Cyfoeth Naturiol Cymru
Natural Resources Wales

Monitoring of the Atlantic woodland bryophyte assemblage in Coed Graig Uchaf SSSI

Des Callaghan (Bryophyte Surveys Ltd)

Evidence Report No 866

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We work to support Wales' economy by enabling the sustainable use of natural resources to support jobs and enterprise. We help businesses and developers to understand and consider environmental limits when they make important decisions.

We work to maintain and improve the quality of the environment for everyone and we work towards making the environment and our natural resources more resilient to climate change and other pressures.

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Frontispiece: *Lepidozia cupressina*.

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1. Crynodeb Gweithredol

Dynodwyd SoDdGA Coed Graig Uchaf ym 1987 ac fe'i dewiswyd fel enghraifft o goetir gyda chasgliad cyfoethog o fryoffytau'r lwerydd. Cynhaliwyd yr arolwg cynhwysfawr cyntaf o fryoffytau ar y safle yn 2014, pan gasglwyd data monitro llinell sylfaen, trwy fapio gridiau o rywogaethau a thrwy sefydlu lleiniau ffotograffig pwynt sefydlog. Mae'r adroddiad hwn yn rhoi canlyniadau ail-fonitro cyntaf y casgliad o fryoffytau coetiroedd yr lwerydd. Mae'r canlyniadau'n dangos rhwng 2014 a 2024 bod y casgliad wedi gweld cynnydd cyffredinol sylweddol mewn digonedd o fewn y SoDdGA o tua 52%. Maent hefyd yn dangos bod hyn yn bennaf oherwydd cynnydd mawr mewn rhywogaethau dyfrol, yn bennaf *Jubula hutchinsiae* a *Radula voluta*, a bod rhywogaethau annyfrol wedi dirywio'n gyffredinol. Nid yw'r rhesymau dros y cynnydd mewn rhywogaethau dyfrol yn glir, er eu bod o bosibl o fewn deinameg poblogaeth arferol y rhywogaethau rheoffytig hyn. Mae'r dirywiad cyffredinol ym mryoffytau annyfrol yr lwerydd yn bryder ac mae tystiolaeth o rai o'r lleiniau monitro ffotograffig pwynt sefydlog yn dangos yn glir eu bod wedi'u gwahardd yn gystadleuol gan fryoffytau mwy, yn enwedig *Rhytidiadelphus loreus*. Gallai hyn o bosib fod yn gysylltiedig â gostyngiad mewn pwysau pori gan eifr gwyllt a defaid. Dylid ymchwilio i ddwysedd yr anifeiliaid hyn o fewn y SoDdGA ac unrhyw ostyngiad posibl dros y 10 mlynedd diwethaf. Dylid hefyd ystyried cynnydd prawf yn y dwysedd stocio defaid.

2. Executive Summary

Coed Graig Uchaf SSSI was designated in 1987 and was selected as an example of a woodland with a rich Atlantic bryophyte assemblage. The first comprehensive bryophyte survey of the site was undertaken in 2014, when baseline monitoring data was collected, by the grid-mapping of species and by the establishment of fixed-point photographic plots. This report provides the results of the first re-monitoring of the Atlantic woodland bryophyte assemblage. Results show that between 2014 and 2024 the assemblage underwent a significant overall increase in abundance within the SSSI, of about 52%. They also show that this was primarily due to a large increase in aquatic species, principally *Jubula hutchinsiae* and *Radula voluta*, and that non-aquatic species underwent an overall decline. Reasons for the increase in aquatic species are unclear, though are potentially within the normal population dynamics of these rheophytic species. The overall decline in the non-aquatic Atlantic bryophytes is a concern and evidence from some of the fixed-point photographic monitoring plots clearly indicates their competitive exclusion by larger bryophytes, especially *Rhytidiadelphus loreus*. This could potentially be related to a reduction in grazing pressure, which is provided by feral goats and sheep. Densities of these animals within the SSSI and any potential reduction over the

past 10 years should be investigated. A trial increase in the stocking density of sheep should also be considered.

3. Background

Bryophytes comprise a diverse group of organisms that are sensitive indicators of the state of the environment. Desiccation tolerance varies greatly between species, and some of the most sensitive species are limited to highly oceanic climates. Oceanic bryophytes are more strongly represented in the British Isles than in any other part of Europe and, due to their general rarity and phytogeographic interest, have received much attention from bryologists and conservationists. The most diverse oceanic communities are found in sheltered lowland ravines along streams and rivers in west Scotland, north-west Wales (Snowdonia), north-west England (the English Lake District) and west Ireland. The best assemblages trigger the selection of Sites of Special Scientific Interest (SSSI) in Britain (Bosanquet et al. 2018) and are of principal importance for conservation under Section 7 of The Environment (Wales) Act 2016.

Coed Graig Uchaf SSSI (32.5 ha) was designated in 1987 and was selected as an example of a woodland with a rich oceanic bryophyte flora. According to the bryophyte selection criteria for SSSIs in Britain (Bosanquet et al. 2018), the 'Atlantic woodland bryophyte assemblage' of Coed Graig Uchaf SSSI scores 50 points, well above the SSSI selection threshold of 12 points. The assemblage includes 19 species: *Breutelia chrysocoma, Drepanolejeunea hamatifolia, Hageniella micans, Harpalejeunea molleri, Jubula hutchinsiae, Lejeunea lamacerina, Lejeunea patens, Lepidozia cupressina, Lepidozia pearsonii, Metzgeria leptoneura, Plagiochila bifaria, Plagiochila exigua, Plagiochila punctata, Plagiochila spinulosa, Pseudomarsupidium decipiens, Radula voluta, Rhynchostegium alopecuroides, Scapania gracilis* and *Sematophyllum demissum*. All are extant within the site and each was recorded during the present fieldwork.

The first comprehensive bryophyte survey of the site was undertaken during 22–25 January 2014, when baseline monitoring data was collected (Callaghan 2014). The aim of this study is to undertake the first re-monitoring of the Atlantic woodland bryophyte assemblage and assess what changes may have occurred. Taxonomy follows Blockeel et al. (2021).

4. Methods

4.1. Grid-mapping of species

A total of 633 OS 10 m grid cells was surveyed during the base-line monitoring in 2014, covering all of the accessible ravine habitat and the best areas of

oceanic woodland within the SSSI. During 3–6 November 2024, all of these grid cells were revisited and a search of each was undertaken for members of the Atlantic woodland bryophyte assemblage and other notable species. GPS waypoints were recorded for all colonies of nationally rare and scarce species, and for all of the Atlantic woodland bryophyte species, except *Lejeunea patens, Plagiochila punctata, Plagiochila spinulosa* and *Scapania gracilis*. These latter four species occurred too frequently to be able to grid-map them fully in the time available, and so only a representative selection of colonies were georeferenced.

4.2. Population trend analysis

Monitoring data from 2014 included counts of the number of 10 m grid cells occupied by twelve species of the Atlantic woodland bryophyte assemblage. Waypoints of these species from the present survey were loaded into GIS and corresponding counts were derived from the 633 grid cells surveyed in 2014. Percentage change in the number of occupied grid cells between 2014 and 2024 was calculated for: (i) each of the twelve species separately; (ii) the twelve species combined as an aggregate; (iii) the aquatic species (n = 3) combined as an aggregate; and (iv) the non-aquatic species (n = 9) combined as an aggregate. Lastly, count data were standardised for the three aggregates by assigning an index of 100 to the baseline year (2014) and calculating indices for 2024 so that each corresponds to a percentage measure of the baseline index.

4.3. Fixed-point photographic plots

Eleven fixed-point photographic monitoring plots were established in 2014 showing habitat conditions and locations of a selection of notable species. These were all re-visited and re-photographed during the present survey.

5. Results

5.1. GPS data

GPS data collected during the present survey are provided in Appendix 1.

5.2. Grid-mapping of species

Distribution maps of the twelve species that were grid-mapped from the Atlantic woodland bryophyte assemblage are provided in Appendix 2.

5.3. Population trend analysis

Table 1 shows counts and percentage change of occupied 10 m grid cells of species and assemblages that were grid-mapped in 2014 and 2024, and Figure 1 shows the population trend for the Atlantic woodland bryophyte assemblage. Whilst the assemblage as a whole has shown a substantial increase of 52%, this has been influenced greatly by the 118% increase of aquatic species, principally *Jubula hutchinsiae* and *Radula voluta*. A contrasting trend is shown by the non-aquatic species, declining by -22%, of which *Lepidozia cupressina* shows the largest decline (-67%), from 15 to 5 occupied grid cells.

5.4. Fixed-point photographic plots

Images of the fixed-point photographic monitoring plots are provided in Appendix 3. A number of these document significant localised declines in non-aquatic species due to competitive exclusion by larger bryophytes, especially within Plots 9 and 11.

Table 1 Counts and percentage change of occupied 10 m grid cells of species and assemblages that were grid-mapped in Coed Graig Uchaf SSSI in 2014 and 2024.

Species	Atlantic species?	Aquatic species?	Count of occupied 10 m grid cells 2014	Count of occupied 10 m grid cells 2024	% change
Bartramia halleriana	No	No	1	2	100%
Bazzania tricrenata	No	No	7	5	-29%
Drepanolejeunea hamatifolia	Yes	No	0	2	n/a
Hageniella micans	Yes	No	1	1	0%
Harpalejeunea molleri	Yes	No	1	1	0%
Hylocomiastrum umbratum	No	No	1	1	0%
Jubula hutchinsiae	Yes	Yes	18	39	117%
Lepidozia cupressina	Yes	No	15	5	-67%
Lepidozia pearsonii	Yes	No	12	7	-42%
Metzgeria leptoneura	Yes	No	4	5	25%
Plagiochila exigua	Yes	No	1	4	300%
Pseudomarsupidium decipiens	Yes	No	10	8	-20%
Radula voluta	Yes	Yes	31	66	113%
Rhynchostegium alopecuroides	Yes	Yes	2	6	200%
Sematophyllum demissum	Yes	No	2	3	50%
Syzygiella autumnalis	No	No	1	1	0%
Atlantic woodland assemblage (aquatic species only)	Yes	Yes	51	111	118%
Atlantic woodland assemblage (non-aquatic species only)	Yes	No	46	36	-22%
Atlantic woodland assemblage (all species)	Yes	Mixed	97	147	52%

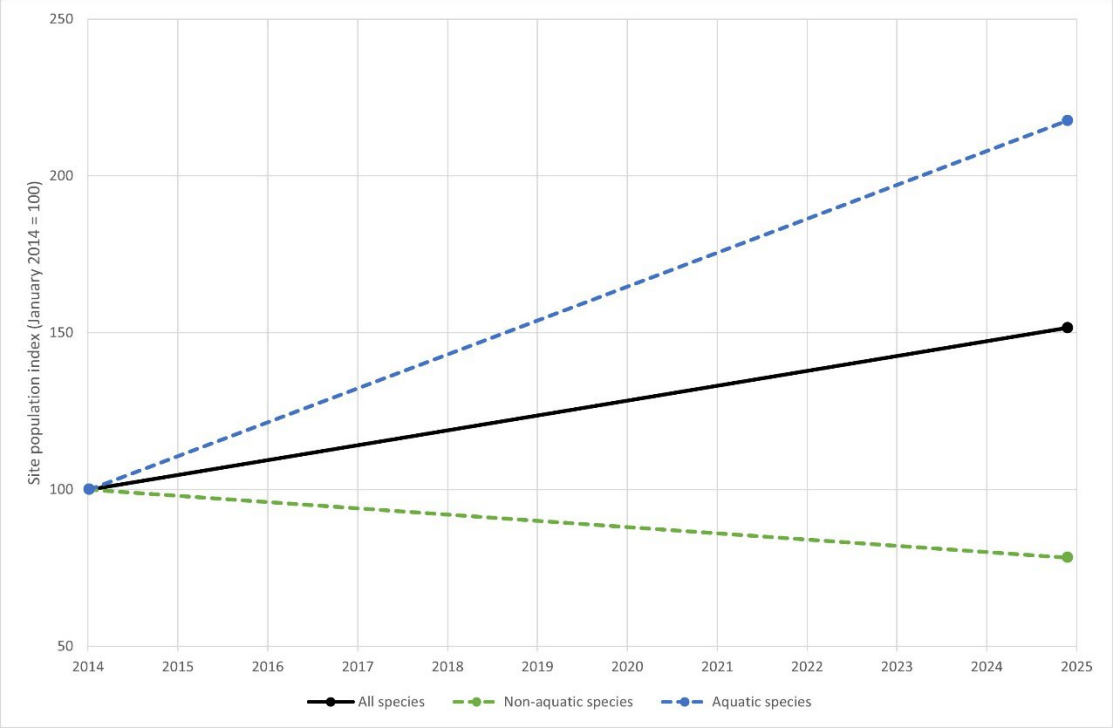

Figure 2. Population trend of the Atlantic woodland bryophyte assemblage at Coed Graig Uchaf SSSI. The aggregate trend is shown for all Atlantic species (*n* = 12) that were grid-mapped in 2014 and 2024, together with sub-sets that include only aquatic species (*n* = 3) and only non-aquatic species (*n* = 9).

6. Discussion

The results of this study show that between 2014 and 2024 the Atlantic woodland bryophyte assemblage of Coed Graig Uchaf SSSI underwent a significant overall increase in abundance, of about 52%. They also show that this was primarily due to a large increase in aquatic species, principally *Jubula hutchinsiae* and *Radula voluta*, and that non-aquatic species underwent an overall decline. Very little reliable population trend data across a similar time period exist for these Atlantic bryophytes in Wales, though at Bontddu Gorge a small increase (6%) in the population of *J. hutchinsiae* was detected between 2013 and 2023 (Callaghan 2023). Whilst that is far less than the enormous increase of 117% detected here, it may suggest this liverwort is undergoing a general increase in Wales, though clearly data from additional sites are required before any firm conclusions can be formed. Why these aquatic Atlantic species have increased at Coed Graig Uchaf over the past 10 years is unclear. The occupied streams have the same general appearance in 2024 as they had in 2014, and the general structure of the woodland canopy also appears to be unchanged. Whilst populations of rheophytic bryophytes can exhibit surprising

stability for periods of time, they can also be subject to major change due intense natural disturbance events caused by extreme spate flows, followed by recovery under more favourable conditions (Bosanquet 2018; Callaghan 2023; Englund 1991). It is therefore possible that the large increase in aquatic species at Coed Graig Uchaf between 2014 and 2024 is simply a natural population recovery following a natural decline. It may be useful to investigate historic flow data for streams and rivers in the region to see if any evidence may support this theory.

The overall decline in the non-aquatic Atlantic bryophytes is a concern and evidence from some of the fixed-point photographic monitoring plots clearly indicates their competitive exclusion by larger bryophytes, especially *Rhytidiadelphus loreus*. This could potentially be related to a reduction in grazing pressure, which is provided by feral goats and sheep. Densities of these animals within the SSSI and any potential reduction over the past 10 years should be investigated. A trial increase in the stocking density of sheep should also be considered.

Climate change is another factor that may have influenced the population trends detected at Coed Graig Uchaf, though there has been very little study of the possible impacts of climate change on woodland Atlantic bryophytes in Britain. Warmer winters may generally benefit these species, but an increasing frequency of extreme drought events during summer are likely to be particularly damaging (Kirkpatrick Baird et al. 2023). The issue is substantially complicated by difficulties in assessing the impact of change in the macroclimate on the specific microclimate occupied by species. In the present context, it is notable that the microclimate occupied by the non-aquatic Atlantic species, which is buffered from the macroclimate by the deciduous woodland canopy, may be impacted quite differently by climate change compared to the microclimate occupied by the aquatic Atlantic species.

This study clearly demonstrates the value of data derived from the grid-mapping of species within sites, allowing population trends to be quantified. It also demonstrates the value of fixed-point photographic plots for helping to understand the causes of any trends detected, and the two methods combined provide a useful approach to better understanding the status of bryophyte populations within sites.

7. Acknowledgements

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8. References

Blockeel TL, Bell NE, Hill MO, Hodgetts NG, Long DG, Pilkington SL, Rothero GP. 2021. A new checklist of the bryophytes of Britain and Ireland, 2020. Journal of Bryology. 43:1–51.

Bosanquet SDS. 2018. Bryophyte monitoring on the Afon Cwmnantcol in Coed Aberartro SSSI. NRW Evidence Report No: 268, 56 pp, Natural Resources Wales,
Bangor.

Bosanquet SDS, Genney DR, Cox JHS. 2018. Guidelines for the selection of biological SSSIs. Part 2: Detailed guidelines for habitats and species groups. Chapter 12 Bryophytes. Peterborough: Joint Nature Conservation Committee.

Callaghan DA. 2014. Bryophyte survey and monitoring at Coed Graig Uchaf, Merioneth. Unpublished report to Natural Resources Wales.

Callaghan DA. 2023. Population trends in hyperoceanic liverworts in Bontddu Gorge after hydroelectric power development. NRW Evidence Report No: 734, 26 pp, Natural Resources Wales.

Englund G. 1991. Effects of disturbance on stream moss and invertebrate community structure. Journal of the North American Benthological Society. 10:143–153.

Hill MO, Preston CD. 1998. The geographical relationships of British and Irish bryophytes. Journal of Bryology. 20:127– 226.

Kirkpatrick Baird F, Spray D, Hall J, Stubbs Partridge J. 2023. Projected increases in extreme drought frequency and duration by 2040 affect specialist habitats and species in Scotland. Ecological Solutions and Evidence. 4(3):e12256

9. Appendices

9.1. Appendix 1: GPS data

Species	Grid Reference
Bartramia halleriana	SH6454326269
Bartramia halleriana	SH6456726278
Bartramia halleriana	SH6456826277
Bazzania tricrenata	SH6463826661
Bazzania tricrenata	SH6463826660
Bazzania tricrenata	SH6454326668
Bazzania tricrenata	SH6452126673
Bazzania tricrenata	SH6451926692
Bazzania tricrenata	SH6449526683
Breutelia chrysocoma	SH6411926164
Breutelia chrysocoma	SH6457326626
Breutelia chrysocoma	SH6431626295
Drepanolejeunea hamatifolia	SH6463726656
Drepanolejeunea hamatifolia	SH6464126666
Drepanolejeunea hamatifolia	SH6464526664
Drepanolejeunea hamatifolia	SH6464526666
Hageniella micans	SH6439226449
Hageniella micans	SH6439126448
Hageniella micans	SH6439326447
Hageniella micans	SH6439126446
Hageniella micans	SH6439126444
Harpalejeunea molleri	SH6463126655
Harpanthus scutatus	SH6451226618
Hylocomiastrum umbratum	SH6456026618
Jubula hutchinsiae	SH6433526465
Jubula hutchinsiae	SH6433826467
Jubula hutchinsiae	SH6433826468
Jubula hutchinsiae	SH6433026474
Jubula hutchinsiae	SH6432826472
Jubula hutchinsiae	SH6432726473
Jubula hutchinsiae	SH6433626466
Jubula hutchinsiae	SH6434226465
Jubula hutchinsiae	SH6435626458
Jubula hutchinsiae	SH6435926448
Jubula hutchinsiae	SH6435826431
Jubula hutchinsiae	SH6435026403
Jubula hutchinsiae	SH6443626374
Jubula hutchinsiae	SH6444426370
Jubula hutchinsiae	SH6445226364
Jubula hutchinsiae	SH6445226363
Jubula hutchinsiae	SH6442126388
Jubula hutchinsiae	SH6442126388
Jubula hutchinsiae	SH6442126390
Jubula hutchinsiae	SH6441626394
Jubula hutchinsiae	SH6441426395

Species	Grid Reference
Jubula hutchinsiae	SH6441526390
Jubula hutchinsiae	SH6441026395
Jubula hutchinsiae	SH6440426401
Jubula hutchinsiae	SH6440626418
Jubula hutchinsiae	SH6440426421
Jubula hutchinsiae	SH6440226417
Jubula hutchinsiae	SH6438826432
Jubula hutchinsiae	SH6438826450
Jubula hutchinsiae	SH6439026448
Jubula hutchinsiae	SH6438926446
Jubula hutchinsiae	SH6438926447
Jubula hutchinsiae	SH6438426450
Jubula hutchinsiae	SH6438126454
Jubula hutchinsiae	SH6437926458
Jubula hutchinsiae	SH6437626460
Jubula hutchinsiae	SH6437126462
Jubula hutchinsiae	SH6436226469
Jubula hutchinsiae	SH6435926469
Jubula hutchinsiae	SH6448026652
Jubula hutchinsiae	SH6448426670
Jubula hutchinsiae	SH6448526668
Jubula hutchinsiae	SH6448826664
Jubula hutchinsiae	SH6448926657
Jubula hutchinsiae	SH6448326662
Jubula hutchinsiae	SH6448426652
Jubula hutchinsiae	SH6448726648
Jubula hutchinsiae	SH6448926647
Jubula hutchinsiae	SH6449126640
Jubula hutchinsiae	SH6448926658
Jubula hutchinsiae	SH6449726659
Jubula hutchinsiae	SH6452026645
Jubula hutchinsiae	SH6453626640
Jubula hutchinsiae	SH6453826628
Jubula hutchinsiae	SH6454826620
Jubula hutchinsiae	SH6455026621
Jubula hutchinsiae	SH6455726621
Jubula hutchinsiae	SH6458326638
Jubula hutchinsiae	SH6463626656
Jubula hutchinsiae	SH6463626656
Jubula hutchinsiae	SH6457926685
Lejeunea lamacerina	SH6434526464
Lejeunea lamacerina	SH6435026408
Lejeunea lamacerina	SH6439926403
Lejeunea lamacerina	SH6436126471
Lejeunea lamacerina	SH6453626702
Lejeunea patens	SH6433826467
Lejeunea patens	SH6433026471
Lejeunea patens	SH6435426461
Lejeunea patens	SH6435926428
Lejeunea patens	SH6435226414

Species	Grid Reference
Lejeunea patens	SH6435426396
Lejeunea patens	SH6456526247
Lejeunea patens	SH6452426266
Lejeunea patens	SH6453526259
Lejeunea patens	SH6454126267
Lejeunea patens	SH6454626261
Lejeunea patens	SH6455326272
Lejeunea patens	SH6456126287
Lejeunea patens	SH6442326388
Lejeunea patens	SH6440626394
Lejeunea patens	SH6439926404
Lejeunea patens	SH6452526565
Lejeunea patens	SH6454126637
Lejeunea patens	SH6460426648
Lejeunea patens	SH6464926665
Lejeunea patens	SH6453426715
Lepidozia cupressina	SH6452426628
Lepidozia cupressina	SH6451826708
Lepidozia cupressina	SH6452726673
Lepidozia cupressina	SH6452226673
Lepidozia cupressina	SH6450426692
Lepidozia cupressina	SH6449926710
Lepidozia pearsonii	SH6456226675
Lepidozia pearsonii	SH6452026673
Lepidozia pearsonii	SH6452126675
Lepidozia pearsonii	SH6455626716
Lepidozia pearsonii	SH6451226615
Lepidozia pearsonii	SH6437826441
Lepidozia pearsonii	SH6449126634
Lepidozia pearsonii	SH6451626617
Lepidozia pearsonii	SH6437826434
Lepidozia pearsonii	SH6438026430
Metzgeria leptoneura	SH6433626468
Metzgeria leptoneura	SH6454826269
Metzgeria leptoneura	SH6454526269
Metzgeria leptoneura	SH6454726271
Metzgeria leptoneura	SH6454826270
Metzgeria leptoneura	SH6454826269
Metzgeria leptoneura	SH6439926406
Metzgeria leptoneura	SH6439926406
Metzgeria leptoneura	SH6440426420
Neckera crispa	SH6456526282
Neckera crispa	SH6456126282
Plagiochila bifaria	SH6454726264
Plagiochila bifaria	SH6456026284
Plagiochila bifaria	SH6440426410
Plagiochila bifaria	SH6447526591
Plagiochila bifaria	SH6456126564
Plagiochila bifaria	SH6448226657
Plagiochila bifaria	SH6448926664

Species	Grid Reference
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Plagiochila exigua	SH6463626657
Plagiochila exigua	SH6450626694
Plagiochila exigua	SH6453526641
Plagiochila exigua	SH6463626662
Plagiochila punctata	SH6435526398
Plagiochila punctata	SH6453826261
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Plagiochila spinulosa	SH6435126416
Plagiochila spinulosa	SH6435126413
Plagiochila spinulosa	SH6435026408
Plagiochila spinulosa	SH6435426396
Plagiochila spinulosa	SH6436126389
Plagiochila spinulosa	SH6436526381
Plagiochila spinulosa	SH6437326370
Plagiochila spinulosa	SH6436726371
Plagiochila spinulosa	SH6440526312
Plagiochila spinulosa	SH6456126247
Plagiochila spinulosa	SH6452526261
Plagiochila spinulosa	SH6453526259
Plagiochila spinulosa	SH6453526270
Plagiochila spinulosa	SH6454626264
Plagiochila spinulosa	SH6457126275
Plagiochila spinulosa	SH6450426289

Species	Grid Reference
Plagiochila spinulosa	SH6449526310
Plagiochila spinulosa	SH6441926389
Plagiochila spinulosa	SH6439726429
Plagiochila spinulosa	SH6439026436
Plagiochila spinulosa	SH6437226485
Plagiochila spinulosa	SH6438426501
Plagiochila spinulosa	SH6440026513
Plagiochila spinulosa	SH6445126614
Plagiochila spinulosa	SH6445626649
Plagiochila spinulosa	SH6447626636
Plagiochila spinulosa	SH6448526541
Plagiochila spinulosa	SH6451626429
Plagiochila spinulosa	SH6455926565
Plagiochila spinulosa	SH6454726555
Plagiochila spinulosa	SH6451626619
Plagiochila spinulosa	SH6458926644
Plagiochila spinulosa	SH6461326653
Plagiochila spinulosa	SH6462026681
Plagiochila spinulosa	SH6457426683
Porella arboris-vitae	SH6444026372
Pseudomarsupidium decipiens	SH6438626502
Pseudomarsupidium decipiens	SH6448626661
Pseudomarsupidium decipiens	SH6448726660
Pseudomarsupidium decipiens	SH6448726668
Pseudomarsupidium decipiens	SH6448826668
Pseudomarsupidium decipiens	SH6449326659
Pseudomarsupidium decipiens	SH6458926695
Pseudomarsupidium decipiens	SH6457326718
Pseudomarsupidium decipiens	SH6450626694
Pseudomarsupidium decipiens	SH6449626710
Pseudomarsupidium decipiens	SH6450126701
Radula voluta	SH6448826674
Radula voluta	SH6448326672
Radula voluta	SH6448426671
Radula voluta	SH6448426670
Radula voluta	SH6448626669
Radula voluta	SH6448726663
Radula voluta	SH6448626664
Radula voluta	SH6448326662
Radula voluta	SH6448326658
Radula voluta	SH6448626650
Radula voluta	SH6448826648
Radula voluta	SH6449126645
Radula voluta	SH6449226636
Radula voluta	SH6449726632
Radula voluta	SH6450126632
Radula voluta	SH6448926661
Radula voluta	SH6451426646
Radula voluta	SH6451626646
Radula voluta	SH6452126644

Species	Grid Reference
Radula voluta	SH6453626641
Radula voluta	SH6455126634
Radula voluta	SH6455426631
Radula voluta	SH6454726632
Radula voluta	SH6454826628
Radula voluta	SH6454626628
Radula voluta	SH6454426628
Radula voluta	SH6454226627
Radula voluta	SH6454026628
Radula voluta	SH6453926627
Radula voluta	SH6453826628
Radula voluta	SH6453626628
Radula voluta	SH6452926631
Radula voluta	SH6457126625
Radula voluta	SH6458426639
Radula voluta	SH6458426641
Radula voluta	SH6458826643
Radula voluta	SH6458926646
Radula voluta	SH6459326645
Radula voluta	SH6459426645
Radula voluta	SH6459526646
Radula voluta	SH6460426648
Radula voluta	SH6458026683
Radula voluta	SH6458026682
Radula voluta	SH6458126690
Radula voluta	SH6458126695
Radula voluta	SH6457626695
Radula voluta	SH6457326693
Radula voluta	SH6456826694
Radula voluta	SH6456126701
Radula voluta	SH6456626697
Radula voluta	SH6457226694
Radula voluta	SH6453226704
Radula voluta	SH6453526702
Radula voluta	SH6453226707
Radula voluta	SH6453526701
Radula voluta	SH6453626698
Radula voluta	SH6453826695
Radula voluta	SH6454026694
Radula voluta	SH6454726691
Radula voluta	SH6455026690
Radula voluta	SH6455426690
Radula voluta	SH6455726691
Radula voluta	SH6455826690
Radula voluta	SH6453726701
Radula voluta	SH6452326696
Radula voluta	SH6449526695
Rhabdoweisia crenulata	SH6456126246
Rhabdoweisia crenulata	SH6456726247
Rhabdoweisia crenulata	SH6455826286

Species	Grid Reference
Rhynchostegium alopecuroides	SH6439626409
Rhynchostegium alopecuroides	SH6436226470
Rhynchostegium alopecuroides	SH6439926390
Rhynchostegium alopecuroides	SH6438826443
Rhynchostegium alopecuroides	SH6437126459
Rhynchostegium alopecuroides	SH6446226358
Scapania gracilis	SH6418226283
Scapania gracilis	SH6417726292
Scapania gracilis	SH6421626317
Scapania gracilis	SH6421026323
Scapania gracilis	SH6420426335
Scapania gracilis	SH6422626333
Scapania gracilis	SH6426626402
Scapania gracilis	SH6428726455
Scapania gracilis	SH6429626458
Scapania gracilis	SH6431626474
Scapania gracilis	SH6435026413
Scapania gracilis	SH6435526398
Scapania gracilis	SH6437326370
Scapania gracilis	SH6436726371
Scapania gracilis	SH6446026249
Scapania gracilis	SH6447326230
Scapania gracilis	SH6452626259
Scapania gracilis	SH6455726263
Scapania gracilis	SH6452526261
Scapania gracilis	SH6453526259
Scapania gracilis	SH6454626264
Scapania gracilis	SH6449526311
Scapania gracilis	SH6439426421
Scapania gracilis	SH6439726429
Scapania gracilis	SH6439026436
Scapania gracilis	SH6437426487
Scapania gracilis	SH6445426646
Scapania gracilis	SH6448526541
Scapania gracilis	SH6448026451
Scapania gracilis	SH6456026545
Scapania gracilis	SH6450926603
Scapania gracilis	SH6458926644
Scapania gracilis	SH6462026681
Scapania gracilis	SH6462826497
Scapania gracilis	SH6456226601
Scapania gracilis	SH6455626713
Scapania umbrosa	SH6435926442
Scorpidium cossonii	SH6431426301
Sematophyllum demissum	SH6450426648
Sematophyllum demissum	SH6463526656
Sematophyllum demissum	SH6446026654
Sphagnum contortum	SH6431526300
Sphagnum teres	SH6431726287
Sphagnum warnstorfii	SH6431326299

Species	Grid Reference
Syzygiella autumnalis	SH6456626682

Species	Grid Reference
Hageniella micans	SH6439226449
Hageniella micans	SH6439126448
Hageniella micans	SH6439326447
Hageniella micans	SH6439126446
Hageniella micans	SH6439126444
Harpalejeunea molleri	SH6463126655
Harpanthus scutatus	SH6451226618
Hylocomiastrum umbratum	SH6456026618
Jubula hutchinsiae	SH6433526465
Jubula hutchinsiae	SH6433826467
Jubula hutchinsiae	SH6433826468
Jubula hutchinsiae	SH6433026474
Jubula hutchinsiae	SH6432826472
Jubula hutchinsiae	SH6432726473
Jubula hutchinsiae	SH6433626466
Jubula hutchinsiae	SH6434226465
Jubula hutchinsiae	SH6435626458
Jubula hutchinsiae	SH6435926448
Jubula hutchinsiae	SH6435826431
Jubula hutchinsiae	SH6435026403
Jubula hutchinsiae	SH6443626374
Jubula hutchinsiae	SH6444426370
Jubula hutchinsiae	SH6445226364
Jubula hutchinsiae	SH6445226363
Jubula hutchinsiae	SH6442126388
Jubula hutchinsiae	SH6442126388
Jubula hutchinsiae	SH6442126390
Jubula hutchinsiae	SH6441626394
Jubula hutchinsiae	SH6441426395
Jubula hutchinsiae	SH6441526390
Jubula hutchinsiae	SH6441026395
Jubula hutchinsiae	SH6440426401
Jubula hutchinsiae	SH6440626418
Jubula hutchinsiae	SH6440426421
Jubula hutchinsiae	SH6440226417
Jubula hutchinsiae	SH6438826432
Jubula hutchinsiae	SH6438826450
Jubula hutchinsiae	SH6439026448
Jubula hutchinsiae	SH6438926446
Jubula hutchinsiae	SH6438926447
Jubula hutchinsiae	SH6438426450
Jubula hutchinsiae	SH6438126454
Jubula hutchinsiae	SH6437926458
Jubula hutchinsiae	SH6437626460

Species	Grid Reference
Jubula hutchinsiae	SH6437126462
Jubula hutchinsiae	SH6436226469
Jubula hutchinsiae	SH6435926469
Jubula hutchinsiae	SH6448026652
Jubula hutchinsiae	SH6448426670
Jubula hutchinsiae	SH6448526668
Jubula hutchinsiae	SH6448826664
Jubula hutchinsiae	SH6448926657
Jubula hutchinsiae	SH6448326662
Jubula hutchinsiae	SH6448426652
Jubula hutchinsiae	SH6448726648
Jubula hutchinsiae	SH6448926647
Jubula hutchinsiae	SH6449126640
Jubula hutchinsiae	SH6448926658
Jubula hutchinsiae	SH6449726659
Jubula hutchinsiae	SH6452026645
Jubula hutchinsiae	SH6453626640
Jubula hutchinsiae	SH6453826628
Jubula hutchinsiae	SH6454826620
Jubula hutchinsiae	SH6455026621
Jubula hutchinsiae	SH6455726621
Jubula hutchinsiae	SH6458326638
Jubula hutchinsiae	SH6463626656
Jubula hutchinsiae	SH6463626656
Jubula hutchinsiae	SH6457926685
Lejeunea lamacerina	SH6434526464
Lejeunea lamacerina	SH6435026408
Lejeunea lamacerina	SH6439926403
Lejeunea lamacerina	SH6436126471
Lejeunea lamacerina	SH6453626702
Lejeunea patens	SH6433826467
Lejeunea patens	SH6433026471
Lejeunea patens	SH6435426461
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Lejeunea patens	SH6435426396
Lejeunea patens	SH6456526247
Lejeunea patens	SH6452426266
Lejeunea patens	SH6453526259
Lejeunea patens	SH6454126267
Lejeunea patens	SH6454626261
Lejeunea patens	SH6455326272
Lejeunea patens	SH6456126287
Lejeunea patens	SH6442326388
Lejeunea patens	SH6440626394
Lejeunea patens	SH6439926404
Lejeunea patens	SH6452526565
Lejeunea patens	SH6454126637
Lejeunea patens	SH6460426648
Lejeunea patens	SH6464926665

Species	Grid Reference
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Lepidozia cupressina	SH6452426628
Lepidozia cupressina	SH6451826708
Lepidozia cupressina	SH6452726673
Lepidozia cupressina	SH6452226673
Lepidozia cupressina	SH6450426692
Lepidozia cupressina	SH6449926710
Lepidozia pearsonii	SH6456226675
Lepidozia pearsonii	SH6452026673
Lepidozia pearsonii	SH6452126675
Lepidozia pearsonii	SH6455626716
Lepidozia pearsonii	SH6451226615
Lepidozia pearsonii	SH6437826441
Lepidozia pearsonii	SH6449126634
Lepidozia pearsonii	SH6451626617
Lepidozia pearsonii	SH6437826434
Lepidozia pearsonii	SH6438026430
Metzgeria leptoneura	SH6433626468
Metzgeria leptoneura	SH6454826269
Metzgeria leptoneura	SH6454526269
Metzgeria leptoneura	SH6454726271
Metzgeria leptoneura	SH6454826270
Metzgeria leptoneura	SH6454826269
Metzgeria leptoneura	SH6439926406
Metzgeria leptoneura	SH6439926406
Metzgeria leptoneura	SH6440426420
Neckera crispa	SH6456526282
Neckera crispa	SH6456126282
Plagiochila bifaria	SH6454726264
Plagiochila bifaria	SH6456026284
Plagiochila bifaria	SH6440426410
Plagiochila bifaria	SH6447526591
Plagiochila bifaria	SH6456126564
Plagiochila bifaria	SH6448226657
Plagiochila bifaria	SH6448926664
Plagiochila bifaria	SH6454026262
Plagiochila exigua	SH6463626657
Plagiochila exigua	SH6450626694
Plagiochila exigua	SH6453526641
Plagiochila exigua	SH6463626662
Plagiochila punctata	SH6435526398
Plagiochila punctata	SH6453826261
Plagiochila punctata	SH6439726411
Plagiochila punctata	SH6439326428
Plagiochila punctata	SH6447826631
Plagiochila punctata	SH6448926634
Plagiochila punctata	SH6448526633
Plagiochila punctata	SH6457226568
Plagiochila punctata	SH6454426623
Plagiochila punctata	SH6460126646

Species	Grid Reference
Plagiochila punctata	SH6464626658
Plagiochila punctata	SH6462226682
Plagiochila punctata	SH6460026662
Plagiochila punctata	SH6455726610
Plagiochila punctata	SH6455626713
Plagiochila punctata	SH6438426423
Plagiochila punctata	SH6462026678
Plagiochila punctata	SH6450926601
Plagiochila punctata	SH6448926634
Plagiochila punctata	SH6450226616
Plagiochila spinulosa	SH6418126294
Plagiochila spinulosa	SH6419526304
Plagiochila spinulosa	SH6420426335
Plagiochila spinulosa	SH6423626320
Plagiochila spinulosa	SH6426726399
Plagiochila spinulosa	SH6429626458
Plagiochila spinulosa	SH6432526472
Plagiochila spinulosa	SH6434926460
Plagiochila spinulosa	SH6434926422
Plagiochila spinulosa	SH6435126416
Plagiochila spinulosa	SH6435126413
Plagiochila spinulosa	SH6435026408
Plagiochila spinulosa	SH6435426396
Plagiochila spinulosa	SH6436126389
Plagiochila spinulosa	SH6436526381
Plagiochila spinulosa	SH6437326370
Plagiochila spinulosa	SH6436726371
Plagiochila spinulosa	SH6440526312
Plagiochila spinulosa	SH6456126247
Plagiochila spinulosa	SH6452526261
Plagiochila spinulosa	SH6453526259
Plagiochila spinulosa	SH6453526270
Plagiochila spinulosa	SH6454626264
Plagiochila spinulosa	SH6457126275
Plagiochila spinulosa	SH6450426289
Plagiochila spinulosa	SH6449526310
Plagiochila spinulosa	SH6441926389
Plagiochila spinulosa	SH6439726429
Plagiochila spinulosa	SH6439026436
Plagiochila spinulosa	SH6437226485
Plagiochila spinulosa	SH6438426501
Plagiochila spinulosa	SH6440026513
Plagiochila spinulosa	SH6445126614
Plagiochila spinulosa	SH6445626649
Plagiochila spinulosa	SH6447626636
Plagiochila spinulosa	SH6448526541
Plagiochila spinulosa	SH6451626429
Plagiochila spinulosa	SH6455926565
Plagiochila spinulosa	SH6454726555
Plagiochila spinulosa	SH6451626619

Species	Grid Reference
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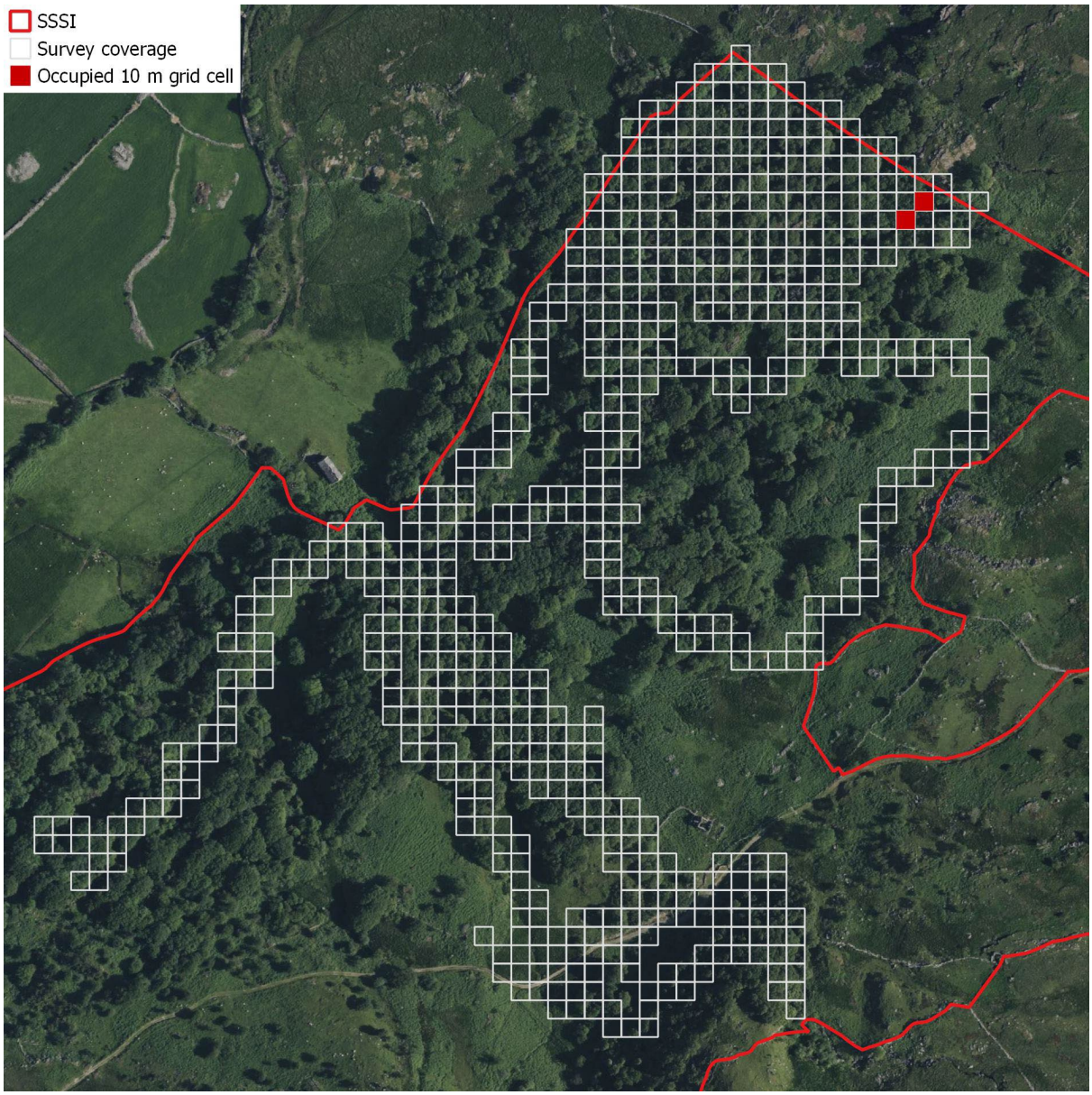
Plagiochila spinulosa	SH6461326653
Plagiochila spinulosa	SH6462026681
Plagiochila spinulosa	SH6457426683
Porella arboris-vitae	SH6444026372
Pseudomarsupidium decipiens	SH6438626502
Pseudomarsupidium decipiens	SH6448626661
Pseudomarsupidium decipiens	SH6448726660
Pseudomarsupidium decipiens	SH6448726668
Pseudomarsupidium decipiens	SH6448826668
Pseudomarsupidium decipiens	SH6449326659
Pseudomarsupidium decipiens	SH6458926695
Pseudomarsupidium decipiens	SH6457326718
Pseudomarsupidium decipiens	SH6450626694
Pseudomarsupidium decipiens	SH6449626710
Pseudomarsupidium decipiens	SH6450126701
Radula voluta	SH6448826674
Radula voluta	SH6448326672
Radula voluta	SH6448426671
Radula voluta	SH6448426670
Radula voluta	SH6448626669
Radula voluta	SH6448726663
Radula voluta	SH6448626664
Radula voluta	SH6448326662
Radula voluta	SH6448326658
Radula voluta	SH6448626650
Radula voluta	SH6448826648
Radula voluta	SH6449126645
Radula voluta	SH6449226636
Radula voluta	SH6449726632
Radula voluta	SH6450126632
Radula voluta	SH6448926661
Radula voluta	SH6451426646
Radula voluta	SH6451626646
Radula voluta	SH6452126644
Radula voluta	SH6453626641
Radula voluta	SH6455126634
Radula voluta	SH6455426631
Radula voluta	SH6454726632
Radula voluta	SH6454826628
Radula voluta	SH6454626628
Radula voluta	SH6454426628
Radula voluta	SH6454226627
Radula voluta	SH6454026628
Radula voluta	SH6453926627
Radula voluta	SH6453826628
Radula voluta	SH6453626628
Radula voluta	SH6452926631
Radula voluta	SH6457126625
Radula voluta	SH6458426639

Species	Grid Reference
Radula voluta	SH6458426641
Radula voluta	SH6458826643
Radula voluta	SH6458926646
Radula voluta	SH6459326645
Radula voluta	SH6459426645
Radula voluta	SH6459526646
Radula voluta	SH6460426648
Radula voluta	SH6458026683
Radula voluta	SH6458026682
Radula voluta	SH6458126690
Radula voluta	SH6458126695
Radula voluta	SH6457626695
Radula voluta	SH6457326693
Radula voluta	SH6456826694
Radula voluta	SH6456126701
Radula voluta	SH6456626697
Radula voluta	SH6457226694
Radula voluta	SH6453226704
Radula voluta	SH6453526702
Radula voluta	SH6453226707
Radula voluta	SH6453526701
Radula voluta	SH6453626698
Radula voluta	SH6453826695
Radula voluta	SH6454026694
Radula voluta	SH6454726691
Radula voluta	SH6455026690
Radula voluta	SH6455426690
Radula voluta	SH6455726691
Radula voluta	SH6455826690
Radula voluta	SH6453726701
Radula voluta	SH6452326696
Radula voluta	SH6449526695
Rhabdoweisia crenulata	SH6456126246
Rhabdoweisia crenulata	SH6456726247
Rhabdoweisia crenulata	SH6455826286
Rhynchostegium alopecuroides	SH6439626409
Rhynchostegium alopecuroides	SH6436226470
Rhynchostegium alopecuroides	SH6439926390
Rhynchostegium alopecuroides	SH6438826443
Rhynchostegium alopecuroides	SH6437126459
Rhynchostegium alopecuroides	SH6446226358
Scapania gracilis	SH6418226283
Scapania gracilis	SH6417726292
Scapania gracilis	SH6421626317
Scapania gracilis	SH6421026323
Scapania gracilis	SH6420426335
Scapania gracilis	SH6422626333
Scapania gracilis	SH6426626402
Scapania gracilis	SH6428726455
Scapania gracilis	SH6429626458

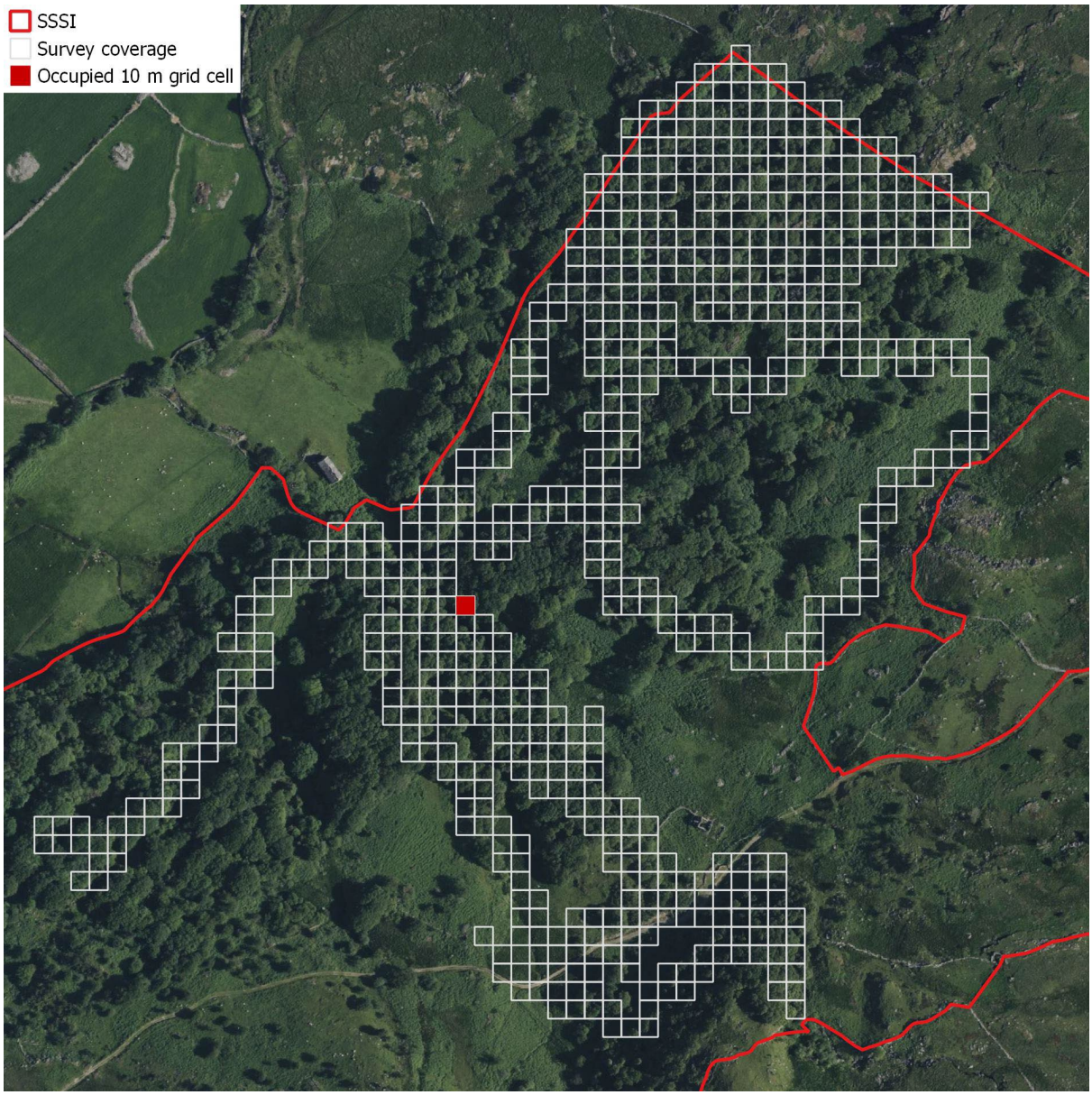
Species	Grid Reference
Scapania gracilis	SH6431626474
Scapania gracilis	SH6435026413
Scapania gracilis	SH6435526398
Scapania gracilis	SH6437326370
Scapania gracilis	SH6436726371
Scapania gracilis	SH6446026249
Scapania gracilis	SH6447326230
Scapania gracilis	SH6452626259
Scapania gracilis	SH6455726263
Scapania gracilis	SH6452526261
Scapania gracilis	SH6453526259
Scapania gracilis	SH6454626264
Scapania gracilis	SH6449526311
Scapania gracilis	SH6439426421
Scapania gracilis	SH6439726429
Scapania gracilis	SH6439026436
Scapania gracilis	SH6437426487
Scapania gracilis	SH6445426646
Scapania gracilis	SH6448526541
Scapania gracilis	SH6448026451
Scapania gracilis	SH6456026545
Scapania gracilis	SH6450926603
Scapania gracilis	SH6458926644
Scapania gracilis	SH6462026681
Scapania gracilis	SH6462826497
Scapania gracilis	SH6456226601
Scapania gracilis	SH6455626713
Scapania umbrosa	SH6435926442
Scorpidium cossonii	SH6431426301
Sematophyllum demissum	SH6450426648
Sematophyllum demissum	SH6463526656
Sematophyllum demissum	SH6446026654
Sphagnum contortum	SH6431526300
Sphagnum teres	SH6431726287
Sphagnum warnstorfii	SH6431326299
Syzygiella autumnalis	SH6456626682

9.2. Appendix 2: Grid-maps of Atlantic bryophyte species

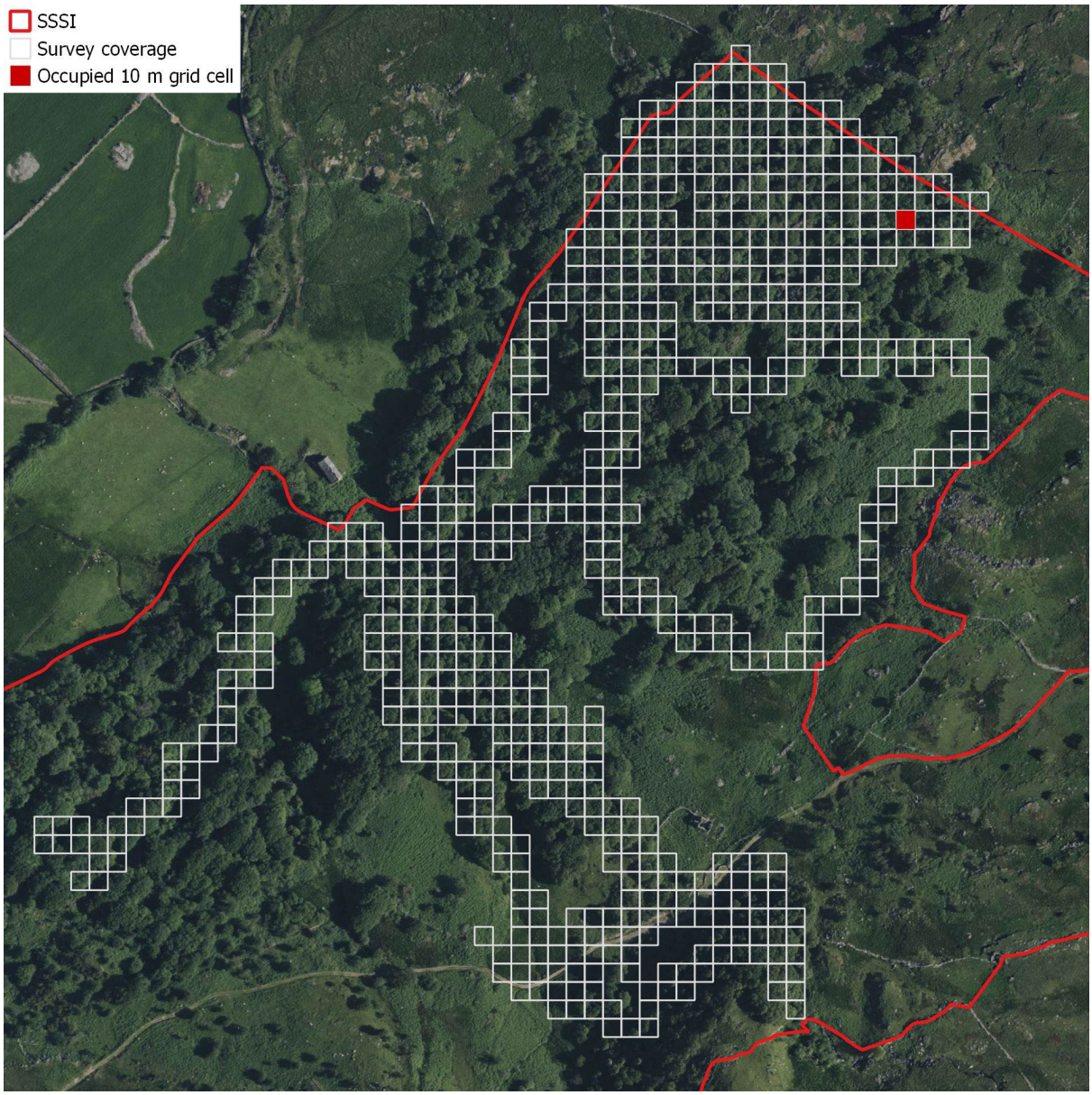
9.2.1. Drepanolejeunea hamatifolia



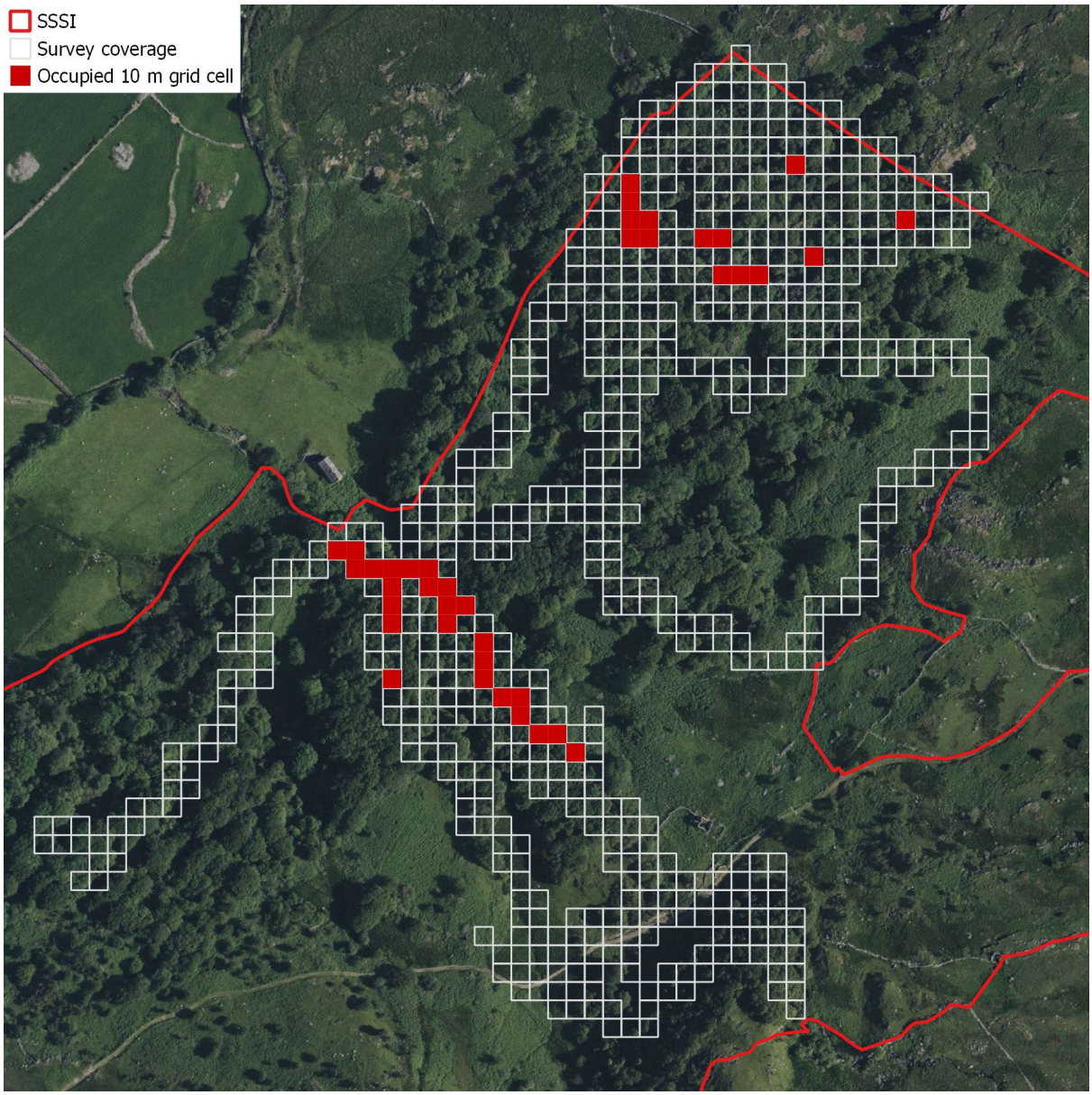
9.2.2. *Hageniella micans*



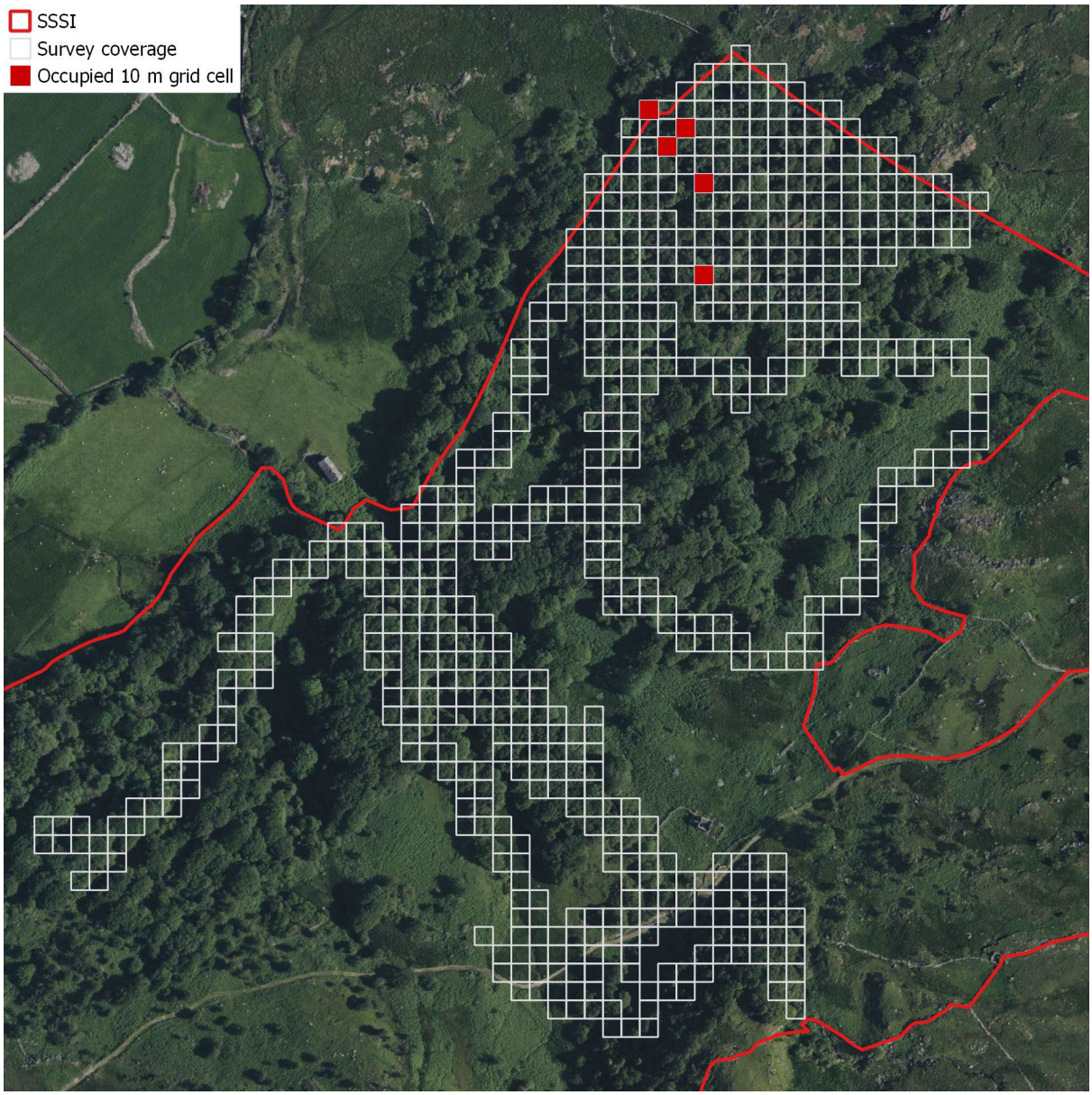
9.2.3. *Harpalejeunea molleri*



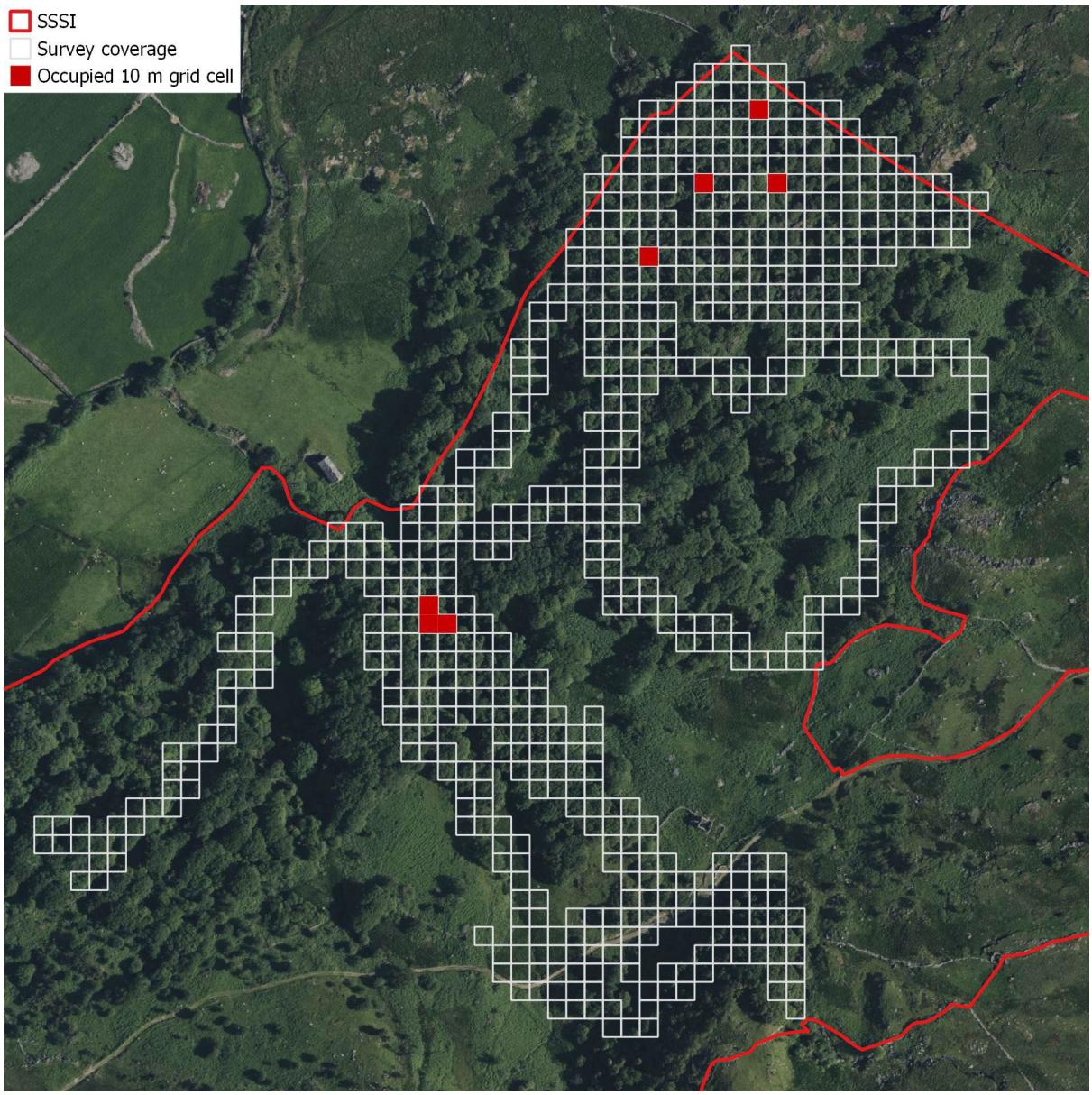
9.2.4. Jubula hutchinsiae



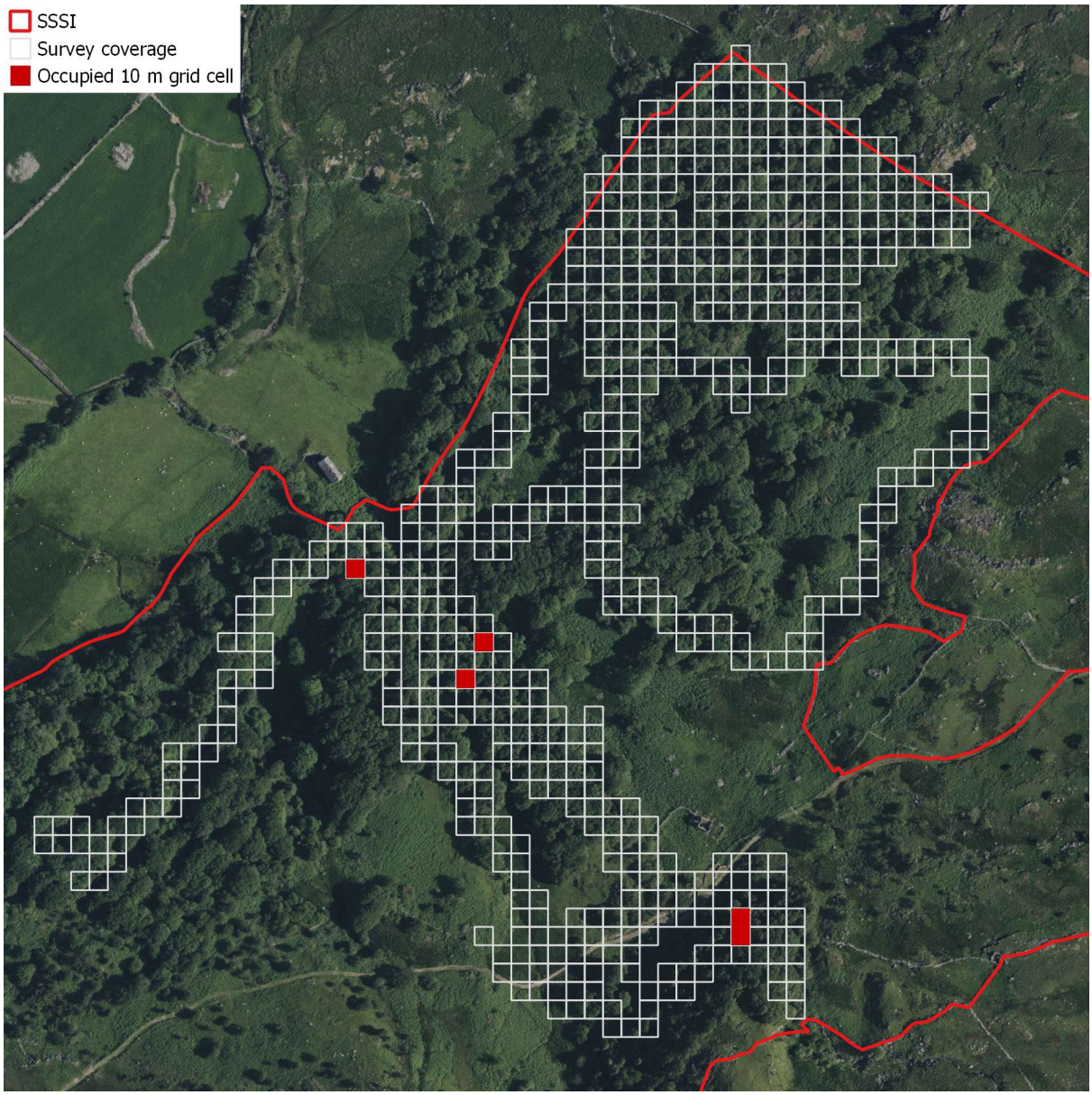
9.2.5. Lepidozia cupressina



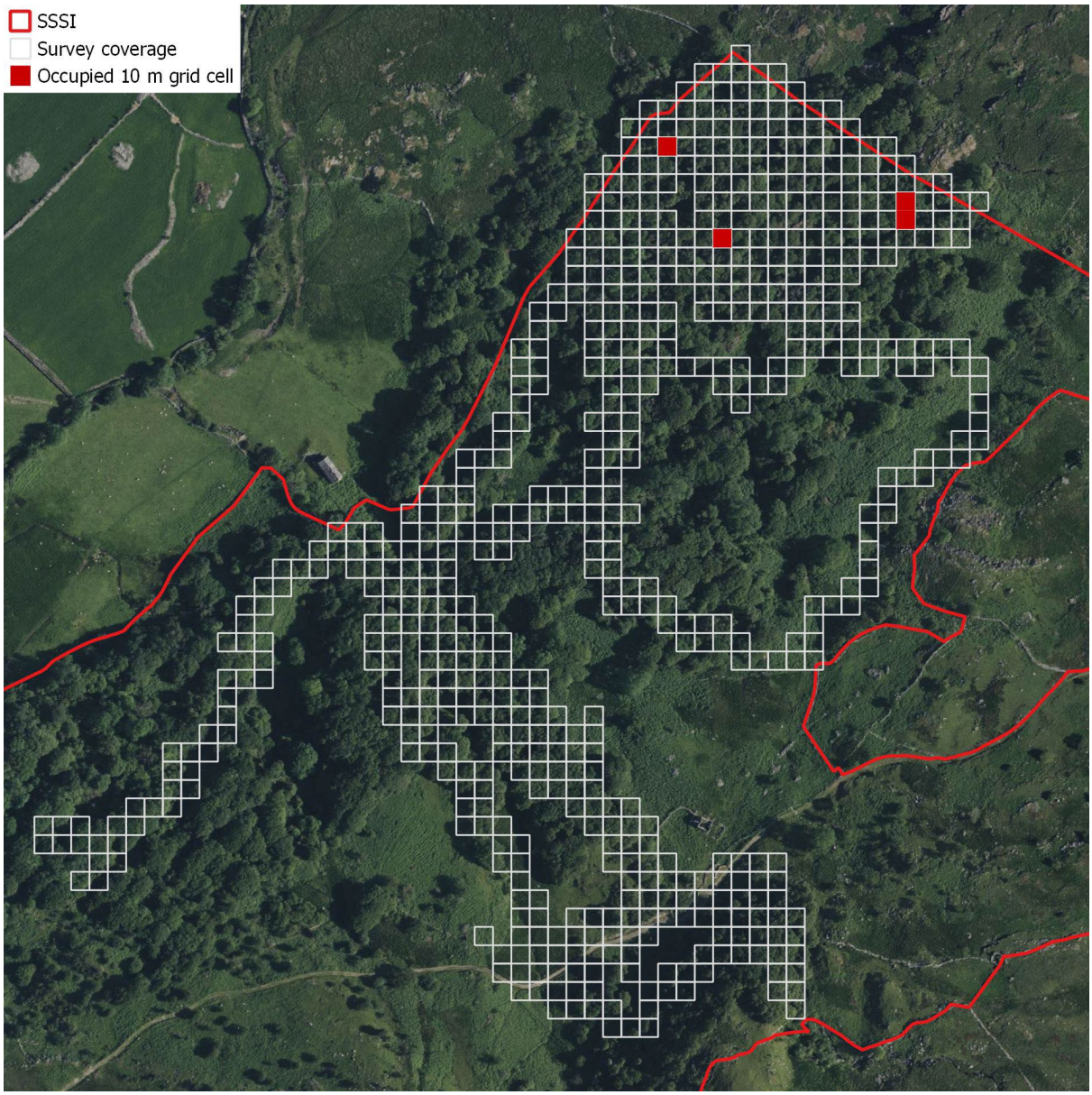
9.2.6. Lepidozia pearsonii



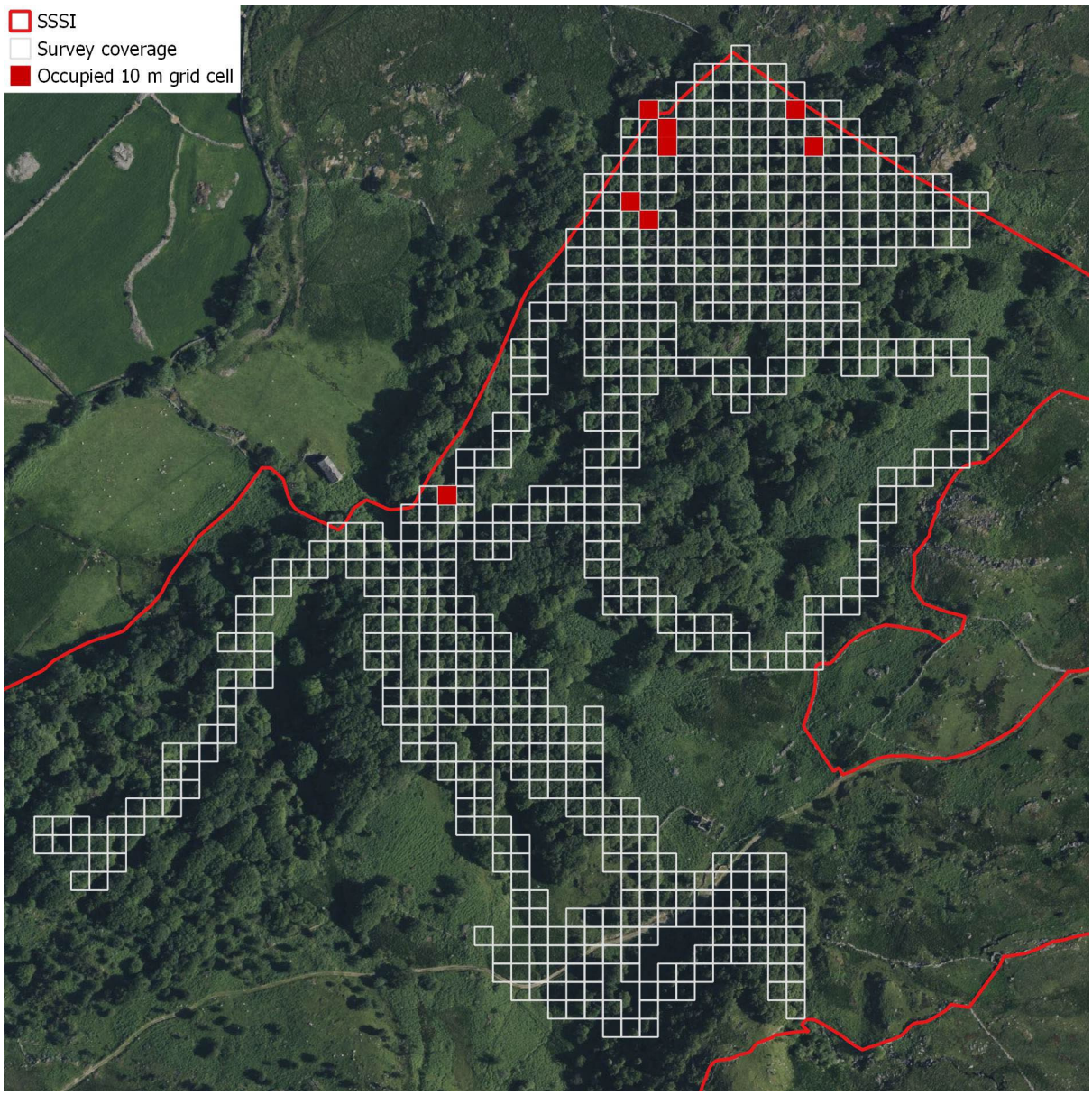
9.2.7. *Metzgeria leptoneura*



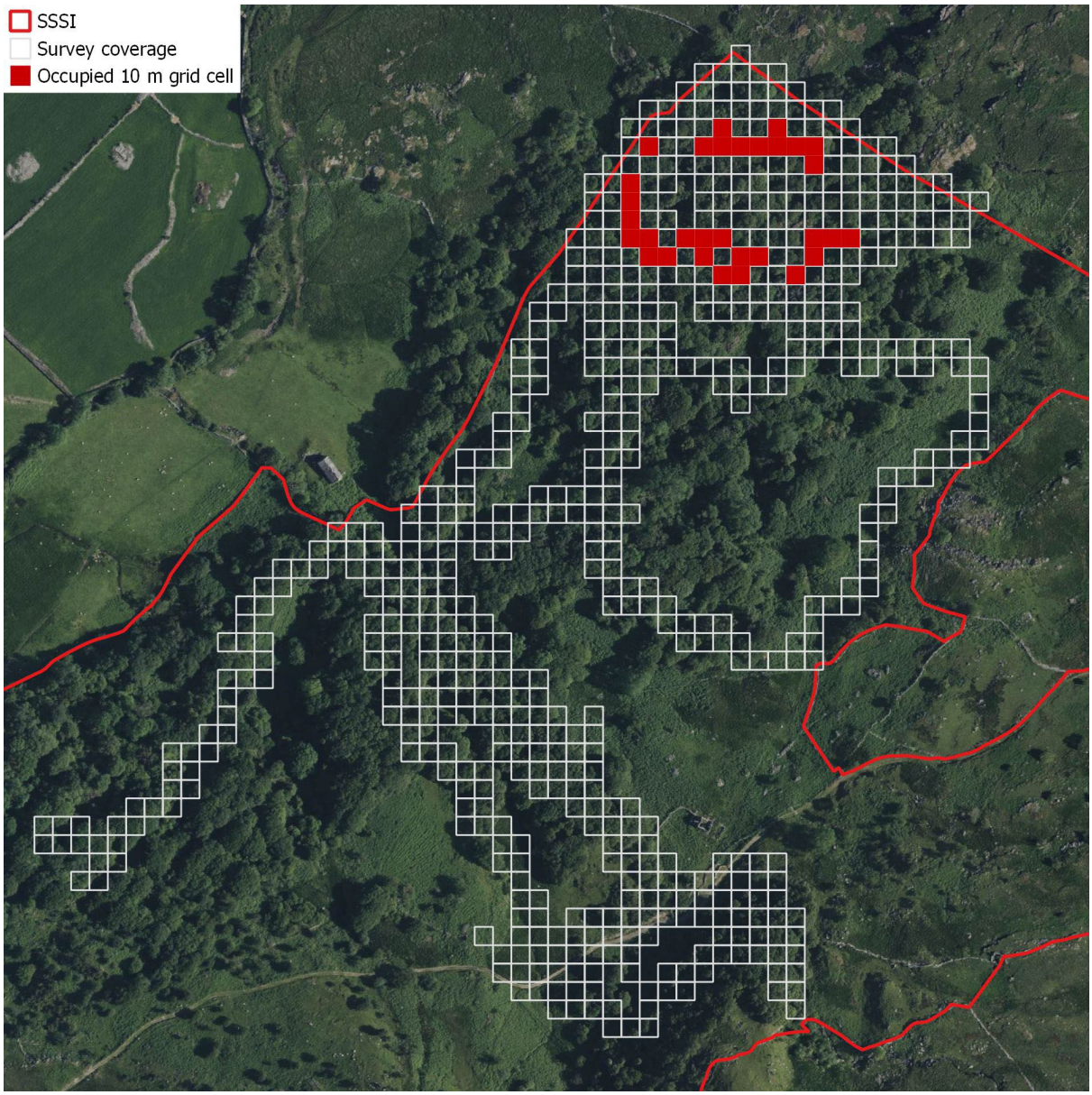
9.2.8. Plagiochila exigua



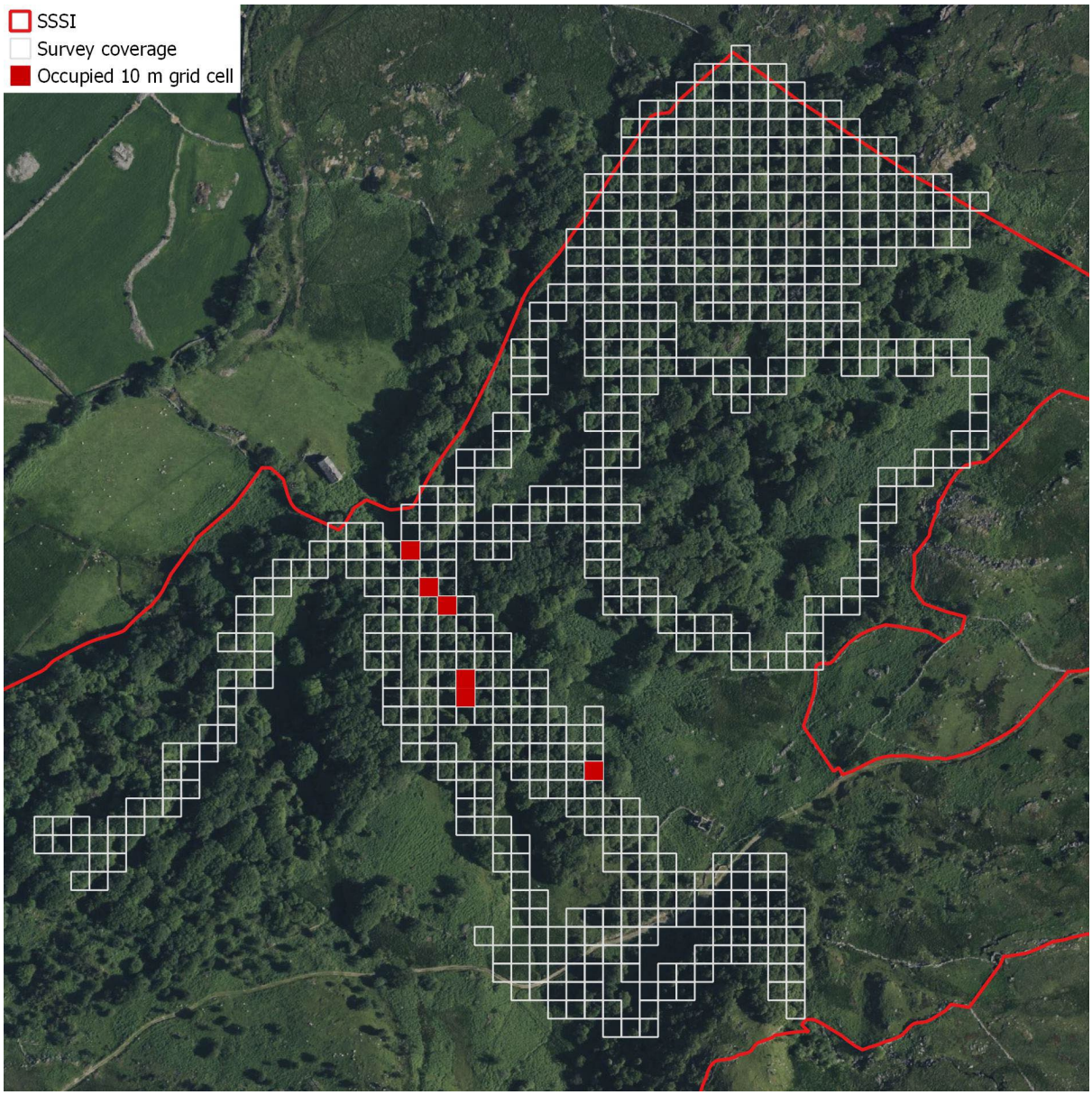
9.2.9. *Pseudomarsupidium decipiens*



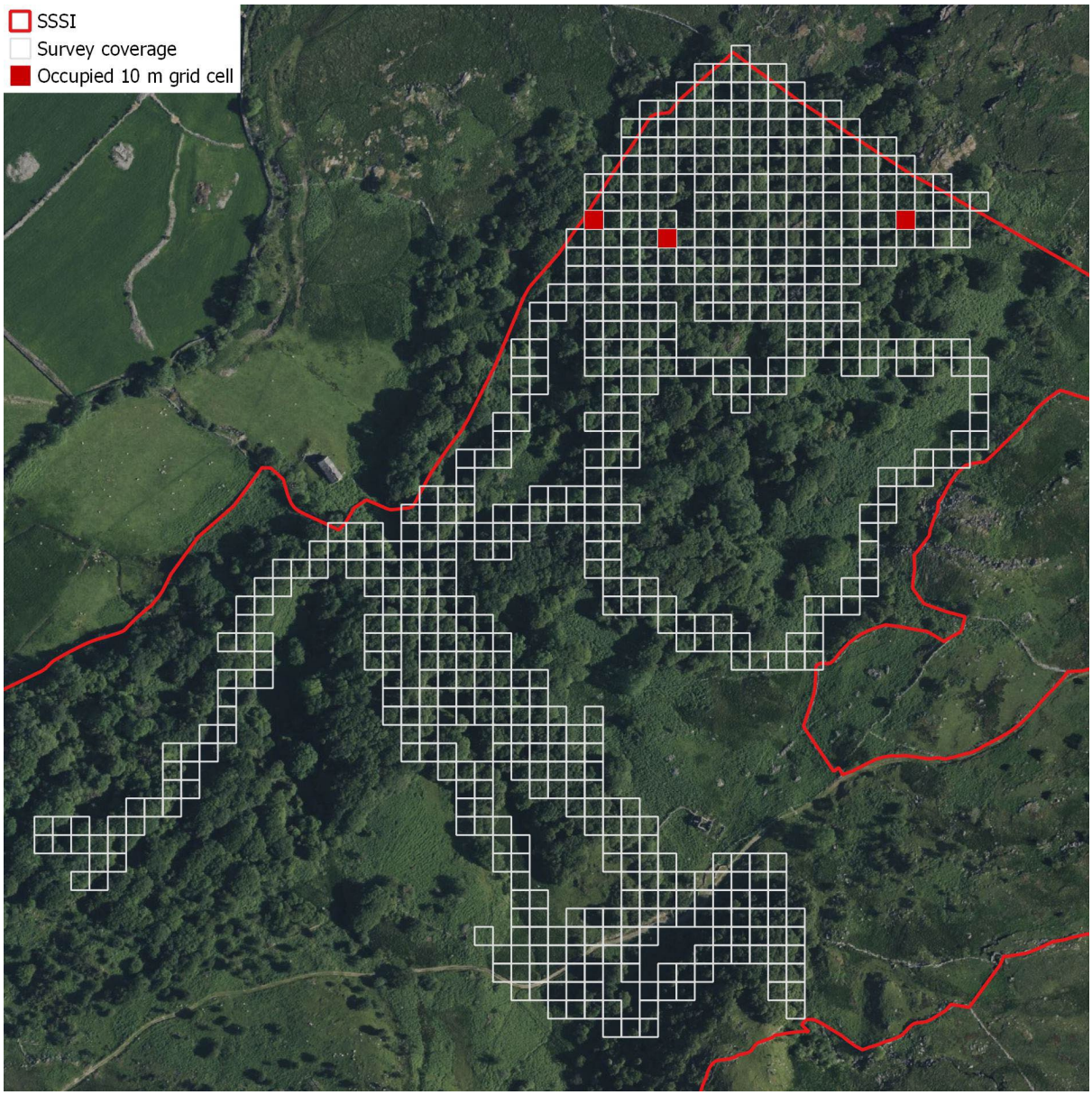
9.2.10. *Radula voluta*



9.2.11. *Rhynchostegium alopecuroides*



9.2.12. *Sematophyllum demissum*



9.3. Appendix 3: Fixed-point photographic monitoring plots

Plot 1 - SH6438426447

Species	Marker colour	Trend since 2014	Comments
Hageniella micans	Red	Large increase	Limited to the upper boulder in 2014, but has now colonised four additional rocks/boulders

Plot 2 - SH6440026425

Species	Marker colour	Trend since 2014	Comments
Metzgeria leptoneura	Blue	Small decline	A minor recent disturbance event seems to have impacted part of the original colony
Jubula hutchinsiae	Red	Stable	-

Plot 3 - SH6445326354

Species	Marker colour	Trend since 2014	Comments
Rhynchostegium alopecuroides	Red	Moderate decline	Reasons for decline unclear.

Plot 4 - SH6456426276

Species	Marker colour	Trend since 2014	Comments
Bartramia halleriana	Red	Moderate decline	The left colony has reduced in abundance significantly, for reasons unclear, whereas the right colony has remained stable.

Plot 5 - SH6448226669

Species	Marker colour	Trend since 2014	Comments
Jubula hutchinsiae	Blue	Stable	
Pseudomarsupidium decipiens	Pink	Increase	Not present within the plot in 2014.
Radula voluta	Red	Large decline	Reason unclear

Plot 6 - SH6450226650

Species	Marker colour	Trend since 2014	Comments
Sematophyllum demissum	Red	Large decline	Strong colony of 15 x 10 cm in 2014, now thinly scattered over 10 x 10 cm. Reason for decline unclear.

Plot 7 - SH6463426658

Species	Marker colour	Trend since 2014	Comments
Harpalejeunea molleri	Red	Stable	Thinly scattered over 20 x 10 cm

Plot 8 - SH6464126664

Species	Marker colour	Trend since 2014	Comments
Bazzania tricrenata	Purple	Moderate decline	Reasons unclear, but perhaps competitive exclusion by robust mosses
Drepanolejeunea hamatifolia	Yellow	Large increase	Not present in 2014 and newly recorded for the site. Thinly scattered over 30 x 20 cm, 30 x 20 cm and 10 x 5 cm.
Jubula hutchinsiae	Blue	Stable	
Plagiochila exigua	Pink	Moderate increase	Only present on right-hand boulder in 2014
Sematophyllum demissum	Red	Stable	Declined on large boulder, where now thinly scattered over 20 x 20 cm plus a 5 x 5 patch, but a new colony (15 x 10 cm) has become established on an adjacent rock.

Plot 9 – SH6456026676

Species	Marker colour	Trend since 2014	Comments
Bazzania tricrenata	n/a	Large decline	Extinct due to competitive exclusion by larger bryophytes, especially *Rhytidiadelphus loreus*
Lepidozia pearsonii	Red	Large decline	Almost extinct, surviving as a single 3 x 2 cm colony, due to competitive exclusion by larger bryophytes, especially *Rhytidiadelphus loreus*

Plot 10 – SH6456026696

Species	Marker colour	Trend since 2014	Comments
Syzygiella autumnalis	Red	Large decline	Almost extinct, surviving as a single 3 x 2 cm colony, due to competitive exclusion by larger bryophytes

Plot 11 – SH6452426688

Species	Marker colour	Trend since 2014	Comments
Bazzania tricrenata	Blue	Large decline	Decline due to competitive exclusion by larger bryophytes, especially *Rhytidiadelphus loreus*
Lepidozia cupressina	Pink	Large decline	Decline due to competitive exclusion by larger bryophytes, especially *Rhytidiadelphus loreus*
Lepidozia pearsonii	Red	Large decline	Decline due to competitive exclusion by larger bryophytes, especially *Rhytidiadelphus loreus*
Pseudomarsupidium decipiens	n/a	Large decline	Extinct due to competitive exclusion by larger bryophytes, especially *Rhytidiadelphus loreus*

Plot 12 – SH6445926654

Species	Marker colour	Trend since 2014	Comments
Sematophyllum demissum	Red	n/a	New colony and plot. Thinly scattered over 90 x 30 cm.

10. Data Archive Appendix

Data outputs associated with this project are archived on server–based storage at Natural Resources Wales.

The data archive contains:

[A] The final report in Microsoft Word and Adobe PDF formats.

The metadata for this project is held as record no NRW_DS161337.

Further copies of this report are available from library@cyfoethnaturiolcymru.gov.uk