

*Cratoneuron commutatum*-*Carex nigra* spring**Synonymy**

Bryophyte flushes Pigott 1956a p.p.; *Carex panicea*-*Campylium stellatum* nodum McVean & Ratcliffe 1962 p.p.; *Cratoneuron*-*Carex nigra* nodum Eddy *et al.* 1969; *Carex nigra*-*Equisetum palustre* nodum Huntley 1979 p.p.; *Saxifraga aizoides*-*Tussilago farfara* nodum Huntley 1979 p.p.; *Saxifraga aizoides*-*Juncus triglumis* nodum Huntley 1979 p.p.

**Constant species**

*Agrostis canina*, *Cardamine pratensis*, *Carex demissa*, *C. nigra*, *C. panicea*, *Festuca rubra*, *Leontodon autumnalis*, *Polygonum viviparum*, *Selaginella selaginoides*, *Trifolium repens*, *Bryum pseudotriquetrum*, *Cratoneuron commutatum*, *C. filicinum*, *Philonotis fontana*.

**Rare species**

*Epilobium alsinifolium*, *E. nerteroides*, *Saxifraga hirculus*, *Oncophorus virens*.

**Physiognomy**

While the *Cratoneuron commutatum*-*Carex nigra* spring preserves the same pattern of generally overwhelming dominance by *Cratoneuron commutatum* (again occasionally supplemented or replaced by *C. filicinum*) as in the *Cratoneuron*-*Festuca* community, the associated flora here is very much richer. This is partly to be seen among the bryophytes, where a variety of other species finds frequent or occasional representation in the mat, though not generally with very much abundance. *Bryum pseudotriquetrum*, however, and *Philonotis fontana*, which are the commonest among these plants, can have moderately high cover and there are many companions which can occur locally as quite prominent patches: *Aneura pinguis*, *Plagiomnium elatum*, *Fissidens adiantoides*, *Philonotis calcarea*, *Ctenidium molluscum*, *Rhizomnium pseudopunctatum*, *Campylium stellatum*, *Drepanocladus revolvens* and *Cinclidium stygium*. Among rarer species, the community also provides a locus for *Oncophorus virens* and *Meesia uliginosa*.

But it is among the vascular element that the increased

richness of the vegetation is most evident, for here a large number of species make a frequent, even if usually low-cover, contribution. Small sedges are particularly noticeable, with *Carex demissa*, *C. nigra* and *C. panicea* constant, *C. pulicaris*, *C. flacca* and *C. dioica* also common. The first three in particular can be quite abundant and, when present in fairly extensive mixtures, these sedges can bring the vegetation close to a Caricion davallianae mire in its structure and composition. Then, there are frequent scattered plants of *Cardamine pratensis*, *Selaginella selaginoides*, *Leontodon autumnalis*, *Polygonum viviparum*, *Trifolium repens*, *Cirsium palustre*, *Ranunculus flammula*, *Sagina nodosa*, *Juncus triglumis*, *J. articulatus*, *J. bulbosus*, *Cerastium fontanum*, *Prunella vulgaris*, *Caltha palustris* (often in its diminutive montane form), *Galium palustre*, *Equisetum palustre*, *Achillea ptarmica*, *Cochlearia officinalis* (often recorded as ssp. *alpina*), *Triglochin palustris*, *Ranunculus acris*, *Anthoxanthum odoratum*, *Festuca ovina*, *Epilobium anagallidifolium* and, in northern England, where it has become very much at home on wet stony ground, the New Zealand introduction *E. nerteroides*. Rare herbs occasionally recorded are *Sedum villosum*, *Minuartia verna*, *Alopecurus alpinus*, *Epilobium alsinifolium* and, in parts of Upper Teesdale, though not in its Scottish localities, this community also provides the characteristic locus for the very rare *Saxifraga hirculus*. Looking at first sight like the much commoner *S. aizoides* when in flower, this plant is easily overlooked because its flowering stems are often cropped by sheep and its leafy shoots are rather inconspicuous among the moss carpet (Ratcliffe 1978).

**Habitat**

This kind of vegetation is confined to montane springs and flushes strongly irrigated by base-rich, calcareous and oligotrophic waters. It is very local in the northern Pennines and central Highlands of Scotland and, though the harsh climatic and edaphic conditions exert a strong influence on the structure and composition of the vegetation, heavy grazing may play a major role in

maintaining the distinctive richness of the community.

Like the *Cratoneuron-Festuca* spring, this vegetation marks out sites of sustained irrigation with waters draining from lime-rich bedrocks, notably the Carboniferous Limestone around Upper Teesdale (Pigott 1956a, 1978a, Eddy *et al.* 1969) and certain of the Dalradian meta-sediments in central Scotland (McVean & Ratcliffe 1962, Huntley 1979). Such areas experience more than 1600 mm rain annually (*Climatological Atlas* 1952), with more than 180 wet days  $\text{yr}^{-1}$  (Ratcliffe 1968) and here the community can be found where excess surface water emerges in well-defined springs or more diffuse seepage lines, producing more or less permanently saturated stagnogley soils, usually with a shallow peaty top-soil (Pigott 1956a, 1978a, Eddy *et al.* 1969). Detailed data on pH and calcium content are sparse but both are probably quite high and tufa-encrustation among the moss mat is often seen. Certainly among both bryophytes and vascular plants, there are obvious calcicolous elements. Apart from the generally overwhelming dominance of *Cratoneuron commutatum* or *C. filicinum*, such species as *Bryum pseudotriquetrum*, *Aneura pinguis*, *Fissidens adianthoides*, *Philonotis calcarea*, *Ctenidium molluscum*, *Cinclidium stygium*, *Drepanocladus revolvens* and *Campylium stellatum* all reinforce this general aspect of the vegetation, together with such herbs as *Carex pulicaris*, *C. flacca*, *C. dioica*, *Briza media*, *Juncus triglumis*, *Triglochin palustris* and *Selaginella selaginoides*.

The other general feature of this kind of vegetation is its montane character. The *Cratoneuron-Carex* spring is a high-altitude community, found mostly above 650 m in areas where mean annual maximum temperatures rarely exceed 23 °C (Conolly & Dahl 1970) with annual accumulated temperatures usually below 500 day-degrees C (Page 1982). Arctic-Alpine plants such as *Polygonum viviparum*, *Juncus triglumis*, *Epilobium angallidifolium* and *E. alsinifolium* are thus a frequent feature here. *Saxifraga hirculus*, it should be noted, though now surviving at higher altitudes in mainland Britain, is actually pre-alpine through Europe as a whole (Pigott 1956a) and, in those more low-level English localities from which it has been eradicated by drainage (Perring & Farrell 1977), probably occurred in quite a wide variety of vegetation types.

A third characteristic of the environment of the *Cratoneuron-Carex* spring is that it is grazed, and trampling and cropping of the herbage by sheep and deer, which have free access over the gently-sloping unenclosed ground on which these springs are usually found, is responsible for the most obvious floristic differences between the community and the *Cratoneuron-Festuca* spring. Not only is the former more species-rich than the latter, something which reflects the more open character of the sward, but its enrichment is of the kind which

reaches its full expression in such vegetation as the *Pinguiculo-Caricetum*, the characteristic small-sedge mire of grazed, base-rich flushes. The frequency of such plants as *Carex nigra*, *C. panicea*, *C. demissa*, *Leontodon autumnalis*, *Trifolium repens* and *Selaginella*, together with the greater variety among the bryophytes, helps place the *Cratoneuron-Carex* spring as a floristic intermediate between these two vegetation types and hints at its possible seral developments.

### Zonation and succession

The *Cratoneuron-Carex* spring typically occurs as a local replacement for the *Cratoneuron-Festuca* spring in sequences of grazed calcicolous communities in upland Britain, where much of the floristic variation can be related to differences in topography and soils.

Commonly, therefore, the community picks out definite springs or flushes within stretches of calcicolous swards developed over drier rendzinas or brown soils. Individual stands are often small, although where vigorous irrigation runs down-slope flushed zones can be very elongated and springs can be very numerous within quite small areas, occurring repeatedly along valley sides. Where they emerge among rockier topography, the stands can be well defined from their surrounds but often here there is quite a gradual transition to the grassland, the extent and richness of the bryophyte mat declining but many of the small herbs retaining high frequency and cover into the sward. In Upper Teesdale, it is generally the *Sesleria-Galium* grassland which provides the context for the *Cratoneuron-Carex* spring, grading to it through the *Carex* or *Carex-Kobresia* sub-communities. Over somewhat less base-rich profiles both there and in Scotland, the *Festuca-Agrostis-Thymus* grassland can be found in similar sequences and this, too, can show transitions to the spring via its intermediate *Carex* sub-community. Often, a zone of the *Pinguiculo-Caricetum* is interposed over the strongly-flushed ground between the spring and the wet grassland, further attenuating the floristic gradation over the space of several metres, with quite gentle shifts among the bryophyte and herb layer in moving from the stagnogley to the rendzinas. At higher altitudes in the central Highlands, such vegetation types can be replaced by the *Cariceto-Saxifragetum* and the *Festuca-Alchemilla-Silene* dwarf-herb community around *Cratoneuron-Carex* springs.

Trampling and grazing in these kinds of zonations play an important part in keeping the vegetation open and varied and may be vital in maintaining the rich calcicolous flora characteristic of the community (Eddy *et al.* 1969). Indeed, such treatment may help mediate a succession from the more species-poor *Cratoneuron-Festuca* spring to this kind of vegetation but the continuing extreme wetness of the ground probably prevents

further development to a Caricion davallianae sward. Withdrawal of grazing is unlikely to be accompanied by a pronounced expansion of mesophytic herbs because of the impoverished soil conditions, although it is possible that some limited increase in plants such as *Saxifraga aizoides*, *Alchemilla glabra*, *Filipendula ulmaria* and *Geum rivale* could produce a fragmentary tall-herb vegetation.

### Distribution

The *Cratoneuron-Carex* spring occurs locally around Upper Teesdale and in the central Scottish Highlands.

### Floristic table M38

<i>Cratoneuron commutatum</i>	V (1–10)	<i>Philonotis calcarea</i>	III (1–5)
<i>Carex nigra</i>	V (1–9)	<i>Alchemilla glabra</i>	III (1–4)
<i>Carex panicea</i>	V (1–6)	<i>Ctenidium molluscum</i>	III (1–6)
<i>Cardamine pratensis</i>	V (1–3)	<i>Carex pulicaris</i>	III (1–4)
<i>Bryum pseudotriquetrum</i>	V (1–5)	<i>Juncus bulbosus</i>	III (1–5)
<i>Leontodon autumnalis</i>	V (1–3)	<i>Bellis perennis</i>	II (1–3)
<i>Festuca rubra</i>	IV (1–3)	<i>Valeriana dioica</i>	II (1–3)
<i>Carex demissa</i>	IV (1–6)	<i>Sedum villosum</i>	II (1–3)
<i>Selaginella selaginoides</i>	IV (1–3)	<i>Saxifraga hirculus</i>	II (1–4)
<i>Philonotis fontana</i>	IV (1–4)	<i>Veronica scutellata</i>	II (1–3)
<i>Trifolium repens</i>	IV (1–3)	<i>Epilobium alsinifolium</i>	II (1–3)
<i>Polygonum viviparum</i>	IV (1–3)	<i>Viola riviniana</i>	II (1–3)
<i>Agrostis canina</i>	IV (1–3)	<i>Briza media</i>	II (1–3)
<i>Cratoneuron filicinum</i>	IV (1–9)	<i>Filipendula ulmaria</i>	II (1–3)
<i>Cirsium palustre</i>	III (1–3)	<i>Rhizomnium punctatum</i>	II (1–3)
<i>Aneura pinguis</i>	III (1–3)	<i>Cinclidium stygium</i>	II (1–3)
<i>Ranunculus flammula</i>	III (1–5)	<i>Geum rivale</i>	II (1–3)
<i>Epilobium palustre</i>	III (1–3)	<i>Carex dioica</i>	II (1–4)
<i>Juncus triglumis</i>	III (1–3)	<i>Calliergon cuspidatum</i>	II (1–6)
<i>Sagina nodosa</i>	III (1–3)	<i>Drepanocladus revolvens</i>	II (1–4)
<i>Cerastium fontanum</i>	III (1–3)	<i>Poa trivialis</i>	II (1–3)
<i>Prunella vulgaris</i>	III (1–3)	<i>Ranunculus repens</i>	II (1–3)
<i>Juncus articulatus</i>	III (1–5)	<i>Veronica beccabunga</i>	II (1–3)
<i>Caltha palustris</i>	III (1–4)	<i>Veronica serpyllifolia</i>	II (1–3)
<i>Galium palustre</i>	III (1–3)	<i>Potentilla erecta</i>	II (1–3)
<i>Equisetum palustre</i>	III (1–3)	<i>Viola palustris</i>	II (1–3)
<i>Achillea ptarmica</i>	III (1–3)	<i>Leiocolea bantriensis</i>	II (1–3)
<i>Cochlearia officinalis</i>	III (1–3)	<i>Oncophorus virens</i>	II (1–3)
<i>Epilobium anagallidifolium</i>	III (1–3)	<i>Taraxacum officinale</i> agg.	II (1–3)
<i>Triglochin palustris</i>	III (1–3)	<i>Euphrasia confusa</i>	II (1–3)
<i>Anthoxanthum odoratum</i>	III (1–3)	<i>Agrostis stolonifera</i>	II (1–4)
<i>Plagiomnium elatum</i>	III (1–3)	<i>Chiloscyphus polyanthos</i>	II (1–3)
<i>Fissidens adianthoides</i>	III (1–5)	<i>Alopecurus geniculatus</i>	II (1–3)
<i>Campylium stellatum</i>	III (1–3)	<i>Carex flacca</i>	II (1–3)
<i>Festuca ovina</i>	III (1–4)	<i>Jungermannia atrovirens</i>	II (1–3)
<i>Ranunculus acris</i>	III (1–3)	<i>Deschampsia cespitosa</i>	II (1–5)

### Affinities

Although a variety of *Cratoneuron*-rich stands described by McVean & Ratcliffe (1962) and Huntley (1979) from the Scottish Highlands can be accommodated in this community, the bulk of the available data originates from around Upper Teesdale, particularly Moor House, where this kind of vegetation was recognised as distinct by Eddy *et al.* (1969). It can be seen as intermediate between the *Cratoneuron-Festuca* spring and Caricion davallianae fens like the *Pinguicula-Caricetum* and accommodated with the former in the *Cratoneuron* alliance.

<i>Brachythecium rivulare</i>	II (1–3)	<i>Sagina procumbens</i>	I (1–3)
<i>Nardus stricta</i>	II (1–3)	<i>Eriophorum angustifolium</i>	I (1–3)
<i>Rhizomnium pseudopunctatum</i>	II (1–3)	<i>Alchemilla filicaulis vestita</i>	I (1–3)
<i>Carex echinata</i>	II (1–5)	<i>Parnassia palustris</i>	I (1–3)
<i>Meesia uliginosa</i>	I (1–3)	<i>Moerckia hibernica</i>	I (1–3)
<i>Thuidium delicatulum</i>	I (1–3)	<i>Plantago lanceolata</i>	I (1–3)
<i>Potentilla palustris</i>	I (1–3)	<i>Achillea millefolium</i>	I (1–3)
<i>Carex lepidocarpa</i>	I (1–3)	<i>Saxifraga stellaris</i>	I (1–3)
<i>Linum catharticum</i>	I (1–3)	<i>Chiloscyphus pallescens</i>	I (1–3)
<i>Epilobium nerteroides</i>	I (1–3)	<i>Gymnostomum aeruginosum</i>	I (1–3)
<i>Minuartia verna</i>	I (1–3)	<i>Fissidens osmundoides</i>	I (1–3)
<i>Leiocolea alpestris</i>	I (1–3)	<i>Juncus acutiflorus</i>	I (1–3)
<i>Poa subcaerulea</i>	I (1–3)		
<i>Climacium dendroides</i>	I (1–3)	Number of samples	26
<i>Thymus praecox</i>	I (1–3)	Number of species/sample	42 (25–57)
<i>Carex rostrata</i>	I (1–3)	Altitude (m)	693 (503–853)
<i>Pellia endiviifolia</i>	I (1–3)	Slope (°)	8 (4–10)
<i>Hylocomium splendens</i>	I (1–3)		



