
H9

Calluna vulgaris-*Deschampsia flexuosa* heath

Synonymy

Heather Moor Smith & Moss 1903, Smith & Rankin 1903 *p.p.*; *Callunetum* Lewis & Moss 1911, Elgee 1914, Tansley 1939, Fidler *et al.* 1970 *p.p.* *Calluno-Ericetum cinereae* Bridgewater 1970 *p.p.*; *Cladonio crispatae-Callunetum* Coppins & Shimwell 1971 *p.p.*; *Pohlio-Callunetum* Shimwell 1975 *p.p.*

Constant species

Calluna vulgaris, *Deschampsia flexuosa*, *Pohlia nutans*.

Physiognomy

In the *Calluna vulgaris*-*Deschampsia flexuosa* heath, *Calluna vulgaris* is almost always the most abundant plant, though it often forms a fairly low, and sometimes quite open, canopy made up of immature individuals: burning is very common on the heathlands where this community occurs, many stands are of a more or less uniform age and relatively few are old enough to have mature or degenerate heather plants. Quite often, too, the cover shows signs of grazing with the heather nibbled close and both these factors have some influence on the contribution of other sub-shrubs. Typically, none of these associates is consistently frequent throughout, though certain species can become quite common and attain a measure of local abundance, if only exceptionally rivalling *Calluna* in their cover. *Vaccinium myrtillus* is the most important of these and, particularly where the community extends to higher altitudes, where the climate is cooler and more humid, its frequency and abundance presage a shift to the *Vaccinium myrtillus*-*Deschampsia flexuosa* heath. Much more locally, *V. vitis-idaea* and/or the hybrid *V. × intermedium* (Ritchie 1955*b*) can be found here, and *Empetrum nigrum* ssp. *nigrum* has sometimes spread in this kind of vegetation, as on Ilkley Moor in West Yorkshire (Fidler *et al.* 1970, Dalby *et al.* 1971). *Erica cinerea* and *Ulex gallii*, by contrast, are very scarce, although stands of the *Calluna*-*Ulex gallii* heath, of which both of these species are characteristic, do occur within the range of the *Calluna*-

Deschampsia heath and can be difficult to separate from it. *Erica tetralix* is likewise rare, although it can figure locally in transitions to the *Ericetum tetralicis*, a fairly common feature in the mosaics of dry and wet heaths seen in the North York Moors (e.g. Elgee 1914).

Apart from *Calluna*, the only other vascular constant of the community is *Deschampsia flexuosa* but, even where the cover of the heather is fairly open, this is often represented by fairly sparse tufts and, under very dense canopies, it can be virtually extinguished. Grazed stands, though, can have higher covers of the grass and then the vegetation may grade to the *Deschampsia* grassland, in which the balance has been decisively shifted against heather. Other grasses play a much more limited role even than this: *Molinia caerulea* can become frequent on moister ground, though usually with but little vigour, but apart from this there are just very occasional plants of *Agrostis capillaris*, *Holcus lanatus*, *H. mollis* and *Festuca rubra*. Other herbs are likewise few in number and generally of low cover: *Juncus squarrosus* can sometimes be found, *Galium saxatile* and *Potentilla erecta* become frequent in grazed stands and *Pteridium aquilinum* occurs occasionally with moderate abundance. Seedlings of oak, birch and *Pinus sylvestris* are sometimes seen but they rarely survive to the sapling stage with such frequent burning and grazing.

Ground cover in the *Calluna*-*Deschampsia* heath is rather variable, but bryophytes and lichens are rarely very abundant, even among the more open canopies of heather, and this element of the flora is often poor in species. But its composition is quite characteristic with small acrocarpous mosses, certain leafy hepatics and encrusting lichens predominating over bulky pleurocarps and fruticose lichens. In contrast to the *Calluna*-*Vaccinium* and *Vaccinium*-*Deschampsia* heaths, for example, *Hypnum cupressiforme* s.l. is of restricted occurrence here and species like *Hylocomium splendens*, *Pleurozium schreberi* and *Ptilidium ciliare* very scarce. *Pohlia nutans*, on the other hand, is very common in all but the most impoverished stands and *Campylopus*

paradoxus and *Dicranum scoparium* also occur occasionally, together with the introduced moss *Orthodontium lineare*. This was first recorded in West Yorkshire in 1920 (Watson 1922) but spread rapidly on to bare ground in both heaths and woods through the heavily-polluted south Pennines and is now, indeed, in some areas, the most frequently encountered moss in this community. Then, over patches of exposed mineral soil, where the humic top has been burned or eroded away, there can be locally abundant *Polytrichum juniperinum*, *P. piliferum* and *P. commune*. Among the leafy hepatics, *Gymnocolea inflata* is particularly characteristic, with occasional *Barbilophozia floerkii*, *Cephalozia bicuspidata*, *Cephaloziella divaricata* and *Calypogeia muellerana*.

The commonest lichens of the community are *Cladonia chlorophaea*, *C. floerkeana*, *C. squamosa*, *C. coniocraea* and *C. fimbriata*, forming occasional scattered patches encrusting the surface of the ground, sometimes with *Lecidea granulosa* and *L. uliginosa* over peat and rotting wood and *Hypogymnia physodes* over old *Calluna* branches and stools.

Sub-communities

***Hypnum cupressiforme* sub-community.** Heather is typically strongly dominant here but, rather exceptionally in the *Calluna*-*Deschampsia* heath, the bushes tend to be large and mature or even degenerate, with their opening centres becoming accessible for recolonisation. *Vaccinium myrtillus* occasionally finds an opportunity to spread in such situations, or *Pteridium aquilinum*, and there are frequent, sometimes dense, tufts of *Deschampsia flexuosa*. But it is among the mosses that the most distinctive features of the vegetation are to be seen, because *Hypnum cupressiforme* s.l. is unusually common and often abundant among the heather stools, with *Dicranum scoparium* also preferential and frequently rivalling *Pohlia nutans* in its cover. Other mosses, though, and leafy hepatics, are sparse and, apart from occasional *Hypogymnia physodes* growing on older *Calluna* branches, lichens are very few.

***Vaccinium myrtillus*-*Cladonia* spp. sub-community.** This is the richest kind of *Calluna*-*Deschampsia* heath, characterised by younger canopies of heather, often in a state of obvious recovery from burning. There is frequently, particularly at higher altitudes, a little *Vaccinium myrtillus* and, more locally, other sub-shrubs can figure, with *V. vitis-idaea* and *V. × intermedium* sometimes marking out sites of surface disturbance (Ritchie 1955b, Shimwell 1973b), *Empetrum nigrum* ssp. *nigrum* spreading where burning combined with grazing has given it an edge over the more palatable species (Fidler *et al.* 1970, Dalby *et al.* 1971). Usually, *D. flexuosa* has rather low cover and, in frequently burned sites, it can be altogether absent,

but over the ground among the sub-shrubs, bryophytes and lichens are more varied than in any other kind of *Calluna*-*Deschampsia* heath. *Pohlia nutans*, *Campylopus paradoxus* and *Orthodontium lineare* all occur frequently as scattered shoots or in small tufts and there are often patches of the typical leafy hepatics of the community, sometimes further enriched by *Calypogeia fissa*, *Cephalozia connivens* and *Cephaloziella hampeana*. Among the lichens, *Cladonia chlorophaea* and *C. floerkeana* are the most frequent, with occasional records, too, for *C. squamosa*, *C. coccifera* and, more locally on some of the Cheshire and Staffordshire heathlands, *C. crispata*, a fruticose species which Coppins & Shimwell (1971) used to separate off samples into a distinct community (see also Shimwell 1973b).

Species-poor sub-community. In this most impoverished form of *Calluna*-*Deschampsia* heath, *Calluna* and *D. flexuosa* are the only constants and, under very dense or frequently-burned canopies of heather, even the latter can be much attenuated in its cover or totally extinguished. *V. myrtillus* occurs occasionally in small amounts but, even where there are considerable areas of bare ground among the sub-shrubs, the bryophyte and lichen flora is dismally poor. *Pohlia nutans*, *Campylopus paradoxus* and *Orthodontium lineare* all show reduced frequencies compared with the last sub-community and there are just very occasional patches of *Gymnocolea inflata* and *Cladonia squamosa*.

***Galium saxatile* sub-community.** *Calluna* remains constant here but it is quite often rivalled in cover by *D. flexuosa* which can form fairly extensive patches of tussocky turf among the heather, locally enriched by a little *Holcus mollis* or *Festuca rubra*. Then, very commonly, there are scattered plants or locally prominent patches of *Galium saxatile* and occasional *Potentilla erecta* with, on scuffed areas, some *Rumex acetosella*. Oak seedlings can sometimes be found too. Lichens and hepatics are noticeably sparse among the grassy ground and, even among mosses, only *Pohlia nutans* and *Hypnum cupressiforme* s.l. occur more than very occasionally.

***Molinia caerulea* sub-community.** Heather is generally very abundant in this sub-community, but *D. flexuosa* is frequently accompanied by small amounts of *Molinia* which brings a little variegation to the canopy. The ground layer, however, is poorly developed with just very sparse *Pohlia nutans* and *Campylopus paradoxus*.

Habitat

The *Calluna*-*Deschampsia* heath is the characteristic sub-shrub vegetation of acid and impoverished soils at low to moderate altitudes through the Midlands and

northern England. The relatively cool and wet climate of this part of Britain has some influence on the floristics of the community but much of its character derives from a combination of frequent burning and grazing with heavy atmospheric pollution around the industrial conurbations of the region.

Throughout the range of the community, which extends in an arc from south Lancashire, round the southern Pennines, taking in stands in the Cheshire/Shropshire plain, Staffordshire and Nottinghamshire, up into the North York Moors and Durham, annual rainfall is almost everywhere more than 800 mm with in excess of 140 wet days yr^{-1} . And, towards the centre of its distribution, in the fringes of the Pennine uplands, where this kind of heath frequently extends above 200 m, precipitation rises steeply to 1000 mm and beyond, with more than 160 wet days yr^{-1} (Climatological Atlas 1952, Ratcliffe 1968, Atkinson & Smithson 1976). Generally, too, the climate is cool, with, over most of the region, annual accumulated temperatures of less than 1100 day-degrees C (Page 1982). Thus, though the winters are not especially harsh – indeed, at lower altitudes, February minima are often above freezing (Page 1982) – the warm oceanic conditions characteristic of the heathlands of south-western Britain are not found here.

In floristic terms, such climatic differences are seen first in the scarcity in this community of *Ulex gallii*, an Oceanic West European sub-shrub that is often co-dominant in the *Calluna-U. gallii* dry heath, typical of similar soils to those found here but centred in the more equable western lowlands of Britain. In fact, the geographical boundary between the two communities is not a hard and fast one: *U. gallii* can be found locally right across the central and southern parts of the range of the *Calluna-Deschampsia* heath but, where it marks out definite stands of the *Calluna-U. gallii* heath, the separation between the communities is often an altitudinal one, the latter kind of heath being generally confined to lower levels within the area of overlap. *Erica cinerea*, too, often marks out what is essentially the same geographical and floristic boundary in this part of the country, though it is, of course, much less narrowly oceanic than *U. gallii* (Bannister 1965, Gimingham 1972), remaining an important component of heaths to the far north of Britain outside the more montane and boreal zones.

On the positive side, the cool and wet climatic conditions are reflected in the occurrence here of *Vaccinium-myrtillus* and, more locally, of *V. vitis-idaea*, *V. × intermedium* and *Empetrum nigrum* ssp. *nigrum*. The first, though of Continental Northern distribution through Europe as a whole, occurs widely in this country where the annual rainfall is more than the usual minimum for the *Calluna-Deschampsia* heath, 800 mm, so it can be found locally in the more southerly lowlands of Britain

in such sub-shrub communities as the *Calluna-U. minor* heath, which provides a locus in the western Weald, in the *U. gallii-Agrostis* heath around Dartmoor and Exmoor and in the *Calluna-U. gallii* heath along the Welsh Marches. But it is here, particularly on less sunny aspects and, more extensively, at somewhat higher altitudes around the Pennine fringes, that it begins to assume the important role that it has in the Myrtilion heaths that are widespread through our uplands. And for *V. vitis-idaea* and *E. nigrum* ssp. *nigrum*, which are Arctic-Alpine in a European context, and much more strongly confined in Britain to the cooler montane zone, the *Calluna-Deschampsia* heath provides an important occasional locus towards the lowland extreme of their ranges. When mixtures of these species occur with heather, the composition of the *Calluna-Deschampsia* heath closely approaches that of the *Vaccinium-Deschampsia* heath, the most widespread sub-shrub vegetation of northern Britain at altitudes over 500 m. Such floristic convergence is best seen in the *Vaccinium-Cladonia* sub-community which, though found throughout most of the range of the *Calluna-Deschampsia* heath, is best developed in the cooler, moister conditions in the Pennine foothills between 200 and 400 m. Even here, however, dominance typically remains with *Calluna*, although various kinds of treatment can give other of the sub-shrubs a temporary or local advantage (see below), thus confusing the natural environmental boundary between the different kinds of heath.

Through the lowland and sub-montane zones of the Midlands and northern England, acidic and impoverished soils suitable for carrying the *Calluna-Deschampsia* heath have developed widely from both pervious drift-free bedrocks and more free-draining superfcials. At moderate altitudes in the southern Pennines, for example, down through West and South Yorkshire and on into Derbyshire and Staffordshire, the resistant sandstones of the Millstone Grit provide an important substrate over the prominent scarps and steep, stepped valley sides that mark the first real rise towards the Pennine summit plateaus. Around this region, running into central Lancashire and down the eastern side of the Pennines, south into Nottinghamshire, then reappearing in the West Midlands, there is the more subdued scenery of the Coal Measures, where arenaceous strata cropping out as cuesta scarps provide scattered tracts of suitable ground. Then, through southern Staffordshire, across much of the Cheshire-Shropshire Plain and up through the Nottinghamshire lowlands, Permo-Triassic sandstones and conglomerates underlie the low but resistant flat-topped hills that occur in Cannock Chase, for example, and which form the basis of the gently undulating scenery of Delamere and Sherwood forests. Across these areas, too, certain superfcials, notably

glacio-fluvial and river terrace drift, together with patches of aeolian sand, underlie this kind of vegetation. Finally, at some remove, in the North York Moors, the *Calluna-Deschampsia* heath can be found over the more pervious strata among the complex sandwich of Jurassic sandstones and shales exposed over the gently-domed surface of the plateau.

Such substrates as these have weathered to a variety of very base-poor soils, with surface acidity generally between pH 3 and 4, highly oligotrophic and at least moderately free-draining, often excessively so. Occasionally, the *Calluna-Deschampsia* heath occurs on steeper slopes and among rock exposures, as around the free faces and weathering detritus of coarser sandstones and grits, and here the profiles may be kept in a more or less permanently immature state, being fragmentary or shallow rankers, often very sandy below. Deeper brown sands, derived from Permo-Triassic sandstones and coarse superficials, and showing some differentiation of horizons, can also be found beneath this kind of vegetation over the gentler ground of the Cheshire-Shropshire plain and around Delamere Forest and Cannock Chase, where the Bridgnorth and Newport series are important, and in Sherwood with its Cuckney profiles (Furness 1978, *Soil Survey* 1983, Ragg *et al.* 1984), though the relative ease with which these soils can be worked and improved for agriculture has left only small fragments with heath in many places. Most often, however, the gentler-sloping surfaces of dips and plateaus of arenaceous rocks, where the community is most widespread and extensive, carry some kind of podzolised profile, like those of the Anglezarke, Belmont and Maw series in the Pennines and North York Moors (Carroll *et al.* 1979, Carroll & Bendelow 1981) and the Goldstone in Delamere and Cannock (Furness 1978, Ragg *et al.* 1984). In such profiles, and particularly those occurring in the rainier environment of the upland fringes, a thick humic top, up to 10 cm or more deep, can develop and be kept quite moist, despite the sharply-draining character of the soil, though frequent burning may repeatedly set back the accumulation of organic detritus and especially intense fires strip the humic horizon right back to the underlying mineral material. In other cases, the development of an iron pan or a bleached hard pan may encourage some drainage impedance in the profile and the *Calluna-Deschampsia* heath can extend some considerable way on to stagnopodzol intergrades to raw peat soils. Typically, however, this is a dry heath community in the sense that conditions are never such as to favour the frequent representation of *Erica tetralix*, although towards the edaphic limits of the *Calluna-Deschampsia* heath on moister ground, burning may play some part in extending the supremacy of heather further than one might expect. Certainly, intimate mosaics of the community with the *Ericetum*

tetralicis wet heath are very common over the more ill-drained parts of the North York Moors and in some places the *Molinia* sub-community can be seen as a transition to such vegetation on wetter soils. Elsewhere, this kind of *Calluna-Deschampsia* heath provides a very local extension of the community on to raised and valley-mire peats scattered through its lowland range, where these have been drained and cut over or otherwise become dry, and in such situations there can be some very modest amelioration of the extremely impoverished soil conditions where the organic matter is disturbed or oxidised.

For the most part, however, the calcifuge and oligotrophic character of the flora of this community accurately reflects the prevailing edaphic conditions and may itself have contributed to the progressive impoverishment of the soils by acidification and promotion of podzolisation following woodland clearance. Some tracts of the *Calluna-Deschampsia* heath may not be very old – in Cannock Chase, for example, tree-felling to supply the local iron industry led to a spread of heath in this Norman forest from the mid-sixteenth century – but much probably dates originally from the combination of worsening climate and deforestation in the Iron Age (e.g. Hicks 1971, Gimingham 1972). And the generally species-poor character of the vegetation bears strong testimony to long histories of burning, to maintain grazing for sheep around the upland fringes and, more recently, as an essential part of the management of moorland for grouse-shooting, particularly important here in the North York Moors. Regular controlled burning, or frequent accidental fires on stretches of heath open for recreation, an important use of stands close to larger centres of population, help maintain the general dominance of *Calluna* in the community and account for the widespread preponderance of more or less permanently immature canopies, sometimes disposed in variegated patterns of burns, or 'swiddens' as they are known in the North York Moors (Elgee 1914), of pioneer and building phases, but not often progressing to the degenerate phase (Watt 1955). Such rare older canopies can be found here, showing the distinctive preferentials of the *Hypnum* sub-community, characteristic of the collapsing centres of the bushes, but these stands are largely confined to fragments of neglected heathland through the Midland plain.

The bulk of younger stands can thus be incorporated in the *Vaccinium-Cladonia* and Species-poor sub-communities, the floristic and structural differences between these two kinds of *Calluna-Deschampsia* heath perhaps reflecting the time since burning and the frequency of fires. Even in the former vegetation, however, the enrichment in bryophytes and lichens beneath the recovering, but still fairly open, heather canopy is of a particular type, and there seems little doubt that, throughout the

community, the abundance and diversity of these elements of the flora are further strongly inhibited by atmospheric pollution (Shimwell 1973b). Through almost the entire range of the *Calluna-Deschampsia* heath, such pollution, as measured by the sulphur dioxide concentration, is of a high order, between 50 and $100 \mu\text{g m}^{-3}$ in the data collated by the Warren Spring Laboratory and many stands lie within the immediate ambit of the great conurbations of south Lancashire, Yorkshire and the Midlands, where the effects of industrial and domestic emissions have been strongly felt for well over a century. The preponderance of the acrocarpous mosses *Pohlia nutans* and *Orthodontium lineare*, and the scarcity of pleurocarps, apart from *Hypnum cupressiforme* s.l., and of Cladina lichens, even in the more mature heaths, can probably be related to this phenomenon (Watson 1922, Hawksworth 1969): these same features can be seen, too, in the impoverished heathlands around the industrial centres of Belgium, The Netherlands and Germany (Barkman in Shimwell 1973b). The often rather slimy surfaces of the peats in the *Calluna-Deschampsia* heath also seem to present a congenial habitat for certain leafy hepatics, most distinctively *Gymnocolea inflata*. Taken together with the restricted role that the *Vaccinia* and *Empetrum nigrum* have here, these characteristics help distinguish the community from the *Calluna-Vaccinium* heath, which is the predominant kind of heather-dominated vegetation through most of the sub-montane zone in northern Britain: essentially, the *Calluna-Deschampsia* heath can be seen as a polluted vicariant of this community, replacing it at the southern lowland extreme of its range.

At such an extreme, it seems that gross disturbance of the heathland habitat provides almost the best opportunity for the local abundance in the *Calluna-Deschampsia* heath of sub-shrubs like *Vaccinium vitis-idaea* and *Empetrum nigrum* ssp. *nigrum* which are very frequent in the *Calluna-Vaccinium* heath. Thus, it is over ground disrupted by such activities as army manoeuvres and quarrying, which destroy the humose topsoil to the profiles, that these species often get a strong hold by rapid rhizomatous spread (Shimwell 1973b). Such conditions, too, seem important for the appearance of *V. × intermedium* which also figures very occasionally in such stands of the community. This vigorous hybrid is of very restricted distribution in Britain (Ritchie 1955b, Perring 1968), being common only at moderate altitudes in Derbyshire and Staffordshire, despite the frequent occurrence together of *V. myrtillus* and *V. vitis-idaea* through much of upland northern Britain. But what seems particular to this area is the combination of somewhat irregular burning with various kinds of disturbance (e.g. Gourlay 1919) in a zone where there is considerable overlap in the floral phenology of the parents (Ritchie 1955b), thus allowing crossing between

plants brought into sudden juxtaposition in an unstable environment.

Combinations of burning with grazing can also help entrench the local abundance of less palatable sub-shrubs like *V. vitis-idaea* (Ritchie 1955a) and *Empetrum nigrum* ssp. *nigrum* (Bell & Tallis 1973), and the spread of the latter in the *Calluna-Deschampsia* heath on Ilkley Moor in West Yorkshire, where during and after the Second World War there was heavy stocking with sheep under a common grazing system with no stint, has been very marked (Fidler *et al.* 1970, Dalby *et al.* 1971).

Long-sustained grazing of more typical stands of the community, where heather, perhaps with some bilberry, makes up the canopy, tends to favour elimination of these palatable sub-shrubs with a consequent expansion of *Deschampsia flexuosa*, and the appearance of Nardo-Galion herbs like *Galium saxatile* and *Potentilla erecta*, features which characterise the *Galium* sub-community, a kind of *Calluna-Deschampsia* heath that is especially common on lowland fragments of heathland associated with wood-pasture as in Sherwood.

Zonation and succession

The *Calluna-Deschampsia* heath can be found in zonation and mosaics with wet-heath and mire vegetation where the major influence on floristic variation is natural differences in the moisture content of suites of base-poor and oligotrophic soils. Even in such situations, however, the effects of such factors as burning, grazing and draining complicate the patterns of vegetation types and, in many cases, these are of overriding importance, their effects being especially clearly seen over more uniform tracts of soils, where patchworks of the community, with grasslands and woodlands, represent stages in regeneration and succession. Neglect of traditional treatments has seen extensive invasion by trees at some sites, particularly in the lowlands, though it is there, too, that previously large tracts of heath and woodland have been most assiduously reclaimed for agriculture. In other cases, both in the lowlands and around the upland fringes, the community has been replaced by coniferous plantations.

In a few sites, the *Calluna-Deschampsia* heath forms the dry-heath component in the classic kind of lowland valley-mire zonation that is so characteristic of central southern and south-west Britain, occurring over the most free-draining of the sequence of acidic soils disposed around elongated hollows through which there is concentration of ground waters draining from the surrounds or from particular springs and flushes. Even through the lowland parts of the range of the community, the climate is not sufficiently oceanic to see the transgression of *Erica tetralix* and *Molinia* on to more free-draining soils, so a humid heath zone, such as is typical of these patterns in the more Atlantic parts of the

country, is lacking, and there is generally a sharper shift, over ground that shows increasingly strong gleying, to the *Ericetum tetralicis* wet heath, where these two species can have ascendancy over *Calluna*; and then, where there is continuous stagnation more or less to the surface, with accumulation of peat proper, the vegetation changes to the *Narthecio-Sphagnetum* bog. This kind of pattern can still be seen in parts of Cannock Chase, developed around the valleys incised into the Bunter sandstones, pebble-beds and breccias (Ratcliffe 1977), but, though the systems are hydrologically similar to those of, say, the New Forest, the flora is, throughout the sequence, of a more impoverished character. Both the *Ericetum* and *Narthecio-Sphagnetum* are approaching their geographical limits in this part of Britain and, over the drier ground, generations of burning and disturbance have much reduced the *Sphagnum* component of the wet heath and favoured a general abundance of heather throughout, thus blurring the boundaries between the communities. More recently, wholesale lowering of the water-table, probably as a result of coal-mining beneath the Chase, is drying out the mire systems there, eliminating the wetter elements or causing them to migrate downstream.

Essentially the same pattern as this can be seen at somewhat higher altitudes in the North York Moors, where certain of the drainage hollows on the plateau, notably at Fen Bog, have zonations which, though also affected by burning and grazing, still show the controlling influence of a stagnation gradient. In this area, though, and around the upland fringes of the southern Pennines, the *Calluna-Deschampsia* heath is more often found in what is really a reverse sequence of communities, giving way over gentler slopes at higher altitudes to wet heath, then to blanket mire, with the development of increasingly thick ombrogenous peats. In the North York Moors, the *Calluna-Deschampsia* heath and the *Juncus-Dicranum* sub-community of the *Ericetum tetralicis* form the bulk of the vegetation cover over the complex patchworks of Anglezarke humo-ferric podzols, Maw stagnopodzols and Wilcocks stagnohumic gleys, with relatively small areas of *Calluna-Eriophorum* mire marking out Winter Hill peats, almost the whole of these patterns being overlain by systems of swiddens burned for grouse-rearing. On the Pennines, the wet-heath zone is much less extensive and the *Calluna-Deschampsia* heath frequently gives way directly, over what is often a much fretted fringe to the ombrogenous peat, to the blanket mire vegetation, characteristically in this part of Britain of the *Eriophorum* type, in which the effects of pollution, grazing, burning and draining are also all too evident. In such zonations, the increase in the abundance of *Eriophorum vaginatum* among the heather is often the only indicator of the switch in vegetation types, species such as *Deschampsia flexuosa*, the acrocar-

pous mosses and encrusting lichens maintaining their frequency over the dry peat margins. Patches of the *Calluna-Deschampsia* heath can recur at higher levels where the peat blanket is interrupted by grit outcrops but, increasingly in the wetter cooler climate of these high edges, the community is replaced by the *Vaccinium-Deschampsia* heath in which bilberry is the typical dominant.

Rather different kinds of vegetation patterns are to be seen where the *Calluna-Deschampsia* heath occurs on tracts of prevailingly dry, base-poor and oligotrophic soils, such as have developed on sandstone scarps and plateaus and over coarser superficals at lower altitudes through the range of the community. In such situations, it is patchworks of the heath with grasslands and woodlands that make up the bulk of the scenery, so characteristic of places like Delamere and Sherwood Forests and the higher ground in Cannock Chase. Such patterns are largely a reflection of treatment history, with burning and grazing, or their neglect, playing a major part in the disposition of stands of various of the sub-communities of the *Calluna-Deschampsia* heath, of *Deschampsia flexuosa* grassland, which is often a grazed derivative of the *Galium* sub-community within which heather has been substantially reduced, and of the *Quercus-Betula-Deschampsia* woodland, which is the characteristic climax forest of dry, acidic soils in this part of Britain, derived from the heath by invasion of oak and birch. Widespread abandonment of traditional treatments has often favoured the succession to woodland, with the virtual extinction of heath in some sites, though temporary patches of the *Calluna-Deschampsia* community comprise the typical gap flora of the *Quercus-Betula-Deschampsia* woodland. In many places, too, land-use changes have led to an extensive spread of the *Pteridium-Galium* community which can readily replace the *Calluna-Deschampsia* heath on the deeper of the soils that it favours.

Commercial afforestation has also been extensive over many stretches of podzolised soils through the range of the *Calluna-Deschampsia* heath which, with some preparation, can support reasonable crops of *Pinus sylvestris*, *P. nigra* var. *maritima* and larches, all of which, especially the pines, are readily able to seed into remaining tracts of open heathland around. The brown sand soils of the Midland plain too, though droughty, highly impoverished and susceptible to erosion by wind and rain, are readily worked and many areas have been reclaimed and improved for arable and pastoral agriculture, fragmenting the remaining distribution of the community.

Distribution

The *Calluna-Deschampsia* heath is concentrated in the southern Pennines and North York Moors with more

local occurrences scattered through the Midland plain. In the former areas, the Species-poor and *Vaccinium-Cladonia* sub-communities are the usual forms, widespread and sometimes extensive over heathlands and moors that are still frequently burned. The *Hypnum*, *Molinia* and *Galium* sub-communities are primarily found on lowland sites where burning has fallen into disuse.

Affinities

The community subsumes much of the heather-dominated vegetation described in the early accounts of the moorland of Northern England (Smith & Moss 1903, Smith & Rankin 1903, Lewis & Moss 1911, Elgee 1914), but its more precise definition essentially follows the proposal of Shimwell (1973*b*) in diagnosing an impoverished heath type distinct from both the lowland *Ulex* heaths of south-west Britain and the Myrtillion communities of the montane zone. In fact, the *Calluna-Deschampsia* heath is somewhat broader than Shimwell's (1973*b*) *Pohlio-Callunetum*, including also some of

what Coppins & Shimwell (1971) grouped in a rather richer *Cladonio crispatae-Callunetum* and it is not so sharply marked off from the upland Myrtillion heaths. Indeed, among the range of other heath types distinguished in Britain, the *Calluna-Deschampsia* heath is best seen as an impoverished replacement for the *Calluna-Vaccinium* heath around its southern limit. From another perspective, the community can be viewed as a degraded northern form of the Continental Genisto-Callunion vegetation included in the *Calluna-Festuca* heath of the eastern lowlands of England, though here the affinities would be based largely on the past distributions of species such as *Genista anglica* and the Cladina lichens, plants which are not in any case restricted to the warmer south-east of the country. In view of its especially impoverished character, Shimwell (1973*b*) proposed erecting a new Pohlio-Callunion alliance to contain this kind of heath and perhaps similar communities described from The Netherlands (Stoutjesdijk 1959, de Smidt 1966, Touw 1969).

Floristic table H9

	a	b
<i>Calluna vulgaris</i>	V (8–10)	V (7–10)
<i>Deschampsia flexuosa</i>	V (3–7)	IV (1–8)
<i>Pohlia nutans</i>	IV (2–5)	IV (2–8)
<i>Hypnum cupressiforme</i>	V (3–8)	II (2–5)
<i>Dicranum scoparium</i>	IV (3–8)	I (1–4)
<i>Pteridium aquilinum</i>	II (2–5)	I (1–4)
<i>Hypogymnia physodes</i>	II (1–2)	I (1–2)
<i>Vaccinium myrtillus</i>	II (1–4)	IV (1–7)
<i>Campylopus paradoxus</i>	I (3–5)	III (2–5)
<i>Cladonia chlorophaea</i>	I (3–5)	III (1–5)
<i>Gymnocolea inflata</i>		III (1–7)
<i>Cladonia floerkeana</i>	I (3)	III (1–4)
<i>Orthodontium lineare</i>	I (2–3)	III (1–3)
<i>Calypogeia muellerana</i>	I (2)	II (1–3)
<i>Cladonia squamosa</i>	I (2–5)	II (2–4)
<i>Cephaloziella divaricata</i>	I (3)	II (1–4)
<i>Barbilophozia floerkii</i>	I (2–4)	II (1–4)
<i>Cladonia coccifera</i>	I (3–4)	II (2–7)
<i>Empetrum nigrum nigrum</i>		I (2–6)
<i>Vaccinium vitis-idaea</i>		I (5–8)
<i>Vaccinium</i> × <i>intermedium</i>		I (2–3)
<i>Cladonia crispata</i>		I (2–6)
<i>Galium saxatile</i>		I (1–3)
<i>Potentilla erecta</i>		I (1)
<i>Rumex acetosella</i>		
<i>Festuca rubra</i>		I (2)
<i>Holcus mollis</i>		
<i>Quercus</i> spp. seedling		
<i>Molinia caerulea</i>	I (3–5)	I (4)

c	d	e	9
V (3–10)	V (4–10)	V (9–10)	V (3–10)
IV (1–8)	V (3–7)	V (3–5)	IV (1–8)
III (1–6)	III (4–7)	II (2–3)	IV (1–8)
I (1)	II (3–5)		II (1–8)
I (1)	I (4)		II (1–8)
I (4–7)	I (3–5)		I (1–7)
I (1)			I (1–2)
II (1–5)	I (4)	I (3)	II (1–5)
III (1–3)	I (2–3)	II (2–4)	II (1–5)
I (2)	I (3)	II (2–4)	II (1–5)
II (1–6)	I (4)	I (2)	II (1–7)
I (1–3)			II (1–4)
II (1–6)			II (1–6)
I (1–5)		I (2)	I (1–5)
II (1–3)		I (2–3)	I (1–4)
I (3–4)	I (3)	I (2–3)	I (1–4)
			I (1–4)
I (2)		I (3–4)	I (2–7)
			I (2–6)
			I (5–8)
			I (2–3)
			I (2–6)
	V (2–5)		I (2–5)
	III (3–4)		I (1–4)
	II (3)		I (3)
	II (3–4)		I (2–4)
	II (3)		I (3)
	II (2–4)		I (2–4)
	I (2)	V (2–5)	I (2–5)

Floristic table H9 (cont.)

	a	b
<i>Cladonia coniocraea</i>	I (3)	I (1–3)
<i>Cladonia fimbriata</i>	I (3)	I (2–3)
<i>Agrostis capillaris</i>	I (3)	I (1–4)
<i>Juncus squarrosus</i>	I (3–4)	I (1–5)
<i>Lepidozia reptans</i>	I (1–3)	I (3)
<i>Holcus lanatus</i>	I (1–3)	I (3)
<i>Pinus sylvestris</i> seedling	I (1)	I (1)
<i>Ptilidium ciliare</i>	I (2–4)	I (2–3)
<i>Eriophorum angustifolium</i>	I (3–4)	I (1–4)
<i>Cladonia uncialis</i>	I (1–4)	I (3–4)
<i>Cornicularia aculeata</i>	I (3)	I (5)
<i>Teucrium scorodonia</i>	I (2)	
Number of samples	34	96
Number of species/sample	7 (4–11)	11 (2–21)
Vegetation height (cm)	44 (22–75)	31 (7–100)
Shrub/herb cover (%)	97 (80–100)	97 (65–100)
Ground layer cover (%)	34 (5–80)	29 (2–85)
Altitude (m)	243 (46–594)	234 (5–487)
Slope (°)	5 (0–50)	9 (0–45)

a *Hypnum cupressiforme* sub-community

b *Vaccinium myrtillus*-*Cladonia* spp. sub-community

c Species-poor sub-community

d *Galium saxatile* sub-community

e *Molinia caerulea* sub-community

9 *Calluna vulgaris*-*Deschampsia flexuosa* heath (total)

c	d	e	9
I (3)	I (2)	I (2)	I (1–3)
I (1)		I (2)	I (1–3)
I (2–3)	I (3–4)		I (1–4)
I (1)	I (2–4)		I (1–5)
I (3)			I (1–3)
I (3)			I (1–3)
		I (1)	I (1)
			I (2–4)
			I (1–4)
			I (1–4)
			I (3–5)
		I (2)	I (2)
36	8	8	175
6 (3–12)	9 (5–14)	7 (3–14)	8 (2–15)
41 (6–100)	36 (10–60)	70 (25–100)	39 (6–100)
89 (45–100)	93 (60–100)	98 (95–100)	97 (45–100)
9 (0–40)	18 (0–50)	6 (0–40)	25 (0–85)
236 (61–375)	113 (60–229)	169 (15–305)	237 (5–594)
6 (0–35)	4 (0–15)	4 (0–30)	7 (0–50)



