



# Five things that could be done when surveying bryophyte populations of conservation concern

**Des Callaghan** makes some recommendations arising from his recent red-listing work

**S**urveys to assess the status of bryophyte species of conservation concern are undertaken regularly in Britain. For the forthcoming IUCN Red List of bryophytes in Britain, I reviewed a large number of the associated reports,

△ Figure 1. Location of *Dumortiera hirsuta* at Groudle Glen, Isle of Man, 2022. *Des Callaghan*

each completed at some point over the past 30 years, and which together covered a broad range of species, distributed throughout England, Scotland and Wales. I obtained from them a

great deal of useful information and learnt how different surveyors have tended to develop their own style of survey methodology. Whilst I am not in favour of detailed prescriptions of how surveys should be done, I think it would be useful if five things were done consistently by surveyors and to a similar standard, along with whatever else is considered necessary for a specific survey. Some of these things are already done regularly, but few surveys include all of them.

I believe that if future surveys did these five things, then the value of surveys would be enhanced, for example, by facilitating the comparison of results across time, across sites, across species and across surveyors. It would also improve the usefulness of surveys for future Red List assessments, allowing more accurate assessments to be completed and, ultimately, more informed conservation planning. The five things are concerned only with what a surveyor could do when undertaking fieldwork and when presenting the results in the associated report. Other matters, such as the archiving of reports and access to them, are beyond the scope of this article.

### The five things

**1. Record the survey route.** The survey route should be recorded via GPS. I use a standalone Garmin GPSMAP 64s hand-held unit, which is rugged and water-resistant, and a pair of Panasonic Eneloop Pro rechargeable batteries provide sufficient charge for two days of fieldwork, with the GPS continually logging the survey route. I understand that a smartphone with a suitable GPS app could also be used, but I have no experience with using these to record survey routes. At the end of the survey, the file of the survey route should be transferred from the device onto a computer and with GIS software overlain on a suitable basemap (see below).

**2. Record coordinates of target species.** When a colony of a target species is found, its location coordinates should be recorded via GPS, using either a standalone GPS or a smartphone app, ensuring that the GPS accuracy is reasonably good (<15 m) before recording the coordinates. In open habitat in Britain, GPS accuracy on my Garmin unit is usually <5 m and in habitat with a cluttered sky, such as in woodland or ravines, it is usually <10 m. To save time, coordinates of further colonies can be ignored if they are within 10 m of a previously logged location, but coordinates of all colonies that are more than 10 m from any previously logged colony should be recorded. I do this by logging a waypoint on the GPS unit and noting the associated species on a dictaphone (Olympus S926).

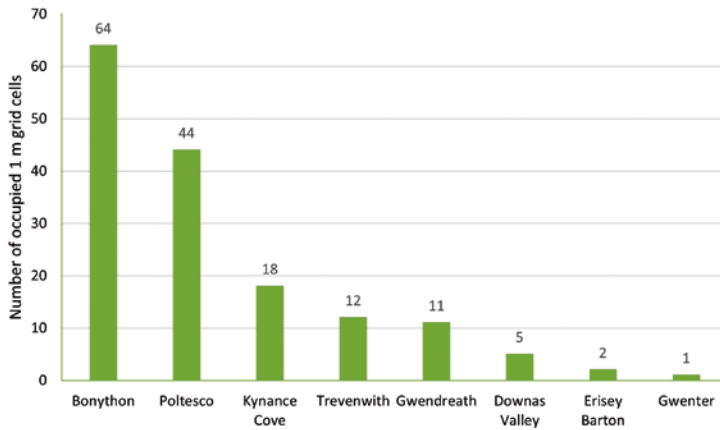
**3. Photograph locations of target species.** For particularly notable species, in addition to GPS coordinates, the location of colonies should be indicated with temporary markers

▽ Figure 2. Location of *Grimmia arenaria* at Dolgledr, Merionethshire, 2022. *Des Callaghan*





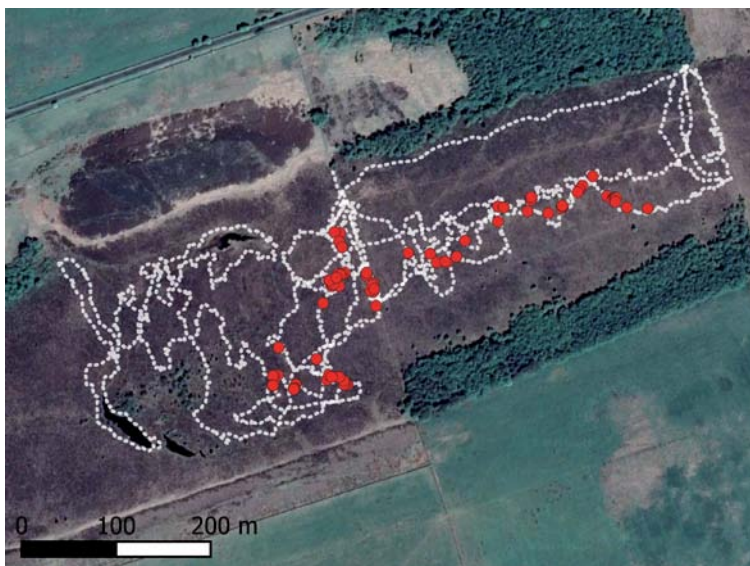
## Five things that could be done when surveying bryophyte populations of conservation concern



◁ Figure 3. Counts of individual-equivalents (occupied 1 m grid cells) of *Lejeunea mandonii* at sites on The Lizard, West Cornwall, 2021–2022.

and the location photographed, making sure the photograph includes a broad view of the habitat to aid finding the location in future. Markers should be removed after taking the photograph, and the photograph should be annotated subsequently to make it clear where the species is located. If a site contains frequent colonies of a species, only a representative set of colonies usually needs to be recorded in this manner. Figs 1 and 2 provide examples.

**4. Count individual-equivalents.** Recording abundance of bryophytes quickly and consistently has caused a lot of trouble for surveyors. Fortunately, the concept of ‘individual-equivalents’ has emerged (Bergamini *et al.*, 2019), becoming an important quantity used in IUCN Red List assessments and providing a useful standard for bryophyte surveying. In most cases, it is easiest to define an individual-equivalent as an occupied 1 m grid



◁ Figure 4. Survey route and locations of individual-equivalents (occupied 1 m grid cells) of *Sphagnum balticum* at Muckle Moss, South Northumberland, 2021. Satellite image © Google, DigitalGlobe.

▷ Figure 5. Survey route and locations of individual-equivalents (occupied 1 m grid cells) of *Timmia megapolitana* at Wheatfen Broad, East Norfolk, 2021. Satellite image © Google, DigitalGlobe.

cell, but for epiphytes an occupied tree is usually more suitable. Often, it is simplest to log a single GPS waypoint for each individual-equivalent found. If all suitable habitat for a species is not covered during a survey, in addition to a count of the number of individual-equivalents found, a population estimate for the whole site should be provided in survey reports. This only needs to be a rough estimate and can indicate a broad range (e.g. 50–250 individual-equivalents), based on the surveyor's best judgement, but can involve a more complex calculation if time and data allow, for example by extrapolating from measured population densities. If multiple sites are included within a survey, a graph of the counts of individual-equivalents can be helpful to visualise the relative importance of each site (Fig. 3). Surveyors may sometimes wish to also measure abundance at a finer resolution than individual-equivalents, such as counts of occupied 10 cm grid cells, thalli or cushions, but this is a matter that is best decided for individual surveys, taking into account the time available for fieldwork, the growth-form of the species and its frequency of occurrence.

**5. Map results.** The survey route and the locations found of target species should be mapped clearly. This is most easily done by using GIS software. I use the free QGIS software ([www.qgis.org](http://www.qgis.org)) coupled with its free FSC plugin ([www.fscbiodiversity.uk/fsc-plugin-qgis-v3](http://www.fscbiodiversity.uk/fsc-plugin-qgis-v3)), most often with Google Satellite as a basemap. Tutorials on the use of QGIS and the FSC plugin are available on YouTube. Figs 4 and 5 provide examples.



### Acknowledgements

Many thanks to Sam Bosanquet (NRW), Jonathan Cox (Natural England) and Dave Genney (NatureScot) for their comments on a draft of this article.

### Reference

**Bergamini, A., Bisang, I., Hodgetts, N., Lockhart, N., van Rooy, J. & Hallingbäck, T. (2019).** Recommendations for the use of critical terms when applying IUCN red-listing criteria to bryophytes. *Lindbergia* 42: 1–5.

### Des Callaghan

e [des.callaghan@outlook.com](mailto:des.callaghan@outlook.com)