
H1

Calluna vulgaris-*Festuca ovina* heath

Synonymy

Callunetum arenosum Tansley 1911 *p.p.*; *Callunetum* Farrow 1915, Watt 1936; *Callunetum arenicolum* Tansley 1939 *p.p.*

Constant species

Calluna vulgaris, *Festuca ovina*, *Dicranum scoparium*, *Hypnum cupressiforme* *s.l.*

Physiognomy

The *Calluna vulgaris*-*Festuca ovina* heath is a heather-dominated community, very poor in vascular associates, though sometimes showing a modest diversity among the bryophytes and, more especially, the lichens. *Calluna vulgaris* is usually the only woody species present and invariably the most abundant. More particularly, *Erica cinerea*, *Ulex minor* and *U. gallii*, which become important constituents of the sub-shrub component of dry heaths further to the south and west, are largely excluded here. They sometimes figure in stands on or near the East Anglian coast, and the first two can occasionally be found in the few stations for the community south of the Thames, but the general scarcity of these species furnishes a good diagnostic criterion, provided that it is remembered that they can be locally eliminated from richer heath types to produce the kind of virtually pure *Calluna* that is usual here. Another general absentee is *Erica tetralix*: this becomes increasingly prominent through the whole range of wet and humid heaths towards south-west Britain but is very scarce here and strictly limited to those rather unusual situations where there is a transition to soils with impeded drainage. *Ulex europaeus* is likewise uncommon, though it can become locally abundant where there has been some disturbance, not necessarily recent, as along trackways or around the margins of plantations.

However, although it is *Calluna* which gives this community its distinctive stamp, the cover and height of the canopy are very variable. This affects not only the gross appearance of the vegetation, which can have a

canopy of living heather anything between 10 and 100 cm tall, covering 50–100% of the ground, but it also has a controlling influence on the variety, abundance and distribution of the associated flora, which is for the most part confined to areas between the *Calluna* clumps and to the centre of those bushes which are collapsing with age or showing early regeneration from the stools or seed. It was from this kind of heath that Watt (1955) first described the now classic phases of heather development, 'pioneer', 'building', 'mature' and 'degenerate', and, in the absence of competing sub-shrubs, the influence of the structural changes in the canopy on the waxing and waning of the herbs and cryptogams is often very clear. Where these phases succeed one another in uninterrupted cycles here, the result is an uneven-aged cover of heather with considerable physiognomic heterogeneity and a correspondingly complex variation in the distribution of the associates. In other cases, sudden perturbations to the growth of the heather, due to a variety of external circumstances, can produce a uniformity of structure and floristics within stands, but make one tract of the community look very different from another. And variations in grazing intensity can also modify the shape and extent of the heather canopy, influencing the proportion of the sub-shrub cover to the other components.

By and large, the contribution of the herbaceous element among anything other than pioneer *Calluna* or heather severely checked by grazing is small, both in cover and in floristic diversity; and, where it becomes more extensive, it is often better to regard the vegetation as a mosaic of this kind of heath and one of a number of associated communities. Typically, here, there is no extensive development of a grassy ground among the heather bushes. *Festuca ovina* is very common through the community as a whole, but it is usually present as scattered tussocks, often of less than 30% total cover and completely extinguished from beneath vigorous building or mature *Calluna*. Other grasses are few and similarly confined: *Agrostis capillaris* occurs occasion-

ally, sometimes with local abundance, and it is usually mixtures of these two species which, thickening up, form the matrix of associated grasslands. In some stands, too, there is a little *Deschampsia flexuosa*, a grass which seems to have increased its representation among this kind of heath since myxomatosis (Ratcliffe 1977). *Agrostis curtisii*, by contrast, which, with *Erica cinerea*, *Ulex minor* and *U. gallii*, becomes very common in dry heaths further to the south and west, is never found; and *Molinia caerulea*, which follows *E. tetralix* in transgressing into drier heaths in more oceanic areas, is very scarce. More mesophytic grasses, such as *Holcus lanatus*, occur only very occasionally, and more basiphile species, like *Avenula pratensis* and *Koeleria macrantha*, are found only in those situations where the community is closely juxtaposed with calcicolous swards, an unusual, though rather distinctive, occurrence.

Associated dicotyledons are few and patchy, being again largely confined to areas of more open heather cover, usually among pioneer growth, or within included patches of sward. *Teucrium scorodonia* is particularly distinctive of one sub-community and *Senecio jacobaea* also occurs occasionally. Then, especially where the grasses thicken up a little, they may be accompanied by species such as *Galium saxatile*, *Cerastium fontanum*, *Campanula rotundifolia* or *Luzula campestris*. Or, where patches of bare soil have been exposed by the decay of mor within degenerate *Calluna*, or where herbivores or human activity have scuffed the ground, *Rumex acetosella* and ephemerals such as *Aphanes arvensis*, *Teesdalia nudicaulis*, *Myosotis ramosissima* or the annual grass *Aira praecox* can sometimes be found. In general, though, this kind of enrichment is modest and sporadic.

Finally, among the vascular plants, there are two species which can play a more important local role, their abundance in relation to *Calluna* often reflecting successional shifts in dominance. The first is *Pteridium aquilinum*. This is typically only occasional within the heath and usually restricted to sparse fronds but, where vigorous marginal growth of the bracken enters a zone of heather in a more open and less competitive condition, it can produce a closed overtopping canopy and come to dominate; conversely, the bracken itself may be overwhelmed where its own degeneration coincides with a local rise in *Calluna* vigour. The results of such competitive interactions, again first described by Watt (1955), are complex mosaics of bracken and heather-dominance which are often hard to separate into discrete stands of *Calluna*-*Festuca* heath and the *Pteridium*-*Galium* community. The second plant of this kind, *Carex arenaria*, is more local in its occurrence and its abundance more clearly related to particular habitat conditions: its presence in quantity helps define one sub-community that is essentially transitional to dune vegetation.

The bulk of the remaining floristic variation in the *Calluna*-*Festuca* heath is found among the bryophytes and lichens. Again, these plants are of variable abundance, and often very patchy within individual stands, being generally sparse in denser heather, more extensive and diverse among open covers and in some cases showing fairly precise patterns of occurrence according to the growth phases of the *Calluna*. Few species occur throughout the community though, among the mosses, *Hypnum cupressiforme* (often recorded as *H. jutlandicum*) is very common and can be found occasionally even among building or mature heather. *Dicranum scoparium* is less persistent in such situations and intolerant of loose sandy substrates but it occurs frequently in more open areas and these two species usually form the bulk of the bryophyte cover among the degenerate and pioneer *Calluna*. In such situations, too, species such as *Hylocomium splendens*, *Pleurozium schreberi*, *Ptilidium ciliare* and *Dicranella heteromalla* have most of their occasional occurrences. *Polytrichum juniperinum* and *P. piliferum* can also figure with some abundance on patches of bare mineral soil among regenerating heather or on rabbit-scuffed ground.

Lichens often rival or exceed the mosses in their cover and variety, though they are more strictly confined to the open degenerate and pioneer phases. *Cladonia* spp. are particularly prominent, with encrusting species, such as *C. pyxidata*, *C. squamosa* and *C. fimbriata*, occurring over patches of bare ground, sometimes with *Cornicularia aculeata*, bulkier species like *C. impexa*, *C. furcata* and *C. arbuscula* being especially abundant among the decumbent branches of old collapsed *Calluna*. On these stems, *Hypogymnia physodes* is very characteristic.

Sub-communities

***Hypnum cupressiforme* sub-community.** The *Calluna* cover in this sub-community is often less than complete and only moderately tall, usually from 3 to 5 dm high, sometimes showing vigorous young growth, though often with many bushes in the degenerate phase. *Erica cinerea* can occasionally be found, though the most prominent associates are typically *Festuca ovina*, which occurs as scattered tussocks, and the cryptogams, whose total cover often exceeds 50%. Among the mosses, both *Hypnum cupressiforme* s.l. and *Dicranum scoparium* are very frequent, the former especially conspicuous as extensive mats in the more open areas, both among the collapsed heather stems and in any small grassy patches between the *Calluna*. Lichens are also abundant on the mor and bare mineral soil exposed within the degenerating bushes with encrusting species, such as *Cladonia pyxidata*, *C. squamosa*, *C. fimbriata* and *C. gracilis* usually predominating, bulkier species like *C. impexa*, *C. uncialis* and *C. arbuscula* being less frequent.

Hypogymnia physodes occurs occasionally on the collapsed heather stems.

***Hypogymnia physodes*-*Cladonia impexa* sub-community.**

The heather cover here is very much the same, in total cover and height, to that above, but degenerate bushes predominate and the contribution of *Festuca ovina*, *Hypnum cupressiforme* s.l. and *Dicranum scoparium* is more uneven, the mosses occurring as small patches among the collapsed stems. Lichens, by contrast, are very abundant in these areas, with encrusting species being joined and exceeded in cover by *Cladonia impexa*, *C. furcata* and occasional *C. macilenta*. *Hypogymnia physodes* also has its best representation in this sub-community, frequent small thalli growing on the old, decumbent heather stems.

***Teucrium scorodonia* sub-community.** Degenerate bushes are scarce here and the heather cover is generally vigorous and extensive, though with some more open included areas. Within these, scattered plants of *Teucrium scorodonia* or *Senecio jacobaea* can sometimes be found, or small stretches of turf, with *Festuca ovina*, *Agrostis capillaris*, *Deschampsia flexuosa* and scattered *Rumex acetosella*, *Galium saxatile* and *Cerastium fontanum*. Lichens are very infrequent but *Hypnum cupressiforme* s.l. and *Dicranum scoparium* remain common among the grasses or, in the case of the former, in moderately dense heather.

***Carex arenaria* sub-community.** In this sub-community, the heather is often tall and somewhat open with scattered plants or denser, intervening patches of *Carex arenaria*, which is sometimes so abundant as to be co-dominant. *Festuca ovina* occurs as sparse individuals and there is sometimes a little *Rumex acetosella*, but other herbs are scarce. Among the cryptogams, only *Hypnum cupressiforme* s.l. is frequent.

Species-poor sub-community. Unbroken canopies of dense and often tall heather, up to 50 cm or more high, are characteristic here, among which virtually no associates can survive, apart from occasional sparse plants of *Hypnum cupressiforme* s.l.

Habitat

The *Calluna-Festuca* heath is confined to base-poor and oligotrophic sandy soils in the more continental lowlands of eastern England. The regional climate has an important influence on the general composition of the community by excluding species of more oceanic heaths and, in the absence of these, the controlling effect of the growth pattern of the heather on floristic variation in the community is often very obvious. This dominance is sometimes itself adversely affected by climate or insect

damage and, particularly in the past, has been widely perturbed by burning and grazing. The demise of these traditional treatments has often been a prelude to improvement for agriculture and forestry which has much reduced and fragmented tracts of the community.

This kind of heath is characteristic of those parts of Britain with low rainfall and a wide range of annual temperatures. For the most part, precipitation is less than 650 mm yr⁻¹ (*Climatological Atlas* 1952) with fewer than 120 wet days yr⁻¹ (Ratcliffe 1968), and a slight tendency for a summer rainfall maximum. As over much of southern Britain, annual accumulated temperatures are generally high, but the contrast between temperature extremes is the most marked of anywhere in the country, with mean annual maxima above 30 °C (Conolly & Dahl 1970), but February minima often below freezing. Such strongly continental conditions prevail over much of East Anglia (lessening a little in severity towards the northern and western coasts), up around the Wash, westwards towards the Chilterns and then south some way beyond the Thames, and they severely restrict the distribution in eastern England of a variety of Oceanic West European species which are of major importance in heaths in parts of Britain with a more equable climate. The *Calluna-Festuca* heath thus takes much of its floristic character from the exclusion of *Erica cinerea*, *Ulex minor*, *U. gallii* and *Agrostis curtisii* from potentially suitable soils in this region, because of sensitivity either to low temperatures in winter, when a measure of physiological activity may be retained (as in *E. cinerea*: Bannister 1965, Gimingham 1972) or to low rainfall (as, perhaps, in *A. curtisii*: Ivimey-Cook 1959); and also from the increasing scarcity in eastern England, and progressive confinement to the kinds of wetter soils quite uncharacteristic here, of *Erica tetralix* and *Molinia caerulea*. A positive response to such continental climatic conditions is scarcely visible in the community, though it can sometimes be seen in the presence of species like *Teesdalia*, which are very distinctive of the open grasslands of this part of Britain, but restricted here by the overwhelming dominance of *Calluna*.

Within this climatic zone, the *Calluna-Festuca* heath is limited to acid and impoverished soils, which have sometimes been derived from arenaceous bedrocks, as in scattered localities in Lincolnshire and around The Weald, but which for the most part have developed from sandy glacio-fluvial drift, sometimes supplemented by aeolian sand and widely affected by periglacial sorting: such heterogeneous parent materials underlie most of the stands in the core of the community's range, in the Breckland, on the north Norfolk commons and along the Suffolk coast. In a few places on the Norfolk coast, the soils have been derived from dune sand.

By and large, the profiles under the community are brown sands, that is non-calcareous brown soils in

which sandy or sandy-skeletal materials predominate in the upper horizons (Avery 1980, *Soil Survey* 1983), including series like the Newport soils, which are extensive on the Suffolk coast, and the Worlington, which is of particular importance in Breckland (Corbett 1973, Hodge *et al.* 1984). Often, the parent material is naturally acidic but, even where it is less prevalently so, decalcification in the free- to excessively-draining profiles has resulted in consistently low surface pH, and there are frequently signs of podzolisation, which process is accentuated by the acidifying properties of *Calluna* and its accumulating mor (Gimingham 1972, Corbett 1973). The community thus shows only very local and limited relief of its generally calcifuge and oligotrophic character, the very sparse representation of mesotrophic or calcicolous species being usually limited to situations where the heath occurs in edaphically-related mosaics, and weedy mesotrophic plants figuring only where there has been some soil disturbance, the occurrence of which can be quite frequent on unenclosed commons and heaths or where rabbits are numerous. More marked instability of the surface of very sandy profiles, with erosion and deposition of loose material by wind, provides a more obvious kind of edaphic variation and is influential in the occurrence of the *Carex arenaria* sub-community. *C. arenaria* is favoured by fresh sand deposition (Noble 1982) and this kind of *Calluna*-*Festuca* heath can be found in coastal and a now very few inland dune systems (e.g. Wangford Warren and Foxhole Heath in Suffolk and on some heaths around Gainsborough), where there is, or has been, mobile sand (e.g. Watt 1937).

Natural decline of the heather cover with age, or its sudden demise because of environmental change, may play some part in exposing the soil surface to erosion and thus contribute to the rise of *C. arenaria* and the loss or exclusion of other species intolerant of a shifting substrate. In the remainder of the community the soil surface is generally stable, but it is such changes in the character of the heather cover that have the most obvious direct influence on floristic variation by mediating differences in light, temperature and humidity over the surface of the mor and mineral soil (Watt 1955, Gimingham 1960, Barclay-Estrup & Gimingham 1969, Barclay-Estrup 1971). Detailed data on such factors are not available for the samples, but simple observation suggests that the Species-poor sub-community is typical of building and mature heather, the *Hypogymnia-Cladonia* of opening, degenerate bushes and the *Hypnum* of those areas with more advanced recolonisation by *Festuca* and young *Calluna*. The *Teucrium* sub-community may also represent a regeneration phase, perhaps sometimes with persistent inclusions of grassy sward.

Cyclical growth and degeneration of the heather can provide marked internal variation within stands of the

community but more even-aged tracts, in which one or other of the phases, with its typical suite of associates, predominates, are widespread. In the past, when more intensive use of lowland heaths was customary, a patchwork of such stretches of heather was often deliberately maintained by burning, to ensure a continuous supply of vigorous growth for grazing stock: such treatment continues at Berner's Heath in the Lakenheath-Elveden complex in Norfolk but it has largely fallen into disuse, although accidental fires do still occur. Even without burning, however, catastrophic death of the *Calluna* can short-circuit the growth cycle, where the bushes succumb wholesale to defoliation by the heather beetle (*Lochmaea saturalis*), to drought which is occasionally severe in a region where crop growth often necessitates irrigation, or to frost, which can occur into late May or early June in this part of Britain (e.g. Farrow 1915, Watt 1971, Ratcliffe 1977). Marrs (1986) suggested that such events might constitute a fairly normal exogenous control on *Calluna* regeneration in susceptible populations and account for the kind of age-structure seen on Cavenham Heath in Breckland, for example, one of the largest intact blocks of this kind of vegetation in East Anglia, but composed almost entirely of extensive more or less even-aged stands, despite the absence of any burning for at least 25 years. As outlined below, the predominance of uncompetitive *Calluna* in such tracts can speed seral progression to other vegetation types, notably bracken or woodland.

Apart from burning, the other major biotic factor which can affect the physiognomy of the *Calluna*-*Festuca* heath is grazing itself, either by stock, now much less widely or intensively pastured on this kind of heath, or by wild herbivores, occasionally deer (as on the Cavenham-Tuddenham heaths) but much more importantly in the past, rabbits. In some areas, rabbits have again become very common, but in many sites, as in parts of Lakenheath-Eriswell Warrens and on Thetford Heath, the rank growth of the heather in this community since myxomatosis is very evident. Consistent heavy grazing of this vegetation keeps the *Calluna* canopy firmly in check, favouring the establishment of Nardo-Galion herbs in accessible places between the bushes (as seen in some stands of the *Teucrium* sub-community) and ultimately extinguishing the heather in a seral shift to close-cropped calcifuge swards dominated by such vascular species or, in extreme cases, lichen-dominated vegetation or open eroding ground. Grazing by cattle, as opposed to the more usual sheep, which still occurs at Eriswell Warrens, can lead to eutrophication of the soils under this kind of heath and the occurrence of rank weeds on scuffed areas of soil.

Very often, however, abandonment of traditional heathland management has been followed by reclamation and improvement of the land under this community

such that, within its possible geographical range, stands now generally survive as much-reduced and fragmented remnants within a landscape given over largely to agriculture and forestry. Although the soils here present considerable problems for cropping, being droughty, lime-deficient, often copper-deficient and susceptible to wind erosion, they have the advantage of being easy to cultivate and much of them has gone to arable, mostly barley and sugar beet (Hodge *et al.* 1984). Yields, though, are low and, as an alternative productive land-use, coniferous afforestation has been widely pursued, mostly with *Pinus sylvestris* or, increasingly, *P. nigra* var. *maritima*. Other losses have been to airfield and military training areas, though the latter use, as around Stanford in Breckland, can provide a measure of protection by its prohibition on other kinds of activity. Even where more substantial tracts of the *Calluna-Festuca* heath survive, however, it should not necessarily be assumed that these are very old. As Sheail (1979) has shown in the Stanford Practical Training Area, changes in agricultural custom and economics can produce a very complex pattern of shifting land use within a relatively small period of time, such that only a very small proportion of the considerable extent of grassland and heath there is more than a century old. More long-established stands of the *Calluna-Festuca* heath are unlikely to be floristically richer than younger ones but they can show much more clearly some of the most interesting aspects of the community, namely its place in a sequence of vegetation and soil types that preserves evidence of post-Glacial climatic change and a kind of land use dating back to prehistoric times.

Zonation and succession

The *Calluna-Festuca* heath is found with a variety of other vegetation types in zonation and mosaics which reflect patterns of edaphic variation and long and diverse treatment histories. Very often now, the neglect of traditional styles of heathland management has blurred the boundaries in such sequences and allowed seral developments previously held in check. More drastic heathland improvement has truncated and fragmented many zonation and stands of the community are frequently abruptly marked off from surrounding arable land or coniferous plantations.

Even the relatively small surviving tracts of heathland in eastern England sometimes stretch over a range of soil parent materials, with either sequences of diverse solid deposits or, very often, a cover of heterogeneous drift, variable in thickness, and thus in the extent to which it masks the influence of the underlying bedrock, and in its own chemical and physical characteristics. The soil mantle is therefore often quite varied, with profiles differing in such features as base-richness, texture and permeability, even within a small compass (e.g. Watt

1936, 1940, Corbett 1973, Hodge *et al.* 1984). Over such sequences of soils, the *Calluna-Festuca* heath has become established on the more acidic and free-draining, accentuating the tendency towards podzolisation and often marked off from neighbouring vegetation types by shifts in one or more of these edaphic factors.

In a few localities, soil moisture is a controlling variable, the community representing the dry-heath element in the kind of pattern so characteristic of the surrounds to southern valley mires (e.g. Rose 1953), where there is a zonation through wet heath to mire vegetation in relation to a locally high ground water-table. On some of the west Norfolk commons, at Sandringham Warren and Roydon Common, for example (Daniels & Pearson 1974, Ratcliffe 1977), the *Calluna-Festuca* heath occupies some of the driest of the sequence of acidic soils, passing on seasonally-waterlogged mineral profiles to the *Ericetum tetralicis*, which then gives way to a variety of mire communities, depending on the base-richness of the ground waters. Although *Calluna* maintains its frequency within the *Ericetum*, its vigour is usually depressed and the boundary between the two kinds of heath is generally well marked by the confinement of *Erica tetralix* and *Molinia* to the wetter ground, a restriction which reflects the continental character of the climate.

Within the range of the *Calluna-Festuca* heath, zonation of this kind are less common than in central southern and south-west Britain and more often the prevailing kind of edaphic variation over the tracts of heathland here is in base-richness among profiles which are more or less uniformly free-draining. Such differences depend upon variations in the amount of calcareous material in the superficials and the proximity to the surface of any limy bedrocks, most importantly through much of East Anglia, the Chalk, and they are particularly influential in the Breckland mosaics of heath and grassland renowned from Watt's (1936, 1940) accounts. Such patterns, still to be seen in whole or part on the remaining fragments of the Stanford-Wretham, Icklingham and Lakenheath-Elveden heaths (Ratcliffe 1977), involve transitions from the *Calluna-Festuca* heath, through calcifuge Nardo-Galion swards, to the *Festuca-Avenula* and *Festuca-Hieracium-Thymus* grasslands, with an edaphic shift from Worlington brown sands with some podzolisation, through Methwold brown calcareous sands, to Newmarket brown rendzinas (Corbett 1973, Hodge *et al.* 1984). Floristic variation within the sequence is more or less continuous and, though the limit of the heath is well marked by the bounds of the dominant *Calluna*, fine mosaics of the community with patches of included grassland are common (though they lose much of their clarity if grazing is relaxed: see below). The degree of order within these soil and vegetation mosaics is, in fact, very vari-

able, dependent as it is on the great heterogeneity of the cover of superfcials, but some especially striking patterns have resulted where the materials have undergone periglacial sorting to produce such features as polygons or stripes. These occur quite widely over the gently-undulating landscape of East Anglia and are often very clearly delineated on unimproved land, because the *Calluna-Festuca* heath typically picks out the areas of deeper and more acidic sandy infill, while the polygon centres or areas between the stripes are occupied by the grasslands (Williams 1964, Corbett 1973, Curtis *et al.* 1976). Especially good examples of the striped kind of patterning can be seen at Eriswell High Warren, on Thetford Heath and around Grimes Graves (Ratcliffe 1977).

Two other kinds of floristic variation can confuse these soil-related patterns. These, too, have some kind of edaphic basis but they are also a reflection of competitive interactions between *Calluna* and two other possible dominants, *Pteridium* and *Carex arenaria*, on the dry acidic soils which the community favours, so the spatial patterns that result are often but a temporary indication of shifting successional developments. *Pteridium* is generally confined to deeper soils, free from parching, but toing and froing of dominance between it and *Calluna* is in large measure dependent upon coincidence of a vigorous, expansive phase in the one with a declining, weakly-competitive phase in the other (Watt 1955), a pattern of growth which is endogenous, though strongly influenced by external biotic or climatic factors (Watt 1971, Marrs 1986). This is why mosaics between the *Calluna-Festuca* heath and the *Pteridium-Galium* community are so diverse on the ground and variable through time. Zonations to the *Carex arenaria* or *Carex-Cladonia* dune communities are likewise related to competition between heather and the sedge, though the greater tolerance of the latter to shifting sand often means that transitions from one vegetation type to the other reflect present or past instability of the sandy soil surface (Watt 1937).

Patchworks of grassland, heath, bracken and sand-sedge compose the characteristic vegetation cover of the heathlands of eastern England and were in the past maintained by the traditional burning and grazing treatments, with rabbits, long encouraged in the warrens of this region, providing a very important additional grazing component. The burning renewed the heather at regular intervals, probably helped keep bracken in check and repeatedly set back any invasion of shrubs or trees; the grazing helped maintain the grassland against expansion of the heath, sharpening up the boundaries between them. The abandonment of these treatments and the demise of rabbits in the myxomatosis epidemic have allowed the grasslands and the heather to grow rank in many places, so that transitions between the

communities have been obscured. They have also permitted seral progressions to scrub and woodland, patches of which, sometimes very dense and extensive, have become common on these heathlands. The most important woody invaders on the dry, acidic soils characterised by the *Calluna-Festuca* heath are *Betula pendula* and the pines, of which there are now such abundant seed-parents in the plantations. Oak, often *Quercus robur* over the range of the community, sometimes figures if there are mature trees fairly close at hand and locally *Rhododendron ponticum* has become common, as at Sandringham Warren, for example. Colonisation of vigorous, dense *Calluna* by these species, particularly birch and pine, is very difficult but degenerate heather, experiencing no burning or grazing, offers ample open ground. Once well established, such trees can shade out the heather and most of its heathland associates and come to dominate in *Quercus-Betula-Deschampsia* woodland, the climax forest of base-poor, free-draining soils in lowland Britain. Natural gaps or cleared areas within such woodland can show a temporary resurgence of the heath, though there is a strong tendency for the *Pteridium-Galium* community to become ensconced in such places or for *Ulex-Rubus* scrub to develop in disturbed areas. Gorse scrub of this kind is also sometimes found around coniferous plantations and often runs across the heathland in strips marking out the edges of trackways.

Distribution

The *Calluna-Festuca* heath occurs widely throughout the eastern lowlands of England, though it is now often very local. More extensive stands survive in Breckland where something of the traditional heathland scenery of this part of the country can still be glimpsed.

Affinities

Impoverished heaths dominated exclusively by *Calluna* can be found throughout Britain and, though these pose a classificatory problem when they are considered out of their context, they should certainly be distinguished from the *Calluna-Festuca* heath, the purity of whose sub-shrub canopy is a real reflection of climatic conditions in eastern England rather than local differences in treatment. This is the most continental of our heaths, though its lack of any positive floristic element reflecting this affinity has meant that it has generally been included within a broadly-defined lowland *Callunetum* (e.g. Tansley 1911, 1939) or marked out as special for other reasons, such as the clarity of its internal dynamics or competitive relationships or because of its place within a regional sequence of communities (Watt 1936, 1940, 1955), features of considerable importance to the conservation value of this vegetation.

The community grades floristically to the *Calluna-*

Erica and *Calluna-Ulex minor* heaths but phytosociologically is best placed in the Genisto-Callunion alliance, which includes the Calluno-Ulicetalia heaths of North Germany, Belgium and The Netherlands in which *Genista pilosa*, *G. anglica* and *G. germanica* are characteristic. In general, however, the *Calluna-Festuca* heath is more species-poor than associations like the *Genisto*

pilosae-Callunetum Oberdorfer 1938, the *Genisto anglicae-Callunetum* Tüxen 1937 and the *Genisto germanicae-Callunetum* Oberdorfer 1957. *G. pilosa* used to occur on Suffolk heaths and *G. anglica* is very occasionally found in the community though, through much of East Anglia, it is more characteristic of Ericetalia wet heaths.

Floristic table H1

	a	b
<i>Calluna vulgaris</i>	V (7–10)	V (7–10)
<i>Hypnum cupressiforme</i>	V (3–6)	II (2–3)
<i>Festuca ovina</i>	IV (1–6)	II (2–4)
<i>Dicranum scoparium</i>	V (3–6)	III (3–6)
<i>Cladonia uncialis</i>	III (2–4)	II (1–5)
<i>Cladonia fimbriata</i>	II (3–4)	II (3)
<i>Erica cinerea</i>	II (3–4)	II (2–5)
<i>Cladonia pyxidata</i>	II (3)	II (2–4)
<i>Cornicularia aculeata</i>	II (3–4)	II (3–6)
<i>Cladonia squamosa</i>	II (3–5)	I (2–3)
<i>Cladonia tenuis</i>	I (4)	I (3)
<i>Erica tetralix</i>	I (3)	I (2–3)
<i>Cladonia arbuscula</i>	I (3)	I (3–6)
<i>Pleurozium schreberi</i>	I (6)	I (7)
<i>Hypogymnia physodes</i>	III (3–4)	IV (2–4)
<i>Cladonia impexa</i>	II (2–6)	IV (3–7)
<i>Cladonia furcata</i>		III (3–6)
<i>Dicranella heteromalla</i>	I (4)	II (2–4)
<i>Cladonia macilenta</i>		II (2–4)
<i>Cladonia coniocraea</i>		I (4)
<i>Rumex acetosella</i>		
<i>Ulex europaeus</i>		
<i>Deschampsia flexuosa</i>		
<i>Holcus lanatus</i>		
<i>Campanula rotundifolia</i>		
<i>Psuedoscleropodium purum</i>		

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

Floristic table H1 (*cont.*)

	a	b
<i>Teucrium scorodonia</i>	I (3)	
<i>Galium saxatile</i>		
<i>Agrostis capillaris</i>		
<i>Cerastium fontanum</i>		
<i>Senecio jacobaea</i>		
<i>Carex arenaria</i>	I (3)	I (3)
<i>Pteridium aquilinum</i>	I (2)	
<i>Hylocomium splendens</i>	I (4)	
<i>Ptilidium ciliare</i>	I (3)	
<i>Polytrichum juniperinum</i>	I (3)	
Number of samples	8	8
Number of species/sample	9 (5–14)	9 (5–12)
Shrub/herb height (cm)	37 (10–60)	39 (30–50)
Shrub/herb cover (%)	89 (50–100)	84 (50–100)
Ground cover (%)	54 (30–80)	50 (25–90)
Altitude (m)		30 (1–76)

a *Hypnum cupressiforme* sub-community

b *Hypogymnia physodes*-*Cladonia impexa* sub-community

c *Teucrium scorodonia* sub-community

d *Carex arenaria* sub-community

e Species-poor sub-community

l *Calluna vulgaris*-*Festuca ovina* heath (total)

c	d	e	l
III (2-3)			I (2-3)
II (2-3)	I (3)		I (2-3)
II (3-6)	I (4)		I (3-6)
II (3-4)			I (3-4)
II (3)			I (3)
I (3)	V (2-10)		II (2-10)
I (4)	I (4)	I (3)	I (2-4)
I (1)	I (5-6)		I (1-6)
I (1)			I (1-3)
I (3)			I (3)
10	7	9	42
10 (5-22)	7 (4-11)	3 (1-8)	7 (1-22)
38 (10-60)	53 (20-100)	59 (25-100)	44 (10-100)
96 (85-100)	100	94 (75-100)	95 (50-100)
28 (2-70)	21 (0-80)	4 (0-30)	31 (0-80)



