

## BRYOPHYTES

### INTRODUCTION

#### The physical background

The climate, landform and geology of Assynt have been dealt with in the introduction to the vascular plant flora but a short account of the features that particularly affect bryophytes is necessary. Assynt has a large total annual precipitation but more important for the bryophytes, particularly those described as 'oceanic', is the total number of wet days or conversely, the absence of any prolonged period of drought. Residents in the area will not be surprised that much of Assynt has in excess of 200 wet days per year (Ratcliffe 1968), with a 'wet day' defined as one with at least 1mm. of rain falling. The ameliorating effect of the relatively warm sea means that Assynt as a whole has fewer than 60 frosty days and fewer than 20 days with snow lying (Page 1982), although these sea-level figures need to be adjusted for the higher ground in the east of the parish.

To give an expression to this type of climate, an index of 'oceanicity' (see Averis 1991 and Page 1982), can be derived from the number of wet days per annum divided by the annual temperature range (mean maximum July temperature minus the mean minimum February temperature). Plotting the areas with the highest index gives a narrow band of 'wet mildness' (or 'cool wetness') that extends down the coast of Highland Scotland, including the Hebrides, and the extreme west of Ireland, and which includes all of Assynt. This index has proved a useful indicator of the distribution of oceanic bryophyte species. This very wet climate has also had a marked effect on bryophytes in another way, through the formation of mire areas where mosses, particularly *Sphagnum*, are often dominant.

Bryophytes are mostly small plants and do not compete well with the larger flowering plants and ferns except where conditions are favourable. The landforms of Assynt with a preponderance of rocky slopes, crags, boulders and ravines provide a wonderful assortment of niches where bryophytes can become established and form long-lived communities. The effects of glaciation are everywhere apparent but particularly so on north and east-facing slopes where the resultant crags and screes provide an important habitat for the hepatic heath described below. The run-off from the melting of the glaciers with an increasingly mild and wet climate, over a landscape largely devoid of vegetation and with prodigious quantities of rock debris gave rise to the, sometimes spectacular, ravines which seam the area. These now form very important sites for bryophytes. Another very recent landform with a distinctive bryophyte community is wind-blown shell-sand which

has a patchy distribution from Achmelvich round to Oldany.

The effects of the underlying rocks are as apparent for the bryophytes as they are for the flowering plants, though the physiological mechanism through which the rock type operates to determine presence or absence is even less well-understood. The large expanse of limestone and the associated Fucooid Beds and the run-off from the calcareous areas have a nationally important bryophyte flora with a number of species limited to this zone. The sandstone is largely rather acid and often has a limited flora although the gritty texture of the rock is ideal, particularly for the smaller liverworts.

As with the flowering plants, it is the complex mineralogy of the gneiss that poses most of the problems. Some facies of the gneiss are strongly base-rich and have a number of 'calcicole' species while others are absent (though frequent enough on the limestone). *Schoenus nigricans* flushes on the gneiss have a limited number of species, *Scorpidium scorpioides*, *Drepanocladus revolvens*, *Aneura pinguis* and *Blindia acuta*, but the expected *Philonotis fontana*, *Dicranella palustris*, *Jungermannia exertifolia* ssp. *cordifolia* and *Bryum pseudotriquetrum* are rarely seen. Some large gneiss crags are almost completely devoid of bryophytes except at the base and in some seepage lines. The autecological studies necessary to provide an explanation for these distribution patterns have not been carried out. However it would seem likely that it is the balance of a range of minerals including pyroxene, hornblende and plagioclase and their breakdown products that are critical, along with the depletion of several trace elements in the gneiss in general (Johnstone and Mykura 1989).

#### Assynt bryophytes in context

In order to put the bryophyte flora of Assynt into context it seems sensible to discuss briefly the importance of the Scottish Highlands as a whole. Britain has an internationally important bryophyte flora; we have approximately 70% of the European bryophytes as compared to only 18% of the European flowering plants. In general, the diversity of bryophytes in Britain increases as you move north and west because of the more diverse geology, more and bigger hills, higher rainfall and less pollution. Within this diverse bryophyte flora, the most important of the bryophyte communities, in global terms, are those which are often described as 'Atlantic' or 'oceanic'.

The climatological and geomorphological features already described for Assynt are common to much of western Scotland. The combination of equable temperatures and consistently high humidity occurs only in a very few areas of the globe, principally on temperate oceanic margins and in high montane zones closer to the equator. In Europe, this zone is limited to the extreme western margins of the continent, where very small areas occur on the coasts of France and Spain and again in south-west Norway. The largest areas are on the western margins of the British Isles, in a band stretching from south-west Ireland to north-west Scotland.

In addition to the climatic factors, buffering from changes in humidity can also be enhanced by a reasonably continuous tree canopy, deeply incised river valleys and by very rocky terrain. The latter two conditions are common in the west of Scotland as a result of glacial and fluvio-glacial processes; the burns tend to be steep and have ravine sections and there are rock-falls and scree slopes, not least those associated with the extensive raised-beaches around the coast. Broadleaf tree cover was probably fairly continuous at one time from Kintyre to Torridon and extensive in favoured spots north of this, probably including much of Assynt.

These various factors have given rise to distinctive and, in global terms, very rare, moss and liverwort communities. Several of the species involved have their only European sites in the British Isles, while many other species that are reasonably common here are extremely rare elsewhere. Perhaps more important is that, though there may be isolated records for most of the species from elsewhere in Europe, it is principally in the British Isles that there are extensive and distinct communities containing these species.

The west coast of Scotland has the largest area of this kind of habitat in Britain and has the largest number of

typical oceanic species as well as many of the most important populations. The available habitat in Assynt, as in much of Scotland, has been much reduced in the last few millennia as most of the species, as well as requiring an oceanic climate, require the further buffering from changes in temperature and humidity provided by a broadleaf tree cover. As the area under permanent broadleaf tree cover has decreased, so the populations of the oceanic species have become increasingly fragmented. This means that any semi-natural woodland with populations of oceanic bryophyte species is scientifically important, both nationally and internationally. A much more detailed analysis of the processes giving rise to this rich woodland flora is given by Averis (1991) and Hodgetts (1993) has a good account of the species involved.

These woodland and ravine communities of bryophytes have a better representation further south than Assynt, with woodlands of larger size, a greater diversity of species and more rarities. However, some sites in Assynt are extremely rich in oceanic species and are of international importance. Outside of the woodlands, there is one oceanic community that has some of its best Scottish sites in Assynt and in similar areas in West Ross just to the south. This is the liverwort community under ericaceous shrubs which has been variously described as 'oceanic' heath, 'oceanic-montane' heath, liverwort-rich heath or the 'mixed Northern Atlantic hepatic mat' (Ratcliffe 1968). This community is described more fully below but, essentially, it is a community of rocky slopes with a north or north-easterly aspect, consisting of *Calluna vulgaris* or, at higher altitudes, *Vaccinium myrtillus*, and with a bryophyte layer below which includes a number of large, leafy liverworts with an extremely restricted and disjunct global distribution. The best sites for this community, in the bigger hills in the east of Assynt, are, again, of international importance.

## BRYOPHYTE COMMUNITIES

### Common species

The object of this section is to describe the typical species of a broad range of habitats in Assynt and also to give some account of the rare or unusual plants. Assynt has some very rare species and several interesting bryophyte communities but the nature of the ground and climate means that a large number of plants occur very widely and it seems sensible to deal with these first. Plants like *Hylocomium splendens*, *Pleurozium schreberi*, *Hypnum cupressiforme*, *Racomitrium lanuginosum*, *Dicranum scoparium*, *Diplophyllum albicans* and to a lesser extent

*Racomitrium fasciculare*, *Thuidium tamariscinum*, *Rhytidiadelphus squarrosus*, *Rhytidiadelphus loreus*, *Isoetecium myosuroides*, *Sphagnum capillifolium*, *Frullania tamarisci* and *Scapania gracilis* can find a niche almost anywhere there is suitable substrate and are usually the most common species in a wide range of habitats. These and some other common species are only mentioned where they form an important, structural part of a community.

### Coast

Assynt has a long coastline, most of which is rocky and

some of which is very exposed. Ubiquitous on all rocky shores within reach of salt spray is *Schistidium maritimum* and the dark-green cushions of this moss occur high up on the sea-blasted Stoer headland. A little higher up the shore, in crevices and on ledges the most frequent species are usually *Trichostomum crispulum* and *Trichostomum brachydontium* and a rarity here is *Tortella flavovirens*, recorded from just two places. Again in the zone above the *Schistidium maritimum*, on the tops of rocks, cushions of *Ulota phyllantha*, with distinctive brown gemmae, are common. Where water seeps down, small patches of *Cratoneuron filicinum* are frequent, and where the rocks are very sheltered, as along the north-facing shore of Eddrachillis Bay, some of the oceanic liverworts can occur, especially *Radula aquilegia*. These sheltered rocky shores often grade into woodland.

Some banks above the sea have good stands of *Weissia controversa* and, rarely, its close relative, *Weissia perssonii* and, on soil in crevices in one rocky slab, there is a good population of *Riccia subbifurca*. *Frullania tamarisci* occurs in abundance both on rocks and in the turf and *Frullania teneriffae* is probably more common on slabby rocks by the coast than elsewhere. In similar sites, and often mixed with *Frullania fragilifolia* and with the same distinctive aroma, there are occasional stands of *Frullania microphylla*. Out on the Stoer peninsula again, in flushed grassland above the cliff edge, are two stands of the 'hyper-oceanic' moss *Myurium hochstetteri*. This plant, one of our most beautiful mosses, is most frequent in the Outer Hebrides and has only a handful of mainland localities; elsewhere it is only known from the Azores, Madeira and the Canary Isles.

The areas of shell-sand form a distinctive coastal community. The mobile sand is often colonised by *Syntrichia ruraliformis* and in amongst the marram *Homalothecium lutescens* is often common. Where the dunes are more stable and in other sandy grassland, *Rhytidadelphus triquetrus* is locally abundant, often with *Hypnum lacunosum* var. *lacunosum*, *Scapania aspera* and more rarely *Enthodon concinnus* and *Ditrichum gracile*. At Achmelvich there are limited populations of a few bryophytes typical of shell-sand areas in Scotland, including *Distichium inclinatum*, *Encalypta vulgaris* and *Amblyodon dealbatus*.

## Rivers and lochs

The riparian flora of many of the rivers and burns is not particularly diverse but often abundant. On the more acid rocks there is a fairly constant community consisting of *Racomitrium aciculare*, *Scapania undulata*, *Marsupella emarginata* and *Brachythecium plumosum* in varying amounts, often accompanied by *Hyocomium armoricum* on rocks above normal water level. On somewhat more base-rich rocks or run-off, *Racomitrium aciculare* is still common but there may

also be stands of *Rhynchostegium riparioides* and in sheltered places, *Thamnobryum alopecurum*. On the sandstone of Quinag, *Rhynchostegium riparioides* is accompanied on two burns by *Rhynchostegium alopecuroides*, a scarce European endemic in its most northerly world locality. *Schistidium rivulare* can be frequent on the upper surfaces of rocks and in one place there is a large population of the nationally scarce *Schistidium agassizii*. With the latter species there are also stands of the Scottish endemic *Bryum dixonii* and this also occurs on the River Inver close to Lochinver. In ravines and where there is some woodland cover the yellow-brown mats of *Hygrohypnum eugyrium* are common. *Fontinalis antipyretica* is relatively infrequent and often restricted to sheltered zones at the margins of rivers or in flushes.

On the faces of boulders in burns and particularly in ravines, but avoiding the limestone, is an oceanic liverwort community of international importance. The micro-habitat is usually the steep faces of rocks in or close by the burn, constantly humid, probably regularly inundated but free from scouring during spate. The most common species here is *Lejeunea patens*, often with *Metzgeria conjugata*, and sometimes with *Lejeunea lamacerina* and *Lejeunea cavifolia*. In the better sites there will also be *Radula aquilegia*, *Drepanolejeunea hamatifolia*, *Harpalejeunea molleri*, *Aphanolejeunea microscopica* and the exquisite *Colura calyptrifolia*. This community is most frequent in wooded ravines but it can persist in more open sites, especially near the coast.

Where the rocks are calcareous, particularly in the Tralligil and the Allt nan Uamh, *Hygrohypnum luridum* is very common, often with *Rhynchostegium riparioides* and more rarely *Amblystegium tenax*. Both rivers also have a good population of the scarce *Hygrohypnum duriusculum*, the rounded leaves of this species rather easily confused with the more abundant *Rhynchostegium riparioides*. Also on the bigger rivers with some base-rich run-off and also on loch margins with inflow from the limestone, there are large, straggling, black patches of *Cinclidotus fontinaloides*. Similarly, *Homalia trichomanoides* has a few sites on lochs and rivers where it will be regularly inundated with base-rich water.

The bryophyte flora of the loch margins also varies markedly with the underlying rocks but consistently provides one of the most interesting habitats in Assynt. On the more acid rocks, the flora is similar to that of the burns, with *Racomitrium aciculare* and *Brachythecium plumosum* prominent often with some *Thamnobryum alopecurum* and *Fontinalis antipyretica*. Other frequent species include *Hygrohypnum eugyrium*, *Bryum capillare*, *Isothecium myosuroides*, *Hypnum cupressiforme*, *Grimmia curvata* and *Racomitrium fasciculare*. The most interesting community usually occurs on basic gneiss boulders and has most of the

species above with smaller amounts of *Schistidium strictum*, *Pterogonium gracile*, *Orthotrichum rupestre*, *Antitrichia curtispindula*, *Pterigynandrum filiforme* and a variety of *Grimmia* species of which the most frequent are *Grimmia curvata*, *Grimmia hartmannii*, *Grimmia trichophylla* and *Grimmia funalis*, with rare stands of *Grimmia longirostris*, *Grimmia decipiens* and the Red Data Book species *Grimmia ovalis*.

The softer margins of the lochs can also have an interesting flora, particularly where there is some flushing from above. On more acid substrates common species are *Pellia epiphylla*, *Scapania undulata*, *Marsupella emarginata*, *Scapania irrigua* and *Jungermannia gracillima* often with some *Sphagnum* species. On open gravel, *Pohlia drummondii* can be frequent and in one place there is a small stand of the Scottish endemic, *Pohlia scotica*. Where there is some flushing, the nationally scarce liverwort *Odontoschisma elongatum* can be abundant, often growing in a rather glutinous, algal layer. Another rarity in this habitat is *Haplomitrium hookeri*, usually as scattered upright stems with other bryophytes on open gravel. During one dry spell, *Fossombronina foveolata* was found to be abundant on sandy loch margins in two areas and it is probably more widespread. Loch margins on the limestone have a very rich flushed turf which can include *Plagiomnium elatum*, *Plagiomnium ellipticum* and rarer plants like *Campyliadelphus elodes*, *Cinclidium stygium* and *Pseudobryum cinclidioides*.

There is very little of what can be described as fen on any of the loch margins despite the frequent occurrence of stands of emergent vegetation. Possibly the best area is by Loch na Claise at Balchladich which has populations of *Drepanocladus polygamus*, *Calliergon giganteum*, *Calliergon cordifolium*, *Plagiomnium elatum* and *Rhizomnium pseudopunctatum*. Most lochs on the gneiss have *Sphagnum* associated with the emergent vegetation, usually *Sphagnum denticulatum*, occasionally with *Cladopodiella fluitans* and *Drepanocladus exannulatus*.

## Woodland

An account of the extent and character of woodland in Assynt is given in the introduction to the vascular plant flora. Much of the rather open birch woodland of recent origin is very dull bryologically and all interest centres on those limited areas of older woodland and on woodland over rocky slopes and in ravines. The woodland floor tends to be dominated by common species like *Hylocomium splendens*, *Rhytidiadelphus loreus*, *Dicranum majus* and *Thuidium tamariscinum*, often in considerable abundance, forming hummocks over low rocks and capping the larger boulders. On wetter banks *Sphagnum capillifolium* is often abundant, sometimes with *Sphagnum subnitens*, *Sphagnum girgensohnii* and *Sphagnum quinquefarium*, often with *Plagiothecium undulatum* and, in crevices, *Hookeria*

*lucens*. On the faces of the rocks and crags in some woodlands, a community develops containing *Isothecium myosuroides*, *Scapania gracilis*, *Hymenophyllum wilsonii*, *Plagiochila spinulosa* and less frequently *Plagiochila punctata*. The extent of this community is the best indicator of a relatively undisturbed 'oceanic' woodland that will have other species of interest.

In these better woodlands, large, pure hummocks of the fine fronds of *Hylocomium umbratum* can develop over boulders and tree stumps, swelling cushions of *Mylia taylori* are frequent, often with *Bazzania tricrenata*, and less commonly *Lepidozia cupressina*. On wetter rocks and crags *Saccogyna viticulosa* is usually abundant and on drier faces the dark-green cushions of *Dicranum scottianum* often occur. Of the rarer species in this habitat, *Geocalyx graveolens* has one site on a wooded crag and *Sphenobolopsis pearsonii* has two sites. *Plagiochila killarniensis* favours more open sites, usually on somewhat basic rocks and has a handful of sites, but the tiny *Plagiochila exigua* was only found in the woodland at Creag an Spardain. At the base of some crags and on boulders near burns the *Lejeunea* community, described above in the section on rivers, can occur.

In some of the higher birch woodland, particularly in ravines where there is an under-story with some heather, a few of the 'oceanic-montane' bryophytes start to appear. The most frequent are *Anastrepta orcadensis* and *Herbertus aduncus* ssp. *hutchinsiae*, but there are also records for *Dicranodontium uncinatum*, *Dicranodontium asperulum*, *Paraleptodontium recurvifolium*, *Plagiochila carringtonii* and *Mastigophora woodsii*. In the limited areas of richer rocks as at Duart or Meallard and on the limestone, more base-demanding bryophytes like *Eurhynchium striatum* are abundant, often with *Rhytidiadelphus triquetrus*. Rocks and tree bases can be covered with *Isothecium alopecuroides* and less frequently *Homalothecium sericeum* but the less common oceanic species are usually absent from the rocks; the *Lejeunea* species that occurs here is normally *Lejeunea cavifolia*.

The epiphytic community on the trees is often not very diverse. In the best, old birch woodland many of the larger trees will have cushions of *Scapania gracilis* and *Plagiochila punctata* extending up the trunk, usually with *Dicranum scoparium* and *Hypnum andoi* and less frequently *Dicranum fuscescens*. In a few sites this community contains the scarce, oceanic liverwort *Leptoscyphus cuneifolius*. *Ulotia crispa* and *Ulotia bruchii* are frequent on the smaller branches of both birch and rowan and the latter often has *Ulotia drummondii* and *Ulotia phyllantha* as well, usually with abundant *Frullania tamarisci*. This 'Ulotia community' is probably best-developed on hazels and willows in sheltered woodland near the coast where it usually has, in addition to the species already mentioned, *Frullania*

*dilatata*, *Radula complanata* and *Metzgeria furcata* and occasionally *Zygodon conoideus*, *Harpalejeunea molleri* and rarely *Ulota calvescens*.

The epiphytic community on more open, nutrient-rich-bark trees like elder, ash and elm is poorly developed in Assynt. Suitable trees are few in number and are often rather exposed, sometimes having little other than abundant *Ulota phyllantha*. A few trees have good stands of *Zygodon viridissimus* var. *viridissimus*, *Zygodon rupestris* is less frequent and there are only single records for species like *Orthotrichum stramineum*, *Orthotrichum affine* and *Orthotrichum pulchellum*.

The bryophyte community on rotting logs is also rather poorly developed in Assynt, possibly because birch, the most frequent tree, breaks down rather rapidly on the ground. *Riccardia palmata* and *Nowellia curvifolia* are both widespread and often abundant, usually with *Cephalozia bicuspidata*, *Cephalozia lunulifolia*, *Scapania umbrosa*, *Lophozia ventricosa* and *Lepidozia reptans*. *Tritomaria exsectiformis*, usually common in this habitat in western woodlands, was only recorded twice. Rotting logs are also the usual habitat for *Dicranodontium denudatum* in Assynt, often with *Campylopus flexuosus*. The tiny, rare liverwort *Calypogeia suecica* has just one site on a log in woodland at Creag an Spardain.

## Heath, mire and flushes

Assynt has vast tracts of heathy ground, with some form of wet heath the most frequent, grading into dry heath on better drained ground with a southerly aspect. The dry heath is usually rather dull bryologically often having little more than an abundance of *Hylocomium splendens*, *Pleurozium schreberi* and *Hypnum jutlandicum*. Where the ground is more rocky there will usually be more *Racomitrium lanuginosum* and occasionally liverworts like *Barbilophozia floerkei* with *Pohlia nutans*, *Campylopus flexuosus* and *Campylopus introflexus* on barer ground.

The wet heath can be equally dour but there is usually a greater variety of species, including *Racomitrium lanuginosum*, *Hylocomium splendens* and *Pleurozium schreberi*. *Sphagnum* species are much less frequent than in the mires but *Sphagnum capillifolium*, *Sphagnum papillosum* and *Sphagnum denticulatum* are usually to be found with smaller amounts of *Sphagnum tenellum* and rarely *Sphagnum molle*. Where there is some flushing, the distinctive 'bottle-brush' stems of *Breutelia chrysocoma* occur, sometimes in huge patches. Where the heath is somewhat degraded or where there is a thin covering over slabby bed-rocks, large cushions of *Campylopus atrovirens* become conspicuous, usually with the equally impressive purple liverwort *Pleurozia purpurea*. The latter species is so common in the western Highlands that it is easy to

forget that it is extremely rare in Europe as a whole and has a highly disjunct world distribution. In wet heath, as in other mire areas, deer and sheep dung often has tufts of *Splachnum sphaericum* while the much rarer *Splachnum ampullaceum* seems limited to the larger droppings of the deer.

Areas of deeper peat with mire vegetation are widespread in Assynt but many of these have been exploited for fuel, particularly those close to roads and habitation, past and present. However, there are large populations of *Sphagnum capillifolium*, *Sphagnum papillosum*, *Sphagnum denticulatum*, *Sphagnum fallax* and *Sphagnum cuspidatum* and these seem to regenerate readily after active extraction of peat has ceased. There are smaller populations of *Sphagnum subnitens*, *Sphagnum compactum* and *Sphagnum tenellum*, the latter two often associated with some degradation of the mire, and this is also the case with the few sites for *Sphagnum molle* and *Sphagnum strictum*. An open area of peat in a mire also provided the one recent site for the impressive moss *Campylopus shawii*. This plant is locally abundant on Skye and the Outer Hebrides but very rare on the mainland and is only known elsewhere from the extreme south-west of Ireland, the Azores and some Caribbean islands.

In the least disturbed areas *Sphagnum capillifolium* and *Sphagnum papillosum* form significant hummocks and these better mires may also have lawns of *Sphagnum magellanicum* and a development of a pool system with floating masses of *Sphagnum denticulatum* and *Sphagnum cuspidatum*. Where there are flushed runnels in the mire, often with stands of *Scorpidium scorpioides*, *Sphagnum teres* can form significant stands and in these richer mires there are rare stands of *Sphagnum contortum* and *Sphagnum subsecundum*. Scattered around Assynt, usually some distance from habitation, are a few undisturbed mires, usually with a good cover of *Calluna vulgaris* and *Eriophorum vaginatum*, with large hummocks of *Sphagnum fuscum* and, less frequently, *Sphagnum austinii*. Most of these are on flat ground perched on a watershed, the best being on Mointeach na Totaig north-east of Loch Urigill, but some are valley mires as at the head of a tributary of Abhainn a' Chnocain.

Most hummocks of *Sphagnum capillifolium* and *Sphagnum papillosum* have small liverworts creeping through them. By far the most common of these is *Odontoschisma sphagni* and this may also occur on decaying hummocks and bare peat. *Mylia anomala* is also quite frequent but *Mylia taylori* also occurs in *Sphagnum* hummocks as well. Species of *Kurzia* are frequent but fertile material seems sparse and it was not possible to identify most stands to species and so the maps are rather sparse. *Cephalozia bicuspidata*, *Cephalozia lunulifolia* and *Calypogeia fissa* occur with some regularity and there are scattered stands of *Calypogeia sphagnicola*. There is only one record for

*Cephalozia connivens* and two for *Cephalozia loitlesbergeri* but these species were certainly overlooked elsewhere. The best populations of the more interesting species tend to be associated with mires that have good hummock development, particularly where there are stands of *Sphagnum austini* and *Sphagnum fuscum*.

Areas of wet ground that are flushed from above are also abundant in Assynt with their flora varying according to the base status of the ground water. Many flushes are overwhelmingly acidic and are dominated by *Sphagnum* species, particularly *Sphagnum denticulatum*, *Sphagnum palustre* and *Sphagnum fallax* often with *Aulacomnium palustre*. On the gneiss there are many flushes that are picked out by stands of *Schoenus nigricans* where *Campyllum stellatum* var. *stellatum*, *Scorpidium scorpioides*, *Aneura pinguis*, *Blindia acuta* and less frequently *Drepanocladus revolvens* are abundant along with some *Sphagnum* species. These flushes, with their peculiar chemistry, are seemingly shunned by all other bryophytes.

Other flushes are at least moderately calcareous and have typical species like *Philonotis fontana*, *Dicranella palustris*, *Brachythecium rivulare*, *Bryum pseudotriquetrum*, *Scapania undulata*, *Fissidens adianthoides*, *Fissidens osmundoides* and infrequently *Jungermannia exertifolia* ssp. *cordifolia*. On the limestone *Palustriella commutata* var. *commutata* and *Palustriella commutata* var. *falcata* can be abundant sometimes with *Philonotis calcarea* and in one case *Tritomaria polita*. Both on the limestone and in higher flushes, particularly on Conival, there are stands of *Philonotis seriata* and many montane flushes also have large patches of *Scapania uliginosa*.

Other rarities associated with flushes include *Amblyodon dealbatus* on the limestone and *Calliergon trifarium*, *Pohlia wahlenbergii* var. *glacialis*, *Sphagnum platyphyllum* and *Scapania degenii* on the gneiss in Coire Gorm. Finally, areas of flushed grassland are quite common and *Ctenidium molluscum* is almost ubiquitous here often with *Fissidens adianthoides* and occasionally *Fissidens osmundoides*, *Thuidium delicatulum* and, in coarser vegetation, *Dicranum bonjeanii*.

### Crags, scree and ravines

Much of the account of bryophytes in woodland applies to many crags and ravines on the lower ground with a northerly aspect, as these tend to have at least some woodland cover. Wooded ravines tend to be the richest sites for bryophytes because of the reasonably constant humidity, rock exposure (often with some variety of base-status), and freedom from disturbance. All the woodland species occur here and frequently there is an admixture of plants with a more montane distribution. On crags and in scree much will depend upon aspect,

with north-facing slopes generally having a much more diverse flora than those that face the sun.

Constant species on crags include almost all the ubiquitous bryophytes listed above, particularly on ledges, and most crags away from the limestone have plants like *Amphidium mougeottii*, *Anoetangium aestivum*, *Racomitrium heterostichum*, *Racomitrium aquaticum*, *Bartramia pomiformis*, *Bartramia ithyphylla*, *Fissidens* species, *Isothecium myosuroides* var. *brachythecioides*, *Andreaea rupestris*, *Polytrichum piliferum* and *Campylopus atrovirens*. The flora will depend very much on base-status with *Homalothecium sericeum*, *Isothecium alopecuroides*, *Tortella tortuosa*, *Ctenidium molluscum*, *Preissia quadrata*, *Plagiochila pelloides*, *Gymnostomum aeruginosum* and *Trichostomum brachydontium* all more or less common on the more base-rich rocks. At the other end of the scale, some crags on the gneiss and the quartzite are almost devoid of any bryophytes except on the larger ledges, and the same is true to a lesser extent, of the more exposed sandstone.

The gneiss, as ever, is the least predictable of the rocks because of the small-scale variation in base-status and the numerous igneous intrusions. The 'better' gneiss is often signalled by stands of *Grimmia funalis* and *Grimmia trichophylla* in open sites, *Neckera crispa* where more sheltered, or *Racomitrium ellipticum* where water trickles down. A large number of such gneiss crags proved to have populations of *Glyphomitrium daviesii*, an interesting find as this is a plant that was thought to be virtually confined to the Tertiary volcanic rocks in Britain (Birks in Hill et al. 1992). It is an extremely oceanic species only known outside the British Isles from Iceland, the Faeroes, Norway, Madeira and the Azores.

The bryophytes on scree slopes are also very dependant on aspect and geology. South-facing block-scrree is usually rather dull and may have little other than *Racomitrium lanuginosum*, *Racomitrium heterostichum*, *Racomitrium fasciculare* and *Diplophyllum albicans*, sometimes with *Hedwigia stellata*, *Ulota hutchinsii* and, on the sheltered side of larger rocks, *Scapania gracilis*. North-facing scree, particularly where the blocks are large, often has a flora like that of the rocky woodland with an abundance of the larger carpet-forming mosses including occasionally *Hypnum callichroum*, much *Scapania gracilis* and *Isothecium myosuroides*, and quite frequently *Hymenophyllum wilsonii* and *Plagiochila spinulosa*. *Mylia taylori* and *Bazzania tricrenata* are usually common, often with *Sphagnum capillifolium*, *Anastrepta orcadensis* and less frequently *Herbertus aduncus* ssp. *hutchinsiae*, providing a clear link with the more montane hepatic community described below. On the rocks, *Dicranum fuscescens* can be frequent often with *Lophozia ventricosa* and rarely *Lophozia sudetica* but *Barbilophozia floerkei* is surprisingly infrequent.

A number of other interesting species have their only sites in these habitats at relatively low level. The predominantly eastern moss *Cyodontium jenneri* has two sites on dry, acid crags on the gneiss, the newly described *Leiocolea fitzgeraldii*, endemic to the British Isles, has two sites on wet gneiss and *Leiocolea heterocolpos* was found once on a ledge of a gneiss crag. *Trichostomum hibernicum* and *Molendoa warburgii*, both apparently endemic to the British Isles, have sites in the more base rich ravines while *Aulacomnium androgynum*, so common elsewhere in Britain, has just two sites on sheltered but extremely acid rocks.

## The limestone

The limestone is extremely rich and has an abundance of the more common calcicole bryophytes so I will concern myself mostly with the species of interest. *Ctenidium molluscum* is abundant in much of the grassland with *Enthodon concinnus* in drier places and usually with *Ditrichum gracile*. Plants collected suggest that *Thuidium recognitum* is more frequent in the grassland than *Thuidium philibertii* but neither are at all common. *Neckera crispa* can occur in the 'Dryas heath', sometimes with *Scapania aspera*, but the latter is much more frequent on boulders and crags. On the north side of Cnoc Eilid Mhathain there is an odd community which has large patches of *Herbertus stramineus* in the heathy grassland over the limestone. Where the grassland is a little damper there are a few sites for *Brachythecium glareosum*. Flushed turf by a burn near Knockan also provides the habitat for *Moerckia hibernica* and the Red Data Book liverwort *Leiocolea gillmanii* in their one Assynt site.

The tops of low rocks in the grassland is the preferred habitat for *Ditrichum flexicaule*, here looking very distinct from *Ditrichum gracile*, being straight-leaved, dark green in colour and, at least in the winter months, with fragile apical shoots with reduced leaves. Also on these lower, easy-angled rocks are cushions of *Tortella densa*, so easily overlooked as *Tortella tortuosa* which is abundant, often with *Didymodon ferrugineus*. Species of *Schistidium* are common on all the boulders; by far the most common seems to be *Schistidium apocarpum* sensu stricto, but *Schistidium robustum* also occurs, as does the nationally scarce species *Schistidium trichodon* in the scree near Creag nan Uamh. Also in this same community on the broken outcrops above Lairig Unapool is a population of the nationally rare *Didymodon icmadophila*.

On the damper limestone the frequent patches of *Orthothecium rufescens* can provide a magnificent display, set off by the grey rocks. On damp ledges in two places there are stands of *Conardia compacta*, the Cambrian limestone providing the only sites north of the Great Glen for this rare plant. On dripping rock faces in caves and sheltered spots by rivers and often covered by

an unpleasant algal slime, there are several populations of *Seligeria trifaria* in by far the most northerly of the two Scottish localities. In the Traligill valley, similar wet places can have very large cushions of *Hymenostylium insigne*, a Red Data Book species with a disjunct world distribution. One of the most interesting finds of the current survey was a small patch of *Hypnum bambergeri*, on a wet ledge on a crag at the very moderate altitude of 180m. This is a rare moss, previously thought to be limited to the Central Highlands where it usually occurs high up on strongly calcareous mica-schist, although there are sites on limestone in the Ben Alder range and Glencoe.

The more montane limestone and the larger crags also have a number of species of interest. Creag Sròn Chrùbaidh is often rather dry but has *Syntrichia princeps* and *Grimmia orbicularis* in one area and scattered stands of *Bryum elegans* and a good range of other calcicoles. The smaller crags near Stronchrubie have some *Leucodon sciuroides* and there is much more on the stone walls in the fields below. Creag nan Uamh and its associated scree are rather better and there are good populations of *Pseudoleskeella catenulata* and *Pseudoleskeella rupestris* on the crag near the cave and on the big boulders below there is a small population of *Encalypta alpina*. The latter also occurs sparingly on the highest limestone in the Bealach Traligill with *Encalypta ciliata* in its only Assynt site. *Encalypta* species (other than *Encalypta streptocarpa*) and a few other limestone bryophytes, like *Anomodon viticulosus*, are surprisingly rare in Assynt given the limestone exposure. The 'high limestone' of Cnoc Eilid Mhathain also has some *Pseudoleskeella catenulata* and good stands of *Mnium thomsonii* and *Scapania aequiloba*.

## Upland

Much of the species that would normally be considered 'upland' have found a place under one or other of the habitats already covered. The occurrence of 'alpine' species at low altitude in the north west of Scotland is a well-known phenomena and is as true for bryophytes as for flowering plants. As explained below, the higher ground in Assynt did not receive the attention it deserves during this survey so this account is rather sketchy. The highest ground, that on the western flanks of Conival, was not covered at all, but older records of mosses like *Aulacomnium turgidum* and *Kiaeria falcata* suggest that more survey work here may prove productive. Unfortunately the excellent late snow-lie vegetation on the north side of Conival is not in Assynt. The sandstone hills are spectacular but provide little area at high altitude and the high ridges of Breabag and Beinn Uidhe are composed mainly of a rather uncompromising quartzite.

The best development of the species-rich ledges that are a feature of the better hills further south, occur where the gneiss reaches its highest altitude on Sàil Gorm on

Quinag, on the north side of Glas Bheinn and on one facies of the sandstone on the north side of Canisp. Here there are ledges with *Distichium capillaceum*, *Ditrichum gracile*, *Leiocolea bantriensis*, *Molendoa warburgii*, *Plagiobryum zieri*, *Orthothecium intricatum* and *Hypnum hamulosum* and rocks with *Grimmia torquata*, *Grimmia curvata* and *Cololejeunea calcarea*. Less common species include *Amphidium lapponicum*, *Isopterygiopsis muelleriana*, *Tortula subulata* var. *graeffii* and *Orthothecium rufescens*.

Most other interesting montane crag and fell field species have only isolated occurrences. *Ditrichum zonatum* var. *zonatum* has a few scattered sites on open soil in exposed sites, usually in a mat with more common species like *Oligotrichum hercynicum*, *Diplophyllum albicans* and *Nardia scalaris*. *Arctoa fulvella* was only seen on a couple of occasions, both sites being on the exposed sandstone rocks on the ridges of Quinag. *Racomitrium macounii* subsp. *alpinum* was seen once in the Bealach Traligill but this is an easy species to overlook. *Plagiothecium platyphyllum* occurs in a few acid flushes high on Quinag and Glas Bheinn and *Kiaeria blyttii* is quite frequent in the larger areas of block scree.

The most important upland community is the heath that develops at the base of crags, on steep slopes and over scree on north or north-east facing slopes. This heath, already described briefly above, usually has an open canopy of *Calluna vulgaris* or at higher altitudes, *Vaccinium myrtillus*, often with an abundance of *Sphagnum capillifolium* or *Racomitrium lanuginosum* in the ground layer. Mixed in with this are reasonably widespread plants like *Scapania gracilis*, *Anastrepta orcadensis*, *Pleurozia purpurea*, *Mylia taylori*, *Herbertus aduncus* ssp. *hutchinsiae* and *Bazzania tricenata* and varying amounts of the rare liverworts *Scapania ornithopodiodes*, *Scapania nimbosa*, *Mastigophora woodsii*, *Plagiochila carringtonii*, *Bazzania pearsonii*, *Anastrophyllum donianum* and *Anastrophyllum joergensenii*. These liverworts have an extraordinary world distribution (see below)

That such an assemblage of disjunct species is present in north-west Britain is remarkable and there are excellent examples in Assynt, particularly in the hills in the east and on Quinag. All these species would appear to require cool, montane, high rainfall sites and it is worth noting that in their Himalaya sites they tend to occur in moist juniper-rhododendron scrub above the natural tree line and it is possible that they are derived from similar dwarf shrub vegetation at or near the tree line in Scotland that has now been largely lost (Long, pers. comm.).

*Anastrophyllum donianum* and *Anastrophyllum joergensenii* tend to be limited to the higher ground, often where there may be some development of snow patches as in Coire Gorm. *Scapania ornithopodiodes* is less demanding and is quite widespread in suitable habitat but *Scapania nimbosa* is rather patchy and often absent from seemingly suitable sites. *Bazzania pearsonii* is probably locally frequent but can be rather hard to distinguish from the abundant *Bazzania tricenata*. Usually most abundant of all are *Plagiochila carringtonii* and *Mastigophora woodsii*, frequently forming large cushions and sometimes extending down into the higher woodland. This type of oceanic-montane heath is covered by the National Vegetation Classification H21b (*Mastigophora woodsii* – *Herbertus aduncus* ssp. *hutchinsiae* sub-community of the *Calluna vulgaris* – *Vaccinium myrtillus* – *Sphagnum capillifolium* heath) or, higher up, H20c (the *Bazzania tricenata* – *Mylia taylori* sub-community of the *Vaccinium myrtillus* – *Racomitrium lanuginosum* heath) and Rodwell (1991), gives a much fuller treatment.

There are other interesting species associated with this kind of habitat. The predominantly woodland species *Plagiochila spinulosa* and *Dicranodontium denudatum* occasionally occur here but much more frequent, particularly on Quinag, is *Dicranodontium uncinatum* which can form fine carpets in the turf below the crags. Also on Quinag, with *Mastigophora woodsii* and *Plagiochila carringtonii*, there are two populations of *Campylopus setifolius*, an uncommon oceanic species in Britain and elsewhere only known from northern Spain.

Species	ex-UK distribution
<i>Scapania ornithopodiodes</i>	W. Ireland, Norway, Faeroes, Himalaya, W. China, Japan, Taiwan, Philippines, Hawaii
<i>Scapania nimbosa</i>	W. Ireland, Nepal, Sikkim, W. China (Yunnan)
<i>Mastigophora woodsii</i>	W. Ireland, Faeroes, N.W. America, E. Himalaya
<i>Plagiochila carringtonii</i>	W. Ireland, Faeroes, Nepal
<i>Bazzania pearsonii</i>	W. Ireland, E. & S.E. Asia, N.W. America
<i>Anastrophyllum donianum</i>	Faeroes, S.W. Norway, Tatra, W. Tibet, Sikkim, Nepal, Bhutan, Yunnan, Alaska, W. Canada
<i>Anastrophyllum joergensenii</i>	S.W. Norway, Sikkim, Nepal, Bhutan, Yunnan

Another species with a disjunct distribution which often occurs close to these plants is the moss

*Paraleptodontium recurvifolium*, outside of the British Isles only known from British Columbia and Alaska.

## HISTORY OF BRYOPHYTE RECORDING

The history of recording in Assynt reflects the magnetic attraction of the limestone, with only a relatively small number of records from sites away from the calcareous band and the mountains close to it. Assynt has never had a resident bryologist and visitors have always had to contend with its relative isolation which, even in these days of good roads, tends to deter all but the few. This means that a small number of intensive visits have produced the vast majority of the records prior to this survey. For example, of the 2733 records in the Biological Records Centre (B.R.C) database that can be localised to Assynt, over 1000 originate from three visits by John Birks and others in 1966, 1967 and 1972.

Written accounts of visits to Assynt with bryological intent are very sparse and a full history of recording would require much time trawling through the herbaria of the early collectors. Given the time-scale of the project and the, probably, limited interest of the information gleaned, this approach was not adopted. Almost all of this information has come from the B.R.C database and from a few papers. It is remarkable that in MacVicar's paper *The Distribution of Hepaticae in Scotland* (1910) there are only two records that he assigns to sites in Assynt, though there are a number of records from Sutherland.

The earliest records from Assynt are those collected by James Robertson in the vicinity of Inchnadamph in 1767 (Henderson and Dickson 1994), background to which is given in the companion section for the vascular plants. These include a number of common species like *Sphagnum palustre*, *Polytrichum commune*, *Hylocomium splendens* (as *Hypnum proliferum*), *Racomitrium lanuginosum* (as *Bryum hypnoides*), *Homalothecium sericeum* (as *Hypnum sericeum*), *Lophocolea bidentata* (as *Jungermannia bidentata*) and *Aulacomnium palustre* (as *Mnium palustre*). There are plants of more interest including *Fissidens bryoides* (as *Hypnum bryoides*) and *Marchantia polymorpha* sensu lato, that are uncommon in Assynt, and three species not now in the Assynt list, *Leptobryum pyriforme* (as *Bryum pyriforme*), *Brachythecium velutinum* (as *Hypnum velutinum*) and *Drepanocladus aduncus* (as *Hypnum aduncum*). We do not know who named these plants and there are no voucher specimens and given the taxonomic changes it seems sensible to merely mention them here.

The earliest record in the B.R.C. is that of *Pleurozia purpurea* from Canisp in 1833, credited to W.H. Campbell, with the specimen in the herbarium in the

Royal Botanic Gardens (R.B.G.) in Edinburgh. This was probably collected during the expedition to Sutherland by Robert Graham in 1833, when a Mr Campbell was certainly a member of the party. However there is no direct mention of a visit to Canisp in the report (Graham 1833) and so some doubt must remain about the source. There will almost certainly be other records from around this date in the Greville herbarium in the R.B.G. and probably elsewhere.

The richness of the bryophyte flora was first revealed during a visit to the area by the noted English bryologists H.N. Dixon, W.E. Nicholson and E.S. Salmon from the 17th to the 24th of July in 1899 (Nicholson 1900). By then, Dixon had already 'traversed the country from Lairg to Altnaharra, whence Ben Clibreck and Ben Hope were ascended, then went on by Tongue and Erriboll to Durness, exploring from this centre Smoo Cave, Cape Wrath and the Far-out Head (sic)'. Based at Inchnadamph, they went over Conival and Ben More Assynt, Canisp, Quinag, Glas Bheinn, Beinn an Fhurain and covered the limestone at Inchnadamph and the Allt nan Uamh, an impressive itinerary for a weeks' botanising. Nicholson's paper in the *Journal of Botany* is, in effect, a list of the first records for Assynt of a considerable number of moss species. A number of their montane records are given as '108... Ben More Assynt' and it is difficult to know whether they were aware that the eponymous mountain is neither in Assynt nor v.c.108, a problem of interpretation which has persisted down the years.

They found many of the interesting species on the limestone and were enthusiastic about its 'southern flora', finding that the hill ground 'is very poor in northern or arctic species as compared with...the Grampians'. South of Inchnadamph they found *Syntrichia princeps* (as *Tortula princeps*) in 'immense, rounded cushions', presumably on Creag Sròn Chrùbaidh where it still occurs. In Glen Dubh on rocks in the Traligill they found *Gymnostomum calcareum* (as *Weisia calcarea*) and also described a robust form of *Hymenostylium recurvirostrum* (as *Weisia curvirostris*), now elevated to species status as *Hymenostylium insigne*. In the Allt nan Uamh they recorded *Pseudoleskeella catenulata*, noting the form that is now recognised as a species, *Pseudoleskeella rupestris*. Other notable finds on the limestone include *Mnium thomsonii*, *Cinclidium stygium*, *Thuidium recognitum*, *Conardia compacta* (as *Amblystegium compactum*) and *Leucodon sciuroides*.

Away from the limestone, Nicholson remarks on a form of *Rhynchostegium riparioides* (as *Eurhynchium rusciforme*) with 'slender, julaceous, brown branches' in a waterfall on Quinag, where it still occurs today and is now considered a species, the nationally scarce *Rhynchostegium alopecuroides*. Also on Quinag they found *Arctoa fulvella*, again the only site found for this plant during the present survey. Again on Quinag and also on Conival they recorded *Bryum mildeanum* but these collections have been re-determined as *Bryum riparium*, the only Assynt records for this species. Other interesting montane species they recorded include *Isopterygiopsis muelleriana* on Beinn Uidhe, *Herzogiella striatella* on Conival and *Bryum muehlenbeckii*, *Calliargon trifarium* and *Tetraplodon angustatus* on Glas Bheinn.

During the 1899 visit, as Nicholson remarks later, 'the Hepatics were left severely alone' (Nicholson 1923) and it was not until 1921 than he returned to remedy this omission, this time in the company of another celebrated bryologist, H.H. Knight. In his account, Nicholson remarks on the relative poverty of the limestone in liverworts compared with the mosses but is enthusiastic about the slopes of Beinn an Fhurain and the 'damp wood by the southern shore of Loch Assynt'. It seem reasonable to assume that this is the wood at An Coimhleum. The most important single discovery of this trip was undoubtedly that of *Anastrophyllum joergensenii*, new to the British Isles, on Beinn an Fhurain. They also made the first West Sutherland records of other members of the of oceanic-montane heath community including *Herbertus aduncus* ssp. *hutchinsiae*, *Mastigophora woodsii*, *Anastrophyllum donianum*, *Bazzania tricrenata*, *Bazzania pearsonii*, *Plagiochila carringtonii* (as *Jamesoniella Carringtonii*), *Scapania ornithopodioides* and *Scapania nimbosa*.

In 'the wood by Loch Assynt' they found an excellent selection of the liverwort species of oceanic woodland most of which were re-found during the current survey. They provide the first West Sutherland records for *Plagiochila spinulosa*, *Plagiochila punctata* and the much less common *Plagiochila exigua* (as *Plagiochila tridenticulata*). They also found a good population of *Leptoscyphus cuneifolius* 'mostly on *Frullania* growing on rock' but during the current survey it was found only on trees here. On 'moist, shaded rocks' they found *Colura calyptrifolia*, *Drepanolejeunea hamatifolia*, *Aphanolejeunea microscopica*, *Lejeunea patens* and *Radula aquilegia*, happily all still frequent in the woodland.

They did find some hepatic interest on the limestone, including *Scapania cuspiduligera* (as *Scapania Bartlingii*) with *Scapania aequiloba* by the Traligill, *Porella platyphylla* and *Radula lindenberiana* on Creag na Uamh and *Harpanthus flotovianus* in the upper part of Gleann Dubh. Nicholson also managed to find several montane species which have eluded this

survey in *Marsupella sphacelata*, *Marsupella alpina* (as *Gymnomitrium alpinum*) and *Marsupella adusta*.

Apart from these two very productive visits described by Nicholson, records in B.R.C. suggest few other visits before World War II. J.B. Duncan visited several times in his long bryological career but added little of interest in Assynt except *Grimmia orbicularis*, though further examination of his herbarium may reveal more useful records. E.C. Wallace visited in 1939 and several times later, recording *Hymenostylium insigne*, *Leucodon sciuroides*, *Antitrichia curtispindula* and new records for *Eurhynchium pumilum* by Inchnadamph and, in 1957, *Taxiphyllum wissgrillii* at Knockan, by far its most northerly site in Britain. In 1946, C.W. Muirhead, more noted as a vascular plant botanist, found *Campylopus shawii* by the Allt a' Bhathaich on Quinag and C.D. Pigott found *Rhytidium rugosum* on cliffs at Inchnadamph in 1950, remarkably the only record.

In 1951, Alan Crundwell made the first of several visits spanning over 40 years and added *Bazzania trilobata*, *Entosthodon attenuatus*, probably from An Coimhleum, *Metzgeria leptoneura* from Quinag and *Weisia controversa* from the limestone. In 1956, he also added *Kiaeria falcata* from Conival and, in 1959, *Trichocolea tomentella* from Elphin. E.F. Warburg visited Inchnadamph in 1952 recording *Gyrowesia tenuis* and *Thuidium philibertii* from the limestone. During the 1950s and 60s, D.A. Ratcliffe made his inevitable, interesting contributions to the records of the area with *Harpanthus flotovianus* from Beinn an Fhurain, *Hygrohypnum duriusculum* from the Allt nan Uamh in 1959, *Myurium hochstetteri* on Stoer in 1961 and *Campylopus setifolius* from Creag na h-Iolaire (Bealach Leireag) in 1966.

In 1960 the British Bryological Society (B.B.S.) summer field meeting was based in Ullapool and made three excursions to Assynt, all to the limestone (Crundwell 1961). At Knockan interesting species included *Reboulia hemisphaerica*, *Pseudoleskeella rupestris* (as *Pseudoleskeella catenulata* var. *acuminata*) and *Hypnum hamulosum*. Despite the attention it had already received, the Inchnadamph area provided a number of interesting new finds including *Weissia rutilans*, *Thuidium recognitum*, *Ulota calvescens*, *Rhynchostegiella teneriffae* (as *Rhynchostegiella teesdalei*) and *Porella cordeana*. Finally, the trip to the Allt nan Uamh and Creag nan Uamh yielded *Seligeria trifaria* (as *Seligeria tristicha*), *Encalypta alpina*, *Rhodobryum roseum*, *Schistidium trichodon* and *Anomobryum julaceum* var. *concinatum*.

In 1966 H.J.B. Birks made the first of his three visits (1966, 1967 and 1972) with H.H. Birks and J. Dransfield which, while contributing only a few new records, confirmed a number of the older rarities and visited areas away from the limestone, like Stoer. The new records made on these trips are *Meesia uliginosa*

from the Allt nan Uamh in 1966, *Aulacomnium turgidum* from Conival and *Sphenobolopsis pearsonii*, probably from An Coimhleum, in 1967 and *Harpanthus scutatus* by Loch Nedd in 1972. Also in 1966, S. Ward made the remarkable find of *Anastrophyllum saxicola* on Meallan Liath Mor and Paddy Coker found *Oncophorus virens* by the Traligill; neither species has been re-found.

Jean Paton made several new records during a visit in 1969 and provided a large number of records for more common species away from the limestone. Interesting liverworts recorded by her include new records for *Lophozia opacifolia* and *Haplomitrium hookeri* from Loch nan Cuaran and the only Assynt record for *Barbilophozia lycopodioides* from Inchnadamph. David

Long has made several visits, first in 1973 with David Chamberlain and again in 1981 and 1982. His were the first records of the interesting flora at Achmelvich including *Amblyodon dealbatus*, *Riccardia incurvata*, *Scapania cuspiduligera* and *Distichium inclinatum*. From the Inchnadamph area came records for the Red Data Book species *Dicranella grevilleana* and also *Hypnum lindbergii*, *Amphidium lapponicum* and *Mnium thomsonii*. In 1978 the two distinguished American bryologists W.B. Schofield and R.M. Schuster found *Barbilophozia kunzeana* in a mire above Creag Sròn Chrùbaidh and *Andreaea megistospora* on rocks near Unapool, the only West Sutherland records for these species. Finally, Ray Woods found *Weissia perssonii* out on the Stoer peninsula in 1985.

## PRESENT SURVEY

The survey work on the flora of the flowering plants and ferns was already well underway before there was any notion of a bryophyte add-on. The idea of attempting to include the bryophytes of Assynt in the planned flora grew out of the records made by the British Bryological Society field meeting in Lochinver in 1992 (Rothero 1993) and the preparations for that meeting. Over the next few years I made regular visits, usually during the winter months, based in Nedd but exploring much of the parish. Driven by the indefatigable enthusiasm of I.M.E., my natural indolence in recording was given a severe jolt and it became apparent that a useful body of records was being built up. Once the decision was made to include bryophytes in the flora, never a conscious one on my part (!), the frequency and duration of my visits to Assynt increased and a deliberate attempt was made to cover as much of the parish as was possible during the time-scale of the vascular flora project.

With such a large number of tetrads (164) and recording limited to, at best, two weeks per year over the last nine years, it is inevitable that most tetrads (99) were only visited once, and a number (48) were not visited at all. Of the 99 tetrads, some were rapidly surveyed en route to somewhere else and some have the merest handful of records. This must be borne in mind when reading the species accounts as well as when using the distribution maps. They are in no way comparable to those of the vascular plant flora as will be apparent if the description of that survey is examined. Even so, this body of records is unique in the Highlands at the moment, and, though more survey time and time to research various herbaria would have produced a more complete work, the opportunity to publish it, warts and all, along with the vascular plant flora, could not be missed.

There is a bias in the recording. The well-known bryophyte flora of the limestone areas did not receive the proportionate coverage it deserves; it has been reasonably well-covered by others. Most survey work took place outside of the summer months, so, despite my personal interest in the montane flora, there is scope for much more recording and interesting finds in the higher hills. With so much wild country to cover, very little attention was paid to the more 'anthropogenic' habitats provided by the settlements, the roadsides and what little cultivation there is. This is reflected in the paucity of records for a good number of ruderal species. I humbly admit to not being an aficionado of the genus *Sphagnum* and this is glaringly obvious in the species accounts.

Apart from the initial work by the B.B.S. in 1992, virtually all the records that are mapped are mine, the only exception being a number of interesting records from David Long, the earliest dating from 1973. Earlier records of species that were either not re-found during this survey or that are rare in Assynt are mentioned in the text but are not mapped. The Assynt bryophyte database used to produce the maps now holds some 13,600 records of 156 liverwort and 345 moss taxa. In addition to this there are some 14 liverworts and 20 mosses reliably recorded for Assynt which were not re-found on this survey. For the bryophytes there is no equivalent to *Anthony* so it is very difficult to be certain how many new species the survey added to the Assynt list but some 34 species recorded during the survey were new for West Sutherland as a whole.

### The future

As I hope I have made clear from the preamble, there is

considerable scope for more bryophyte recording in Assynt. There are large gaps in the maps that it would be satisfying to fill. The limestone certainly has more interesting species to be found, with many of the smaller crags and burns having had few if any visits. More attention to the mire areas by someone with more

expertise in *Sphagnum* and an enthusiasm for *Cephalozia* species would be worthwhile, and there must be more than one site for *Campylopus shawii*. The higher hills have had only cursory attention and offer the possibility of good plants in spectacular scenery. And then there is the rest of Sutherland.

## PLAN OF SPECIES ACCOUNT

The bryophyte accounts are in systematic order beginning with the liverworts. This order and the taxonomy follows the most recent bryophyte *Census Catalogue* published by the British Bryological Society (Blockeel and Long 1998). There have been numerous changes in moss nomenclature since the publication of the standard British moss flora (Smith 1978) and, where appropriate, I have included a synonym. We are fortunate in having an excellent new British liverwort flora (Paton 1999) which should be consulted for the liverwort taxonomy and for much fuller accounts of the species. Those tetrads which were not visited are

marked 'X'; in one or two cases there may be an odd record from one of these tetrads so there may be a dot superimposed on the 'X'.

\*The following species was inadvertently omitted from p.236 of the Species Account:

*Bryum riparium* I.Hagen

Recorded, as *B. mildeanum*, from both Quinag and Conival by Dixon and Nicholson in 1899 (Whitehouse 1963).