Cyfoeth Naturiol Cymru
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Grassland Fungi baseline surveys of the Chirk Castle and Maes Gwyn Estates and a repeat survey of Baddy's Park

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Evidence Report No 697

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1. Crynodeb Gweithredol

Arolygwyd Parc Baddy (Baddy's Park) ar Stâd Yr Ymddiriedolaeth Genedlaethol yn Castell y Waun ar amryw achlysur, y mwyaf diweddar yn 2016 (Evans, 2016) ac mae'n cael ei gydnabod fel un o Bwysigrwydd Cenedlaethol ar gyfer ei boblogaeth o ffwng glaswelltir. Dynodwyd yr holl barcdir ar Stâd Castell y Waun fel Safle o Ddiddordweb Gwyddonol Arbennig (SoDdGA) yn 2011 am ei nodweddion sy'n cynnwys y ffwng glaswelltir, sef y rhywogaethau 'CHEGD' mae'n ei gefnogi. Ni chafwyd arolygon ffurfiol o'r blaen ar yr un o'r caeau glaswelltir ar draws y stâd nac ychwaith ar Stâd Maes Gwyn sydd ar y ffîn ond fewn y SoDdGA er tu allan i ymylon Yr Ymddiriedolaeth Genedlaethol. Comisiynwyd yr arolwg yma yn ystod hydref 2022 i ddod o hyd i unrhyw ardaloedd eraill sy'n bwysig ar gyfer ffwng glaswelltir ac i alluogi cynllunio ar gyfer eu rheoli at y dyfodol er budd y ffwng. Yn ychwanegol gwnaethwyd arolwg arall o Barc Baddy.

Cofnodwyd ffwng glaswelltir ar pob un o'r caeau a arolygwyd, gyda niferoedd ac amlder y rhywogaethau yn amrywio rhyngddynt. Cofnodwyd cyfanswm o 52 rhywogaeth 'CHEGD' dros yr arolygon, yn cynnwys 12 rhywogaeth newydd at restr Stâd Castell y Waun: 2 Clavarioid, 5 rhywogaeth *Hygrocybe*, 4 rhywogaeth *Entoloma* ac 1 Tafod y ddaear. Cofnodwyd 2 rywogaeth sy'n cael eu cydnabod fel dangosyddion da iawn o laswelltir o safon sef *Hygrocybe punicea* Cap cŵyr rhuddgoch a *H. citrinovirens* Cap cŵyr lemon. Mae presenoldeb y rhain yn yn dangos fod dal yna ardaloedd bychain o ychdig o'r caeau sydd wedi aros heb eu gwella, tra fod y rhan fwyaf o'r tîr a arolygwyd yn ymddangos ei fod wedi ei rannol wella. Adnabuwyd 2 o gaeau Stâd Castell y Waun; 'Horse Park' ac 'Old Golff & Tynygroes' fel rhai o Bwysigrwydd Cenedlaethol ar gyfer eu ffwng glaswelltir a buasai 'Horse Park' ynghyd a Parc Baddy yn deilwng ar gyfer statws SoDdGA o'u herwydd. Mae 11 cau o Stâd Castell y Waun a 4 o Stâd Maes Gwyn o Bwysigrwydd Rhanbarthol. Cofnodwyd nifer o rywogaethau o bwys cadwraeth Prydeiniol a Rhyngwladol a mae eu presenoldeb yn atgyfnerthu yr angen i reoli'r caeau mewn ffordd gydymdeimladwy er mwyn cynnal y cynefinoedd ac i ddiogelu a chwyddo'r poblogaethau ffwng yma. Rhoddir argymhelliadau ar gyfer rheolaeth o'r caeau ac at eu monitro ar gyfer y dyfodol.

2. Executive Summary

Baddy's Park on the National Trust's Chirk Castle Estate has been surveyed on several occasions, most recently in 2016 (Evans, 2016) and is considered of National Importance for its grassland fungi assemblage. All the parkland on the Chirk Castle Estate was designated as a SSSI in 2011 for features including the grassland fungi, the 'CHEGD' species it supports. No formal surveys had been conducted previously on any of the other grassland fields across the Estate or on the adjacent Maes Gwyn Estate, lying within the SSSI but beyond the NT boundaries. This baseline study was commissioned in the autumn of 2022 to identify any other areas important for grassland fungi and to enable planning for the future management of the grasslands for the benefit of the fungi. In addition a repeat survey was conducted of Baddy's Park.

Grassland fungi were recorded on all fields surveyed, with the number of species and their abundance varying between fields. A total of 52 CHEGD species were recorded during the surveys with 12 species new to the Chirk Estate list: 2 Clavarioids, 5 *Hygrocybe* species, 4 *Entoloma* species and 1 earthtongue. *Hygrocybe punicea* Crimson Waxcap and *H. citrinovirens* Citrine Waxcap, 2 species regarded as very good indicators of a quality grassland, were recorded and they indicate that there are still small areas of a few fields which have remained unimproved, while most of the land surveyed appears to be semi-improved. Two Chirk Castle Estate fields, Horse Park and Old Golff & Tynygroes, have been identified as being of National Importance for their grassland fungi, and Horse Park along with Baddy's Park would qualify for SSSI status for their grassland fungi alone. Eleven Chirk Estate fields and 4 Maes Gwyn Estate fields are of Regional Importance. A number of species of British and of International conservation concern were recorded and their presence reinforces the need to manage the fields sympathetically to maintain the habitats and to preserve and enhance these fungal populations. Recommendations are given for managing the fields and for future monitoring.

3. Introduction

This report documents grassland fungi surveys of fields on the National Trust's Chirk Castle Estate and fields on the adjoining Maes Gwyn Estate under the ownership of Kronospan, in the autumn of 2022.

Baddy's Park on the Chirk Castle Estate has been surveyed previously on several occasions, (Evans, 2006; Woods & Day, 2008; Evans, 2011; Evans, 2016), and is considered to be of National Importance for its grassland fungi with a total of 42 species, including 19 species of *Hygrocybe*, (waxcaps) recorded on the field. The Chirk Estate was designated as a SSSI in 2011 for features including the diverse grassland fungi assemblage identified on Baddy's Park and the field is managed to preserve and enhance these fungi. The remainder of the fields across the Estate are believed to be mainly of unimproved or semi-improved grassland and have not been fertilised or improved in recent years. The historic management of the land is not known, but they have probably had some fertiliser input in the past. These fields are also likely to support a variety of grassland fungi. This baseline survey of 17 previously unsurveyed fields on the Chirk Estate (Table 1) was commissioned to identify any further areas containing rich and diverse assemblages and to enable decisions to be made on their future management. A repeat survey of Baddy's Park was conducted simultaneously.

Six fields on Kronospan's Maes Gwyn Estate (Table 1) lie adjacent to the Chirk Estate and are within the SSSI; they were surveyed as part of the baseline surveys and for future management planning.

Maps showing locations of the Chirk Castle and Maes Gwyn Estates and maps of individual fields are included in Appendix II.

Table 1. Chirk Castle Estate and Maes Gwyn Estate Fields and Areas

Chirk Castle Estate Field Name	Field Number	Area
Baddy's Park	SJ2737 8747	21.49ha
Baddy's Paddock	SJ2737 9082	3.68ha
Upper Llwyn y Cil	SJ2738 6906	6.80ha
Horse Park	SJ2738 6248	10.81ha
Pleasure Ground Ley	SJ2738 2847	13.69ha
Upper Deer Park	SJ2737 3697	16.82ha
Deer Shed Paddock	SJ2737 4771	4.40ha
Middle Paddock	SJ2638 6112	0.92ha
Big Paddock	SJ2638 5119	1.85ha
Old Golff (also known as Gwyningar)	SJ2638 3029	5.72ha
Old Golff & Tynygroes	SJ2638 2961	11.93ha
Jericho	SJ2638 3552	9.12ha
Middle Ley	SJ2638 6574	7.62ha
Pool Ley	SJ2638 8250	8.39ha
Drive Ley	SJ2738 0352	8.43ha
Pheasantry	SJ2738 2290	7.98ha

Chirk Castle Estate Field Name	Field Number	Area
Middle Lawn	SJ2638 8923	3.58ha
Top Lawn	SJ2738 0216	2.78ha
Maes Gwyn Field 1 (by Gwyningar Cottage)	SJ2637 2886	1.8ha
Maes Gwyn Field 2 (North of Rose Cottage)	SJ2638 1295	9.9ha
Maes Gwyn Field 3 (North of Mars Wood)	SJ2538 9378	9.4ha
Maes Gwyn Field 4 (Lower Deer park)	SJ2637 8370	12.0ha
Maes Gwyn Field 5 (Offa's Dyke opp. Lower Deer Park)	SJ2637 5595	4.1ha
Maes Gwyn 6 (East of Tynygroes)	SJ2639 5805	10.9ha

4. Background to the CHEGD Fungi

4.1. The CHEGD species

The fungal surveys concentrated on the suite of grassland fungi, known as the 'CHEGD' species, which only thrive in undisturbed semi-improved or unimproved grassland. The CHEG profile was originally devised by Rotheroe, (2001) and was adapted to the acronym CHEGD by Griffith *et al*. (2006). The grassland is typically fairly short, grazed or mown with cuttings removed, well drained and often with a high moss content. This habitat and consequently the fungi it supports are now rare in much of lowland Britain as a result of agricultural intensification and both are of conservation concern (Rotheroe, 1999). These fungi are intolerant of 'improvement', such as the use of fertilisers, ploughing, reseeding or disturbance including compaction etc. They will quickly disappear and may not return for decades if at all.

The 'CHEGD' group is composed of members of the genera *Hygrocybe* (Waxcaps) and *Entoloma* (Pinkgills); and the families Clavariaceae (Fairy Clubs) and Geoglossaceae (Earth Tongues). The D element includes the genera *Dermoloma*, *Pseudotricholoma* and *Camarophyllopsis*. These groups of fungi are unrelated but appear to have similar ecological requirements. The colourful and charismatic Hygrocybes, called waxcaps because of the waxy texture of the fruitbodies, are the most visible component of the grassland fungi and have attracted the most attention. Good sites have become known as 'Waxcap Grasslands' (Rotheroe *et al.*, 1996).

Optimum fruiting of these fungi can be very weather dependent as they do not tolerate dry, windy or frosty weather very well, and fruiting may be inhibited or any fungi present quickly desiccate or rot if weather conditions are unsuitable. The fruiting season generally ranges from September to December with October usually being the optimum month for most species. However, different species of fungi may fruit at different times during the autumn season and more than one visit and a spread of dates will often increase the number of species recorded. A single visit will only take a 'snapshot' of the fungi present on that day and it may take several years to obtain a full list for a site.

4.2. Nomenclature of the Grassland Fungi used in this Report

The Latin fungal names of the grassland fungi used follow those currently listed in the Index Fungorum database http://www.indexfungorum.org/. Following DNA analysis, the Hygrocybes (waxcaps) have now been reclassified and several have been given new generic names, (Lodge *et al*., 2013). In addition new species of waxcaps are being identified from their DNA profiles; this survey is thus, only based on the current knowledge of the waxcaps. The current Latin names of all grassland fungi species recorded during the surveys are shown in the tables, with the accepted English names, (BMS) and the Welsh names (Brown *et al*., 2015) shown in Table 5.

4.3. Indicator Classes of Grassland Fungi and Quality Assessment of a Site

A grassland site can be assessed by a total count of the grassland fungi species and this is the simplest way of expressing and comparing the value of a site by its 'CHEGD' profile. The greater the number of CHEGD species present, the more important the grassland. It has been suggested that the importance of a site can also be evaluated by the number of *Hygrocybe*, (waxcap) species recorded, both on a single visit and over multiple visits. A site classification system was proposed by Rald (1985) and was adapted by Vesterholt *et al*. (1999) (Table 2).

Table 2. The site classification system of Rald, (1985), adapted by Vesterholt *et al*., (1999).

Conservation Value	*Hygrocybe* spp. in one visit	Total no. of *Hygrocybe* spp.
Internationally important	15+ (?)	22+
Nationally important	11-14	17-21
Regionally important	6-10	9-16
Locally important	3-5	4-8
Of no importance	1-2	1-3

Some grassland fungi, however, are more tolerant of improvement than others and are the first to return when improvement is ceased; there is also a group of species that are only found on the highest quality grasslands that have had the least or no improvement and where the ground may have been undisturbed for decades. The relative values of the individual species, both for their rarity and as indicators of quality grasslands, can also be taken into account to determine the value of a site. They can be assessed as high, medium or low value indicator species of the quality of a grassland (Table 3).

4.4. Conservation Status of Grassland Fungi species

Grassland fungi have been assessed for their conservation status in Great Britain and across the world. The Red Data List for Threatened British Fungi was prepared by the British Mycological Society (BMS), working with the Joint Nature Conservation Committee (JNCC) (Evans *et al*., 2006), and the

International Union for the Conservation of Nature's (IUCN) Global Fungal Red List Initiative is assessing fungi threatened by habitat loss, loss of symbiotic hosts, pollution, over exploitation, and climate change on a worldwide basis. https://www.iucnredlist.org/. Species of conservation concern recorded during the surveys are indicated in Table 5 and profiled in Appendix III.

Table 3. Indicator Classes of Grassland Fungi (McHugh *et al*., 2001; revised Evans & Aron, 2008; Evans, 2015).

High Value	Medium Value	Low Value
Camarophyllopsis foetens	*Clavaria fumosa*	*Clavaria acuta*
Camarophyllopsis schulzeri	*Clavaria incarnata*	*Clavaria fragilis*
Clavaria amoenoides	*Clavaria straminea*	*Clavulinopsis corniculata*
Clavaria zollingeri	*Clavulinopsis fusiformis*	*Clavulinopsis helvola*
Cuphophyllus colemanniana	*Clavulinopsis umbrinella*	*Clavulinopsis laeticolor*
Cuphophyllus lacmus	*Cuphophyllus flavipes*	*Clavulinopsis luteoalba*
Entoloma anatinum	*Cuphophyllus fornicatus*	*Cuphophyllus pratensis*
Entoloma asprellum	*Cuphophyllus pratensis* var. *pallidus*	*Cuphophyllus virgineus*
Entoloma atrocoeruleum	*Cuphophyllus radiatus*	*Dermoloma cuneifolium*
Entoloma bloxamii	*Cuphophyllus russocoriaceus*	*Entoloma cf ortonii*
Entoloma caesiocinctum	*Cuphophyllus virgineus* var. *fuscescens*	*Entoloma conferendum*
Entoloma cf corvinum	*Cuphophyllus virgineus* var. *ochraceopallidus*	*Entoloma infula*
Entoloma cf griseocyaneum	*Entoloma chalybaeum*	*Entoloma papillatum*
Entoloma cf lividocyanulum	*Entoloma cf clandestinum*	*Entoloma sericellum*
Entoloma cf longistriatum	*Entoloma exile*	*Entoloma sericeum*
Entoloma cf mutabilipes	*Entoloma jubatum*	*Geoglossum fallax*
Entoloma cf poliopus	*Entoloma porphyrophaeum*	*Gliophorus irrigataus*
Entoloma cf politoflavipes	*Entoloma serrulatum*	*Gliophorus psittacinus*
Entoloma corvinum	*Geoglossum cookeianum*	*Hygrocybe ceracea*
Entoloma formosum	*Geoglossum umbratile*	*Hygrocybe chlorophana*
Entoloma longistriatum var. *sarcitulum*	*Gliophorus laetus*	*Hygrocybe coccinea*
Entoloma mougeotii	*Gliophorus psittacinus* var. *perplexus*	*Hygrocybe conica*
Entoloma prunuloides	*Gloioxanthomyces vitellinus*	*Hygrocybe insipida*
Entoloma sp. Section *Undati*	*Glutinoglossum glutinosum*	*Hygrocybe quieta*
Geoglossum atropurpureum	*Hygrocybe acutoconica*	*Trichoglossum hirsutum*
Hygrocybe citrinovirens	*Hygrocybe aurantiosplendens*	
Hygrocybe punicea	*Hygrocybe cantharellus*	
Hygrocybe spadicea	*Hygrocybe conica* var. *conicoides*	
Hygrocybe splendidissima	*Hygrocybe glutinipes*	
Microglossum olivaceum	*Hygrocybe helobia*	
Neohygrocybe ingrata	*Hygrocybe intermedia*	
Neohygrocybe nitrata	*Hygrocybe miniata*	
Neohygrocybe ovina	*Hygrocybe mucronella*	
Pseudotricholoma metapodium	*Hygrocybe reidii*	
Ramariopsis crocea	*Porpolomopsis calyptriformis*	
Trichoglossum walteri	*Ramariopsis kunzei*	

5. Survey Methodology

5.1. Survey Dates

The surveys were carried out over 3 separate weeks between October and November 2022, with approximately 2 weeks between visits. The fungi can start appearing earlier in September, but dry weather in the summer and the early autumn had delayed fruiting in most areas. The first surveys were conducted between the 8th and 12th October following a period of rain, the second surveys between the 28th October and 3rd November, and the third surveys between the 11th and 18th November. Over the survey periods there were no prolonged dry spells and there was sufficient rainfall to keep the ground moist underfoot. There were no frosts.

5.2. Survey Method

The survey of each field was by a walkover method by 2 surveyors. The aim was to look at as much of a field as possible on each visit. The surveyors walked backwards and forwards recording all the CHEGD species seen. No count was made of individual fruitbodies unless there was only a single or very few individuals in the field or the species was of significance. A general observation was made of the abundance, distribution or localisation of a species or concentration of species on the field.

It is recognised that the 'walkover' method used may not allow for direct comparison with other grassland fungi sites because of the variations in area between sites and in recording effort. However, the main remit was for a total count of CHEGD species for each field and identification of the most important areas for the fungi. The total number of species recorded and especially the number of waxcaps combined with the indicator value of individual species can be used as an indication of the mycological importance of a field and allow for comparison with other sites.

Photographs of representative and significant fungal species were taken as a record and for illustration purposes. Photographs were taken of each field, including any important areas for fungi. Individual 10-figure grid references were recorded with a GPS for any significant species to enable relocation of populations in the future. Most species were identified in the field but any specimens requiring determination or confirmation, including microscopic study, were retained. A few critical species were dried and sent for DNA analysis at Aberystwyth University.

A total of approximately 7 hours were spent on Baddy's Park on each of the 3 survey visits. Less time was spent on each of the other fields and time spent depended on the site area and number of fungi present. General observations were made of each field including sward length, weed cover and current grazing management.

6. Results

6.1. Outline

Grassland fungi were recorded on every field surveyed over the 3 visits and a total of 52 CHEGD species (C10,H23,E13,G5,D1) were recorded from all the surveys. These are shown in Table 5 along with their accepted English and Welsh names and any British or International conservation status. The abundance of fruitbodies and variety and number of species varied greatly between fields, probably indicating varying degrees of improvement and intervention in previous years. All fields are currently managed with natural grazing by either cattle or sheep and receive no artificial inputs, or they are cut for silage (Middle Lawn and Top Lawn). Brief descriptions of the habitat are given for each field, and important areas of the field for grassland fungi and any significant species recorded are highlighted and discussed. The combined results of the 3 surveys for each field are shown in Table 6. The CHEGD profile and total and the field ranking using the site classification system of Rald (1985) & Vesterholt *et al.* (1999) (Table 2) are shown in Table 4. The significant species recorded are individually profiled in Appendix III, and 10 figure grid references and field locations are given in Table 8.

6.2. Chirk Castle Estate Fields

6.2.1. Baddy's Park, 21.49ha.

Baddy's Park has been surveyed for its grassland fungi on several occasions between 2005 and 2016, and there have been additional visits to the field during the annual waxcap walk and a workshop in 2016. The cumulative total of CHEGD species recorded over this period is 42, composed of 9 Clavarioid species, 19 *Hygrocybe* species, 9 *Entoloma* species, 4 Geoglossaceae and 1 *Dermoloma*, (C9,H19,E9,G4,D1). The 19 species of *Hygrocybe* recorded, with a maximum of 17 on a single visit, ranks this field of National Importance for its *Hygrocybe* species alone with the additional interest of 2 British RDL Clavarioid species, *Clavaria straminea* Straw Club and *C. incarnata* Skinny Club, recorded on the field, both of which are listed as 'Near Threatened'.

Baddy's Park was surveyed in 2022 on the 8th and 29th October and on the 11th November. The field was additionally visited during a family waxcap walk for the NT on the 28th October. Fungi were few in number on the first visit despite rain in the previous week and rain overnight. The ground was moist and herbage length was optimum for grassland fungi at ~10cms over much of the field indicating that the current grazing levels were adequate. Sheep were present on the field during all three surveys. More fungi were recorded on the 2nd and 3rd visits. In general fewer fungi were present on the field compared to previous surveys and this could be due to the hot, dry summer in 2022 which may have had an adverse effect on the fungi, delaying and reducing

fruiting. *Entoloma* species in particular were notable by their absence and very few were recorded.

The 2016 report, (Evans, 2016) outlines areas of the field and species recorded on each; these are not discussed in this report. Results were broadly similar to the previous survey with no significant differences and fungi were recorded over most of the field. All of the *Hygrocybe* species on the cumulative field list were recorded over the 3 surveys in 2022 with the exception of *H. punicea*, which has only been recorded on a single occasion in 2016 near the Main Gate Lodge. Only 3 species of *Entoloma* and 2 species of earthtongue were recorded and the Clavarioids *Clavaria incarnata* and *C. acuta* Pointed Club were also not re-recorded on the field. A few clubs of *C. straminea* were found on the 2nd survey.

Of special significance was finding 2 specimens of a dark, brick-red, viscid *Hygrocybe*, collected on the west side of the field during the family waxcap walk on the 28th October. It was provisionally identified as *Gliophorus* cf *sciophanus* (Photo 1) and would have previously been recorded as *Gliophorus psittacinus* var. *perplexa*, a variant of the common *G. psittacinus* Parrot Waxcap. It was dried and sent for DNA fingerprinting to Professor Gareth Griffith at Aberystwyth University and the *G. sciophanus* identification was confirmed. The SSSI Guidelines use a standard list for scoring and do not include this species, it therefore does not count towards the official CHEGD score for the site and can only be included in the site total.

Photo 1: *Gliophorus sciophanus*

No further new species were added to the field list in 2022. A total of 35 CHEGD species (C7,H18,E6,G2,D1) plus *G. sciophanus* were recorded on Baddy's Park in 2022, with a maximum of 15 *Hygrocybe* species recorded on the 2nd survey. The results of all surveys to date of the Park are shown in Table 7. The cumulative total for Baddy's Park now stands at 42 CHEGD species (C9,H19,E9,G4,D1).

The lawns immediately outside the Davies Gates at the entrance to Baddy's Park, including the adjacent road verges, were additionally surveyed briefly on the 29th October and 11th November. These are now included within the SSSI. A good range of species were recorded including a couple of *Hygrocybe punicea* Crimson Waxcap on the left lawn by the gates where it has been recorded previously. This grassland is managed by mowing and has remained unimproved and thus able to support this high value indicator species. A total of 16 CHEGD species (C5,H9,E1,G0,D1) were recorded between the lawns and verges.

The 2 private, mown lawns next to the Main Gate Lodge, which are separated from but technically within Baddy's Park, were not surveyed in 2022, but a brief survey during a visit in November 2021 recorded 5 Clavarioid species, 3 *Hygrocybe* species and *Dermoloma*. Of significance was the re-recording of *Hygrocybe punicea* and *Clavaria straminea*, both recorded here previously in 2016, and additionally a couple of clubs of the RDL *C. incarnata* were present. The lists for these lawns and the Davies Gate lawns are included in Table 6.

6.2.2. Baddy's Paddock, 3.68ha.

Baddy's Paddock lies to the north of Baddy's Park and slopes gently down from the north-west. It was surveyed on the 8th and 29th October and on the 11th November. The sward length was over 5cms with longer heads of *Agrostis*, and was quite mossy. Visually it appeared to have had no recent improvement. The field was sheep grazed and there were nettles on the periphery where sheep congregate increasing the nitrogen levels. The field was very dry underfoot on the first visit and very few fungi were recorded; more fruitbodies were present on the 2nd and 3rd surveys, however, the abundance was low and they were sporadic across the field. The majority of the species recorded were common species which are tolerant of a small amount of improvement and regarded as poor indicators of a high quality grassland. A few *Entoloma porphyrophaeum*, Lilac Pinkgill were recorded on the northern edge of the field along with a single *Hygrocybe mucronella*, Bitter Waxcap; both species are IUCN assessed as 'globally Vulnerable'. These 2 species can tolerate a small amount of improvement, but are still regarded as quite good indicator species.

A total of 14 CHEGD species (C3,H8,E3,G0,D0) were recorded over the 3 surveys, with a maximum of 7 *Hygrocybe* species on the 2nd survey ranking the field as 'Locally Important'.

6.2.3. Upper Llwyn y Cil, 6.80ha.

Upper Llwyn y Cil is continuous with Lower Llwyn y Cil, which was not surveyed as it is outside the NT's ownership. The Upper Llwyn y Cil section was surveyed on the 9th and 30th October and on the 12th November. Sward length was 5 to 20cms varying across the field and the ground was moist underfoot on all 3 surveys. The whole field is cattle grazed by store cattle and stock were present on the field on all three surveys. Fungi were just starting to

appear following a period of rain on the first survey and were optimum by the second survey.

Photo 2: *Hygrocybe aurantiosplendens*

Photo 3: *Cuphophyllus russocoriaceus*

Fungi were spread throughout the field and there were sizeable groups of some species, particularly the common *Hygrocybe chlorophana* Golden Waxcap, *Cuphophyllus pratensis* Meadow Waxcap and *Cuphophyllus virgineus* Snowy Waxcap. A selection of less common, medium value indicator species was recorded on the field. A group of 4 fruitbodies and a single fruitbody of the uncommon *Hygrocybe aurantiosplendens* Orange Waxcap (Photo 2) were recorded along the southern edge of the field and a further small group in the centre on the second visit (IUCN assessed as 'globally Vulnerable' to be published shortly). A small group of *Hygrocybe reidii*, Honey Waxcap were recorded growing in moss on a small bank at the western end of the field on the 2nd and 3rd visits (IUCN assessed as 'Data Deficient' 'DD'). A small group of the uncommon *Cuphophyllus russocoriaceus* Cedarwood Waxcap (Photo 3) were recorded along the southern boundary adjacent to the track on the 3rd survey. This is the first record of this *Hygrocybe* species on the Chirk Estate and it was not recorded on any other field. It looks superficially similar to *C. virgineus* but is distinguished by its smell. Two groups of 3 and a single *Hygrocybe intermedia* Fibrous Waxcap (Photo 4) were recorded at the eastern end of the field on the 2nd visit (IUCN assessed as 'globally Vulnerable'). *Hygrocybe quieta*, Oily Waxcap (Photo 5) was recorded in low numbers in the eastern end of the field (IUCN assessed as 'globally Vulnerable'). A few *Clavaria straminea* Straw Club were recorded on the southern side of the field on the second visit. Due to its cryptic pale beige colouration it was probably present elsewhere in the field. Its National Status is 'Rarely reported but apparently widespread' and it is on the British Red Data List as 'Near Threatened', (Evans, S. *et al.*, 2006).

A total of 27 CHEGD species were recorded over the 3 surveys, (C7,H14,E5,G0,D1), with a maximum of 13 *Hygrocybe* species recorded on the 2nd survey ranking the field at least of 'Regional Importance'.

Photo 4: *Hygrocybe intermedia*

Photo 5: *Hygrocybe quieta*

6.2.4. Horse Park, 10.81ha.

Horse Park lies to the east of Pleasure Ground Ley and north of Upper Llwyn y Cil and is bounded on its north-eastern end by a minor road. The field was surveyed on the 9th and 30th October and on the 12th November. The field is cattle grazed and no stock was present during the surveys; sward length was 5-10cms with little moss. Relatively few fungi were recorded on the western side, the north-west corner and at the southern end of the field. The western side appeared lusher and had more rye grass compared to the eastern side of the field. The latter proved more productive in both numbers of species and individuals. From the centre of the field on the eastern side there is a moderate slope down to the road and this slope was particularly rich. Fewer fungi were found on the north western side. A small number of species were recorded on the first visit including a few *Entoloma* species which were not seen on later surveys. Relatively few *Entoloma* species were recorded during the whole survey on any field and this could be due to the timing of the surveys – Entolomas can fruit early – or they were not present due to the semi-improved nature of the grasslands. Of note was *Entoloma prunuloides* Pale Pinkgill (Photo 6), a single specimen was recorded on the slope on the north eastern side. It has not been recorded previously on the Chirk Estate and is assessed as 'globally Vulnerable'. *Entoloma chalybaeum* Indigo Pinkgill (Photo 7) and *E. atrocoeruleum* Navy Pinkgill are small black/blue-black species and a few individuals were recorded at 3 locations on the field.

Photo 6: *Entoloma prunuloides*

Photo 7: *Entoloma chalybaeum*

The 2nd and 3rd visits proved the most productive. This field appeared to have largely escaped improvement on the eastern side, especially on the slope in the north eastern half. A group of 8 *Hygrocybe punicea* Crimson Waxcap (Photo 8) was recorded here on the 2nd survey and a group of 6 was recorded in the same location on the 3rd survey. This species is of significance being intolerant of any improvement or disturbance; it will quickly disappear and not return for decades if at all. It is regarded as an excellent indicator species of an unimproved, high quality grassland and often indicates that several other waxcap species could be present on the same site. There was an abundance of species and individuals growing on this area of the field, and the brightly coloured waxcaps were visible from a distance. Other *Hygrocybe* species of note recorded on the slope and nearby included *Cuphophyllus flavipes* Yellow-foot Waxcap, *Cuphophyllus fornicatus* Earthy Waxcap, *C. pratensis* var. *pallidus*, *Hygrocybe aurantiosplendens* Orange Waxcap, *H. intermedia* Fibrous Waxcap, *H. mucronella* Bitter Waxcap (Photo 9) and *Porpolomopsis calyptriformis* Pink Waxcap. All are considered moderately good indicator species of an unimproved or semi-improved grassland. *C. pratensis* var. *pallidus* is a pale form of *Cuphophyllus pratensis* Meadow Waxcap not recorded previously on the Chirk Castle Estate. It was also recorded on Middle Ley, Drive Ley and Pheasantry.

Photo 8: *Hygrocybe punicea*

Photo 9: *Hygrocybe mucronella*

Several groups of *Entoloma porphyrophaeum* Lilac Pinkgill were recorded, both above the slope and in the south-east corner near the gate. Clavarioid species were sporadic across the slope and field including a few *Clavaria straminea* Straw Club on the eastern side on the 3rd survey. Only a single species of earthtongue was recorded. A few individuals of *Geoglossum fallax* Deceptive Earthtongue were recorded across the field on the 3rd survey.

A total of 35 CHEGD species (C7,H19,E7,G1,D1), were recorded over the 3 surveys with a maximum of 18 *Hygrocybe* species recorded on the 3rd survey ranking the field of 'National Importance'.

6.2.5. Pleasure Ground Ley, 13.69ha.

Pleasure Ground Ley is a large field on the east side of the main drive. The field was surveyed on the 9th and 30th October and on the 12th November. The sward length varied over the field, up to 20cms and was heathy in parts with

lots of *Agrostis*. It is cattle grazed and stock were present on the field during the surveys. Fungi were recorded over the whole field but there were few at the northern end and no areas where fungi were concentrated. The species recorded were predominantly the common, lower value species indicating that the field has had some improvement in the recent past and these species have tolerated the improvement or are the first species to return. These species included *Hygrocybe chlorophana*, *H. ceracea*, *Gliophorus psittacinus*, *Cuphophyllus virgineus* and *C. pratensis*. Of note was *Hygrocybe quieta* Oily Waxcap, IUCN assessed as 'globally Vulnerable', a very few were recorded in the northern half of the field.

A total of 17 CHEGD species (C5,H9,E1,G1,D1) were recorded over the 3 surveys, with a maximum of 7 *Hygrocybe* species recorded on the 2nd and 3rd surveys ranking the field of 'Regional Importance'.

6.2.6. Upper Deer Park, 16.82ha.

Upper Deer Park is a large cattle grazed field with a moderate slope from west to east. It was surveyed on the 9th and 30th October and on the 12th November. Sward length was 5 to 7cms and there was little *Agrostis* or moss and it appeared to have had some improvement at some time. Very few fungi were recorded on the field, and they were sporadic with no concentrations. The *Hygrocybe* species recorded were all common, least value indicator species. *Gliophorus psittacinus* Parrot Waxcap was the commonest species recorded. Only a single *Hygrocybe coccinea* Scarlet Waxcap and 3 *Hygrocybe insipida* Spangle Waxcap were recorded on the field on the southern edge on the 3rd survey. The only species of significance recorded was *Entoloma porphyrophaeum*, a few were recorded on the eastern side on the 3rd survey. IUCN assessed as 'globally Vulnerable'.

A total of 13 CHEGD species (C4,H5,E3,G0,D1) were recorded over the 3 surveys, with a maximum of 5 species on the 3rd survey ranking the field of 'Local Importance'.

6.2.7. Deer Shed Paddock, 4.40ha.

Deer Shed Paddock is a small field to the south of Upper Deer Park and the gate was open with access to stock between the 2 fields. It was surveyed on the 9th and 30th October and on the 12th November. No stock was on the field during the surveys and it was assumed to be cattle grazed. The field appeared to have had some disturbance with a lot of thistle growth. The eastern side was heathy and tussocky with an *Agrostis* thatch of over 20cms and appeared under-grazed for grassland fungi. Nettles around the trees suggested nitrogen enrichment by the stock dunging there. There was little moss and few fungi were recorded over the 3 surveys. There was no abundance of fungi on any area of the field although a few more fungi were recorded at the western side.

A total of 8 CHEGD species (C2,H5,E0,G1,D0) were recorded, with a maximum of 3 species on the 2nd and 3rd surveys ranking the field as very marginally of 'Local Importance' at present.

6.2.8. Middle Paddock, 0.92ha.

Photo 10: Steep bank at SE end

Photo 11: *Hygrocybe punicea* on bank

Middle Paddock is a small field adjacent to Big Paddock. It was surveyed on the 10th and 31st October and on the 13th November. The sward was 10 to 20+ cms long and was lush and tussocky in parts, particularly in the northern half of the field and could benefit from some grazing. This end appeared to have had some improvement. Further areas of the field were damp and rushy or overgrown and unsuitable for grassland fungi including the area to the west near the old Offa's Dyke which passes along this edge of the field. Very few fungi were recorded in these areas.

A steep bank at the south-eastern end of the field (Photo 10) proved to be the most productive area and could have remained undisturbed and unimproved due to the slope. It supported a large colony of *Hygrocybe punicea* Crimson waxcap (Photo 11), the excellent indicator species of a quality habitat. More than 25 individuals of all ages were recorded together on both the 2nd and 3rd visits. Other species of *Hygrocybe* were recorded on the bank including *Porpolomopsis calyptriformis* Pink Waxcap, recorded on all 3 surveys, with 14 recorded on the 2nd survey and 11 on the 3rd survey. Several *Entoloma porphyrophaeum* were recorded in the same area on all 3 surveys.

A total of 19 CHEGD species (C4,H12,E2,G0,D1) were recorded over the 3 surveys, with a maximum of 11 *Hygrocybe* species on the 2nd survey ranking this field of 'Regional Importance'.

6.2.9. Big Paddock, 1.85ha.

Big Paddock is a small field lying to the south of Jericho. It was surveyed on the 9th October and on the 1st and 13th November. The field is sheep grazed and the sward was mostly short 5 to 10cms with a little moss and there were longer sections of over 20cms with a lot of *Agrostis*. This field was especially notable for the large populations of *Porpolomopsis calyptriformis* Pink Waxcap and *Entoloma porphyrophaeum* Lilac Pinkgill in the southern half of the field. Neither species were recorded on the first survey. On the 2nd survey over 50 fruitbodies of Pink Waxcap (Photo 12) were recorded at the southern end including 2 groups of 20+ and a group of 9+. Fewer individuals were recorded in the same area on the 3rd survey. Several *E. porphyrophaeum* were

recorded growing in large fairy rings and as individuals in the southern end of the field and towards the northern end on the 2nd and 3rd surveys. Several groups of *Clavaria fumosa* Smoky Spindles (Photo 13) were recorded growing in the southern half of the field on the 2nd and 3rd surveys. They were often seen growing beside the *P. calyptriformis* suggesting they require similar habitats. This species has not been recorded on Baddy's Park previously and is new to the Estate list. It was also recorded on Middle Lawn in front of the Castle. *C. fumosa* is regarded as a medium value indicator species.

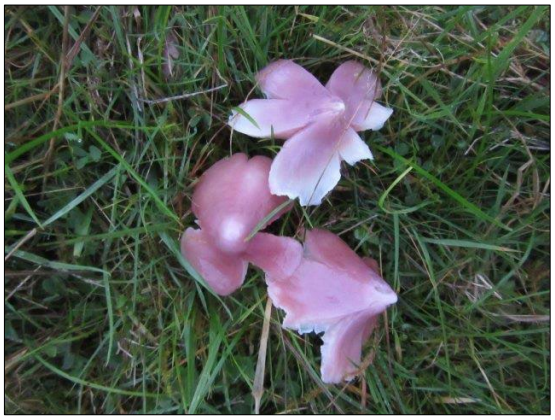

Photo 12: *Porpolomopsis calyptriformis*

Photo 13: *Clavaria fumosa*

Other common species present in good numbers included *Clavaria fragilis* White Spindles, *Cuphophyllus pratensis* Meadow Waxcap, *Gliophorus psittacinus* Parrot Waxcap and *Gliophorus irrigatus* Slimy Waxcap. This field is worthy of sensitive management for the Pink Waxcaps alone.

A total of 14 CHEGD species (C4,H9,E1,G0,D0) were recorded, with a maximum of 9 *Hygrocybe* species on the 2nd survey ranking the field as of 'Regional Importance'.

6.2.10. Old Golff (also known as Gwyningar), 5.72ha.

Old Golff lies to the south of Old Golff & Tynygroes and to the west of Jericho. It was surveyed on the 11th October and the 3rd and 14th November. The sward was ~5cms with some *Agrostis* and moss. Fungi were recorded at low numbers over the whole field and the richest area was the bank and slope on the western side. The most significant species was *Hygrocybe citrinovirens* Citrine Waxcap (Photo 14); a group of 4 fruitbodies was recorded on the slope on the western side. This species is a high value indicator species and new to the Chirk Castle list. It was also recorded on Old Golff & Tynygroes and on Pool Ley. *H. citrinovirens* is IUCN assessed as 'globally Vulnerable'. Two *Hygrocybe intermedia* Fibrous Waxcap (Photo 15), a medium value indicator species, were recorded on the bank on the western side.

The bright red *Hygrocybe coccinea* Scarlet Waxcap was present on the slope and bank with 2 large groups of 20+ in the far west corner. Three species of earthtongue were recorded and these were scattered over the field and mainly recorded on the 3rd survey. The remainder of the species recorded were

mainly common, low value indicator species e.g. *Cuphophyllus virgineus* Snowy Waxcap.

Photo 14: *Hygrocybe citrinovirens*

Photo 15: *Hygrocybe intermedia*

A total of 21 CHEGD species (C3,H12,E2,G3,D1) were recorded over the 3 surveys, with a maximum of 11 *Hygrocybe* species on the 2nd and 3rd surveys ranking the field of 'Regional Importance'.

6.2.11. Old Golff & Tynygroes, 11.93ha

Photo 16: Steep bank on western side

Photo 17: *Hygrocybe coccinea* on bank

Old Golff & Tynygroes lies to the north of and adjoins Jericho and Old Golff. It was surveyed on the 11th October and on the 3rd and 14th November. The field is sheep grazed with a sward length of ~5cms containing some *Agrostis* and moss. Sward length was longer at the south-western end. The centre of the field had few fungi and fungi recorded were concentrated along the northern and western sides, with relatively few recorded on the south side. Two areas of the field were the most productive for the variety of species recorded; the southern end of a steep bank on the western side of the field (Photo 16, 17) and a ditch and dyke running along the length of the northern periphery (Photo 18). These areas may have escaped any improvement in the past due to their topography and the nature of the ditch.

Fungi were recorded both in the ditch and nearby on the associated dyke and 13 *Hygrocybe* species were recorded in this area alone. Of note was *Hygrocybe reidii* Honey Waxcap (Photo 19) growing in the mossy sides of the

ditch. This is IUCN assessed as ‘globally Data Deficient’. This species was recorded in a similar habitat on Pool Ley, Upper Llwyn y Cil and in Maes Gwyn Field 2. It was not seen in the main body of the field but was also recorded on the short mossy turf of the western bank.

Photo 18: Ditch along northern periphery

Photo 19: *Hygrocybe reidii*

Growing in similar habitats was *Gliophorus laetus* Heath Waxcap (Photo 20) and it was also recorded both in the ditch and on the western bank. This species is not officially on the Chirk Castle Estate list and has not been recorded in Baddy’s Park, however, it was recorded in 2017 by the author growing on the lawn above the Old Tennis Court in the Castle gardens. In 2022 surveys it was also recorded on Maes Gwyn Field 2 on a bank, similarly growing in short mossy turf.

Photo 20: *Gliophorus laetus*

Photo 21: *Cuphophyllus flavipes*

Two fruitbodies of *Porpolomopsis calyptriformis* Pink Waxcap were recorded in the ditch on the 3rd visit. *Cuphophyllus flavipes* Yellow-foot Waxcap (Photo 21), a medium value indicator species, was present both in the ditch and on the adjacent dyke. Both species are IUCN assessed as ‘globally Vulnerable’. Other species recorded in the ditch included *Hygrocybe coccinea* Scarlet Waxcap *Gliophorus irrigatus* Slimy Waxcap and *Clavulinopsis luteoalba* Apricot Club (Photo 22).

The bank on the western side of the field, especially its southern end, looked very suitable for grassland fungi and fairly unimproved. A range of species were recorded here including good numbers and groups of *Hygrocybe*

coccinea, Scarlet Waxcap, *H reidii* Honey Waxcap, *Cuphophyllus pratensis* Meadow Waxcap and *Gliophorus psittacinus* Parrot Waxcap. No species of high value e.g. *Hygrocybe punicea* Crimson Waxcap was recorded in this area despite its suggested potential. *Hygrocybe* species recorded across the rest of the field were mainly common, low value indicator species dominated by *Hygrocybe ceracea*, Butter Waxcap and *Cuphophyllus virgineus* Snowy Waxcap. These were present sporadically and in low numbers.

Two *Hygrocybe mucronella* Bitter Waxcap were recorded along the southern periphery with Jericho (IUCN assessed as 'globally Vulnerable') and a single *Cuphophyllus fornicatus* Earthy Waxcap was found towards the western end; these 2 species are regarded as medium value indicator species.

Three species recorded on Old Golff & Tynygroes are of special note. A single *Hygrocybe citrinovirens* Citrine Waxcap was recorded on the southern periphery with Jericho on the 2nd survey. This species is regarded as a high value indicator species and was a new species to the Chirk Castle Estate list. A group of 3 were also recorded on Pool Ley and a group of 4 on Old Golff during the 2022 surveys. It is IUCN assessed as globally Vulnerable'.

A few clubs of the British RDL species *Clavaria straminea* were recorded on the western side of the field. *Trichoglossum walteri* Short Spored Earthtongue is an uncommon to rare earthtongue and regarded as a good indicator species. A single club was recorded in the south-west corner on the 1st survey.

Groups of *Ramariopsis kunzei* Ivory Coral (Photo 23) were impressively present in large numbers in the field, particularly along a line running parallel to the ditch in the northern half and then sporadically across the rest of the field. *R. kunzei* is regarded as a medium value indicator species and appears to be a Chirk Castle speciality and the relatively uncommon species was present in half of the fields surveyed.

Photo 22: *Clavulinopsis luteoalba*

Photo 23: *Ramariopsis* *kunzei*

A total of 30 CHEGD species (C7,H18,E2,G2,D1) were recorded over the 3 surveys, with a maximum of 15 *Hygrocybe species* on the 2nd and 3rd surveys ranking the field of 'National Importance'.

6.2.12. Jericho, 9.12ha

Jericho lies to the south-east of Old Golff & Tynygroes, with Old Golff to the south-west and Pool Ley and Middle Ley to the east. It was surveyed on the 10th October and the 3rd and 14th November. The field is sheep grazed and the sward is mainly short 3-5cms with little *Agrostis* and some moss. The field appeared visually to have had some improvement in the past.

Fungi were recorded over the whole field but were generally sporadic with no areas of high abundance. The majority of the species recorded were common, low value species e.g. *Gliophorus psittacinus* Parrot Waxcap, *Hygrocybe ceracea* Butter Waxcap and *Cuphophyllus virgineus* Snowy Waxcap. Four species of earthtongue were recorded including *Trichoglossum walteri* Short Spored Earthtongue in the south-west corner on the 3rd survey. It is a British RDL species and IUCN assessed as 'globally Vulnerable', and is regarded as a good indicator species. Other medium value indicator species recorded included a few groups of *Ramariopsis kunzei* and a few *Hygrocybe glutinipes* Glutinous Waxcap.

A total of 23 CHEGD (C6,H9,E3,G4,D1) species were recorded over the 3 surveys, with a maximum of 8 *Hygrocybe* species on the 3rd survey ranking the field of 'Regional Importance'.

6.2.13. Middle Ley, 7.62ha.

Photo 24: Fairy Ring on Middle Ley

Photo 25: *Cuphophyllus fornicatus*

Middle Ley lies to the north of Pool Ley and south of Maes Gwyn Field 6. It was surveyed on the 11th and 31st October and on the 16th November. The sward was lush and over 10cms in parts with very little *Agrostis* and moss and with some clover content. The field appeared somewhat improved especially in the northern half. The presence of *Cirsium arvense* Creeping Thistle and *Cirsium palustre* Marsh Thistle along the southern boundary with Pool Ley could indicate some disturbance. The southern side of the field appeared slightly less improved with more moss. The field was sheep grazed and stock was present on the field on 2 of the visits with open access from Pool Ley.

Fungi were recorded sporadically over the field with no areas of abundance. The majority of the species recorded were common, low value indicator

species including *Cuphophyllus virgineus* Snowy Waxcap, *Hygrocybe ceracea* Butter Waxcap and *Hygrocybe conica* Blackening Waxcap. Clavarioids were scattered over the field. Two species of note were recorded on the field. Large fairy rings of *Entoloma porphyrophaeum*, Lilac Pinkgill (Photo 24) were recorded on all 3 surveys in the southern two-thirds of the field; the outer limit of the circles where the fruitbodies appear is characteristically lush and green and can be recorded from a distance, this makes the ring visible even when no fruitbodies are present. A few clubs of the British RDL species *Clavaria straminea* Straw Club, were recorded in the north-eastern corner.

A few fruitbodies of *Cuphophyllus pratensis* var. *pallidus* Pale Waxcap, were recorded, these are very similar to the normal orange-brown *Cuphophyllus pratensis* Meadow Waxcap but are much paler in colour. Similar fruitbodies were recorded on Drive Ley, Pheasantry and Horse Park. A single *Cuphophyllus fornicatus* Earthy Waxcap (Photo 25), regarded as a good indicator species, was recorded on the north-east edge of the field.

A total of 19 CHEGD species (C5,H9,E3,G1,D1) were recorded over the 3 surveys, with a maximum of 8 *Hygrocybe* species on the 2nd survey ranking this field of 'Regional Importance'.

6.2.14. Pool Ley, 8.39ha.

Photo 26: *Hygrocybe coccinea* on the north-eastern side of Pool Ley

Pool Ley is a large, sheep grazed field, between Middle Ley to the north and Drive Ley to the south. It was surveyed on the 12th and 30th October and on the 16th November. The sward was 5 to 10cms with lots of *Agrostis* and moss and appeared less improved compared with Middle Ley. The area to the side of Middle Ley had a large number of thistles continuous with those in Middle Ley.

Fungi were recorded over most of the field, with fewer at the southern end. The highest density and abundance were recorded on the northern-eastern half, particularly along the periphery adjacent to the lake and around the end of the Offa's Dyke bank on the north-eastern side of the field (Photo 26). The majority of the fungi recorded were the common, lower indicator value species including a large number of *Gliophorus psittacinus* Parrot Waxcap, *Cuphophyllus pratensis* Meadow Waxcap, *C. virgineus* Snowy Waxcap, *Hygrocybe ceracea* Butter Waxcap, *H. coccinea* Scarlet Waxcap and *H. chlorophana* Golden Waxcap. A few *Hygrocybe reidii* Honey Waxcap were recorded on the side of the bank running along the north-eastern periphery. It was recorded in a very similar habitat in Old Golff & Tynygroes, Upper Llwyn y Cil and in Maes Gwyn Field 2. A few large, very visible fairy rings of *Entoloma porphyrophaeum* were present across the northern half of the field.

A group of three *Hygrocybe citrinovirens* Citrine Waxcap, a high value indicator species, was recorded on the 3rd survey on the southern edge of the field. It was also recorded on Old Golff and on Old Golff & Tynygroes. This species has not been recorded on Baddy's Park and is new to the Chirk Park Estate list. Recording a single high value indicator species only on the edge of the field suggests the majority of the field has had improvement in the past, although not in recent years.

A small group of *Entoloma chalybaeum* Indigo Pinkgill were recorded on the 2nd survey. This species was also recorded in front of the Davies Gates and on Baddy's Park. On the 3rd survey a couple of *Trichoglossum walteri* Short Spored Earthtongue were recorded together on the southern half of the field. This is an uncommon to rare earthtongue and is found infrequently compared to the common *Trichoglossum hirsutum* Hairy Earthtongue. *T. walteri* is a British RDL species and IUCN assessed as 'globally Vulnerable'. This species was also recorded on Old Golff & Tynygroes, Jericho and Maes Gwyn Field 4. It is a new species for the Chirk Castle Estate list. No *Hygrocybe* species of the highest indicator value were recorded suggesting that Pool Ley has had previous improvement but not in recent years.

A total of 26 CHEGD species (C5,H13,E5,G2,D1) were recorded over the 3 surveys, with a maximum of 12 *Hygrocybe* species on the 2nd survey ranking the field of 'Regional Importance'.

6.2.15. Drive Ley 8.43ha.

Drive Ley lies to the east of Pool Ley with the main Castle entrance road on its eastern boundary. It was surveyed on the 12th and 31st October and on the 16th November. The field appeared very green and lush with little *Agrostis* and moss suggestive of some improvement in the recent past. It was fairly herb rich and the sward was over 10cms in parts, especially at the southern end. No stock was present on the field during the surveys but it was assumed to be either cattle or sheep grazed. The fungi were mainly recorded at the south-western end, along the southern and eastern sides and at the north-eastern end of the field with very few recorded in the central section. *Cuphophyllus virgineus* Snowy Waxcap was very common and recorded throughout the field

and especially at the north-east end. This species can tolerate some improvement and is one of the first species to recolonise a grassland.

Photo 27: Fairy Ring on Drive Ley

Photo 28: *Entoloma porphyrophaeum*

Porpolomopsis calyptriformis Pink Waxcap was recorded on the 2nd and 3rd surveys in the south-west corner of the field; a group of 2 and a single were recorded on the 2nd and a group of 3 on the 3rd survey. Of special note in Drive Ley was the number of large fairy rings of *Entoloma porphyrophaeum* Lilac Pinkgill that were recorded (Photos 27 & 28). The majority of these were along the southern and eastern sides of the field and they were visible from a distance and from the road. A few fruitbodies of *Cuphophyllus pratensis* var. *pallidus* Pale Waxcap (Photo 29), were recorded near the car park end of Drive Ley. These are very similar to the normal orange-brown *Cuphophyllus pratensis* Meadow Waxcap but are much paler in colour. Similar fruitbodies were recorded on Middle Ley, Pheasantry and Horse Park.

Photo 29: *C. pratensis* var. *palllidus*

Photo 30: *Clavaria straminea*

A single *Cuphophyllus fornicatus* Earthy Waxcap was recorded at the north-east end of the field; this is regarded as a medium value indicator species. The RDL species *Clavaria straminea* Straw Club (Photo 30) was recorded on the southern edge, the eastern edge and at the north-east end of the field.

A total of 20 CHEGD species (C3,H12,E3,G1,D1) were recorded over the 3 surveys with a maximum of 9 on the 2nd survey ranking the field of 'Regional Importance'.

6.2.16. Pheasantry 7.98ha

Pheasantry adjoins Drive Ley at its north-west end. It was surveyed on the 12th and 31st of October and on the 16th November. The field is sheep grazed with only a few sheep present on any of the surveys. The sward was variable from 3 to 10cms with some *Agrostis* and moss. Fungi were recorded over the whole field with a greater abundance on the east side of the track that runs through the field. The richest areas for species and numbers were the eastern side and south eastern end, on and below a bank.

Pheasantry was especially rich for Clavarioid species with a total of 7 recorded. Several groups of *Clavaria fragilis* White Spindles (Photo 31) were recorded in the eastern side and groups of *Ramariopsis kunzei* Ivory Coral were recorded higher up on the west of the track. *Clavulinopsis corniculata* Meadow Coral (Photo 32) was widespread and very common on the west side of the track and at the far northern end of the field where the sward was very short. Other yellow Clavarioid species were widespread throughout the field. Of special note were collections of the RDL species *Clavaria straminea* Straw Club. Several groups were recorded on the eastern side of the field.

Photo 31: *Clavaria fragilis*

Photo 32: *Clavulinopsis corniculata*

The eastern side looked the most suitable for grassland fungi and the greatest range of species was recorded in this area. The *Hygrocybe* species recorded over the field were mainly common species including *Cuphophyllus virgineus* Snowy Waxcap, *Cuphophyllus pratensis* Meadow Waxcap, *Gliophorus psittacinus* Parrot Waxcap, and *Hygrocybe ceracea* Butter Waxcap. No *Hygrocybe* species of highest indicator value was recorded. On the 3rd survey 2 *Porpolomopsis calyptriformis* Pink Waxcap were recorded on the eastern periphery. This is regarded as a medium value indicator species. *Entoloma porphyrophaeum* Lilac Pinkgill was recorded on 2 areas on the east side of the field including a fairy ring. Pheasantry appeared to have good potential and it can be expected that with suitable management further species will be recorded on the field.

A total of 25 CHEGD species (C7,H12,E3,G2,D1) were recorded over the 3 surveys, with a maximum of 9 *Hygrocybe* species recorded over the 3 surveys ranking the field of 'Regional Importance'.

6.2.17. Middle Lawn

Middle Lawn lies to the north of the Castle and portcullis and slopes gently down northwards to a ha-ha on its northern perimeter which separates the field from the main drive and verge. Top Lawn lies to the east separated only by a track. The 2 lawns have had previous improvement but they have now been managed as traditional hay meadows/wildflower meadows for 5 years by winter grazing with sheep and taking 2 silage cuts in the summer. The fields were scarified and donor seed sourced from North Wales to increase the wildflower diversity. The sward is now herb rich with a variety of plants; sward length was short ~5cms during the survey period.

Middle Lawn was surveyed on the 12th and 28th October and on the 18th November. A good range of Clavarioids were recorded including several groups of *Clavaria fragilis* White Spindles and *Ramariopsis kunzei* Ivory Coral. A few clubs of *Clavaria straminea* Straw Club were recorded on the western side on the 2nd survey. This British RDL species was recorded on several other fields during the surveys. Two groups of *Clavaria fumosa* Smoky Spindles (Photo 33) were recorded on the eastern side of the field. This medium value indicator species is new to the Chirk Castle Estate list and was additionally recorded in Big Paddock.

Photo 33: *Clavaria fumosa*

Photo 34: *Porpolomopsis calyptriformis*

Porpolomopsis calyptriformis Pink Waxcap (Photo 34) was recorded mainly on the south- eastern side of the field with groups of up to 7 fruitbodies present. A couple of individuals were recorded in the northern half. *Entoloma porphyrophaeum* Lilac Pinkgill was present in good numbers on the field with several rings recorded in the southern half and individuals recorded at the northern end. These two species are medium value indicators. Good numbers of other common species of *Hygrocybe* were recorded over the field and 1 further *Entoloma* species, but no earthtongues or *Dermoloma* were found.

A total of 19 CHEGD species (C7,H10,E1,G0,D0) were recorded on Middle Lawn over the 3 surveys, with a maximum of 9 *Hygrocybe* species on the 2nd survey ranking the field of 'Regional Importance'.

Grassland fungi were noted growing on the road verge on the northern perimeter of Middle Lawn (Photo 35). This very small area was looked at

briefly on the 12th and 16th November and a total of 9 CHEGD species (C0,H8,E0,G1,D0) were recorded there. Of special note were a few fruitbodies of *Hygrocybe punicea* Crimson Waxcap. This species will only grow on grasslands that have had no improvement and it was able to persist on the unimproved grass verge yet was absent from the adjacent Middle Lawn which has had some improvement in the past. It similarly grows on the unimproved verge outside the Davies Gates and the unimproved lawns by the Main Gate Lodge. Seven other *Hygrocybe* species were growing on the verge close to the *H. punicea* including *H. quieta* Oily Waxcap. The verges are assumed to be managed by mowing.

Photo 35: Road verge below Middle Lawn supporting *Hygrocybe punicea*

6.2.18. Top Lawn

Top Lawn lies to the north of the Castle with Pleasure Wood on its eastern side and the track dividing it from Middle Lawn on its western side. Its history and management are similar to Middle Lawn. The sward looked very lush and less herb rich compared to Middle Lawn, and the field appeared to be improved and unsuitable for grassland fungi. It was looked at briefly on the 3rd November and only a very few, or a single fruitbody of 5 species were found at the northern end of the field. All the species were common, low value indicator species.

A total of 5 species were recorded (C1,H4). Top Lawn ranks marginally of 'Local Importance'.

6.3. Maes Gwyn Estate

6.3.1. Maes Gwyn Field 1 (Gwyningar Cottage)

Maes Gwyn Field 1 lies to the west of Maes Gwyn Field 4, south of Gwyningar Wood and slopes down southwards towards the Ceiriog Valley. The field was surveyed on the 10th October and on the 1st and 13th November. The field is

cattle grazed and stock were present on some of the surveys. Sward length was short ~5cms with some clover content. There is a gentle slope down from north to south towards the river and bracken has been cut at the bottom of the slope. The previous management history of the field is unknown, but it has had no recent improvement and is naturally grazed.

A range of common species were recorded over most of field apart from the north edge of the field to the east of the cottage. Particularly notable were the large numbers of *Gliophorus psittacinus* Parrot Waxcap (Photo 36) on the field particularly on the southern side. Good numbers of *Gliophorus irrigatus* Slimy Waxcap (Photo 37) were recorded on the north side of the field to the west of the cottage and a few were recorded on the southern side of the field. A single *Cuphophyllus fornicatus* Earthy Waxcap was recorded at the western end; this is a medium value indicator species. No species of high indicator value was recorded suggesting that there has been some improvement in the past.

A total of 15 CHEGD species (C3,H9,E2,G1,D0) were recorded over the 3 surveys, with a maximum of 9 *Hygrocybe* species on the 2nd survey ranking the field of 'Regional Importance'.

Photo 36: *Gliophorus psittacinus*

Photo 37: *Gliophorus irrigatus*

6.3.2. Maes Gwyn Field 2 (North of Rose Cottage)

Maes Gwyn Field 2 lies to the north-west of Old Golff & Tynygroes and adjoins Field 3 on its western side. A minor road runs along its east/north-east perimeter and the Offa's Dyke path passes through the south of the field. It was surveyed on the 11th October and on the 2nd and 15th November. The field is cattle grazed and stock were present on the field during the surveys. The field appears to have had some improvement and in the main body of the grassland the sward was lush and short 3-5cms with rye grass and white clover and very little moss. There is a moderate slope from north to south on the main, north-western side of the field. Two areas with a steep bank and associated valley on the north-eastern side appeared to have had very little intervention, probably due to their inaccessibility for a tractor (Photos 38, 39 & 40). These areas were regarded as being largely unimproved with very short grass and some moss content.

The main body of the field had very few grassland fungi present and these were dominated by sporadic *Cuphophyllus virgineus* Snowy Waxcap, a few *Hygrocybe ceracea* Butter Waxcap and *Gliophorus psittacinus* Parrot Waxcap, all common, low indicator value species. The banks and associated valleys to the east were the most productive areas and most of the species recorded on the field were present here.

Photo 38: Upper section of valley from S.

Photo 39: Upper section of valley from N.

Of greatest significance was the recording of *Hygrocybe punicea* Crimson Waxcap (Photo 41). This is an excellent indicator species only found on grasslands without any improvement and confirmed that this area had escaped any inputs. This species often fruits late in the season and was only recorded on the 3rd visit. Three individuals were recorded separately on the eastern side of the northern bank and a group of 2 were recorded together on the bank, south of a group of trees. Other species recorded on the banks included *Cuphophyllus pratensis* Meadow Waxcap, *Hygrocybe coccinea*, Scarlet Waxcap *H. chlorophana* Golden Waxcap, *H. quieta* Oily Waxcap, *Dermoloma cuneifolium* Crazed Cap, and the Clavarioids *Clavulinopsis corniculata* Meadow Coral and *C. luteoalba* Apricot Coral.

Photo 40: Lower section of valley from N.

Photo 41: *Hygrocybe punicea*, valley side

Several groups of *Hygrocybe reidii* Honey Waxcap were growing on the sides of both of the short, mossy banks and this species was found in a similar habitat in Old Golff & Tynygroes, Upper Llwyn y Cil and Pool Ley. *Gliophorus laetus* Heath Waxcap was also recorded growing in the mossy turf on the

sides of the southern bank. This species was additionally recorded on Old Golff & Tynygroes and was new to the Chirk Castle species list.

A total of 24 CHEGD species (C4,H13,E3,G3,D1) were recorded over the 3 surveys, with a maximum of 12 *Hygrocybe* species on the 3rd survey ranking the field of 'Regional Importance'.

6.3.3. Maes Gwyn Field 3 (North of Mars Wood)

Maes Gwyn Field 3 lies to the north of Old Golff & Tynygroes and adjoins Maes Gwyn Field 2 on its eastern side. The Offa's Dyke Path passes through the south of the field. It was surveyed on the 11th October and on the 2nd and 14th November. The field is sheep grazed and the sward was mainly very short at <5cms. There is a moderate slope down from north to south. The remains of a large manure heap in the south of the field, below the Offa's Dyke Path suggests that manure may be spread on the field but the exact management of the field is unknown.

A good range of the common, lower value indicator species were recorded over the whole field, with more present in the southern half above the Offa's Dyke Path and few in the northern half. These included *Hygrocybe ceracea* Butter Waxcap, *Cuphophyllus virgineus* Snowy Waxcap *Gliophorus psittacinus* Parrot Waxcap and sporadic *C. pratensis* Meadow Waxcap. Only one group of *H. coccinea* Scarlet Waxcap was recorded on the western side of the field and a single *Dermoloma cuneifolium* Crazed Cap in the southern half. No fungi were growing in the much lusher grass by the manure heap and relatively few species and individuals were seen on the area below the Path, with a few more at the eastern side. Several groups of *Ramariopsis kunzei* Ivory Coral, regarded as a medium value indicator species, were recorded above the Offa's Dyke Path in the southern half of the field. On the 3rd survey a large number of earthtongues were recorded in the southern half above the Path; earthtongues tend to appear later in the season. These were predominantly *Geoglossum fallax* Deceptive Earthtongue (Photo 42), with a few *Trichoglossum hirsutum* Hairy Earthtongue.

Photo 42: *Geoglossum fallax*

Photo 43: *Clavaria incarnata*

Of note was a single club of *Clavaria incarnata* Skinny Club (Photo 43) recorded on the 2nd survey just below the Offa's Dyke Path. This species has been recorded previously on Baddy's Park and on the lawn by the Main Gate Lodge, Baddy's Park in 2021. It is a British Red Data List species regarded as 'Near Threatened' and is regarded as a medium value indicator species.

A total of 18 CHEGD species (C5,H10,E0,G2,D1) were recorded over the 3 surveys, with a maximum of 8 *Hygrocybe* species on the 2nd and 3rd surveys ranking the field of 'Regional Importance'.

6.3.4. Maes Gwyn Field 4 (Lower Deer park)

Maes Gwyn Field 4 is a large field south of the Chirk Castle Estate, and lies to the east of Maes Gwyn Field 5. The field is bounded by woodland on its northern, eastern and southern sides and slopes gently down from north to south. There is a small copse of trees in the centre of the western half. It was surveyed on the 10th October and on the 1st and 13th November.

The field is cattle grazed with stock present on some of the surveys. A silage cut is taken in June. No fertiliser has been used in recent years but it is assumed to have had some improvement in the past. Sward length varied across the field and was longer on the north-western edge with nettles and thistles from manure enrichment in this area. The southern margins of the field were shorter and there was a large amount of *Plantago lanceolata* Ribwort Plantain present in the sward here.

Photo 44: *Cuphophyllus fornicatus*

Photo 45: *Clavulinopsis* *umbrinella*

Fungi were recorded over the whole field. The most frequent *Hygrocybe* species recorded included *Gliophorus psittacinus* Parrot Waxcap, *Cuphophyllus pratensis* Meadow Waxcap, *C. virgineus* Snowy Waxcap, *Hygrocybe ceracea* Butter Waxcap and *H. conica* Blackening Waxcap. *Hygrocybe coccinea* Scarlet Waxcap was only recorded on the far eastern side of the field, present as a few large groups. Only a single group of *Gliophorus irrigatus* Slimy Waxcap was recorded at the western end. These are all low value indicator species. A single *Hygrocybe aurantiosplendens* Orange Waxcap was recorded on the 2nd survey at the far eastern end and several individuals and small groups of *Cuphophyllus fornicatus* Earthy

Waxcap (Photo 44) were recorded on the field at both the western and eastern sides; these 2 species are both regarded as medium value indicator species.

The very short marginal areas dominated by the plantain were especially good for earthtongues and Clavarioid species and a total of 4 and 8 species respectively were recorded for the whole field. The marginal area on the southern side also supported some groups of *Entoloma* species including *E. cf poliopus* a pinkgill, *E. serrulatum* Blue-edge Pinkgill and *E. asprellum* Roughened Pinkgill, not recorded on the main part of the field. *E. porphyrophaeum* Lilac Pinkgill was recorded in the short margin at the eastern end. There were quite large numbers of the common *E. sericeum* Silky Pinkgill on the margins and on the main field.

The whole field was notable for the range of Clavarioid species Fairy Clubs recorded. A total of 8 species were found and these included *Clavaria straminea* Straw Club, a British Red Data list species regarded as 'Near Threatened'. A few clubs were recorded at the south-eastern end of the field. A single group of *Clavulinopsis umbrinella* Beige Coral (Photo 45) was recorded at the north-eastern end of the field. This species has not been recorded on the Chirk Castle Estate. *Ramariopsis kunzei* Ivory Coral was very common and lots of groups were recorded on several parts of the field. These 3 Clavarioid species are all regarded as medium value indicator species. Other Clavarioid species including *Clavulinopsis corniculata* Meadow Coral and *Clavaria fragilis* White Spindles were common across the whole field and in the short margins.

Four species of earthtongue were recorded; *Geoglossum fallax* Deceptive Earthtongue, *Glutinoglossum glutinosum* Glutinous Earthtongue, *Trichoglossum hirsutum* Hairy Earthtongue and a few clubs of the uncommon to rare *T. walteri* Short Spored Earthtongue. Two groups were recorded on the southern edge and 2 groups in the centre of the field, to the east of the copse of trees. It is a British RDL species as 'Near Threatened' and IUCN assessed as 'globally Vulnerable'. This species was also recorded on Pool Ley, Old Golff & Tynygroes and Jericho on the Chirk Estate and is a new species for the Chirk Castle Estate list.

Photo 46: *Trichoglossum hirsutum*

Photo 47: *Glutinoglossum glutinosum*

A total of 33 CHEGD species (C8,H13,E7,G4,D1) were recorded over the 3 surveys, with a maximum of 12 *Hygrocybe* species on the 2nd survey ranking the field of 'Regional Importance'.

6.3.5. Maes Gwyn Field 5 (Offa Dyke opp. Lower Deer park)

Maes Gwyn Field 5 is a small field to the west of Maes Gwyn Field 4 and to the south of Middle Paddock. It was surveyed on the 10th October and on the 1st and 13th November. The field slopes gently down to the south with a bank on the western side and a stream and vehicle tracks run across the field. Previous management of the field was unknown but it has not received any inputs in recent years. The field had not been grazed by stock for 18 months and had been partially flailed at the end of September to remove some of the longer grass, (pers. comm. gamekeeper). The cut material had not been removed. The area of the field at the upper, northern end by a barn appeared very enriched with nettles and docks and the grass in this area was long and with tussocks. Herbage length on a bank on the western side was 30cms and appeared uncut; other parts of the field were long, with tussocks and a thatched sward and the whole field could benefit from grazing.

Surveying was more difficult due to the length of the herbage in parts and smaller species could have been missed. Additionally many species do not fruit in longer swards. No fungi were recorded on the 1st survey and a small number of species were recorded on the 2nd and 3rd surveys. A group of 4 and 2 groups of 2 *Porpolomopsis calyptriformis* Pink Waxcap were recorded growing on the slopes in the northern third of the field and a single fruitbody was recorded at the southern end of the field. Several groups and individuals of the large *Entoloma porphyrophaeum* Lilac Pinkgill were recorded in the northern and southern thirds of the field; this species was easily visible despite the sward length. Both these species are regarded as medium value indicator species. A small number of the common species *Cuphophyllus pratensis* Meadow Waxcap, *C. virgineus* Snowy Waxcap, *Gliophorus psittacinus* Parrot Waxcap and *Hygrocybe ceracea* Butter Waxcap were recorded mainly in the areas by the paths/tracks where the herbage was shorter. A single group of 3 *Gliophorus irrigatus* Slimy Waxcap was recorded in the northern third of the field.

A total of 8 CHEGD species (C1,H6,E1,G0,D0) were recorded over the 3 surveys, with a maximum of 6 *Hygrocybe* species on the 2nd survey ranking the field of 'Local Importance'.

6.3.6. Maes Gwyn Field 6 (East of Tynygroes)

Maes Gwyn Field 6 lies to the north of Middle Ley and is bounded by a road on its northern perimeter. It was surveyed on the 12th October and on the 2nd and 15th November. This field had been recently ploughed and reseeded and was lush and green. The sward length was 5-10cms with no moss and was not expected to support any grassland fungi. The field is sheep grazed and stock was present during the 3 surveys. As predicted no grassland fungi were growing in the reseeded part of the field. However, there was a small area to

the east of a small group of trees, on the eastern side beside the woodland that had not been ploughed and was short and mossy. A small number and selection of CHEDG species were recorded here comprised of *Hygrocybe ceracea* Butter Waxcap, *Gliophorus psittacinus* Parrot Waxcap, *Cuphophyllus virgineus* Snowy Waxcap and *Clavulinopsis laeticolor* Handsome Club.
Clavulinopsis corniculata Meadow Coral was recorded on the bank by the fence separating Field 6 from Middle Ley. A ditch runs along the northern edge by the road (Photo 48) and 8 species were recorded in the ditch which had also escaped the reseeding. A few fruitbodies of *Cuphophyllus pratensis* Meadow Club, *C. virgineus* Snowy Waxcap, *Dermoloma cuneifolium* Crazed Cap, *Hygrocybe ceracea*, *H. chlorophana* Golden Waxcap, *H. coccinea* Scarlet Waxcap, *Ramariopsis kunzei* Ivory Coral and *Clavulinopsis laeticolor* Handsome Club were recorded here and this provides an indication of some of the species that might have been present in the main body of the field before improvement.

Photo 48: The ditch running along the northern side of Field 6

A total of 10 CHEGD species (C3,H6,E0,G0,D1) were recorded over the 3 surveys, with a maximum of 5 *Hygrocybe* species on the 3rd survey ranking the field (ditch area) of 'Local Importance'.

7. Discussion

The aim of this study was to obtain background data on the grassland fungi present on the Chirk Castle Estate and Maes Gwyn Estate fields which are all within the SSSI boundary. The SSSI was designated in 2011 for features including the grassland fungi assemblage recorded on Baddy's Park on the Chirk Estate. This field has been surveyed on several occasions and was re-surveyed during this study, but none of the other grasslands have been looked at previously.

All the fields surveyed on both estates show evidence of varying amounts of improvement in the past, probably by the use of fertilisers, albeit minimal. They are now managed organically by natural grazing by either sheep or store cattle, or mown as with Middle Lawn and Top Lawn. They should therefore be described as predominantly semi-improved rather than unimproved grasslands. Evidence for this is shown by looking at the sites where a high value indicator species like *Hygrocybe punicea* Crimson Waxcap has been recorded. This species will not tolerate any agricultural improvement and is only found on the highest quality, unimproved grasslands. It has been recorded immediately outside Baddy's Park on the lawn by the Davies Gates and on the private, closely mown lawn of the Main Gate Lodge, just inside the Park, yet only a single individual has ever been recorded on the Baddy's Park itself, close to the Lodge in 2016. Similarly a few *H. punicea* were recorded on the unimproved drive verge below Middle Lawn and not on the field. Further fields on both estates however, had small areas which would have been inaccessible to a tractor, e.g. ditches and steep banks, or for other reasons have escaped improvement and have retained a more diverse range of grassland fungi in these niches, while the main body of these fields only supports more tolerant species like *Gliophorus psittacinus* Parrot Waxcap and *Cuphophyllus virgineus* Snowy Waxcap.

Maes Gwyn Field 6 has been ploughed and reseeded recently and illustrates the devastating effects of such improvement. No grassland fungi at all were present on the main body of the field, however, a small bank and ditch on the periphery with the road which had not been ploughed still retained a number of species. An area near the woodland edge of the field had not been ploughed on this occasion and also supported a few common species.

Grassland fungi were recorded on all fields on both of the estates; numbers, range and quality of species recorded varying field by field. It should be noted, as illustrated by Field 6, that the highly improved fields that predominate in much of lowland Britain will contain no grassland fungi. The fields on both estates all support some species and they can be expected to become more diverse over time if managed sympathetically for the fungi and more species will be recorded. Fields with grassland fungi populations are now rare in lowland Britain especially due to agricultural intensification and are worthy of conservation. Habitat loss in particular has resulted in several species of grassland fungi now being of conservation concern, both in Britain and globally, and 14 species with a conservation status were recorded over both the estates increasing the importance of preserving these fungi.

Very few fungi were recorded on the 1st surveys in the middle of October which is often the optimum time to survey; this is considered to be the result of the hot, dry summer and relatively little rain in September which would have delayed fruiting. The surveys in late October/early November and in mid-November were more productive due to adequate rainfall and heavy dews during this period. There were no frosts in November during the survey periods and fungi continued fruiting late in to the month.

A total of 52 CHEGD species (C10,H23,E13,G5,D1) were recorded over the three surveys of the Chirk Castle and the Maes Gwyn Estates (Table 6). Twenty-four *Hygrocybe* species were recorded including five previously unrecorded species for the Chirk Castle Estate list: *Gliophorus sciophanus* new to Baddy's Park, (not included in the CHEGD total), *Cuphophyllus pratensis* var. *pallidus* on Horse Park, Middle Ley, Drive Ley and Pheasantry; *C. russocoriaceus* on Upper Llwyn y Cil; *Hygrocybe citrinovirens* on Pool Ley, Old Golff & Tynygroes and Old Golff; and *Gliophorus laetus* on Old Golff & Tynygroes. The latter species was also on Maes Gwyn Field 2. Ten Clavarioid species were recorded including *Clavaria fumosa* new to the Estate list, found on Big Paddock and Middle Lawn, but not on Baddy's Park, and *Clavulinopsis umbrinella* only recorded on Maes Gwyn Field 4. Entolomas were fairly low both in number of species and abundance. They often fruit early and may have been missed or were inhibited from appearing by the early lack of rain. Four new species were recorded over the 3 surveys, *E. prunuloides* and *E. atrocoeruleum* on the Chirk Castle Estate and *E. asprellum* and *E. cf. poliopes* on the Maes Gwyn Estate. Five species of Geoglossaceae were recorded with *Trichoglossum walteri* Short Spored Earthtongue new to the Chirk Castle list. This species was found on Pool Ley, Jericho and Old Golff & Tynygroes on the Chirk Estate and on Maes Gwyn Field 4. *T. walteri* is both a British RDL species and IUCN assessed as 'globally Vulnerable'.

Fourteen of the species recorded during the surveys are of British and global conservation value (Table 5) and these are described along with their conservation status and the fields where they were recorded in Appendix III. Ten figure grid references for locations of significant species are given in Table 8.

Using the site classification system of Rald (Table 2) all the fields have been ranked as to their importance as grassland fungi sites (Table 4). Out of the 24 fields, 6 rank of 'Local Importance' and 15 of 'Regional Importance'. Horse Park and Old Golff & Tynygroes on the Chirk Estate rank of 'National Importance' alongside Baddy's Park. With the exception of Baddy's Park, the rankings are all from the results of surveying in a single season and the species list for each field can be expected to increase in following years. JNCC guidelines for the selection of biological SSSIs (Bosanquet *et al*., 2018), states that a site can be considered for SSSI notification if the total count of *Hygrocybe* species reaches or exceeds 19. Horse Park with 19 species and Baddy's Park with 19 species both meet this criteria and could be notified as SSSIs solely for their grassland fungi. A further 4 fields meet or exceed the SSSI threshold for the number of Clavarioid species they support which is stated as 7; (Upper Llwyn y Cil, Pheasantry and Middle Lawn with 7 species and Maes Gwyn Field 4 with 8 species).

With the correct management, the Chirk Castle and Maes Gwyn Estate fields should continue to be important reservoirs for the grassland fungi communities they have been shown to support. Although colonisation of new sites is often slow, the retention of fungus-rich grasslands in the Welsh landscape will allow recolonisation of areas where agricultural intensity declines. Individual fields are discussed by Chirk Castle and Maes Gwyn Estates below.

Table 4. CHEGD profile, CHEGD total and Site Ranking of Fields

Chirk Castle Estate Fields	CHEGD Profile	CHEGD total	Ranking (using Table 2)
Baddy's Park	C9,H19,E9,G4,D1	42	Nationally Important
Baddy's Paddock	C3,H8,E3,G0,D0	14	Locally Important
Upper Llwyn y Cil	C7,H14,E5,G0,D1	27	Regionally Important
Horse Park	C7,H19,E7,G1,D1	35	Nationally Important
Pleasure Ground Ley	C5,H9,E1,G2,D1	18	Regionally Important
Upper Deer Park	C4,H5,E3,G0,D1	13	Locally Important
Deer Shed Paddock	C2,H5,E0,G1,D0	7	Locally Important
Middle Paddock	C4,H12,E2,G0,D1	19	Regionally Important
Big Paddock	C4,H9,E1,G0,D0	14	Regionally Important
Old Golff	C3,H12,E2,G3,D1	21	Regionally Important
Old Golff & Tynygroes	C7,H18,E2,G2,D1	30	Nationally Important
Jericho	C6,H9,E3,G4,D1	23	Regionally Important
Middle Ley	C5,H9,E3,G1,D1	19	Regionally Important
Pool Ley	C5,H13,E5,G2,D1	26	Regionally Important
Drive Ley	C3,H12,E3,G1,D1	20	Regionally Important
Pheasantry	C7,H12,E3,G2,D1	25	Regionally Important
Middle Lawn	C7,H10,E1,G0,Do	19	Regionally Important
Top Lawn	C1,H4,E0,G0,D0	5	(Locally Important)
Maes Gwyn Field 1	C3,H9,E2,G1,D0	15	Regionally Important
Maes Gwyn Field 2	C4,H13,E3,G3,D1	24	Regionally Important
Maes Gwyn Field 3	C5,H10,E0,G2,D1	18	Regionally Important
Maes Gwyn Field 4	C8,H13,E7,G4,D1	33	Regionally Important
Maes Gwyn Field 5	C1,H6,E1,G0,D0	8	Locally Important
Maes Gwyn Field 6	C3,H6,E0,G0,D1	10	(Locally Important)

7.1. Chirk Estate Fields

Baddy's Park has been surveyed on several previous occasions and is ranked as 'Nationally Important' for its Hygrocybes alone; the grassland fungi assemblage it supports is part of the SSSI designation for the estate. This wider survey in 2022 has indicated that other fields on the estate also support important assemblages and species of grassland fungi, while there are a small number of fields that appear to have had more improvement and only support small numbers of species. The recording of any fungi however, indicates that any historical improvement is fairly low and no fungi would be found on highly improved fields, e.g. the typical ryegrass, highly fertilised leys found in much of lowland Britain. It can be expected that with suitable and sensitive management the diversity of the grassland fungi on all fields on the estate will increase with time. Baddy's Paddock, Upper Deer Park, Deer Shed Paddock and Top Lawn all appear to have had previous improvement and this was

reflected by the low number, range and quality of the species recorded in them. These fields all rank only of ‘Local Importance’ for their Hygrocybes.

One of the highlights of the surveys was Horse Park. This field was notable for the number and variety of species present and their abundance, particularly on the slope on the north-east side of the field making them visible from a distance. *Hygrocybe punicea* Crimson Waxcap, recorded on the slope, indicates that this area of the field at least has largely escaped any previous improvement. Lush areas of the field with fewer species on the western side do suggest there has been some fertiliser use on other areas in the past. Ten species with RDL or IUCN conservation value were recorded on the field increasing its value further: *Clavaria straminea*, *Cuphophyllus flavipes*, *Entoloma prunuloides*, *E. porphyrophaeum*, *Hygrocybe aurantiosplendens*, *H. intermedia*, *H. mucronella*, *H. quieta*, *H. punicea* and *Porpolomopsis calyptriformis*. The field ranks of ‘National Importance’ for its Hygrocybes following the recording over only a single season and it can be expected that further species might be recorded in future years with continued suitable management.

Photo 49: *Hygrocybe punicea* on bank in Middle Paddock

A further highlight was Middle Paddock, a small damp field which appeared very unremarkable on first impressions. The sward was quite long and lush and in need of some grazing. However, a steep bank at its southern end with shorter grass supported a large group of *Hygrocybe punicea* (Photo 49) along with good numbers of *Porpolomopsis calyptriformis* and *Entoloma porphyrophaeum*. It can be assumed that the steep bank was inaccessible to a tractor and historically left untouched, allowing this very small area to remain unimproved and able to support the high and medium value indicator species. It is important that this part of the field continues to be managed sympathetically, and combined with more grazing of the field to obtain a shorter sward the number of species recorded is predicted to increase. Middle Paddock currently ranks of ‘Regional Importance’.

With the exception of the single *H. punicea* recorded in Baddy's Park in 2016, none of the other fields surveyed on the Chirk Estate supported *H. punicea*, but its presence on the drive verge below Middle Lawn, on the unimproved verge next to Baddy's Park and on the Main Gate Lodge lawn indicates that it might have occurred more widely on the fields at one time.

Old Golff & Tynygroes showed signs of previous improvement with large areas of the field only supporting common, low value indicator species but the area of the field with the bank and ditch on the northern periphery and the bank/slope on the western side supported good numbers of species, including the high value indicator *Hygrocybe citrinovirens* on the latter, indicating no or lower inputs historically on these two areas. This species and *Gliophorus laetus* which was recorded both in the ditch and on the bank area were new to the Chirk Castle Estate list. *Clavaria straminea* and *Trichoglossum walteri* both British RDL species and several IUCN listed species were recorded on the field. Old Golff & Tynygroes ranks alongside Baddy's and Horse Park as of 'National Importance'.

The remainder of the Chirk Estate fields all rank of 'Regional Importance' from the 2022 survey results and supported good ranges of both low and medium value indicator species. Of note Big Paddock, lying just north of Middle Paddock, supported an impressive number of the beautiful *Porpolomopsis calyptriformis* growing together with *Entoloma porphyrophaeum* in the southern end of the field, and *Clavaria fumosa* was additionally found here, new to the Chirk Castle Estate list. Upper Llwyn y Cil supported a number of species of conservation concern and *Cuphophyllus russocoriaceus* was recorded there new to the Chirk Castle Estate list and only found on this field.

The surveys in 2022 have identified a rich and diverse range of grassland fungi across the majority of the fields despite some previous improvement, and a few fields have retained some parts which may have escaped improvement in the past and have kept a more diverse range of grassland fungi. The number and range of CHEGD species recorded, many with both British and International conservation concern, reinforces the need to conserve and maintain these important fungi and the habitats in which they thrive by sensitive and appropriate management.

7.2. Maes Gwyn Fields

All fields surveyed on the Maes Gwyn Estate supported a range of grassland fungi. Even Field 6 which had been recently ploughed and reseeded, and thus was not expected to support any of these fungi, still had pockets on the periphery which had escaped the plough and where they were able to persist. No grassland fungi however, were present on the resown sward, and their chances of survival there are minimal, demonstrating the negative effect of such drastic improvement. All the other fields appeared to have had some previous improvement but are now being managed without artificial inputs which should allow grassland fungi to thrive, and it can be expected that with sensitive management in to the future the number of species present in the fields will slowly increase. Fields 1, 2, 3 and 4 all rank of 'Regional Importance'

for their grassland fungi and Fields 5 and 6 currently rank of 'Local Importance'.

The most important field surveyed on the Maes Gwyn Estate was Field 2. This field appeared to have had considerable previous improvement and the main body of the field only supported a small range of the common, lower indicator value species that can tolerate a small amount of improvement. However, a valley with steep sides on the field edge would have been inaccessible to a tractor and as a result would have remained unimproved; it supported a good range of species including a few *Hygrocybe punicea*, a species which will only persist on sites which have had no disturbance or artificial inputs and it is regarded as an excellent indicator of a quality un-improved grassland. The recording of this species is thus of significance and often indicates that several other *Hygrocybe* species might be growing in the same habitat. A good number of CHEGD species were recorded nearby over the 3 surveys including *Gliophorus laetus* and *H. reidii* recorded growing on the sides of the banks, along with *Clavulinopsis luteoalba*. All three waxcap species appear to favour the short, mossy grass of a slope or bank and they were recorded infrequently across the two estates in similar habitats. *H. punicea* was only recorded on two other fields during the 2022 surveys, both on the Chirk Castle Estate, also growing on small areas which appeared to have escaped historical improvement. It indicates that there are few areas of completely unimproved grassland on the estates and that the majority of the grassland is semi-improved. The need to preserve these few remaining fragments of pristine habitat is therefore very important.

Care is needed to ensure this area of Maes Gwyn Field 2 remains unimproved to preserve the fragile habitat and the suite of fungi it supports. It is assumed that all the fields are now being managed without artificial inputs but care will be needed if manure spreading is used to ensure there is no runoff on to the slopes/steep sides of the valley area. Manure or slurry spreading is not recommended for grassland fungi sites.

Maes Gwyn Fields 1, 3 and 4 all contained a good range of lower value indicator value species that can tolerate a little improvement. Maes Gwyn Field 4 was interesting for its excellent range of 8 Clavarioids and 4 Geoglossaceae including the 2 RDL species *Clavaria straminea* and *Trichoglossum walteri*. *Clavulinopsis umbrinella* recorded here has not been found elsewhere. The number of Clavarioid species exceeds the SSSI threshold. The field also has potential for a range of the smaller *Entoloma* species which favour the very short habitat as present on the field periphery.

Field 1 was fairly rich in fruitbodies particularly the multi-coloured *Gliophorus psittacinus* Parrot Waxcap. The majority of species recorded were low value indicator species but the species range should improve with suitable management.

Field 3 also supported mainly lower value species and some of these may have survived a small amount of improvement or be returning following the cessation of applying artificial inputs. The only species of significance was the

RDL *Clavaria incarnata*, a single club of which was recorded on the 2nd survey. The remains of a manure heap in the field suggests that manure might be being spread on the field. This is generally not recommended for grassland fungi sites which should rely solely on natural grazing without fertiliser inputs.

Field 5 has potential and may support further species. The field would benefit from more grazing; the long sward length may have inhibited species from fruiting or they weren't visible. The presence of *Porpolomopsis calyptriformis* and *Entoloma porphyrophaeum*, 2 medium value indicator species, suggests the field should support other species. At present this field only ranks of 'Local Importance' along with Field 6.

All fields on the Maes Gwyn Estate with the exception of Field 6 appear to be mainly semi-improved grasslands and if managed correctly will continue to support a range of grassland fungi and the number of species can be expected to increase over time.

7.3. Environmental DNA (eDNA) as a method for surveying sites

The traditional way of surveying a site for grassland fungi relies on the presence of any fruitbodies and their identification by an experienced mycologist. This has limitations as the fruitbodies will only appear at certain times of the year, they only last for a short period and they are additionally affected by environmental conditions, especially the weather. Sites need to be surveyed over several years to obtain a full list and the number of mycologists who can do this work is small.

Environmental DNA (eDNA) in the soil is starting to be used to assess sites and these new advances in eDNA techniques are discussed in Detheridge & Griffith (2021). The fungi exist as mycelial networks in the soil and a series of soil samples taken across a site will include some of this mycelium. The samples are processed and the DNA extracted. Using eDNA metabarcoding analysis all the species present are identified and their abundance assessed. The correct species identification is reliant on a high quality sequence database to match the metabarcoding data to and these databases are continually being added to and improved.

The two methods, traditional surveying and eDNA analysis, are not completely comparable and eDNA will usually identify more species than the traditional survey method. However, some species identified in the soil may never produce fruitbodies because they are immature or the biomass is too small and this needs to be taken in to consideration when interpreting the data. Species may be absent from the eDNA list as well, depending on where the soil sample was taken. The two methods can therefore be regarded as complementary. eDNA has the advantage of not being limited by time of year or availability of experienced surveyors and it may be cost effective to do eDNA sampling on a site prior to traditional surveys and the list of species obtained could be used to target future surveying, especially of rare species. The cost of eDNA sampling is expected to fall as techniques become more streamlined.

8. Conclusions

Grassland fungi were present in varying number of species and abundance on all fields surveyed on both the Chirk Castle and Maes Gwyn Estates. A total of 52 CHEGD species and 12 species new to the Chirk Estate list were recorded. One species of *Hygrocybe: Gliophorus sciophanus* was added to the site list for Baddy's Park but is not included in the CHEGD total.

The absence of any high value indicator species on most of the fields suggests that they are all predominantly semi-improved, with no inputs in recent years. However, *Hygrocybe punicea* recorded on Middle Paddock and Maes Gwyn Field 2 and *H. citrinovirens* recorded on Old Golff, Old Golff & Tynygroes and Pool Ley, both indicate that there remain small areas on these fields which have escaped the historical improvement and remain unimproved.

Horse Park and Old Golff & Tynygroes on the Chirk Castle Estate have been identified to be of 'National Importance' for their grassland fungi in addition to Baddy's Park. Horse Park and Baddy's Park would qualify for SSSI status in their own right for the number of *Hygrocybe* species they support. Eleven further fields on the Chirk Castle Estate and 4 on the Maes Gwyn Estate are of 'Regional Importance'.

Several species of National and International conservation concern were recorded across the fields increasing the importance to manage them sympathetically for their grassland fungi. Management recommendations are given to help preserve and enhance the fungal assemblages and it is recommended that the fields should be monitored through further survey work over time. It is suggested that eDNA studies could be used to complement the traditional walkover survey method. The results of the baseline surveys in a single season suggest that further species will be recorded in future years on all fields.

9. Recommendations for the Management of the Chirk Castle and Maes Gwyn Estates

9.1. General recommendations for grassland fungi sites.

- Avoid the use of any fertilisers, lime or added manures. These alter the nutrient levels in the soil and soil chemistry and will result in the loss of grassland fungi species. Waxcap pastures should rely only on natural fertilisation by grazing animals. Spreading of slurry/manure may additionally have a negative effect on the grassland fungi and is discouraged.

- Sheep grazing is thought to be the best way to graze a waxcap pasture, with the aim of achieving a close cropped, short sward of around 5 to 10cms maximum. This can be monitored by measuring the grass height and if needed the stocking rates and thus the grazing pressure adjusted accordingly to get the optimum sward length in the field. Longer swards are

not detrimental to the mycelium in the soil, but fungi are more difficult to record and often don't fruit.

- Cattle and mixed grazing can also be used to achieve a suitable sward length but cattle are more likely to cause poaching to the ground especially in wet weather and around feeding areas.

- Avoid poaching of the ground especially during wet periods and during the winter as it can damage the fungal mycelium in the soil. Poaching can be a problem especially around gateways and feeding stations. Cattle and horses are more prone to cause poaching than sheep. It may be advisable to restrict cattle grazing to spring and summer months when poaching will be less of an issue.

- Ideally, supplementary feeding should be avoided. It may result in localised enrichment of the soil around the troughs and encourage poaching in these areas. If supplementary feeding must be used, position the troughs in areas which are known to be poorer for grassland fungi.

- Avoid any field operations like ploughing or harrowing, including chain harrows which can damage the grass, moss layers and fungal mycelium in the soil. Invasive weeds like creeping, marsh and spear thistles and nettles should ideally be controlled only by cutting or pulling.

- Application of systemic chemicals to control thistles e.g. "Weed Wipe" (glyphosate), using a light vehicle to only spray the plants, shouldn't cause too many problems. The chemical should break down quite quickly in the soil and there is 'no evidence' of it having a direct effect on fungi or being detrimental to fungal mycelium, but it is important to ensure that large areas are not devegetated (pers. comm. Professor Gareth Griffith, Aberystwyth University). However, removal by hand where practical would always be the best approach.

- Avoid compaction of the soil by heavy vehicles and any action which might affect the soil structure and the drainage of the field. Compaction can be especially damaging during wet weather. Aim to use lighter vehicles for any field operations that must be undertaken. If the use of vehicles to carry heavy loads across the field is unavoidable, avoid numerous separate tracks/routes across the grass and adopt a single route so that any resulting damage is limited to a narrow strip. Fox example, a line along the field edge of Paddy's Park could be suitable as few grassland fungi have been recorded there immediately adjacent to the walls and woodland edges where the ground is much drier and where there are often more nettles and thistles.

- Control of moles within a field might be considered especially if they are numerous molehills in areas of high fungal interest. It can be assumed that the moles' underground activities might have a detrimental effect on the fungal mycelium (pers. comm. Ray Woods).

- Continue monitoring of fields in future years, this will develop a more complete site list and monitor the effects of the grassland management.

- Consider the use of eDNA to complement traditional surveying. eDNA may identify the presence of rare fungi and other species not recorded on a field previously and enable targeted surveying in the autumn.

9.2. Specific Recommendations for Chirk Castle and Maes Gwyn Estates

- Chirk Castle Estate: Baddy's Park appears to be being managed appropriately for the grassland fungi and sward height was optimum on most areas of the field. Baddy's Paddock and Deer Shed Paddock would benefit from more grazing or a light topping if being managed for the fungi, although both fields appeared to support only a small number of species and individuals. Middle Paddock supporting *Hygrocybe punicea* would benefit from some controlled sheep grazing to obtain a shorter sward. This field is important for its population of *H. punicea*, *Porpolomopsis calyptriformis* and *Entoloma porphyrophaeum* on the bank area and the potential for other species to be recorded here is quite high. The majority of the other fields on the estate appeared to being adequately grazed by either sheep or store cattle with minimal areas with a sward length of over 10cms. There were no signs of poaching by the latter. There was some evidence of enrichment of the swards in corners of some fields and around trees from where stock congregate encouraging the growth of nettles and thistles, but this was minimal. Middle Lawn is unusual as it was scarified some years ago in order to establish a wildflower meadow on the field. Scarification and other disturbance of the ground are usually discouraged as it damages the fungal mycelium in the soil which is mainly in the top 10cms. However, a number of species are still present in the field despite this intervention. Scarification or similar are still not recommended for a grassland

- Chirk Castle Estate: The grassland fungi, especially the colourful and charismatic waxcaps and Clavarioids, are an important asset to several of the fields. These should be continued to be promoted as a feature of the Chirk Castle Estate grounds. Consider raising the visiting public's awareness of these fungi by the use of interpretation boards at the entrance to a field, possibly with explanatory leaflets, and photos and information on the Chirk Castle website. A grassland fungi walk is already established as an annual event on Baddy's Park and could be extended to encompass other fields e.g. Horse Park that have been identified as very good for waxcaps etc.

- Chirk Castle Estate: It is recommended that the Chirk Castle Nature Conservation Group could be restarted and meet regularly to discuss and advise on matters relevant to, or affecting the biodiversity and management of the Estate. Management plans for the benefit of the grassland fungi could be discussed at these meetings.

- Maes Gwyn Estate: The fields are currently receiving no artificial inputs (pers. comm.). Most of the fields were being adequately grazed to obtain a short sward of around 5 to 10cms. Field 5 would benefit from more grazing and the

longer sward present at the time of the surveys may have precluded some species from being recorded and discouraged some from fruiting. Field 2 was the most important field with the steep bank and valley area and the suite of fungi including *Hygrocybe punicea* that were recorded there. Much of the rest of the field appeared to have had some historical improvement and was currently being cattle grazed. It is not known if manure is being spread on the field; however, there appeared to be the remains of a large manure heap in the adjacent Field 3. The spreading of manure is not recommended for a grassland fungi site, but if done the valley area should be avoided to keep it as unimproved as possible. Field 6 had been resown and is not expected to support any grassland fungi for perhaps decades to come. The remaining fungi present in the peripheral ditch should persist. All fields with the exception of Field 6 have the potential to increase their value for grassland fungi and by managing without inputs and with just natural grazing the range of species should increase over time.

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12. Appendices

It has not been possible to make the data tables included in the Appendices of this report comply with Accessibility Legislation. This Accessible version of the report therefore includes the full text but excludes the appendices. A full PDF of the report is available from the Natural Resources Wales Library and has been sent to the national Deposit Libraries.