

Opportunity to explore rare habitats, together with an individual's psychological attributes, practical strategies for searching, and willingness to collect material all influence whether a bryologist is likely to find and identify uncommon mosses and liverworts, as **Mark Lawley** discusses.

Rare habitats

By and large, rare species are rare because their favoured haunts are rare. For naturalists interested in mosses and liverworts, calcareous rock in the mountains, base-rich fen, oceanic ravines, flood-zones of unpolluted rivers and the splash and draw-down zones of lakes and reservoirs are particularly rewarding habitats to search. Sites that are unusually rich in metals such as copper, zinc or lead are also rare, and sometimes support uncommon bryophytes.

Calcareous rock is much less widespread than acidic rock in Britain and Ireland, and bryologists always take interest when they come across lime-loving species such as *Ctenidium molluscum* or *Tortella tortuosa* on rock, or *Ctenidium molluscum* and *Campylium stellatum* on wet soil because other, rarer species may be nearby. Montane limestone is particularly rare in Britain, and high altitude ensures a combination of wind, extended periods of high humidity and moisture, lack of shade in most places, as well as an unusual array of minerals and nutrients available to plants. Base-rich fens are also rare,

► A wooded ravine, Kaimies River, Loch Awe, Ross-shire.
Gordon Rothero

The psychology of discovery: finding and recognizing uncommon bryophytes

many of those in the British lowlands having been drained. Bryophytes in ravines near the Atlantic seaboard benefit from high rainfall and humidity; such conditions particularly favour liverworts (but also numerous mosses) that cannot withstand desiccation.

And plants growing in the flood zones of unpolluted rivers have to withstand a most unusual combination of conditions, for while they benefit from flowing water that brings nutrients from upstream and washes away metabolic wastes, they also have to tolerate erosion of the ground and the effect of moving particles abrading stems and leaves, as well as periods of desiccation. Mosses and liverworts growing in the splash and draw-down zones of lakes and reservoirs also have to withstand an unusual combination of wetting, drying and enrichment by minerals and other nutrients.

As bryologists gain experience, they get better at recognizing places that are likely to harbour uncommon species. This will, of course, improve their likelihood of finding them.

Psychological attributes

Once a naturalist has arrived at a rare habitat, his chances of finding and recognizing rare species depend upon his ability to recognize and discern forms that differ – however subtly that may be – from other similar, commoner species. This psychology of identification – or why some people make better naturalists than others – is a taboo subject. We are encouraged to adopt the orthodox mantra that everyone is equally able, and to pretend that it is therefore mere chance that a particular person happened to find a rare species. But nothing could be further from the truth. We are not all equal. Some are more equal than others.

Yet why do the 'more equal' make better naturalists than others? The first reason is superior

ability to concentrate on what they see before them. We can all gaze at what surrounds us as we stroll along, but that is not enough. In order to recognize and identify uncommon species we must look hard at, think about, and name every organism that we encounter. Not everyone is able and prepared to make that effort.

Naturalists identify species according to the differences between them, which encourages them to overlook variation within species, and misidentify organisms that look different as a species with which we are already familiar (Lawley, 2009). Some naturalists therefore not only pretend that all the individuals of a species look alike, but paradoxically that different forms can also be classified as a species with which they are already familiar.

‘... Just as little do we see a tree exactly and entire with regard to its leaves, branches, colour, shape; it is so much easier for us to put together an approximation of a tree.’ (Nietzsche, 1886).

Even when we encounter a different, unusual species we still fabricate the greater part of what we see, and often fail to recognize it as different, imagining that we have seen another, commoner species that we are accustomed to finding. Indeed, identification guides encourage us to do this, for they do not include species which have not previously been found or described, or are known only from far distant countries. A naturalist therefore tends to identify an unfamiliar organism as belonging to whichever species is the best approximation in the book. Good naturalists, however, are forever prepared to recognize a difference and consider the possibility that it may signify a rare species, alive to the possibility that they have found something with which they are unfamiliar. Wordsworth (1807) reflected on this problem of the mind and eye staying forever young when he wrote

Ode: Intimations to Immortality:

There was a time when meadow, grove and stream,
The earth, and every common sight,
To me did seem
Apparelled in celestial light,
The glory and the freshness of a dream.
It is not now as it hath been of yore; -
Turn wheresoe'er I may,
By night or day,
The things which I have seen I now can see
no more.
... Though the radiance which was once so bright
Be now for ever taken from my sight,
Though nothing can bring back the hour
Of splendour in the grass, of glory in the flower ...

Why, for example, was the Reverend John Fergusson (1834–1907) able to recognize great rarities so soon after taking up bryology? He apparently took up the study of mosses in 1866, and in 1868 discovered *Anomodon attenuatus*, *Cynodontium fallax* and *Grimmia elatior* (all three mosses being very rare and new to Britain) in Angus (Forfarshire). Nor was this mere beginner's luck visited three times over in quick succession on the same soul, for he also found *Mielichhoferia elongata* in Angus in about 1870, *Grimmia ungeri* and *G. montana* (as *G. alpestris*) near Ballater, South Aberdeenshire in 1870 and 1872 respectively, *Grimmia* cf. *austrofunalis* in 1872, *Andreaea frigida* on Ben Macdhui in the Cairngorms in 1873, and apparently collected *A. crassinervia* in 1890 near Loch Dubh, Lochnagar, south Aberdeenshire. The voucher for *A. crassinervia* is at New York, but the provenance of Fergusson's specimen is doubted. He may also have been the person who found the exceedingly rare *Encalypta brevicollis* in Angus in 1871. In

addition, Fergusson found *Hygrohypnum molle* on Lochnagar, and *Eurhynchium pulchellum* at an unspecified locality in Scotland. Of liverworts he added *Cephalozia pleniceps*, *Fossombronina wondraczekii*, *Harpanthus flotovianus*, *Jame-soniella autumnalis*, *Jungermannia atrovirens*, *J. polaris* and *Marsupella sprucei* to Scotland's known bryoflora (Lawley, 2008). Fergusson therefore merits recognition as one of Britain's most outstanding bryologists, but has attracted very little attention from botanical historians. And even if he had, we still might not know what made him so outstandingly accomplished at finding and recognizing rarities.

The cultural circumstances in which an individual is reared and lives in his early years profoundly influence what he notices and how he interprets images during the rest of his life. Thus, people who grew up blindly accepting authority and the contemporary cultural status quo are less likely to question what they read in manuals of identification and hence less likely to recognize species that are not described in those manuals. Conversely, naturalists who are prepared to think ‘No, these descriptions do not fit this species that I have found, so it must be something different’ are more likely to find new species.

A naturalist may also sometimes develop a skill superior to his contemporaries for finding a particular species. Harold Whitehouse, for example, several times found the rare *Bryum mildeanum*, but no one seems to have recorded *B. mildeanum* for some years. Latterday bryologists have either lost or not acquired Whitehouse's ability to recognize this species, and are therefore likely to regard *B. mildeanum* not only as rare, but also decreasing. Yet is it, or should we rather acknowledge that Dr Whitehouse's ability to recognize it was rare? Again, species such as *Weissia rostellata* and *W. squarrosa* ‘declined’ when bryologists stopped examining arable fields, but

‘increased’ again during the survey of arable bryophytes between 2001 and 2005. *Pylaisia polyantha* is another species that is regarded as having ‘declined’, but might it perhaps instead have been that bryologists have lately lost or not

▼ *Grimmia elatior* (top) and *Harpanthus flotovianus* (bottom). Michael Lüth



acquired the knack of realizing which particular habitat it favours?

From my own experience, I wonder how best to interpret the current distributional status of *Tortula amplexa*. Having found it in 2007, I was thereafter 'primed' with its image in the fore of my mind, which doubtless enabled me to recognize it at another site in 2008. But this does not constitute evidence that *T. amplexa* is increasing. It may be increasing, but alternatively (or additionally) it may be that the number of bryologists who recognize it in the field has increased by one.

Practical ways to increase the likelihood of finding uncommon species

Apart from and in addition to the naturalist's individual psychological bent, naming (or trying to name) everything a bryologist encounters also requires him to move very slowly, in order that he may examine minutely and not miss anything. Nevertheless, in order to make best use of the time available on an excursion, we must move on to somewhere that we recognize as environmentally different when nothing different is coming to notice.

In 2009, the National Trust commissioned a survey of bryophytes in selected flushes on Shropshire's Long Mynd. This provided an opportunity to very closely examine numerous flushes, as a result of which the small liverworts *Barbilophozia kunzeana*, *Cephalozia pleniceps*, *Jamesoniella undulifolia* and *Scapania paludicola* came to notice. None of these species had previously been recorded from the Mynd, even though numerous expert bryologists had explored this ground, which (even before the survey of 2009) was the most thoroughly examined in Shropshire. Furthermore, despite the very close examination of selected flushes in 2009, I am certain that plenty more remains to



▲ *Scapania paludicola*. Michael Lüth

be found, for what one person misses, others with different search images and strategies will surely notice. It would therefore make a fascinating bryological experiment if several accomplished bryologists were to assiduously quarter these and other flushes on the Long Mynd. I am willing to bet that numerous additional uncommon bryophytes would be found on the Mynd for the first time. This would substantiate the vagaries and individual idiosyncrasies of searching in the field and show that different naturalists may notice what others fail to find.

At the opposite end of the spectrum from thoroughly searched sites, many districts of the British mainland remain badly under-recorded by bryologists, even though Britain is one of the most thoroughly explored places on the planet. This is because naturalists are as ovine in their mental make-up as any other sector of society, and instinctively make beelines for districts and sites that are already renowned for their uncommon species. Yet the rewards can be startlingly good when – as occasionally happens – an independent soul decides not to join the queue, but instead veers off the beaten bryological track.

This happened, for example, at the BBS's Summer Meetings in 2004. The first week was spent on Rum, when some of the Society's best field bryologists assembled to scour the island, finding many uncommon species, numerous of which were first records for Rum. The second week, however, saw a very much smaller band of bryologists in the little-heralded (and hitherto hardly explored) vice-county of North Aberdeenshire, previously described as part of 'the worst-recorded area on the mainland of Great Britain' (Hill *et al.*, 1991), and certainly devoid of the spectacularly alluring scenery and habitats so prevalent on Rum. During the week-long meeting in North Aberdeenshire, nearly 100 new vice-comital vouchers were collected (and if as many accomplished bryologists had attended as went to Rum, this number would surely have been far higher), including the second record of *Lophozia herzogiana* from Britain and the entire northern hemisphere (and indeed only the third from anywhere). Discoveries during the week also included significant extensions of range for the oceanic species *Glyphomitrium daviesii* and the southern *Epipterygium tozeri*. Few if any of the rarities seen the previous week on Rum matched the unexpectedness of these discoveries in North Aberdeenshire. So if you wish to find uncommon species in new places, 'never join a queue', but with an open mind go into the countryside and search where others have not thought to look.

Collecting, collecting, collecting

The bryologist who finds and identifies rare species will also very probably collect a great deal of material. If one cannot name something in the field, take a gathering home to identify with the aid of the microscope. Don't just walk away from it in the field, and pretend you haven't noticed it.

Moreover, it is very easy to overlook

differences and misidentify species in the field. Identities often become more apparent when bryophytes are examined microscopically, and most bryologists have probably experienced the surprise of only noticing a species in a gathering once they are examining their material at home under the microscope, with optimal light and magnification. One is reminded of Cuvier's (1807) comment in the same year that Wordsworth published *Intimations to Immortality*, that the indoor naturalist is able to examine the products of nature at his leisure ... [and] 'it is really only in his room that [the naturalist] can roam freely through nature'.

And to accurately determine with final certainty the identity of an uncommon species, the naturalist must be calm and reason logically when tracking through couplets in keys, reading descriptions of species, and considering alternative possible determinations. For my part, I freely confess that my identifications tend to be impetuous and my conclusions impulsive, rather than considered and reflective. So I will now defer to other bryologists, in the hope that they will take up the thread of this discussion.

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Further reading

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