

# BAP surveillance in Scotland

What is the status of Scotland's BAP species? **Nick Hodgetts, Gordon Rothero & Dave Genney** discuss their efforts and methodologies as part of a surveillance programme by Scottish Natural Heritage

One of the mechanisms for species conservation in the UK is the Biodiversity Action Plan (BAP). The current list of BAP species was drawn up in 2009 and naturally includes many species that occur in Scotland. Some of these are relatively well-known – *Herbertus borealis*, for example, now reinstated as a good species (Bell *et al.*, 2012; Bell & Long, 2012), is fairly well-known at its one site in the Beinn Eighe National Nature Reserve, where monitoring has been in place for some years. However, there is a substantial subset of Scottish BAP species about which we knew very little when they first appeared on the list. Therefore, Scottish Natural Heritage (SNH) decided to put a programme of surveillance in place to tackle this problem. Species were prioritised according to their perceived decline in Scotland, whether they are both rare/endemic and threatened in Scotland, and whether Scotland holds more than 75% of the UK population. This project has now been running since 2010, with Gordon Rothero and Nick Hodgetts being responsible for all the fieldwork under the direction of Dave Genney, the SNH cryptogam adviser. In addition, several species in Scotland have been targeted by other bryologists, either for professional or amateur

△ *Acrobolbus wilsonii*. Nick Hodgetts

reasons.

Our approach has been to collate existing records, to target fieldwork where it is likely to yield most results, and to produce a 'surveillance dossier' giving all the available information on each species. The dossiers are dynamic documents, published on the SNH website, and updated as and when new data become available. They provide: 1) general information about the species, including a description; sections on ecology, distribution in Scotland (including a full list of sites), the UK and the world; threats; management and *ex situ* conservation; 2) a full literature list and details of the surveillance methodology, which is tailored to each species/natural group of species; 3) conservation assessments, both site-specific and overall assessment for the given species in Scotland; 4) detailed information about the species at each site where it has been recorded. Surveillance efforts attempt to convey information about the size and condition of populations of rare species as well as bare presence/absence data. Negative records are also incorporated into the dossiers.

The main goal of all this effort is to establish the status of Scotland's BAP species and devise

reproducible methodologies for surveillance, so that future workers can use the dossiers to return to known sites as well as explore potential new sites, and so establish the performance of each species. The principles of surveillance are somewhat different from those of simple recording: 1) surveillance is highly targeted; 2) once the target species is found, it is then necessary to record a large amount of detailed information including: extent, abundance, substrate, associates, threats and potential threats. The exact methodology depends on the ecology of the species. Methods can range from a quick 'look-see', recording along transects, to detailed recording of stands within a fixed area. Recording from the same site more than once and exploring new places are both useful.

The BAP species in Scotland are quite a mixed bunch. At one end of the spectrum we have *Bryum schleicheri*, a species with a single known extant site in the UK, which has been well-known and nurtured carefully since the 1980s. In this case, a species dossier scarcely seems necessary at first, yet it is still useful as it draws together all the work on this species over the years. One can see more or less at a glance the history of the plant, both at its extant site and the sites from which it has apparently disappeared; the efforts to perpetuate the plant *in situ*; the collection of a specimen for *ex situ* conservation; and whether it is worthwhile looking at any of its old sites, or indeed completely different sites, to try to find new populations. For *B. schleicheri*, the conclusion appears to be that it is heading for oblivion, and can be sustained in the wild only by a programme of gardening to keep the coarse vegetation from encroaching on its flush. The issue is whether we should continue to do this, or simply let it go. Encouragingly, recent 'gardening' has had good results, so we're not



△ Maren Flagmeier and Philippa Revill inspect a *Marsupella arctica* site. G. Rothero

giving up just yet!

*Acrobolbus wilsonii* is a completely different case. It is currently known from 32 localities in the western Highlands and islands, with a further five localities with old records. While relatively frequent in Scotland, it is a globally rare taxon, with only a smattering of records in Ireland, the Faroe Islands and Macaronesia, and possibly (if it is indeed the same species) from central and southern America. *Acrobolbus* usually grows in small quantity and seems to be fairly restricted to certain hyperoceanic places, yet new colonies still occasionally turn up. The most important action for this species is to keep an eye on the best populations. The BAP surveillance project has also been trying to find new populations in likely-looking areas, so far without success. Serendipitously, another project run by SNH, to examine all the burns in the Sunart Special Area of Conservation, has revealed more *Acrobolbus* sites.

An even rarer plant, *Lejeunea mandonii*, is currently known from only three localities in Scotland. As well as monitoring these, the project has a programme of investigating other sites where it might occur. It was observed that *L. mandonii* always occurs in base-rich, hyperoceanic places, characteristically associated with *Harpalejeunea molleri*, *Neckera complanata*, *Plagiochila exigua* and *Radula voluta*. Using coincidence mapping

▽ Example of a change table in a species dossier: a summary of the conservation status of *Sphagnum balticum* in Scotland. Red = negative trend, green = positive trend or no change, grey = unknown trend.

Attribute	Trend	Detail
Range	↘	One site in E. Inverness-shire, the other in S. Aberdeenshire; former site in Dumfriesshire 1960-1994: Decline from 2 to 1 site
	↔	1996-2007: No change (but new site discovered)
	?	2008-2010: Unknown (Loch Muick site not surveyed in period)
Population	?	Total of ca. 110 patches & ca. 4300 stems at one site; 'very rare' at second site; disappeared from third site. 1960-2000: Unknown
	↔	2001-2010: No change to main population
Habitat quality	↘	Good at the two extant sites; another site destroyed due to afforestation. 1960-1994: Decline due to afforestation
	↔	1996-2010: No change
Site protection		No extant sites within a SSSI. Main population adjacent to SSSI but within an NNR. Secondary population included in an SPA. Both sites in Cairngorms National Park.
Threats		Afforestation, disruption to hydrology, peat haggling, invasive alien species, climate change, nitrogen deposition
Overall assessment		Endangered (GB status); rare and threatened in Scotland; one current populations fairly large, protected and apparently ± stable, the other small and in unknown condition

from the Biological Records Centre, a list of sites was produced where at least three of these four species occur, and a subset of these was targeted for survey in an attempt to find new sites for *L. mandonii* – no luck yet though! It is probably more likely that any 'new' stands will be found more or less by chance during other bryological work. Ash die-back is of course a potentially disastrous disease for *L. mandonii*, as all the Scottish colonies grow on this tree.

A key element of BAP surveillance is repeatability and standardising effort, so that surveillance can take place using the same methodology each time. The known *L. mandonii* localities in Scotland are all on ash trees next to burns in ravines. The methodology for surveillance of the known populations is to 1) record populations using fixed point photography; 2) estimate abundance; 3) record associates; 4) note

the condition of the population, and any actual or potential threats in the vicinity. On the other hand, the methodology for searching for new populations is to pick a fixed point along a likely-looking burn and then to spend an hour each exploring upstream and downstream searching for *L. mandonii*, targeting especially ash trees and likely-looking rock outcrops, but also other potentially suitable trees such as hazel and elm; birch and oak are disregarded.

A similar methodology has been used for *Habrodon perpusillus*. The centre of its distribution in Scotland is Killin in Perthshire. Populations are occasionally recorded outwith this area but appear to be transient, with older records not being refound and new ones cropping up occasionally. Therefore the decision was taken, for BAP surveillance purposes, to concentrate on the core population at Killin,





△Above left: *Andreaea nivalis*. G. Rothero; △Above right: *Timmia austriaca* at Meall Corraniach. G. Rothero

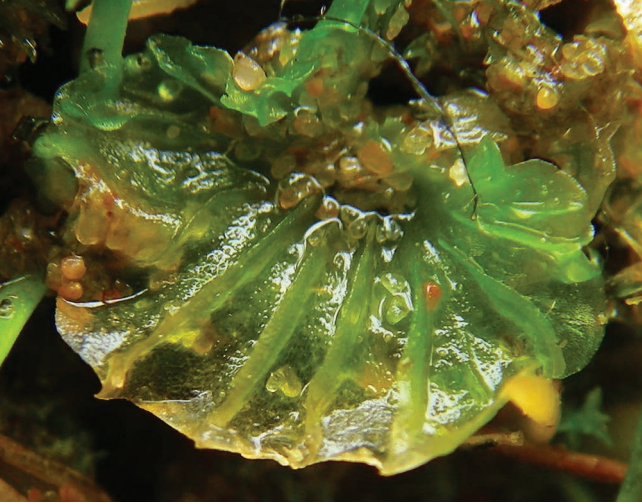
where it grows conveniently on well-illuminated roadside trees. As with *L. mandonii*, a central point in the vicinity of known stands of *Habrodon* was chosen, and an hour spent walking in each direction along the road from the central point, recording trees en route, concentrating on ash, sycamore, willow and field maple, while oak, alder and birch were ignored. Results showed that *Habrodon* is present but rare in Glen Lyon, but really quite abundant in the village of Killin itself, with at least dozens of colonies present, and apparently actively colonising new trees. Since the survey covered only roadside trees, one wonders how many more populations may occur in nearby fields and gardens.

Another 'success' has been *Adelanthus lindenbergianus*. Known for some years at a single site on Islay, the BAP surveillance strategy of looking at ecologically similar spots elsewhere has already yielded a new site for this species on Jura.

Some taxa can be treated together. For example, the sand-dune *Bryums* form a natural group, albeit a notoriously difficult one, with identification often possible only after microscopic examination. All one can really do is to check on the quality of the habitat, and establish presence or absence of each species periodically. There is indeed a problem with species that cannot be identified with confidence in the field and therefore would require an unacceptable level of collecting if

'normal' monitoring methods are to be used. We have to be pragmatic about these species and acknowledge that there is only so much one can do. *Sphagnum balticum* is not only rather tricky in the field, but also grows in places so fragile and so easily damaged by bryologists tramping around that anything more than very infrequent sampling would be counter-productive. In this case, it is probably best simply to monitor the overall quality of the site on a regular basis, with more targeted work restricted to every decade or so.

The project has raised some interesting questions too. What about *Mielichhoferia mielichhoferiana*? This moss is apparently known from two sites in the Highlands, but is it actually there or does its supposed presence derive from the historical confusion surrounding the taxonomy of this species and *M. elongata*? Preliminary work suggests that we may have only a single species of *Mielichhoferia* in Scotland – *M. elongata*, but fieldwork and examination of herbarium specimens is continuing. We suspect that both species of *Mielichhoferia* should really be on the BAP list but *M. elongata* 'got lost' when the taxonomy changed. There are other mysteries too. Is Scottish *Pohlia obtusifolia* really a good species or merely a wide-leaved form of *P. nutans*? Does *Grimmia sessitana* still occur in Scotland? Did it ever? Has *Timmia austriaca* really declined or have some old records been based on misidentified *T. norvegica*? What is



△Above: *Petalophyllum ralfsii*. D. Genney

really happening with *Splachnum vasculosum*? And who knows anything at all about *Tayloria tenuis* or *Aplodon wormskioldii*?

We hope it is clear that there is still a lot to do on Scottish BAP species, and we would encourage all BBS members to look out for these species and submit records whenever they find them, certainly to BRC but also to one of us, so that a better, more complete picture of what is happening to some of these rare plants can be

collated and used by future generations for their conservation. And, if possible, please include some extra information in the record too. How big is the population? How long did you spend looking? What area did you cover? There will always be a huge variation between recorders, but we can try to standardise as much as possible.

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### References

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- Bell, D., Long, D.G., Forrest, A.D., Hollingsworth, M.L., Blom, H.H. & Hollingsworth, P.P. (2012)** DNA barcoding of European *Herbertus* (Marchantiopsida, Herbertaceae) and the discovery and description of a new species. *Molecular Ecology Resources* **12**: 36-47.

### Appendix: list of Scottish

#### BAP species:

*Acrobolbus wilsonii*  
*Adelanthus lindenbergianus*  
*Anastrophyllum joergensenii*  
*Andreaea nivalis*  
*Anomodon longifolius*  
*Aplodon wormskioldii*  
*Barbilophozia kunzeana*  
*Bryoerythrophyllum caledonicum*  
*Bryum calophyllum*  
*Bryum cyclophyllum*  
*Bryum knowltonii*  
*Bryum marratii*  
*Bryum salinum*  
*Bryum schleicheri*  
*Bryum warneum*  
*Buxbaumia viridis*  
*Cyclodictyon laetevirens*  
*Daltonia splachnoides*

*Dicranum spurium*  
*Dicranum undulatum*  
*Ditrichum plumbicola*  
*Dumortiera hirsuta*  
*Entosthodon pulchellus*  
*Eurhynchiastrum pulchellum*  
*Fossombronia foveolata*  
*Grimmia elongata*  
*Grimmia sessitana*  
*Habrodon perpusillus*  
*Hamatocaulis vernicosus*  
*Herbertus borealis*  
*Homomallium incurvatum*  
*Hygrohypnum styriacum*  
*Jamesoniella undulifolia*  
*Leiocolea rutbeana*  
*Lejeunea holtii*  
*Lejeunea mandonii*  
*Lioclaena lanceolata*

*Marsupella arctica*  
*Mielichhoferia mielichhoferiana*  
*Orthodontium gracile*  
*Orthotrichum gymnostomum*  
*Orthotrichum obtusifolium*  
*Orthotrichum pumilum*  
*Pallavicinia lyellii*  
*Petalophyllum ralfsii*  
*Plagiobryum demissum*  
*Pohlia obtusifolia*  
*Pohlia scotica*  
*Pseudoleskea incurvata*  
*Radula carringtonii*  
*Riccia canaliculata*  
*Sphagnum balticum*  
*Splachnum vasculosum*  
*Tayloria lingulata*  
*Tayloria tenuis*  
*Timmia austriaca*