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Wales

Lichen survey of Nannerth Woods



Andy Acton

Evidence Report No 621

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1. Crynodeb Gweithredol

Mae Ray Woods wedi ymweld ag ardaloedd o goetir yng nghoed Nannerth sawl gwaith rhwng 1977 a 2011. Mae Ray wedi cofnodi fflora cen nodedig gan gynnwys *Cresponea premnea* sef rhywogaeth Dan Beth Bygythiad ar Restr Goch Cymru a'r gymuned o gennau *Lobarion* sy'n dod o dan Adran 7 Deddf yr Amgylchedd (Cymru). Mae'r gymuned hon yn Nannerth yn cynnwys cofnodion ar gyfer *Pannaria conoplea* sydd Dan Beth Bygythiad yng Nghymru, a dwy rywogaeth sydd Dan Fygythiad ar Restr Goch Cymru: *Ricasolia (Lobaria) amplissima* a *Lobaria pulmonaria*. Gwelai Ray y goedwig fel "darn o goetir arbennig a hardd iawn" gyda "llawer o goed hynafol sy'n cefnogi dangosyddion coetir hynafol" a nododd mai "prin yw'r coedwigoedd ym Maesyfed sydd â lefel debyg o amrywiaeth". Yn seiliedig ar y data sydd ar gael, ystyriodd Cyfoeth Naturiol Cymru y byddai'r safle'n debygol o fod yn gymwys fel Safle o Ddiddordeb Gwyddonol Arbennig newydd a chomisiynodd waith arolygu pellach.

Mae'r prif gen sydd o ddiddordeb yn gysylltiedig â choed derw hynod ond mae rhagor o rywogaethau o ddiddordeb yn bresennol ar goed gwern, ynn a chyll. Mae'r diddordeb yn cynnwys rhywogaethau Cenedlaethol Anfynych, rhywogaethau mynegai 'dangosyddion hen goetiroedd' (Sanderson *et al.* 2018) coetiroedd Cefnforol Deheuol (**SOWI**) a Choedwigoedd Glaw Ucheldirol (**URI**) a nifer o rywogaethau sydd ar y rhestr goch naill ai yn y DU (Woods a Coppins 2012) a/neu Gymru (Woods, 2010).

Roedd y gymuned o hen dyfiant *Lobarion pulmonariae* o risgl tra-fasig yn bresennol, yn bennaf ar goed derw hen/hynod; er ei fod yn lleol iawn roedd yn cefnogi nifer o gennau nodedig. Roedd y gymuned o risgl asid cefnforol *Parmelietum laevigatae* yn bresennol ac wedi datblygu orau ar goed derw ac, yn fwy lleol, gwern. Er bod y ffurf ddeiliog ar y gymuned gyda *Hypotrachyna laevigata* yn brin ym 1998 (a heb ei weld yn 2021), roedd cymunedau cramennog oedd yn gysylltiedig â'r *Parmelietum* yn bresennol dros ardal helaeth ac wedi datblygu'n dda yn lleol gan gynnwys rhywogaethau nodedig.

Ymhlith y rhywogaethau nodedig hysbys ar y safle mae:

- **1 rhywogaeth ar Restr Goch y DU sy'n newydd i Gymru** (yr Alban yw'r unig lle arall lle mae'n hysbys): *Pachyphiale ophiospora*.
- **5 rhywogaeth ar y Rhestr Goch sydd Dan Fygythiad yng Nghymru:** *Lobaria pulmonaria*, *Normandina acroglypta*, *Ricasolia (Lobaria) amplissima*, *Scutula (Bacidia) circumspecta* a *Heterodermia obscurata* sy'n newydd i Sir Faesyfed.
- **10 rhywogaeth ar y Rhestr Goch sydd Dan Beth Bygythiad yng Nghymru:** *Bacidia biatorina*, *Biatora chrysantha*, *Catinaria atropurpurea*, *Cresponea premnea*, *Dimerella lutea*, *Mycobilimbia epixanthoides*, *Mycobilimbia pilularis*, *Pannaria conoplea*, *Parmeliella triptophylla* a *Thelotrema lepadinum*.
- 12 o rywogaethau **URI** (y trothwy ar gyfer statws SoDdGA yw 10 rhywogaeth).

- 18 o rywogaethau **SOWI** (y trothwy ar gyfer statws SoDdGA yw 20 rhywogaeth).

Mae'r sgôr URI ar gyfer y safle a'r nifer fawr o rywogaethau nodedig yn dangos bod y safle o bwysigrwydd cadwraeth ac yn gymwys i gael statws SoDdGA. Er bod y rhan fwyaf o'r rhywogaethau mwy nodedig yn brin iawn neu'n lleol, gyda rhai yn bresennol mewn un neu ddau leoliad yn unig neu hyd yn oed ar ambell goeden yn unig, mae rhywogaethau eraill sydd i'w cael mewn hen goetir (e.e. rhywogaethau **URI** cramennog) yn eithaf cyffredin.

Mae rhai rhywogaethau nodedig sy'n bresennol ar un neu ddwy goeden yn unig yn bresennol fel patshys mawr (e.e. *Cresponea premnea*, *Heterodermia obscurata*, *Parmeliella triptophylla*) felly er bod digwyddiadau stocastig fel gwyntoedd a all ddiwreiddio coed yn fygythiad ar hyn o bryd, dylent weithredu fel ffynonellau cytrefu rhagorol os cânt eu rheoli'n briodol a bod y gwaith rheoli'n yn sicrhau bod safleoedd derbyn addas gerllaw.

Mae'r ardaloedd y tu allan i waharddleoedd bellach wedi'u gorbori. Mae ardaloedd o fewn gwaharddleoedd wedi adfywio'n llwyddiannus ond nid ydynt bellach wedi'u pori'n ddigonol. Mae effaith negyddol llygredd nitrogen yn destun pryder. Rhoddir argymhellion priodol o ran mesurau rheoli i gynnal/gwella'r fflora cen.

2. Executive Summary

Areas of woodland at Nannerth woods have been visited by Ray Woods several times between 1977 and 2011. Ray has recorded a notable lichen flora including the Welsh Red-listed Near Threatened **NT** species *Cresponea premnea* and the Environment (Wales) Act Section 7 *Lobarion* lichen community. The latter community at Nannerth includes records for *Pannaria conoplea* Near Threatened **NT** in Wales, and two Welsh Red-Listed Vulnerable **VU** species: *Ricasolia (Lobaria) amplissima* and *Lobaria pulmonaria*. Ray regarded the wood as an “impressive and extremely beautiful piece of woodland” with “many ancient trees that support ancient woodland indicators” and noted that “few woods in Radnor can compare in diversity”. Based on the available data Natural Resources Wales considered the site would probably qualify as a new Site of Special Scientific Interest and commissioned further survey work.

The main lichen interest is associated with veteran oak trees but additional interest is present on alder, ash and hazel. The interest includes Nationally Scarce species, ‘old woodland indicator’ index species (Sanderson *et al.* 2018) of Southern Oceanic woodlands (**SOWI**) and Upland Rainforests (**URI**) and a number of species that Red-listed either in the UK (Woods & Coppins 2102) and/or Wales (Woods, 2010).

The old growth *Lobarion pulmonariae* community of more base rich bark was present, mostly on old/veteran oak; although very local it supported a number of notable lichens. The oceanic acid bark *Parmelietum laevigatae* community was present and best developed on oak and more locally alder. Although the leafy form of the community with *Hypotrachyna laevigata* was rare in 1998 (and not seen in 2021), crustose communities allied to the *Parmelietum* were widespread and locally well-developed including notable species.

Notable species known from the site include:

- **1 UK Red-Listed species new to Wales** (only otherwise known from Scotland): *Pachyphiale ophiospora*.
- **5 Red-Listed Vulnerable **VU** in Wales:** *Lobaria pulmonaria*, *Normandina acroglypta*, *Ricasolia (Lobaria) amplissima*, *Scutula (Bacidia) circumspecta* and *Heterodermia obscurata* new to Radnorshire.
- **10 Red-Listed Near Threatened **NT** in Wales:** *Bacidia biatorina*, *Biatora chrysantha*, *Catinaria atropurpurea*, *Cresponea premnea*, *Dimerella lutea*, *Mycobilimbia epixanthoides*, *Mycobilimbia pilularis*, *Pannaria conoplea*, *Parmeliella triptophylla* and *Thelotrema lepadinum*.
- 12 **URI** species (the threshold for SSSI status is 10 species).
- 18 **SOWI** species (the threshold for SSSI status is 20 species).

The URI score for the site and the large number of notable species indicates the site is of conservation importance and qualifies for SSSI status. Although most of the more notable species are very rare or localised with some only occurring at one or two locations or even on only on a few trees, other old woodland species (e.g. crustose **URI** species) are quite widespread.

Some notable species that are present on only one or two trees occur as large patches (e.g. *Cresponea premnea*, *Heterodermia obscurata*, *Parmeliella triptophylla*) so although currently threatened by stochastic events such as windthrow, should act as excellent colonisation sources if they are managed appropriately and management ensures suitable receptor sites are nearby.

The areas outwith exclosures are now overgrazed. Areas within exclosures have successfully regenerated but are now undergrazed. The negative impact of nitrogen pollution is a cause for concern. Appropriate management recommendations are given to maintain/enhance the lichen flora.

3. Introduction

Areas of woodland at Nannerth woods have been visited by Ray Woods several times between 1977 and 2011. Ray has recorded a notable lichen flora including the Welsh Red-listed Near Threatened **NT** species *Cresponea premnea* and the Section 42 *Lobarion* lichen community. The latter community at Nannerth includes records for *Pannaria conoplea* Near Threatened **NT** in Wales, and two Welsh Red-Listed Vulnerable **VU** species: *Ricasolia amplissima* and *Lobaria pulmonaria*. Ray regarded the wood as an “impressive and extremely beautiful piece of woodland” with “many ancient trees that support ancient woodland indicators” and noted that “few woods in Radnor can compare in diversity” (see Appendix 11.1).

Based on the available data NRW considered the site would probably qualify as a new Site of Special Scientific Interest. NRW commissioned 3 days lichen survey of the polygons outlined in red in Figure 1, to determine if the site does qualify.



Figure 1: Nannerth Woods.

4. Aims and Objectives

The aims and objectives of the study were to:

- Record Nationally Scarce, Nationally Rare and 'old woodland indicator' index species (Sanderson *et al.* 2018) and species that are Red-listed either in the UK (Woods & Coppins 2102) and/or Wales (Woods, 2010).
- Discuss the notable species recorded.
- Generate maps of the best trees for lichens.
- Combine 2021 survey data with older records, to produce a site dossier that includes records of all notable lichens.
- Discuss findings.

5. Methods

5.1 Field survey

The fieldwork took the form of a walkover survey of the study site over 3 days (17th-19th November 2021) The survey visited Coed Nannerth-fawr and Nannerth Fawr including some sections along the west side of the river. Access permissions had not been secured for the separate block of Nannethffrwd and so this was not visited. Permissions were secured for the narrow strip of woodland along the eastern side of the river (e.g. around Bwlch-gwyn-isaf) but unfortunately this was not visited due to time constraints.

Potential lichen habitats within the areas visited were searched for lichens, lichenicolous fungi and non-lichenized micro-fungi traditionally recorded by lichenologists. Survey effort concentrated on those microhabitats likely to support well-developed lichen communities and/or notable species.

Species lists were compiled and target notes recorded for features/species of particular interest such as Nationally Rare/Scarce, Red-Listed or otherwise notable species. Target notes were sometimes used to make a note on other features of interest. Locations were recorded using a handheld Garmin eTrex H Global Positioning System (GPS). Samples were collected of species not readily identifiable in the field using a x14 hand lens, for subsequent identification in the laboratory. As small a sample as possible was collected using hammer and chisel or knife, as appropriate.

Samples collected in the field were identified in the laboratory using the standard literature (Smith *et al.*, 2009 *et seq.*; and various keys in the published and unpublished literature), compound/binocular microscopes, and chemical analysis. Field records and identifications from laboratory work were collated. All records will be submitted to the British Lichen Society (BLS) and be subsequently available through the National Biodiversity Network (<http://data.nbn.org.uk/>).

5.2 Desk study

A list of all notable species recorded was compiled based of the results of the fieldwork plus the data available on NBN. Some additional lichen records not on NBN were taken from an annotated sketch map after visits by Ray Woods and David Hargreaves in 1987/1992 (see Appendix 11.1).

6. Site account

6.1 Main lichen habitats and lichen communities

The main lichen interest in many areas was associated with old/veteran oak trees but more locally there was high interest on ash, alder and hazel.

The old growth *Lobarion pulmonariae* community of more base rich bark was very local but included records for *Lobaria pulmonaria*, *Mycobilimbia epixanthoides*, *Mycobilimbia pilularis*, *Parmeliella triptophylla* and *Peltigera horizontalis*. *Pannaria conoplea* and *Ricasolia amplissima* are known from the site but were not seen in 2021. A 'proto-*Lobarion* was recorded where bark conditions are not quite so acidic (e.g. with *Catinaria atropurpurea*, *Normandina pulchella*, *Lopadium disciforme*) perhaps indicating conditions might be becoming more suitable for colonisation by leafy *Lobarion* species (provided pollution levels are not limiting). However, colonisation sources are very local so whether this will happen naturally is unknown; optimising nearby site conditions to maximise chances for colonisation is recommended.

The *Lecanactidetum premneae* community (a community of the rough dry of ancient oaks) was recorded on a couple of veteran oaks along the river.

The oceanic acid bark *Parmelietum laevigatae* community was scarcer than would be expected given the abundance of apparently suitable habitat throughout the site (mainly oak but also old/veteran birch and more locally alder). The community was generally poorly developed and on most trees where it was seen was not particularly diverse being generally limited to only those less specialist members of the community that appear to more readily colonise suitable habitat; these include *Megalania pulverea* and *Trapelia corticola* which were both fairly frequent in suitable habitat. Species such as *Ochrolechia tartarea* and *Sphaerophorus globosus* were seen a few times but no *H. laevigata* was recorded in 2021 (it was recorded by Ray Woods in 1992). Crustose upland rainforest species in communities allied to the *Parmelietum* did however include records for *Biatora chrysantha* (on oak and alder) and where conditions were less acidic *Dimerella lutea* (on oak) and *Lopadium disciforme* (on oak, and rarely ash). Several veteran oaks also supported *Micareea doliiformis*.

The deadwood niches associated with veteran trees were locally frequent but despite the apparent suitability of the deadwood habitat the lichen interest recorded was not exceptional. However, deadwood niches are difficult to survey and more detailed, targeted survey of deadwood niches could find additional interest.

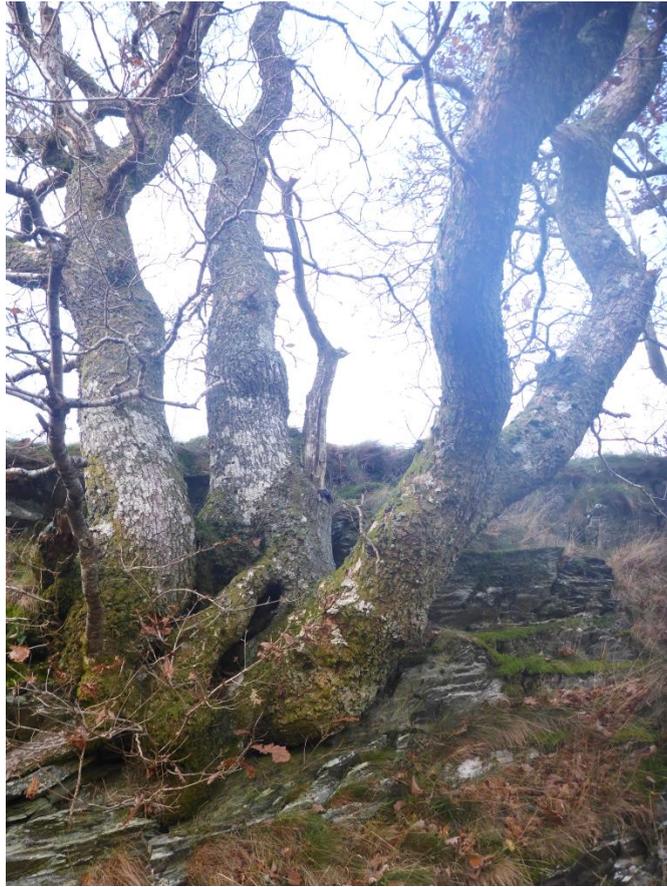


Figure 2: veteran multi-stemmed oak on small outcrop at TN5 with *Micarea doliiformis*.



Figure 3: veteran pasture oak (target note TN35). Species included *Thelotrema lepadinum* Red-Listed **NT** in Wales but also some nitrophytes on the twigs (*Physcia tenella*, *Xanthoria parietina*).



Figure 4: old hazel with *Normandina pulchella* and *N. acroglypta* (the latter Red-listed **VU** in Wales, target note TN23). Hazel adds diversity to the site. Most hazels currently support low lichen interest but locally hazel did support some additional notable species including *Thelotrema lepadinum* (Red-Listed **NT** in Wales, TN 19) and *Heterodermia obscurata* (Red-listed **VU** in Wales, TN 39).



Figure 5: Impressive deadwood habitat. This dead standing oak (at TN4) supported *Micarea doliiformis* on loose dead bark and although this species is likely to be lost at this location as the decay continues, the flora on the bare lignum might be colonised by deadwood specialists provided the tree remains standing.

6.2 Notable lichens

A list of notable lichens at Nannerth is given in Appendix 11.2. The more notable species are summarised below. UK conservation value is listed in bold black text.

Notable **URI** *Parmelietum* species on oak include:

<i>Biatora chrysantha</i>	URI	NS	NT in Wales
<i>Bryobilimbia sanguineoatra</i>	URI	NS	
<i>Lopadium disciforme</i>	URI		
<i>Micarea doliiformis</i>	URI	NS	

Additional species on patches of more basic bark of veteran trees include:

<i>Bacidia biatorina</i>	SOWI		NT in Wales
<i>Catinaria atropurpurea</i>	SOWI		NT in Wales
<i>Dimerella lutea</i>			NT in Wales
<i>Lobaria pulmonaria</i>	SOWI		VU in Wales
<i>Mycobilimbia epixanthoides</i>	SOWI		NT in Wales
<i>Mycobilimbia pilularis</i>	SOWI		NT in Wales
<i>Pachyphiale ophiospora</i>		NR	New to Wales
<i>Parmeliella triptophylla</i>	SOWI		NT in Wales
<i>Pannaria conoplea</i> ¹	SOWI		NT in Wales
<i>Ricasolia amplissima</i> ¹	SOWI		VU in Wales
<i>Scutula circumspecta</i> ²		VU NS	VU in Wales

Additional species of rough bark of veteran oaks included:

<i>Cresponea premnea</i>	SOWI		NT in Wales
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The small branches and old twigs of a veteran oak supported

<i>Usnea florida</i>	SOWI	NT	Least Concern in Wales
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Smooth patches of bark on oak and the smooth stems of some hazels support:

<i>Thelotrema lepadinum</i>	SOWI		NT in Wales
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Other lichen interest associated with hazel included:

<i>Heterodermia obscurata</i>	SOWI	NT NS	VU in Wales
<i>Normandina acroglypta</i>			VU in Wales

¹ *Lobarion* species previously recorded from the site by Ray Woods that were searched for but could not be found in 2021. *R. amplissima* appears to now be extinct at the site. *P. conoplea* might also be extinct but further survey work for this species is recommended.

² Species recorded by Ray Woods 1988. Current status unknown.

7. Notes on the lichens

7.1 Notes on some the more notable lichens

Each of the more notable species is discussed briefly below. Target Note locations (TNs) are shown on the map in section 7.2. Full details of all target notes are given in Appendix 11.3.

Bacidia biatorina

SOWI NS

NT in Wales

Recorded on 5 oaks near the river (TN60, 64, 67, 68, 69). The lack of browsing is posing a serious threat to this species (see TNs).

Biatora chrysantha

URI NS

NT in Wales

Recorded on 3 old alders and an oak (TN10, 29, 58). Small poorly developed thalli of this sterile green crust would be easily overlooked.

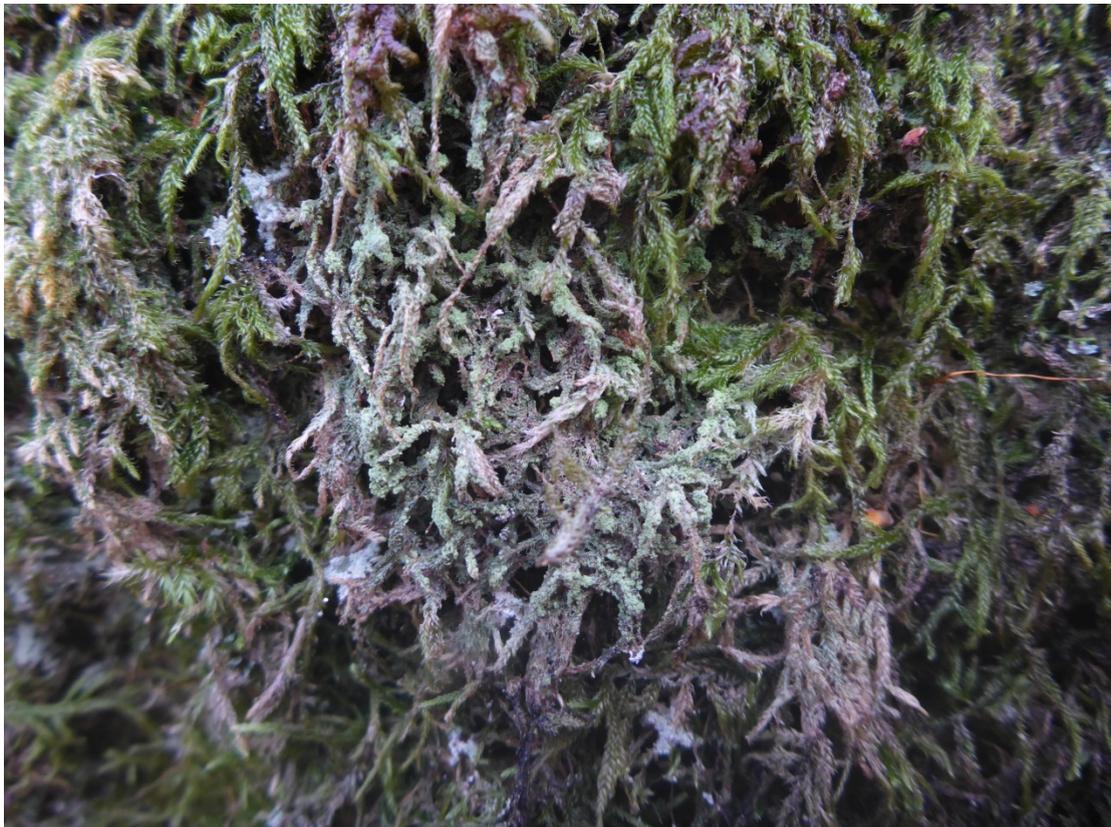


Figure 6: The greenish crust of *Biatora chrysantha* (TN58).

Bryobilimbia sanguineoatra

URI NS

Recorded on 2 oaks (TNs 54, 57).



Figure 7: The greenish crust of *Bryobilimbia sanguineoatra* with black fruits.

Catinaria atropurpurea

SOWI

NT in Wales

Recorded on 1 oak in 2021 (at TN34). Previously recorded in on an oak with *Cresponea premnea* (TN38, see Appendix 11.1) but this species could have easily been overlooked in 2021).

Cresponea premnea

SOWI

NT in Wales

Recorded on 2 veteran riparian oaks (TN38, 56). At TN38 Rhododendron is present adjacent to the trunk. *C. premnea* is abundant and the shock of removal might impact the population (though perhaps not as this species can usually tolerate exposure). Certainly the Rhody bush should as a minimum be monitored and cut back as necessary to prevent it touching/smothering the trunk. If this cannot be done or if Rhody starts to regenerate in the vicinity, then eradication is recommended.



Figure 8: Rhododendron poses a potential threat to *Cresponea premnea* (NT in Wales) on a veteran oak along the river at TN38.



Figure 9: The fruits of *Cresponea premnea* NT in Wales.

Dimerella lutea

NT in Wales

Recorded on one oak (TN30).



Figure 10: The thin greenish-greyish crust of *Dimerella lutea* 'apricot' fruits **NT** in Wales.

Heterodermia obscurata

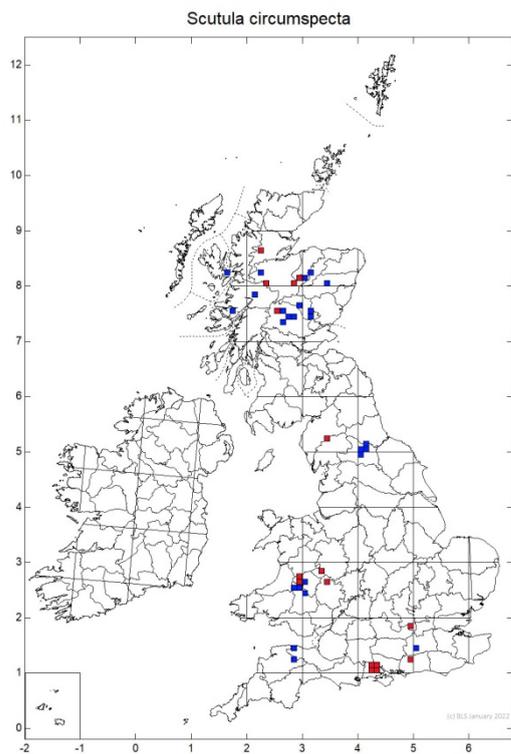
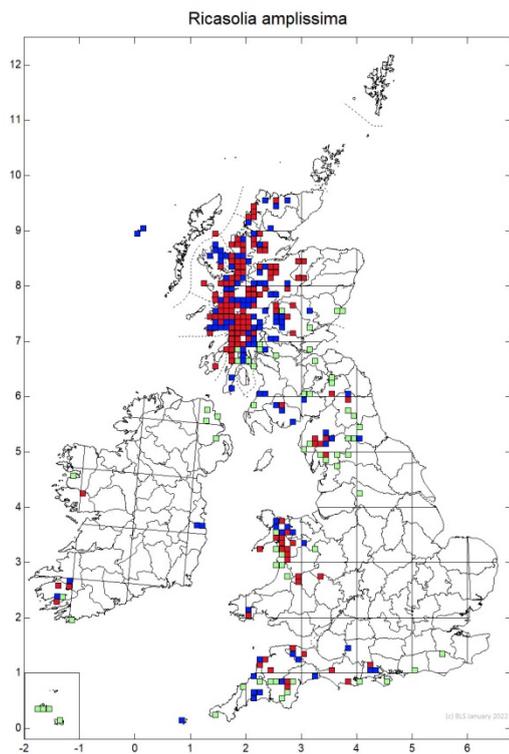
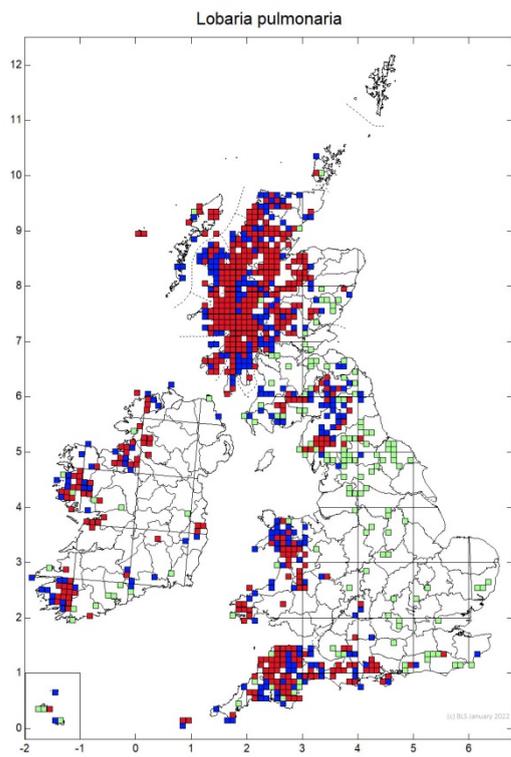
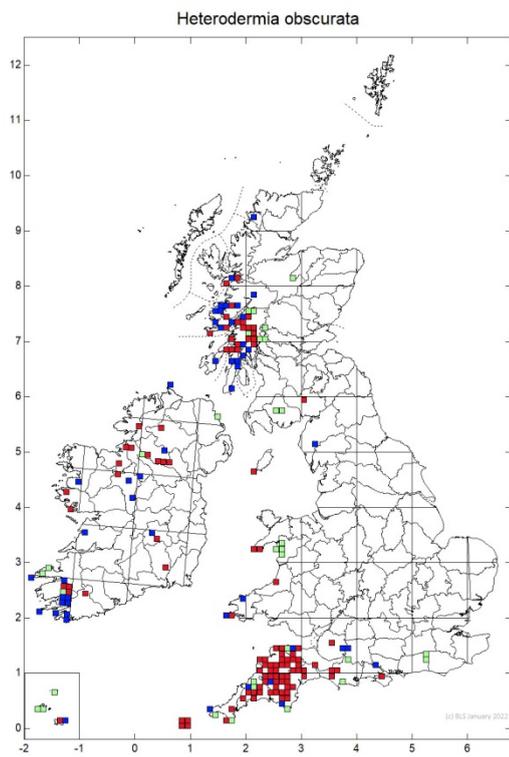
SOWI NT NS

VU in Wales

A large healthy patch recorded on one hazel (TN39). Recorded as new to Radnorshire (VC 43) and in Wales only otherwise known from near the coast (Figure 12). The hazel (as well as others in the area) is over browsed and could do with a few basal shoots establishing, but browsing exclusion is not recommended. Temporary reduction in browsing in the area would be appropriate.



Figure 11: *Heterodermia obscurata* **VU** in Wales on mossy Hazel.



Key to map date classes

- 2000+
- 1960 - 1999
- 1650 - 1959

Figure 12: Distribution maps of some of the most notable species recorded in 2021.

Lobaria pulmonaria

SOWI

VU in Wales

Recorded on one oak (TN70) where *Prunus spinosa* scrub poses a serious threat. Ray Woods has in the past recorded another tree with this species in the vicinity of TNS 41, 43, 44. Several trees here were examined but no *L. pulmonaria* was seen (though it might have been overlooked as the light was poor). In the vicinity of TNS 41-44 excessive establishing tree regeneration poses a threat to the lichen flora (refer to TNS).



Figure 13: Oak tree with *Lobaria pulmonaria* associated with damper seepages at a fork in the trunk.

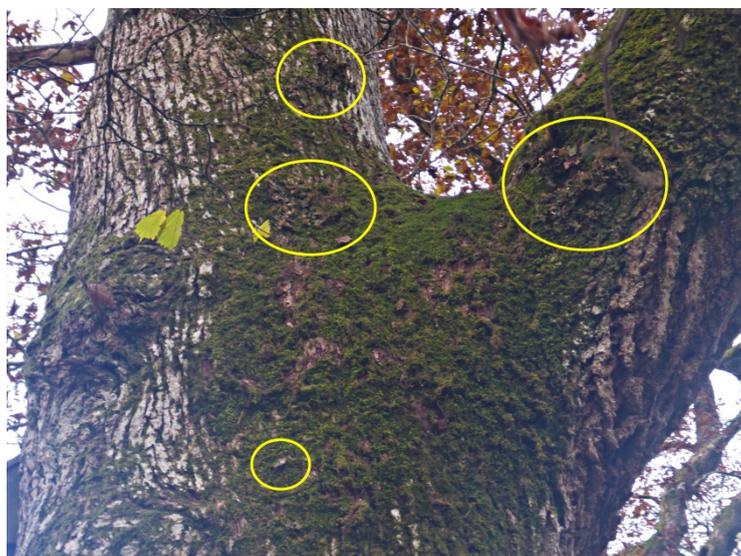


Figure 14: Closer view of the fork with *Lobaria pulmonaria*.

Lopadium disciforme

URI

On 8 oaks (TNs 10, 12, 14, 45, 57, 59, 60, 61, 67) and one ash tree (TN59).

Micarea doliiformis

URI NS

On 6 oaks (TNs 2, 5, 11, 20, 40, 56) and a dead standing oak (TN4). It will probably be lost from the latter dead tree soon (see Figure 5).

Mycobilimbia epixanthoides

SOWI

NT in Wales

Well-developed patches on one oak at TN68. Smaller thalli of this species can be very easily overlooked.



Figure 15: Large patches of *Mycobilimbia epixanthoides* occurring as a sterile greenish crust overgrowing bryophytes at the base of an oak near the river (TN68).

Mycobilimbia pilularis

SOWI

NT in Wales

Recorded fertile on one oak TN67; a green crust on a nearby tree (TN65) is probably also referable to *M. pilularis* but it was not fertile. At both locations under-browsing is posing a serious threat.



Figure 16: The lumpy greenish crust of *Mycobilimbia pilularis* with pale brownish convex fruits (TN67).

Normandina acroglypta

NT in Wales

Recorded fertile on a hazel at TN23.

Pachyphiale ophiospora

NR

new to Wales

A single fruit found on a sample collected from an oak (TN13), confirmed by Brian Coppins as a new species for Wales.

Pannaria conoplea

SOWI

NT in Wales

Not recorded 2021. Recorded by Ray woods in the vicinity of TN69 but not seen in 2021. Current status unknown but further searching would be worthwhile. At this location under-browsing is posing a threat to the lichen flora.

Parmeliella triptophylla

SOWI

NT in Wales

Abundant on one oak near the river (TN64, Figures 17, 18). Under-browsing is posing a threat.

Peltigera horizontalis

SOWI

Recorded on one oak (TN67).

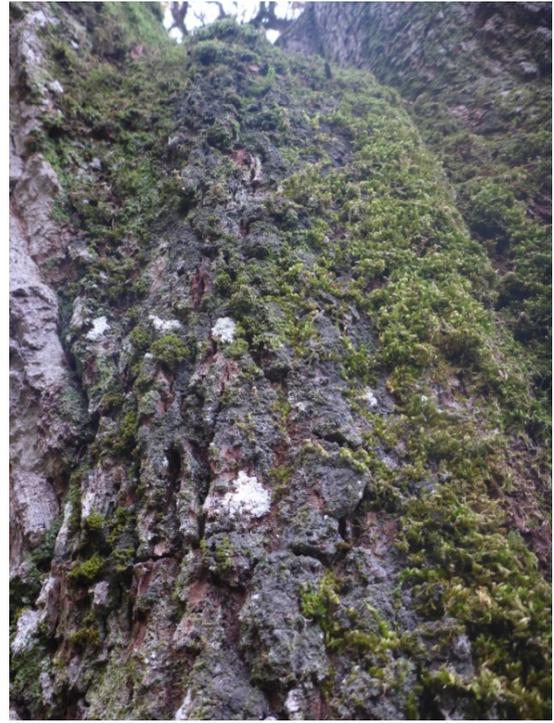


Figure 17 (left): A large streak of abundant *Parmeliella triptophylla* at TN64 (visible as a large dark grey streak running up the middle of the west face of the trunk).

Figure 18 (right): TN64 - closer view of a section of another large streak of *Parmeliella triptophylla* on the south face of the trunk facing the river.

Ricasolia (Lobaria) amplissima **SOWI** **VU** in Wales

This species could not be found in 2021 and might now be extinct at the site. Despite several apparent locations on the NBN, it has previously been recorded on only one oak at the site (Ray Woods, pers. comm) - a veteran oak at TN28. Note *R. amplissima* is marked on the map in Appendix 11.1 - the oaks at this location (in the vicinity of TN46) were searched in 2021 as candidates for the *R. amplissima* tree shown on the map before the TN28 location was confirmed (see notes for TN46).

- Ray first recorded it as new to Powys noting ‘One large colony on ancient oak first found in 1977. Noted again in 1987, 1988 and 1989 but whole colony lost for unknown reasonsby 2005’. See Ray’s map in Appendix 11.1.
- Ray observed ‘no natural recolonisation by 2009 so translocated from Ochr Cefn. A few transplants slowly growing in 2011’.
- A tiny fragment of *R. amplissima* was found on an old stag oak at TN28 in 2020; the fragment had clearly been translocated to the tree by Ray Woods (pers. comm. Catherine Blower, NRW).
- In 2021 traces of netting were found on the oak (Figures 19, 20) but no trace of *R. amplissima* could be seen.

The oak at TN28 should be periodically re-examined to check if *R. amplissima* recovers.



Figure 19 (left): the stag headed oak at TN26:

Figure 20 (right): The location of the translocation site (TN26).



Figure 21: Closer view of translocation site with netting (TN26).

Scutula circumspecta (syn. *Bacidia circumspecta*) **SOWI** **NS VU** **VU** in Wales
Recorded in 1988 by Ray Woods near the river at SN948714. Not recorded 2021 but easily overlooked.

Thelotrema lepadinum **SOWI** **NT** in Wales
Recorded on 7 oaks (TNs 3, 35, 38, 56, 62, 65, 68) and 2 hazels (TNs 19, 39). The species is absent from many of the oaks and hazels that appear to otherwise currently provide lots of suitable habitat for this species. In some areas there appears to have been some break in ecological continuity for this species. This break presumably relates to past woodland management. Possible reasons might include a decline in abundance of smooth bark habitat due to scarcity/localised absence of smooth hazel stems as a result of long term grazing, or of coppicing. It would be interesting to set up plots to monitor any long term recovery of this species. Further exploration is likely to find this species on additional trees/shrubs for example the stock enclosure between TN13 and TN42 was only examined relatively briefly and could be a key area for this (and other) lichen species.



Figure 22: The Barnacle lichen *Thelotrema lepadinum*.

Usnea florida **NT in UK** but Least Concern (LC) in Wales
Noted on a couple of oaks but not systematically recorded, and likely to be on more.

7.2 Target Note locations

The locations of the target notes including notable species discussed in section 7.1 are shown in Figure 23. Full details are given in the Appendices. Some areas were examined only briefly due to time constraints and some areas remain unexplored. In addition to new locations for recorded species, further survey work could find additional species new to the site.

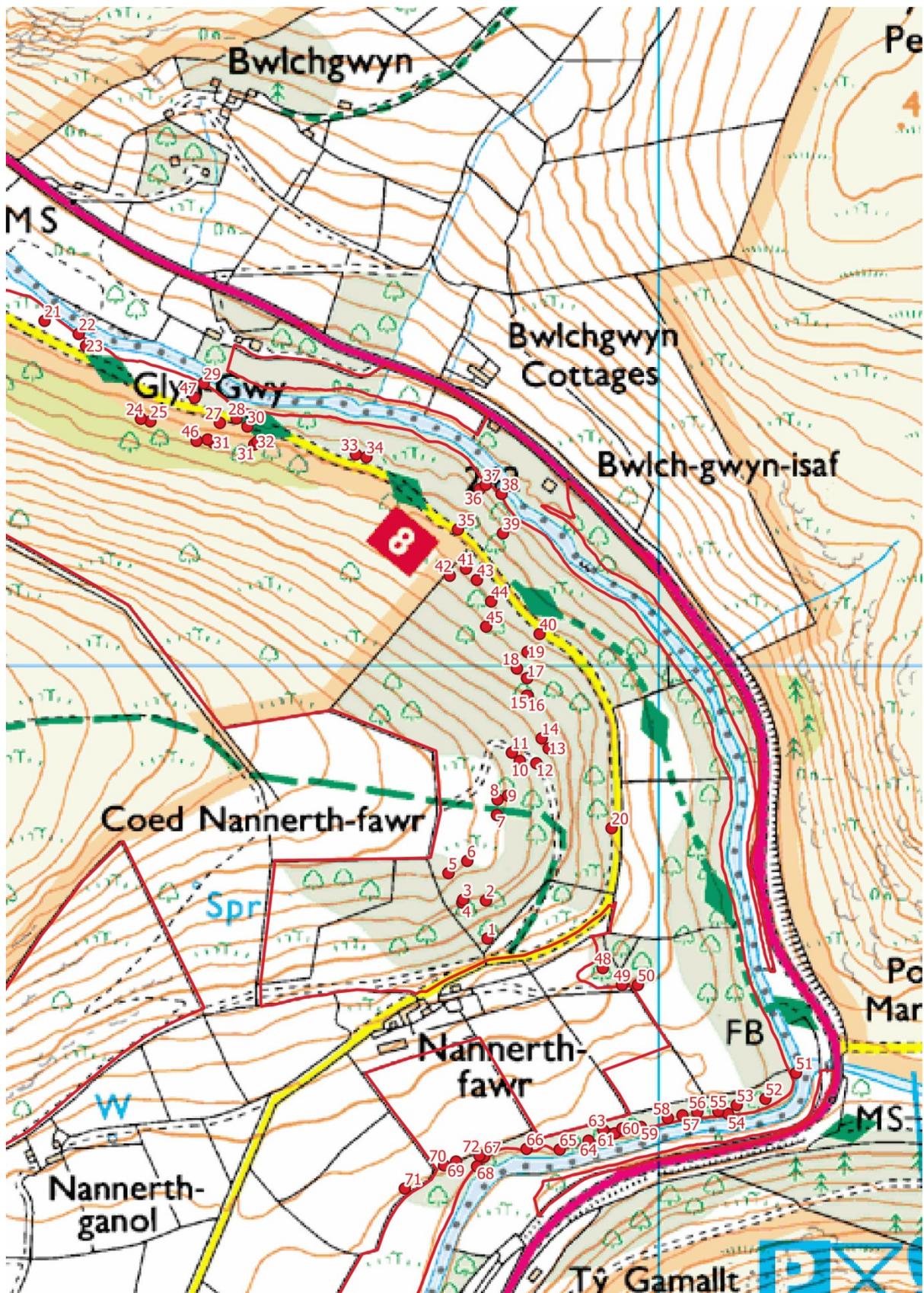


Figure 23: Target note locations.

8. Evaluation

Woodland habitats for lichens can be assessed on the basis of notable assemblages of species as well as the presence of particularly notable species (e.g. Red-Listed species). Various indices have been developed to assess woodlands (e.g. Coppins & Coppins 2002 who developed the indices of Francis Rose). The woodland habitats for lichens can be assessed against the SSSI criteria using three indices: the Upland Rainforest Index (**URI**), the Southern Oceanic Woodland Index (**SOWI**) and the Pinhead index (Sanderson *et al.*, 2018).

8.1 Upland Rainforest Index (URI) score

Twelve URI species have been recorded (Table 1). Note two of these species were not recorded in 2021 and are marked with a * in Table 1: *Hypotrachyna laevigata* and *Mycoblastus sanguinarius f. sanguinarius*. An additional notable species recorded in this community in 2021 is *Biatora chrysantha* (regarded as 'Bonus' species for oceanic woods by Coppins & Coppins, 2002). The threshold for SSSI quality is 10 in this area of Britain (Sanderson *et al.* 2018).

Table 1: Upland Rainforest Index (URI) species; all were recorded in 2021 except those marked *.

Scientific name
<i>Bryobilimbia sanguineoatra</i>
<i>Heterodermia obscurata</i>
<i>Hypotrachyna laevigata*</i>
<i>Lepraria membranacea</i>
<i>Lopadium disciforme</i>
<i>Megalaria pulverea</i>
<i>Micarea doliiformis</i>
<i>Mycoblastus caesius</i>
<i>Mycoblastus sanguinarius f. sanguinarius*</i>
<i>Ochrolechia tartarea</i>
<i>Sphaerophorus globosus</i>
<i>Trapelia corticola</i>

8.2 Southern Oceanic Woodland Index (SOWI) score

Seventeen SOWI species have been recorded (Table 2). Note two of these species have not been recorded recently and at least one could now be extinct at the site (*Ricasolia amplissima* and possibly *Pannaria conoplea*); these are marked * in Table 2. The threshold for SSSI quality is 20 in this area of Britain (Sanderson *et al.* 2018). Additional notable species recorded in 2021 that indicate high quality habitats and were regarded as 'Bonus' species for oceanic woods by Coppins & Coppins (2002) include *Biatora chrysantha*.

Table 2: Southern Oceanic Woodland Index (SOWI) species; all were recorded in 2021 except those marked *.

Species
<i>Anisomeridium ranunculosporum</i>
<i>Bacidia biatorina</i>
<i>Catinaria atropurpurea</i>
<i>Chaenotheca brunneola</i>
<i>Cladonia caespiticia</i>
<i>Heterodermia obscurata</i>
<i>Lecanora jamesii</i>
<i>Lobaria pulmonaria</i>
<i>Mycobilimbia epixanthoides</i>
<i>Mycobilimbia pilularis</i>
<i>Pannaria conoplea*</i>
<i>Parmeliella triptophylla</i>
<i>Peltigera horizontalis</i>
<i>Pertusaria multipuncta</i>
<i>Ricasolia amplissima*</i>
<i>Thelotrema lepadinum</i>
<i>Usnea florida</i>

8.3 Pinhead Index

The Pinhead community (*Calicetum hyperelli* and *C. abietinum*) is a specialist community of bark and lignum niches sheltered from direct rainfall with the fruiting bodies (the ‘pinhead’) raised on a tiny stalks (the ‘pins’). Typical niches are areas of lignum in the rain shadow of upper limbs, on the underside of decorticate limbs, on the rain-sheltered side of a leaning dead standing tree trunk, sheltered crevices in very rough gnarly bark, and hollows in veteran trees. The Pinhead Index is used to assess the quality of these specialist lichen niches at a site. Five ‘pinhead’ species have been recorded (Table 3). The threshold for SSSI quality is 10 pinhead species (Sanderson *et al.* 2018).

Table 3: Pinhead lichens.

Species
<i>Calicium glaucellum</i>
<i>Calicium salicinum</i>
<i>Calicium viride</i>
<i>Chaenotheca brunneola</i>
<i>Chaenotheca ferruginea</i>

8.4 Overall evaluation

The **URI Index** scores clearly indicates the site is of SSSI quality. The occurrence of eighteen **SOWI** species (just below the SSSI threshold) and a large number of

notable species also supports the high quality of the site. The latter includes 1 Nationally Rare species *Pachyphiale ophiospora* that is new to Wales, 10 species that are Near Threatened **NT** in Wales and 5 species that are Vulnerable **VU** in Wales. The presence of *Heterodermia obscurata* **VU** in Wales is especially notable in a regional context.

9. Discussion

9.1 History and historical threats

The woodlands visited in 2021 are shown as broadleaved woodlands on the 1888 Six-inch map (survey date 1887). Many areas have noticeable canopy gaps and these areas were presumably largely managed for sheltered grazing, but locally some areas may have had periods of more intensive woodland management.

For example the oak dominated stands immediately upslope of the building at Nannerth Fawr appear to be have been managed more intensively at some point in the past. The lower slopes here are dominated by rather even aged but well-spaced mature/postmature oak, though there are scattered trees that appear to be older and with a more open grown form (veteran pasture trees). The relatively well-spaced nature might indicate management thinning for timber at some point, and the stands here could even be of planted origin. There are also some multi-stemmed veterans on outcrops which were perhaps formerly coppiced.

Moving further upslope and further north, the number of pasture style trees increases in abundance and the woodland structure has the appearance of one that has largely arisen under a wood pasture regime. Further north from the buildings oak is still abundant but not so dominant there is scattered veteran birch. and also more of an understorey including some good stands of old hazel.

Further north the scattered veteran pasture trees have become infilled at some point with stands of mature birch. To the north of the site there are also stands of alder on alluvial flats near the river.

9.2 Recent and current threats

Ray Woods pointed out that the woods were heavily grazed and some areas in need of regeneration in 1988. Today significant areas have been fenced and successfully regenerated. Other areas remain heavily grazed. Some of these heavily grazed areas have had some level of birch infill in the past and there is no urgency for regeneration, whereas others would benefit from reduction in browsing (see section 9.4).

9.3 Pollution

The *Lobarion* community is very sensitive to SO₂ pollution and, although some forms of woodland management such as tree felling will have removed the *Lobarion* lichen habitat directly and led to declines, its apparent absence from the study site on veteran oaks (often a key habitat for the *Lobarion* where conditions are suitable) probably at least partly relates to past acid rain effects.

Currently the main pollution effect is from ammonia. There was widespread evidence of nutrient enrichment on small branches/twigs of oak and hawthorn as well as hazel

and ash (e.g. TNs 1, 7, 8, 13, 15, 21, 22, 24, 25, 32, 33,35, 36, 50, 55, 72). Species recorded included: *Physcia aipolia*, *P. tenella*, *Caloplaca citrina* agg. and *Xanthoria parietina*. Although patches of nitrophytes were fairly frequent and easy to find, nitrophytes were not abundant and no obvious yellowing of branches (due to abundant *Xanthoria*) was observed from a distance. There was also no evidence of nitrogen enrichment on oak trunks.

Nitrogen sensitive spp. remain dominant with *Usnea subfloridana* and *Evernia prunastri* remaining common on branches and *Parmelia* spp, *Hypogymnia* and *Ochrolechia androgyna* were frequent to abundant throughout.

The *Parmelietum laevigatae* is a community of acidic bark and is very vulnerable to ammonia pollution. The relative scarcity at Nannerth of some species that prefer highly acidic or leached bark might also be due partly to nitrogen pollution for example *Ochrolechia tartarea* and *Sphaerophorus globosus* were seen a few times and no *H. laevigata* was recorded. The absence of the latter might partially relate to intensity of woodland management history rather than just be a result of increased nitrogen (see above). *Parmelia*. spp. were noticeably abundant and this probably relates to a combination of factors including woodland management (see above) as well as its greater tolerance of any increase nitrogen (compared with say, more N-sensitive old growth *Parmelietum* and *Lobarion* species).

Minimising use of fertilisers (organic or inorganic) in the general area is recommended for this and other sites near ancient woodland. Good practice should include giving a wide berth to woodland edges when applying fertilisers, and taking into consideration wind speed/direction. Any application of fertiliser during tree planting schemes should be strongly discouraged.

9.4 Grazing, regeneration, infill and woodland structure

High epiphytic lichen interest is strongly associated with woodland features that arise under a regime of browsing - and maintenance of high lichen interest in woodlands is dependent on grazing. With heavy browsing a rich lichen flora can persist for long periods and in the absence of other factors (such as intensive woodland management and pollution) decline in the lichen flora is gradual, occurring over relatively long timescales (being largely driven by cumulative loss of veterans over time due to natural death). In contrast, without sufficient browsing the lichen flora can decline very quickly (within 5-20 years if browsing is very low/excluded); this is largely due to increased shade on lower trunks (e.g. due to tree regeneration, ivy).

Since Ray's observation in 1988 that much of the Nannerth woods was not regenerating, some areas at Nannerth have been stock fenced to regenerate the woods and there has been supplementary planting. This has led to widespread regeneration phase areas, with pole and sapling stage trees.

The oak-dominated areas at just upslope and just north of the buildings at Nannerth, and some of the areas of oak-dominated woods along the river, have poor structural and compositional diversity. Both would benefit from some very low density recruitment/planting to increase variety of shrubs and provide a greater range of substrates and microclimatic niches for lichens e.g. more base rich bark, and more

sheltered/humid patches. For example diversifying with birch, willow, rowan, hazel and holly is desirable. However this is probably not urgent as other areas of the site have undergone successful regeneration (e.g. further upslope of the Nannerth buildings the bracken patches have abundant established saplings (Figure 24)); this includes much birch but also rowan, oak, hazel and aspen. Trees have generally not been planted too close to veterans here, and some glades remain unplanted, so on balance excessive shade should hopefully not pose a threat to lichens. Although some dense stands of young trees are fine, some thinning of some of the stands of the dense young birch would be good at some point. The aim should be to ensure a good amount of trees throughout the area establish and mature in relatively well-lit conditions/in or at the edges of more or less permanent glades, so they can be colonised by more light demanding species and develop more open grown forms (section 9.5).



Figure 24: Successful regeneration and planting in bracken areas along the top of the woodland edge.

A stock fenced area between c. target note TN13 and TN42 has a much more diverse composition of old/veteran trees including abundant old hazel and occasional veteran birch and old rowan as well as veteran oak. The regeneration of the woodland in the stock fences is impressive with basal regeneration of hazel stools as well as saplings poles of a good range of tree/shrub species (both naturally regenerated and planted/protected). However, enough has now established and control of further regeneration is recommended.

Reintroduction of stock would be good with careful monitoring of impacts. Some losses /thinning of regeneration (via browsing/bark stripping) should be accepted

(and in some areas the thinning would be welcome) but careful stock control might be needed to limit damage and ensure some of the more palatable species are not thinned too much. Appropriate browsing should hopefully minimise the need for manual interventions if done soon enough.

Halo thinning of regeneration is recommended around some of the veterans. Refer to target notes for details but examples where intervention is needed include:

- Control of *Prunus* scrub and tree seedling/sapling regeneration to protect the *Lobaria* community near the river (TNs60-71, note the regeneration is often not clearly visible in the TN photos).
- Halo thinning around veteran pasture oaks in the stock fenced area at Coed Nannerth-fawr. The target notes give some examples (TNs 41-45) but further survey would undoubtedly find many other veterans where halo thinning is desirable.

Temporary reduction in browsing is desirable in some areas outwith exclosures for example to allow some new basal regeneration to establish on some of the hazels (e.g. in the north of the site c. TN 23, 39). Any grazing regime should take into account that very dense flushes of basal regeneration are generally less desirable for the lichen interest on old hazel.



Figure 25: Thicket regeneration of *Prunus spinosa* adjacent to an oak with *Lobaria pulmonaria* (TN 70). Note the pole stage regeneration around veteran pasture trees at Dol y mynach (target note TN41).



Figure 26: Lower trunk of an oak with *Bacidia biatorina* (Welsh Red-listed **VU**, TN 69) is now heavily shaded by *Prunus spinosa* and young hazel stems. *Prunus* should be removed and hazel stems thinned (see TN69 details). This is in the vicinity of a 1987/1988 record for *Pannaria conoplea* (Red-Listed **NT** in Wales).



Figure 27: Heavy browsing suppressing basal regeneration of hazel outwith the exclosures (target note TN39).

9.5 Future veterans

Halo thinning around existing veterans and using appropriate browsing to control excessive regeneration should be the priority, but the development of potential future lichen habitat is also important. Encouraging the development of future veteran habitat with diverse range of microhabitat conditions/lichen niches is the key.

Restructuring some areas will increase diversity by creating glades/gladed conditions, appropriate browsing levels will allow some low level regeneration but maintain diversity by prevent infill of all glades with dense regeneration, and preventing long term succession to even-structured, dense canopy high forest.

In addition to halo thinning around the veterans, halo thinning saplings/poles around selected young maturing/mature trees could be undertaken to promote the development of future veterans with a diverse range of lichen niches. In the north of the site there has been a flush of regeneration presumably at some point in the 20th Century with fairly dense stands of mature birch (e.g. area with TNs 25, 26, 27) now well established in an area that appears to have been formerly much more open with scattered veteran pasture trees. Some of these stands would benefit from thinning including thinning mature birch around any open grown veterans that predate the birch, but also thinning around potential 'future veterans' (e.g. Figure 28).

Trees selected for management as 'future veterans' should not be limited to oak. Although the more notable species were recorded on veteran oak, birch is important for the *Parmelietum* community. Veteran birch is an important, largely missing component of the oak dominated woods and development of future veteran birch (as well as veterans of other species such as rowan, hazel and holly) should be promoted.

The trees should be selected on the basis of current form. For example specimens with more interesting form such as low split trunks, multi-stemmed trunks, leaning trunks, large low limbs, will provide more niches than trees with tall straight trunks with no lower limbs. Appropriate browsing levels would be essential to maintain niches in suitable condition for lichen colonisation as the trees age.



Figure 28: young oak overtopped by maturing birch (target note TN26). An example of where appropriate thinning could be adopted to encourage the development of trees with more interesting, more open grown form including low spreading limbs. Without intervention shaded lower limbs can die off sooner.

9.6 Further survey work

Desirable survey/monitoring work is listed below:

- Survey to determine additional veteran trees where halo thinning is required in the stock enclosure at Coed Nannerth-fawr.
- Targeted search for more trees with *L. pulmonaria* (see TNs).
- Targeted search for *Pannaria conoplea* to confirm presence.
- Targeted search for *Hypotrachyna laevigata* to confirm presence.
- Targeted search for *Scutula circumspecta* to confirm presence.
- Monitor the oak at TN28 for any recovery of *R. amplissima*.
- Set up plots to monitor long term colonisation of hazel by *T. lepadinum*.
- Further survey of veteran trees/hazels within areas not visited (refer to Target Note map). Obvious examples include: other areas in the Coed Nannerth-fawr enclosure north of TN13, other riparian woods south of Bwlch-gwyn-isaf (both sides of river).

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11. Appendices

The Appendices have been removed to comply with Accessibility legislation because they comprise complex multi-entry data tables with numerous blank cells and/or photographs for use during on-site monitoring. They are available in full from the NRW Library.



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