M8
Carex rostrata-Sphagnum warnstorfii mire

Synonymy
Carex rostrata-Sphagnum warnstorfianum nodum McVean & Ratcliffe 1962, Eddy *et al.* 1969; *Violo-Epilobietum sphagnetosum recurvae* Jones 1973 *p.p.*; *Menyantho-Sphagnetum teretis* Dierssen 1982.

Constant species
Carex nigra, *C. rostrata*, *Epilobium palustre*, *Festuca ovina*, *Potentilla erecta*, *Selaginella selaginoides*, *Viola palustris*, *Aulacomnium palustre*, *Calliergon cuspidatum*, *Hylocomium splendens*, *Rhizomnium pseudopunctatum*, *Sphagnum teres*, *S. warnstorfii*.

Rare species
Homalothecium nitens, *Sphagnum subsecundum*.

Physiognomy
The *Carex rostrata-Sphagnum warnstorfii* mire has a dominant cover of sedges over an extensive carpet of base-tolerant Sphagna and a fairly numerous and diverse assemblage of herbs. As in the lowland counterpart of this community, the *Carex-Sphagnum squarrosum* mire, *Carex rostrata* and *C. nigra* are the commonest sedges, the former generally the more abundant and often of high cover, the latter usually subordinate though locally dominant. Other poor-fen sedges, *C. panicea*, *C. echinata* and *C. demissa*, occur frequently and sometimes in abundance, and *C. pulicaris* is occasional, but the more calciolous *C. dioica* is rare and *C. curta*, an occasional associate of *C. rostrata* in oligotrophic mires, likewise scarce. There is frequently a little *Eriophorum angustifolium* among the sedge cover, much less often small amounts of one of the bulkier Junci, *Juncus articulatus* or, more rarely, *J. effusus* or *J. acutiflorus*.

The *Sphagnum* carpet is typically extensive and quite distinctive in the prominence, along with *S. recurvum*, of the base-tolerant *S. teres* and *S. warnstorfii*, the latter an especially good preferential for this kind of montane mire. *S. subsecundum sensu stricto* occurs more occasionally but is also very characteristic and the community provides one of the loci in Britain for *S. contortum*, though it is not so common here as in the *Carex-Calliergon* mire. *S. squarrosum* occurs occasionally but is not so consistent as in the *Carex-Sphagnum squarrosum* mire. Other low-frequency species include *S. palustre*, *S. girgensohnii*, *S. capillifolium*, *S. subnitens* and *S. papillosum*, all generally of low cover. *S. cuspidatum* and *S. auriculatum* are typically absent.

Other bryophytes are numerous with *Aulacomnium palustre* and *Rhizomnium pseudopunctatum* attaining higher frequency here than in any other of our montane mires. Also distinctive are *Calliergon cuspidatum*, *C. stramineum* and, less frequently, the montane *C. sarmentosum*, though not *C. trifarium* which is more typical of the *Caricetum saxatilis*. Quite common and more strictly diagnostic than any of these is *Homalothecium nitens*. Then there are frequent records for *Hylocomium splendens* and *Rhytidiadelphus squarrosus* and such indicators of some base-enrichment as *Pellia endiviifolia*, *Drepanocladus revolvens*, *Bryum pseudotriquetum*, *Thuidium tamariscinum*, *Campylium stellatum* and *Fissidens adianthoides*. *Philonotis fontana*, *Polytrichum commune*, *Aneura pinguis*, *Lophocolea bidentata s.l.*, *Calypogeia fissa*, *Scapania nemorosa* and *Chiloscyphus polyanthos* are occasional.

Scattered among the bryophytes is a quite rich mixture of herbaceous associates, though these are typically of low total cover. Some are poor-fen species like *Viola palustris* and *Epilobium palustre* and, more occasional, *Caltha palustris*; others, plants which are of broader affinities, but well represented in the Caricion nigrae, such as *Potentilla erecta* and *Galium saxatile*. But, along with these, is constant *Selaginella selaginoides*, a good preferential against other communities of the Scheuchzerietalia. Then, grasses can be quite numerous, with *Festuca ovina* (and *F. vivipara*), *Nardus stricta*, *Anthoxanthum odoratum* and *Agrostis stolonifera*, all generally present as scattered shoots or small tussocks; and there can be a few individuals of *Thalictrum alpinum*, *Polygonum viviparum*, *Leontodon autumnalis*, *Luzula multiflora* or, in wetter places, *Potentilla palustris* and *Juncus*

bulbosus. Small bushes of *Erica tetralix* can be seen in some stands and there can be some seedlings of *Salix aurita*, though Arctic-Alpine willows, which are a prominent feature of similar vegetation in Scandinavia, are absent from British stands.

Habitat

The community is strictly confined to raw peat soils in waterlogged hollows in the montane zone of Britain where there is moderate base-enrichment by drainage from calcareous rocks.

Conditions suitable for the development of this kind of mire, which requires some degree of stagnation without the formation of base-poor and oligotrophic peat, are only rarely encountered: in the montane zone, small basins or perched flats generally develop more oligotrophic mires. The community is thus restricted to areas where ground waters drain from calcareous bedrocks and is especially characteristic of the Central Highlands of Scotland where Dalradian limestones, schists and epidiorites occur at high altitudes. It has also been recorded at Moor House in Cumbria (Eddy *et al.* 1969) and from Widdybank Fell in Durham (Jones 1973, Bradshaw & Jones 1976) where drainage is from Carboniferous Limestone; and it occurs in fragmentary form on more calcareous outcrops in the Moffat Hills in Dumfries and the Lake District (Eddy *et al.* 1969), though these localities have not been sampled.

The peat deposits on which the community is found are typically quite deep, usually more than 1 m (McVean & Ratcliffe 1962), with a high and stagnant water-table, features which help to mark off the habitat from that of montane flushed grasslands on the one hand (what McVean & Ratcliffe (1962) called *Hypno-Caricetum alpinum*) and, on the other, the *Caricetum saxatilis* mire, where there is a strong and constant through-put of water and greater calcium-enrichment. The base-status of the waters and peats here is usually in the range pH 5.5–6, a feature reflected in the intermediate character of the vegetation which is very similar to that of the *Carex-Sphagnum squarrosum* mire, found in analogous situations in the lowlands. Quite base-tolerant Sphagna predominate in the bryophyte carpet, with species such as *Aulacomnium* and *Calliergon stramineum*, and poor-fen sedges and dicotyledons are prominent above; and, although some moderately calcicolous bryophytes and herbs help mark off the community from the rest of the Caricion nigrae mires, these have not yet gained the ascendancy they show in the Caricion davallianae rich fens.

What helps separate this community from its lowland counterpart is a small but distinct montane element in the flora. This kind of mire is generally confined to altitudes between 400 and 800 m, where the mean annual maximum temperature is usually below 23 °C (Conolly & Dahl 1970), and the presence of *Sphagnum warnstorfii* and the occasional *Calliergon sarmentosum*, together with Arctic-Alpine herbs such as *Thalictrum alpinum* and *Polygonum viviparum*, is quite diagnostic. In comparison with similar Scandinavian vegetation, however, this component is not well developed in Britain.

Zonation and succession

The *Carex-Sphagnum warnstorfii* mire typically occurs as small stands which can be sharply marked off from unirrigated surrounds or which can form part of swamp and mire complexes where water-depth and degree of base-richness influence the vegetation patterns. In the former situation, the community can occupy stagnant hollows in tracts of montane grasslands with a fringe of irrigated sward between, or mark out areas of base-enrichment below high-altitude ombrogenous bog, usually the *Calluna-Eriophorum* mire. In more extensive soligenous areas, it can be seen in zonations analogous to those in which the *Carex-Sphagnum squarrosum* mire occurs at lower altitudes, with the *Caricetum rostratae* replacing it towards open water and patches of the *Carex curta-Sphagnum russowii* and *Carex-Calliergon* mires indicating areas with a waning or increasing influence of base-richness.

The frequent presence of seedlings of *Salix aurita* in stands of the community may indicate a tendency towards the development of montane willow scrub but such successions have never been seen to progress further.

Distribution

Apart from a few far-flung (and sometimes fragmentary) stands in southern Scotland and northern England, the community is confined to the Central Highlands.

Affinities

The *Carex-Sphagnum warnstorfii* mire stands largely as originally defined by McVean & Ratcliffe (1962) and, though its relationships with other poor fens are very close, it seems better to retain it as a discrete community rather than unite it in a more broadly-defined unit like the *Violo-Epilobietum* of Jones (1973). It lies within the Caricion nigrae, though the presence of more basiphilous species place it close to the boundary with the rich-fens of the Caricion davallianae. It can be seen as the montane counterpart of the *Carex-Sphagnum squarrosum* mire and, among the upland mires, shares with the *Carex curta-Sphagnum russowii* mire a good representation of Nardetalia grassland species.

Although very local in Britain this kind of vegetation has clear affinities with Scandinavian mires like the *Salix lapponum-Carex rostrata-Sphagnum warnstorfii* sociation of Nordhagen (1943), the *Aulacomnieto-Sphagnum warnstorfii* of Dahl (1956) and the *Menyantho-Sphagnetum teretis* of Dierssen (1982).

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Floristic table M8

Carex rostrata	V (6–9)
Sphagnum warnstorfii	V (4–7)
Rhizomnium pseudopunctatum	V (2–3)
Viola palustris	V (2–4)
Sphagnum teres	IV (2–6)
Aulacomnium palustre	IV (3–4)
Hylocomium splendens	IV (1–4)
Carex nigra	IV (2–6)
Festuca ovina	IV (2–5)
Potentilla erecta	IV (1–3)
Calliergon cuspidatum	IV (1–3)
Epilobium palustre	IV (2)
Selaginella selaginoides	IV (1–3)
Rhytidiadelphus squarrosus	III (1–3)
Homalothecium nitens	III (3–6)
Carex panicea	III (2–6)
Eriophorum angustifolium	III (2–4)
Pellia endiviifolia	III (1–3)
Galium saxatile	III (1–3)
Philonotis fontana	III (1–4)
Carex echinata	III (4–6)
Nardus stricta	III (2–4)
Carex demissa	III (2–6)
Drepanocladus revolvens	III (2–4)
Bryum pseudotriquetrum	III (1–2)
Calliergon stramineum	III (1–3)
Sphagnum recurvum	III (2–6)
Thalictrum alpinum	II (2–3)
Carex pulicaris	II (3)
Polygonum viviparum	II (2–3)
Luzula multiflora	II (1–2)
Anthoxanthum odoratum	II (2–3)
Leontodon autumnalis	II (2–3)
Thuidium tamariscinum	II (1–3)
Caltha palustris	II (2–3)
Campylium stellatum	II (3)
Juncus bulbosus/kochii	II (2–4)
Polytrichum commune	II (2)
Aneura pinguis	II (2–3)
Sphagnum girgensohnii	II (1–3)
Lophocolea bidentata s.l.	II (1–3)
Agrostis stolonifera	II (1–4)
Fissidens adianthoides	II (2)
Potentilla palustris	II (2–4)
Sphagnum subsecundum	II (3–8)
Erica tetralix	II (2–4)
Calypogeia fissa	II (1–2)
Drepanocladus fluitans	II (1–3)
Scapania nemorosa	II (1–3)
Sphagnum palustre	II (1–4)
Chiloscyphus polyanthos	II (1–2)
Juncus articulatus	II (1–2)
Calliergon sarmentosum	II (2)
Climacium dendroides	I (1–2)
Salix aurita	I (1)
Alchemilla vulgaris agg.	I (2)
Ptilidium ciliare	I (1–2)
Tritomaria quinquedentata	I (1–3)
Euphrasia officinalis agg.	I (3)
Cerastium fontanum	I (1)
Festuca vivipara	I (2)
Pinguicula vulgaris	I (1–2)
Rhytidiadelphus loreus	I (1–2)
Dicranum bonjeani	I (2)
Sphagnum papillosum	I (1–7)
Sphagnum contortum	I (2–3)
Pleurozium schreberi	I (1–2)
Pseudoscleropodium purum	I (1)
Equisetum palustre	I (3)
Cirsium palustre	I (2)
Scapania undulata	I (3)
Sphagnum squarrosum	I (1–9)
Plagiomnium rostratum	I (2)
Cardamine pratensis	I (1–2)
Jungermannia atrovirens	I (2)
Thuidium delicatulum	I (2)
Galium palustre	I (2)
Dicranella palustris	I (1–3)
Brachythecium rutabulum	I (2–3)
Pedicularis palustris	I (1)
Carex lepidocarpa	I (2)
Empetrum nigrum nigrum	I (3)
Calluna vulgaris	I (1)
Alchemilla filicaulis vestita	I (1)
Betula seedling	I (1)
Trientalis europaea	I (3)
Crepis paludosa	I (2)
Calypogeia trichomanis	I (1)
Empetrum nigrum hermaphroditum	I (1–2)
Carex bigelowii	I (4)
Deschampsia cespitosa	I (3)
Parnassia palustris	I (3)
Ptilium crista-castrensis	I (2)
Carex saxatilis	I (1)

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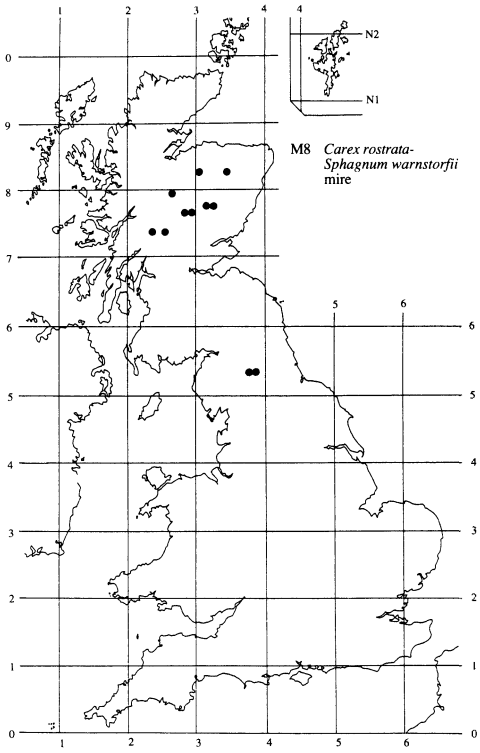
Carex curta	I (2–3)
Harpanthus flotovianus	I (2)
Ranunculus acris	I (4)
Agrostis capillaris	I (4)
Festuca rubra	I (3)
Linum catharticum	I (1)
Juncus effusus	I (2)
Carex dioica	I (1)
Epilobium anagallidifolium	I (1)
Riccardia multifida	I (2)
Alchemilla glabra	I (1)
Brachythecium rivulare	I (1)
Valeriana dioica	I (1)
Triglochin palustris	I (1)
Veronica scutellata	I (1)
Pellia epiphylla	I (1)
Juncus acutiflorus	I (2)
Potamogeton polygonifolius	I (1)
Luzula sylvatica	I (1)
Calliergon giganteum	I (1)
Sphagnum subnitens	I (1–4)
Hypnum jutlandicum	I (3)
Ctenidium molluscum	I (2)
Drosera rotundifolia	I (1)
Leiocolea bantriensis	I (1)
Number of samples	10
Number of species/sample	36 (22–46)
Vegetation height (cm)	32
Vegetation cover (%)	100
Altitude (m)	613 (427–833)
Slope (°)	5 (0–25)



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