A LICHEN SURVEY OF THE
NATIONAL BOTANIC GARDEN OF WALES

Alan Orange

August 1997

Department of Biodiversity and Systematic Biology
National Museum and Gallery Cardiff
CF1 3NP
1. Introduction
Construction work at the site of the new National Botanic Garden of Wales began in late 1996, and there will be significant changes to the habitats presently available at the site as work proceeds. The present preliminary survey of the lichens of the site is intended to provide a baseline against which to assess changes in the lichen flora, and to identify any species of special conservation interest.

2. The site
The National Botanic Garden occupies a site of 230 hectares near Llanarthne, 11 km east of Carmarthen, grid ref. 22/52.18 (Fig. 1). All parts of the site are within vice-county 44 and the 10 km square 22/51. The site is centred upon the neglected 18th century park of Middleton Hall. A system of former lakes is partly occupied at present by alder and sallow carr; at the north end of the site the Afon Gwynon is bordered by woodland comprising mainly young trees. Much of the site is presently meadow and pasture. A number of mature parkland trees remain, mostly oak (Quercus robur). Natural rock outcrops are very few and small in extent, and there are two small disused quarries east of Waun Las Farm. The walled garden at Middleton Hall, and various buildings, provide other habitats for saxicolous species.

3. Methods
The site was visited on 16-18 July 1997. Only a part of the site could be visited in the time available, mainly the valley of the Afon Gwynon, the old lake system, the area around Waun Las Farm, and the walled garden at Middleton Hall. A small number of voucher specimens have been deposited in the herbarium of the National Museum and Gallery Cardiff (NMW). As well as lichens (lichenized fungi), the survey included non-lichenized, lichenicolous fungi, and a small number of non-lichenized, non-lichenicolous fungi traditionally recorded by lichenologists. Nomenclature follows Purvis et al. (1992) for lichens, and Hawksworth (1983) for lichenicolous fungi, unless indicated in the Appendix.

4. Results
A total of 195 taxa were recorded, of which 181 were lichens (see Appendix).

4.1. Lichens on trees
A total of 102 lichens were recorded on bark. The flora confirms that air quality at the site is good, corresponding to Zone 8 or better on the Hawksworth and Rose scale (Hawksworth & Rose 1976). The lichen flora in most wooded areas of the site is limited by heavy shade and a scarcity of mature trees. Few lichen species appeared to be favoured by shade, e.g. Arthonia spadicea, Dimerella pineti, Porina aenea and P. leptalea, although some were clearly favoured by shelter and humidity. In open situations, trunks of mature oak were dominated by species of the association Parmelietum revolutae, including Parmelia caperata, P. subrudecta, P. sulcata, Pertusaria albescens, P. amara and Pyrrhosphora quereana. Dry sides of mature trunks carried species including Calicium viride, Chrysorthrix candelaris, Clostophum griffithii, Lepraria incana and Schizomatus decolorans. A number of "old forest" species occurred on oaks in more sheltered situations (see section 4.3). Low branches of oak and ash in open situations carried a flora showing slight nutrient enrichment, including the species Fuscidea lighfootii, Hypogymnia tubulosa, Lecanora chlorotica, Lecidella elaeochroma, Parmelia exasperata, P. exasperatula, P. laciniata, P. revoluta, P. sulcata, Physcia tenella, Ramalina fastigiata and Xanthoria polycarpa. A number of species were
confined to elder, namely *Caloplaca cerina*, *Haleciania viridescens*, *Lecanaria cyrtella*,
*Lecanora sambuci* and *Macentina stigonemoides*.

4.2. Lichens on wood
Wooden fence posts carried species including *Buellia griseovirens*, *Cladonia* spp.,
*Hypocenomyce scalaris*, *Lecanora conizaeoides*, *L. pulicaris*, *L. symmicta* and *Ochrolechia
microstictoides*. These species also occurred on old logs, stumps, and standing dead trees, but
a few species were confined to, or more abundant on these natural substrates, including
*Chrysothrix flavovirens*, *Calicium glaucellum*, *Cladonia parasitica* and *Micarea prasina*. A
few species on wood are indicative of nutrient enrichment, such as *Candelariella vitellina*,
*Lecanora dispersa* and *Rinodina exigua* on an animal pen at Waun Las Farm.

4.3. Indicators of age and ecological continuity
Study of many sites with a documented history has shown that certain lichen species are
"faithful" to ancient woodlands with a long history of ecological continuity, and are rarely
found in sites of relatively recent origin, even when apparently suitable substrates are available
(Rose 1976). This observation led to the development of indices designed to provide an
estimate of the likelihood of ancient origin and ecological continuity at a site, based on the
occurrence of certain of the "faithful" species, designated as 'indicator species'. An "Index of
Ecological Continuity" was devised by Rose (1974), and later improved to produce a "Revised
Index of Ecological Continuity" (RIEC) (Rose 1976). The RIEC uses a list of 30 lichen
species and is calculated as \( RIEC = n/20 \times 100 \), where \( n \) is the number of species from the list
that occur at the site. A more sensitive index, the "New Index of Ecological Continuity"
(NIEC) was developed by Rose (1992). Each lichen from a list of 70 species scores 1, up to a
maximum of 70. A second list of "bonus species" produces a second figure which is quoted
separately. The NIEC is said to be more effective in grading woodlands by their conservation
value, but is not intended to replace the RIEC entirely (Rose 1992).

Species found during the present survey which are used in the calculation of the indices are
shown in Table 1. The site attains an RIEC of 45 and an NIEC of 11 (Note that the two
*Chaenotheca* species count as a single score). These moderate scores suggest some degree of
ecological continuity. They are comparable to those of mature sites known to have been
clear-felled or planted, but which are adjacent to areas of ancient woodland, allowing some
colonisation of old woodland species (Rose 1976, 1992). The scores compare well with those
of many parkland sites in Wales (Orange 1996), where only 3 out of 22 sites surveyed
equalled or exceeded the scores in the present survey.

Apart from *Lecanora jamesii* and *Porina leptalea*, which are probably rather poor indicators
of old woodland, and *Cladonia parasitica*, which can grow in more or less open situations,
the RIEC and NIEC species found in the present survey are concentrated within sheltered and
humid areas of the site. Most are to be found on old trees, but *Usnea floridula* occurs on sallow.
The eastern margin of Llyn Canol is of particular importance, with 5 RIEC species found on a
number of old oaks in a small area (Fig. 1).

4.4. Lichens on rocks and soil
Walls and buildings are the main substrate for saxicolous species at the site. The walls of the
walled garden are of mortared sandstone or brick, so that species typical of weakly calcareous
rock are frequent, including *Lecanora campestris*, *Lecidella scabra* and *Rhizocarpon*
concentricum, as well as more strongly calcicole species including Caloplaca flavescentis, Lecanora albescens, Protoblastenia rupestris, Verrucaria nigrescens and V. viridula. Uncommon species in the walled garden included Lecanora conferta and Pyrenocollema monense. Calicuage species of unshaded rocks were uncommon at the site, including Lecanora intricata, L. polymorpha and Porrinida tuberculosa. Shaded and sheltered acidic rocks in a small quarry east of Waun Las (not shown on the 1: 10 000 map) had Enterographa hutchinsiae, Micarea bauchiana, M. hulata and Psilolechia lucida. This quarry appears to be of considerable age, as a number of large sweet chestnuts grow in front of it. Aquatic communities were poorly developed due in part to excessive shade and to lack of suitable hard substrates: the Afon Gwynon near Pont Felin-gwâd had Verrucaria aquatilis, V. hydrela and V. praetermissa on frequently inundated stones, and poorly developed V. aquatilis was found in streamlets. Soil habitats were poorly developed, comprising a few shaded banks with species including Baeomyces rufus, Chaenotheca furfuracea, Cladonia caespiticia and Lepraria spp.

5. Conservation
Maintenance of the lichen interest at the site might focus on the following aspects:
1. maintenance of the diversity of substrates and habitats
2. maintenance of the old-forest (RIEC and NIEC species)
3. protection of specific uncommon species.

By their very nature, old-forest species are slow to colonise new sites, and if these species are lost as a result of construction of the new gardens, they are unlikely to recolonise in the foreseeable future. The old oaks along the eastern margin of Llyn Canol carry five of the RIEC species, albeit in small quantity. These oaks are presently shaded by adjacent carr and might benefit from a small amount of additional light. However, complete removal of surrounding trees and shrubs may result in loss of the RIEC species due to loss of shelter and humidity. It is perhaps unlikely that the presence of the restored lake nearby would completely compensate for this loss.

A number of additional species may be regarded as Nationally Scarce, recorded as occurring in 16-100 10-km squares in Great Britain. These are listed in Table 2. At least two of these are probably severely under-recorded, but others are probably genuinely local in occurrence, though widespread in Wales. Enterographa hutchinsiae, Opegrapha multipuncta and Micarea hulata occurred in small quarries east of Waun Las Farm, Lecanora conferta and Pyrenocollema monense occurred on old walls at Middleton Hall, and Rinodina oxydata occurred on low rocks in pasture.

6. References


TABLE 1. Species found at the National Botanic Garden of Wales which are used in the calculation of indices of ecological continuity.

<table>
<thead>
<tr>
<th>Species</th>
<th>RIEC</th>
<th>NIEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthonia vinosa</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Arthopyrenia ranunculospora</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Catillaria atropurpurea</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Chaenotheca bruneola</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Chaenotheca hispidula</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Cladonia caespiticia</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Cladonia parasitica</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Dimerella lutea</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Enterographa crassa</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Lecanactis premnea</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Lecanora jamesii</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Nephroma laevigatum</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Porina leptalea</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Pyrenula chlorospila</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Usnea florida</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

TABLE 2. Species recorded at Middleton Hall which are recorded from fewer than 100 10-km squares in Great Britain (data partly from Hodgetts et al. 1996).

<table>
<thead>
<tr>
<th>Species</th>
<th>probable status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterographa hutchinsiae</td>
<td>widespread in Wales, but local, restricted to shaded, humid habitats.</td>
</tr>
<tr>
<td>Halecania viridescens</td>
<td>recently described, under-recorded.</td>
</tr>
<tr>
<td>Lecanora conferta</td>
<td>under-recorded, but still apparently local in Wales.</td>
</tr>
<tr>
<td>Micarea lutulata</td>
<td>under-recorded, but local.</td>
</tr>
<tr>
<td>Opegrapha multipuncta</td>
<td>?under-recorded, local.</td>
</tr>
<tr>
<td>Pyrenocollema monense</td>
<td>?under-recorded.</td>
</tr>
<tr>
<td>Rinodina oxydata</td>
<td>apparently local in Wales.</td>
</tr>
<tr>
<td>Thelocarpon magnussonii</td>
<td>under-recorded, ephemeral species.</td>
</tr>
</tbody>
</table>
FIG. 1. Map showing the present boundary of the National Botanic Garden, and the location of some of the notable lichens.
Appendix: Species recorded.

[LF] = lichenicolous fungus, [F] = non-lichenized, non-lichenicolous fungus. Grid references are given for selected records. Tree numbers quoted below were assigned for informal field use only.

_Abrotallus microspermus_ [LF]
- Present as the anamorph.

_Abrotallus parmeliaemum_ [LF]
- Apothecia present.

_Agonimia tristicula_
- on wall of walled garden, 520181. Sterile.

_Anisomaridium nyssaegemum_
- frequent on elder, one record on oak. Fertile.

_Arthonia didyma_
- on young shaded ash trunks near Pont Felin-gât. Fertile.

_Arthonia radiata_
- frequent on smooth bark and on twigs, recorded on oak, beech, ash and elder. Fertile.

_Arthonia spadicea_
- on shaded oak trunk on east side of Llyn Canol, 524178, and on hazel near Waun Las Farm. Fertile.

_Arthonia vinosa_
- rare; on trunk of old oak (no. 11/3) at margin of carr on east side of Llyn Canol, 524178. Fertile.

_Arthopyrenia ramunculospora_
- rare; on trunk of old oak (no. 11/8) c. 525177 at margin of carr on east side of Llyn Canol, and on trunk of mature oak (no. 20/9) NE of Waun Las Farm at 530182. Fertile.

_Bacidia phacodes_
- rare; on shaded sheltered ivy stem on ruined building on NW side of walled garden, 519181. Fertile.

_Bacidia sabuletorum_
- occasional on walls of walled garden. Fertile.

_Bacidia viridifarinosa_
- rare, on very shaded and sheltered bark at base of trunk of oak (no. 4/1) at north end of Llyn Mawr, 525185, and on sheltered shaded rocks in small quarry east of Waun Las Farm at 529180. Sterile. First vice-county record.

_Baeomycetes ruftus_
- occasional; on soil on upturned stump, 529180, and on shaded soil banks at 528182. Fertile at second locality.

_Beolosia nidariensis_
- local on NW-facing brick wall on NW side of walled garden, 519181. Sterile.

_Biatoropsis usneorum_ [LF]
- on thallus of Usnea florida.

_Buellia aethalea_
- rare; on low stones forming bridge over ditch, 530181. Fertile.

_Buellia griseovirens_
- frequent on wooden fenceposts, also recorded on dead standing pine trunk, and on bark of beech and sycamore. Sterile.

_Buellia punctata_
- occasional on wooden fenceposts and oak trunks. Fertile.

_Calciolum glaucum_
- rare on wood; on fallen trunk of oak (no. 11/9) at south end of Llyn Canol, and on dead standing trunk of Scots Pine at 531181. Fertile.

_Calciolum viride_
- occasional; recorded on dry bark of 3 mature oak trunks, 525186, SE of Y Neuadd at 522181 and east of Waun Las Farm at 530180. Fertile.

_Caloplaca arenaria_
- rare; on two low rock outcrops in field to NE of Waun Las Farm, 529182. Fertile. First vice-county record.

_Caloplaca cerina_
- rare; on elder at edge of carr on east side of Llyn Canol. Fertile.

_Caloplaca citrina_
- frequent on old walls of the walled garden, and on a concrete post.

_Caloplaca flavescens_
- at Waun Las Farm.

_Caloplaca holocarpa_
- occasional on walls of the walled garden, and on concrete post by Y Neuadd. Fertile.
Caloplaca isidigera
First vice-county record.
rare; on old wall SE of stable block at Middleton Hall. Sterile.

Caloplaca obscurella
First vice-county record.
rare; base of young sycamore trunk in field at 531180. Fertile.

Candelaria concolor
rare; on trunk of ash tree on south side of Middleton Hall.

Candelariella reflexa
occasional; on wooden fencepost, beech trunk, and base of young sycamore. Sterile.

Candelariella viellina
wooden post near Y Neuadd, and wooden door of animal pen at Waun Las Farm. Sterile.

Catillaria atropurpurea
rare; on trunk of old oak (no. 11/6) on eastern edge of carr at Llyn Canol, c. 524178, small quantity with the mosses Homalothecium sericeum and Zygodon baumgartneri.

Catillaria chalybata
occasional; on wall at walled garden, bark at base of young sycamore trunk, and on low rock outcrop near Waun Las Farm. Fertile.

Catillaria lenticularis
walls of walled garden.

Catillaria pulverea
occasional on shaded bark in humid areas, recorded on ash near Pont Felin-gât, and on sallow at north end of Llyn Canol. Sterile. One collection contained atranorin and zeorin by TLC.

Chaenotheca brunnea
rare; dry fissures on trunk of old oak (no. 11/1) at edge of carr on east side of Llyn Canol, 524178. Fertile.

Chaenotheca ferruginea
occasional on dry oak trunks (recorded on 4 mature trees), recorded once on a wooden fencepost. Sometimes fertile.

Chaenotheca furfuracea
rare; on sheltered and shaded soil bank by track in woodland near Pont Felin-gât. Sterile.

Chaenotheca hispida
rare; on dry, shaded bark at base of trunk of oak (no. 4/1) at north end of Llyn Mawr, 525185. Fertile.

Chrysothrix candelaris
occasional and in small quantity on trunks of mature oaks. Sterile.

Chrysothrix flavovirescens Tønsb.
occasional on dry acid wood or bark; on oak trunk, on exposed wood on sweet chestnut trunk, and on dead standing pine. Sterile.

Cladonia caespiticia
on soil by track near Pont Felin-gât, on old stump (of sweet chestnut?) east of Waun Las Farm at 529180. Fertile at second locality.

Cladonia chlorophaea

Cladonia coniocraea
occasional on bark and wooden posts. Sterile.

Cladonia digitata
occasional, local; on old stump, exposed wood of sweet chestnut trunk, and on dead standing pine, all near Waun Las Farm. Fertile.

Cladonia fimbrata
occasional; recorded on soil, ash trunk, sallow and wooden posts. Sterile.

Cladonia glauca
on wooden post SE of Y Neuadd. Sterile.

Cladonia macilenta
occasional on bark (oak, sallow and alder) and on posts. Sometimes fertile.

Cladonia ochrochlorea
fence post on east side of Llyn Canol. Sterile.

Cladonia parasitica
occasional on wood; fencepost supports at 525179, oak log (no. 11/2) at 524178, oak log in pasture at 529181, old stump (sweet chestnut) at 529180. Fertile.

Cladonia polydactyla
fence post support at 525179. Fertile.

Cladonia pyxidata
old fallen oak by Llyn Canol, 524177. Sterile.

Cladonia ramulosa
old fallen oak by Llyn Canol, 524177. Sterile.
Clauzadea monticola
Fertile. wall of walled garden. Fertile.

Clionostoma griffithii
Fertile. frequent on dry bark, especially of mature oaks, also on ash.

Cladonia hypenomycye [LF]
Fertile. frequent on thallus of Hypenomycye scalaris.

Collema crispum
Sterile. occasional on walls; walled garden and by Afon Gwynon.

Collema tenax
walls of walled garden. Fertile.

Dimereella lutea
at 530182. Fertile. rare; on trunk of mature oak (no. 20/9) NE of Waun Las Farm.

Dimerella pine to
Gwynon. Fertile. on shaded acid bark of birch and alder in woodland by Afon

Diplociccia canescens
locally frequent on wall at NE end of walled garden. Sterile.

Diplotomma alboatra
cells of walled garden. Fertile.

Endococcus alpestris [LF]
on thallus of Usnea subfloridana. Fertile.

Endococcus rugulosus [LF]
on thallus of Verrucaria viridula in walled garden. Fertile. First

vice-county record.

Enterographra crassa
rare; on trunks of two old oaks (nos. 11/1 and 11/3) on east side
of Llyn Canol at 524178. Fertile.

Enterographra hutchinsiae
rare; on shaded rocks in small, long-disused quarry east of
Waun Las Farm at 529180. Fertile.

Enterographra zonata
shaded wall of walled garden. Sterile.

Evertina prunastri
frequent on tree trunks and branches, recorded on oak, beech,
elder, sallow and pine. Sterile.

Foraminella ambigua
rare; small quantity on old wooden fence post in field at
531180, and small quantity on wood of standing dead pine trunk at 531181. Sterile.

Fuscidea lightfoodii
frequent on branches, including sallow, oak and ash. Fertile.

Graphis elegans
occasional on bark, recorded on alder and beech. Fertile.

Graphis scripta
current on bark, recorded on ash, hornbeam, beech and hazel.

Guignardia olivieri [LF]
Fertile. on thallus of Xanthoria parietina near Llyn Canol. Fertile. First
vice-county record.

Gyalecta truncigena
rare; on shaded ivy stem on ruined building on NE side of
walled garden, and on old ash NE of Waun Las Farm at 527181. Fertile.

Gyatideopsis anastomosans
rare; on sallow in woodland near Pont Felin-gat. Fertile.

Halecania viridescens
on dead elder twigs in small walled enclosure at SW corner of
walled garden. Fertile. First vice-county record.

Homostegia pigottii [LF]
on thallus of Parmelia sulcata.

Hypenomycye scalaris
frequent on wooden fenceposts, also on stumps, exposed wood
on trunk of sweet chestnut, one record on bark of Scots Pine. Sterile.

Hypogymnia physodes
recorded on sallow, alder, and dead pine. Sterile.

Hypogymnia tubulosa
frequent on branches, including oak, alder, ash, sallow and
apple. Sterile.

Illosporium corallinum [LF]
on thallus of Physcia aipolia. Anamorph.

Japewia carollii
Llyn Mawr. Fertile.

Lecanactis premnea
rare; on dry bark on trunk of mature oak (no. 11/1) at edge of
carr on east side of Llyn Canol at 524178. Fertile.
Lecania cyrtella on dead elder twigs in small walled enclosure at SW corner of walled garden. Fertile.

Lecanora altema rare; wooden fence post near Waun Las Farm.

Lecanora albescens frequent on walls of walled garden, and on concrete post. Fertile.

Lecanora argentinata frequent on tree trunks, including oak, ash and hornbeam. Fertile.

Lecanora campestris frequent and conspicuous on walls of walled garden, also on concrete post near Waun Las Farm. Fertile.

Lecanora carpinea on fallen branch of ash at 524179. Fertile.

Lecanora chloropera frequent on tree trunks and branches, including oak, beech and ash. Fertile.

Lecanora conferta rare; on siliceous blocks on mortared NW-facing walls of walled garden at 520181. Fertile. First vice-county record.

Lecanora conizaeoides occasional to frequent on wooden posts, also on wood of dead standing pine; one record from living pine bark. Fertile.

Lecanora dispersa on wall of walled garden, and on wooden door of animal pen at Waun Las Farm. Fertile.

Lecanora expallens occasional on dry bark of oak and beech, and on wooden posts. Sterile.

Lecanora intricata rare; on low stone forming bridge over ditch at 530181.

Lecanora jamesii frequent on tree trunks and branches, including sallow, ash, beech and oak, also on wooden fence posts. Sterile.

Lecanora polytrapa rare; on low rock outcrop in field at 528182. Fertile.

Lecanora pulicaris occasional on wooden fence posts. Fertile.

Lecanora saligna on wood of dead standing oak in field east of Y Neuadd at 523181, and on wooden fence post near Llyn Canol. Fertile.

Lecanora sambuci on dead elder twigs in small walled enclosure at SW corner of walled garden. Fertile. First vice-county record.

Lecanora symmicta occasional on wooden fence posts. Fertile.

Lecidea euracochroma frequent on tree trunks and branches, including ash, oak, hornbeam, elder, beech. Fertile.

Lecidea scabra occasional on walls of walled garden, and on low rock outcrop in field near Waun Las Farm. Fertile.

Lecidea stigmaeata on walls of walled garden. Fertile.

Lepraria incana frequent on dry bark and rocks, recorded on beech, hornbeam, alder and oak. Material on one mature oak was tinged orange due to the presence of parietin. Sterile.

Lepraria jackii occasional on dry bark and rock; on oak by Llyn Canol, on ash by NE arm of Llyn Mawr, and on rocks in small quarry at 531179. Sterile. First vice-county record.

Lepraria lesdainii occasional in dry crevices of walls of walled garden. Sterile.

Lepraria lobifrons frequent on dry bark, rock and soil; recorded on ash, birch, sallow, alder and oak. Sterile.

Lepraria rigidaula occasional on dry bark and soil, recorded on ash, sallow and alder. Sterile. First vice-county record.

Leproloma vonauxii on wall of walled garden. Sterile.

Leptogium subtile rare; on shaded fragments of brick from rubble tipped onto west bank of north end of Llyn Canol at 524180. Fertile.
Lichenodiplis lecanorae [LF] on apothecia of Lecanora saligna on dead standing oak at 523181. Anamorph.

Macentina stigonemoides on sheltered side of elder trunk at edge of carr at Llyn Canol. Fertile.

Micarea bauchiana on shaded rocks in small, long-disused quarry east of Waun Las Farm at 529180. Fertile.

Micarea lutulata on shaded rocks in small, long-disused quarry east of Waun Las Farm at 529180. Fertile.

Micarea prasina occasional on old stumps of oak and sweet chestnut; woodland by Afon Gwynon, by Llyn Canol, and in quarry at 531179. Fertile. Three specimens analysed by TLC all contained micareic acid.

Mycohastus sterilis occasional, on sallow, alder and on fence posts. Sterile.

Nephroma laevigatum rare; one small thallus overgrowing the moss Isothecium myosuroides on large ash trunk near Pont Felin-gât at 527188. Sterile. First vice-county record.

Normandinia pulchella occasional on tree trunks, recorded on 7 trees (6 ash and 1 oak). Sterile.

Ochrolechia androgynosa on trunks of two mature oaks. Sterile.

Ochrolechia microstictoides frequent on wooden fence posts. Sterile.

Ochrolechia parella rare; on walls of walled garden. Fertile.

Opegrapha gyrocarpa local on shaded wall of walled garden, and in quarry at 529180. Fertile.

Opegrapha herbarum rare; on dry, shaded bark at base of trunk of oak (no. 4/1) at north end of Llyn Mawr, 525185. Fertile.

Opegrapha multipuncta rare; on shaded rocks in small quarry at 531179. Sterile. First vice-county record.

Opegrapha ochrolechia dead wood of ivy stem on ruined building by walled garden, and on dry bark of large ash near Waun Las Farm. Fertile.

Opegrapha vermicellifera rare; on oak by Llyn Canol, and on ivy stem on ruined building by walled garden. Sterile.

Opegrapha vulgata occasional on bark, recorded on ash and on ivy stem. Fertile. frequent, recorded on beech, oak, pine and on fence post.

Parmelia coperata occasional on twigs in open situations; on oak on east side of Llyn Canol, on oak and ash near Waun Las Farm, and on apple in walled garden. Fertile.

Parmelia exasperata occasional on twigs in open situations; on oak on east side of Llyn Canol, ash and oak near Waun Las Farm, and apple in walled garden. Sterile.

Parmelia glabrata occasional to frequent on tree trunks, including oak, ash and beech, and on a fence post. Sterile.

Parmelia laciniatula on twigs of oak and beech in field near Waun Las Farm at 530182. Sterile.

Parmelia perlata frequent on tree trunks and branches, including sallow, oak, evergreen oak, ash, alder, sycamore and elder. Sterile.

Parmelia revoluta frequent on tree trunks and branches, including ash, sallow, oak, beech, elder and alder. Sterile.

Parmelia saxatilis frequent on trees, but probably less so than P. sulcata; recorded on oak and ash. Sterile.

Parmelia subaurifera frequent on tree trunks and branches, recorded on oak, sallow, elder, alder and ash. Sterile.
Parmelia subrudecta

central on tree trunks and branches, recorded on oak, ash, 
elder and apple. Sterile.

Parmelia sulcata

central on tree trunks and branches, recorded on oak, ash, 
elder, sallow and apple. Noted fertile once on sallow at north end of Llyn Canol.
Peltigera didactyla

rare; on thin soil on low rock outcrop in field to NE of Waun Las Farm, 529182. Fertile.
Peltigera membranacea

locally frequent in woodland; on ash near Pont Felin-gât, on 
shaded mossy rubble by Llyn Canol, frequent on bases of sallow trunks near north end of 
Llyn Canol. Fertile.
Peltigera precatiata

locally frequent, mainly in shaded humid areas, on ash trunks in 
woodland near Afon Gwynon and near Waun Las Farm, shaded mossy rubble by Llyn Canol, locally abundant on sallow at Llyn Canol, unshaded outcrop in field near Waun Las Farm. Fertile.
Pertusaria albescens

central on tree trunks, including oak, beech and ashy, one 
record on elder. Sterile.
Pertusaria amara

central on tree trunks, including oak, ash, alder and sallow, 
and on wood of dead pine. Sterile.
Pertusaria hymenea

occasional, on oak and hazel. Fertile.
Pertusaria leioplaca

occasional, recorded on ash and hornbeam. Fertile.
Pertusaria multitunica

local on shaded smooth bark, near Afon Gwynon and Llyn 
Mawr. Fertile.
Phaeophyscia orbicularis

on wall and on ash trunk near Middleton Hall.
Phlebitis argena

frequent on trees, recorded on oak, ash, sallow, alder, and 
apple, also locally frequent and conspicuous on NW-facing brick walls of walled garden.
Sterile.
Physcia adscendens

on young ash near Middleton Hall. Sterile.
Physcia aipolia

central on tree branches, recorded on oak, ash, elder and 
sallow. Fertile.
Physcia tenella

frequent on tree branches, recorded on oak, ash, elder and 
apple. Often fertile.
Placynthiella dasaea

on wood and dead bark on standing dead oak in field east of Y 
Neuadd at 523181. Fertile.
Placynthiella icmalea

on moss on sallow branch and on oak log, by Llyn Canol.
Fertile.
Platismatia glauca

occasional on tree trunks and branches, recorded on alder and 
sallow. Sterile.
Porina aenea

on smooth shaded bark of ash in woodland SW of Middleton 
Hall at 517179. Fertile.
Porina chlorotica

occasional on shaded rock; on stones in woodland near Afon 
Gwynon, on ruined bulding by walled garden, and in small quarry east of Waun Las 
Farm. Fertile.
Porina leptalea

on very shaded bark of birch in woodland near Afon Gwynon.
Fertile.
Porpidia macrocarpa

rare; on small rock outcrop at edge of field near Waun Las Farm 
at 529182. Fertile.
Porpidia soredizodes

rare; on NW-facing brick wall of walled garden at 519181. 
Sterile. Contained stictic acid by TLC.
Porpidia tuberculosa occasional on acid rock; wall by westernmost corner of walled
garden, in small quarry at 529180, and on low rocks forming bridge over ditch at
530181. Sterile.

Protoblastenia rupestris frequent on walls and concrete posts. Fertile.

Psilolechia lucida rare on dry rocks and soil; rare on walls of walled garden, and
east of Waun Las Farm on soil on an upturned stump and on rocks in small quarry.
Sterile.

Pyrenocollema monense rare; on mortar of wall in walled garden at 520181. Fertile. First
vice-county record.

Pyrenula chlorospila rare; on smooth bark-plate of a large ash in woodland near Pont
Felin-gât at 527188. Fertile.

Pyrrhospora quernea frequent on trunks of mature trees in open situations, mainly on
oak, also recorded from beech. Sometimes fertile.

Ramalina farinacea frequent on trunks and branches of trees, recorded on oak, ash,
beech, elder and apple. Sterile.

Ramalina fastigiata occasional on tree branches, recorded on ash, elder and apple.
Fertile.

Rhizocarpon concentricum occasional on slightly calcareous rocks and walls. Fertile.

Rinodina exigua rare; on wooden door of animal pen at Waun Las Farm. Fertile.
First vice-county record.

Rinodina oxydata rare; on low rock outcrop in field at 528182, with Caloplaca
arenaria. Fertile. First vice-county record.

Sarcogyne regularis occasional on walls of walled garden. Fertile.

Schizomatomma decolorans rare on dry bark on mature oak trunks in open situations; north
of Llyn Mawr at 525186, and near Waun Las Farm at c. 530182. Sterile.

Stenocybe pullulata [F] on lower sides of alder twigs near Afon Gwynon and near Waun
Las Farm, probably frequent. Fertile.

Stigmidium microspilum [LF] on thallus of Graphis scripta in woodland near Pont
Felin-gât. Fertile. First vice-county record.

Stigmidium sp. [LF] on thallus of Verrucaria aquatilis in Afon Gwynon.
Fertile.

Tephromela atra rare; on wall at westernmost end of walled garden. Fertile.

Thelocarpon magnussonii rare; on shaded stones in small quarry east of Waun Las Farm at
531179. Fertile. First vice-county record.

Toninia aromatica occasional on walls of walled garden. Fertile.

Trapelia coeruicata rare; on low rock outcrop in field at 529182. Fertile.

Trapelia involuta rare; on low rock outcrop in field at 528182. Sterile.

Trapatopsis granulosa occasional on stumps and wooden posts, one record from alder
bark. Sterile.

Usnea cornuta local on trunks of trees; on sallow and alder at Llyn Canol, and
on two oaks near Waun Las Farm at 529181 and 530182. Sterile.

Usnea floridana local; on sallow in north end of Llyn Canol and south end of
Llyn Mawr. Fertile.

Usnea subfloridana occasional on branches of trees, recorded on oak, alder, sallow
and apple, also on wooden post. Fertile on sallow at south end of Llyn Mawr.

Verrucaria aquatilis on frequently inundated stones in Afon Gwynon near Pont
Felin-gât, and stream at 525179. Fertile.

Verrucaria baldensis occasional on mortar on walls of walled garden. Fertile.

Verrucaria glaucina occasional on mortar on walls of walled garden. Fertile.
Verrucaria hydrela
  Pont Felin-gât. Fertile. on frequently inundated stones in streams, Afon Gwynon near
Verrucaria nigrescens
  Fertile. frequent on walls of walled garden, and on a concrete post.
Verrucaria praetermissa
  Felin-gât. Fertile. First frequent on mortar and calcareous sandstone on walls of walled
  vice-county record.
Verrucaria viridula
  garden. Fertile. occasional on slightly calcareous rocks; on retaining wall near
Verrucaria sp.
  Afon Gwynon, and at walled garden. Fertile. A widespread greenish species of uncertain
  identity.
xanthoria parietina
  frequent on branches of trees including oak, ash and apple, but
never conspicuously abundant. Fertile.
xanthoria polycarpa
  frequent on tree branches, recorded on oak and elder, and on
  wooden posts. Fertile.
  First vice-county record.

<table>
<thead>
<tr>
<th>Number of species recorded</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Lichenized</td>
</tr>
<tr>
<td>Non-lichenized, lichenicolous</td>
</tr>
<tr>
<td>Non-lichenized, non-lichenicolous</td>
</tr>
<tr>
<td>All groups</td>
</tr>
</tbody>
</table>

Indices of ecological continuity: RIEC = 45 NIEC = 11
20.10.97

Alan Orange's Lichen survey (August 1997)

Survey on 16-18 July 1997. Areas surveyed within RCE include 210 hectares of red sandstone, 170 hectares of species-mixed grasslands, 170 hectares of old sandstone, 17 hectares around Warren Lane Farm, and 17 hectares of old sandstone. 195 taxa recorded, of which 181 were lichens.

On fields: 102 lichens recorded in total. The lichen flora

combination that air quality at this site is good; Zone 8 of the

better on a new Swalesworth score.

Section 4.3: Indicators of age and ecological condition

Indicators derived by Rode (1974, 1976, 1992)

- Older index of ecological condition: based on a set of 50

lichens: R.I.E.C. = N x 20 x 100, where N is the number of

lichens present in the area:


70 spp. in each 10-site survey.

Middleton scores: R.I.E.C. = 65 - large, but not very

(unknown species) N.I.E.C. = 11 - clear, but

surveyed by Orange (1986) only 3 instead of 17 or 18 species at Middleton.

- Excellent report, giving a comprehensive overview of RCE lichens and

its significance, including a high air quality at this site, but not the

most important species (myco-lichen) present in the proportion of R.I.E.C

spp. - where is, a rare, RCE indicator species. 8 of 18 lichens

10.10.97

Q K.