatable *Phragmites* is the dominant fen monocotyledon, as it usually is. Constant removal of herbage and the effects of trampling by the stock, generally cattle in central and eastern England, would both favour the abundance of hemicryptophytes, particularly rosette species, among the *Molinia* tussocks and, though no data are available, variations in the intensity of grazing probably underlie the floristic differences between sampled stands of the *Eupatorium* and Typical sub-communities.

Grazing is of importance, too, in the maintenance of the *Juncus-Erica* sub-community which occurs most often within tracts of heaths and grassland on commons and around the upland fringes of the south and west of Britain, where there is often free access to stock, frequently mixtures of cattle, sheep and ponies, throughout the year. In this type of *Cirsio-Molinietum* there is, as described above, some edaphic limit on the representation of ericoid sub-shrubs but grazing probably helps keep these in check in relation to the *Molinia* and, particularly when combined with burning, such treatment may lead to an extension of the *Cirsio-Molinietum* on to ground that would typically support wet heath.

Zonation and succession

The *Cirsio-Molinietum* is typically found as part of transitions between tall-herb fens or other kinds of mire vegetation on the one hand and grasslands or dry heaths on the other. Essentially, such sequences reflect variations in the soil water-regime but the particular communities involved differ according to the base-status of the mire waters and their surrounding soils and with the regional climate. And the proportions of the different vegetation types within the zonations are very much influenced by the degree to which treatments have modified the natural patterns. Land improvement has increasingly modified the drier portions of the zonations and often destroyed the community altogether by extending drainage and reclamation right on to areas of mire. In other cases, stands remain intact but have become fragmented and isolated within intensive agricultural landscapes. Even where larger tracts have survived longer, the abandonment of traditional treatments has often left them to revert to rank secondary fen and scrubby woodland.

Within central and eastern England, where the usual context for the community is the surrounds of calcareous mire systems, extensive zonations are now scarce. However, it is still possible to see, at various localities in the flood-plain mires of Broadland (Wheeler 1978, 1980*c*) and the Fens (Godwin 1978) and along the margins of chalkland rivers in East Anglia (Haslam 1965) and elsewhere (Wheeler 1975, Ratcliffe 1977), transitions from the Typical or *Eupatorium* sub-communities to Phragmitetalia fen. Around the Norfolk Broads, the latter is usually some form of *Peucedano-Phragmitetum*, elsewhere generally the *Phragmites-Eupatorium* fen, and the extent and clarity of the junctions between such vegetation types and the *Cirsio-Molinietum* depend in large measure on how treatments have been imposed and withdrawn over the sequence of progressively drier soils through the mire. In some places, the boundaries between old mowing-marsh compartments can still be marked by fairly abrupt switches from what was fen-meadow mown for litter to tall-herb fen cut for reed or sedge. In parts of Wicken and in other reserves where mowing is used as part of the management of the vegetation, such transitions remain crisp and provide not only a glimpse of the once-widespread patchwork of secondary fen, but also an active indication of how one community can be transformed into another. Often, however, such patterns are now blurred by long neglect, with *Phragmites* re-establishing itself through the *Cirsio-Molinietum* and apparently capricious mixtures of fen and fen-meadow plants occurring in rank jumbles, frequently invaded by scrub. Commonly, then, transitions from the *Cirsio-Molinietum* to Phragmitetalia vegetation have to be seen in the much more compressed sequences found in ill-drained field corners and along marginal ditches, where it is grazing that usually mediates the transition.

Another, still fairly widespread, though increasingly local, zonation to be seen in this part of Britain occurs around the soligenous fen vegetation associated with springs and seepage lines fed by calcareous waters. In such situations, the Typical sub-community often forms a marginal zone around the *Schoenetum* which occupies the central area where base-richness and through-put

are at a maximum. Grazing often occurs throughout such zonations and floristic continuity is therefore maintained through resistant small herbs whose edaphic tolerances are fairly broad. What marks the switch in vegetation types is the increasing representation of calcicoles in moving to the heart of the spring-fen, both among the vascular plants and in the bryophytes which are often well represented in the rather open areas of sward between the dominants, and the switch from a preponderance of *Molinia* to *Schoenus*. Withdrawal of grazing in such vegetation results in the development of the ranker and impoverished *Festuca-Juncus* sub-community of the *Schoenetum*, which is very close in its composition to the Typical *Cirsio-Molinietum* and perhaps represents a successional extension of the latter into more calcareous situations with neglect.

Both these types of zonations can be complicated by the occurrence of the other kind of lowland southern fen-meadow, the *Juncus-Cirsium* community alongside the *Cirsio-Molinietum*. As explained above, a combination of edaphic and treatment factors may differentiate these vegetation types, the latter apparently favouring drier ground than the former, though perhaps also being derived from it where mowing or grazing have been applied over long periods of time. Whatever the particular environmental influences on each, the communities are certainly very close and sometimes have to be distinguished simply by the proportions of their usual dominants, *J. subnodulosus* and *Molinia*. Fen helophytes, large sedges and dicotyledons can also occur in the *Juncus-Cirsium* fen-meadow, so very complex patchworks of dominance, superimposed over lower tiers of herbage which share many species in common, have to be expected in such situations: they are a reflection of floristic convergence where agricultural activities have been brought to bear around the more accessible fringes of these mire systems.

Under traditional treatments, and particularly grazing, there was often a strong measure of continuity between such fen-meadows and the vegetation of the drier ground beyond the influence of a fluctuating water-table in topogenous mires or above springs and seepage lines. This is less so now that agricultural improvement has pressed very closely around ill-drained remnants of the landscape, but in some localities good uninterrupted zonations can still be seen. In eastern England, for example, topogenous hollows in drift or springs in the Chalk sometimes pass above to rendzina soils developed from the bedrock, when the Typical sub-community can grade to some sort of Mesobromion sward, usually in this part of Britain, the *Festuca-Avenula* grassland or, towards central England, its derivatives dominated by *Bromus erectus* or *Brachypodium pinnatum*. Species such as *Briza media*, *Agrostis stolonifera*, *Festuca rubra* and some mesophytic dicotyledons like *Prunella vulgaris*, *Ranunculus acris* and *Plantago lanceolata*, run on into the calcicolous sward and there may be some transgression of herbs in the opposite direction, but generally speaking the boundary is quite a sharp one. Over less pervious and calcareous bedrocks, but where there has still not been very much improvement of the surrounding grassland, the Typical *Cirsio-Molinietum* can pass to the *Centaureo-Cynosuretum*, with which it is linked through plants like *Holcus lanatus*, *Centaurea nigra*, *Festuca rubra*, *Anthoxanthum odoratum*, *Briza media*, *Potentilla erecta* and *Succisa pratensis*. And, then, where artificial fertilisers have been applied to such swards and the land drained and perhaps top-sown or ploughed and re-seeded, a Cynosurion sward like the *Lolio-Cynosuretum* may surround what are simply fragments of the *Cirsio-Molinietum* which have not yet succumbed to improvement. Outside major areas of calcareous mire vegetation like Broadland, it is often these drier ends of transitions in which the community can be found, marking out remnant topogenous hollows within tracts of pasture.

Towards south-western Britain, these latter kinds of zonations also occur but here there is a shift in the constituent vegetation types towards the more calcifuge. Thus, it is the *Juncus-Erica* sub-community that is the usual type of *Cirsio-Molinietum* that is found in moderately base-rich damper hollows in pastures around the upland fringes, and this can grade on the drier grazed surround to acidophilous sub-communities of the *Lolio-Cynosuretum* or *Centaurea-Cynosuretum* or to mesophytic types of *Festuca-Agrostis-Galium* grassland (NCC Devon Heathland Report 1980), according to the degree of improvement.

More distinctive, however, is the widespread occurrence of the *Juncus-Erica* sub-community within heathland complexes in south-west Britain, most notably on the common lands of the Devon Pebble Beds, on the Culm in the north-west of that county and more locally on Gower. Here, in the kind of sequence well seen in the study of Aylesbeare Common by Ivimey-Cook *et al.* (1975), the *Cirsio-Molinietum* occupies sloping ground around tracts of the *Ericetum tetralicis*, to which it may grade through the *Succisa-Carex* sub-community of the wet heath, and, more locally, of the *Schoenus-Narthecium* mire, both of which in turn can pass over permanently waterlogged ground to the *Narthecio-Sphagnetum*. On drier ground, the *Juncus-Erica* sub-community often grades to some kind of *Ulex gallii-Agrostis* heath, into which *Molinia* runs but where *E. tetralix*, *Calluna* and *U. gallii* increase their cover to become major elements of the vegetation, and from which Molinietalia herbs are mostly excluded.

In such zonations, expansion of the cover of *Molinia* can make the patterns very difficult to interpret because this tends to swamp the representation of any associates

which might give some clue as to the original character of the vegetation. Burning followed by heavy grazing is especially likely to favour the spread of *Molinia* on the moister ground in these sequences, and it is quite common for the *Cirsio-Molinietum* to occur with more impoverished vegetation with *Molinia*, *J. acutiflorus*, *Potentilla erecta* and perhaps occasional *Cirsium palustre* and *Angelica*, which would probably be grouped within the *Molinia-Potentilla* mire. This is largely a western and northern equivalent to the *Cirsio-Molinietum* but the ranges of the two vegetation types overlap around the upland fringes of the south-west and, in this area of transitional climate, treatments are perhaps quite readily able to convert the one into the other.

In the absence of any kind of treatment, all stands of the community are probably able in theory to progress to scrub or woodland, although reversion to tall-herb fen around topogenous mires or the development of a very dense *Molinia* cover may greatly hinder invasion of woody plants. The ultimate character of any woodland vegetation probably also differs according to the edaphic conditions. In the flood-plain mires of central and eastern England, the natural successor to Phragmitetalia fen is the *Salix-Betula-Phragmites* woodland and it is possible that abandoned fen-meadow may revert to the final stages of this seral line, developing into the *Alnus-Filipendula* sub-community, where the influence of the base-rich ground waters is not too remote. However, long-continued mowing or grazing on somewhat drier ground may be accompanied by the surface-leaching and nutrient-depletion that favour the ultimate establishment of the *Betula-Molinia* woodland over neglected fen-meadow: the *Juncus* sub-community of that forest type can show considerable floristic similarity to the Typical *Cirsio-Molinietum* and birch invasion may effect a ready conversion of the one to the other. To the south-west, too, *Betula pubescens* is the most likely coloniser of ungrazed heaths among which the *Juncus-Erica* sub-community occurs, and there perhaps the *Juncus* or *Sphagnum* sub-communities of the woodland may succeed the fen-meadow. Stands of the *Cirsio-Molinietum* around more base-rich soligenous mires, very local to the west but widespread further east, could perhaps develop into Alno-Ulmion forest, though the *Alnus-Fraxinus-Lysimachia* woodland is essentially an oceanic community rare in the drier parts of Britain.

Distribution

The community is widespread through the lowland south of the country but has become increasingly local with changes in agricultural practice. The Typical sub-community is the commonest kind of *Cirsio-Molinietum* in central and eastern England with the *Eupatorium* sub-community much more confined to East Anglia. In the south-west, the *Juncus-Erica* sub-community replaces the Typical form and the landscape context of the *Cirsio-Molinietum* shows a shift from more base-rich topogenous mires and spring-fens to heaths and acid grasslands.

Affinities

The classification of British *Molinia*-dominated vegetation raises particular difficulties because *Molinia* becomes increasingly catholic in its floristic associations towards the Atlantic seaboard of Europe, occurring abundantly with us in assemblages which bear little relationship to the various kinds of Molinieta characterised from the Continent (e.g. Passarge 1964), and, by virtue of its often uncompromising dominance, frequently overwhelming such associates as might give a clear clue to the affinities of the herbage. Such species-poverty can be a problem here, and the general prominence of *Molinia* has sometimes led to this vegetation being termed simply a *Molinietum* (e.g. Godwin 1941, Willis & Jefferies 1959, Ivimey-Cook *et al.* 1975) or grouped with other rather different swards for which such a general tag would be equally suitable (e.g. Wheeler 1975). In each of these studies, however, at least some of the stands included are very distinct from the kinds of *Molinia* grassland so extensive in western Britain and from any other mires and heaths in which this grass can be prominent. The more calcicolous and eastern of these, Wheeler (1980*c*) saw as forming the core of the community which he referred to the *Cirsio-Molinietum* Sissingh & de Vries 1942 (Vanden Berghen 1951, Westhoff & den Held 1969), a Dutch version of the more general *Molinietum caeruleae atlanticum* described from western Europe (Duvigneaud & Vanden Berghen 1945, Duvigneaud 1949, Le Brun *et al.* 1949). As defined here, the *Cirsio-Molinietum* takes in Wheeler's *typicum* and *eupatoretosum* (earlier termed *peucedanetosum*: Wheeler 1978) but excludes most of what he termed a *nardetosum*. Some less basiphilous vegetation of this kind can be accommodated in the Typical sub-community here, but the more obvious trend in this direction is seen in the *Juncus-Erica* type, the south-western *Cirsio-Molinietum*, unsurveyed by Wheeler, but well seen as including the most species-rich *Molinia* swards described from a Devon heathland by Ivimey-Cook *et al.* (1975).

What unites the British vegetation of this kind and brings it within the *Cirsio-Molinietum* as originally defined, is the occurrence of *Molinia* with such species as *Cirsium dissectum*, *Succisa pratensis*, *Carex panicea*, *C. hostiana*, *C. pulicaris* and *Potentilla erecta* (Westhoff & den Held 1969), an assemblage quite unique among our *Molinia* swards. And the presence, in the south-western type, of *J. conglomeratus* would confirm Continental phytosociologists in their allocation of this community

to the Junco conglomerati-Molinion alliance within the Molinietalia (Westhoff & den Held 1969).

Even at the alliance level, however, the affinities of this vegetation are diverse. First, through plants such as the more basiphilous sedges, *Schoenus* and certain orchids, there are clear relationships, particularly in the Typical sub-community, with the Caricion davallianae, and the *Cirsio-Molinietum* is commonly found in the same sites as the *Schoenetum* (e.g. Wheeler 1980*c*). Second, there is the obvious similarity between the community and Phragmition and Magnocaricion tall-herb fens included in the Phragmitetalia, with the *Eupatorium* sub-community containing vegetation whose transitional character is known to reflect seral interchange between the two (Godwin 1941). Third, there is the close relationship between the *Cirsio-Molinietum* and the other southern lowland fen-meadow, the *Juncus-Cirsium* community, whose general affinities are with the Calthion, but which often intergrades with this Junco-Molinion type through an abundance of general Molinietalia plants encouraged by similar treatments. Inevitably, the direct effects of mowing and grazing, and of neglect, and their influence on the vegetation through soil changes, result in a frustrating degree of floristic convergence among many of the smaller elements of these different kinds of vegetation and a confusing medley of apparently interchangeable dominants through contiguous stands.

Towards the west, there are different problems. Here, the *Cirsio-Molinietum* comes close to Ericion tetralicis vegetation and the kinds of transitions to that alliance seen in the *Schoenus-Narthecium* mire. Usually, however, such gradations are more readily perceived than those between the *Juncus-Erica* sub-community of the fen-meadow and its northern and western equivalent, the *Molinia-Potentilla* grassland. This, too, can probably be placed in the Junco-Molinion alliance, and, though it is often considerably more impoverished than the *Cirsio-Molinietum*, transitions are quite common, particularly in south-western Britain.

Floristic table M24

	a	b	c	24
Molinia caerulea	V (3–6)	V (1–8)	V (4–8)	V (1–8)
Potentilla erecta	V (1–3)	V (1–4)	V (2–4)	V (1–4)
Succisa pratensis	IV (2–6)	V (1–5)	IV (2–5)	V (1–6)
Cirsium dissectum	IV (1–3)	IV (1–4)	IV (1–6)	IV (1–6)
Lotus uliginosus	IV (1–3)	IV (1–3)	IV (2–4)	IV (1–4)
Carex panicea	III (1–3)	IV (2–5)	III (1–4)	IV (1–5)
Galium uliginosum	IV (1–5)	IV (1–4)		III (1–5)
Valeriana dioica	IV (1–3)	IV (1–3)		III (1–3)
Centaurea nigra	III (1–3)	IV (1–4)	I (1–3)	III (1–4)
Juncus subnodulosus	IV (1–5)	III (1–3)		III (1–5)
Equisetum palustre	III (1–3)	III (1–3)		II (1–3)
Vicia cracca	III (1–3)	III (1–4)		II (1–4)
Filipendula ulmaria	III (1–3)	III (1–5)		II (1–5)
Linum catharticum	II (1–3)	II (1–3)		II (1–3)
Gymnadenia conopsea	II (1–3)	II (1–3)		II (1–3)
Eupatorium cannabinum	V (1–3)	II (1–2)		II (1–3)
Phragmites australis	V (1–5)	II (1–8)		II (1–8)
Campylium stellatum	III (1–2)	I (1)	I (2)	I (1–2)
Cladium mariscus	III (1–6)			I (1–6)
Lythrum salicaria	II (1–3)	I (1–2)		I (1–3)
Dactylorhiza incarnata	II (1–2)	I (1–3)		I (1–3)
Holcus lanatus	I (2)	IV (1–4)	III (2–5)	III (1–5)
Anthoxanthum odoratum	I (1)	III (1–4)	III (3–6)	III (1–6)
Hydrocotyle vulgaris	I (1–3)	III (1–3)	II (1–2)	II (1–3)

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Carex pulicaris		III (1–3)	II (1–3)	II (1–3)
Luzula multiflora		III (1–3)	II (1–3)	II (1–3)
Ranunculus acris		II (1–2)	III (2–4)	II (1–4)
Pseudoscleropodium purum		II (1–3)	II (2–6)	II (1–6)
Festuca rubra		II (1–2)	II (4–7)	II (1–7)
Cardamine pratensis		II (1–3)	II (1–2)	II (1–3)
Briza media	I (1)	III (1–4)		II (1–4)
Rumex acetosa	I (1)	II (1)	I (3)	II (1–3)
Epipactis palustris	I (1)	II (1–4)		I (1–4)
Potentilla reptans	I (1)	II (1–3)		I (1–3)
Hypericum tetrapterum	I (1)	II (1–3)		I (1–3)
Cirsium arvense	I (1)	II (1–4)		I (1–4)
Carex nigra		II (1–4)	I (1–4)	I (1–4)
Trifolium pratense		II (1–3)	I (1)	I (1–3)
Polygala vulgaris		II (1–4)		I (1–4)
Leontodon taraxacoides		II (1–3)		I (1–3)
Juncus articulatus		II (1–4)		I (1–4)
Eriophorum angustifolium		II (1–2)		I (1–2)
Dactylorhiza fuchsii		II (1)		I (1)
Galium verum		II (1–3)		I (1–3)
Cerastium fontanum		II (1–3)		I (1–3)
Potentilla anserina		II (1–3)		I (1–3)
Juncus acutiflorus	I (7)	I (1–6)	IV (2–7)	II (1–7)
Juncus conglomeratus		II (1–4)	III (1–7)	II (1–7)
Erica tetralix		II (1–4)	III (2–4)	II (1–4)
Galium palustre		I (1–2)	III (1–3)	II (1–3)
Dactylorhiza maculata		I (1–4)	III (2–3)	II (1–4)
Calluna vulgaris		I (4–5)	II (1–5)	I (1–5)
Juncus effusus		I (1–3)	II (3–5)	I (1–5)
Serratula tinctoria		I (1)	II (1–3)	I (1–3)
Narthecium ossifragum		I (1)	II (2–4)	I (1–4)
Aulacomnium palustre		I (1–3)	II (3–4)	I (1–4)
Ranunculus flammula		I (1–2)	II (1–3)	I (1–3)
Hypnum cupressiforme		I (1)	II (3–4)	I (1–4)
Achillea ptarmica		I (1)	II (2–4)	I (1–4)
Agrostis canina canina			II (3–6)	I (3–6)
Scutellaria minor			II (1–2)	I (1–2)
Viola palustris			II (3–4)	I (3–4)
Sphagnum auriculatum			II (2–7)	I (2–7)
Hypericum undulatum			II (2–3)	I (2–3)
Salix repens			II (1–4)	I (1–4)
Pedicularis sylvatica			II (1–3)	I (1–3)
Senecio aquaticus			II (1–2)	I (1–2)
Thuidium tamariscinum			II (3–5)	I (3–5)
Eurhynchium praelongum			II (1–4)	I (1–4)
Cirsium palustre	III (1–4)	IV (1–5)	III (1–3)	III (1–5)
Angelica sylvestris	III (1–2)	III (1–3)	III (1–5)	III (1–5)
Calliergon cuspidatum	III (1–2)	III (1–3)	III (1–3)	III (1–3)
Mentha aquatica	III (1–4)	III (1–4)	III (2–4)	III (1–4)

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Floristic table M24 *(cont.)*

	a	b	c	24
Carex hostiana	III (1–3)	III (1–3)	II (1–6)	III (1–6)
Agrostis stolonifera	III (1–3)	II (1–4)	II (1–4)	II (1–4)
Brachythecium rutabulum	III (1–3)	II (1–3)	II (1–6)	II (1–6)
Prunella vulgaris	II (1–3)	II (1–2)	II (2–3)	II (1–3)
Deschampsia cespitosa	II (1–4)	II (1–3)	I (2)	II (1–4)
Schoenus nigricans	II (1–5)	II (1–4)	I (8)	II (1–8)
Plantago lanceolata	I (1)	II (1–4)	II (1–4)	II (1–4)
Lathyrus pratensis	I (1–3)	II (1–3)	II (1–2)	II (1–2)
Pulicaria dysenterica	I (1)	II (1–3)	II (3–4)	II (1–4)
Rubus fruticosus agg.	I (1)	I (1–3)	I (1–2)	I (1–3)
Salix cinerea sapling	I (1–3)	I (1–3)	I (2)	I (1–3)
Danthonia decumbens		I (1–3)	I (1–5)	I (1–5)
Anagallis tenella		I (1–6)	I (1–3)	I (1–6)
Sphagnum subnitens		I (1–2)	I (4–7)	I (1–7)
Lychnis flos-cuculi		I (1–4)	I (3)	I (1–4)
Drosera rotundifolia		I (1–3)	I (3)	I (1–3)
Alnus glutinosa sapling	I (1)	I (1–2)		I (1–2)
Number of samples	19	33	31	83
Number of species/sample	21 (15–32)	29 (14–52)	19 (9–29)	26 (9–52)

a *Eupatorium cannabinum* sub-community
b Typical sub-community
c *Juncus acutiflorus-Erica tetralix* sub-community
24 *Cirsio-Molinietum caeruleae* (total)

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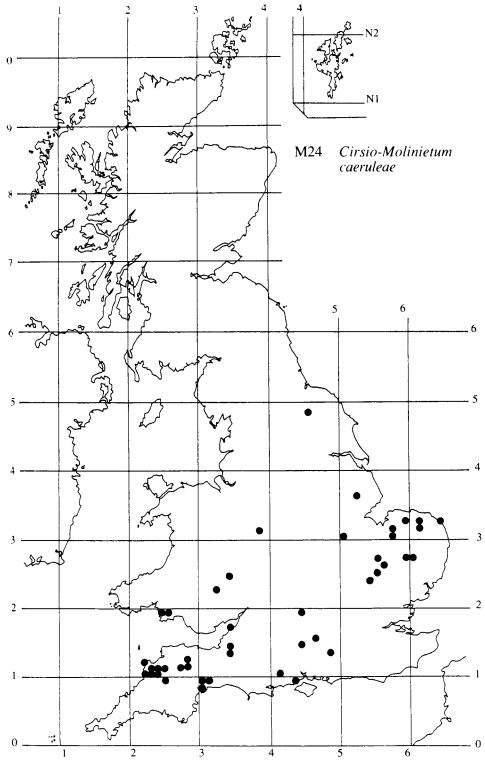

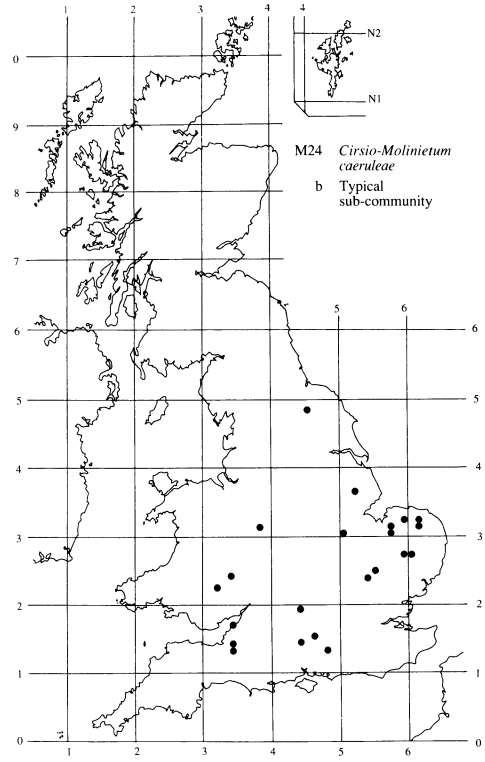

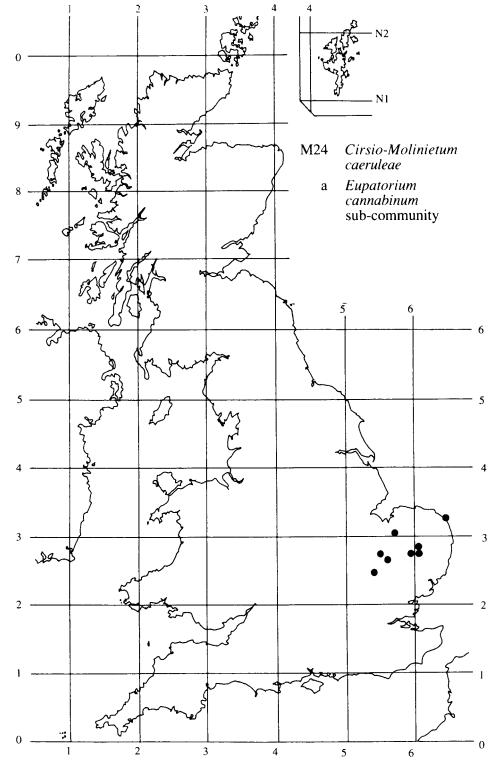

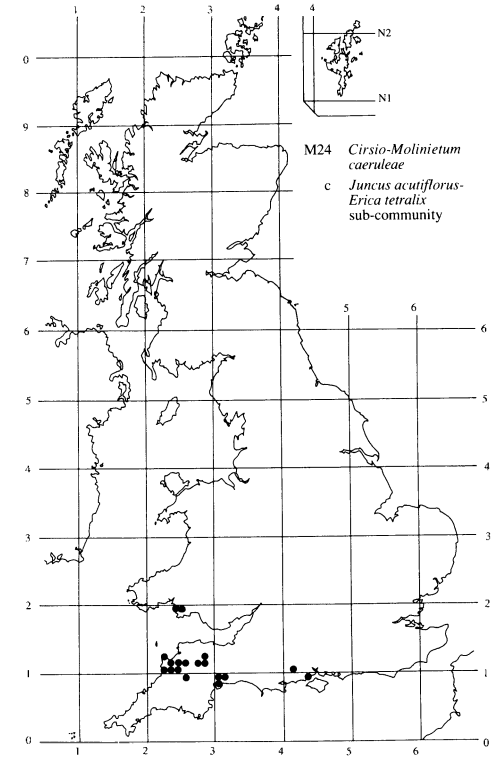

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