
H11

Calluna vulgaris-*Carex arenaria* heath

Synonymy

Dune heath *auct. angl.*, *Calluna-Erica cinerea* heath
Gimingham 1964b, 1972 p.p.; *Calluna-Empetrum*
nigrum heath Gimingham 1964b, 1972 p.p.

Constant species

Calluna vulgaris, *Carex arenaria*.

Rare species

Euphorbia portlandica, *Trifolium suffocatum*, *Usnea*
flammea.

Physiognomy

Calluna vulgaris is the only constant sub-shrub throughout the *Calluna-Carex arenaria* heath, and it is often present in abundance, sometimes as an overwhelming dominant in rather impoverished vegetation. Generally, though, the cover of heather is discontinuous, decidedly patchy in younger or grazed stands, and there is frequently some other sub-shrub present, either intimately mixed with the *Calluna* or with the bushes of the co-dominants forming a more distinct mosaic. The most characteristic of these associates is *Erica cinerea*, with *Empetrum nigrum* ssp. *nigrum* figuring in some places, and each of these can be abundant, locally to the exclusion of *Calluna* itself. Very occasionally, *Ulex gallii* can be found and in some stands *Rosa pimpinellifolia* is plentiful, with *Erica tetralix* and *Salix repens* occurring in transitions to wetter heath. *Vaccinium myrtillus* is typically very rare.

Even when some of these other sub-shrubs are present, the community can be distinguished from similar assemblages by the constancy of *Carex arenaria*, though this is hardly ever more than moderately abundant and often distinctly senile, except where the sand substrate becomes locally mobile, when renewed vigour and cover in the plant usually presage a transition to patches of *Carex* dune vegetation. *Ammophila arenaria* is also frequent through the community, though it is characteristically sparse and usually decidedly moribund, with just scattered shoots.

In more species-poor stands, little else than these plants may be represented, but other tracts of this kind of heath show considerable enrichment. First, among grasses, there is often some *Festuca rubra* or *F. ovina* (inadequately distinguished in the available data), with *Agrostis capillaris* and *Anthoxanthum odoratum* also occurring frequently in some situations and, less commonly, *Poa pratensis* (probably *P. subcaerulea*). The annuals *Aira praecox* and, more sparsely, *A. caryophylllea* can sometimes be found too. Apart from *C. arenaria*, sedges are absent though *Luzula campestris* occurs quite often.

Variation among the dicotyledonous associates is fairly modest but *Galium verum*, *Lotus corniculatus*, *Viola riviniana* and *Thymus praecox* all occur quite frequently in all but the denser stands of bushes, and there can also be some *Campanula rotundifolia*, *Galium saxatile*, *Hypochoeris radicata*, *Jasione montana* and *Sedum anglicum*. Often, mixtures of these species, together with the grasses, form the basis of a sward running among the sub-shrubs, when there can be strong floristic continuity with adjacent dune grasslands.

Certain bryophytes, especially hypnoid mosses such as *Hypnum cupressiforme* s.l., *Pleurozium schreberi*, *Hylocomium splendens* and *Rhytidiadelphus triquetrus* can also be present among the turf and more open bushes. In other situations, acrocarps like *Polytrichum juniperinum*, *P. piliferum* and *Ceratodon purpureus* can be patchily abundant on areas of bare ground or there may be extensive carpets of lichens.

Sub-communities

***Erica cinerea* sub-community:** *Calluna-Erica cinerea* heath, 'dune-heath' variant Gimingham 1964b. In this sub-community, *Calluna* and *E. cinerea* are generally co-dominant though one or the other may show local pre-eminence, with *E. cinerea* sometimes colonising new sites well in advance of *Calluna*. *Empetrum nigrum* ssp. *nigrum* is typically absent but *Ulex gallii* occurs very

occasionally and, at some sites, *Rosa pimpinellifolia* is a distinctive invader.

F. rubra/ovina is very common at low to moderate covers with scattered shoots of *C. arenaria* and *L. campestris* and very sparse *Ammophila*. *Agrostis capillaris* is scarce and *Anthoxanthum* occurs only occasionally but, in more open areas, there is quite often some *Aira praecox* or *A. caryophyllaea*. Then, there is occasional *Lotus corniculatus*, *G. verum*, *V. riviniana* and *Thymus* with *H. radicata*, *J. montana* and *Ononis repens* preferential at low frequencies. Patches of *Sedum anglicum* are prominent at some sites, often marking out more pebbly ground, and this kind of *Calluna*-*Carex* heath also provides a locus for the rare *Euphorbia portlandica* and *Trifolium suffocatum*.

Quite often, however, the really distinctive element among the associated flora here is the cryptogams which, in more attenuated or patchy swards, can occupy the bulk of the ground between the bushes. Apart from occasional plants of *H. cupressiforme* and *P. schreberi*, however, hypnoid mosses are rather sparse and it is usually the acrocarps that are more abundant, with *Dicranum scoparium* an additional preferential. Even more varied and plentiful in many stands, though, are the lichens, particularly *Cladonia* spp., with *C. impexa*, *C. arbuscula*, *C. furcata* all common, *C. floerkeana*, *C. pyxidata*, *C. gracilis*, *C. foliacea* and *C. uncialis* occasional and *C. rangiferina*, *C. rangiformis*, *C. subcervicornis*, *C. bacillaris*, *C. crispata* and *C. coccifera* also recorded infrequently. *Cornicularia aculeata* and *Hypogymnia physodes* are very often found, too, with *C. muricata* and *Peltigera canina* in some stands. A further very distinctive feature at certain localities is the occurrence of ground-growing *Usnea* spp., particularly *U. subfloridana* and *U. articulata*, and sometimes the more local *U. flammea*.

***Empetrum nigrum* ssp. *nigrum* sub-community:** *Calluna*-*Empetrum nigrum* heath Gimmingham 1964b, 1972 p.p. *E. cinerea* can sometimes be found here among the *Calluna*, but *Empetrum nigrum* ssp. *nigrum* is the usual co-dominant and, indeed, it can exceed the heather in cover, its shoots abundant in mixed canopies or the plants forming large circular patches which locally monopolise the ground. *Salix repens* also occurs occasionally in this vegetation with *Erica tetralix* in transitions to wetter heath.

F. rubra/ovina remains common, though usually at low covers, among frequent *C. arenaria* and *L. campestris* and locally tussocky *Ammophila*. In contrast to the *Erica* sub-community, however, *Agrostis capillaris* is very common with occasional *Anthoxanthum* and there is sometimes a little *Poa pratensis*. *L. corniculatus*, *G. verum*, *V. riviniana* and *Thymus* remain quite common, but preferential to this sub-community are *G. saxatile* and *C. rotundifolia*.

Among the cryptogams, acrocarpous mosses remain occasional but more prominent are hypnoid species with *H. cupressiforme*, *Pleurozium* and *R. triquetrus* joined by *Hylocomium splendens* and, less commonly, *Ptilidium ciliare*, each of these sometimes moderately abundant. *Cladonia arbuscula* and *C. impexa* can be patchily plentiful, too, with occasional *Cornicularia aculeata* and *H. physodes*, but there is nothing like the variety and richness of the lichen flora characteristic of the *Erica* sub-community.

Species-poor sub-community. *Calluna* is typically an overwhelming dominant here and often the only sub-shrub, with just occasional bushes of *E. cinerea* or *Empetrum*. *C. arenaria* remains constant but it is usually sparse and *Ammophila* is decidedly infrequent and moribund. *F. rubra/ovina* is generally absent and grasses are sometimes represented just by very puny tufts of *Anthoxanthum* or *Deschampsia flexuosa*. Dicotyledonous associates are likewise often very few indeed and of low cover among the dense heather bushes but *Campanula rotundifolia* and *Galium saxatile* can sometimes be found in more open places. There, too, or over the stools of older, collapsing *Calluna* bushes there can be some *H. cupressiforme*, *Pleurozium*, *D. scoparium*, *R. triquetrus* and very occasional *Cladonia arbuscula*.

Habitat

The *Calluna*-*Carex* heath is the characteristic sub-shrub vegetation of stabilised base-poor sands on dunes and plains around the coasts of Britain. Unusually among our lowland heaths, the community develops in primary successions by the colonisation of dune grasslands on acidic sands that have become fixed or where, with the passage of time, more lime-rich wind-blown sediments have become leached. However, it is probably dependent now for its establishment on particular episodes of relief from grazing and, though variations in regional climate and substrate affect the character of the vegetation, predation by herbivores continues to influence its composition and structure, and ultimately to control its maintenance against reversion to grassland or progression to scrub and woodland.

The *Calluna*-*Carex* heath is largely confined to sands with a pH of less than 5, able to develop only on those stretches of coastal dunes and plains which have formed by the accretion of initially quartzitic material or where more calcareous deposits have been eluviated above. Around the seaboard of Britain, more acidic dune sands are actually very local, with sites like South Haven in Dorset and Tentsmuir in Fife providing rather exceptional situations for the development of the community. Elsewhere, the amount of calcium carbonate in the sediment supply, usually derived from comminuted shelly material, can be very considerable and it is only where this has been leached from the upper part of the

profile that the surface becomes congenial for the establishment of the sub-shrubs and the more calcifuge herbs and cryptogams. Evidence from a variety of dune systems suggests that, where the initial carbonate content is not more than 5%, most of this will have been lost from the top decimetre of soil within 300 to 400 years (Ranwell 1972, Willis 1985a). Clearly, climate will have some effect on this process, leaching tending to be speedier towards the wetter and cooler north and west of Britain: although dune sands in this part of the country are often initially lime-rich, the *Calluna-Carex* heath is markedly more common there than in the drier south and east. In fact, though, it is possible that only quite superficial or local reduction in the base-richness of the ground is necessary for the sub-shrubs to get an initial hold and, once *Calluna* is established, this may itself speed the shift in conditions by acidifying the substrate.

Even with sands which are initially fairly base-poor or which become quite quickly leached, there is the additional requirement of general surface stability of the sediment before the community can become well established, a condition that is met only in older dunes and on consolidated sand plains. Locally, it appears that *Empetrum nigrum* ssp. *nigrum* can capitalise upon renewed surface disturbance on largely fixed sands in regions of cooler climate pioneering the development of the *Calluna-Carex* heath, a feature familiar from parts of Denmark and Sweden (Landsberg 1955, Gimingham 1964b, 1972) but, in general, this is a vegetation type of the later stages in dune successions, following on from various kinds of grassy sward on stable ground.

Very importantly in such situations, *Ammophila arenaria*, the dominant plant of more mobile base-rich sands all around the British coast, has begun to lose its vigour, proliferative shoot production coming to an end and flowering becoming less free with but sparse regeneration from seed (Gimingham 1964a, Huiskes 1979). The reasons for this decline are unclear, but they are probably connected to the kinds of edaphic changes that follow upon the increased fixity of the sand surface, not simply the eluviation of bases but also the accumulation of organic matter above, the increased capacity for moisture retention and a modest enhancement of the trophic state of the profile (Tansley 1939, Salisbury 1952, Ranwell 1972, Willis 1985a). Such changes favour an expansion of other plants as the competitive edge of the *Ammophila* wanes, its clones becoming reduced to scattered groups of debilitated shoots that are inherited by the vegetation which succeeds the marram-dominated communities. More locally, and especially on acid sands where *Ammophila* performs less well even in the earlier stages of succession, *C. arenaria* assumes this pioneering role, then declining in a similar way as accretion becomes insignificant.

Since water and nutrients often remain strongly limit-

ing to plant growth even on the older and more stable dune surfaces, rather attenuated grassy swards appear to be a fairly natural successor to *Ammophila* or *Carex* vegetation. At this stage, however, the incidence and intensity of grazing probably become of crucial significance to the direction of the sere. The kinds of grassland which develop on more base-poor and impoverished fixed sands are characterised by senile *C. arenaria* and *Ammophila* with *F. rubra*, *F. ovina*, *A. capillaris*, *Anthoxanthum*, *L. campestris*, *G. verum*, *Lotus corniculatus*, *H. radicata*, *D. scoparium*, *Hypnum cupressiforme*, *P. schreberi*, *Hylocomium splendens* and a variety of lichens, particularly *Cornicularia aculeata* and *Cladonia* spp. Clearly, such a flora is virtually identical to the herbaceous and cryptogam elements of the *Calluna-Carex* heath, and what determines whether sub-shrubs establish along with or subsequent to such assemblages seems to be the extent of predation by herbivores. In this kind of habitat, these include rabbits and stock, mostly sheep, though with cattle important in some areas.

In fact, seedlings of the sub-shrubs are extremely rare in what one supposes to be the grassy precursors of the community, or even in transitions to or mosaics with existing stands of the *Calluna-Carex* heath, the occurrence of scattered well-established bushes usually marking the shift on the ground from one vegetation type to the other. It looks, therefore, as if succession to the heath is rarely a steady process even where grazing is slight, but more related to particular perturbations in its intensity (Gimingham 1972). The demise of rabbits with myxomatosis may therefore have been important in the establishment or spread of heath at some sites, though at St Cyrus in Aberdeenshire the epidemic was followed by the appearance of a solitary plant of heather and any subsequent spread was hindered by the recovery of the rabbit population (Gimingham 1972). Perhaps, now, with the widespread reclamation of the dune hinterland, the rarity of seed-parents has become critical to the development of heath. Interestingly, where we have evidence of what happens where stretches of acid dune sands pass in and out of cultivation, as on Tentsmuir, abandonment of arable areas can be marked by a secondary resurgence of the *Calluna-Carex* heath (Leach 1985). As with so many stretches of lowland heath, then, the survival of the community may be strongly dependent upon a distinctive type of sporadic or non-intensive agricultural tradition.

The particular character of the *Calluna-Carex* heath which develops under these conditions depends partly on the nature of the climate experienced by the dune system. Around much of the coast of Britain, and particularly in the west where the temperature regime is more equable, the broadly oceanic *Erica cinerea* can find this kind of habitat very congenial. Indeed, it quite often colonises in advance of *Calluna*, forming substantial

bushes before the heather is able to establish (Gimingham 1964b). The very free-draining character of the substrate helps maintain the somewhat open, patchy cover of perennial herbs characteristic of the *Erica* sub-community, with annuals, acrocarps and lichens capitalising on areas of bare ground. This aspect of the vegetation is especially prominent in more southerly stands of the sub-community where rainfall is low. In some sites, as on The Ayres in the Isle of Man, mixtures of sand and consolidated pebbles on the dunes provide an especially distinctive setting for this kind of *Calluna*-*Carex* heath, supporting a particularly rich lichen flora.

With the shift on to acidic sands in the cooler and wetter north of Britain, the *Erica* sub-community is locally replaced by the *Empetrum* sub-community. *E. nigrum* ssp. *nigrum* is well able to colonise such substrates, particularly where they are kept moist by the damp climate, getting a hold on patches of moss or even, as noted above, on stretches of quite mobile sand. Its long shoots grow prostrate and form roughly circular patches which can help consolidate the sand surface, aiding the subsequent establishment of *Calluna* and, more locally, *Salix repens* (Gimingham 1964b, 1972). The frequency of *A. capillaris* and *G. saxatile* among the associates in this kind of *Calluna*-*Carex* heath perhaps reflects a more base-poor soil surface than in many stands of the *Erica* sub-community, and the prevalence of hypnoid mosses and fruticose lichens, as against acrocarps and encrusting lichens, the less parched and open character of the ground.

In the absence of grazing, the *Calluna*-*Carex* heath can acquire the dense and impoverished character of the Species-poor sub-community, although renewed predation by stock can reverse such a development in perhaps quite a short time: at Tentsmuir, for example, tall *Calluna* has been virtually eliminated from some areas put under pasturing in the 1950s (Leach 1985). In fact, except where periodic droughts take their toll, the maintenance of shorter and more diverse covers of the *Calluna*-*Carex* heath is probably dependent on a certain amount of grazing.

Zonation and succession

The *Calluna*-*Carex* heath is a local element of zonation and mosaics on older stretches of coastal dunes and sand plain, grading to grasslands or various kinds of *C. arenaria* or *Ammophila* vegetation, or to scrub, woodland and bracken, in patterns which reflect the progression of the dune sere, differences in the character of the soils and the influence of past and present treatments. In most cases, the community would probably progress readily to scrub and woodland with relief from grazing, provided seed-parents of suitable shrubs and trees were available.

The most striking complex of vegetation types among

which the *Calluna*-*Carex* heath can be found involves the more calcifuge of the swards characteristic of stable dune sands. Quite often, it occurs within stretches of the *Carex*-*Festuca*-*Agrostis* grassland, typically a short turf dominated by mixtures of *C. arenaria*, *F. ovina*, *F. rubra*, *A. capillaris* and *Poa pratensis* with *Anthoxanthum* and *L. campestris* occurring on the more impoverished substrates, and scattered plants of *G. saxatile*, *G. verum* and *L. corniculatus*. Such vegetation can pass imperceptibly into the grassy ground of more open tracts of the *Calluna*-*Carex* heath, the major difference between the communities being the presence of sub-shrubs. Generally speaking, the distribution of these presents a sharp boundary: occasional bushes are sometimes to be seen isolated among more extensive stretches of grassland, but there is rarely that gentle gradation of size and age among the bushes that denotes a continuous process of invasion. More usually, it looks as if the patterns reflect past colonisation events, with the grassland/heath transitions often subsequently sharpened up by renewed grazing.

Bryophytes can be fairly numerous and abundant in the *Carex*-*Festuca*-*Agrostis* grassland, with patches of species like *D. scoparium*, *P. juniperinum*, *C. purpureus*, *Pleurozium schreberi* and *H. splendens* providing further continuity with the heath and, though lichens are generally less varied and abundant in the grassy swards, *Cornicularia aculeata*, *Cladonia arbuscula* and *C. rangiformis* can occur in both vegetation types. This latter element, though, is much more generally obvious in those few localities where the *Calluna*-*Carex* heath occurs with the *Carex*-*Cornicularia* community. In that assemblage, *C. arenaria* is the only constant vascular plant in a characteristically very open turf, with just occasional scattered tussocks of *F. ovina* and *F. rubra*, sparse *L. campestris* and only sporadic representation of most of the dicotyledonous associates listed above. However, *H. radicata* is common, together with *Rumex acetosella*, and there are quite often some annuals including *Aira praecox*. Most striking, though, and providing continuity with the lichen assemblage typical of the *Erica* sub-community of the *Calluna*-*Carex* heath, is *Cornicularia aculeata* and a great variety and abundance of *Cladonia* spp. Again, in such patterns, it is the occurrence of the sub-shrubs which provides the major distinction between the vegetation types.

There is little doubt that the incidence and intensity of grazing, past and present, mediates much of the variation in patterns such as these developed over tracts of fairly uniform base-poor sands. In other situations, where the *Calluna*-*Carex* heath has managed to become established somewhat earlier in the dune succession on sands that are a little less stable or leached, treatments can interact with edaphic differences to produce other zonation patterns. Then, the community usually passes to some

form of *Festuca-Galium* grassland, and where this is represented by the *Luzula* sub-community there can be considerable floristic continuity among the herbaceous element of the vegetation types, with *F. rubra*, *A. capillaris*, *Anthoxanthum*, *L. campestris* and *C. arenaria* contributing throughout to the turf. Quite apart from the disappearance of the sub-shrubs, however, the grassland is usually more varied in its vascular component with frequent records for such plants as *G. verum*, *L. corniculatus*, *Plantago lanceolata*, *Trifolium repens*, *Hieracium pilosella*, *Achillea millefolium*, *Veronica chamaedrys* and *Senecio jacobaea*. Bryophytes and lichens are usually not so plentiful either, with *Brachythecium albicans*, *Homalothecium lutescens*, *Rhytidiadelphus squarrosus* and *Pseudoscleropodium purum* providing the bulk of the cryptogam cover.

More rarely, the *Calluna-Carex* heath can be found in sharper transitions to Typical *Festuca-Galium* grassland in which *Ammophila* may remain locally vigorous with some small measure of continuing accretion, or even to the *Ammophila-Festuca* community which is characteristic of still quite mobile and lime-rich dune sands around our coasts. Generally, though, the passage to this latter vegetation or to the *Carex arenaria* community is indicative of secondary local disturbance of the sand surface in tracts of dune or plain which are largely stable, something which can result from the burrowing or scuffing activities of rabbits or recreational activities of human visitors.

Transitions to moister ground between dune ridges and in the surrounds to slacks can complicate these patterns. Sometimes, in such situations, there is a fairly sharp switch from heath to some fairly damp dune sward such as the *Ranunculus-Bellis* or *Prunella* sub-communities of the *Festuca-Galium* grassland or the *Ononis* sub-community of *Salix-Holcus* slack. In other places, the *Calluna-Carex* heath passes into wet heath or heathy grassland on damp base-poor ground with quite a humic topsoil. There, *C. arenaria*, *F. ovina*, *Anthoxanthum* and *G. saxatile* can maintain some representation, along with certain of the hypnoid mosses, *Calluna* persisting patchily on drier areas, but dominance usually passes to mixtures of *Erica tetralix*, *Nardus stricta*, *Juncus squarrosus* and *Salix repens*. Transitions to such vegetation can be hard to diagnose, but the better-developed assemblages usually seem to be some form of *Nardus-Galium* grassland or run-down *Ericion tetralicis* wet heath.

Release from grazing can allow stands of the *Erica* and *Empetrum* sub-communities to develop the leggy and impoverished look of the Species-poor sub-community, with the associated sub-shrubs and many of the herbs and cryptogams overwhelmed by the *Calluna*. Where soil impoverishment under long-entrenched heather has not become too severe, and where parching of the surface is relieved somewhat, such vegetation may

progress to woodland provided suitable seed-parents are not beyond the range of dispersal. Where more open stretches of ground remain among the bushes, birch is a very likely early invader, *Betula pendula* predominating on these drier soils, with *B. pubescens* becoming important in transitions to moister ground, where establishment is that much more ready. The appearance of birch, together with *Pinus sylvestris* and other conifers seeding in from the plantations that are an extensive feature of some stretches of fixed dunes, can presage a fairly speedy succession to thickets of the *Quercus-Betula-Deschampsia* woodland, within which the heath flora survives only in more open glades.

In other situations, and particularly where there is some more obvious relief from soil impoverishment after bouts of manuring by stock or infestation with rabbits, or where there is a legacy of disturbance around old enclosures, scrub may supervene in the succession. Often, patches of *Ulex-Rubus* scrub mark out such enriched areas: *Calluna* may persist as occasional bushes in such vegetation, with species such as *F. rubra*, *A. capillaris*, *Anthoxanthum* and *Galium saxatile* forming much of the grassy ground, but the abundance of *U. europaeus* and *R. fruticosus* agg. is very striking and there are often patches of more mesophytic grasses like *Dactylis glomerata* and *Holcus lanatus*. *Pteridium aquilinum* can also occur among such scrub, thickening up where deeper sands are kept a little moister along the foot of dunes or on shady aspects into stands of the *Pteridium-Galium* community.

Distribution

The *Calluna-Carex* heath is a very local community on dunes along the coasts of western England and Wales, becoming commoner in Scotland. Much the most widespread type is the *Erica* sub-community with the *Empetrum* sub-community replacing it locally in north and east Scotland. The Species-poor sub-community can occur throughout the range where conditions are suitable.

Affinities

Early descriptive accounts of British heaths rarely made more than passing reference to the occurrence of sub-shrub vegetation on coastal dune systems, and later studies have usually described the different forms as sub-types of communities with wider, inland distributions. Indeed, the overall similarity of the vegetation included here to these inland heaths is very obvious, with often only *C. arenaria* and *Ammophila* providing any positive characterisation: where the former species occurs in stands of the *Calluna-Festuca* heath in eastern England the separation of the communities can be especially problematical. Generally, however, the *Erica* sub-community has been related to what in this scheme is called the *Calluna-Erica* heath, a vegetation type with a

broadly oceanic character and well represented in other sub-maritime habitats around the western seaboard of Britain, as on drying blanket mire close to sea-level and on sea-cliffs outside the influence of salt-spray. Similarly, the *Empetrum* sub-community has been seen as close to what is here termed *Calluna-Vaccinium* heath (Gimingham 1964b, 1972). On balance, though, the diagnosis of a distinct community seems a more satisfac-

tory solution, especially in view of the development of this vegetation as part of primary successions on dunes, albeit under the strong influence of biotic, often anthropogenic, factors. As for the phytosociological affinities of the community, the best locus would seem to be in a broadly-defined *Ericion* alliance in the sense of Böcher (1943).

Floristic table H11

	a	b	c	11
<i>Calluna vulgaris</i>	V (1–9)	V (2–9)	V (7–10)	V (1–10)
<i>Carex arenaria</i>	V (1–5)	V (2–4)	V (2–4)	V (1–5)
<i>Festuca ovina</i>	IV (1–8)	IV (2–5)		III (1–8)
<i>Luzula campestris</i>	III (1–4)	III (2–3)		III (1–4)
<i>Polytrichum piliferum</i>	III (1–6)	III (2–5)		III (1–6)
<i>Cornicularia aculeata</i>	III (1–6)	II (1–5)		II (1–6)
<i>Dicranum scoparium</i>	V (1–8)	II (2)	II (1–4)	III (1–8)
<i>Erica cinerea</i>	V (1–8)	II (2)	I (3–6)	III (1–8)
<i>Cladonia impexa</i>	IV (1–7)	II (2–3)		III (1–7)
<i>Cladonia furcata</i>	II (1–5)	I (2)		II (1–5)
<i>Aira praecox</i>	III (1–5)	I (2–3)		II (1–5)
<i>Cladonia floerkeana</i>	II (1–5)	I (2)		I (1–5)
<i>Cladonia pyxidata</i>	II (1–2)	I (2)		I (1–2)
<i>Cladonia gracilis</i>	II (1–7)			I (1–7)
<i>Cladonia foliacea</i>	II (1–4)			I (1–4)
<i>Aira caryophyllea</i>	II (1–3)			I (1–3)
<i>Rosa pimpinellifolia</i>	II (2–5)			I (2–5)
<i>Hypochoeris radicata</i>	II (1–3)			I (1–3)
<i>Cladonia uncialis</i>	II (1–5)			I (1–5)
<i>Jasione montana</i>	I (1–3)			I (1–3)
<i>Campylopus introflexus</i>	I (1–4)			I (1–4)
<i>Cladonia rangiferina</i>	I (1–5)			I (1–5)
<i>Sedum anglicum</i>	I (1–4)			I (1–4)
<i>Cladonia rangiformis</i>	I (2–4)			I (2–4)
<i>Ulex gallii</i>	I (1–7)			I (1–7)
<i>Ononis repens</i>	I (2–4)			I (2–4)
<i>Usnea articulata</i>	I (1–6)			I (1–6)
<i>Cladonia subcervicornis</i>	I (2–4)			I (2–4)
<i>Cladonia bacillaris</i>	I (1–2)			I (1–2)
<i>Cladonia crispata</i>	I (1–2)			I (1–2)
<i>Cornicularia muricata</i>	I (1–4)			I (1–4)
<i>Empetrum nigrum nigrum</i>		V (2–9)	II (1–7)	II (1–9)
<i>Cladonia arbuscula</i>	III (1–6)	IV (2–9)	I (2)	III (1–9)
<i>Agrostis capillaris</i>	I (2–6)	IV (2–4)		II (2–6)
<i>Galium saxatile</i>	I (2)	III (2–4)	I (2)	II (2–4)
<i>Campanula rotundifolia</i>	I (2)	III (2–4)	I (2–4)	II (2–4)
<i>Hylocomium splendens</i>		III (2–5)	I (2)	II (2–5)
<i>Pohlia nutans</i>	I (3)	II (2)	I (2)	I (2–3)

Floristic table H11 (cont.)

	a	b	c	11
<i>Poa pratensis</i>	I (3)	II (2)		I (2–3)
<i>Ptilidium ciliare</i>		II (2)	I (2)	I (2)
<i>Salix repens</i>		II (2–5)		I (2–5)
<i>Vaccinium myrtillus</i>		I (2)		I (2)
<i>Potentilla erecta</i>		I (2)		I (2)
<i>Erica tetralix</i>		I (1–8)		I (1–8)
<i>Hypogymnia physodes</i>	IV (1–8)	II (2)	IV (1–6)	III (1–8)
<i>Hypnum cupressiforme</i>	II (3–6)	III (2–4)	IV (2–6)	III (2–6)
<i>Ammophila arenaria</i>	III (1–4)	III (2–5)	II (1–4)	III (1–5)
<i>Pleurozium schreberi</i>	I (1–6)	III (2–5)	III (1–5)	II (1–6)
<i>Polytrichum juniperinum</i>	III (1–6)	II (2)	II (2)	II (1–6)
<i>Anthoxanthum odoratum</i>	II (1–4)	II (2–4)	I (2)	II (1–4)
<i>Ceratodon purpureus</i>	II (1–3)	II (2–4)	I (2)	II (1–4)
<i>Lotus corniculatus</i>	II (1–2)	II (2)		II (1–2)
<i>Galium verum</i>	II (1–3)	II (2–4)		II (1–4)
<i>Rhytidiadelphus triquetrus</i>		II (2–4)	II (2)	I (2–4)
<i>Peltigera canina</i>	I (1–4)	II (2)	I (1)	I (1–4)
<i>Viola riviniana</i>	I (2–3)	II (2)		I (2–3)
<i>Thymus praecox</i>	I (2–6)	II (2–4)		I (2–6)
<i>Usnea subfloridana</i>	I (2)	I (2)	I (2)	I (2)
<i>Pseudoscleropodium purum</i>	I (4)	I (2)	I (3)	I (2–4)
<i>Deschampsia flexuosa</i>	I (3)	I (2)	I (1–2)	I (1–3)
<i>Lophocolea bidentata</i> s.l.	I (1–2)	I (2)	I (2)	I (1–2)
<i>Cladonia coccifera</i>	I (1–3)	I (2)		I (1–3)
<i>Cerastium fontanum</i>	I (1–2)	I (2)		I (1–2)
<i>Trifolium repens</i>	I (1–3)	I (2)		I (1–3)
<i>Hieracium pilosella</i>	I (1–2)	I (2)		I (1–2)
<i>Rumex acetosella</i>	I (1–3)	I (2)		I (1–3)
<i>Teesdalia nudicaulis</i>	I (3–4)	I (2)		I (2–4)
<i>Racomitrium canescens</i>	I (1–3)	I (2)		I (1–3)
<i>Senecio jacobaea</i>	I (3)	I (2)		I (2–3)
Number of samples	32	25	10	67
Number of species/sample	17 (8–28)	17 (13–26)	10 (3–14)	16 (3–28)
Vegetation height (cm)	14 (3–55)	10 (4–25)	60 (30–100)	18 (3–100)
Shrub/herb cover (%)	56 (10–98)	no data	90 (50–100)	62 (10–100)
Ground layer cover (%)	55 (5–90)	no data	33 (5–60)	50 (5–90)
Altitude (m)	4 (2–8)	no data	2 (0–5)	3 (0–8)
Slope (°)	8 (0–50)	no data	4 (0–25)	6 (0–50)

a *Erica cinerea* sub-communityb *Empetrum nigrum nigrum* sub-community

c Species-poor sub-community

11 *Calluna vulgaris*-*Carex arenaria* heath (total)

