H4
Ulex gallii-Agrostis curtisii heath

Synonymy
Callunetum arenosum western heaths Tansley 1911 *p.p.*; Somerset upland heath Watson 1932 *p.p.*; *Callunetum* south-western heaths Tansley 1939 *p.p.*; *Agrostis setacea* 'Short Heath' Coombe & Frost 1956*a*, Marrs & Proctor 1978; *Agrostidetum setaceae cornubiense* Coombe & Frost 1956*a*, Ivimey-Cook 1959, Ivimey-Cook *et al.* 1975; *Erica vagans-Erica tetralix* 'Wet Heath' Coombe & Frost 1956*a*; *Agrosto setaceae-Ulicetum gallii* Bridgewater 1970; Heath, Grassland with Gorse & Grass-heath Ward *et al.* 1972*a*, all *p.p.*; *Calluna-Ulex gallii* heaths Gimingham 1972 *p.p.*; Intermediate Tall/Short Heath Marrs & Proctor 1978; Species-poor *Erica cinerea* Heath NCC Devon Heathlands Report 1980; Species-poor Dry *Agrostis setacea* Heath NCC Devon Heathlands Report 1980; *Ulex europaeus-Molinia caerulea* limestone heath NCC South Gower Coast Report 1981 *p.p.*; *Agrostis curtisii* heath Hopkins 1983.

Constant species
Agrostis curtisii, *Calluna vulgaris*, *Erica cinerea*, *E. tetralix*, *Molinia caerulea*, *Potentilla erecta*, *Ulex gallii*.

Rare species
Agrostis curtisii, *Carex montana*, *Erica ciliaris*, *E. vagans*.

Physiognomy
In its general floristics, the *Ulex gallii-Agrostis curtisii* heath is very similar to the *Ulex minor-Agrostis* heath, the major difference being the replacement of the one gorse by the other. Without close inspection of the petals and calyx, the different lengths of which are diagnostic, separation of these two genetically variable and vegetatively plastic species can be difficult (Proctor 1965, Wigginton & Graham 1981), but they show an almost perfect vicarism in their range: they do not occur together here, the western limit of *U. minor* in east Dorset serving as a boundary between the two communities. Apart from this, however, the heaths share five constants, *Calluna vulgaris*, *Erica cinerea*, *E. tetralix*, *Molinia caerulea* and *Agrostis curtisii* and, together with *U. gallii*, these generally account for the bulk of the vascular cover. But their proportions and structural arrangements are very variable so the gross appearance of the vegetation can differ quite markedly from stand to stand, something reflected in the use of epithets such as 'short heath' (Coombe & Frost 1956*a*) and 'grass heath' (Ward *et al.* 1972*a*). Quite often, sub-shrubs and grasses comprise an intimately mixed canopy of continuous cover, compact and springy and quite low, sometimes little more than 1 dm high; in other cases, the elements may be of similar short stature but disposed in a more obvious mosaic with clumps of sub-shrubs separated by small stretches of sward in which grasses predominate. Then, again, some stands have a much taller canopy of woody species, half a metre or so high, with the other vascular associates relegated to a patchy understorey. And there can be quite extensive areas of barer ground breaking up the cover into discrete islands. Some of these differences are fairly consistent and, accompanied by the presence of preferential species, help to distinguish the various sub-communities. Others, particularly those related to burning and grazing, which are quite common here but often not practised very systematically, can be more disordered or ephemeral.

Of the common sub-shrubs, *Calluna* and *U. gallii* are the most consistently represented, and both can be quite abundant. Indeed, when there is a dominant species here, it is most frequently *Calluna*, the vigour of which is especially noticeable several years after a fire, and whose abundance is favoured in the long term by a regime of more regular burning, such that in areas like the Dartmoor fringes with its tradition of swaling, this community can make some contribution to vegetation which has been grouped within a general *Callunetum* (e.g. Tansley 1911, 1939) or heather moor (Harvey & St. Leger-Gordon 1974). *Calluna* can dominate, too, as leggy bushes, in stands that have been long unburned and ungrazed, whereas, in the immediate aftermath of a fire or under heavy herbivore pressure, it can be much

reduced. On moister soils occupied by this kind of heath, its contribution is also less important. *U. gallii* is likewise very variable in its cover, though it is only exceptionally a dominant and, in the mixed grassy-heath kind of canopy, where it is often kept in check by grazing, its low shoots may be more perceptible to the ankle than to the eye, at least outside its late summer and autumn flowering season. After burning, however, it can show a considerable increase in cover provided herbivores do not continually nibble off the soft young shoots sprouting from the stools and eat any seedlings. *U. europaeus*, by contrast, is very scarce in this community and almost always in disturbed places.

As in the *Ulex minor-Agrostis* heath, the frequent occurrence together here of *Erica cinerea* and *E. tetralix* provides one distinctive difference between this vegetation and the corresponding dry heath of the region. In fact, neither is as frequent overall as *Calluna* or *U. gallii* and in some sub-communities one or the other can be markedly patchy in its occurrence. There is a reciprocal element in this behaviour, *E. cinerea* being less abundant on moister soils and less sunny aspects (as in the *Erica tetralix* and *Scirpus* sub-communities), *E. tetralix* being less competitive on drier ground, but superimposed on this is the better response of the former to burning, after which it can be dominant for some time before *Calluna* supervenes (a feature best seen here in the *Erica cinerea-Agrostis* sub-community). In fact, quite often, more or less equal amounts of the two species occur intermingled, and both can show a general reduction in relation to grasses in stands which are heavily grazed (as in the *Festuca* sub-community).

Four other sub-shrubs are of more restricted occurrence in this kind of heath, though they are preferential or differential for particular sub-communities and can give the vegetation a distinctive appearance. The first is *Vaccinium myrtillus*, becoming generally more common in this part of Britain with its wetter regional climate, and especially likely to be encountered here at higher altitudes where rainfall is locally greater. Such situations are better represented in the *Festuca* and *Scirpus* sub-communities, though in both these kinds of heath grazing can reduce the cover of this palatable sub-shrub to very sparse scattered shoots. Then, stands of the wetter *Erica tetralix* sub-community can have some *Salix repens*, though it is rarely abundant.

The other two species, the nationally-rare *Erica ciliaris* and *E. vagans*, are very local in occurrence, though often more obvious than either of the above when present. Both tend to favour situations near the limit of soil moisture tolerated by this vegetation, found in the *Erica tetralix* sub-community. For *E. ciliaris*, this kind of heath, together with the *Ericetum tetralicis* which replaces it on more strongly waterlogged ground, provides the locus for its Devon and Cornish occurrences and it can occur in abundance here, accompanying or replacing *E. tetralix*. *E. vagans* can show similar prominence on the Lizard, in Cornwall, to which it is strictly confined in mainland Britain, in *Ulex gallii-Agrostis* heath that is transitional, floristically and on the ground, to the *Erica vagans-Schoenus* heath, characteristic of more base-rich gleys and one of the two communities in which this ericoid plays a major role on this headland.

Even in stands where sub-shrubs are more obviously dominant, the two community grasses, *A. curtisii* and *Molinia* almost always make some contribution to the vascular cover and quite often they rival or exceed the woody plants in abundance. *A. curtisii*, in particular, is an important plant here and the *Ulex gallii-Agrostis* heath provides its major locus throughout its range west of Poole Harbour. It can become especially abundant after burning (as in the *Agrostis-Erica* sub-community) and, being relatively unpalatable, will persist even where this treatment is combined with grazing, when it can be a dominant in grassy heath (seen in the *Festuca* sub-community). *Molinia* is rather less consistent throughout and in general not as abundant as *A. curtisii*. It tends to follow *E. tetralix* in its preference for moister soils, though it can increase greatly after fires, but, being palatable, may not be so prominent in grazed stands.

Other grasses, too, and some cyperaceous plants, are among the more common and occasionally abundant associates in the *Ulex gallii-Agrostis* heath, a feature that, in general, is not met with in the *Ulex minor-Agrostis* heath. None is frequent throughout but as preferentials for some of the sub-communities they make an obvious contribution. Among the grassier heaths included here (and predominating in the *Festuca* sub-community), *Festuca ovina* and *Danthonia decumbens* are particularly important, with *Agrostis capillaris* and *A. canina* ssp. *montana* more occasional, *Nardus stricta*, *Festuca rubra*, *Anthoxanthum odoratum* and *Deschampsia flexuosa* sparse and less obviously preferential. Among sedges found in this kind of heath, *Carex binervis* and *C. pilulifera*, though not very frequent, are rather characteristic of these grassier stands and, where the soils are a little more base-rich, *C. flacca* or, on moister ground, *C. panicea* can occur. The rare *C. montana*, a sedge that is rather catholic in its floristic affinities in Britain, has been recorded in this vegetation in South Wales (Ivimey-Cook 1959). Playing a more prominent part than any of these sedges, however, in stands on cooler and moister west-facing slopes, is *Scirpus cespitosus* (the frequency of which helps define a *Scirpus* sub-community).

Apart from *Potentilla erecta*, which occurs as a constant with reasonable consistency in all the sub-communities, though even then only as scattered plants, dicotyledonous herbs are not a frequent component of

this vegetation overall. *Polygala serpyllifolia* and *Pedicularis sylvatica* occur occasionally, and sometimes (as among the Lizard stands in Hopkins 1983) with locally high frequency. *Viola lactea* can also become common in disturbed situations and, among grassier heaths, *Galium saxatile* is weakly preferential. Where the soils are drier and more base-rich, species such as *Thymus praecox* and *Helianthemum nummularium* can occur intermixed with the heath calcifuges in vegetation which has been included in 'limestone heath' (e.g. Ivimey-Cook 1959).

Finally, among the vascular plants found here, there is *Pteridium aquilinum*. This is only occasional throughout and often represented just by scattered fronds but, where this kind of heath extends on to deeper soils that are kept free of any waterlogging, it can become locally abundant and it frequently dominates in stretches of the *Pteridium-Galium* community closely juxtaposed with the heath and often spreading through associated grasslands.

The ground cover in the *Ulex gallii-Agrostis* heath is rather variable in its extent and diversity, though rarely very abundant or showing any marked species-richness. No bryophyte or lichen occurs with any frequency throughout and, in ranker grassy swards or among vigorous building sub-shrubs, total cover can be very low. Then, there may be just a little *Hypnum cupressiforme s.l.* or *Dicranum scoparium*, the two mosses which are found most commonly overall, though even these are quite often absent altogether. More open areas may have some *Campylopus paradoxus*, the introduced *C. introflexus* or, sometimes showing marked local frequency (as on Aylesbeare Common in Devon: Ivimey-Cook *et al.* 1975), *C. brevipilus*; and these can be accompanied by *Racomitrium lanuginosum* and hepatics such as *Calypogeia fissa*, *Cephalozia bicuspidata* and *C. connivens*. With peat-encrusting *Cladonia* spp., such as *C. floerkeana*, *C. coccifera*, *C. chlorophaea*, and larger taxa such as *C. impexa*, *C. crispata*, *C. uncialis* and *C. arbuscula*, such a suite can attain prominence on bare ground in the middle years of regrowth after burning, before the sub-shrub or grass cover has become extensive, or, more locally, within the centre of degenerate heather bushes. New fires destroy such a ground flora which shows a temporary replacement by species such as *Polytrichum juniperinum*, *Ceratodon purpureus* and *Funaria hygrometrica*, which can be patchily abundant for some time.

Sub-communities

***Agrostis curtisii-Erica cinerea* sub-community:** Species-poor *Erica cinerea* heath NCC Devon Heathlands Report 1980. Unusually among the vegetation included within the *U. gallii-Agrostis* heath, this sub-community shows an almost total absence of *E. tetralix*. Otherwise, however, all the constants remain frequent, though there is quite a strong tendency for *A. curtisii* to be dominant. In contrast to the *Festuca* sub-community, however, such a trend is not accompanied by a general increase in the cover of grasses: *Molinia* is rarely abundant and, though *Danthonia* occurs occasionally, *A. curtisii* usually forms a virtually pure and densely-tussocky sward in such stands in which even the sub-shrubs are reduced to sparse shoots. In other cases, *E. cinerea* or, more rarely, *U. gallii* or *Calluna*, have the highest cover and then *Potentilla erecta* and bryophytes and lichens are somewhat better represented, though, by and large, both vascular and cryptogam associates are few in number throughout.

***Festuca ovina* sub-community:** Grass-heath Ward *et al.* 1972 *p.p.*; Species-poor *Erica cinerea* heath NCC Devon Heathlands Report 1980 *p.p.*; Species-poor Dry *Agrostis setacea* Heath NCC Devon Heathlands Report 1980. As in the previous sub-community, *A. curtisii* is often the most abundant species here, though it is not quite so uncompromisingly dominant: most commonly, it is the leading component of a fairly rich mixture of sub-shrubs and herbs for which the term grass-heath is probably the most appropriate. Among the woody plants, both *U. gallii* and *Calluna* retain very high frequencies and the latter can have moderately high cover. *E. cinerea*, however, is much more patchy in its occurrence and quite often totally absent and *E. tetralix*, though considerably more common than in the first sub-community, is still not constant; and usually neither of these plants is abundant. Likewise, *Vaccinium myrtillus*, which is more frequent here than in any other kind of *Ulex gallii-Agrostis* heath, is often present as sparse shoots, and these commonly show signs of having been nibbled.

More strictly preferential, and generally more abundant, is *Festuca ovina* which, with the constant *A. curtisii* and *Molinia caerulea*, frequent *Danthonia decumbens* and occasional *Agrostis capillaris* and *A. canina* ssp. *montana*, occurs in intimate mixtures with the sub-shrubs or as a grassy matrix between the bushes, the height and arrangement of these different elements strongly reflecting the particular grazing regime. Also rather distinctive of this kind of vegetation, though not occurring very commonly, are *Carex pilulifera* and *C. binervis*, usually found as scattered tufts in the sward, though with the former sometimes locally abundant after burning. On moister ground, there can also be some *C. panicea*, and, in south Wales, *C. montana* has been recorded (Ivimey-Cook 1959). Among the other associates, *Potentilla erecta* is very common and frequently accompanied here by *Galium saxatile*. Locally, there can be a patchy over-canopy of *Pteridium*, though this does not reach its full development until July. Then,

in some stands, where the soils are somewhat more base-rich than is usual for this kind of vegetation, there is a distinctive enrichment by species such as *Thymus praecox*, *Helianthemum nummularium* and *Carex flacca*, producing what has sometimes been included in a 'limestone heath' community (e.g. Ivimey-Cook 1959).

Among denser covers in this sub-community, where the herbage is matted with grass litter, bryophytes and lichens can be very sparse but, where the sward is nibbled shorter or among gaps in the sub-shrub canopy, *Hypnum cupressiforme s.l.*, *Pleurozium schreberi*, *Pseudoscleropodium purum* and *Dicranum scoparium* can occasionally be found and, out of reach of trampling, *Cladonia impexa*.

***Erica tetralix* sub-community:** *Agrostis setacea* 'Short Heath' Coombe & Frost 1956*a*, Marrs & Proctor 1978; *Agrostidetum setaceae cornubiense* Coombe & Frost 1956, Ivimey-Cook 1959, Ivimey-Cook *et al.* 1975; *Erica vagans-Erica tetralix* 'Wet Heath' Coombe & Frost 1956*a*; Intermediate Tall/Short Heath Marrs & Proctor 1978; *Agrostis curtisii* heath Hopkins 1983. This kind of *Ulex gallii-Agrostis* heath shows a strong general uniformity of composition, with some striking local floristic peculiarities and quite a wide range of physiognomic variation. Both of the grasses and sub-shrubs of the community, including now *E. tetralix*, have very high frequency here, and each can be abundant, either in mixed canopies or in covers where one or other of the species is more obviously dominant. Sometimes, too, there can be a little *V. myrtillus*. *Potentilla erecta* occurs frequently and there can be occasional *Danthonia decumbens*, *Polygala serpyllifolia* or *Carex panicea*. Among stands on the Lizard, from where this vegetation was first described as 'Short Heath' or *Agrostidetum setaceae cornubiense* by Coombe & Frost (1956*a*), the last two species, together with *Pedicularis sylvatica*, *Dactylorhiza maculata* ssp. *ericetorum* and *Salix repens* show increased local frequency.

More striking, however, is the occasional occurrence of *E. ciliaris* or *E. vagans* in this kind of heath. In some of its Devon and Cornish stations, the former can be very abundant here, sometimes totally replacing *E. tetralix*, though not usually being accompanied by any other floristic peculiarities. *E. vagans*, too, can be found in this vegetation on the Lizard as a generally low-cover member of an otherwise unchanged vascular cover. But its typical position when it occurs here is in spatial transitions to the *Erica vagans-Schoenus* heath and it is occasionally accompanied by some of its associates in that vegetation type, notably *Serratula tinctoria* and *Sanguisorba officinalis*. Such more distinctive assemblages (characterised as intermediate vegetation by Coombe & Frost 1956*a*, Marrs & Proctor 1978 and Hopkins 1983) could be recognised as a variant.

As usual in this community, bryophytes and lichens show a varying representation here, with the most diverse and extensive covers developing on patches of bare ground that have remained unburned for some time but uncolonised by a dense growth of vascular plants. In many stands on the Lizard, peculiar drainage conditions help to maintain such more open areas permanently. Not only is this kind of heath of very short stature in this district, but the cover of grasses and sub-shrubs is broken into discrete clumps, between which are pans, waterlogged in winter but often parched in summer. These support but a few sparse shoots of *Molinia* and *Carex panicea* but can develop a varied cover of mosses and lichens (Hopkins 1983).

***Scirpus cespitosus* sub-community.** The constant occurrence in this sub-community of the strongly preferential *Scirpus cespitosus* with very frequent *Calluna*, *Molinia* and *E. tetralix* gives something of the appearance of a *Scirpus-Erica* wet heath, especially those types which, as here, have fairly common *E. cinerea* and *V. myrtillus*. But the continuing constancy of *U. gallii* and *A. curtisii* provide a good distinction, and the latter especially is sometimes very conspicuous in this vegetation with an extensive cover of dense tussocks. In other stands *Molinia* is abundant, though most often it is *Calluna* which dominates.

Other distinctive features of this sub-community are very few but *Dicranum scoparium* is rather frequent and, more obviously, *Leucobryum glaucum* is preferential, its pale green hummocks sometimes having high cover. Lichens, too, may be conspicuous with occasional records for *Cladonia impexa* and *C. uncialis*.

Habitat

The *Ulex gallii-Agrostis* heath is confined to the warm oceanic parts of south-west Britain where it occurs on a variety of moist, acid soils. Climatic and edaphic conditions combine to influence the general character of this vegetation and interactions between them, in relation to altitude, aspect and surface relief, are partly responsible for the floristic differences seen in the various sub-communities. In most situations, however, burning and grazing are of great importance to the maintenance of the community against succession to woodland and they have a marked effect on the floristics and physiognomy of the vegetation. Other past treatments, like cultivation and abandonment, may also have influenced the composition and distribution of this kind of heath and, in more recent times, intensive improvement for agriculture has reduced and fragmented its extent.

Compared with the climate of central southern England, the conditions experienced by this community show a further shift towards an oceanic extreme, with a more equable temperature regime and increased

humidity. Moving west from Poole Harbour, mean annual maximum temperatures begin to fall away a little, to 27 °C or less, from the high values that prevail over much of central and eastern England (Conolly & Dahl 1970), but the winters are markedly less severe: throughout a deep fringe all around the south-western seaboard, February minima are at least 2 °C above freezing (*Climatological Atlas* 1952) and there are fewer than 40 frosts per year (Page 1982). The floristic differences which mark this temperature shift are actually small. Already, in central southern England, a strong Oceanic West European character is becoming visible, with species such as *Erica cinerea*, *E. tetralix* and *A. curtisii* occurring together as constants in the *U. minor-Agrostis* heath, and *E. ciliaris* figuring as a distinctive occasional. That basic pattern continues here, the major general difference between the communities being the switch from *U. minor* to *U. gallii*. The sharp boundary between these two species along the south coast, in east Dorset, marks the geographical division between the heath types and it may reflect a greater need by *U. gallii* for the milder conditions that prevail to the west of the line (Proctor 1965).

More obvious, however, than any simple floristic response to the more oceanic character of the climate through south-west Britain, is the fact that, in the more equable and moist environment, this kind of heath is able to extend to altitudes and on to soils which, in a harsher and drier climate, would be uncongenial and occupied instead, where sub-shrub vegetation has developed, by different types of upland heath or lowland dry heath. As it is, with the relatively mild winter temperatures, the same basic assemblage of Oceanic West European plants occurs in this community, not only on sites close to sea-level like the Lizard and parts of the Gower coast, and on inland commons at low altitudes, as in east Devon, but also up to levels of 500 m or so on the moorland fringes of Dartmoor, Bodmin Moor and Exmoor, something which gives the heath vegetation of much of this part of Britain a strong uniformity. And, within this general framework, the floristic differences to be seen in the various sub-communities can be understood in relation to interactions between soil conditions and the increase in rainfall on moving through this altitudinal range.

Like its eastern counterpart, the *U. minor-Agrostis* heath, this is a vegetation type of acid soils that are too moist for dry heath but not so consistently waterlogged as to be able to sustain wet heath. And, as in that community, this intermediate edaphic character is marked by the distinctive coincidence of *E. cinerea* with *E. tetralix* and *Molinia*, species which, in the more continental parts of Britain, are rather sharply partitioned into dry and wet heaths respectively (Rutter 1955, Bannister 1965, 1966, Gimingham 1972); and, again, by the constant contribution from *A. curtisii*, a grass typical of moist but not waterlogged soils (Ivimey-Cook 1959). In the drier climate of central southern England, such soil conditions are often maintained by some impedence to drainage in brown earths or podzolic profiles with an argillic B horizon or impervious pan. And this is quite often the case here, particularly at lower altitudes where the annual precipitation is in the order of 1000 mm (*Climatological Atlas* 1952) with around 140 wet days yr^{-1} (Ratcliffe 1968), that is, not very much greater than that in parts of, say, the New Forest. On the Devonshire Pebble-Bed commons, for example, which run northwards to the east of the Exe, the *U. gallii-Agrostis* heath occurs on stagnogleys and gleyed podzols developed over the gently-dissected surface of the Triassic dip slope, a very similar topographic and edaphic context to that of moist heaths further to the east (Ivimey-Cook *et al.* 1975). On the Lizard, too, where the community marks out stretches of base-poor loess and Crousa Gravels deposited over serpentine and gabbro (Coombe & Frost 1956*b*, Hopkins 1983), sub-surface drainage impedence over the more or less level platform of the headland results in extensive gleying, with surplus winter rain draining away laterally and only slowly (Staines 1984, Findlay *et al.* 1984). In such situations as these, the *Erica tetralix* sub-community is especially characteristic, functioning very much as a western continuation of typical *U. minor-Agrostis* heath, occurring in very similar lowland heath landscapes and again providing an occasional locus on wetter soils for *E. ciliaris*. Additionally here, in some Lizard stands, there is the rather striking occurrence of *E. vagans* and some of its associates from the heaths endemic there, but this has been clearly related (Coombe & Frost 1956*a*, Hopkins 1983) to a thinning of the drift mantle over the base-rich serpentine or gabbro, with a rise in superficial pH from less than 5 to just above: in its general floristic and edaphic features, the 'Short Heath' of this area thus clearly belongs here.

Some of these lowland gleyed soils show a shallow accumulation of mor humus beneath sub-shrub covers that have not been burned for some time but, with a shift to higher ground, where annual rainfall increases towards 1600 mm (*Climatological Atlas* 1952) with over 160 wet days yr^{-1} (Ratcliffe 1968), there is a strong tendency for profiles with impeded drainage to develop a humose top-soil. Around the fringes of Dartmoor, Bodmin Moor and Exmoor, therefore, over ill-draining stretches of Devonian and Carboniferous shales and mudstones and granite, the *U. gallii-Agrostis* heath is often found on stagnohumic gleys that form an intergrade between mineral stagnogleys and the thick ombrogenous peats mantling the highest and wettest ground. Here, the *Scirpus* sub-community is the characteristic type, with *Scirpus* itself and, to a lesser extent,

Vaccinium myrtillus, both Continental Northern plants, and the general moorland context, giving the vegetation a rather different feel from that of the lowland *Erica* sub-community.

One other consequence of the increased rainfall characteristic of the higher ground of north-west Somerset and the heartlands of Devon and Cornwall is that there the *U. gallii-Agrostis* heath is able to extend on to more free-draining soils that are kept moist as much by high precipitation as by any drainage impedence: indeed, such conditions probably represent the edaphic optimum for *A. curtisii* (Ivimey-Cook 1959). Quite commonly, then, over more pervious Devonian or Carboniferous sandstones and coarse granitic debris or boulders, the community can be found on moist brown podzolic profiles or podzols proper. In such situations, the *Festuca* sub-community is particularly distinctive with *V. myrtillus* again indicating the wetter and somewhat cooler conditions which prevail at higher altitudes, though much of the character of this kind of *U. gallii-Agrostis* heath reflects the treatment which the vegetation has received on this quite well-drained ground over the fringing upland slopes (see below). Indeed, this is the type of grass-heath likely to develop throughout the region wherever grazing has been applied to the community on soils which show some relief from drainage impedence: it is the usual sub-community found, down to quite low altitudes, over loess-smeared Carboniferous Limestone in south Wales, for example, where incomplete masking of the base-rich bedrock sometimes permits the development of stands with a modest admixture of calcicoles (e.g. Ivimey-Cook 1959, NCC South Gower Coast Report 1981).

As with other kinds of lowland heath, human activity has undoubtedly played an important part in the extensive development of this community over stretches of impoverished acid soils and, within the general floristic framework set by climatic conditions, treatments continue to have an important effect on the composition and structure of the vegetation and on the disposition and extent of stands through the region. With a community like the *U. gallii-Agrostis* heath, which spans a fair range of altitudes and makes a contribution to different types of agricultural landscape, the pattern of treatments from place to place has probably been very varied, and there are certainly differences today in intensity and type of use. Even within a particular area, the history of exploitation can be very complex: on the Lizard, for example, Hopkins (1983) described the community from a patchwork of heaths that, in Napoleonic times, was actually less extensive than at present, probably because of wartime reclamation, and which, even in the relatively short time since then, has experienced regimes of burning and grazing, gorse-cutting and turf-paring, with bouts of neglect and more recent intensive improvement for farming or forestry and enclosure for military training and telecommunications purposes.

The most drastic of the traditional treatments is burning, though on the Lizard, this is not now a deliberate practice outside the enclosed and cliff-top heaths and, even there, where it is used to encourage a flush of new herbage and control the spread of *U. europaeus* and *Prunus spinosa* over the stretches of deeper soil, many fires are started outside the close season and allowed to burn uncontrolled. In the unenclosed inland heaths, where the *Erica tetralix* sub-community makes a bigger contribution to the vegetation cover, accidental fires are frequent, perhaps more so now with the accumulation of litter and dead wood following the demise of grazing and fuel-gathering, the overgrowth of turf-pits, which provided breaks, and the increase in visitors (Hopkins 1983). In the less rainy weather of summer, the soil surface, even of the stagnogleys, can become parched and the vegetation become very inflammable, so intense fires often clear the ground completely, leaving much exposed mineral soil. After burning, Hopkins (1983) noted that eutrophic weeds, such as *Epilobium angustifolium* and *Chenopodium rubrum*, could figure briefly but the first real stage in recolonisation was the spread of acrocarpous mosses, which occupied the ground for some years before the reappearance of the characteristic suite of bryophytes and *Cladonia* spp. In fact, Hopkins (1983) considered that even this assemblage might represent an impoverished version of the potential cryptogam flora, its further development curtailed by frequent fires. And, in this area, Coombe & Frost (1956*a*) thought that burning was an important contributory factor, maintaining the distinctive open pans in which wind erosion could hinder extensive recolonisation by vascular plants.

In less exposed situations, burning tends to favour the eventual resurgence of dominance by *Calluna*, in both the *Erica tetralix* and *Scirpus* sub-communities of this kind of heath and, where practised judiciously, can maintain a continuous supply of vigorous building-phase heather through a mosaic of swales. In fact, as on the Lizard, burning of many stands of the community at lower altitudes is generally now an accidental and uncontrolled affair and often infrequent, so many stands have a rank and leggy *Calluna* canopy. In some areas, however, as around the periphery of Dartmoor, swaling is still a regular practice, if not always as carefully controlled as it might be, maintaining heather as the eventual dominant over many hectares (Ward *et al.* 1972*a*, Harvey & St. Leger-Gordon 1974).

In the early stages of regeneration, however, burning can favour marked local heterogeneity in the canopy of both the *Erica* and *Scirpus* sub-communities, by allowing opportunity for *A. curtisii* to regrow from surviving

stools and to seed in, often in great profusion, to bare areas. *E. cinerea*, too, can show some temporary prominence in the early years of recovery. Some of this variety in dominance can be readily accommodated within these kinds of *U. gallii-Agrostis* heath but the *Agrostis-Erica* sub-community seems to consist mainly of stands of the community where *Calluna* and *E. tetralix* have been more thoroughly eclipsed by their rivals. It can be found throughout the geographical and altitudinal range of the heath and over a variety of soils.

One other important treatment-related development in the *U. gallii-Agrostis* heath is the response to grazing. On the Lizard, grazing is now confined to the cliff-top heaths and the inland enclosures and actually seems to be increasing in the latter with the switch from dairying to beef production, for which, with some time on improved pasture plus supplementary feeding, this kind of vegetation can provide a reasonable bite. On the unenclosed heaths, however, grazing seems to have ceased fifty or so years ago, with the combination of low economic returns, the failure of the commoners to protect their rights and the neglect in wartime (Hopkins 1983). On the upland fringes, by contrast, the community continues to provide extensive pasturage on the slopes between the enclosed and often improved grasslands below and the wet heath and blanket mire above, with grazing by sheep, cattle and ponies (Ward *et al.* 1972*a*, Harvey & St. Leger-Gordon 1974). Often combined with a burning regime, such consistent herbivore pressure favours the development, particularly on the more free-draining soils, of the *Festuca* sub-community, with its low total cover of sub-shrubs, abundance of *A. curtisii*, *Festuca ovina* and other grasses and somewhat richer total vascular flora.

Zonation and succession

The *U. gallii-Agrostis* heath is typically found in zonations with other heath communities and mires over sequences of soils which differ mainly in their moisture regime, occasionally in their base-richness. The particular sub-communities, and the other vegetation types, involved in these patterns vary with altitude and are throughout subject to modification by treatments. Throughout most of its range, such human interference has maintained this vegetation against progression to woodland, though abandonment of traditional treatments has in recent years often been a prelude to improvement for agriculture or forestry with permanent loss of the community.

In its typical lowland setting, best seen now on the Devonshire Pebble-Bed commons, from the largest of which, at Aylesbeare, the vegetation pattern was described by Ivimey-Cook *et al.* (1975), the *U. gallii-Agrostis* heath is found in very much the same general kind of sequence as is characteristic of stretches of impoverished acid soils further east, around Poole, in the New Forest and on the commons of Surrey and Sussex. Essentially, it replaces the *U. minor-Agrostis* heath as the intermediate component of the zonation from dry to wet heath developed over soils with an increasing tendency to surface-waterlogging, except that, in the wetter climate typical of this more westerly region, the contribution of the dry heath becomes proportionately less prominent. Generally, at these lower altitudes, the *U. gallii-Agrostis* heath is represented by the *Erica tetralix* sub-community and, as in the Aylesbeare transect (Ivimey-Cook *et al.* 1975), this can occupy the bulk of the less waterlogged ground. Where more sharply-draining acidic soils are present, however, it gives way to drier heath of the *Calluna-Ulex gallii* type, a community into which *Calluna*, *E. cinerea* and *U. gallii* run as consistent components but from which *E. tetralix*, *Molinia* and usually also *A. curtisii* are excluded. In the opposite direction, the *U. gallii-Agrostis* heath gives way to some kind of *Ericetum tetralicis* with the move to mineral soils with seasonal surface waterlogging. Here, it is *Calluna*, *E. tetralix* and *Molinia* which provide the major continuity of cover, although *A. curtisii*, *E. cinerea* and *U. gallii* can run some way into the wet heath if soligenous influence, even gentle flushing, maintains good aeration. Such more gradual transitions can be seen to some extent at Aylesbeare (Ivimey-Cook *et al.* 1975) but they are more obvious at some of the sites included in the NCC Devon Heathlands Report (1980), at Hares Down, for example. In the full sequence of vegetation types in this kind of site (Rose 1953), the zonation usually continues over permanently-waterlogged peat into the *Narthecio-Sphagnetum* valley bog and, over gently-undulating topography, the whole pattern may be laid out as elongated, concentric zones. Often, however, the physiography is more complex than this and parent material heterogeneity can introduce further variations in the moisture or mineral regime. Commonly, as at Aylesbeare, there is some soligenous influence down the slopes such that Junco-Molinion vegetation intervenes through the zonation or, along soakways, the *Schoenus-Narthecium* mire can occur. And, as on heathlands in central southern England, deeper brown earth soils can have patches of the *Pteridium-Galium* community and on disturbed areas the *Ulex-Rubus* scrub.

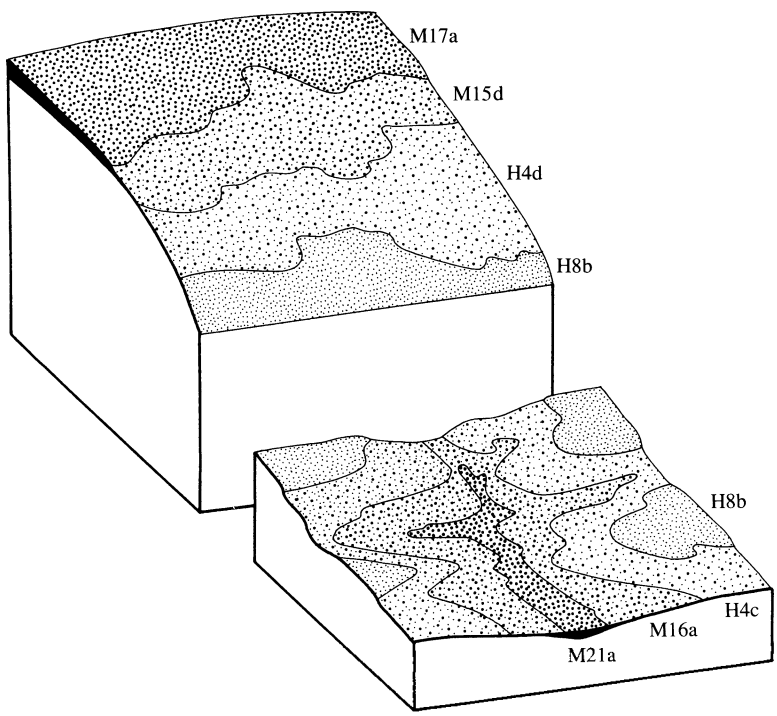
In such systems as these, the measure of base-enrichment is usually modest and dependent upon the concentration of sub-surface drainage waters from any local more calcareous substrates. On the Lizard, the *U. gallii-Agrostis* heath occurs in a rather different and peculiar situation, forming the most calcifuge element in a series of sub-shrub communities whose general character is controlled by the underlying serpentine and gabbro. Only where the dominating influence of these bedrocks is masked by acidic loess or Crousa Gravels are the soils sufficiently base-poor to support the *U. gallii-Agrostis*

heath in this area, and from the deeper deposits, *Erica vagans*, the characteristic species through much of the Lizard heathland, is excluded. Around the thinner margins of the drift patches, however, it appears in a distinctive strip, usually 2–10 m wide, of the vegetation transitional to the *E. vagans-Schoenus* heath of the base-rich gleys developed directly over the igneous parent materials (Coombe & Frost 1956*a*, Hopkins 1983). On loess-contaminated brown earths, heath transitional to the other major sub-shrub community of the inland areas, the *E. vagans-Ulex europaeus* heath, can sometimes be found (Hopkins 1983).

With the move to higher altitudes and a wetter climate, the *Scirpus* sub-community tends to replace the *Erica* sub-community and it can sometimes be found in the kind of dry–wet heath sequence typical of the lowlands, around the valley bogs of Dartmoor. On these upland fringes, however, there is a tendency for the whole character of the vegetation pattern to shift towards the sub-montane. In the first place, around the elongated topogenous hollows that drain radially across the fringes of Dartmoor, the *Scirpus* sub-community often gives way, on wetter ground, to some type of *Scirpus-Erica* wet heath or Junco-Molinion vegetation which then passes, in the water-tracks, to *Carex echinata-Sphagnum* mire, often rush-dominated. And, in the other direction, towards drier, sometimes rocky, ground, it is replaced by the *Caluna-Vaccinium* heath. Second, on a grander scale, the *U. gallii-Agrostis* heath makes a major contribution to the zone of marginal sub-shrub vegetation that runs concentrically all around Dartmoor, grading above, through *Scirpus-Erica* wet heath to the *Scirpus-Eriophorum* blanket mire and passing below to *Festuca-Agrostis* grassland and improved pasture (Figure 26).

Similar gross landscape patterns, though not so intact or clear, can be seen over the other major upland areas of the south-west, Bodmin Moor and Exmoor, and they reflect the tendency, in the more humid climate, for gentle slopes to accumulate a mantle of ombrogenous peat and for wet and dry heath to be pushed on to the steeper margins. But there is also a strong element of

Figure 26. Zonations of heaths and mires on the lowland commons and moorland fringes of south-west England.
H4c *Ulex gallii-Agrostis* heath, *Erica* sub-community
H4d *Ulex gallii-Agrostis* heath, *Scirpus* sub-community
H8b *Calluna-Ulex gallii* heath, *Danthonia* sub-community
M15d *Scirpus-Erica* wet heath, *Vaccinium* sub-community
M16a *Ericetum tetralicis* wet heath, Typical sub-community
M17a *Scirpus-Eriophorum* mire, *Drosera-Sphagnum* sub-community
M21a *Narthecio-Sphagnetum* mire, *Sphagnum-Rhynchospora* sub-community



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cultural influence in the zonations, with sub-shrub vegetation becoming confined to a narrow belt of relatively unimproved land, edaphically impoverished and sometimes topographically intractable, above the limit of more intensive agriculture. Traditionally around these upland fringes, the heath zone has provided low-grade pasture, periodically renewed by burning, so it is often the *Festuca* sub-community that occurs in these kinds of zonations. And, in such situations, it is very obvious that grazing can mediate a conversion from *U. gallii-Agrostis* heath in which sub-shrubs predominate, through the grass-heath of this sub-community to calcifugous grassland of the *Festuca-Agrostis-Galium* type. The upland margins in the south-west often consist of ill-defined mosaics of these vegetation types (e.g. Ward *et al.* 1972*a*) and enclosures below frequently contain improved pasture which has been derived from the heath and grassland by further treatment, liming, fertilising and top-sowing, which can effect a fairly ready conversion to calcifuge types of *Lolio-Cynosuretum*. Injudicious grazing can, however, create problems along the way, permitting the spread of *Nardus stricta*, for example, or *Pteridium*. On Dartmoor, the pasturing of the heaths by mixed herds of cattle, sheep and ponies may help keep these in check: ponies nibble out the centre of *Nardus* tussocks (Havinden & Wilkinson 1970) and cattle can trample out spreading bracken (Sayer 1969).

Careless burning, too, can precipitate a run-down of the *U. gallii-Agrostis* heath. The spread of *A. curtisii*, a relatively unpalatable grass (Ivimey-Cook 1959, Ward *et al.* 1972*a*), is a common problem in newly-burned heaths, and with frequent fires it may become more or less permanently dominant in vegetation of the *Agrostis-Erica* type. In other cases, *Molinia* may become very abundant in a shift to Junco–Molinion vegetation. And, even where there is regeneration of the sub-shrubs, repeated burning can impoverish the cryptogam flora, and uncontrolled fires destroy the characteristic mosaic of dominance seen in well-managed swales.

Through most of its range, however, burning and grazing have been essential to the maintenance of the vegetation against progression to woodland. Except in situations like the Lizard, where exposure to high and frequent winds is combined with a general scarcity of seed-parents, invasion of shrubs and trees occurs readily in the absence of treatments. Patchy development of the *Ulex-Rubus* scrub is often seen over disturbed ground in the *U. gallii-Agrostis* heath, along trackways, field margins and the edges of plantations, but of greater long-term significance is colonisation by birch which can fairly quickly form an open canopy to developing *Betula-Molinia* woodland. Very commonly, however, the abandonment of traditional treatments in the lowlands has been followed eventually by improvement and conversion of the land to pasture or plantation.

Distribution

The community is confined to south-west Britain, beyond a line from mid-Dorset to the Quantocks, and including parts of the south Wales seaboard. The *Erica* sub-community is especially characteristic of lower altitudes, being well represented on the Devon Pebble Bed commons, the lower fringes of Dartmoor and Bodmin Moor and on the Lizard. At higher levels, particularly on Dartmoor and Exmoor, it is replaced by the *Scirpus* and *Festuca* sub-communities, though the latter type can also be found throughout the region where this kind of heath occurs on free-draining soils with grazing. The *Agrostis-Erica* sub-community also occurs throughout.

Affinities

In the sequence of non-maritime heaths that runs around the southern and western seaboard of Britain, this community represents an oceanic extreme, early recognised as distinctive among lowland heather-dominated vegetation (e.g. Tansley 1911, 1939, Watson 1932) by virtue of the coincident occurrence of *U. gallii* and *A. curtisii*, though first given detailed definition from its rather unusual context on the Lizard (Coombe & Frost 1956*a*, Hopkins 1983). Thereafter, Ivimey-Cook *et al.* (1975) set this kind of heath in its typical lowland framework as part of the sequence of dry and wet heaths around southern valley mires.

In that kind of setting, the floristic character of the *U. gallii-Agrostis* heath as a western replacement for the *U. minor-Agrostis* heath is very clear, despite the difficulty of giving precise ecological meaning to the vicariant switch from the one gorse to the other (Proctor 1965): this is one of the pair of heaths that, with the increasing oceanicity of climate towards the south-west, becomes interposed between the wet and dry types, seeing a transgression of *E. tetralix* and *Molinia* on to ever more free-draining soils where they coexist with *E. cinerea* and the gorse species and providing the major British locus for *A. curtisii*. On this view, the community takes its place within the Atlantic wet heaths of Böcher's (1943) Ulicio-Ericion tetralicis or the Ulicion of Bridgewater (in Gimingham 1972), grading in one direction to drier heaths of an Ericion cinereae, in the other to the wet heaths of the Ericion tetralicis. Alternatively, one could stress the continuity with the drier western sub-shrub vegetation of the *Calluna-U. gallii* heath, as in Gimingham's (1972) grouping, an approach that would reflect the Continental division of north-west European heaths of this type into a less oceanic Ulicion nanae Duvigneaud 1944 and a more oceanic Ulicion gallii des Abbayes & Corillion 1940, the latter containing equivalent vegetation of the western French seaboard, like the *Ulici gallii-Ericetum ciliaris* Géhu 1973.

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Floristic table H4

	a	b
Ulex gallii	V (1–8)	V (1–5)
Agrostis curtisii	V (2–9)	V (1–8)
Calluna vulgaris	V (1–8)	V (1–6)
Molinia caerulea	IV (1–8)	IV (1–8)
Erica cinerea	V (1–8)	III (1–4)
Potentilla erecta	IV (1–5)	V (1–3)
Erica tetralix	I (1–3)	III (1–4)
Festuca ovina		V (1–8)
Vaccinium myrtillus	II (1–8)	IV (1–4)
Danthonia decumbens	II (1–4)	III (1–5)
Galium saxatile	II (1–4)	III (1–3)
Pteridium aquilinum	I (2–3)	II (1–7)
Carex binervis	I (2)	II (1–3)
Carex pilulifera	I (1)	II (1)
Agrostis capillaris	I (2–3)	II (1–5)
Pleurozium schreberi	I (7)	II (1–3)
Agrostis canina montana	I (1–2)	II (2–3)
Pseudoscleropodium purum	I (2–4)	II (1–3)
Rhytidiadelphus squarrosus		II (1)
Carex flacca		I (1–2)
Helianthemum nummularium		I (1–3)
Lotus corniculatus		I (1–3)
Thymus praecox		I (1–3)
Carex montana		I (2–4)
Carex panicea	I (1)	I (1–2)
Erica ciliaris		
Erica vagans		
Salix repens		
Dicranum scoparium	I (1–5)	III (1–6)
Scirpus cespitosus		I (1)
Leucobryum glaucum		I (1–5)

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

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Floristic table H4 *(cont.)*

	a	b
Polygala serpyllifolia	II (1–2)	I (1)
Hypnum cupressiforme s.l.	II (1–5)	II (1–3)
Nardus stricta	I (1–3)	II (1–4)
Cladonia impexa	I (1–10)	II (1–5)
Cladonia floerkeana	I (1)	I (1)
Festuca rubra	I (1)	I (1–6)
Campylopus paradoxus	I (2–4)	I (1–2)
Cephalozia bicuspidata	I (2)	I (1)
Pohlia nutans	I (1–2)	I (1)
Deschampsia flexuosa	I (1–7)	I (1–2)
Anthoxanthum odoratum	I (1)	I (1–2)
Calypogeia fissa	I (1)	I (1)
Pedicularis sylvatica	I (1)	I (1)
Lophocolea bidentata s.l.	I (2)	I (1)
Hypogymnia physodes	I (1)	
Cladonia coccifera		I (1)
Cladonia chlorophaea		I (1–2)
Juncus squarrosus		I (1)
Cladonia crispata		I (1)
Cladonia arbuscula	I (1)	I (1–2)
Polytrichum juniperinum	I (4)	I (8)
Calypogeia muellerana	I (3)	
Viola lactea	I (1)	
Campylopus introflexus	I (5)	
Cuscuta epithymum		I (1)
Racomitrium lanuginosum		I (1)
Polygala vulgaris		I (1)
Diplophyllum albicans		I (1)
Luzula multiflora		I (1)
Cladonia fimbriata		
Cladonia uncialis		
Cladonia furcata		

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

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Cladonia subcervicornis

Number of samples	27	36
Number of species/sample	10 (5–17)	14 (6–19)
Shrub/herb height (cm)	27 (5–70)	22 (3–50)
Shrub/herb cover (%)	94 (70–100)	95 (65–100)
Ground layer cover (%)	14 (0–100)	8 (0–90)
Altitude (m)	227 (50–430)	283 (24–500)
Slope (°)	6 (0–60)	5 (0–10)

a *Agrostis curtisii-Erica cinerea* sub-community
b *Festuca ovina* sub-community
c *Erica tetralix* sub-community
d *Scirpus cespitosus* sub-community
4 *Ulex gallii-Agrostis curtisii* heath (total)

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I (1–4)	I (2)	I (1–4)
77	32	172
9 (6–13)	11 (8–19)	11 (5–19)
22 (5–45)	23 (6–40)	23 (3–70)
95 (75–100)	92 (70–100)	95 (65–100)
11 (0–80)	22 (1–70)	10 (0–100)
206 (46–435)	257 (150–400)	235 (24–500)
4 (0–20)	4 (0–5)	5 (0–60)

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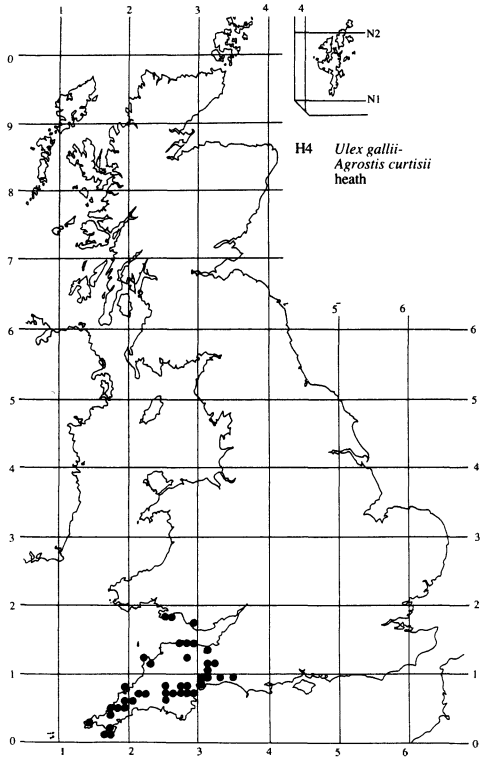

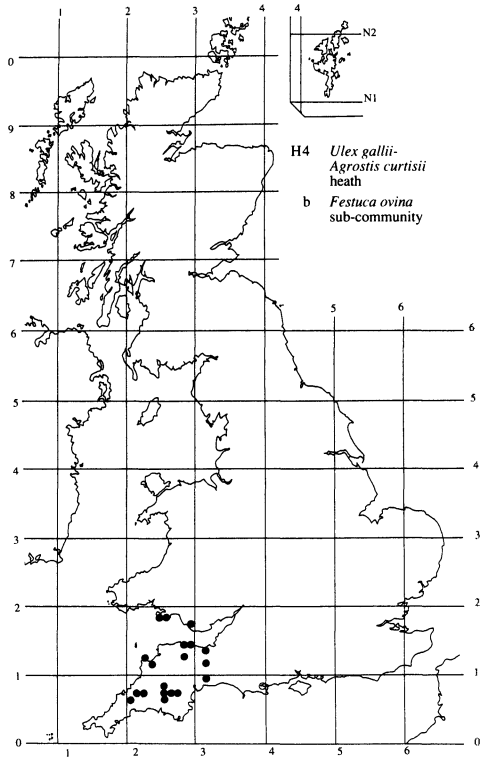

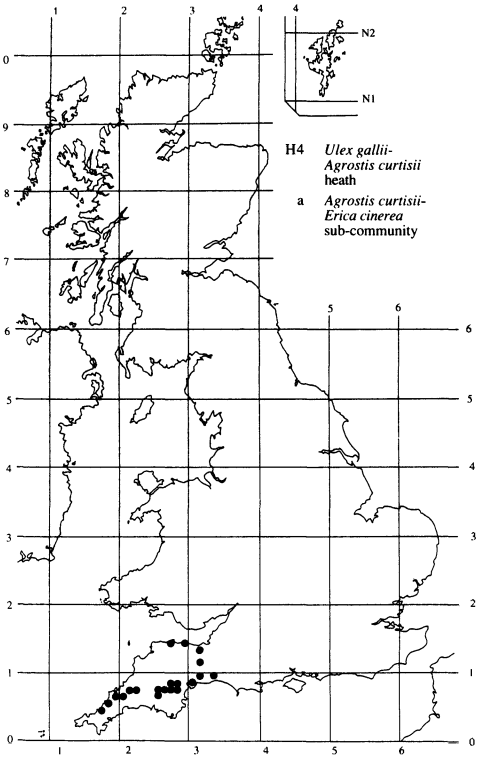

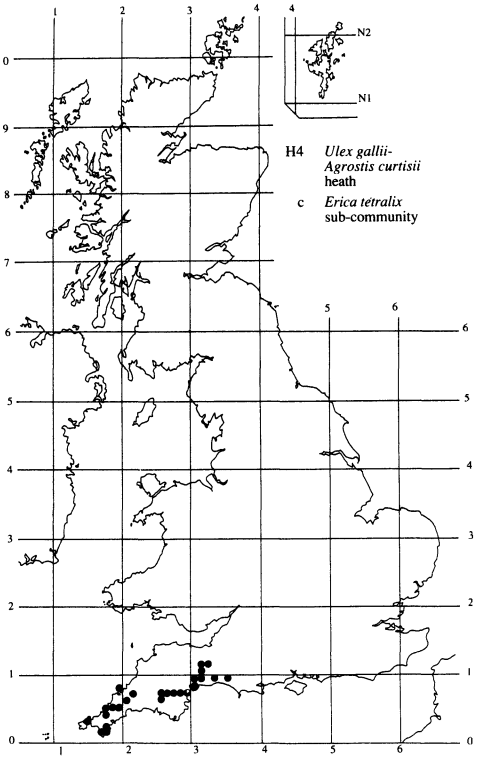

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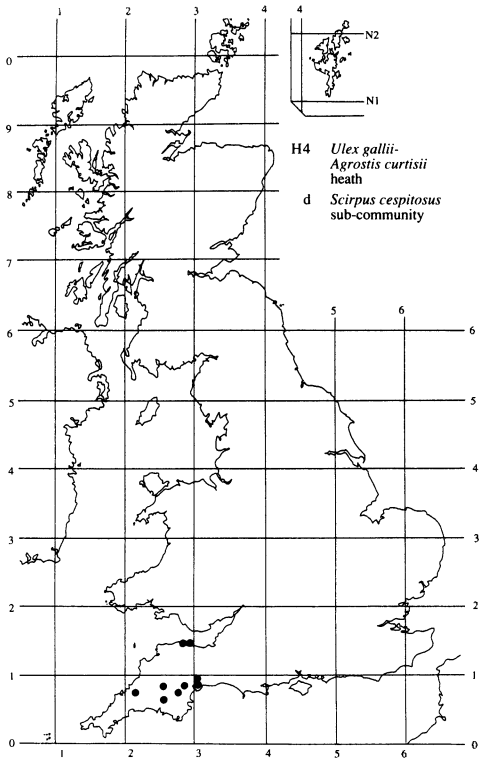

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