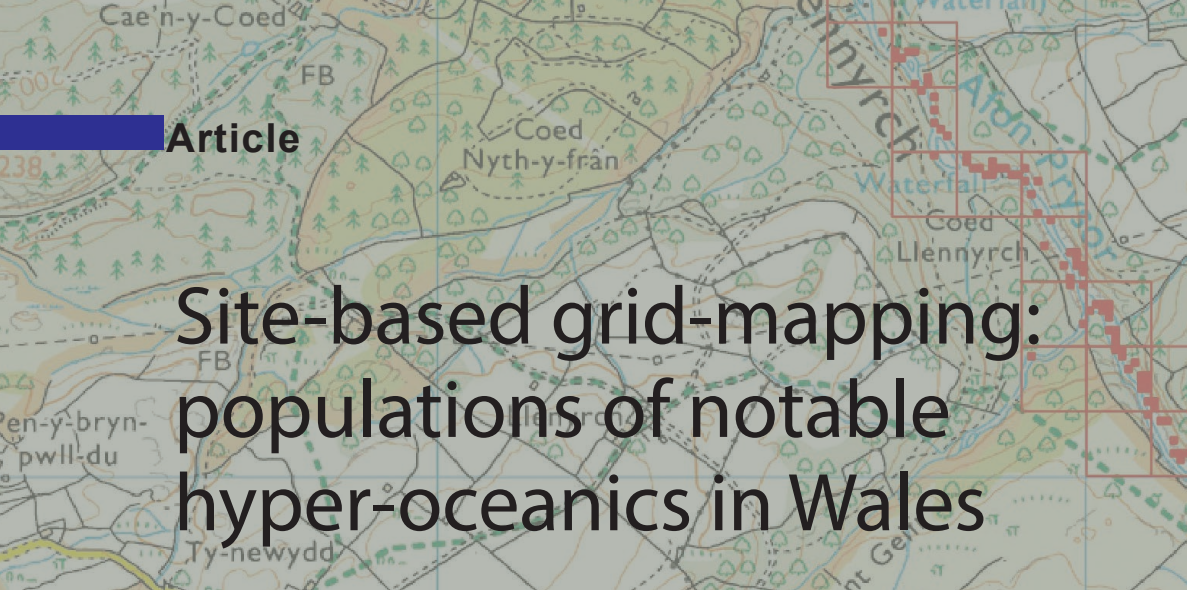


Article

Site-based grid-mapping: populations of notable hyper-oceanics in Wales

Des Callaghan presents results from a developing method for surveying and monitoring bryophytes, with a focus on hyper-oceanics in Wales

Introduction

In an attempt to document the distribution and abundance of important bryophyte species at sites, I first began grid-mapping populations in 2011 on the old tin mines of Cornwall. The method borrows from the technique we use commonly for the production of atlases, such as Blockeel *et al.* (2014), applying it at a finer resolution to suit the size of the survey sites. The initial results seemed useful and I subsequently wrote an article on the approach for *British Wildlife* (Callaghan, 2013), which generated some interest from folks involved with the monitoring of butterflies, dragonflies, flowering plants and other groups. Today, I use grid-mapping during most of the surveys I undertake, coupled with other methods. I have convinced myself that it is worth doing and some illuminating results have arisen. One of the more interesting outcomes is a measure of the size of a population within a site, given by the count of the number of grid cells occupied. A benefit of this metric is that it is a relatively standard measure across species, across sites and across time. As far as I know, similar population information has not before been available for bryophytes at the scale of sites and so the purpose of this article is to illustrate some of the results, and some of the questions that arise.

Method

A typical bryophyte survey of a site involves searching accessible areas, compiling an inventory of species detected and collecting GPS locations for the most notable finds. Grid-mapping is just a small extension of this procedure. The only extra work done is that ALL locations found for target species are logged as waypoints with a GPS unit (I use a Garmin GPSMAP 62s receiving data from the EGNOS satellites, which provides a positional accuracy of about 4 m in open terrain and about 10 m when the sky is substantially obscured). In many cases this is not much extra work, especially if a dictaphone is used to note which species is located at each waypoint, though for rich sites it can become time-consuming. The subsequent deskwork requires loading the waypoints into QGIS (freely available GIS software) and with the use of its free 'Tom.bio Biological Recording' plugin, grid-maps of species are easily produced. The result for a particular species is a map of the site with its occupancy indicated in OS grid cells (I tend to use 10 x 10 m and 100 x 100 m grid cell sizes). I also log my survey trail with the GPS and show this on the maps produced so that it is clear where I ventured and, importantly, where I did not.

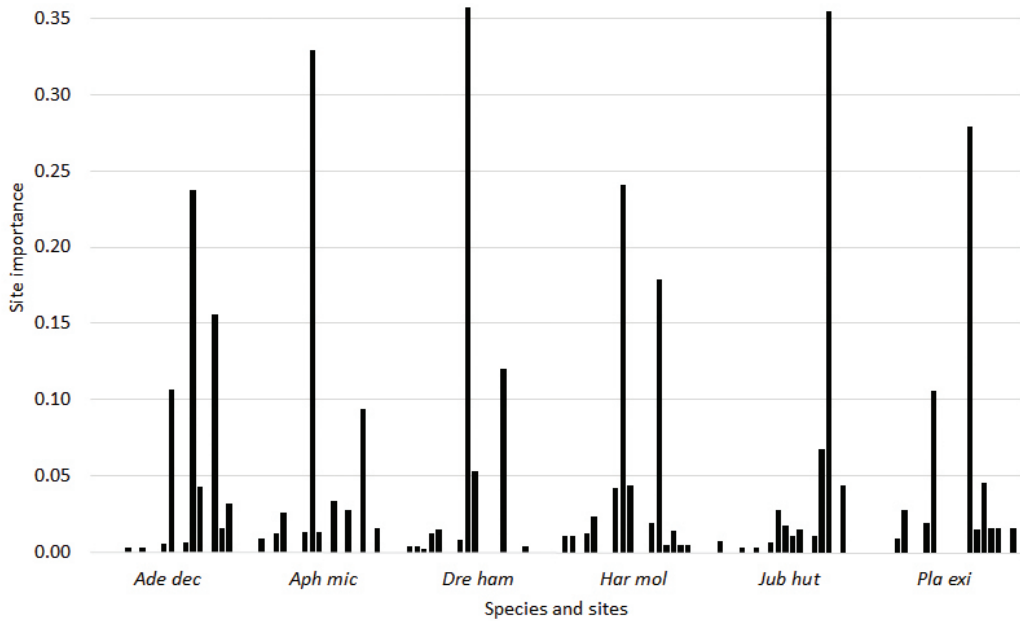
The detail with which a bryophyte survey of

Table 1. Counts of the number of OS 10 x 10 m grid cells occupied by notable hyper-oceanic bryophytes at sites surveyed in Wales

Site	Grid reference	Survey days[1]	Species[2]														
			Ade dec	Aph mic	Cam set	Col cal	Dic sco	Dre ham	Har mol	Jub hut	Lep cun	Lep cup	Lep pea	Met lep	Pla exi	Pla het	Rad aqu	Rad vol
Afon Conwy (Conwy Falls to Fairy Glen)	SH801540	3		++				1	2	1								
Afon Cynfal, Rhaeadr y Cwm	SH739416	6		2	7	6		2	4									
Afon Las	SH617579	2						1										
Afon Llugwy (Swallow Falls to Miners Bridge)	SH779569	2		3				6	5	1					1			
Bontddu Gorge	SH667194	4	1	6				7	9	++					3			2
Carn Gafallt	SN940648	4								1		8						
Ceunant Cynfal NNR	SH699413	5	1									20		3				
Ceunant Geifr	SH667379	1		3		3		4	16	2					2			
Ceunant Llennyrch	SH664391	9		**73**	3	**17**		**166**	**87**	8	3		2		11		**3**	2
Coed Aber Artro	SH605269	3	2	2				16	12	5							1	1
Coed Crafnant	SH619288	4	37							3		**130**						
Coed Cwmgwared	SH414478	1		5						4				1				
Coed Cymerau	SH689428	5	2						5			4	7					
Coed Ganllwyd	SH720245	6	**73**	4	**8**	8		34	46	3	1		1		**26**			
Coed Graig Uchaf	SH644266	4	10						1	18		15	12	**4**	1			**31**
Coed y Parc	SH735168	3		13					3	**88**			4		3			4
Coed y Rhygen	SH683370	5	35					1	1		**29**	++			1	**7**		
Coedydd Abergwynant	SH679171	3	3	2					1	7					1			2
Cwm Llyfnant	SN720974	4 ½	6				**1**					9	**20**					
Hafod y Llan	SH632517	4													1			
TOTAL		78 ½	170	>113	18	34	1	238	192	>141	33	>186	46	8	50	7	4	42

[1]Number of days of field survey.

[2]Ade dec - *Adelanthus decipiens*, Aph mic - *Aphanolejeunea microscopica*, Cam set - *Campylopus setifolius*, Col cal - *Colura calyptrifolia*, Dic sco - *Dicranum scottianum*, Dre ham - *Drepanolejeunea hamatifolia*, Har mol - *Harpalejeunea molleri*, Jub hut - *Jubula hutchinsiae*, Lep cun - *Leptoscyphus cuneifolius*, Lep cup - *Lepidozia cupressina*, Lep pea - *Lepidozia pearsonii*, Met lep - *Metzgeria leptoneura*, Pla exi - *Plagiochila exigua*, Pla het - *Plagiochila heterophylla*, Rad aqu - *Radula aquilegia*, Rad vol - *Radula voluta*. ++ - large population present but no grid-mapping data collected due to time constraints. Largest population of each species is highlighted in red.



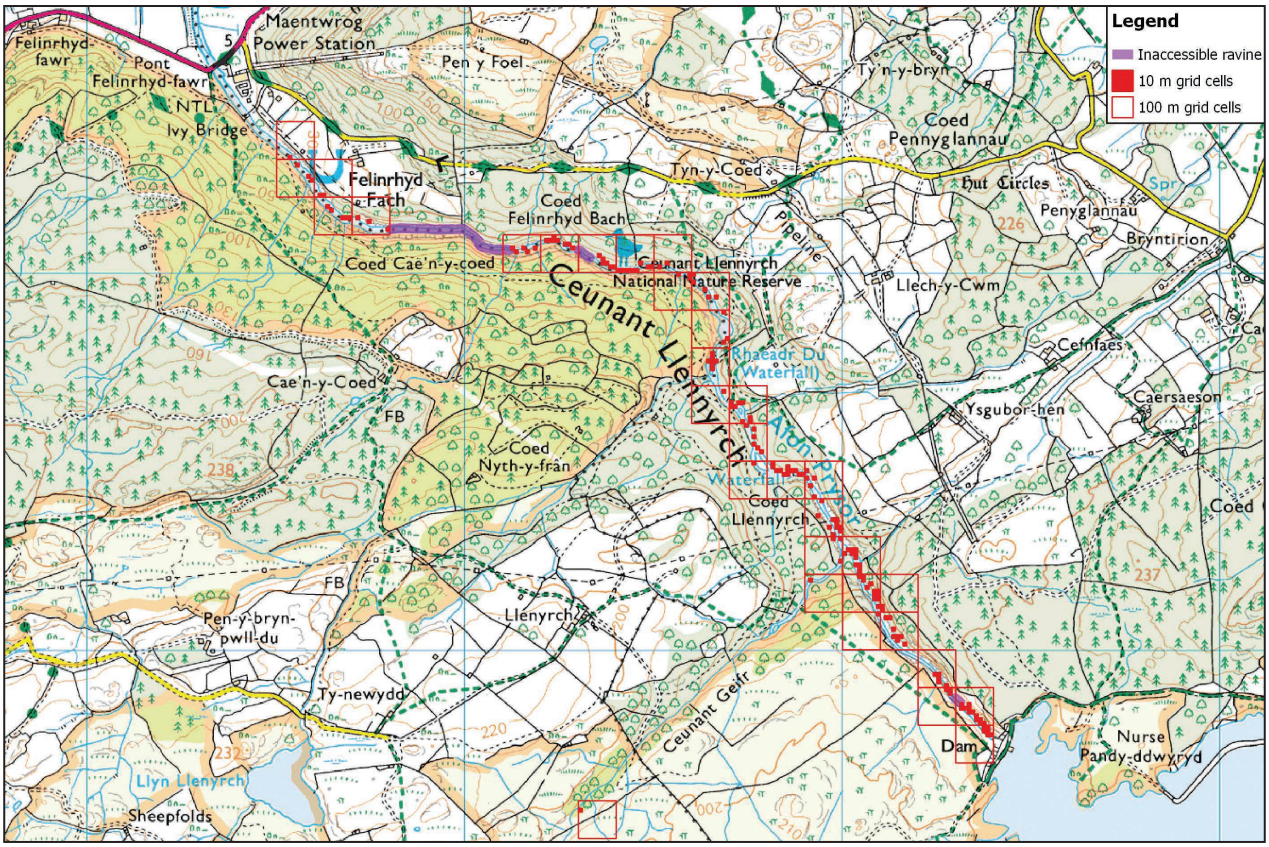
△Fig. 1: Site importance for notable hyper-oceanic bryophytes recorded in ten or more of the 20 survey sites. Site importance for a species is given as x/y, where x = total number of 10 x 10 m grid cells in which a species was found across all survey sites (n=20) and y = total number of 10 x 10 m grid cells in which a species was found within an individual site. Note that data are missing for a large population of A*phanolejeunea microscopica* at one site and a large population of *Jubula hutchinsiae* at another site, though this does not affect the overall pattern. Ade dec - *Adelanthus decipiens*, Aph mic - *Aphanolejeunea microscopica*, Dre ham - *Drepanolejeunea hamatifolia*, Har mol - *Harpalejeunea molleri*, Jub hut - *Jubula hutchinsiae*, Pla exi - *Plagiochila exigua*.

a site is undertaken varies greatly. In order to compare population sizes between sites, coverage of each site needs to be reasonably comprehensive. An average oceanic woodland requires about four days of fieldwork. The results presented here were collected during comprehensive surveys of sites in Wales during 2011 to 2015. The data are extracted from a much larger dataset, but to keep things manageable, and comprehensible, I only present results for the more notable hyper-oceanic species (Hill & Preston, 1998). This group is chosen because in a European context Wales is especially important, and as climate change progresses these species may be especially prone to population increases or decreases.

Results and discussion

Table 1 shows counts of the number of OS 10 x 10 m grid cells occupied by notable hyper-oceanic bryophytes at 20 sites. The locations include most of the best sites in Wales for these plants, concentrated in Snowdonia. Some important sites, such as Hafod Iwfog, have not so far been covered, though it is hoped the gaps will be filled gradually. Each count is, in effect, a population index of a species at a site. It can be envisaged that even these raw data may help inform conservation decisions, for example with regards to site management, site protection and Environmental Impact Assessment.

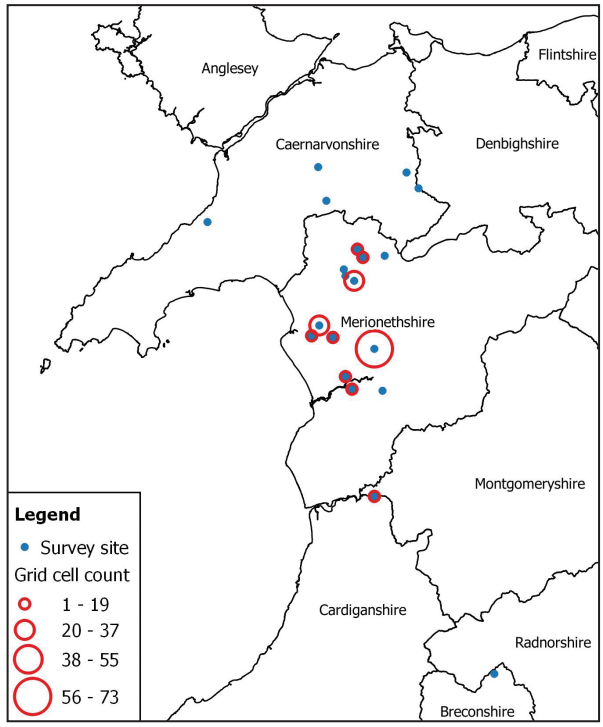
One trend evident in the data is that a species will often have a large population at very few sites and will tend to occur at most of its sites in relatively small quantity. This is true for all of the species that were recorded in a good number of sites, as illustrated by Figure 1. The most striking example from these data is the tremendous population of *Drepanolejeunea hamatifolia* along



△Fig. 2: Grid-map of *Drepanolejeunea hamatifolia* at Ceunant Llennyrch and Ceunant Geifr. The survey route is not shown here to lessen clutter. ▽Fig. 3: OS 10 x 10 m grid cell counts for *Adelanthus decipiens*.

the gorge of Ceunant Llenyrch (Fig. 2). We can now say with some confidence that this is by far the largest population of this scarce liverwort in Wales, possibly in Britain. The reserve manager and others knew that *D. hamatifolia* was present here in good amounts, but I don't think anyone suspected just how significant the site is for the plant.

Figure 3 maps the overall data for *Adelanthus decipiens*. This plant, typical of large boulders in grazed oceanic woodland, was recorded in 10 of the 20 survey sites. In terms of population size, most sites where it was found (n=7) fall within the lowest quartile and only one, Coed Ganllwyd, is within the upper quartile. Again, it was generally known that Coed Ganllwyd was a good site for this plant, but there was little understanding of how the population really compared to other sites and there was no evidence that it is, in fact, the most important location for the species in Wales. It is a particular



△Fig. 4 (above): Excellent deadwood habitat at Coed Crafnant supports an exceptional population of *Lepidozia cupressina*. D.A. Callaghan. △Fig. 5 (below): *Jubula hutchinsiae*. D.A. Callaghan

pity that we do not have comparable historic data at a good selection of sites, since grazing has declined recently in many oceanic woodlands in Wales and, as a consequence, populations of this special plant have likely suffered. Over the next couple of decades, site-based grid-mapping could start to provide insights into population trends of species within and across sites, and that may well deliver benefits for the often data-poor campaign of bryophyte conservation.

A question that soon comes to the mind when looking at these data is why are some sites so good for some species and, conversely, so bad for others? Why is it that Coed Crafnant supports a fantastic population of *Lepidozia cupressina* (Fig. 4) whilst it is absent, or at best extremely rare, at some of the most celebrated sites for hyper-oceanics, such as Ceunant Llennyrch and Coed

△Fig: 6: The Afon Merch flowing through oceanic oak woodland at Hafod y Llan, where four days of survey effort failed to find any *Adelanthus decipiens*. D.A. Callaghan

Ganllwyd? What makes the Afon Arran (Coed y Parc) so good for *Jubula hutchinsiae* (Fig. 5) and the Afon Goedol (Coed Cymerau) so bad? And why is there no *Adelanthus decipiens* in the grazed and bouldery woodland of Hafod y Llan (Fig. 6), which seems ideal for the plant? Whilst we can begin to offer some answers, they will be based on little more than speculation, and often we just have no idea. It may be that some sites are not bad at all for some species, their absence simply being a matter of limited dispersal ability and pure chance. Endless conjecture can progress. What is certain is that the ground is rich for some interesting and valuable research.

The purpose of this article was to present some results from the site-based grid-mapping approach, which I hope have been of interest. If anyone would like further information, please get in touch by email.

Acknowledgements

Three people have been especially instrumental in laying the ground for the results here presented, namely Sam Bosanquet (NRW), Dave Lamacraft (Plantlife) and Doug Oliver (NRW). Their generous help and trust have been fundamental. Many thanks to all of the landowners for allowing access permission and to the many donors that have contributed finances. The latter include, but are not limited to, The Ashley Family Foundation, The National Trust, Natural Resources Wales, Welsh Government and RSPB.

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