M6
Carex echinata-Sphagnum recurvum/auriculatum mire

Synonymy

Juncus acutiflorus flush bog Ratcliffe 1959*a*; *Juncus effusus* flush bog Ratcliffe 1959*a*; *Sphagneto-Juncetum effusi* McVean & Ratcliffe 1962, Eddy *et al.* 1969 *p.p.*, Birks 1973, Prentice & Prentice 1975; *Sphagneto-Caricetum sub-alpinum* McVean & Ratcliffe 1962, Prentice & Prentice 1975, Evans *et al.* 1977; *Juncus effusus-Sphagnum* mire Ratcliffe 1964, Ferreira 1978; Sub-alpine *Carex-Sphagnum* mire Ratcliffe 1964, Ferreira 1978; *Juncus effusus-Sphagnum recurvum* sociation Edgell 1969; *Carex-Sphagnum recurvum* nodum Birks 1973; *Violo-Epilobietum sphagnetosum recurvae* Jones 1973 *p.p.*; *Carex-Sphagnum-Polytrichum* nodum Huntley 1979: *Caricetum echinato-paniceae* (Birse & Robertson 1976) Birse 1980 *p.p.*, *Juncus effusus-Sphagnum recurvum* Community (Birse & Robertson 1976) Birse 1980; *Sphagnum recurvum-Juncus effusus* mire Ratcliffe & Hattey 1982, *Sphagnum-Carex nigra* mire Ratcliffe & Hattey 1982; *Caricetum nigrae* Dierssen 1982; *Juncus effusus* Gesellschaft Dierssen 1982.

Constant species

Carex echinata, *Polytrichum commune*, *Sphagnum auriculatum/recurvum* (*Agrostis canina* ssp. *canina*, *Molinia caerulea*, *Potentilla erecta*, *Viola palustris*).

Physiognomy

The *Carex echinata-Sphagnum recurvum/auriculatum* mire has a quite distinct general character but shows a wide range of variation in its composition, more particularly in the proportional representation of its different structural components, something which can have a marked effect on the gross physiognomy of the vegetation. Essentially, this is a poor-fen in which either small sedges or rushes dominate over a carpet of more oligotrophic and base-intolerant Sphagna and it is in these two elements that most of the differences in the community can be seen: variation among the former helps characterise the four sub-communities; differences in the latter allow variants to be distinguished.

The constants of the *Carex echinata-Sphagnum* mire are very few. Among the vascular plants, only *Carex echinata* itself attains uniformly high frequency throughout but, of other sedges that can be found here, *C. nigra* and *C. panicea* are quite common and *C. demissa* occasional; and, although this combination can be found in other Caricion nigrae mires, taken together with the other floristic features of this community, it is quite diagnostic. Two further negative characteristics of the sedge component serve to sharpen up the definition of the vegetation. First, more calcicolous species, such as *C. dioica*, *C. pulicaris*, *C. lepidocarpa* and *C. flacca* are either very infrequent or totally absent; and second, though species like *C. rostrata* and *C. curta* can occur in more swampy stands, they are of no more than local significance. The rarity of the former sedges helps to separate the community from the Caricion davallianae rich fens; the infrequency of the latter marks off the vegetation from communities like the *Carex rostrata-Sphagnum* mire which comes close to the Rhynchosporion and in which the *Carex rostrata* facies of Eddy *et al.* (1969) is best placed.

The most frequent vascular associates of the sedges are grasses and poor-fen dicotyledons. Among the former, *Agrostis canina* ssp. *canina* and *Molinia caerulea* are the commonest species, though both show considerable variation in frequency from one sub-community to another and in abundance from stand to stand: when the latter is prominent, it may be difficult to separate this community from more species-poor kinds of Junco-Molinion vegetation. *Anthoxanthum odoratum* is also quite frequent throughout and in some kinds of *Carex echinata-Sphagnum* mire, *Nardus stricta* and *Festuca ovina* are well represented, together with *Juncus squarrosus*, when the community comes close in its floristics to flushed Nardetalia grasslands. The most common of the dicotyledons are *Viola palustris* and *Potentilla erecta* and each can be locally abundant, though generally both occur as scattered individuals. More occasionally, there can be some *Galium saxatile*, *G. palustre*, *Cirsium*

palustre, *Epilobium palustre*, *Succisa pratensis*, *Ranunculus flammula* or *Cardamine pratensis* usually represented in fragmentary assortments rather than as a consistently rich suite. Sometimes, species such as *Narthecium ossifragum*, *Drosera rotundifolia* and *Erica tetralix* can be found, particularly where the community marks out flushed areas within Oxycocco-Sphagnetea mires and wet heaths.

In two of the sub-communities, mixtures of these vascular associates form a background to dominance of sedges or mixtures of sedges and grasses or, occasionally, of *Eriophorum angustifolium*, which is rather patchily represented in the community, but much more common among these kinds of *Carex echinata-Sphagnum* mire. Such vegetation types have usually been characterised as some form of *Sphagneto-Caricetum sub-alpinum* (McVean & Ratcliffe 1962, Ratcliffe 1964, Prentice & Prentice 1975, Evans *et al.* 1977) or an equivalent (Birks 1973, Birse & Robertson 1976, Birse 1980, Ratcliffe & Hattey 1982). But it also makes good sense to include in this community poor fens which have essentially the same floristic composition but which are dominated by the rushes, *Juncus effusus* or *J. acutiflorus* (usually not both together), vegetation which, in earlier schemes, has usually been designated as a distinct *Sphagneto-Juncetum* (McVean & Ratcliffe 1962, Ratcliffe 1964, Eddy *et al.* 1969, Birks 1973, Prentice & Prentice 1975) or an equivalent (Ratcliffe 1959*a*, Edgell 1969, Birse & Robertson 1976, Birse 1980, Ratcliffe & Hattey 1982). These rushes are sparsely represented in sedge-dominated kinds of *Carex echinata-Sphagnum* mire but their predominance helps characterise two further sub-communities.

Apart from the continuation throughout all these sub-communities of the vascular species already described, this kind of mire is also distinguished by the prominence of a ground carpet of Sphagna, the luxuriance of which provides a generally good separation from closely-related Nardetalia and Molinietalia communities. The most frequent species throughout are *Sphagnum recurvum* and *S. auriculatum* and generally one or the other of these predominates, this pattern of replacement enabling variants to be recognised, with varying degrees of clarity, in each of the four sub-communities. *S. subnitens* and *S. papillosum* which are occasional, and *S. capillifolium*, which is much scarcer, all tend to follow *S. auriculatum*; *S. palustre* is more evenly distributed throughout. Montane species, such as *S. russowii* and *S. lindbergii*, and more base-tolerant ones, like *S. squarrosum*, *S. teres*, *S. warnstorfii* and *S. contortum*, are very scarce or absent, features which help separate the community from related mires of higher altitudes or of more calcareous flushes.

Other bryophytes are few in number but *Polytrichum commune* is very frequent and often abundant, particularly where the community extends on to gleyed mineral soils with a humic top rather than deeper peats. *Rhytidiadelphus squarrosus* is occasional and *Calliergon stramineum* and *Aulacomnium palustre* occur patchily throughout. In contrast to similar Molinietalia communities, species such as *Calliergon cuspidatum* and *Plagiomnium undulatum* are conspicuously rare.

Sub-communities

***Carex echinata* sub-community:** *Sphagneto-Caricetum sub-alpinum* McVean & Ratcliffe 1962 *p.p.*, Evans *et al.* 1977; *Carex-Sphagnum recurvum* nodum Birks 1973; *Violo-Epilobietum sphagnetosum recurvae*, *Sphagnum palustre* variant, typical sub-variant Jones 1973 *p.p.*; *Caricetum echinato-paniceae typicum*, typical variant (Birse & Robertson 1976) Birse 1980; *Sphagnum-Carex nigra* mire Ratcliffe & Hattey 1982 *p.p.* The vegetation here is usually dominated by mixtures of sedges in which *C. echinata* is generally the leading member with *C. nigra* and *C. panicea* rather less common, though locally abundant, and *C. demissa* occasional. *Eriophorum angustifolium* is quite frequent and it, too, may dominate but rushes are typically scarce and of low cover: *Juncus effusus* occurs occasionally but generally in small isolated tussocks. Apart from *Molinia* and *Agrostis canina* ssp. *canina*, both of which are very common and sometimes abundant, grasses are rather scarce: *Nardus* figures in some stands but does not occur with the consistency characteristic of the next sub-community.

The *Sphagnum* carpet is typically extensive and luxuriant. *S. palustre* occurs fairly often throughout but *S. recurvum* and *S. auriculatum* show a well-marked pattern of replacement, the latter tending to become more prominent in the more Atlantic climate of the far west of Britain, where it is sometimes accompanied by *S. subnitens* and *S. papillosum*. In this variant, too, there are some distinctive features of the vascular element of the vegetation because, though *Viola palustris* and *Potentilla erecta* remain frequent throughout, *Drosera rotundifolia*, *Narthecium ossifragum*, *Erica tetralix*, *Juncus bulbosus/kochii* and *Menyanthes trifoliata* show some preference for the *S. auriculatum* type of flush. Such stands come close to Oxycocco-Sphagnetea mires in their composition and are often found in contact with them.

***Carex nigra-Nardus stricta* sub-community:** *Sphagneto-Caricetum sub-alpinum* McVean & Ratcliffe 1962 *p.p.*, Prentice & Prentice 1975; Sub-alpine *Carex-Sphagnum* mire Ratcliffe 1964, Ferreira 1978. The general predominance, among the vascular element, of cyperaceous plants continues in this sub-community: indeed, *C. nigra* and *C. panicea* rival *C. echinata* in their high frequency

and mixtures of these species often account for the bulk of the cover. *Eriophorum angustifolium* is very common, too, though usually not abundant, and *Luzula multiflora* can sometimes be found in small amounts. More specifically diagnostic, however, is the high frequency of *Nardus stricta* and the occasional occurrence of *Festuca ovina* which, with frequent *Anthoxanthum odoratum*, often give the vegetation the appearance of a flushed grassland. *Juncus squarrosus* is a further good preferential but *J. effusus* is very scarce and *J. acutiflorus* absent.

The *Sphagnum* cover is variable in its extent and, as in the previous sub-community, in its composition, features which again enable variants to be distinguished. In some stands, *S. recurvum* and *S. palustre* are the commonest species in a rather patchy carpet. In such vegetation, poor-fen herbs such as *Ranunculus flammula*, *Epilobium palustre* and *Cirsium palustre* tend to be a little more frequent and the sedge component can occasionally be enriched by *C. demissa*, *C. dioica* or *C. pulicaris*. *Rhytidiadelphus squarrosus* is very frequent and there can be some *Drepanocladus exannulatus* and *Calliergon cuspidatum*. It is here that the community most closely approaches the Nardetalia in its composition. By contrast, other stands preserve the general features of the sub-community but have a greater abundance of Sphagna, among which *S. auriculatum*, *S. subnitens* and *S. papillosum* are preferential, and quite often a small amount of *Molinia* among the other grasses.

***Juncus effusus* sub-community:** *Juncus effusus* flush bog Ratcliffe 1959; *Sphagneto-Juncetum effusi* McVean & Ratcliffe 1962, Eddy *et al.* 1969 *p.p.*, Birks 1973, Prentice & Prentice 1975; *Juncus effusus-Sphagnum recurvum* sociation Edgell 1969; *Violo-Epilobietum sphagnetosum recurvae*, *Sphagnum palustre* variant, typical sub-variant Jones 1973 *p.p.*; *Juncus effusus-Sphagnum* mire Ferreira 1978; *Juncus effusus-Sphagnum recurvum* Community (Birse & Robertson 1976) Birse 1980; *Sphagnum recurvum-Juncus effusus* mire Ratcliffe & Hattey 1982; *Sphagnum-Carex nigra* mire Ratcliffe & Hattey 1982 *p.p.*; *Juncus effusus* Gesellschaft Dierssen 1982. Sedges are less frequent and varied and much less abundant in this community and the vegetation is dominated physiognomically by *Juncus effusus*, occurring as prominent tussocks, sometimes of high total cover. *J. acutiflorus* can also occur occasionally though the two rushes are generally mutually exclusive in this community. Consistently frequent vascular associates are few and sometimes this vegetation is very impoverished but there is quite often some *Agrostis canina* ssp. *canina* and scattered plants of *Potentilla erecta* and, rather diagnostic here, *Galium saxatile*. *Carex echinata*, *Molinia caerulea* and *Viola palustris* are also fairly common, *Eriophorum angustifolium* and *C. nigra* occasional and *Rumex acetosa* and *Lotus uliginosus* can occur as weak preferentials.

The *Sphagnum* carpet is generally extensive and luxuriant and almost always *S. recurvum* is the dominant species, occasionally with some *S. palustre*, but stands can be found where these are supplemented or more usually replaced by *S. auriculatum*, often with *S. subnitens* and occasionally *S. papillosum*. *Polytrichum commune* remains very frequent, and, on less deep peats and on peaty gleys, it can be very abundant.

***Juncus acutiflorus* sub-community:** *Juncus acutiflorus* flush bog Ratcliffe 1959*a*; *Caricetum echinato-paniceae*, *Juncus acutiflorus* Subassociation, typical variant (Birse & Robertson 1976) Birse 1980. The general physiognomic character of rush-dominance over an extensive *Sphagnum* carpet is maintained here, but *J. acutiflorus* almost totally replaces *J. effusus* as the leading species and, among the vascular associates, *Molinia* becomes more consistently frequent. Where this grass is abundant, this vegetation comes close in its floristics to the more impoverished of the Junco-Molinion communities, with which it also shares frequent records for such species as *Potentilla erecta*, *Viola palustris*, *Agrostis canina* ssp. *canina*, *Anthoxanthum odoratum*, *Carex echinata* and, less commonly, *C. nigra* and *C. panicea*. What helps separate the vegetation types is that here, in common with other kinds of *Carex echinata-Sphagnum* mire, the vascular element is generally not much richer than this sparse assemblage of poor-fen species. *Succisa pratensis* occurs fairly often but *Cirsium palustre*, *Angelica sylvestris* and *Eupatorium cannabinum* are either very sparse or absent. And, though *Molinia* can be locally prominent, it does not consistently share dominance with *J. acutiflorus*.

Also, here, the Sphagna are more generally abundant than in the Junco-Molinion with *S. palustre* common throughout and *S. recurvum* or *S. auriculatum* with *S. subnitens*, *S. papillosum* and *S. capillifolium* having dominance in the carpet. *Hypnum jutlandicum* is a frequent preferential in the *S. auriculatum* variant and quite commonly there can also be some bushes of *Myrica gale* and some *Erica tetralix* among the rushes.

Habitat

The *Carex echinata-Sphagnum* mire is the major soligenous community of peats and peaty gleys irrigated by rather base-poor but not excessively oligotrophic waters in the sub-montane zone in Britain. Its very widespread occurrence in the north-western parts of the country is in large measure a reflection of the prevalence there of more acidic substrates and the frequency of flushing on gentle to moderate slopes, though climate probably plays a direct part in limiting the distribution of one sub-community and of the variants. This kind of mire is

commonly found within tracts of unenclosed pasture on the upland fringes and grazing has some influence on its floristics and physiognomy.

A high water-table and some amelioration of the very impoverished nutrient status characteristic of many waterlogged acid peats are essential pre-requisites for the development of this community and usually here both of these conditions are met by flushing from obvious springs or seepage lines or by the concentration of drainage waters into water-tracks or streams. Typically, the *Carex echinata-Sphagnum* mire marks out such sites on slopes of 1–10° within mire systems, where the soils are raw peats or, more often, in tracts of mineral soils where it is usually found over stagnohumic gleys or humic stagnopodzols, or sometimes over humic groundwater gleys on small alluvial terraces alongside upland streams (Ratcliffe 1959*a*, McVean & Ratcliffe 1962, Edgell 1969, Birks 1973, Birse & Robertson 1976, Birse 1980).

In such habitats as these, the through-put of waters gathered from the mire surfaces or from expanses of acidic soils or emerging from siliceous bedrocks or superficials provides sufficient enrichment to allow the development of the fairly diverse sedge or rush canopy and a modest poor-fen flora. Available data are very sparse but the studies of Birse & Robertson (1976) suggest that C/N ratios in vegetation of this kind are about 15 (compared with around 30 for ombrogenous peats) with levels of total phosphorus generally much higher than in the kind of habitat typical of the Rhynchosporion pools. The rise to prominence here of *Carex nigra*, *C. echinata*, *C. panicea*, *Juncus effusus*, *J. acutiflorus*, *Viola palustris* and *Potentilla erecta* provide a good indication of this environmental difference. The waters and soils, however, remain quite acid and poor in calcium, with a superficial pH usually between 4.5 and 5.5 (McVean & Ratcliffe 1962, Birks 1973, Birse & Robertson 1976), so that even moderately base-tolerant Sphagna, like *S. squarrosum* and *S. teres*, which mark the beginnings of a transition to the Caricion davallianae in the *Carex-Sphagnum squarrosum* mire, are poorly represented in the carpet.

The community is commonest at altitudes between 200 and 400 m and, though it can extend considerably higher, it is generally replaced in similar habitats above 650 m by the *Carex-Sphagnum russowii* mire, where species like *C. panicea*, the Junci and *Molinia* are scarce and where there is a distinct high-montane element among the sedges and Sphagna that is quite absent here. Stands can be encountered virtually at sea-level but the *Carex echinata-Sphagnum* mire is absent or no more than fragmentarily represented over most of the south-eastern lowlands of Britain, probably because suitable edaphic conditions are rare, rather than because of climatic exclusion. Within the community, however, climate is probably involved in the association of the *Juncus acutiflorus* sub-community with sites at lower altitude along the more westerly oceanic fringe. In this kind of *Carex echinata-Sphagnum* mire, too, *Molinia* tends to be better represented such that the vegetation comes very close to the distinctly Atlantic Junco-Molinion communities. And, as among the Rhynchosporion bog pools, the prominence of *Sphagnum auriculatum* here, which enables variants to be recognised in each of the sub-communities, is probably also related in some way to increased oceanicity in moving to the far west.

The other floristic differences within the community are of more uncertain origin but are perhaps related to a combination of the degree of waterlogging and the extent of grazing, factors which are often related because of the inaccessibility of wetter stands to the stock and deer which commonly graze the upland fringes where this kind of mire occurs. The general prominence of Nardo-Galion species throughout British Caricion nigrae mires is quite marked (in comparison, say, with their equivalents in Scandinavia: see Nordhagen 1928, 1943, Dahl 1956) and is a measure of the great prevalence of pasturing throughout our uplands. Within the *Carex echinata-Sphagnum* mire, more intensive grazing on somewhat firmer, drier ground may account for the differences between the *Carex nigra-Nardus* sub-community which is more frequent among calcifugous hill pastures and the *Carex echinata* sub-community of wetter flushes and soligenous areas within mires. And it has also been suggested that the general switch from sedge- to rush-dominance seen among the sub-communities might be related to treatment, perhaps sometimes grazing alone or, on mire surfaces, combinations of grazing, burning and drainage.

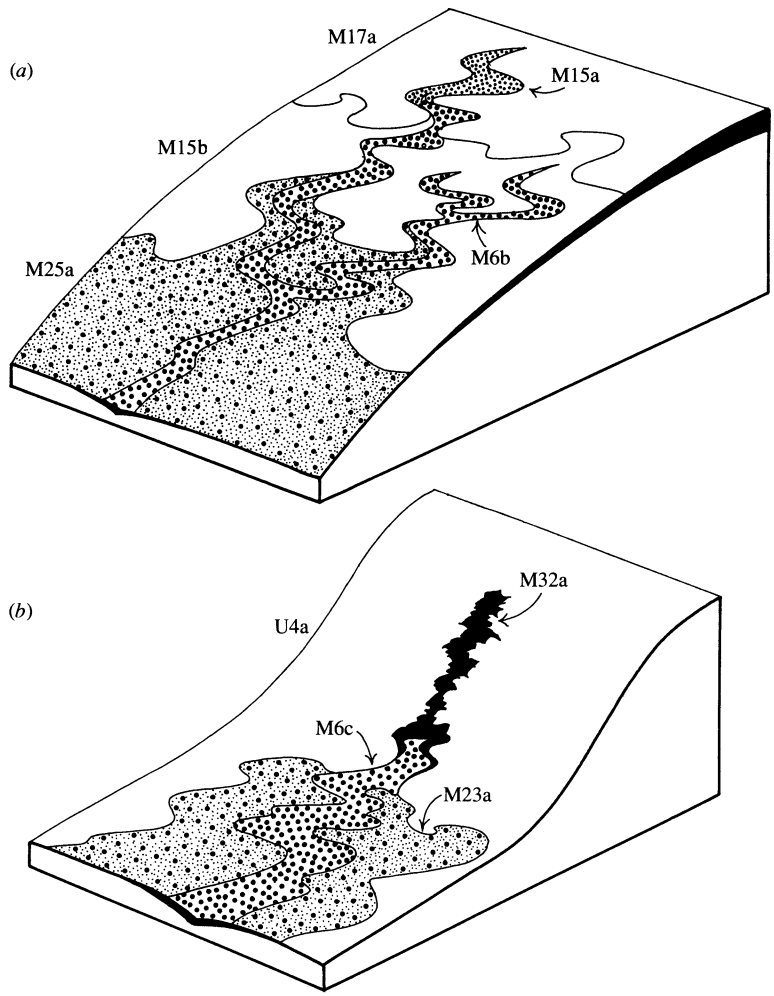
Zonation and succession

The *Carex echinata-Sphagnum* mire typically occurs as small stands among other mire communities, grasslands and heaths and sometimes with swamps and spring vegetation, where zonations are related to the water regime and the base- and nutrient-status of the environment. Grazing, especially where combined with drainage, can convert the community to grasslands and exclusion of herbivores would be expected to permit progression to wet scrub and woodland, though this would, in many cases, probably be slow and patchy.

Where the community occurs within or alongside mires, it usually marks out linear tracks where there is an obvious channelling of soligenous waters on the sloping peat surface, as on blanket and raised mires, or around the margins, as in the lagg of raised and basin mires. It can be found in association with all the major Erico-Sphagnion communities. In more oceanic areas, it occurs with the *Scirpus-Eriophorum* blanket mire, where

Figure 13. Base-poor flushes among mire (*a*) and pasture (*b*).
M6b *Carex echinata-Sphagnum* mire, *Carex-Nardus* sub-community
M6c *Carex echinata-Sphagnum* mire, *Juncus effusus* sub-community
M15a *Scirpus-Erica* wet heath, *Carex* sub-community
M15b *Scirpus-Erica* wet heath, Typical sub-community
M17a *Scirpus-Eriophorum* mire, *Drosera-Sphagnum* sub-community
M23a *Juncus-Galium* rush-pasture, *Juncus acutiflorus* sub-community
M25a *Molinia-Potentilla* mire, *Erica* sub-community
M32a *Philonoto-Saxifragetum*, *Sphagnum* sub-community
U4a *Festuca-Agrostis-Galium* grassland, Typical sub-community

it is usually represented by the *Carex echinata* or *Juncus acutiflorus* sub-communities, typically their *Sphagnum auriculatum* variants (McVean & Ratcliffe 1962, Birks 1973). Further east, low-altitude *Calluna-Eriophorum* blanket mire provides a common context for the *Juncus effusus* sub-community, generally its *Sphagnum recurvum* variant (Eddy *et al.* 1969). The community is also found with the *Erica-Sphagnum papillosum* raised mire and occasionally as a strip alongside the central zone of more acidic valley bogs with the *Narthecio-Sphagnetum* mire (Rose 1953). In such situations, it may occur in close association with Littorelletea pools and pass laterally to the drier mire surface with changes in the *Sphagnum* carpet and a switch to dominance of the vascular plants of the active plane. Rather more complex patterns can be seen where the *Carex echinata-Sphagnum* mire occupies the wetter areas within tracts of degraded or disturbed peat, where it is often found with the *Scirpus-Erica* wet heath to the far-west (Figure 13) or the *Erica-Sphagnum compactum* wet heath further east,



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and fragmentary recolonising vegetation, in pools and over redistributed peat and on streamside gravels and alluvium.

On the gentler slopes of the upland fringes, the *Carex echinata-Sphagnum* mire picks out seepage areas and water tracks where there is local accumulation of peat or a peaty topsoil to gleys of various kinds. Here, the sharpness of the vegetation boundaries is very variable according to the degree of flushing. With diffuse irrigation, there may be a very gradual transition to the surrounding grassland or heath; where waters emerge from vigorous springs or are channelled into definite trickles and streams, the junctions are correspondingly sharp and stands can be clearly seen and mapped from a great distance (and from aerial photographs), particularly if the dominants are rushes or if the *Sphagnum* carpet is well developed. The way the distribution of the community can provide an effective indication of the drainage system is well seen on the published maps of Cader Idris in Dyfed (Edgell 1969) and of Moor House in Cumbria (Eddy *et al.* 1969).

Where waters originate from definite springs, the community may pass upstream, and fragmentarily along its length, to the *Philonoto-Saxifragetum*. Laterally, around its margins, there is usually a transition to Nardo-Galion or Juncion acutiflori grasslands, or to heaths, as the peat thins to a humose topsoil over less strongly-gleyed profiles. These communities, particularly the grasslands, have some species in common with the *Carex echinata-Sphagnum* mire and, where grazing stock have access, there may be a strong continuity among the sedges and dicotyledons, blurring the boundary. Where the community occurs on drift-smeared slopes, outlying patches of the mire may mark areas of local waterlogging in hollows and on gentle slopes, creating a mosaic with the grasslands and heaths and, where uncontrolled grazing has allowed a spread of rushes over generally poorly-drained ground, this may mask the patterning among the smaller herbs and bryophytes.

Long-continued grazing, especially on naturally drier soils or where there has been some drainage, probably converts the *Carex echinata-Sphagnum* mire to the *Juncus-Galium* mire or swards dominated by mixtures of *Nardus stricta* and *Juncus squarrosus*. And with a concerted attempt at improvement with drainage and lime and fertiliser application, lower-altitude stands can be reduced to narrow strips of wet ground within pastures of *Lolio-Cynosuretum*. At all stages, neglect and blockage of drains may permit a reversion.

A combination of grazing on drier fringes and pronounced waterlogging elsewhere helps prevent the establishment of woody plants in the community but where these get a hold, they would probably lead to the development of the *Salix-Galium* woodland or the wetter forms of the *Betula-Molinia* woodland. Under existing conditions, however, the *Carex echinata-Sphagnum* mire seems to be a substantially stable component of the sub-montane landscape.

Distribution

The community is virtually ubiquitous in the upland fringes of Britain and intensive survey (as in Wales on the distribution map, which includes data from Ratcliffe & Hattey 1982) is guaranteed to increase the density of known occurrences. All the sub-communities occur throughout the range, though the *Juncus acutiflorus* type is commoner in the far west (not well shown on the maps) and the variants show a clear relationship to oceanicity.

Affinities

As defined here, the *Carex echinata-Sphagnum* mire brings together a variety of poor fens which have generally been separated on the basis of physiognomic dominance by either small sedges or rushes. The community is the major Caricion nigrae mire of the submontane parts of Britain, occupying a central position on a floristic axis related to base-status and calcium content of the waters between the mires of the Rhynchosporion and those of the Caricion davallianae. It grades in both directions, its combination of poor-fen herbs and absence of more base-tolerant Sphagna or hypnoid mosses and calcicolous vascular plants providing good general characters. It also shows close affinities with Juncion and Junco-Molinion communities in the Molinietalia and with Nardo-Galion vegetation and, in these directions, the balance between Sphagna and poor-fen herbs and grasses helps define the limits of the vegetation types. Caricion nigrae mires of this kind are widespread in Europe and similar communities have been described from France, Germany (Tüxen 1937, Schwickerath 1940, Ellenberg 1978), The Netherlands (Westhoff & den Held 1969) and Belgium (LeBrun *et al.* 1949), Norway and Iceland (Dierssen 1982 who also included British stands in his *Caricetum nigrae*).

Floristic table M6

	a	b	c	d	6
Carex echinata	V (1–8)	V (3–8)	III (1–5)	III (1–5)	IV (1–8)
Polytrichum commune	IV (1–8)	II (2–5)	V (2–9)	III (1–7)	IV (1–9)
Agrostis canina canina	IV (1–6)	III (1–5)	III (5–9)	III (2–6)	III (1–9)
Potentilla erecta	III (1–7)	IV (1–5)	II (1–5)	V (1–6)	III (1–7)
Viola palustris	III (2–5)	IV (1–5)	II (2–5)	III (1–6)	III (1–6)
Sphagnum recurvum	III (3–10)	III (1–9)	III (2–10)	III (1–9)	III (1–10)
Molinia caerulea	V (2–9)	II (2–5)	II (2–7)	IV (1–8)	III (1–9)
Sphagnum auriculatum	III (2–10)	II (3–6)	II (1–8)	II (1–6)	II (1–10)
Sphagnum palustre	II (2–8)	II (2–8)	II (2–10)	III (1–8)	II (1–10)
Drosera rotundifolia	II (1–5)			I (1–4)	I (1–5)
Potentilla palustris	I (1–5)				I (1–5)
Menyanthes trifoliata	I (3–5)				I (3–5)
Vaccinium oxycoccos	I (1–4)				I (1–4)
Eriophorum angustifolium	III (1–6)	V (2–7)	II (1–4)	I (1–3)	III (1–7)
Carex nigra	II (1–6)	V (3–8)	II (1–7)	II (1–4)	II (1–8)
Carex panicea	III (1–6)	IV (1–8)	I (3–4)	II (2–7)	II (1–8)
Nardus stricta	II (1–7)	IV (1–6)		I (2–3)	II (1–7)
Juncus squarrosus	II (2–7)	III (1–4)		I (1)	II (1–7)
Festuca ovina	I (1–5)	II (1–4)	I (2–6)	I (1–5)	I (1–6)
Ranunculus flammula	I (1–4)	II (1–4)		I (1–3)	I (1–4)
Luzula multiflora		II (1–2)		I (1–4)	I (1–4)
Carex dioica		II (1–2)			I (1–2)
Drepanocladus exannulatus		II (1–9)			I (1–9)
Agrostis capillaris		I (2–3)			I (2–3)
Cardamine pratensis		I (1–2)			I (1–2)
Juncus effusus	II (1–5)	I (1)	V (4–10)	I (1–3)	II (1–10)
Rumex acetosa			II (1–6)	I (2)	I (1–6)
Lotus uliginosus			I (1–5)		I (1–5)
Juncus acutiflorus			I (4–5)	V (4–9)	II (4–9)
Sphagnum capillifolium	I (2–4)	I (4)		II (1–7)	I (1–7)
Hypnum jutlandicum				II (1–5)	I (1–5)
Myrica gale				II (6–8)	I (6–8)
Anthoxanthum odoratum	II (2–4)	III (1–3)	II (1–5)	III (1–5)	II (1–5)
Sphagnum subnitens	II (4–6)	II (3–5)	II (2–6)	I (1–7)	II (1–7)

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Rhytidiadelphus squarrosus	I (1–4)	II (1–3)
Narthecium ossifragum	II (1–5)	II (1–5)
Sphagnum papillosum	II (3–8)	II (3–5)
Juncus bulbosus/kochii	II (1–5)	II (1–5)
Carex demissa	II (1–6)	II (1–5)
Aulacomnium palustre	I (1–6)	II (1–5)
Galium saxatile	I (1–5)	II (1–4)
Erica tetralix	II (1–4)	I (5)
Calliergon stramineum	I (3–4)	I (1–7)
Galium palustre	I (1–4)	I (1–3)
Cirsium palustre	I (1–4)	I (1–2)
Succisa pratensis	I (1–4)	I (1–3)
Epilobium palustre	I (2–3)	I (1–3)
Carex curta	I (1–4)	I (1–3)
Carex rostrata	I (4)	I (3–4)
Juncus articulatus	I (1–6)	I (2)
Eriophorum vaginatum	I (2–4)	I (4–5)
Calliergon cuspidatum		I (1–4)
Hydrocotyle vulgaris		I (2–6)
Carex pulicaris		I (1–3)
Holcus lanatus		I (1–3)
Lophocolea bidentata s.l.		
Number of samples	77	23
Number of species/sample	13 (6–24)	19 (11–26)
Herb height (cm)	23 (6–70)	22 (10–50)
Herb cover (%)	74 (15–100)	77 (40–95)
Bryophyte height (mm)	51 (20–150)	37 (30–50)
Bryophyte cover (%)	70 (5–100)	44 (2–95)
Altitude (m)	412 (7–1065)	419 (1–689)
Slope (°)	7 (0–28)	6 (0–18)
Soil pH	4.9 (3.4–6.0)	3.9 (3.3–4.5)

a *Carex echinata* sub-community
b *Carex nigra-Nardus stricta* sub-community
c *Juncus effusus* sub-community
d *Juncus acutiflorus* sub-community
6 *Carex echinata-Sphagnum recurvum/auriculatum* mire (total)

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II (1–7)	II (1–5)	II (1–7)
	II (1–5)	II (1–5)
I (1–9)	I (1–8)	II (1–9)
I (1–3)	I (1)	I (1–5)
	I (2–3)	I (1–6)
II (1–4)	I (1–3)	I (1–6)
II (1–5)	I (1–4)	I (1–5)
	II (1–6)	I (1–6)
I (1–4)	I (1–3)	I (1–7)
I (1–4)	I (1)	I (1–4)
	I (1–3)	I (1–4)
	I (1–6)	I (1–6)
	I (1)	I (1–3)
		I (1–4)
		I (3–4)
		I (1–6)
		I (2–5)
	I (1–5)	I (1–5)
	I (2–3)	I (2–6)
	I (1–3)	I (1–3)
	I (1–2)	I (1–3)
I (1–4)	I (1–4)	I (1–4)
62	42	204
16 (2–32)	17 (2–28)	15 (2–32)
52 (10–100)	53 (10–120)	36 (6–120)
80 (30–100)	77 (40–100)	75 (15–100)
52 (10–150)	58 (10–150)	52 (10–150)
70 (1–100)	58 (3–100)	65 (1–100)
389 (9–746)	203 (8–380)	371 (1–1065)
3 (0–10)	4 (0–12)	5 (0–28)
4.3 (3.3–5.7)	4.3 (3.7–4.5)	4.6 (3.3–6.0)

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Floristic table M6, variants

	ai	aii	bi	bii
Carex echinata	IV (2–8)	V (1–8)	V (3–8)	V (4–8)
Polytrichum commune	V (2–8)	III (1–6)	I (2–5)	III (2–5)
Agrostis canina canina	IV (1–6)	III (3–6)	IV (1–5)	II (3)
Potentilla erecta	III (1–7)	III (1–5)	IV (1–5)	V (2–4)
Viola palustris	II (3–4)	IV (2–5)	IV (1–5)	III (3–5)
Sphagnum recurvum	IV (3–10)	I (4–6)	III (1–8)	V (2–9)
Molinia caerulea	V (2–9)	V (2–8)		III (2–5)
Sphagnum auriculatum	I (2)	V (2–10)	II (3–6)	IV (1–9)
Sphagnum palustre	III (2–8)	II (3–5)	II (2–6)	II (2–8)
Drosera rotundifolia	I (4)	III (1–5)		
Potentilla palustris	I (3–5)	I (1–5)		
Menyanthes trifoliata	I (3)	II (3–5)		
Vaccinium oxycoccos	II (1–4)	I (4)		
Eriophorum angustifolium	II (1–4)	III (1–6)	V (2–7)	V (2–5)
Carex nigra	III (3–6)	II (1–6)	V (4–8)	V (3–8)
Carex panicea	II (2–6)	III (1–5)	IV (1–8)	III (2–4)
Nardus stricta	I (3–4)	II (1–7)	IV (1–6)	IV (1–4)
Juncus squarrosus	I (3–6)	II (2–7)	II (1–4)	IV (1–3)
Festuca ovina	I (3–5)	I (1–4)	I (1–3)	III (2–4)
Ranunculus flammula		I (1–4)	III (1–4)	I (3)
Luzula multiflora			II (1–2)	II (1–2)
Carex dioica			II (1–2)	I (2)
Drepanocladus exannulatus			II (1–9)	I (1–3)
Agrostis capillaris			I (3)	II (2–3)
Cardamine pratensis			I (1–2)	
Juncus effusus	II (3–5)	II (1–5)	II (1)	
Rumex acetosa				
Lotus uliginosus				
Juncus acutiflorus				
Sphagnum capillifolium	I (3–4)	I (2–4)		I (4)
Hypnum jutlandicum				
Myrica gale				
Anthoxanthum odoratum	II (3–4)	II (2–4)	III (1–2)	III (3)
Sphagnum subnitens		II (4–6)		III (3–5)
Rhytidiadelphus squarrosus	II (2–4)	I (1–4)	III (1–3)	I (2)

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ci	cii	di	dii
III (1–5)	III (1–5)	III (1–5)	IV (1–5)
V (2–8)	V (5–9)	IV (1–7)	II (1–4)
III (2–7)	III (5–9)	IV (3–6)	II (2–5)
III (1–5)	I (3)	V (1–6)	V (2–5)
II (2–5)	II (4)	IV (1–6)	II (1–2)
V (2–10)		V (1–9)	II (1–9)
II (2–7)	III (4–5)	IV (1–8)	V (5–8)
I (1)	V (4–8)	I (4–6)	IV (1–5)
II (2–10)	I (4)	III (1–8)	IV (1–8)
			II (1–4)
II (1–4)	I (1)	I (1)	II (2–3)
II (1–7)	I (4)	III (1–4)	I (3–4)
I (2–3)	II (3–4)	I (2–4)	IV (2–7)
		I (2–3)	I (2–3)
		I (1)	
II (2–6)		I (2–5)	I (1–3)
		I (1–3)	I (3)
		I (1–4)	
			I (1)
V (4–10)	V (5–9)	I (1–3)	
II (1–6)	I (4)	I (2)	
I (1–5)	II (2–4)		
I (4–5)		V (5–9)	V (4–7)
			III (1–7)
		I (3)	IV (1–5)
		I (1)	III (6–8)
II (1–5)	II (4–5)	III (1–5)	II (1–4)
I (6)	IV (2–5)	I (2–4)	II (1–7)
II (1–6)	I (7)	II (1–5)	III (1–2)

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Narthecium ossifragum	I (2–4)	II (1–5)	II (1–5)	III (2–3)				IV (2–5)
Sphagnum papillosum	I (4–8)	II (3–7)		III (3–5)	I (1–9)	II (3–5)	I (5–8)	II (1–7)
Juncus bulbosus/kochii	I (2–3)	III (1–5)	III (1–5)	II (2–3)		II (1–3)		II (1)
Carex demissa	I (6)	II (1–6)	II (1–5)	I (2)				I (2–3)
Aulacomnium palustre	II (1–6)	I (1–3)	II (1–4)	III (1–5)	II (1–4)	I (2)	I (1–3)	I (2)
Galium saxatile	I (1–5)	I (1–3)	II (1–4)	II (2–3)	III (1–5)		I (1–4)	
Erica tetralix	I (1–4)	II (1–4)		I (5)				IV (1–6)
Calliergon stramineum	II (3–4)	I (3)	I (2–7)	II (1–3)	II (1–4)		I (1–3)	
Galium palustre	I (1–4)	I (1–4)	I (1–3)		I (1–4)	II (1–3)	I (1)	
Cirsium palustre	II (1–3)	I (1–4)	I (1–2)				I (1–3)	I (1)
Succisa pratensis	II (2–4)	I (1–4)	I (1)	I (3)			I (2–4)	III (1–6)
Epilobium palustre	I (3)	I (2)	II (1–3)				I (1)	
Carex curta	I (1–4)			I (1–3)				
Carex rostrata	I (4)	I (4)		II (3–4)				
Juncus articulatus	II (1–6)	I (1–5)		I (2)				
Eriophorum vaginatum	I (2–4)	I (2)		II (4–5)				
Calliergon cuspidatum			II (1–4)	I (1)			I (5)	I (1–3)
Hydrocotyle vulgaris			II (2–6)				I (2–3)	
Carex pulicaris			II (1–3)				I (1)	I (1–3)
Holcus lanatus			I (1–3)	I (2)			II (1)	I (1–2)
Lophocolea bidentata s.l.					II (1–4)		I (4)	I (1–2)
Number of samples	34	43	14	9	57	5	27	15
Number of species/sample	12 (6–24)	14 (6–24)	18 (11–24)	21 (19–26)	16 (2–31)	17 (4–32)	16 (2–28)	19 (15–28)
Herb height (cm)	26 (6–70)	21 (10–60)	25 (12–50)	13 (10–15)	54 (10–100)	38 (10–80)	60 (35–120)	44 (10–75)
Herb cover (%)	81 (20–100)	69 (15–100)	78 (40–95)	70	82 (30–100)	73 (40–100)	74 (40–100)	81 (45–98)
Bryophyte height (mm)	66 (20–150)	41 (20–150)		37 (30–50)	54 (10–150)	44 (40–70)	58 (10–150)	60 (40–80)
Bryophyte cover (%)	66 (18–100)	72 (5–100)	42 (2–95)	55 (40–70)	68 (1–100)	76 (15–100)	64 (15–90)	50 (3–100)
Altitude (m)	412 (30–884)	413 (7–1065)	407 (1–689)	445 (390–540)	400 (9–746)	313 (140–440)	239 (8–380)	152 (40–290)
Slope (°)	6 (0–28)	8 (0–20)	5 (0–18)	8 (0–13)	3 (0–10)		6 (0–12)	2 (0–8)
Soil pH	4.9 (3.4–5.9)	4.8 (3.4–6.0)		3.9 (3.3–4.5)	4.4 (3.3–5.7)	4.0 (3.3–4.5)	4.3 (3.7–4.5)	

ai *Carex echinata* sub-community, *Sphagnum recurvum* variant
aii *Carex echinata* sub-community, *Sphagnum auriculatum* variant
bi *Carex nigra-Nardus stricta* sub-community, *Sphagnum recurvum* variant
bii *Carex nigra-Nardus stricta* sub-community, *Sphagnum auriculatum* variant
ci *Juncus effusus* sub-community, *Sphagnum recurvum* variant
cii *Juncus effusus* sub-community, *Sphagnum auriculatum* variant
di *Juncus acutiflorus* sub-community, *Sphagnum recurvum* variant
dii *Juncus acutiflorus* sub-community, *Sphagnum auriculatum* variant

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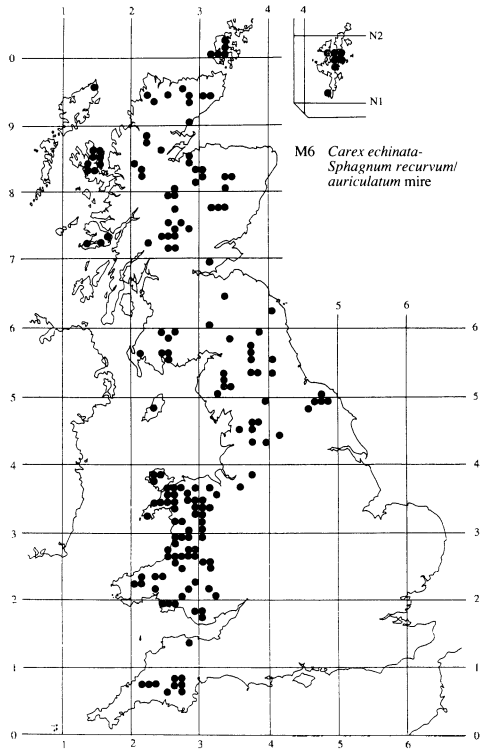

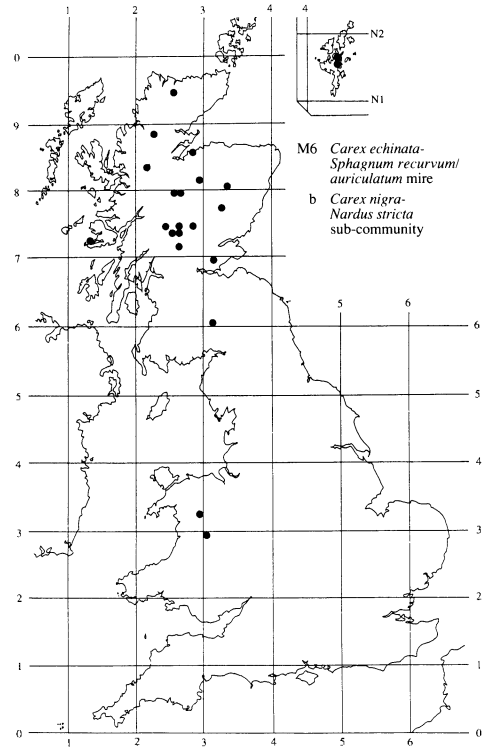

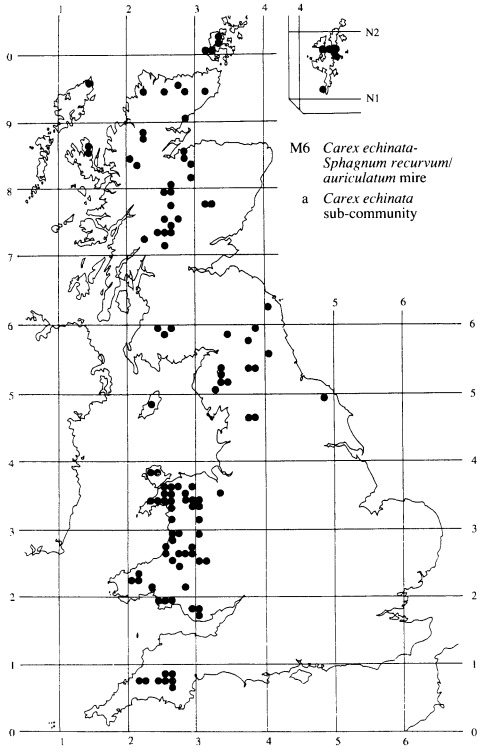

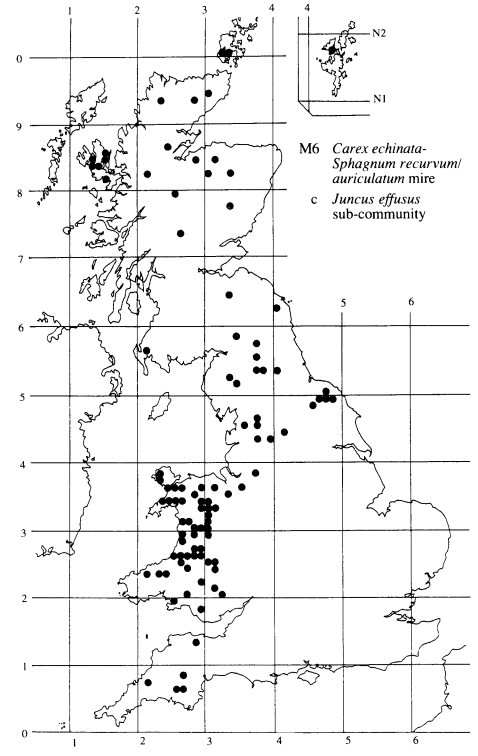

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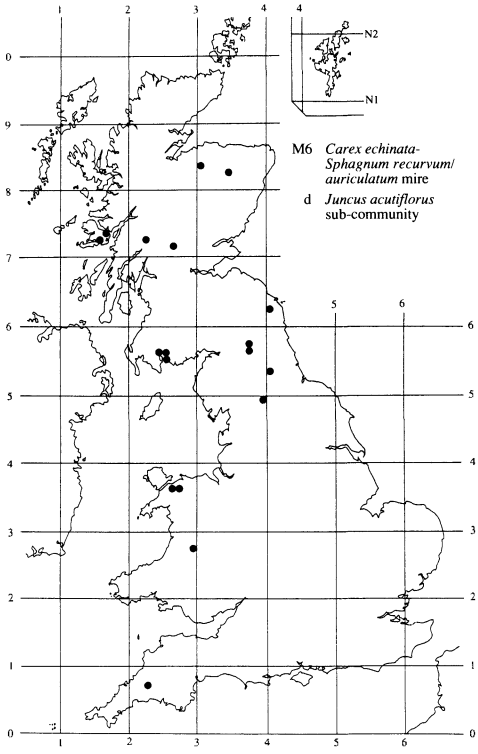

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