M7
Carex curta-Sphagnum russowii mire

Synonymy
Sphagneto-Caricetum alpinum McVean & Ratcliffe 1962, Eddy *et al.* 1969; Alpine *Carex-Sphagnum* mire Ratcliffe 1964; *Carex aquatilis-rariflora* nodum McVean & Ratcliffe 1962, Ratcliffe 1964; *Violo-Epilobietum sphagnetosum recurvae* Jones 1973 *p.p.*; *Caricetum nigrae* Dierssen 1982 *p.p.*; *Caricetum rariflorae* Dierssen 1982; *Drepanoclado exannulati-Caricetum aquatilis* Dierssen 1982 *p.p.*

Constant species
Carex curta, *C. echinata*, *Eriophorum angustifolium*, *Viola palustris*, *Sphagnum papillosum*, *S. russowii*.

Rare species
Carex aquatilis, *C. rariflora*, *Sphagnum lindbergii*, *S. riparium*.

Physiognomy
The *Carex curta-Sphagnum russowii* mire is a community whose prominent cyperaceous and *Sphagnum* components both have a distinct northern and montane character. Among the former element, *Eriophorum angustifolium* and *Carex echinata* are both very frequent and provide a floristic link with the lower-altitude *Carex echinata-Sphagnum* mire; the latter species can be abundant here and is sometimes co-dominant in the sedge canopy. But, in contrast to that community, the Continental Northern *Carex curta* is a constant in this kind of mire and is quite frequently of high cover; and it is often accompanied by either the Arctic-Alpine *C. bigelowii* or the Arctic-Subarctic *C. aquatilis* and *C. rariflora*. *C. nigra* can also occur, sometimes in abundance, but *C. rostrata*, which can accompany it in some wetter Caricion nigrae mires, is typically scarce and of low cover. *Scirpus cespitosus* is occasionally found and, particularly in transitions to blanket mire, there may be a little *Eriophorum vaginatum*. *Juncus bulbosus/kochii* and *J. squarrosus* occur at low frequencies but, in contrast to the *Carex echinata-Sphagnum* mire, bulkier Junci, like *J. effusus* and *J. acutiflorus*, are very scarce here and do not function as alternative dominants over the *Sphagnum* carpet.

As in other Scheuchzerietalia mires, this carpet is typically very extensive and some of the prominent species are of wide distribution. Thus, *Sphagnum papillosum* is common throughout and it can be very abundant, especially where the community grades to surrounding blanket mire. Then, in the different sub-communities, there can be frequent records for *S. subnitens*, *S. auriculatum*, *S. capillifolium* or *S. recurvum*. Much more distinctive here is the constancy of the northern, high-altitude species *S. russowii* and, in one of the sub-communities, *S. lindbergii*. *S. girgensohnii* may also be found and *S. riparium* occurs in this community at some of its few Scottish stations. In contrast to more base-rich mires at high altitudes, *S. warnstorfii* and *S. contortum* are typically absent.

Among the Sphagna, there is frequently some *Polytrichum commune*, *Calliergon stramineum* or *C. sarmentosum* and, preferentially in one of the sub-communities, *Drepanocladus exannulatus*, *Polytrichum alpinum* and *P. alpestre*. *Lophozia ventricosa* occurs occasionally and there is sometimes a little *Scapania undulata* or *S. uliginosa*.

In this ground, grasses and dicotyledons play a relatively minor role, though, among the former, *Nardus stricta* is very common and *Agrostis canina* ssp. *canina* quite frequent, and both can be locally abundant. *A. stolonifera* and *Festuca vivipara* can also sometimes be found, but *Molinia caerulea*, a prominent species in the *Carex echinata-Sphagnum* mire, is typically absent. *Viola palustris* and *Galium saxatile* are the commonest dicotyledons of the community but are typically of low cover and not consistently accompanied by the richer suites of poor-fen herbs characteristic of lower-altitude mires. The Arctic-Alpine *Saxifraga stellaris* is fairly frequent in one sub-community.

https://doi.org/10.1017/9780521391658.011 Published online by Cambridge University Press

Sub-communities

***Carex bigelowii-Sphagnum lindbergii* sub-community:** *Sphagneto-Caricetum alpinum* McVean & Ratcliffe 1962, Eddy *et al.* 1969; Alpine *Carex-Sphagnum* mire Ratcliffe 1964; *Violo-Epilobietum sphagnetosum recurvae*, *Sphagnum papillosum* variant Jones 1973 p.p.; *Caricetum nigrae* Dierssen 1982. In this sub-community, *C. echinata* and the preferentially frequent *C. bigelowii* tend to dominate among the sedge canopy, with *C. curta* still common, though not usually of very high cover. Other sedges are rather scarce but *Nardus stricta* and *Agrostis canina* ssp. *canina* are frequent and, among the few dicotyledons, *Saxifraga stellaris* is preferential.

The other distinctive features of this kind of *Carex-Sphagnum russowii* mire are to be found in the bryophyte element. First, among the Sphagna, *S. lindbergii* is strongly diagnostic and, with *S. papillosum*, usually makes up the bulk of the cover, with *S. russowii* frequent, though usually less abundant. Then, there can be locally prominent patches of *S. subnitens*, *S. auriculatum* (both var. *auriculatum* and var. *inundatum*) or *S. compactum* with, less commonly, *S. magellanicum* or *S. cuspidatum*. Second, the associated bryophyte flora is a little richer than in the *Carex aquatilis-Sphagnum recurvum* sub-community. *Polytrichum commune* occurs frequently but more distinctive are *Calliergon sarmentosum*, *Drepanocladus exannulatus*, *Polytrichum alpinum*, *P. alpestre* and, more rarely, *Pellia epiphylla* and *Racomitrium lanuginosum*.

***Carex aquatilis-Sphagnum recurvum* sub-community:** *Carex aquatilis-rariflora* nodum McVean & Ratcliffe 1962, Ratcliffe 1964; *Violo-Epilobietum sphagnetosum recurvae*, *Sphagnum papillosum* variant Jones 1973 *p.p.*; *Caricetum rariflorae* Dierssen 1982; *Drepanoclado exannulati-Caricetum aquatilis* Dierssen 1982 *p.p.* *Carex echinata* remains frequent and is often abundant here but, in contrast to the above, *C. curta* is often co-dominant and *C. bigelowii* very scarce. More striking is the occurrence in some stands of the rare *C. aquatilis*, here growing dwarfed in contrast to its appearance in the *Caricetum vesicariae* or *Caricetum rostratae* of open-water transitions and, especially good as a diagnostic species, *C. rariflora*, a very shy flowerer and thus easily missed or under-estimated. *C. nigra* is also more common here than in the other sub-community and, like the two rare sedges, it can be locally abundant.

There is also a little more diversity here among the vascular associates. *Nardus* is only occasional and sparse but *Festuca vivipara*, *Agrostis stolonifera*, *Deschampsia flexuosa*, *Luzula multiflora* and *Galium saxatile* are strongly preferential and there are occasional records for *Epilobium palustre* and *Trientalis europaea*.

The bryophyte element, too, is distinctive. *Sphagnum papillosum* and *S. russowii* both remain very frequent but the most abundant species is usually *S. recurvum*, a rather uncommon and low-cover member of the *Sphagnum* carpet in the other sub-community. *S. lindbergii* is absent and *S. subnitens*, *S. auriculatum*, *S. compactum* and *S. capillifolium* very scarce but *S. girgensohnii* and *S. riparium* are weakly preferential and there is occasionally some *S. teres*. Other bryophytes are rather few in number but *Polytrichum commune* tends to be better represented here and *Calliergon stramineum* replaces *C. sarmentosum*.

Habitat

The *Carex-Sphagnum russowii* mire is confined to high-altitude sites where peaty soils are irrigated by oligotrophic and base-poor waters, being most characteristic of hollows and drainage channels in blanket mire or flushes and seepage areas in tracts of montane moss-heaths.

Throughout its range, the community is found largely at altitudes of more than 650 m, extending up to more than 1100 m on the high summit plateaus of the Central Highlands of Scotland. In this region, which comprises the centre of distribution, the mean annual maximum temperature is generally less than 20 °C (Conolly & Dahl 1970), with conditions a little less extreme where the community extends on to the southern Pennines, at a few far-flung localities within a 25 °C isotherm (Eddy *et al.* 1969, Jones 1973, Bradshaw & Jones 1976). Winters in these areas are long and bitter and snow-lie may play some part in determining the distribution of stands, particularly those of the *Carex bigelowii-Sphagnum lindbergii* sub-community (McVean & Ratcliffe 1962).

This community is very much an altitudinal replacement for the *Carex echinata-Sphagnum* mire, a feature noted in McVean & Ratcliffe's (1962) designation of the two vegetation types as *Sphagneto-Caricetum alpinum* and *sub-alpinum* respectively. There is a fairly strong floristic overlap between the two communities but the pre-eminence here of montane plants like *Carex curta*, *C. bigelowii*, *C. aquatilis*, *C. rariflora*, *Saxifraga stellaris*, *Sphagnum russowii*, *S. lindbergii* and *S. riparium* and the scarcity of species such as *Carex panicea*, *Juncus effusus* and *Molinia* provide a generally good separation. However, the representation of some of the rare species is decidedly local and deliberate selection of stands in the data inherited from McVean & Ratcliffe (1962) may have produced an over-sharp picture of the differences. At lower altitudes, the two communities can grade into one another, a feature well seen in the *Sphagneto-Caricetum alpinum* which Eddy *et al.* (1969) described from Moor House in Cumbria. The upper altitudinal limit of the community may be partly set by scarcity of suitable sites, though *Sphagnum* growth, even among

https://doi.org/10.1017/9780521391658.011 Published online by Cambridge University Press

the more montane species, may be inhibited at extremely high levels (McVean & Ratcliffe 1962).

The *Carex-Sphagnum russowii* mire occupies very similar edaphic situations to those characteristic of its low-altitude counterpart, occurring on permanently moist peats fed by nutrient-poor waters collecting in hollows or percolating from granitic rocks, quartzose mica-schists or siliceous sedimentaries. The poverty of bases and cations here is a major difference between the habitat of this community and those of the *Carex-Sphagnum warnstorfii* mire, which is not so strikingly montane but which has a more base-tolerant *Sphagnum* component, and the *Caricetum saxatilis* which is found at comparable altitudes but which is much more obviously calcicolous.

The exact nature of the edaphic environment may play some part in determining the floristic differences between the two sub-communities, with the *Carex aquatilis-Sphagnum recurvum* type perhaps more characteristic of deeper peats with more stagnant ground-water (McVean & Ratcliffe 1962), but such a suggestion remains unconfirmed.

Zonation and succession

The community is typically found as small stands, most commonly in association with high-altitude *Calluna-Eriophorum* blanket mire, usually of the *Vaccinium-Hylocomium* sub-community (the *Empetreto-Eriophoretum* of McVean & Ratcliffe 1962), within which it can occupy hollows or drainage channels or form part of recolonising vegetation over eroded areas (McVean & Ratcliffe 1962, Eddy *et al.* 1969). Transitional zones around such stands of the *Carex-Sphagnum russowii* mire are often marked by an increase in *Eriophorum vaginatum* and a shift towards dominance of *S. papillosum* in the moss carpet. In other situations, the community can mark out spring or seepage lines within tracts of montane moss-heaths like the *Carex bigelowii-Polytrichum alpinum* or *Racomitrium-Carex bigelowii* communities, or high-level grasslands dominated by *Nardus stricta* or *Juncus squarrosus*, sometimes occurring in mosaics with floristically-related snow-bed vegetation. Where there is strong flushing, the community is often found around the *Philonoto-Saxifragetum* spring and rill community.

Most of the occurrences of the *Carex-Sphagnum russowii* mire are close to or above the potential forest limit in the Scottish Highlands and the community is probably an essentially stable component of the vegetation pattern under present-day conditions; and it would probably remain so were grazing to be much reduced.

Distribution

The community is largely confined to the higher reaches of the Central Highlands of Scotland. The *Carex aquatilis-Sphagnum recurvum* sub-community is the more local type, being concentrated around the Clova-Caenlochan area of the east-central Highlands, with the *Carex bigelowii-Sphagnum lindbergii* sub-community extending also to the hills of the Ben Alder and Creag Meagaidh massifs and to some isolated localities in the north-west Highlands. Essentially similar vegetation, with a poorer representation of the montane element, occurs at Moor House in Cumbria and on Widdybank Fell in Durham and perhaps also in Wales.

Affinities

As defined here, the *Carex-Sphagnum russowii* mire unites the two closely-related noda which McVean & Ratcliffe (1962) characterised from high-altitude oligotrophic flushes, retaining their distinction (with some minor re-allocation of samples) at sub-community level. The community is a high-montane counterpart of the *Carex echinata-Sphagnum* mire and clearly belongs among the poor-fens of the Caricion nigrae. Its nearest counterparts on the European mainland can be found among the series of mires described from Scandinavia by Nordhagen (1928, 1943), Dahl (1956) and Dierssen (1982) where *Sphagnum lindbergii* (and, to a lesser extent, *S. riparium*) occurs prominently in association with *Calliergon stramineum*, *Drepanocladus exannulatus* and a variety of sedges including *C. rariflora* and *C. aquatilis*. Such vegetation has usually been placed in a separate alliance, the Caricion lasiocarpae or Leuco-Scheuchzerion, within the Scheuchzerietalia.

Floristic table M7

	a	b	7
Eriophorum angustifolium	V (2–5)	V (2–4)	V (2–5)
Sphagnum papillosum	V (1–10)	IV (3–5)	V (1–10)
Carex curta	IV (1–5)	V (4–7)	IV (1–7)
Viola palustris	IV (2–3)	V (2–3)	IV (2–3)
Carex echinata	IV (2–7)	IV (3–6)	IV (2–7)
Sphagnum russowii	IV (1–3)	IV (2–3)	IV (1–3)

https://doi.org/10.1017/9780521391658.011 Published online by Cambridge University Press

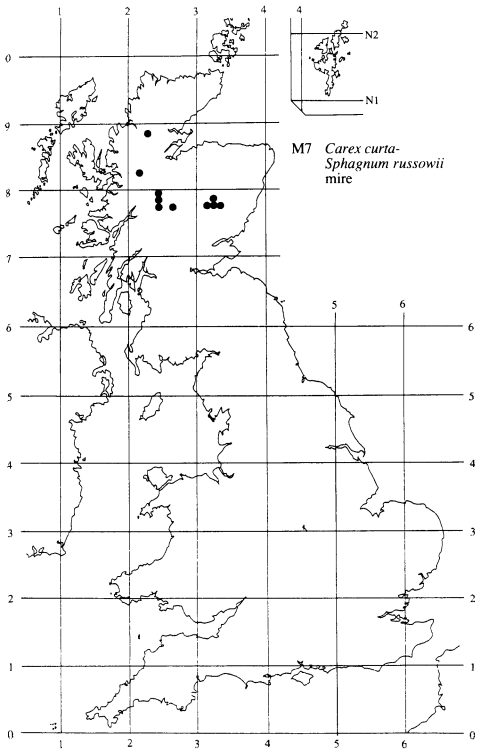
Sphagnum lindbergii	V (2–9)		III (2–9)
Nardus stricta	IV (1–5)	II (1–3)	II (1–5)
Carex bigelowii	IV (1–6)	I (3)	II (1–6)
Sphagnum subnitens	IV (1–5)	I (1)	II (1–5)
Sphagnum auriculatum auriculatum	IV (1–7)		II (1–7)
Agrostis canina canina	III (1–4)	I (1)	II (1–4)
Drepanocladus exannulatus	III (1–3)		II (1–3)
Calliergon sarmentosum	III (1–3)		II (1–3)
Sphagnum capillifolium	II (2–5)	I (5)	I (2–5)
Polytrichum alpestre	II (2–4)	I (3)	I (2–4)
Sphagnum compactum	II (2–5)	I (1)	I (1–5)
Saxifraga stellaris	II (1–2)	I (1)	I (1–2)
Polytrichum alpinum	II (2)	I (3)	I (2–3)
Juncus bulbosus/kochii	II (2–3)		I (2–3)
Sphagnum magellanicum	II (2)		I (2)
Pellia epiphylla	II (1–2)		I (1–2)
Rubus chamaemorus	I (1–2)		I (1–2)
Ptilidium ciliare	I (2)		I (2)
Hylocomium splendens	I (1–3)		I (1–3)
Racomitrium lanuginosum	I (1–2)		I (1–2)
Sphagnum cuspidatum	I (1–2)		I (1–2)
Dicranum scoparium	I (1–3)		I (1–3)
Philonotis fontana	I (1–2)		I (1–2)
Scapania uliginosa	I (3–5)		I (3–5)
Polytrichum commune	III (1–3)	V (1–4)	III (1–4)
Sphagnum recurvum	II (2–4)	V (5–9)	III (2–9)
Calliergon stramineum	II (1–3)	IV (1–2)	II (1–3)
Carex aquatilis	I (5)	IV (1–6)	II (1–6)
Festuca vivipara	I (1–2)	IV (1–2)	II (1–2)
Luzula multiflora	I (2)	IV (1)	II (1–2)
Carex nigra	I (2–5)	IV (4–6)	II (2–6)
Agrostis stolonifera		IV (3–4)	II (3–4)
Sphagnum girgensohnii	I (3)	III (5)	II (3–5)
Galium saxatile	I (1–2)	III (1–2)	II (1–2)
Carex rariflora	I (2)	III (3–5)	II (2–5)
Deschampsia flexuosa		III (1–3)	I (1–3)
Sphagnum riparium	I (6)	II (3–8)	I (3–8)
Sphagnum teres		II (3)	I (3)
Epilobium palustre		II (1–3)	I (1–3)
Trientalis europaea		II (1–3)	I (1–3)
Eriophorum vaginatum	III (1–3)	IV (1–4)	III (1–4)
Lophozia ventricosa	II (1–2)	II (1)	II (1–2)
Scirpus cespitosus	II (1–3)	II (1)	II (1–3)
Deschampsia cespitosa	I (1–3)	II (1)	I (1–3)
Vaccinium myrtillus	I (1–2)	I (1)	I (1–2)
Aulacomnium palustre	I (2–3)	I (1)	I (1–3)
Pohlia nutans	I (2–3)	I (2)	I (2–3)
Sphagnum auriculatum inundatum	I (2)	I (1)	I (1–2)
Cladonia arbuscula	I (2)	I (1)	I (1–2)

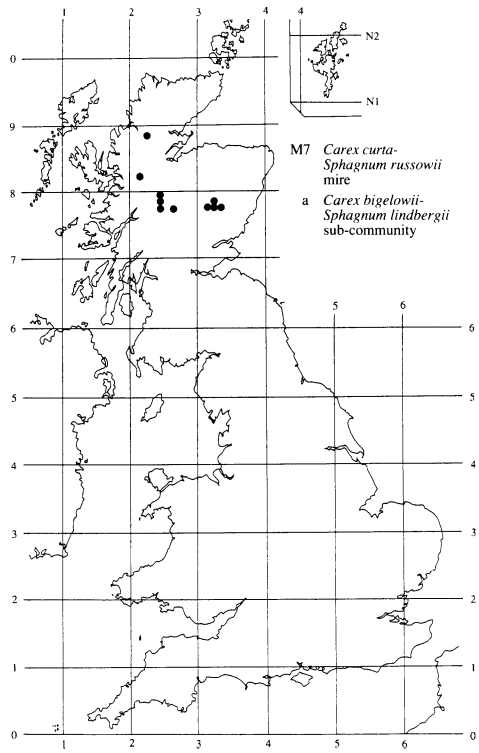
https://doi.org/10.1017/9780521391658.011 Published online by Cambridge University Press

Floristic table M7 *(cont.)*

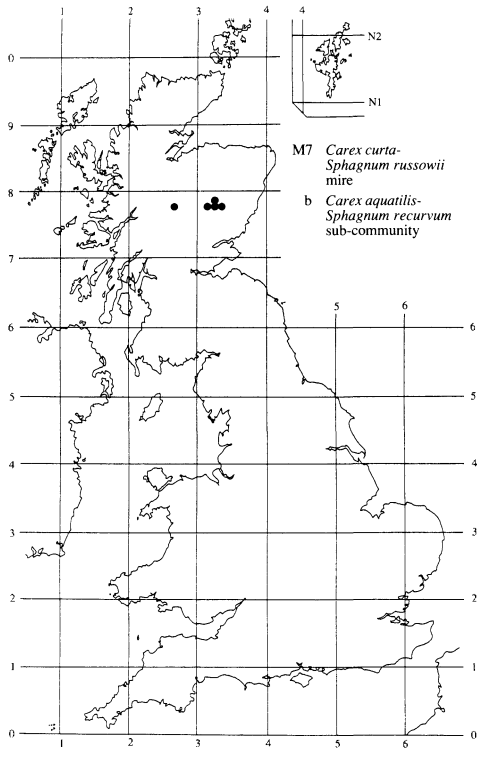
	a	b	7
Juncus squarrosus	I (1)	I (1)	I (1)
Anthoxanthum odoratum	I (1)	I (1)	I (1)
Scapania undulata	I (2)	I (1)	I (1–2)
Carex rostrata	I (1)	I (1)	I (1)
Epilobium anagallidifolium	I (1)	I (2)	I (1–2)
Number of samples	15	7	22
Number of species/sample	20 (11–27)	19 (14–23)	20 (11–27)

a *Carex bigelowii-Sphagnum lindbergii* sub-community
b *Carex aquatilis-Sphagnum recurvum* sub-community
7 *Carex curta-Sphagnum russowii* mire (total)





https://doi.org/10.1017/9780521391658.011 Published online by Cambridge University Press



https://doi.org/10.1017/9780521391658.011 Published online by Cambridge University Press