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# The Macrofungi of Dinefwr Park: A Pilot Study

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## 1 INTRODUCTION

Fungi are an integral part of all ecosystems. They have a vital role in the detritus cycle, breaking down plant and animal tissue and returning the breakdown products to the system. They are also important in promoting the health and growth of higher plants, forming intimate symbiotic links, known as mycorrhizas, which supply plants with scarce mineral nutrients in return for simple sugars. Underground fungal mycelia and above ground fruit bodies are also an important source of food for a wide range of animals, particularly invertebrates, and some species rely on fungal fruit bodies for shelter.

The present survey was undertaken as a pilot study to predict the potential fungus flora (mycota) of the Park and to assess the conservation value, from a mycological standpoint, of the various habitats represented in the Park.

The survey (and this report) concentrated mainly on the two major fungal habitats in the Park – the parkland (grassland) and the pasture woodland.

Certain groups of fungi can be used as reliable indicators of habitat quality, eg ancient woodland and traditional, unfertilised, grazed grassland. In the latter context, Waxcaps (species of *Hygrocybe s.l.*) have been used to judge the conservation value of unimproved grasslands – a habitat which is regarded as endangered throughout Europe.

## 2 METHODS

A series of recording visits were made to the Park between the months of June and December, 1998, inclusive. The timing of the visits was intended to coincide with what was thought to be the most favourable environmental conditions for fungal fruiting, ie several days after rainfall. The visits, which lasted approximately four hours, aimed to cover all habitats, although on some occasions certain habitats were subject to more intensive investigation, when fruiting in those areas was more abundant.

Fruit bodies of common or easily identifiable fungi were left *in situ* but for most identifications it was necessary to collect representative samples for closer macroscopic and microscopic examination in the laboratory. Dried voucher material was retained for all but the commonest species and this material will be deposited in the herbarium of the National Botanic Garden of Wales.

A literature search was made for previous records for the Park and the herbarium at the Royal Botanic Gardens, Kew, was also visited for the same purpose. Existing records were also extracted from the records database of the British Mycological Society.

During the study period, the author was engaged in two other surveys – of the Hafod Estate in Ceredigion (Cardiganshire vice-county) and of 10 grassland locations in Carmarthenshire. The author also made casual visits to other locations in West Wales: eg Garn Ddyrys, near Tumble, Blaenavon, Breconshire; the grounds of St David's College, University of Wales, Lampeter, Ceredigion; Maestir Churchyard, Lampeter; Llanrhystud Chapelyard, Ceredigion; the lawn at Llanerchaeron Estate, Ceredigion (NT).... Past records from these sites enabled cumulative lists to be compiled. Data was also obtained from recording visits by other workers at Gilfach Farm, Rhyader, Radnorshire. The 17 sites surveyed personally by the author are itemised in Table 1 below.

Thus it was possible to make comparisons between Dinefwr Park and Hafod (for all habitats) and between the Park and all other sites (for grassland species).

(It should be noted that many of these sites were chosen because they were known to be, or expected to be, prime grassland sites for fungi.)

The data obtained from all this fieldwork were entered into the BMS database.

**Table 1: Details of sites visited in the present survey**

Site No.	Location	Code	Grid Ref
1	'Talley' SSSI	TAL	SN62-30-
2	Pwll Edrychiad SSSI	PED	SN584162
3	Caeau Nant Garenig SSSI	CNG	SN673124
4	Cae Blaen-dyffryn SSSI	CBD	SN604445
5	Caeau Blaen-byderyn SSSI	CBB	SN558439
6	Carreg Cennen SSSI	CCN	SN670191
7	Whitehill Down SSSI	WHD	SN290135
8	Rhosydd Castell-du SSSI	RCD	SN655116
9	Waun-las (Middleton)	WLS	SN528178
10	Caeau Caradog	CCG	SN694460
11	Llanerchaeron Estate (NT)	LLAN	SN480600
12	Llanrhystud Chapelyard	LRST	SN547692
13	Hafod Estate	HAFO	SN756731
14	<b>Dinefwr Park</b>	<b>DINF</b>	<b>SN617225</b>
15	Maestir Churchyard, Lampeter, Cards	MAES	SN553494
16	St David's College lawns, Lampeter, Cards	STD	SN579482
17	Garn Ddyrys, Tumble	GARN	SO258117

## 2.1 Evaluation of Woodland Habitats

No systematic methodology exists for the quantification of conservation value of woodland habitats from a mycological point of view. However, the presence or absence of ancient woodland indicator species can be used to judge conservation value and to make comparisons between sites, as can the extent of the mycorrhizal mycota and the number of lignicolous fungi using native trees as substrates.

## 2.2 Evaluation and Quantification of Conservation Value of Nutrient Poor Grasslands (Waxcap Grasslands)

The conservation of this habitat has been subjected to intensive study in recent years, both in Britain and Europe and the resultant data provided a well-documented context against which to evaluate the Dinefwr findings.

The data relating to grasslands were analysed using the methodologies proposed by Rald (1985), Rotheroe *et al* (1996), Rotheroe (1997) and Rotheroe (1999). These methods are summarised in APPENDIX I.

## 2.3 Nomenclature

In general the classification of the Dictionary of the Fungi (Hawksworth, et al, 1995) has been used in this study. However, there is some disagreement currently over aspects of nomenclature for certain groups. For the Entolomataceae (Pink-gill species), this study uses the nomenclature of Noordeloos, 1992, which reduces some genera to sub-generic level, ie *Leptonia* and *Nolanea*, rather than the classification of the Dictionary of the Fungi, which

retains these at generic level. For *Hygrocybe*, the nomenclature follows Boertmann (1995), with a number of small modifications proposed by Henrici (1996).

### 3 RESULTS

A full list of species recorded at Dinefwr Park during the survey is given in APPENDIX II. (Note: Some 10 records were obtained from the BMS database, made by a visiting mycologist in 1994. However, all of the taxa involved were re-recorded in the present survey)

The main areas of conservation interest for fungi are indicated on the map at APPENDIX III.

A list of those species recorded at Dinefwr Park which feature in the British Red Data List of Ing (1992) [BRDL], the European Red Data List of Ing (1993) [ERDL] and the Welsh Red Data List of Rotheroe (1998) [WRDL] is shown in Table 2 below.

**Table 2: Red Data List species recorded at Dinefwr Park**

*Ganoderma resinaceum* (Lacquered Bracket) - ERDL, WRDL  
*Hygrocybe intermedia* (Intermediate Waxcap) - ERDL  
*Porpoloma metapodium* (Reddening False Waxcap) - BRDL, WRDL

#### 3.1 Woodland Mycota

The numbers of species of different nutritional modes associated with various tree species at Dinefwr Park and Hafod Estate are listed in the tables below. The significance of these data is outlined in the Discussion below.

**Table 3: Number of lignicolous species associated with various trees at Dinefwr Park**

<i>Quercus</i>	33
<i>Pinus</i>	8
<i>Fagus</i>	7
<i>Acer</i>	4
<i>Fraxinus</i>	3
<i>Castanea</i>	2
<i>Salix</i>	2
<i>Sambucus</i>	1
<i>Picea</i>	1
<i>Betula</i>	0

**Table 4: Number of mycorrhizal and humicolous species associated with various trees at Dinefwr Park**

<i>Quercus</i>	25
<i>Pinus</i>	1
<i>Fagus</i>	1
<i>Acer</i>	0
<i>Fraxinus</i>	0
<i>Castanea</i>	0
<i>Salix</i>	0
<i>Sambucus</i>	0
<i>Picea</i>	0
<i>Betula</i>	2

**Table 5: Number of lignicolous species associated with various trees at Hafod Estate (1998)**

Quercus	1
Pinus	1
Fagus	10
Acer	1
Fraxinus	0
Castanea	0
Salix	0
Sambucus	0
Picea	0
Betula	0
Larix	1

**Table 6: Number of mycorrhizal and humicolous species associated with various trees at Hafod Estate (1998)**

Quercus	0
Pinus	7
Fagus	3
Acer	0
Fraxinus	0
Castanea	0
Salix	0
Sambucus	0
Picea	0
Betula	0
Larix	2
Cupressus	2

Many of the fungi included in the totals above are not confined to oak, but the following taxa are indicator species of ancient oak woodland:

**Table 7: Ancient oak woodland indicator species recorded at Dinefwr Park**

Gymnopus fusipes (Spindle Shank)
Daedalea quercina (Oak Maze-gill)
Fistulina hepatica (Beefsteak)
Ganoderma resinaceum (Lacquered Bracket)
Ischnoderma resinosum (Resinous Polypore)

### 3.2 Grassland Mycota

Data assembled for the survey sites is given in Table 8, below. For an explanation of terms and abbreviations used in the table see APPENDIX I.

(Note: Not all visits are logged in the table – only sufficient to indicate comparative fruiting patterns and periodicity of fruiting.)

**Table 8: Waxcap-grassland indicator species  
recorded at 17 locations during present survey**

Site No.	Location	Date	C	H	E	G
11	Llanerchaeron Estate (NT)	27 Sep, 1998	1	6	0	0
12	Llanrhystud Chapelyard	29 Sep, 1998	0	4	0	0
13	Hafod Estate	29 Sep, 1998	2	12	1	0
14	Dinefwr Park	30 Sep, 1998	0	1	0	0
3	Caeau Nant Garenig SSSI	1 Oct, 1998	0	0	0	0
8	Rhosydd Castell-du SSSI	1 Oct, 1998	0	0	0	0
2	Pwll Edrychiad SSSI	1 Oct, 1998	1	8	3	0
7	Whitehill Down SSSI	2 Oct, 1998	1	3	0	0
9	Waun-las (Middleton)	2 Oct, 1998	1	9	1	0
4	Cae Blaen-dyffryn SSSI	7 Oct, 1998	0	7	2	0
6	Carreg Cennen SSSI	7 Oct, 1998	2	13	3	0
5	Caeau Blaen-bydernyn SSSI	12 Oct, 1998	1	4	0	0
10	Caeau Caradog	12 Oct, 1998	0	3	0	0
1	'Talley' SSSI	13 Oct, 1998	1	10	1	0
13	Hafod Estate	14 Oct, 1998	1	15	0	0
11	Llanerchaeron Estate (NT)	15 Oct, 1998	0	9	0	0
14	Dinefwr Park	18 Oct, 1998	1	6	0	0
11	Llanerchaeron Estate (NT)	20 Oct, 1998	2	6	0	0
2	Pwll Edrychiad SSSI	21 Oct, 1998	1	8	3	1
9	Waun-las (Middleton)	21 Oct, 1998	2	10	3	0
17	Garn Ddyrys, Tumble	24 Oct, 1998	1	17	0	4
14	Dinefwr Park	28 Oct, 1998	1	5	0	0
15	Maestir Churchyard, Lampeter, Cards	28 Oct, 1998	2	7	1	2
11	Llanerchaeron Estate (NT)	29 Oct, 1998	1	10	0	0
6	Carreg Cennen SSSI	1 Nov, 1998	3	14	1	0
1	'Talley' SSSI	1 Nov, 1998	1	9	6	0
6	Carreg Cennen SSSI	16 Nov, 1998	1	7	0	0
16	St David's College lawns, Lampeter, Cards	14 Nov, 1998	2	9	3	3
11	Llanerchaeron Estate (NT)	15 Nov, 1998	4	13	4	1
9	Waun-las (Middleton)	20 Nov, 1998	1	1	0	0
14	Dinefwr Park	21 Nov, 1998	0	0	0	0
13	Hafod Estate	1 Dec, 1998	1	2	0	0

Evaluation using the Rald formula: (See APPENDIX I) Table 9 below shows the total number of Waxcap species recorded on a single visit to the prime locations.

**Table 9: Highest number of Hygrocybe (Waxcap) taxa  
recorded on a single visit (1998)**

Site No.	Location	C	H	E	G
17	Garn Ddyrys, Tumble	1	17	0	4
13	Hafod Estate	1	15	0	0
6	Carreg Cennen SSSI	3	14	1	0
11	Llanerchaeron Estate (NT)	4	13	4	1
9	Waun-las (Middleton)	2	10	3	0
1	'Talley' SSSI	1	9	6	0
16	St David's College lawns, Lampeter, Cards	2	9	3	3
2	Pwll Edrychiad SSSI	1	8	3	1
15	Maestir Churchyard, Lampeter, Cards	2	7	1	2
4	Cae Blaen-dyffryn SSSI	0	7	2	0
14	Dinefwr Park	1	6	0	0

Cumulative totals of indicator species recorded up to the end of December, 1998, are given in Table 10 below.

**Table 10: Cumulative list of indicator species recorded from the 10 sites with the highest number of Waxcap species**

Site	C	H	E	G
Garn Ddyrys, Tumble	3	28	0	5
Hafod Estate	4	26	7	0
Llanerchaeron (NT)	6	23	5	2
Gilfach Farm, Rhayader	3	23	0	0
Waun-las Farm, Middleton	4	22	3	0
Carreg Cennen SSSI	4	19	4	0
'Talley' SSSI	2	16	14	0
Pwll Edrychiad SSSI	3	11	3	1
St David's College lawns, Lampeter	2	9	3	3
Dinefwr Park	1	9	0	0

Evaluation of these grasslands according to the "Top Twenty-four" formula proposed by Rotheroe (1999), see APPENDIX I, produces the following results:

**Table 11: List of 10 highest ranking Waxcap Grasslands in survey using "Top Twenty-four" Scores**

Llanerchaeron	A6 B4
Hafod Estate	A4 B8
Gilfach Farm, Rhayader	A4 B4
Garn Ddyrys, Tumble	A3 B10
Waun-las Farm, Middleton	A3 B5
'Talley' SSSI	A1 B5
<b>Dinefwr Park</b>	<b>A1 B2</b>
St David's College Lawns, Lampeter	A1 B2
Carreg Cennen	A1 B2
Pwll Edrychiad SSSI	A1 B1

## 4 DISCUSSION

Unfortunately for this survey, 1998 was one of the worst years of the present decade for macrofungal fruiting in England and Wales. This observation is based on the author's personal experience and also on a consensus of opinion amongst members of the British Mycological Society. Peaks of fruiting in the autumn fungus season appear to occur when hot summers are succeeded by plentiful late summer/early autumn rainfall. In 1998 there was a long period of dry (but not particularly warm) weather in the early summer. This period was followed by long and heavy bouts of rainfall, with some particularly cold spells. The effect of these conditions was severely to restrict fruiting of thermophilic genera such as Milk-caps and Brittle Caps (Russulales), while the Boletes (Boletales) virtually "missed a year" (A. Hills, pers. comm.).

### 4.1 Woodland fungi

The main conservation value at Dinefwr Park is undoubtedly its mature oak woodland, some areas of which may be regarded as ancient woodland. And in spite of the unfavourable season, the quality of this woodland (including the dead wood resource) is reflected in the numbers of species associated in various ways with *Quercus*. As Tables 3 and 4 illustrate, oak is by far the

most frequent substrate or associate tree for lignicolous, humicolous and mycorrhizal species. This is in stark contrast to the data shown in Tables 5 and 6 for Hafod Estate, where only one species was recorded growing on oak, even though the estate has a substantial number of mature examples of this tree. (This comparison of numbers is perhaps somewhat invidious because, in the author's experience, the Hafod woodland was probably worse affected by the unfavourable weather conditions last year than any other woodland visited. However, it is fair to note the pattern of the main tree associations.) Had the season been more conducive to thermophilic species, the numbers of Boletes, Milk-caps and Brittle caps found in association with oak at Dinefwr would undoubtedly have been much greater. However, the presence of ancient woodland indicator species suggests a potentially rich mycota. It is worthy of note that annual brackets of *Fistulina hepatica* (Beefsteak) were recorded on a large number of oaks (perhaps as many as 12), widely distributed in the Deer Park. This may be regarded as a measure of the mycological value of the Park. Likewise, that old fruit bodies of *Ganoderma australe* (the so-called Beech Bracket, which is as common on oak as it is on beech), were recorded both on grouped oaks within the Deer Park as well as on a single mature oak in the Inner parkland.

Beech is also an important tree for fungi at Dinefwr, although it is, of course, not native in this part of Wales. However both the beech and the non-native pine must be regarded as being of high conservation value here, in mycological as well as in general terms.

The policy of the National Trust of retaining deadwood both in the closely-wooded areas and in the open parkland areas is to be applauded. It is noted that Dinefwr Park is the single most important site in Wales for the specialist fauna of decaying timber. Time might reveal that the same may be true for lignicolous fungi, although in view of the limited data at present available that contention cannot be justified at the moment.

Deadwood in the form of large, mature fallen trees in the open parkland provides a major habitat for the decomposer fungi. This is a rare habitat because it has more frequently been conventional for land managers to tidy up such "eyesores". However, the greatest numbers of species of lignicolous fungi were recorded on such fallen tree trunks in the open parkland – far greater than on deadwood in the woodland, for example. In addition to the high number of species, the large numbers of fruit bodies of many species recorded on these fallen trees was remarkable. Because this habitat is a rare one, there is virtually no literature referring in particular to fungal growth and fungal communities on fallen trees in open parkland, as opposed to deadwood in woodland. It has been suggested (R. Watling, pers. comm.) that different breeding patterns and strains of fungi might be found here by virtue of the relative isolation of the fungal populations, compared to those in close proximity in woodland. The author knows of no research into such a proposition.

Relevant to this point may be the occurrence of a very small variety of the common Sulphur Tuft (*Hypholoma fasciculare*) described as *H. var pusillum*. This was found fruiting in troupes on a fallen trunk of *Pinus maritima* in parkland above Bog Wood in the Deer Park on the visit of 21 November, 1998. This variety is mentioned in passing in the British Fungus Flora 5 (Watling & Gregory, 1987) but no known British records of the taxon could be traced, although in the Herbarium at Kew a single collection of *Hypholoma fasciculare* from the South-east is annotated as having very small fruit bodies. Since the above authors state that the variety is interfertile with the typical form, it may not be worth separating. But Watling (pers. comm.) has speculated that the relative isolation of the fallen pine may have caused the small variety to have arisen. Further study is needed to investigate these matters. It is worth mentioning that a species of *Gymnopilus* (a Pine-cap) fruiting on the same trunk could not be identified (either by the author or by mycologists at the Kew Herbarium). It is hoped that further collections of this species may be collected in 1999, so that its true identity might be elucidated. These taxa were among eight different fungal species collected from the pine, while similar numbers of species were recorded fruiting on three fallen oaks, in the Deer Park and Inner Park.

It is noteworthy that a number of lignicolous fungi were recorded from unusual hosts at Dinefwr Park. These included: *Pluteus salicinus* (Willow Shieldcap) on *Acer*; *Ganoderma australe* (Beech Bracket) on *Fraxinus*; and *Fistulina hepatica* (Beefsteak) on *Castanea* – the latter very unusual.

## CONCLUSIONS

This survey has shown that, even in an unpropitious year for fungal fruiting, Dinefwr Park has an interesting and important mycoflora. The grasslands have been shown to be of regional importance, so far as the Waxcap community is concerned. The rich potential of the mature oak woodland is hinted at in the data obtained. Observations over a single season (and an atypical one) are clearly insufficient to establish the full extent of the mycota. Indeed, Orton (1986) has indicated that in his opinion a minimum of ten years is needed to understand the full mycological potential of a site. (A substantial number of relatively common species were not recorded in the park during the relatively short survey period in 1998.) Further monitoring might well indicate that the conservation value of the grassland habitat is even greater than appears at present to be the case and that the mycota of the oak woodlands is, perhaps, of national importance. Investigation of the spring mycota at Dinefwr is also recommended.

In general the management of the estate is clearly favourable to the conservation of the mycota and it is suggested that present practices should continue.

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## APPENDIX I: Summary of Methodologies used in this Study to Evaluate Conservation Value of Nutrient Poor Grasslands (Waxcap Grasslands)

Workers in Norway and Denmark have proposed that *Hygrocybe* (Waxcap) species, together with the other characteristic unimproved grassland fungi, should be used as indicator organisms for judging the conservation value of a given locality. Several different formulae for grading the relative habitat quality of a site have been proposed and perhaps the simplest of these is that of Rald, 1985. (Other, more complicated methods tend to produce identical results!) Rald separated four classes by the number of species found:

### Conservation value

#### Total number of *Hygrocybe* species listed

Of national importance (I)	17-32 (11-20 during a single visit)
Of regional importance (II)	9-16 (6-10 during a single visit)
Of local importance (III)	4-8 (3-5 during a single visit)
Of no importance (IV)	1-3 (1-2 during a single visit)

The Rald prediction based on a single visit is useful but should be used with caution. The timing of the single visit is crucial. The phenology of fruiting of the sub-genus *Leptonia* – which makes up about half of all grassland species in the Entolomataceae (Species with pink spores, known in the vernacular as “Pink-gills”) – tends to be early, perhaps in July and August, if weather conditions are favourable. Their flush may be over by the time Waxcap fruiting peaks. (Taken to the extreme, of course, a single visit in January would produce a completely nil return!)

In assessing results using the Rald formula, additional weight can be given to sites which contain species which feature on the British Red Data List of Endangered Fungi (Ing, 1993) and the Red List of Endangered European Macrofungi (Ing, 1994).

Rotheroe *et al.*, 1996, suggested that the Waxcap profile of a site, for comparison purposes, could be expressed in a shorthand using the following code letters:

- C (Clavarioid fungi – Fairy Clubs)
- H (*Hygrocybe s.l.* – Waxcaps)
- E (grassland species of the Entolomataceae – Pink-gills)
- G (Geoglossaceae – Earth Tongues)
- and D (*Dermoloma* – Flourey False Waxcaps).

Thus a site with survey records of eight waxcaps, two fairy clubs, two earth tongues and one species of *Leptonia*, would be described as: C2, H8, E1, G2. The shorthand system has been used in the present study, except that, in the interests of simplicity, *Dermoloma* and *Porpoloma* are merged with H. This is legitimate, since they have the same ecological affinities and *Porpoloma* was, until recent taxonomic revisions, traditionally included in the genus *Hygrophorus* (as was *Hygrocybe*), while the current classification places *Dermoloma* in the tribus *Hygrocybeae*. (The effect of this minor departure from the Rald criteria is insignificant.) That author therefore interpreted Rald in this fashion and also referred to the ‘CHEG profile’ as a means of making easy quantitative assessments for comparison of different sites and to suggest their relative conservation value. The combined use of Rald criteria and CHEG profiles has proved successful in making comparative assessments of sites during the first three years of the BMS Waxcap-grassland Survey – a long-term study of grasslands being carried out throughout the British

Isles. (NOTE: In using these numerical formulae a variety record is given equal weighting to that of a species. Thus the numbers refer to taxa, rather than species.)

A further system of weighting is proposed by Rotheroe (1999). His "Top Twenty-four" formula for evaluation of conservation value of Waxcap Grasslands relies heavily on the presence of certain waxcap species, but not exclusively so. It includes the presence of five other indicator species of unimproved grassland. A total of 24 species is listed as representing indicators of the highest quality Waxcap Grassland. The species selected are as follows:

#### Category A

*Hygrocybe punicea* (Blood-red Waxcap, European Red Data List species)  
*Hygrocybe ovina* (Sheep Waxcap, European Red Data List species)  
*Hygrocybe ingrata* (Spindle-shank Waxcap, European Red Data List species)  
*Hygrocybe lacmus* (Lacquered Waxcap)  
*Hygrocybe splendidissima* (Splendid Waxcap)  
*Hygrocybe nitrata* (Nitrous Waxcap, European Red Data List species)

#### Non-Waxcap species

*Entoloma bloxamii* (Bloxam's Pink-gill, British Red Data List species)  
*Microglossum olivaceum* (Olivaceous Earth Tongue, British Red Data List species)  
*Trichoglossum walteri* (Walter's Earth Tongue)  
*Entoloma incanum* (Mousy Pink-gill)  
*Porpoloma metapodia* (Reddening False Waxcap, British Red Data List species)  
*Clavaria zollingeri* (Zollinger's Fairy Club, British Red Data List species)

#### Category B

*Hygrocybe spadicea* (Date-coloured Waxcap, British Red Data List species)  
*Hygrocybe citrinovirens* (Lemon-green Waxcap, European Red Data List species)  
*Hygrocybe intermedia* (Intermediate Waxcap, European Red Data List species)  
*Hygrocybe caliptriformis* (Pink Waxcap, a British Red Data List Species)  
*Hygrocybe flavipes* (Yellow-footed Waxcap)  
*Hygrocybe helobia* (Garlic Waxcap)  
*Hygrocybe colmanniana* (Colmann's Waxcap)  
*Hygrocybe quieta* (Tranquil Waxcap, European Red Data List species)  
*Hygrocybe fornicata* (Arched Waxcap, European Red Data List species)  
*Hygrocybe aurantiosplendens* (Orange Splendid Waxcap)  
Any other species in the Geoglossaceae, except *G. fallax* (Scaly Earth Tongue)  
*Hygrocybe irrigata* (Slippery-eel Waxcap, European Red Data List species)

The species are listed in order of their value as indicators of the highest conservation value. This is the criterion in making the list. (Some in the list are, in fact, rather common, ie *Hygrocybe punicea*. However, this species above all is an indicator of the best waxcap sites. It is said by Boertmann to fruit only in localities with eight or more *Hygrocybe* species.)

A profile can thus be applied to any location in the following way: A location which has two species in the A category and three in the B category would be termed an A2 B3 site.

The value of this method of assessment is that the potential conservation value of a grassland can be predicted if any of the above species are found to occur, even if total numbers recorded on any or several occasions are few, for one reason or another. (Because presence or absence of a species can be noted only if it fruits, it often takes several years for the complete mycota of a site to emerge.)

## APPENDIX II: Dinefwr Park Fungus Records

### Key to terms used in description of Nutritional Modes of fungi listed

**Saprotroph:** An organism that uses only dead organic matter as a nutrient source, eg *Hypholoma fasciculare* (Sulphur Tuft) which is lignicolous; and *Hygrocybe* (Waxcaps), which is humicolous.

**Necrotroph:** An organism that derives its energy from the dead cells of a living host, eg *Ganoderma* (Beech Bracket).

**Biotroph:** An organism that uses living cells as nutrient sources. This term embraces both parasites such as *Armillaria mellea* (Honeytuft), which may kill the host and then become necrotrophic; plant diseases such as rusts and smuts; and mycorrhizal fungi, which derive nutrients from the host but provide nutrients to the host in exchange, eg *Russula* (Brittle-caps).

Name of Fungus	Ord	Medium	Associated Organism	Habitat	Nutrition Mode	Herbarium	Notes
<u>Agaricales (Mushrooms &amp; Toadstools)</u>							
Amanita fulva (Tawny Grisette)	01	Soil	Quercus, Betula	Pasture woodland	Biotroph (Mycorrhizal)		
Amanita rubescens (Blusher)	01	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)		
Amanita rubescens var annulo-sulphureo (Yellow-ringed Blusher)	01	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	Rare MR98113
Armillaria lutea (Yellow Honeytuft)	01	Wood, dead, log	Quercus	Pasture woodland	Biotroph (Weak parasite)	NBGW	
Armillaria ostoyae (Ostoy's Honeytuft)	01	Wood, log, dead	Pinus	Pasture woodland	Biotroph (Weak parasite)	NBGW	
Bolbitius vitellinus (Yellow Cowpat Fungus)	01	Grass, debris	Poaceae	Estate parkland	Saprotroph		
Clitocybe fragrans (Fragrant Agaric)	01	Soil	Poaceae	Estate parkland	Saprotroph	NBGW	
Clitocybe phyllophila (White Funnel-cap)	01	Leaf litter	Quercus	Pasture woodland	Saprotroph	NBGW	Rare in Wales MR98159
Coprinus atramentarius (Common Inkcap)	01	Wood, buried	?	Pasture woodland	Saprotroph		
Coprinus comatus (Shaggy Inkcap)	01	Soil		Estate parkland	Saprotroph		
Coprinus disseminatus (Fairies' Bonnets)	01	Wood, stump		Pasture woodland	Saprotroph		
Coprinus micaceus (Glistening Inkcap)	01	Wood, stump	Aesculus	Pasture woodland	Saprotroph		
Coprinus niveus (Snowy Inkcap)	01	Dung		Estate parkland	Saprotroph	NBGW	
Cortinarius flexipes (Scurfy Cobweb-veil)	01	Soil	Quercus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	
Flammulina velutipes (Velvet Shank)	01	Wood, log		Pasture woodland	Saprotroph		
Galerina hypnorum (Moss Galerina)	01	Soil	Bryophyta	Estate parkland	Saprotroph		
Galerina mutabilis (Two-toned Galerina)	01	Wood, dead, log	Quercus	Estate parkland	Saprotroph		
Gymnopilus penetrans (Small Pine-cap)	01	Wood, dead, stick	Pinus, Quercus	Estate parkland	Saprotroph	NBGW	
Gymnopilus sp. (A Pine-cap)	01	Wood, dead, trunk	Pinus	Estate parkland	Saprotroph	NBGW & Kew	MR98159
Gymnopus erythropus (Red-stemmed Tough-shank)	01	Leaf litter	Quercus	Estate parkland	Saprotroph	NBGW	
Gymnopus fusipes (Spindle Shank)	01	Wood, trunk, base	Quercus	Pasture woodland	Saprotroph	NBGW	Indicator of ancient oak woodland
Gymnopus peronatus (Wood Woolly Foot)	01	Litter	Aesculus	Pasture woodland	Saprotroph		
Hygrocybe ceracea (An orange-yellow Waxcap)	01	Soil	Poaceae	Estate parkland	Saprotroph	NBGW	
Hygrocybe chlorophana (Golden Waxcap)	01	Soil	Poaceae	Estate parkland	Saprotroph		

Hygrocybe conica (Blackening Waxcap)	01	Soil	Poaceae	Estate parkland	Saprotroph		
Hygrocybe flavipes (Yellow-footed Waxcap)	01	Soil	Poaceae	Estate parkland	Saprotroph	NBGW	Indicator of high conservation- value grassland
Hygrocybe glutinipes (Glutinous Waxcap)	01	Soil	Poaceae	Estate parkland	Saprotroph	NBGW	MR98114
Hygrocybe intermedia (Intermediate Waxcap)	01	Soil	Poaceae	Estate parkland	Saprotroph	NBGW	Indicator of high conservation- value grassland. European Red Data List species
Hygrocybe pratensis var pallida (Meadow Waxcap - white var)	01	Soil	Poaceae	Estate parkland	Saprotroph	NBGW	
Hygrocybe psittacina (Parrot Waxcap)	01	Soil	Poaceae	Estate parkland	Saprotroph		
Hygrocybe virginea (White Waxcap)	01	Soil	Poaceae	Estate parkland	Saprotroph		
Hygrophoropsis aurantiaca (False Chanterelle)	01	Litter	?	Pasture woodland	Saprotroph		
Hypholoma fasciculare (Sulphur Tuft)	01	Wood, dead, log	Quercus	Estate parkland	Saprotroph		
Hypholoma fasciculare var pusillum (ditto, small form)	01	Wood, dead, log	Pinus	Estate parkland	Saprotroph	NBGW & Kew	1st British record? MR98165 - See text
Hypholoma sublateritium (Brickcap)	01	Wood, dead, buried	Quercus	Pasture woodland	Saprotroph	NBGW	
Inocybe asterospora (Star- spored Fibre-cap)	01	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	
Inocybe geophylla (White Fibre-cap)	01	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)		
Inocybe geophylla var lilacina (Lilac Fibre-cap)	01	Leaf litter	Quercus/Pinus	Pasture woodland	Biotroph (Mycorrhizal)		
Inocybe napipes (Turnip- foot Fibre-cap)	01	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	
Laccaria amythestina (Amethyst Deceiver)	01	Soil	Quercus	Pasture woodland	Biotroph (Mycorrhizal)		
Laccaria laccata (Deceiver)	01	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)		
Macrolepiota procera (Parasol Mushroom)	01	Soil	Poaceae	Estate grassland	Saprotroph		
Marasmius oreades (Fairy Ring Champignon)	01	Soil	Poaceae	Estate parkland	Saprotroph		
Marasmius rotula (Collared Marasmius)	01	Litter	?	Pasture woodland	Saprotroph		
Mycena arcangeliana (Steel-grey Mycena)	01	Wood, dead, log	Quercus, Pinus	Estate parkland	Saprotroph		
Mycena galopus (Milk- drop Mycena)	01	Wood, dead, log	Quercus	Estate parkland	Saprotroph		
Mycena haematopus (Bleeding Mycena)	01	Wood, dead, log	Quercus, Pinus	Estate parkland	Saprotroph		
Mycena inclinata (Gregarious Mycena)	01	Wood, dead, log	Quercus, Pinus	Estate parkland	Saprotroph		
Mycena leptcephala (Nitrous Mycena)	01	Wood, dead, log	Quercus	Pasture woodland	Saprotroph		
Oudemansiella mucida (Porcelain Cap)	01	Wood, dead, branches	Fagus	Pasture woodland	Necrotroph		

Oudemansiella radicata (Rooting Shank)	01	Wood, dead	Fagus	Pasture woodland	Saprotroph		
Panaeolus ater (Black Dunghead)	01	Soil, rich	Poaceae	Estate parkland	Saprotroph		
Panaeolus foenisecii (Hay Cap)	01	Soil, rich	Poaceae	Estate parkland	Saprotroph		
Panaeolus rickenii (Ricken's Dunghead)	01	Soil, rich	Poaceae	Estate parkland	Saprotroph		
Panaeolus sphinctrinus (Fringed Dunghead)	01	Soil, rich	Poaceae	Estate parkland	Saprotroph		
Pholiota gummosa (Glutinous Scale-head)	01	Wood, dead, buried		Estate parkland	Saprotroph		
Pholiota squarrosa (Shaggy Scale-head)	01	Wood, living, trunk base	Quercus	Pasture woodland	Saprotroph		
Pleurotus dryinus (Veiled Oyster)	01	Wood, dead, log	Quercus	Estate parkland	Saprotroph	NBGW	Rare in Wales
Pluteus cervinus (Fawn Shieldcap)	01	Wood, dead	Acer, Fagus, Quercus	Estate parkland	Saprotroph		
Pluteus griseopus (Grey-footed Shieldcap)	01	Wood, dead, stick		Pasture woodland	Saprotroph	NBGW	MR98111
Pluteus mitissimus (Mild Shieldcap)	01	Wood, dead, rotten	Acer	Pasture woodland	Saprotroph	NBGW	MR98110
Pluteus salicinus (Willow Shieldcap)	01	Wood, dead	Acer	Pasture woodland	Saprotroph		Unusual host MR98112
Porpoloma metapodium (Reddening False-waxcap)	01	Soil	Poaceae	Estate parkland	Saprotroph	NBGW	Indicator of high conservation-value grassland MR98115 British Red Data List species
Psilocybe semilanceata (Liberty Cap)	01	Soil, dungy	Dung	Estate parkland	Saprotroph		
Rhodotus palmatus (Wrinkled Peach)	01	Wood, dead, branch	Ulmus	Estate poolside	Saprotroph	NBGW	
Schizophyllum commune (Split-gill Fungus)	01	Wood, dead, stick	?	Pasture woodland	Saprotroph	NBGW	
Stropharia semiglobata (Round Slime-cap)	01	Dung	Poaceae	Estate parkland	Saprotroph		
Tricholomopsis platyphylla (Broad-gilled Agaric)	01	Wood, dead, log	Quercus	Pasture woodland	Saprotroph		
<u>Aphylllophorales (Brackets, Fairy Clubs)</u>							
Bjerkandera adusta (Burnt Bracket)	02	Wood, dead, stump	Fagus	Pasture woodland	Necrotroph		
Chondrostereum purpureum (Purple Stereum)	02	Wood, dead, log	Picea, Quercus	Pasture woodland	Necrotroph		
Clavaria vermicularis (White Spindles)	02	Soil	Poaceae	Estate parkland	Saprotroph	NBGW	
Daedalea quercina (Oak Maze-gill)	02	Wood, dead, stump	Quercus	Pasture woodland	Necrotroph	NBGW	
Daedaleopsis confragosa (Blushing Bracket)	02	Wood, dead, trunk	Salix	Estate woodland	Necrotroph	NBGW	
Fistulina hepatica (Beefsteak)	02	wood, trunk	Quercus, Castanea	Pasture woodland	Necrotroph	NBGW	Castanea very unusual host

Ganoderma australe (Beech Bracket)	02	Wood, living & dead, trunk	Fagus, Quercus, Fraxinus	Estate parkland	Necrotroph	NBGW	Unusual on Fraxinus
Ganoderma resinaceum (Lacquered Bracket)	02	Wood, living, trunk	Quercus	Estate parkland	Necrotroph	NBGW	Ancient woodland indicator species. European Red Data List species
Grifola frondosa (Hen of the Woods)	02	Wood, living, trunk base	Quercus	Pasture woodland	Necrotroph	NBGW	
Ischnoderma resinoseum (Resinous Polypore)	02	Wood, dead, log	Quercus	Estate parkland	Necrotroph	NBGW	First Welsh record. Ancient woodland indicator species
Laetiporus sulphureus (Chicken of the Woods)	02	Wood, living, trunk	Quercus	Estate parkland	Necrotroph		
Meripilus giganteus (Giant Bracket)	02	wood, trunk	Fagus sylvatica	Pasture woodland	Necrotroph		
Panellus serotinus (Olive Oyster)	02	Wood, dead, fallen trunk	Quercus	Estate parkland	Necrotroph	NBGW	Rare in Wales
Polyporus squamosus (Dryad's Saddle)	02	wood, stump	Castanea sativa	Pasture woodland	Necrotroph		
Stereum hirsutum (Hairy Stereum)	02	Wood, dead, stick	Fagus, Quercus	Pasture woodland	Necrotroph		
Trametes gibbosa (White Beech Bracket)	02	Wood, dead, stump	Fagus sylvatica	Pasture woodland	Necrotroph		
Trametes versicolor (Many-zoned Bracket)	02	Wood, dead, stick	Corylus	Pasture woodland	Necrotroph		

Boletales (Boletes)

Boletus chrysenteron (Red-cracked Bolete)	04	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)		
Boletus porosporus (Pored-spore Bolete)	04	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	

Dacrymycetales (Jelly spot fungi)

Calocera cornea (Jelly Antler-fungus)	07	wood, log		Pasture woodland	Saprotroph		

Gasteromycetes (Puffballs, Stinkhorns, etc)

Calvatia utriformis (Mosaic Puffball)	11	Soil	Poaceae	Estate parkland	Saprotroph		
Lycoperdon pyriforme (Pear-shaped Puffball)	11	Wood, dead	Quercus	Pasture woodland	Saprotroph		
Mutinus canina (Dog Stinkhorn)	14	Leaf litter	?	Pasture woodland	Saprotroph	NBGW	
Phallus impudicus (Stinkhorn)	14	Wood, debris, buried		Pasture woodland	Saprotroph		
Scleroderma bovista (Potato Earthball)	11	Leaf litter	Quercus	Estate parkland	Biotroph (Mycorrhizal)		

Russulales (Milkcaps & Brittle-caps)

Lactarius piperatus (Peppery Milkcap)	16	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	Rare in Wales
Lactarius quietus (Oak Milkcap)	16	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)		
Russula albifolia (A blackening Brittle-cap)	16	Soil	Quercus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	
Russula atropurpurea (Blackish-purple Brittle-cap)	16	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)		
Russula cyanoxantha (Charcoal Burner)	16	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)		
Russula grisea (Grey-green Brittle-cap)	16	Litter	Quercus, Fagus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	
Russula nitida (Shining Brittle-cap)	16	Litter	Betula	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	MR98124
Russula vesca (Bare-toothed Brittle-cap)	16	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	
Russula virescens (Cracked Green Brittle-cap)	16	Leaf litter	Quercus	Pasture woodland	Biotroph (Mycorrhizal)	NBGW	

Tremellales (Jelly fungi)

Exidia glandulosa (Witch's Butter)	20	Wood, dead, log	Quercus	Pasture woodland	Saprotroph	NBGW	
Hirneola auricula-judea (Jew's Ear)	20	Wood, dead, branch	Sambucus, Acer, Fagus, Fraxinus	Pasture woodland	Saprotroph		Latter 3 - unusual hosts

Ascomyetes (Cup fungi. Flask fungi. etc)

Daldinia concentrica (Cramp Ball)	02	Wood, dead	Fraxinus	Pasture woodland	Saprotroph		
Peziza sp (A cup fungus)	50	Wood, dead, stick	?	Pasture woodland	Saprotroph	NBGW	
Rhytisma acerinum (Tar Spot)	53	Leaf, living	Acer	Estate parkland	Biotroph (Parasite)		Indicator of sulphur-free air
Ustulina duستا (Carbon Cushion)	55	Wood, dead, bark	Fagus	Pasture woodland	Saprotroph		
Xylaria hypoxylon (Candle Snuff)	55	Wood, dead, stick		Pasture woodland	Saprotroph		
Xylaria polymorpha (Dead Man's Fingers)	55	Wood, dead, stick	Quercus	Pasture woodland	Saprotroph		