

Provisional atlas of Waxcap fungi *Hygrocybe* in Cardiff

Cardiff Council 2009



PART 1

MAIN REPORT

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A provisional atlas of Waxcap fungi *Hygrocybe* in Cardiff

SUMMARY

Waxcaps are fungi belonging to the genus *Hygrocybe*. In Europe they are found in a variety of nutrient-poor grasslands which are either grazed or mown. In North America they occur in woodlands. There has been a dramatic loss of waxcap grasslands across Europe due to the intensification of agriculture, especially in lowland areas. Western Britain, including Wales, now supports some of the best assemblages of waxcaps in Europe. Interest in the taxa has developed due to national waxcap survey initiatives and to national and Local Biodiversity Action Plans (LBAPs). This provisional atlas is an output of the Cardiff Waxcap Species Action Plan (SAP).

The purpose of this atlas and report is to identify the distribution of waxcaps and waxcap grasslands in Cardiff, especially those worthy of conservation. Various surveys of waxcaps were conducted in Cardiff between 2002 and 2008. These resulted in over 1,000 records of 31 species of waxcaps from 52 sites. The data has been entered onto the Cardiff Biological Database.

Several species-rich sites have been designated as non-statutory Sites of Importance for Nature Conservation (SINC) and one site has been designated as a Site of Special Scientific Interest (SSSI) for grassland fungi. Nearly all the species-rich sites in Cardiff are either anthropogenic grasslands or small horse-grazed pastures. Using criteria developed in continental Europe, Cardiff has a significant number of regionally important sites as well as a few sites of national and international importance.

CRYNODEB

Mae Capiau Cwyr yn ffwng sy'n perthyn i'r genws *Hygrocybe*. Yn Ewrop, ceir hyd iddynt mewn amryw o laswelltiroedd heb fawr faeth sy'n cael eu pori neu fod rhywun yn torri'r glaswellt. Yng Ngogledd America maent yn byw mewn coetiroedd. Mae lleihad sylweddol wedi bod yn y nifer o laswelltiroedd capiau cwyr ar draws Ewrop oherwydd dwysâd amaethyddiaeth yn enwedig mewn ardaloedd iseldir. Mae Gorllewin Prydain, gan gynnwys Cymru, nawr yn cefnogi rhoi o'r casgliadau gorau o gapiau cwyr yn Ewrop. Mae diddordeb yn y dacsonomeg wedi datblygu oherwydd mentrau arolwg capiau cwyr a Chynlluniau Gweithredu Bioamrywiaeth Lleol a Chenedlaethol. Mae'r atlas dros dro hwn yn allbwn o Gynllun Gweithredu Rhywogaeth (CGRh) Capiau Cwyr Caerdydd.

Bwriad yr atlas a'r adroddiad yw nodi'r dosraniad o gapiau cwyr a glaswelltiroedd capiau cwyr yng Nghaerdydd, yn enwedig y rheiny sy'n deilwng o'i gwarchod. Cynhaliwyd amryw arolygon capiau cwyr yng Nghaerdydd rhwng 2002 a 2008. Golygodd hyn dros 1,000 o gofnodion o 31 rhywogaeth o gapiau cwyr o 53 safle. Mae'r data wedi'u cofnodi ar Gronfa Ddata Fiolegol Caerdydd.

Mae nifer o safleoedd rhywogaeth-gyfoethog wedi'u dynodi'n Safleoedd o Bwysigrwydd Cadwraeth Natur (SoBCN) anstatudol ac mae un safle wedi'i ddynodi'n Safle o Ddiddordeb Gwyddonol Arbennig (SoDdGA) ar gyfer ffwng glaswelltir. Mae bron i bob safle yng Nghaerdydd yn laswelltir anthropogenig neu'n gaeau bychain a borir gan geffylau. Gan ddefnyddio meini prawf a ddatblygwyd ar gyfandir Ewrop, mae gan Gaerdydd nifer sylweddol o safleoedd pwysig yn rhanbarthol yn ogystal ag ychydig safleoedd o bwysigrwydd cenedlaethol a rhyngwladol.



INTRODUCTION

Waxcaps is the common name given to fungi of the genus *Hygrocybe*. The common name refers to the fact that many species are at least partly waxy, moist or slimy. Another feature of the genus is that some species are brightly coloured, often yellow, orange or red, although there are also several duller brown and grey species. They are found in nutrient-poor, semi-improved grasslands and dune systems in Europe. There are at least 35 species in Wales, 31 of which have been recorded in Cardiff since 2000.

There are several other fungi taxa which occur in grasslands alongside those of the genus *Hygrocybe*. These include the *Clavariaceae* (club and spindle fungi), *Entoloma* (pink-gill agarics) and *Geoglossaceae* (earth-tongues). Grassland fungi communities are sometimes assessed using the species richness of these four taxa. The score is referred to as a CHEG score, taking the initial letters from each taxa. The other taxa in the CHEG group are generally more difficult to identify than *Hygrocybes*.

Interest in waxcaps has grown considerably since the British Mycological Society launched its waxcap-grassland survey in 1996. The conservation charity Plantlife UK launched a nationwide waxcap grassland survey in 2002 with a focus on the Pink Meadow Waxcap *H. calyptriformis* which was then a priority species in the UK Biodiversity Action Plan. This helped stimulate interest in waxcaps, and in Cardiff a group SAP was produced as part of the LBAP in 2002. The SAP has driven much of the effort to survey potential waxcap-grassland sites in Cardiff and to identify those worthy of conservation.

It should be noted that although over 1,000 records of waxcaps have been collected in Cardiff during the period 2000–2008, this does not present a complete picture of waxcap distribution in Cardiff, hence the 'provisional' nature of the atlas. Many sites have only been visited a few times, often in only a couple of seasons. Due to the erratic nature of fruiting body production and great variations between years, it is necessary to make multiple visits to a site throughout the season and over several years to establish a full list of waxcap species for a site. No doubt there are also waxcap grasslands in Cardiff which have yet to be discovered.

The nomenclature and taxonomy in this report follows David Boertmann, *Fungi of Northern Europe, vol. 1: The Genus Hygrocybe*, (1996).

WAXCAP ECOLOGY

Many aspects of the ecology of waxcaps are still poorly known. Most of our knowledge comes from the recording of the fruiting bodies (carpophores), which appear mostly in autumn, peaking late October to mid-November. The majority of the fungal organism is the underground mycelium, which is difficult to study. The mycelium can be extensive and possibly very long-lived. It is not known what it feeds on although it is thought to be dead organic matter. Waxcap grasslands frequently contain extensive areas of mosses (often *Rhytidiadelphus squarrosus*), although the nature of any association between the fungi and the



mosses is not understood.

An interesting feature of the genus is the high concentrations of species in the same genus that can occur in a small area. For example, over 20 species have been recorded in a 100 meter long section of Llanishen reservoir embankment, 11 species in less than 0.5 hectare of the Airshaft No. 4 spoil tip and 6 species in a few square meters at either end of a single grave in Western Cemetery. It is not known how long the mycelium lives or takes to develop before fruiting or what triggers fruiting. It has been suggested (Evans 2004) that perhaps some of the rare species may not be rare but simply fruit more rarely. Evidence from DNA studies also suggests a poor correlation between fruiting bodies and the mycelia (Griffith, Bratton & Easton 2004).

The surveys in Cardiff provide some interesting evidence with regard to the establishment of waxcap assemblages over time, as some sites can be dated accurately. For example, the most species-rich site in Cardiff, Llanishen reservoir, with 28 species, was constructed in 1886, and at the second most species-rich site, Radyr Cricket Club and junction fields, the main pitch (20+ species) was created in 1890. It is not known, however, how much disturbance was caused to the existing fungal mycelium. A much newer site is County Hall, which was constructed in 1995. It has only one species *H. conica*, which is often the first species to colonise new grasslands.

THE CARDIFF BIOLOGICAL DATABASE

The Cardiff Biological Database was established by the former Cardiff City Council in 1993. It is currently managed by the Environmental Advice Team within the Strategic Planning Service of Cardiff Council. Most records on the Database are situated within the current Unitary Authority boundary, which includes parts of Vice County 41 Glamorgan and, east of the river Rhymney, VC 35 Monmouthshire. In December 2008 it contained over 107,000 records. This includes 1,095 records of waxcaps, of which all but 20 are from the period 2000–2008. In addition to the 31 species recorded in Cardiff since 2000, two species were recorded pre-2000 but not since. These are *H. miniata* from Llanishen in 1944, recorded by J.C. Gilchrist, and *H. nitrata* from Flatholm on 30th August 1997, recorded by Libby Robinson. *H. miniata* is one of several very similar small red species which are difficult to identify. It is not known what the identification was based on and the record is probably best regarded as unconfirmed. The record of *H. nitrata* is one of several fungi recorded on Flatholm during 1997 but there is no other information concerning this record.

For most records in Cardiff, identification has been based on macroscopic features alone. These included the shape, colour, texture and vidity (sliminess) of the pileus (cap), stipe (stalk) and lamellae (gills), including the way in which the latter join the stipe as well as any distinctive smell. In the case of some difficult species such as *H. aurantiosplendens*, identification by Peter Sturgess has been based on microscopic features such as gill structure or spores.

Records of waxcaps have been accepted in good faith and have not been subject to external verification.



WAXCAP SURVEYS IN CARDIFF

The variations between years of fruiting by waxcaps is evident from the surveys undertaken regularly at Llanishen and Lisvane reservoirs during 2002–2004. In 2002, 17 species were recorded, in 2003 (a very dry year) only 11 species, while 28 species were found in 2004.

The owners of Llanishen/Lisvane reservoirs (Western Power Distribution) also commissioned waxcap surveys of other potential sites in South Wales, including Cardiff in 2005. A waxcap identification training event for volunteers was held in 2004 with the Glamorgan Fungus Group. The Countryside Council for Wales (CCW) commissioned surveys of Llanishen/Lisvane reservoirs and Radyr Cricket Club as part of a survey of five waxcap-grassland sites in Mid and South Glamorgan in 2006 (Evans & Mitchel 2007). Cardiff Council commissioned Sturgess Ecology to undertake surveys of seven sites in 2008. In addition, staff from Cardiff Council undertook surveys of potential and known waxcap-grassland sites within Cardiff from 2002 until 2008. Most visits were targeted during the peak fruiting period. All the surveys have been undertaken on a 'walk-over' basis with systematic mapping of transects; however, Llanishen Reservoir has been surveyed on the basis of 100m long sub-sections.

Due to variations in the number of visits, season, expertise of the recorders, the routes taken and length of the vegetation at the time of survey, data between sites and years cannot be directly comparable on a scientific basis. It does, however, provide a good indication of the relative value of the sites when factors such as the year and number of visits are taken into consideration.

THE GEOGRAPHY OF CARDIFF

Cardiff County was established as a Unitary Authority in 1996. It covers an area of 148.7 square kilometres (including the part of the Severn estuary above Mean Low Water). About half the area is urbanised. The remaining area is dominated by permanent pasture, with a smaller area in arable use. Horse grazing is a significant use of much of the pasture. Woodlands are also widely distributed throughout the County.

The geology of Cardiff includes a ridge of Carboniferous limestone to the north of the M4. Overlying the limestone in the north-west of the area is Garth Hill, which is the southern limit of the more acidic rocks of the South Wales coalfields. At 307m, Garth Hill is also the highest point in Cardiff. There are sandstone and mudstone rocks, especially in the north of the area. The central and southern parts of Cardiff are largely made up of glacial deposits in the alluvial plains of the river valleys. In the Bristol Channel 8km south of Cardiff Bay lies Flat Holm Island, which is an outcrop of limestone.

CONSERVATION OF WAXCAPS IN CARDIFF

Threats

One of the greatest threats to waxcaps in Cardiff and elsewhere is the continuing loss of semi-improved grassland. In 2007 Cardiff Council undertook a ground-truthing



review of sites which were classed as semi-improved grassland in the Phase 1 survey of the early 1990s. This showed that about 100 hectares, around one third of the Phase 1 resource, had been lost. The three significant factors in this loss were development, improvement (re-seeding) and abandonment leading to colonisation by bracken and scrub. It is not known if any of the lost sites supported waxcap grasslands, but it is very likely that some good waxcap grasslands had been destroyed without ever having been recorded. Apart from re-seeding, agricultural improvement through the application of chemical pesticides and fertilisers is also a major threat. The Environmental Assessment (Uncultivated and Semi-natural Areas) Regulations 1999 have proved ineffective at protecting grasslands in Cardiff as two semi-improved grassland sites in Penttyrch, one of which is part of a non-statutory Site of Importance for Nature Conservation (SINC), have been ploughed under in recent years. Neither had been surveyed for waxcaps.

There is a pressing need for effective mechanisms to ensure appropriate management of semi-improved grassland in general. At present it is almost entirely dependent on the continuation of existing management (often ignorant of the conservation value) or it requires the goodwill of those enlightened landowners who want to conserve biodiversity on their land. The small horse-grazed pastures also fall outside the scope of agri-environment schemes such as Tir Gofal and Tir Cynnal.

Management

The conservation value of many waxcap sites may not be apparent as the sites may be botanically species-poor, such as amenity grasslands for example. The conservation of waxcaps grassland is dependent on maintaining the low nutrient status of the grassland. Inputs of fertilisers such as nitrogen reduce the species richness of grassland fungi. The other key management requirement is the maintenance of short turf through either grazing or mowing. Many of the better waxcap sites in Cardiff are horse-grazed pastures. Horses are not regarded as an ideal grazing animal for waxcap grasslands and it is not known what, if any, changes have occurred to the waxcap communities of those horse-grazed sites which were previously grazed by agricultural livestock. The management of horse grazing for waxcaps needs to be better understood, especially with regard to grazing levels and the management of horse latrines. The good sites are not heavily grazed and in many cases are periodically under-grazed; however, this can lead to a dense sward, which is unfavourable for fruiting.

Conservation Designations in Cardiff

As a result of the survey work undertaken since 2002, several sites have received conservation designations for their waxcap interest.

Statutory designation as a Sites of Special Scientific Interest (SSSI) allows the Countryside Council for Wales (CCW) to influence the management of the site.

Non-statutory designations sites are known as Sites of Importance for Nature Conservation (SINCs) in Cardiff. Their selection is based on the *Guidelines for the selection of Wildlife Sites in south Wales* published by Gwent Wildlife Trust (2004) as modified by Cardiff Council's *Supplementary Planning Guidance on Biodiversity* (2006). The threshold



for designation for waxcaps is eight species or the presence of UK BAP species. SINC designation identifies the importance of the site within the planning system but does not provide any mechanism to influence the management of sites.

SSSIs

Llanishen and Lisvane Reservoir Embankments.

This site was designated as a Site of Special Scientific Interest (SSSI) for its grassland fungi in 2006.

Sites of Importance for Nature Conservation (SINC)

The Biodiversity SPG (2006) designated 5 new SINCs for waxcaps, the 2007 review added another and enlarged one site.

The following SINC have been designated for their waxcap assemblages:

- Briwnant Footpath field (1.21 ha);
- Cefn Onn Amenity field (1.14 ha);
- Radyr Cricket Ground and junction fields (18.67 ha);
- Twmpath field (2.33 ha);
- Twynau Gwynion field (1.15 ha);
- Wenallt Road (south) field (2.24 ha).

The following existing SINC now have waxcaps as a qualifying feature:

- Garth Hill;
- Coed Transh yr Hebog (this site includes the Airshaft No 4 spoil tip but not the Transh yr Hebog grassland);
- Blackweir Wood (this site includes Bute Park Arboretum).

The survey work in 2008 has identified two new sites that qualify under the current criteria.

These are:

- the Wenallt Farm fields; and
- the Church Road / Caerau Lane fields.



RESULTS AND DISCUSSION OF THE SURVEYS

Waxcaps have been recorded at 52 sites in 40 1km grid squares in Cardiff. Some sites are aggregations of adjacent fields and therefore the actual extent of waxcap distribution sometimes extends beyond the grid reference used for recording. For example, all the Llanishen / Lisvane reservoir embankments have been recorded as the 1km grid square ST1881 although the waxcap grassland there includes parts of the 1km squares ST1882 & ST1982.

Figure 1: No. of spp. per 1km square

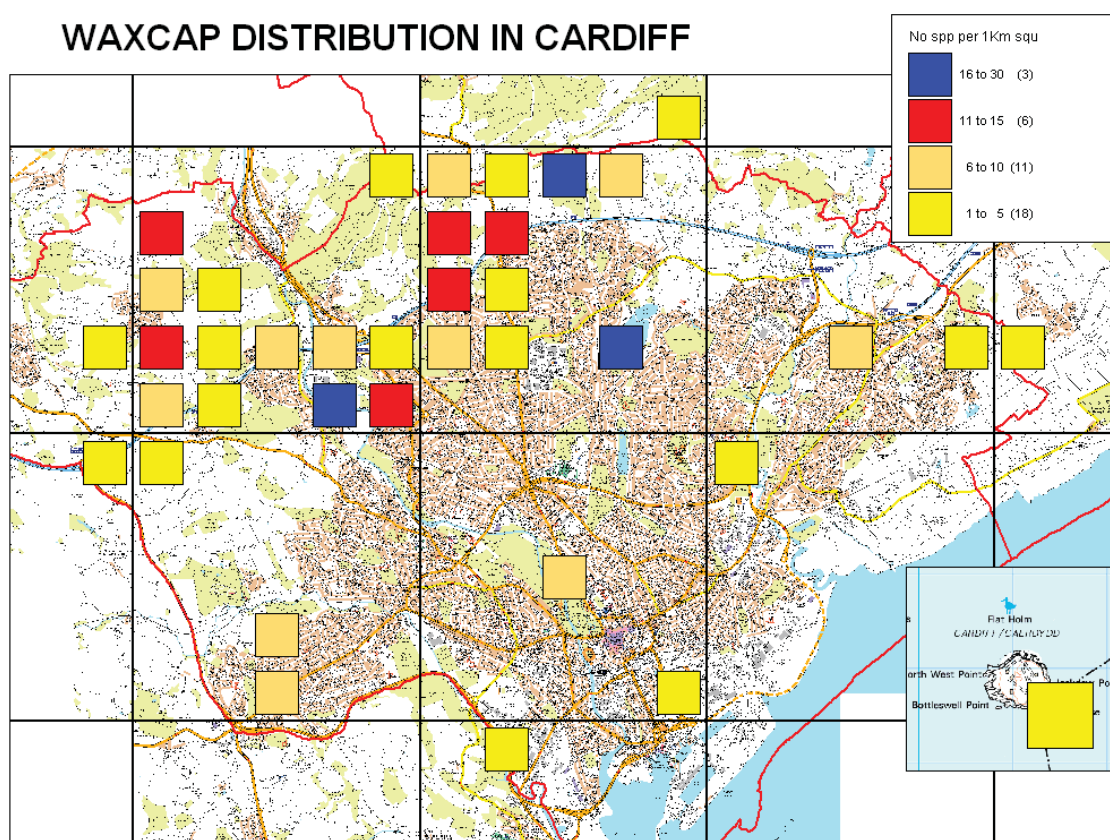


Figure 1 clearly shows a concentration of waxcap grasslands in the north and north-west of the area. The data partly reflects survey effort but also the distribution of less improved grasslands, especially horse-grazed pastures. There are three areas of the county with an absence of records. These are the rural western plain of Cardiff between St. Fagans and the M4, the north-eastern corner of the county, and the Gwent levels in the south-east. The first two areas are the most intensively farmed areas, dominated by improved pasture and arable land. A few potential sites in these areas have not been surveyed due to access restrictions. The Gwent levels is mostly improved pasture with limited access.

Table 1 shows the number of species per site. The two sites with over 20 species clearly stand out and the eight sites with between 10 and 17 species are also likely to be important.

Table 1. Number of species per site

Site	Total spp
Llanishen-Lisvane Reservoirs Embankments	28
Radyr Cricket Ground / junction fields	23
Cefn Onn Amenity field	17
Twmpath fields	14
Twynau Gwynion field	13
Briwnant footpath field	12
Church Road/Caerau Lane fields	12
Garth Hill	12
Airshaft No 4 spoil tip	11
Wenallt Road field (south), Rhiwbina	10
Bute Park Arboretum	9
Llanrumney Green north	9
Wenallt Farm fields	8
Court Farm fields	7
Rhiwbina, North Cardiff (observer's garden - PS)	7
Transh yr Hebog grassland	7
Trewern Field, Pentyrch	7
Cwmffynnonau fields	6
Iron Bridge Road sports field	6
Western Cemetery	6
Blaen Buellai field off Pen-y-Waun	5
Blaengwynlais fields	5
Flat Holm	5
Blaen Buellai southern paddock field	4
Morganstown level crossing field north	4
Rhiwbina (north) / Wenallt	4
Rhiwbina ST1581	4
Tydu Marsh	4
Upper Stockland west	4
Llanishen, Cardiff	3
Cefn Bychan east fields	2
Craig Lisfaen east	2
Fortran Road	2
Goitre-Fawr footpath, Radyr	2
Heol Goch - east field	2
Heol-y-Parc west field	2
Pant Mawr Cemetery field	2
Rhiwbina ST 16 82	2
Rhiwbina ST 16 81	2
Thornhill (south), Cardiff	2
Thornhill Crematorium	2
Whitchurch Hospital fields	2
Briwnant-Isaf south field	1
Castell-y-briwydd field 2	1
County Hall, Cardiff	1
Cwmrhyddgoed fields	1
Forest Farm fields	1
Graig Footpath	1
Howardian fields	1
Leckwith Ind. Est. Flyover meander	1
Radyr - Penrhos	1
Woodstock Business Park - west grassland	1

Figure 2. Frequency of species by 1km square

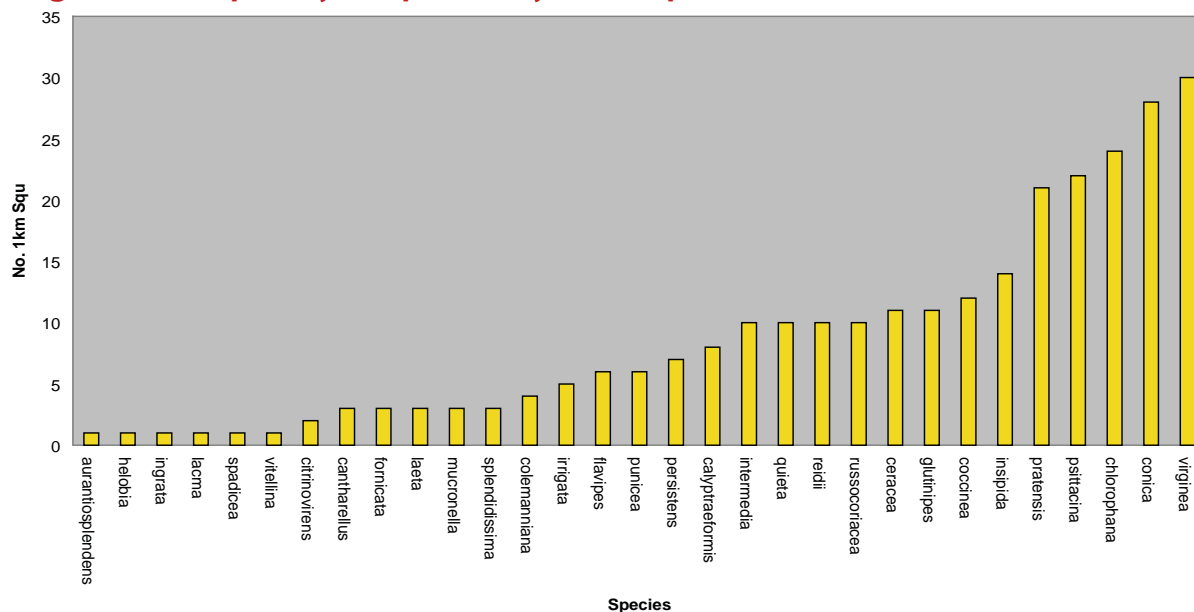


Figure 2 shows the frequency of species by 1km square. The five most frequently occurring species occur in 52.5% to 75% of those squares with waxcap records. These five species also account for about half of the total number of records on the database. A concentration of survey effort and records from the more species-rich sites has increased the proportion of records of the scarcer species in the database. If the survey effort had been more evenly spread, the five commoner species would no doubt make up an even higher percentage of the total number of records. The next most frequently occurring species includes a suite of eight species which have been recorded in 25–35% of squares with records.

Site Evaluation

Attempts to evaluate the importance of individual waxcap grasslands have either been based on assessments of species richness or the presence of rarer species, or those which are considered to be good indicators of species richness. One of the most widely used methods based on species richness is that proposed by Rald (1995), which includes classification based on a single visit as well as totals gained from multiple visits. This has been adapted by Vesterholt et al. (1999) to include a threshold for international importance (see Table 2). The thresholds are for taxa and so include varieties as well as species.

Table 2. Conservation Importance of Waxcap sites. Rald (1985) / Vesterholt et al. (1999)

Conservation Value	Total <i>Hygrocybe</i> taxa	Number of taxa in a single visit	Number of sites in Cardiff
International importance	22+	15+	2
National importance	17-21	11-14	2
Regional importance	9-16	6-10	12
Local importance	4-8	3-5	13
No importance	1-3	1-2	23



Based on the Rald / Vesterholt criteria, Cardiff appears to be very important for Waxcaps with two sites of international importance, two sites of national importance and 12 sites of regional importance. The scale was, however, developed on the basis of data from continental Europe. The results from Cardiff reflect the importance of Wales for waxcaps in a European context. The results from Cardiff are, however, not exceptional in Welsh or UK contexts. Although waxcaps are still under-recorded, assemblages of 10+ species have been found at numerous sites – for example, 28 sites with 10+ species in Ireland, many with data from a single visit (McHugh et al. 2001). Perhaps the criteria for assessing importance on a spatial level need to be refined for the British Isles. The distinction between regional and local is not clear in a UK context where much biological recording and non-statutory conservation designations are based on the Watsonian system of vice-counties which does not match Local Authority boundaries.

The site summary tables below include figures for the total and the maximum single-visit number of taxa recorded for each of the sites classed as being of more than local importance. The main figures are for taxa with figures for number of species given in parentheses where different.

International Importance

Site Name: Llanishen & Lisvane Reservoir Embankments		Grid Ref: ST188818
Habitat: Man-made earth embankments		Area (ha.): 6.2
Total taxa (spp.): 29 (28)	Single visit taxa (spp.): 23	
<p>With 28 species recorded, this site is clearly of at least national importance and is designated as a SSSI for its waxcap grassland. The waxcaps were first discovered on the north-western embankment of Llanishen reservoir, the main fruiting area, in 2002. Subsequent surveys, especially in 2004, found more species and a more widespread distribution of carpophores around the embankments. The site has a complicated history of planning applications for residential development from 2003 to 2008. This has raised the profile of the site and its importance for waxcaps. At the time of writing (February 2009) the planning situation has yet to be resolved.</p>		

Site Name: Radyr Cricket Club and junction fields		Grid Ref: ST137803
Habitat: Cricket pitches and horse-grazed pasture		Area (ha.): 18.67
Total taxa (spp.): 27 (23)	Single visit taxa (spp.): 19	

The site comprises the main pitch, the practice pitch (constructed during the 1970s) and three horse-grazed pastures. The most species-rich areas are the outfield of the main pitch, the west side of the west field, the northern part of the east field and to a lesser extent the practice pitch. The south field is the least species-rich part of the site. Some of the rarer species are extremely localised within the site, with single fruiting bodies of *H. helobia* recorded in October 2005 and August 2007 from the same small area of rough grass just south of the cricket pitch / football pitch and *H. punicea* from short grass at the northern end of the east field in October 2006. The site has also had abundant summer fruiting of *H. intermedia* with about 100 fruiting bodies on the practice pitch alone in July 2007. Grazing pressure appears to have decreased in recent years with only a few areas of short turf remaining. There are now extensive areas where the sward is probably too high and too dense for fruiting by most *Hygrocybe* species. The site total of 23 species was achieved in the first two visits in late October 2005 and 2006.



National Importance

Site Name: Cefn Onn Amenity field		Grid Ref: ST176843
Habitat: Amenity grassland		Area (ha.): 1.14
Total taxa (spp.): 17	Single visit taxa (spp.): 8	
<p>This is a small field which is maintained as amenity grassland within Cefn Onn Country Park. The site exhibits characteristics of mediaeval ridge and furrow cultivation. The high species total results from multiple visits by several observers in different years. However the number of fruiting bodies at the site is often low. The site accommodates moderate numbers of visitors during the summer. As the species total is only marginal for a nationally important site, it is perhaps best to consider the site as being of regional importance.</p>		

Site Name: Briwnant Footpath field		Grid Ref: ST160832
Habitat: Horse-grazed pasture		Area (ha.): 1.21
Total taxa (spp.): 12	Single visit taxa (spp.): 11	
<p>This is a small field which is also only marginal in terms of national importance criteria with 11 species having been recorded on a single visit. The site total is only 12 species but this is from only four visits. There are four other small horse-grazed pastures in the Wenallt area, see discussion of these sites aggregated together at the end of the site-summary tables.</p>		

Regional Importance

Site Name: Twmpath field		Grid Ref: ST153822
Habitat: Horse-grazed pasture		Area (ha.): 2.33
Total taxa (spp.): 16 (14)	Single visit taxa (spp.): 8	
<p>This site has been surveyed more frequently than the other small horse grazed pastures and therefore the list of taxa is likely to be more complete. Carpophores are reported to be usually rather small on this site (P Sturgess <i>pers. comm.</i>). It is one of only three sites in Cardiff where <i>H. splendidissima</i> and <i>H. citrinovirens</i> have been recorded.</p>		

Site Name: Twynau Gwynion Field		Grid Ref: ST152837
Habitat: Horse-grazed pasture		Area (ha.): 1.15
Total taxa (spp.): 13	Single visit taxa (spp.): 10	
<p>These fields have only been surveyed twice, in 2004, a very good year. The field was no longer grazed by horses in 2008. The connected field immediately to the north is almost totally dominated by bracken, which is also developing in the waxcap field.</p>		



Site Name: Church Road / Caerau Lane Fields		Grid Ref: ST105816
Habitat: Horse-grazed pasture		Area (ha.): 10.15
Total taxa (spp.): 12	Single visit taxa (spp.): 9	

This is one of the largest remaining areas of semi-improved grassland in Cardiff. It is a complex of several fields to the south-east of Pentyrch. The grazing intensity differs between the various fields, and the highest number of waxcaps were seen in the most heavily grazed fields (Sturgess Ecology 2008).

Site Name: Garth Hill (Mynydd Garth)		Grid Ref: ST105837
Habitat: Common land grazed by sheep and cattle		Area (ha.): 45
Total taxa (spp.): 12	Single visit taxa (spp.): 8	

This is a large flat topped hill. The south side is dominated by bracken and there is a sharp demarcation between the bracken and acid grassland on the upper part of the site. The north-western part has extensive gorse and many waxcaps were found in this area. It is the only site in Cardiff where *H. vitellina* has been recorded.

Site Name: Airshaft No. 4 spoil tip		Grid Ref: ST17728481
Habitat: Spoil-tip grassland grazed by rabbits		Area (ha.): 0.1
Total taxa (spp.): 11	Single visit taxa (spp.): 5	

This is a small area of rock spoil that was excavated from the adjacent Airshaft No. 4 along the tunnel of the Cardiff to Caerphilly railway. It is the only known waxcap grassland in Cardiff which is maintained entirely by rabbit grazing although the Council did undertake bramble control in 2004.

Site Name: Wenallt Road (south) Field		Grid Ref: ST155827
Habitat: Horse-grazed pasture		Area (ha.): 2.24
Total taxa (spp.): 11(10)	Single visit taxa (spp.): 7	

Grazing pressure seems quite variable on this site and in recent years the sward has been too tall for waxcap surveys. It is one of only three sites in Cardiff where *H. citrinovirens* has been recorded.

Site Name: Iron Bridge Road sports field		Grid Ref: ST13438162
Habitat: Amenity grassland		Area (ha.): 0.05
Total taxa (spp.): 6	Single visit taxa (spp.): 6	

This is a very small area of grassland in the south-west corner of the sports field behind the football pitch. It is a fragment which seems to have escaped the intensive management of the rest of the field. The best species here is *H. russocoriacea* which has been recorded on all three survey visits in November 2005, 2007 and 2008.



Site Name: Bute Park Arboretum		Grid Ref: ST17437735
Habitat: Amenity grassland (arboretum in parkland)		Area (ha.): 0.05
Total taxa (spp.): 9	Single visit taxa (spp.): 4	
<p>This is the only site in Cardiff for the UK BAP species Date-coloured Waxcap <i>H. spadicea</i>. Despite regular visits (at least four per year) to this very small site in every autumn from 2002 to 2008, only a single fruiting body was recorded on one visit in September 2004. The species had previously been recorded at the site in 1992 and 2000. This is a very atypical site for <i>H. spadicea</i>, which usually occurs on thin soils over limestone rather than in alluvial plains in river valleys. Although nine species have been recorded, fruiting by several species has been extremely sparse; <i>H. pratensis</i> and <i>H. conica</i> have not been recorded since 2002, and <i>H. quieta</i> and <i>H. ceracea</i> have only been recorded on a single date each. The site is a remnant of the former unimproved pasture which became part of Bute Park Arboretum. It was originally planted with elms, which died of Dutch elm disease in the 1970s. It was then replanted with a range of trees. What is left of the waxcap grassland is confined to a small glade.</p>		

Site Name: Llanrumney Green north		Grid Ref: ST227816
Habitat: Amenity grassland in Council estate		Area (ha.): 3.2
Total taxa (spp.): 9	Single visit taxa (spp.): 5	
This is a rather unpromising looking piece of amenity grassland in the middle of a Council estate. The most noteworthy species from this site is a single record of <i>H. mucronella</i> .		

Site Name: Wenallt Farm Fields		Grid Ref: ST153840
Habitat: Horse-grazed pasture		Area (ha.): 3.85
Total taxa (spp.): 8	Single visit taxa (spp.): 7	
This site was only surveyed in 2008, not a particularly good year. The owner reported that there had been many more fungi four years earlier. The horse dung is spread around the fields with chain harrow in autumn to avoid the establishment of horse latrines (Sturgess Ecology 2008).		

Site Name: Transh yr Hebog grassland		Grid Ref: ST180848
Habitat: Permanent pasture		Area (ha.): 5.2
Total taxa (spp.): 7	Single visit taxa (spp.): 7	
Grazing pressure seems quite light on this site and many areas have a dense sward. It has only been surveyed twice in October 2004 and 2005.		

Site Name: Trewern Field		Grid Ref: ST104807
Habitat: Horse-grazed pasture		Area (ha.): 8.19
Total taxa (spp.): 8(7)	Single visit taxa (spp.): 6	
Grazing pressure seems quite variable on this site. The field also contains wetter areas but all the waxcaps have been recorded on the drier slopes in the north of the field.		



There are five small horse-grazed pastures within 2 square kilometres in the Wenallt area. With the exception of the Twmpath fields (14 species), which has been well surveyed, the other sites have had relative few visits. Wenallt Road (south) field has 10 species from seven visits, Twynau Gwynion has 13 species from just two visits and Wenallt Farm fields has 8 species from three visits in 2008. If these five sites are considered as a cluster and the species lists aggregated together, it comprises 21 with 23 taxa. This would class the aggregated site species total as being of international importance under the Vesterholt criteria. The total area of the five sites is only 10.78 hectares.

Waxcap Grassland Types in Cardiff

An interesting feature of waxcap grasslands in Cardiff is that the most species diverse sites are either anthropogenic grasslands (maintained by human activity) or horse-grazed pasture. The only species-rich site which is grazed by agricultural livestock (sheep and cattle) is Garth Hill, which is common land.

The anthropogenic sites include an eclectic mix with reservoir embankments, a cricket pitch, an industrial spoil tip and parklands. An important factor in the development of the waxcap grassland at Llanishen and Lisvane Reservoir embankments is the consistent safety-driven management since their creation in the mid and late nineteenth century. In order to prevent the development of rank grassland and scrub woodland, which could hinder the detection of any leaks, the embankments have been subject to regular mowing. Furthermore, the steep slopes and non-agricultural use have meant that there has been little or no application of fertilisers and other agricultural chemicals. This management is common to all reservoir embankments. Therefore, potentially many reservoir embankments in the UK could have species-rich waxcap grasslands. If future surveys prove this to be the case it will be interesting to see if factors such as slope aspect, proximity to other waxcap grasslands and time since construction are significant factors.

Anthropogenic grasslands are clearly an important habitat for waxcaps in Cardiff, with two sites classed as being of national importance. However, other anthropogenic grassland types which often support waxcaps, such as cemeteries and churchyards, were very poor in Cardiff. No waxcaps were recorded in any churchyards and only two cemeteries supported a few species. Waxcaps also occur in some small domestic garden lawns in Cardiff, particularly in Rhiwbina, which was built on unimproved pasture in the 1930s. This habitat has no doubt declined over the decades as individual households have treated their lawns with fertilisers.

The importance of the horse-grazed pastures is notable as this form of management is generally regarded as less favourable than grazing by other livestock. In Cardiff the importance of horse grazed sites is likely to reflect the fact that they are more or less the only permanent pastures to have escaped significant nutrient enrichment from agricultural fertilisers. Many of these sites are small single fields, typically less than 3 hectares. Only the junction fields adjacent to Radyr Cricket Club and the Chuch Road / Caerau Lane complex in Pentyrch are significantly larger at 15–20 hectares. However, the aggregated species total of 22 from the five small horse-grazed sites in the Wenallt area (10.78 hectares) demonstrates the importance of this habitat for waxcaps in Cardiff.



RECOMMENDATIONS

New SINC_s

It is recommended that the following new sites are designated as SINC_s:

- Wenallt Farm fields;
- Church Road / Caerau Lane complex.

SINC criteria

Due to the relatively short, weather dependent season for surveying and the variation in carpophore abundance between years, decisions regarding the designation of non-statutory sites need selection criteria which encompass data from both single and multiple site visits.

It is therefore recommended that consideration be given to making the following modification to the SINC designation guidelines F8 – Fungi.

- *all grassland sites with at least 8 species of waxcap (Hygrocybe spp.)*
Should be replaced with: ALL GRASSLANDS WITH A TOTAL OF 12 SPECIES OF WAXCAP (HYGROCYBE SPP.) OR 7 SPECIES OF WAXCAP (HYGROCYBE SPP.) RECORDED AT A SINGLE VISIT.

Justification: The threshold of eight species is probably too low for total species. A total of 12 species would show up the important sites, and a single visit threshold of seven species would highlight sites such as Wenallt Farm fields and Wenallt Road (south). These sites have had relatively few visits but the species found indicate a richer flora is likely.

This amendment should be made through a future SINC report and amendment of Cardiff Council's *Supplementary Planning Guidance on Biodiversity*. It should also be recommended as an amendment in the *Guidelines for the Selection of Wildlife Sites in South Wales*, in the event of a revision of this document.

Site Management

The management of the following sites needs to sustain their waxcap assemblages.

Llanishen and Lisvane Reservoir embankments

This can be addressed by CCW through their statutory role in administering the SSSI notification.

Radyr Cricket Club and junction fields

The cricket club should be advised of the benefits to waxcaps of continuing the existing management of the main and practice pitches and the importance of not applying any chemical fertilisers or pesticides. The adjacent horse-grazed fields would benefit from an increase in grazing levels. These fields could also be subject to demand for increased and possibly new amenity uses. Any planning application for a change of use should be determined with regard to the Biodiversity SPG. Any change of use should be subject to



appropriate conditions requiring no chemicals, ploughing or levelling / re-modelling of ground levels in the key waxcap areas. A management plan should be required with a key objective of maintaining the waxcap assemblage by sympathetic management, including regular mowing and/or grazing and no application of chemical fertilisers or pesticides. A more regulated approach to management could be preferable to the current under-grazing and subsequent development of rank grassland.

Bute Park Arboretum

The site for the UK BAP species Date-coloured Waxcap *H. spadicea* is threatened by shading from the trees in the Arboretum, with new planting having occurred in 2002. Attempts to secure the area as open grassland have so far not been successful.

Cefn Onn Amenity field

The Council's Parks Service was informed of the waxcap interest of this site and management requirements in 2004. The site is mown regularly in summer and no chemicals applied.

Further survey work

The following sites should be priorities for further survey work:

- Radyr Cricket Club and junction fields;
- Garth Hill;
- Transh yr Hebog grassland;
- Church Road / Caerau Lane complex (Penttyrch);
- Wenallt Farms fields;
- Briwnant footpath field.

Verification of records

Identifications of some species of waxcaps is relatively straightforward while other species can be easily confused. The process of verifying records could be improved if, as with other taxa such as birds and invertebrates, those scarce or difficult species requiring supporting evidence, such as photographs and in some cases specimens, was listed.

ACKNOWLEDGEMENTS

Cardiff Council is grateful to Peter Sturgess and the Glamorgan Fungi Group who have contributed many records to the database and helped with identification issues.



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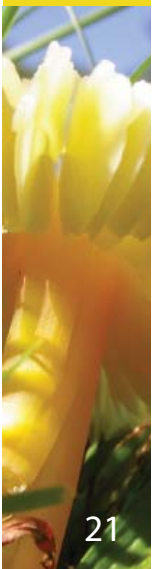
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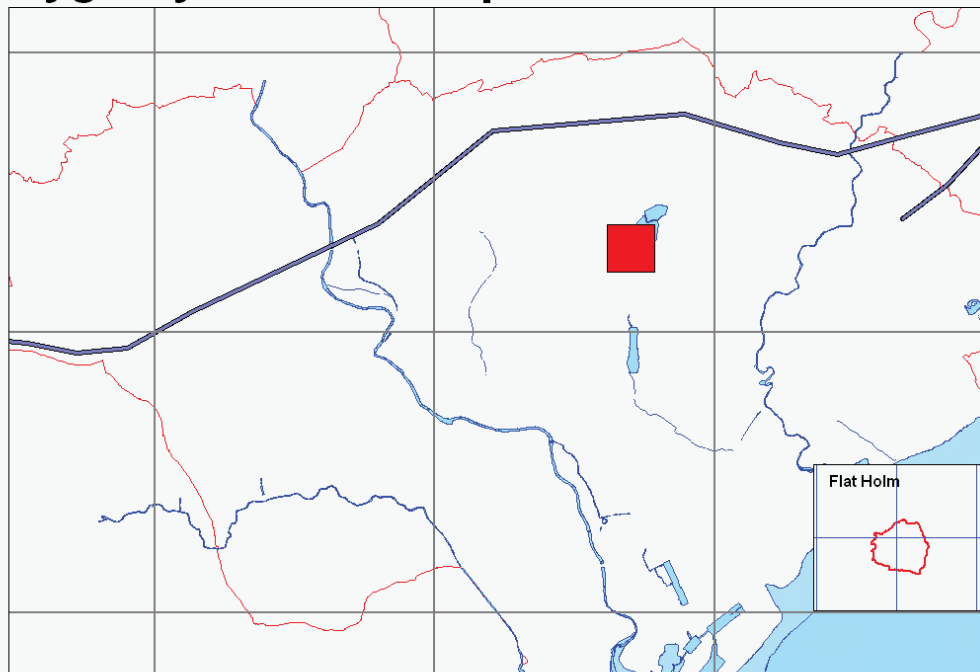
Distribution Maps of Waxcap Species in Cardiff 2000 - 2008

APPENDIX 1

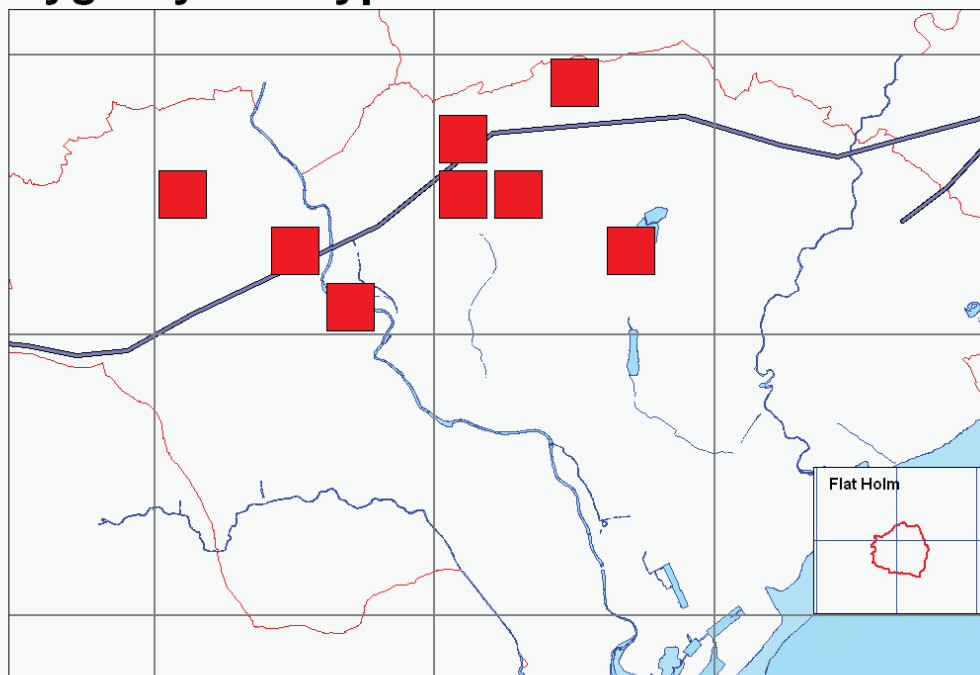


The following maps show the distribution of Waxcap species in Cardiff from data gathered between 200 and 2008. The resolution is at 1km square.

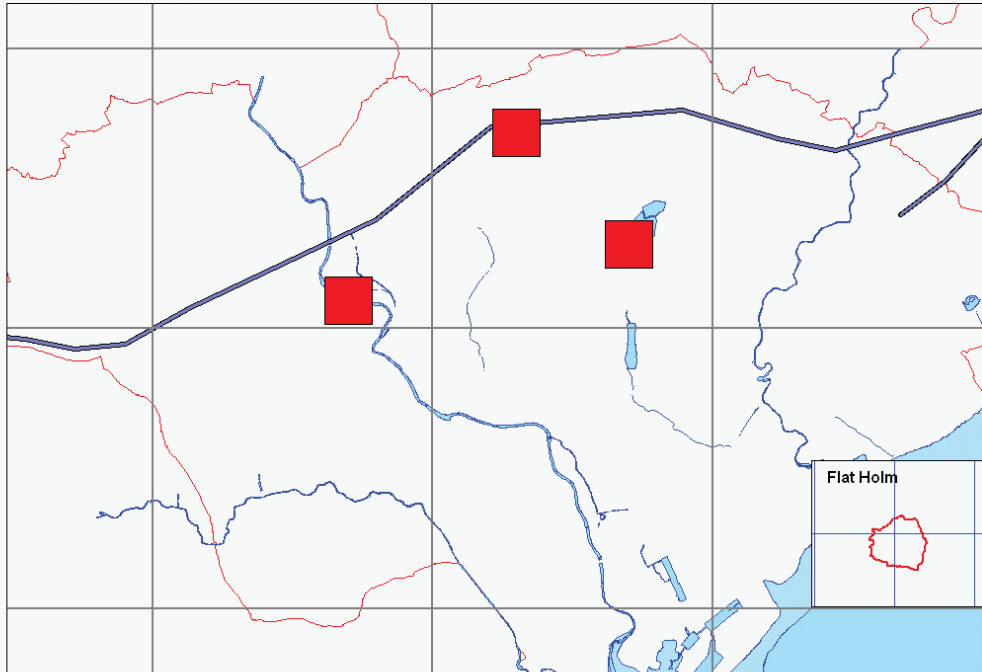
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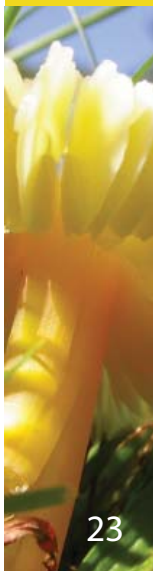
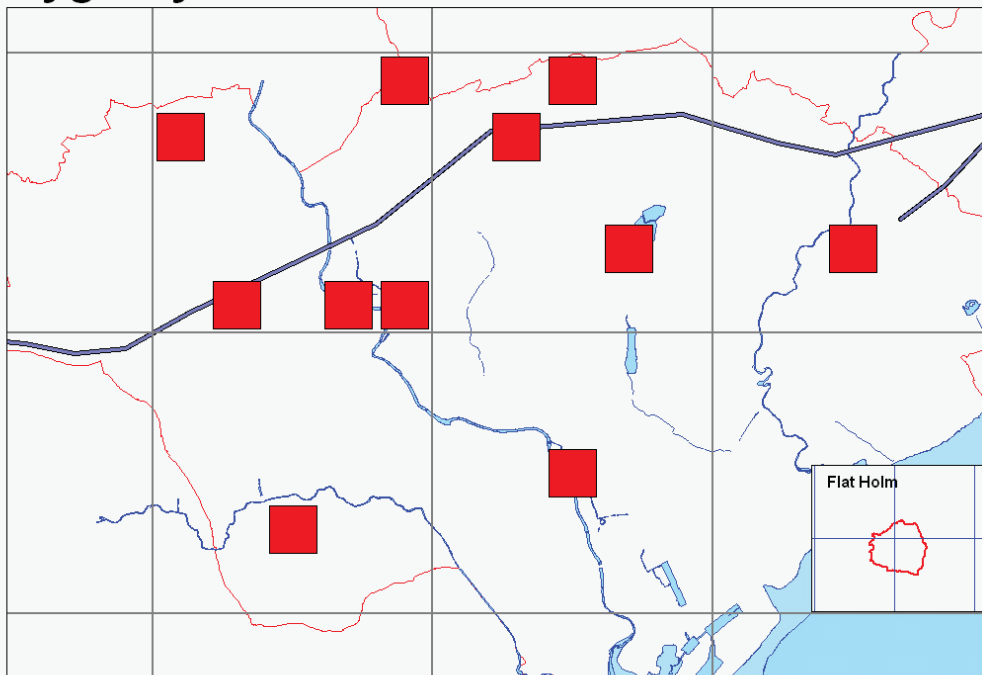
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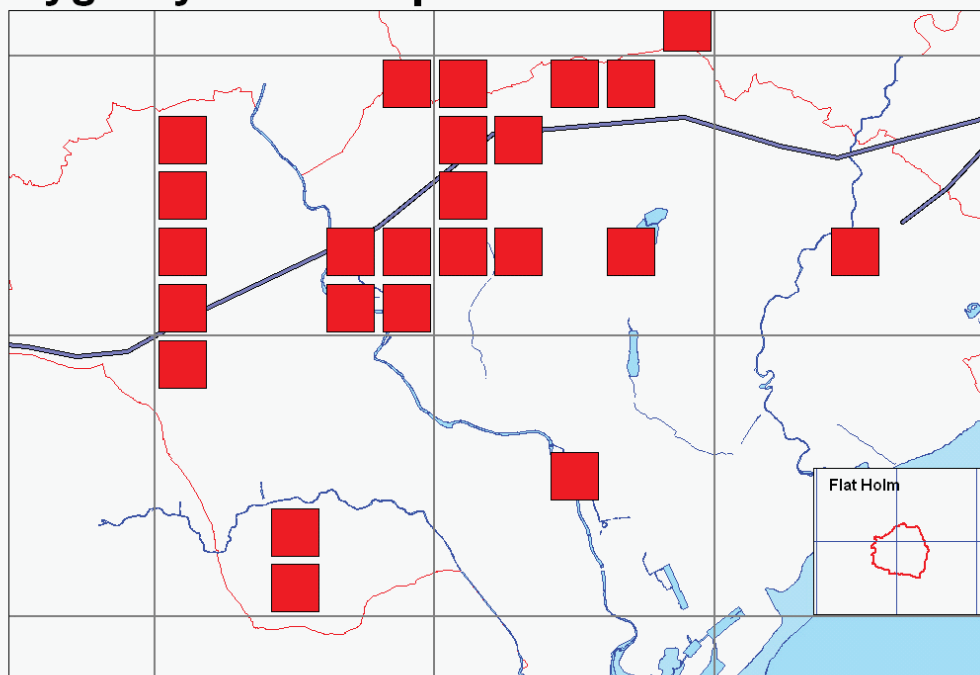
Hygrocybe cantharellus



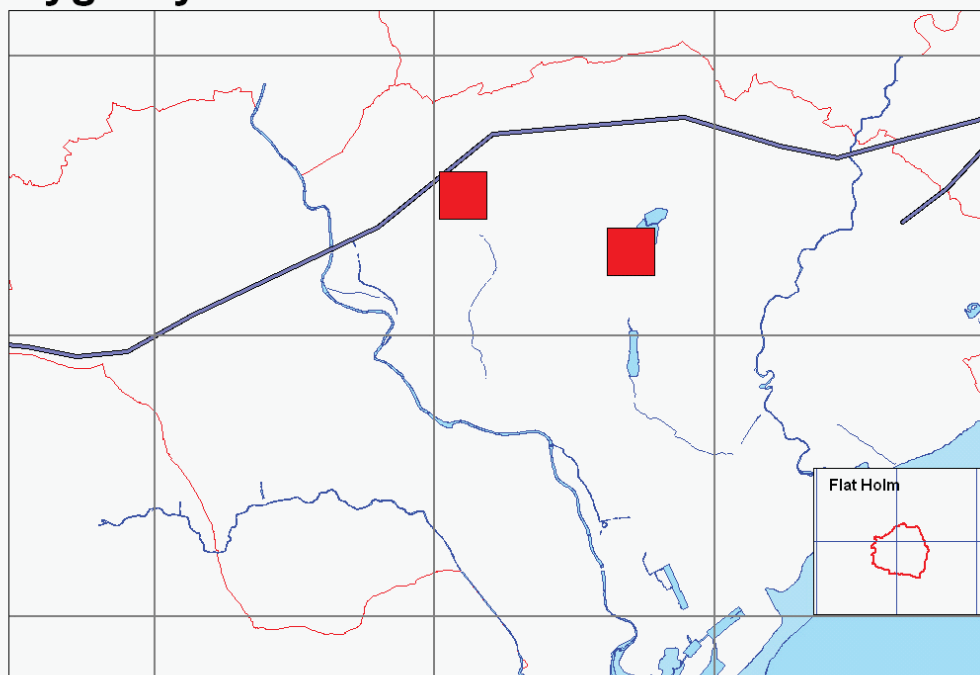
Hygrocybe ceracea



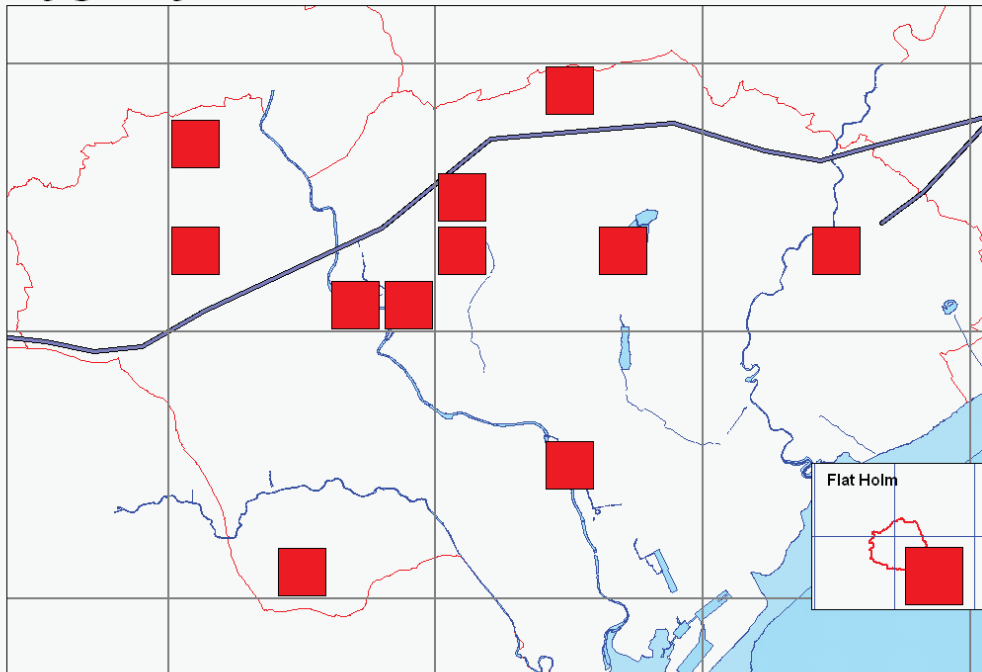
Hygrocybe chlorophana



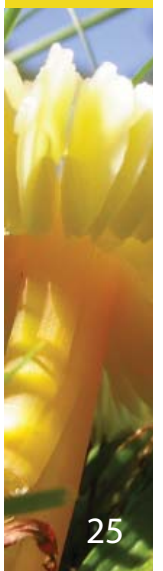
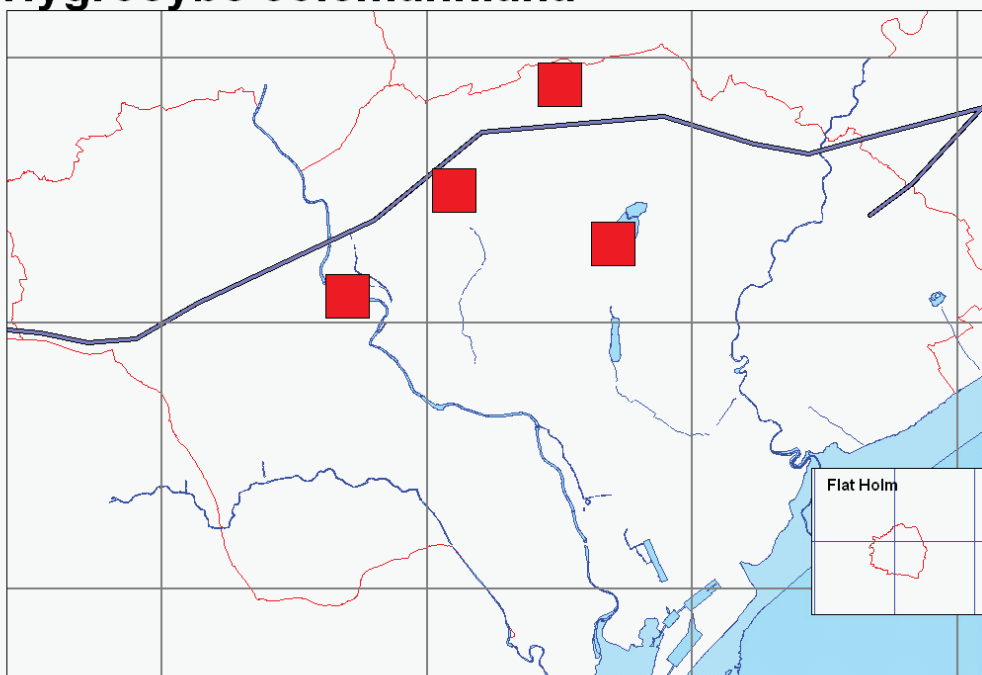
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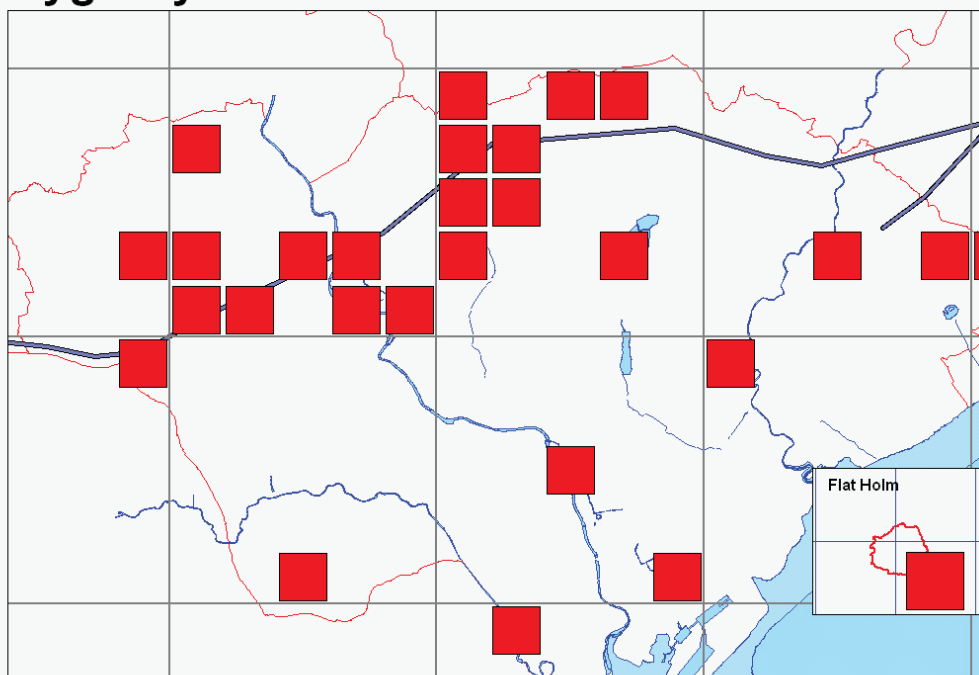
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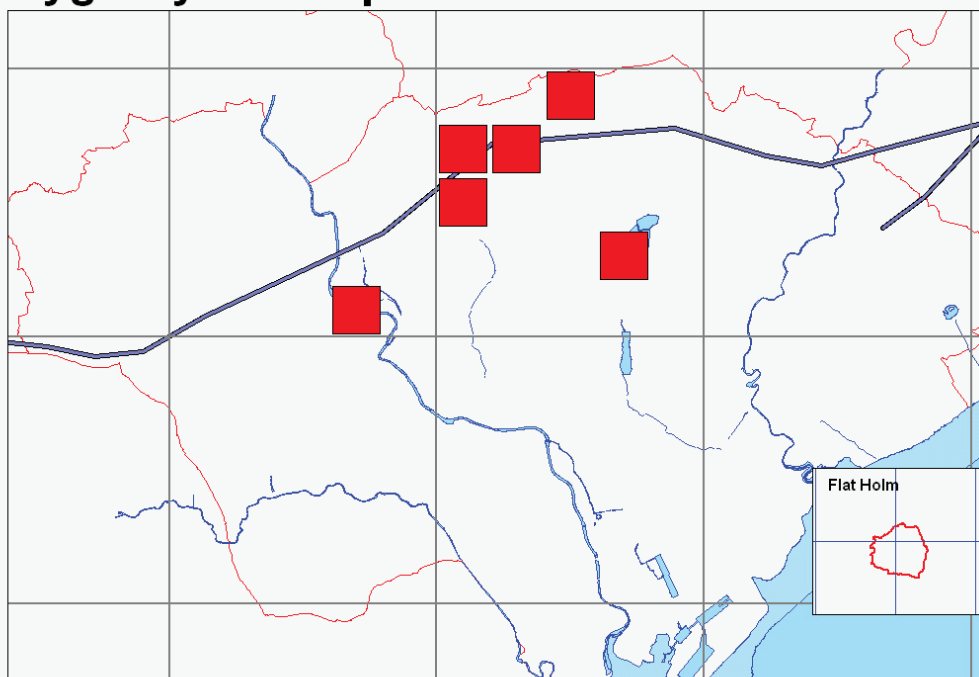
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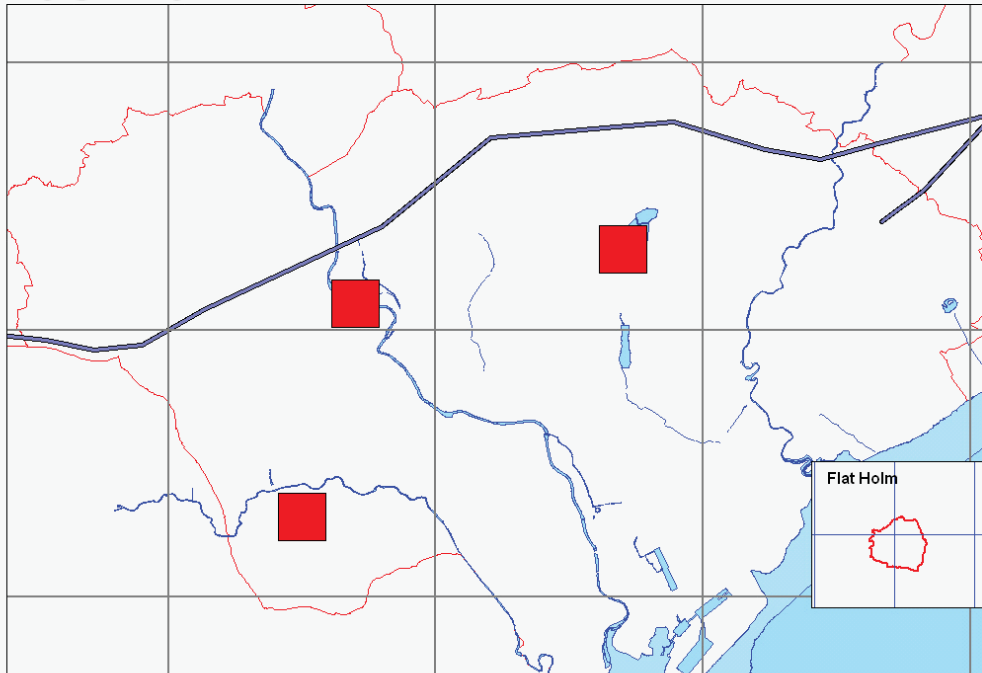
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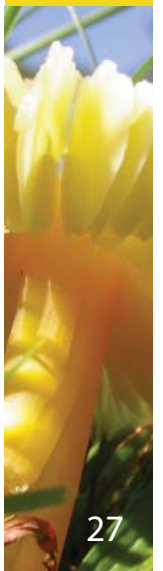
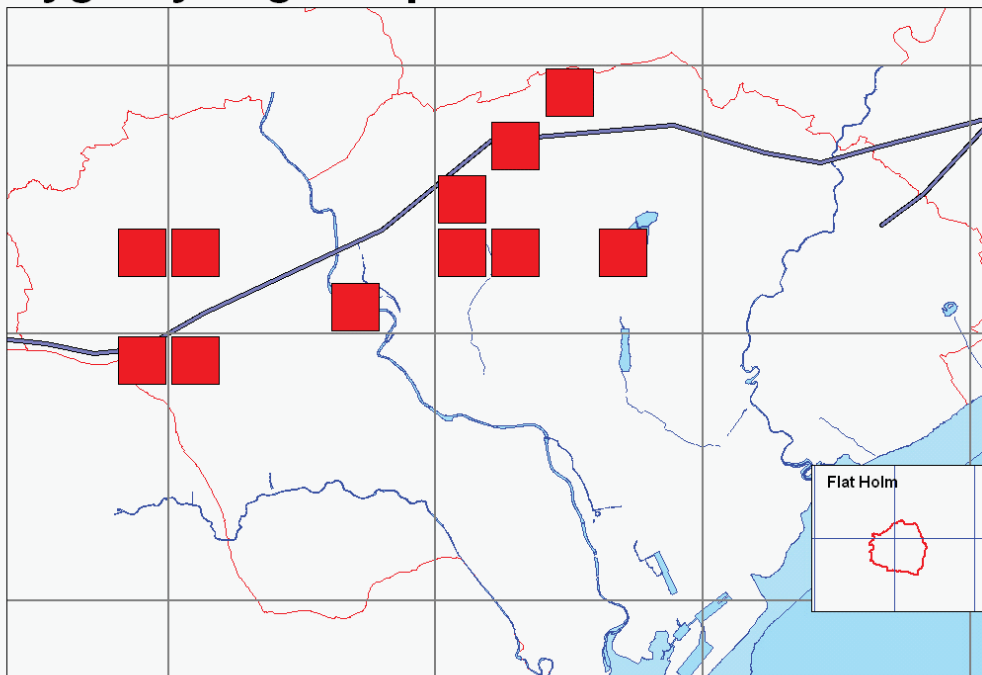
Hygrocybe flavipes



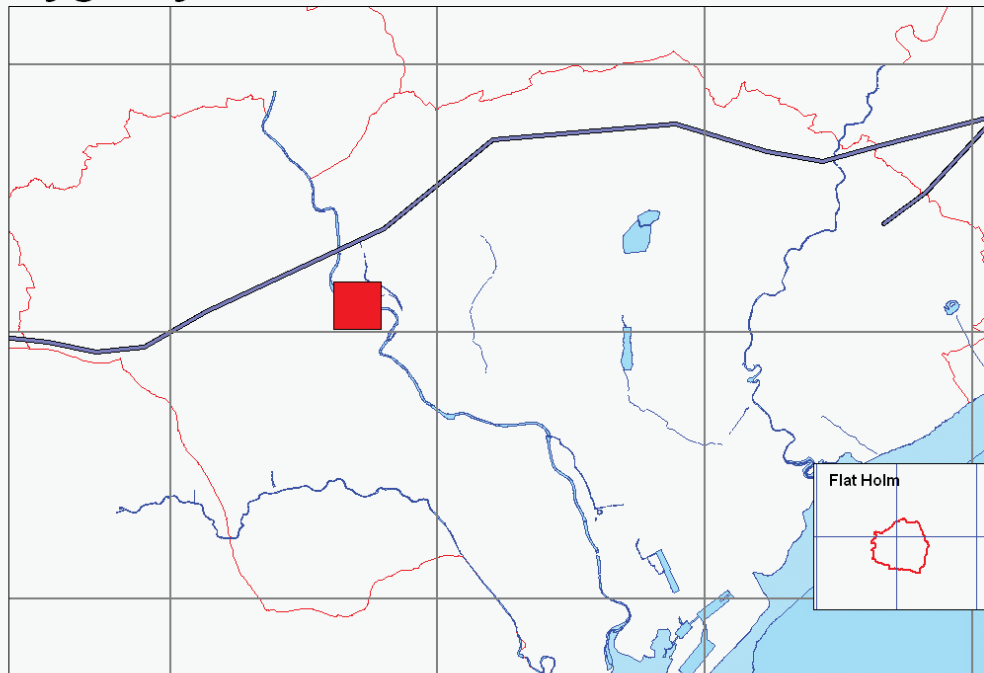
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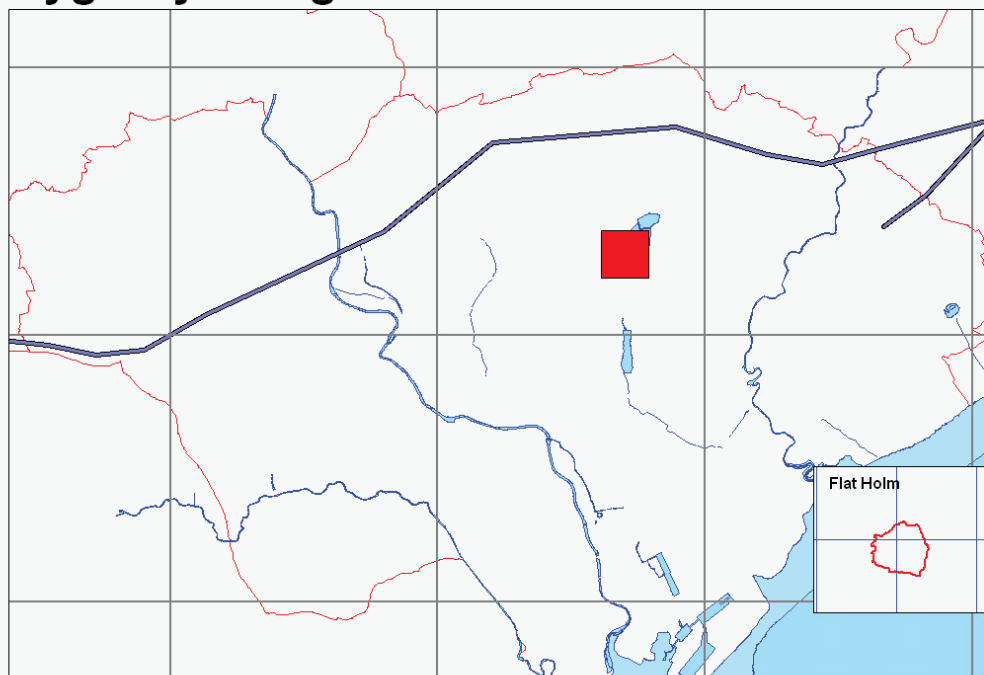
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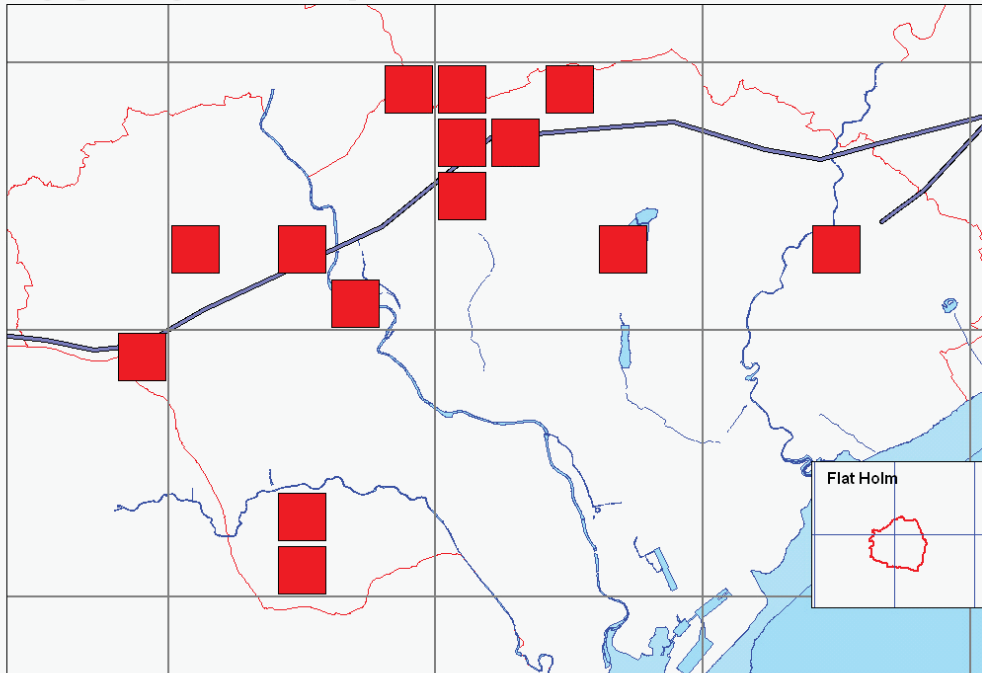
Hygrocybe helobia



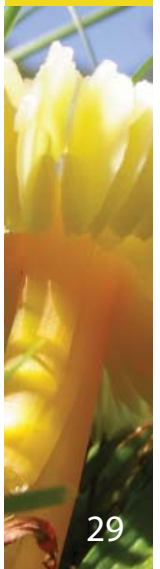
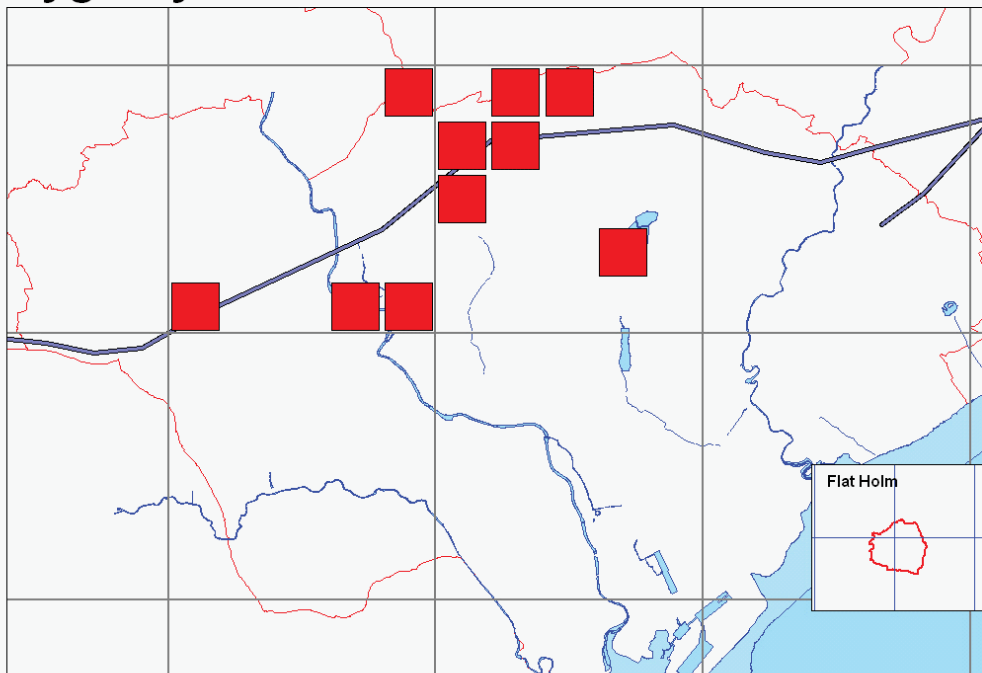
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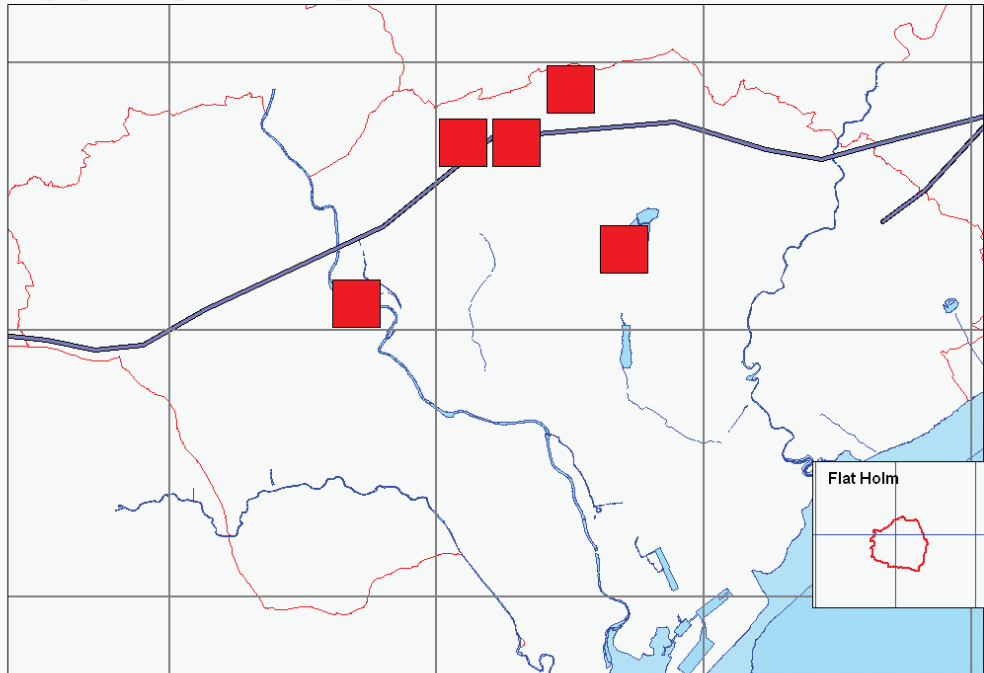
Hygrocybe insipida



Hygrocybe intermedia



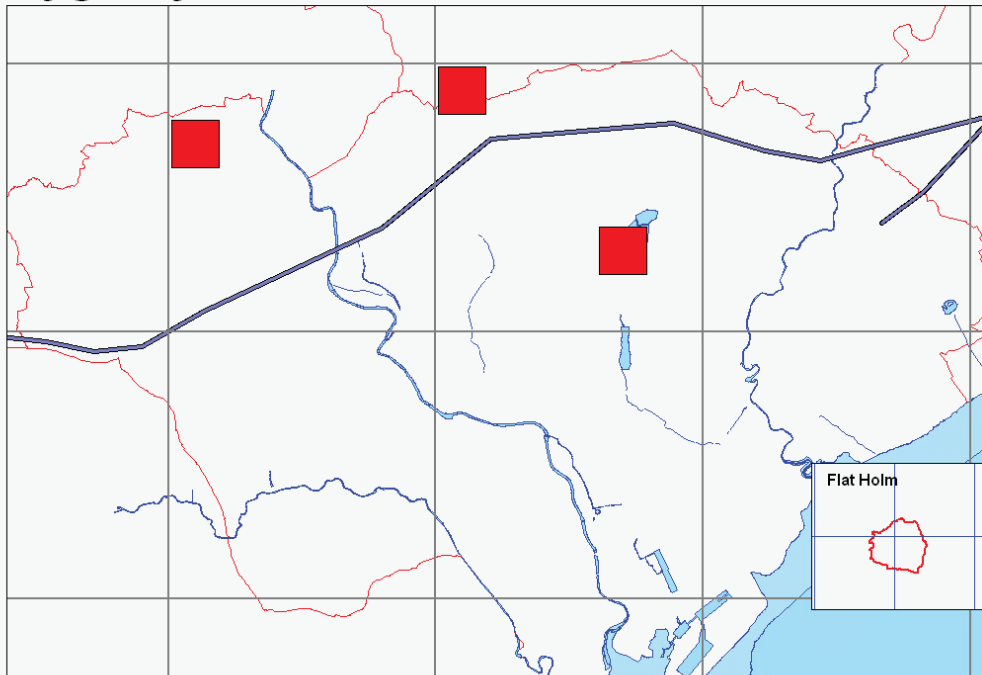
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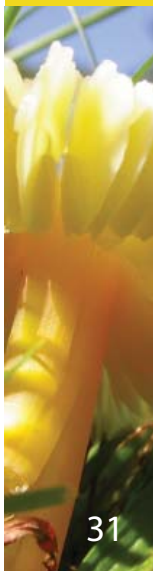
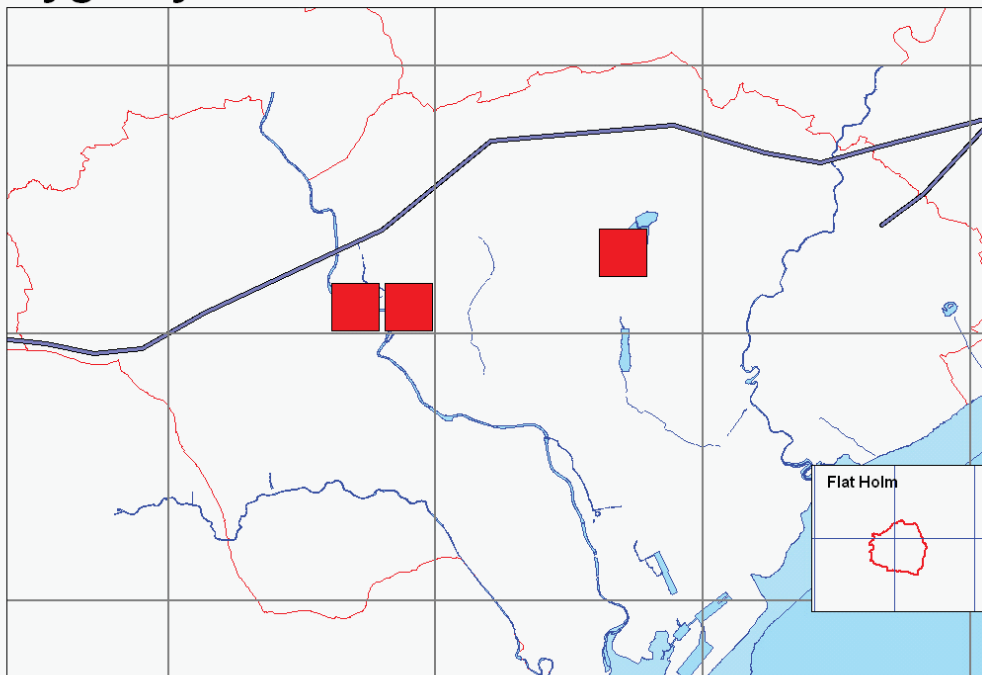
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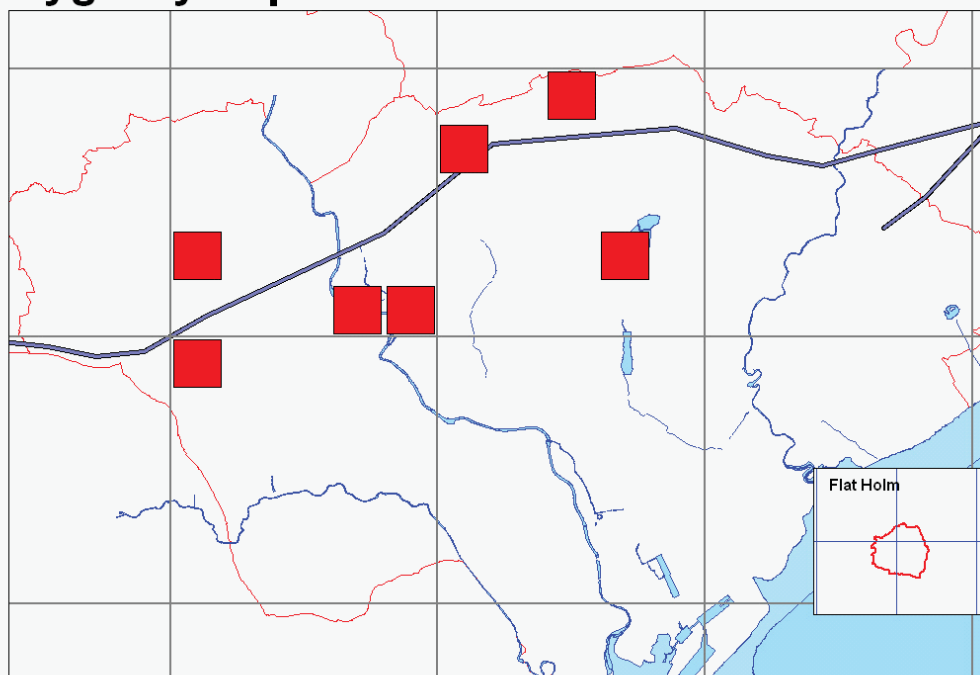
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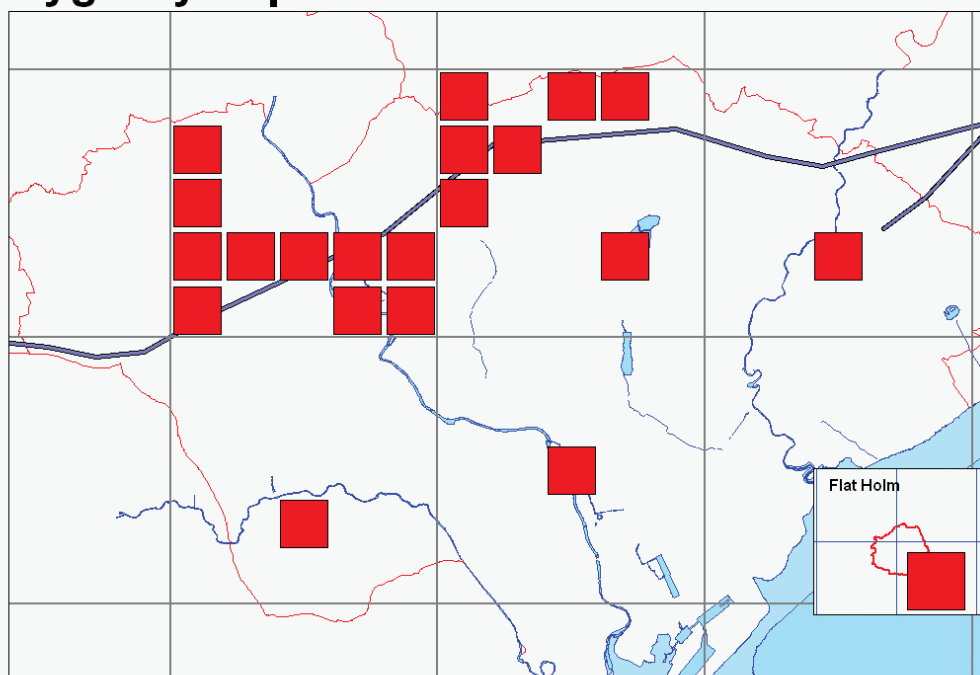
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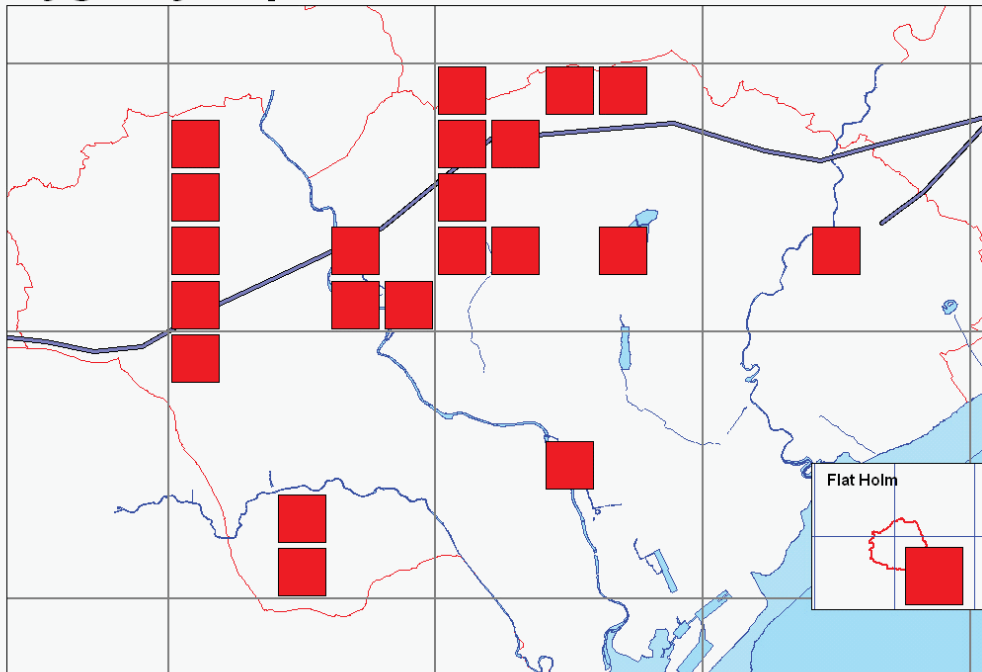
Hygrocybe persistens



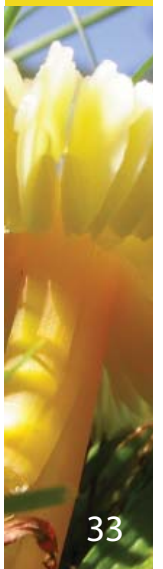
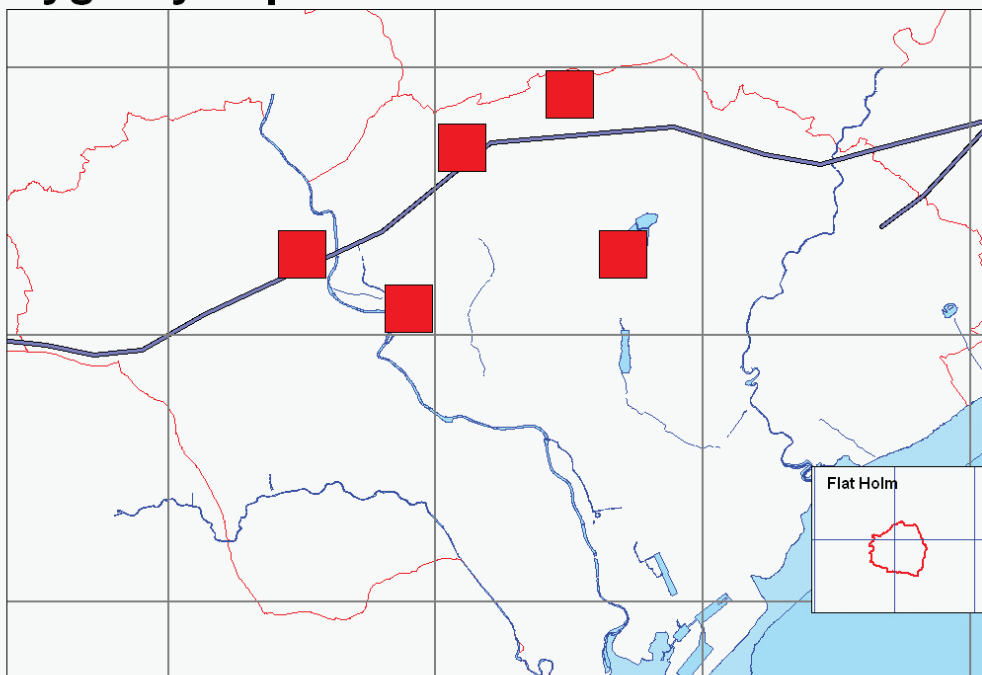
Hygrocybe pratensis



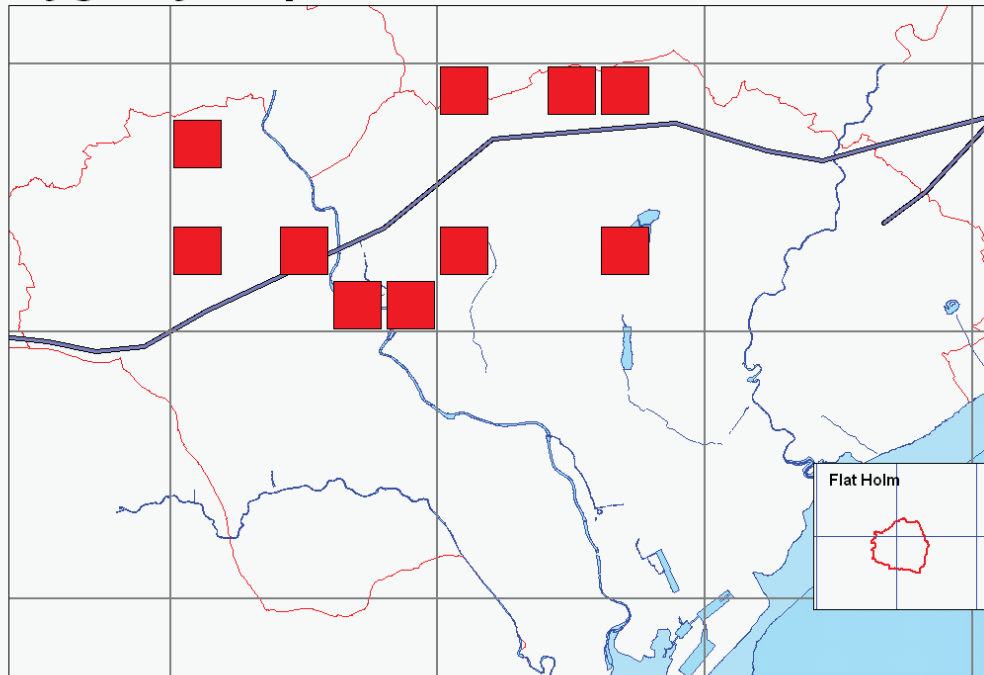
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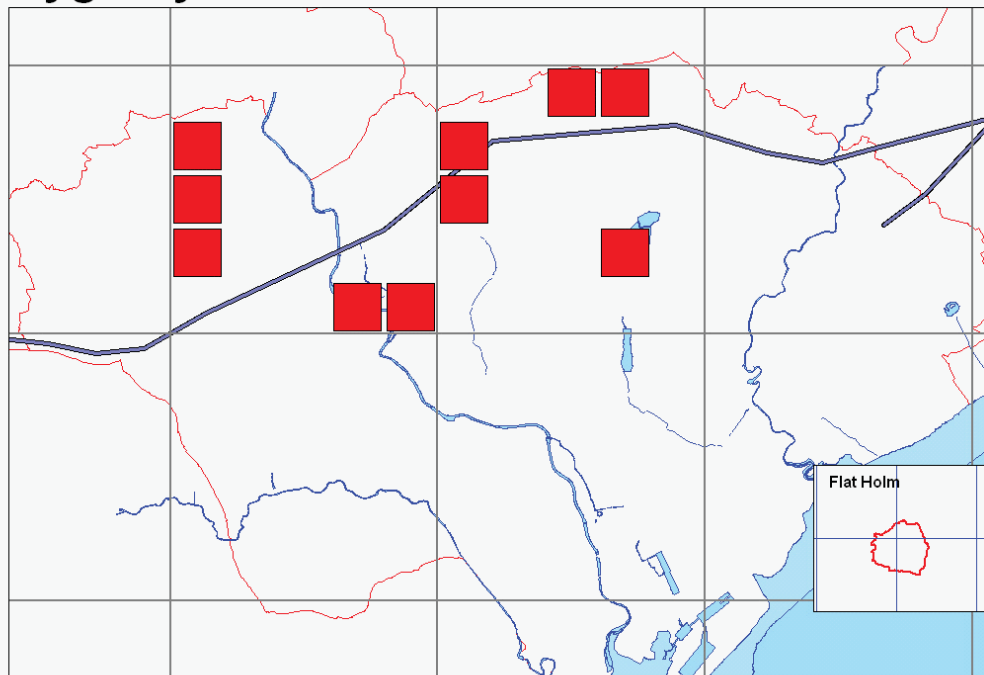
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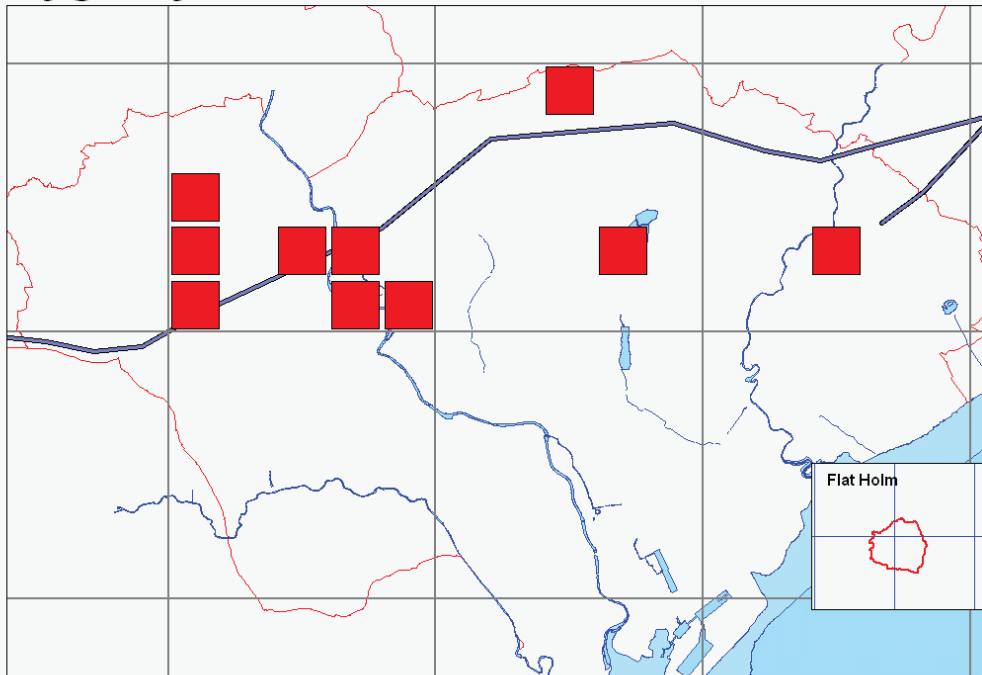
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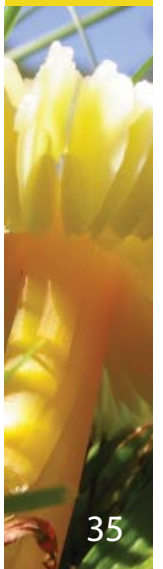
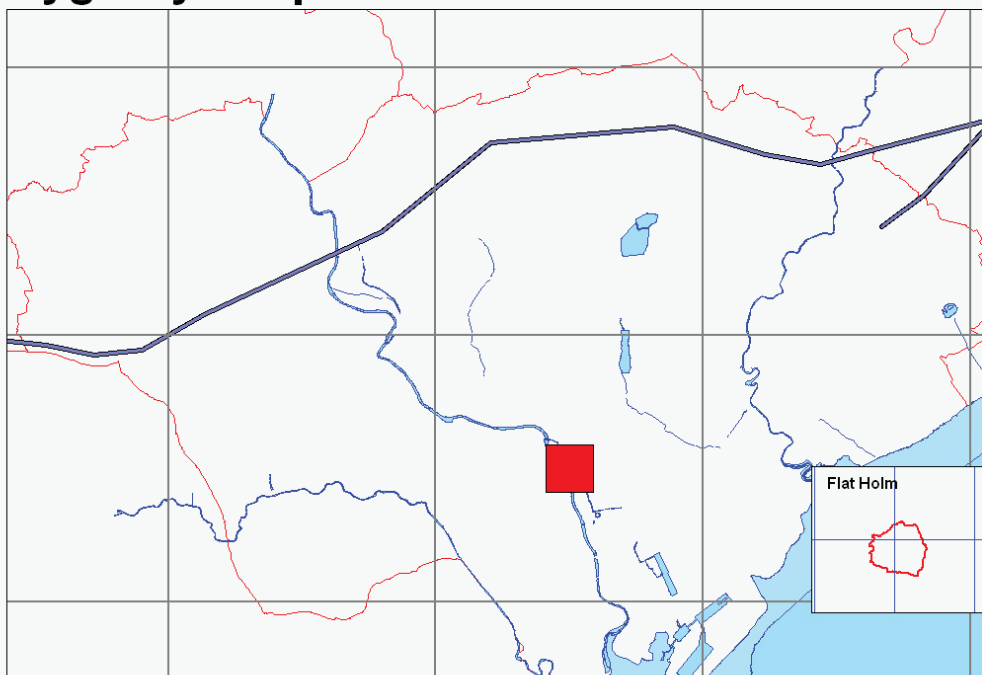
Hygrocybe reidii



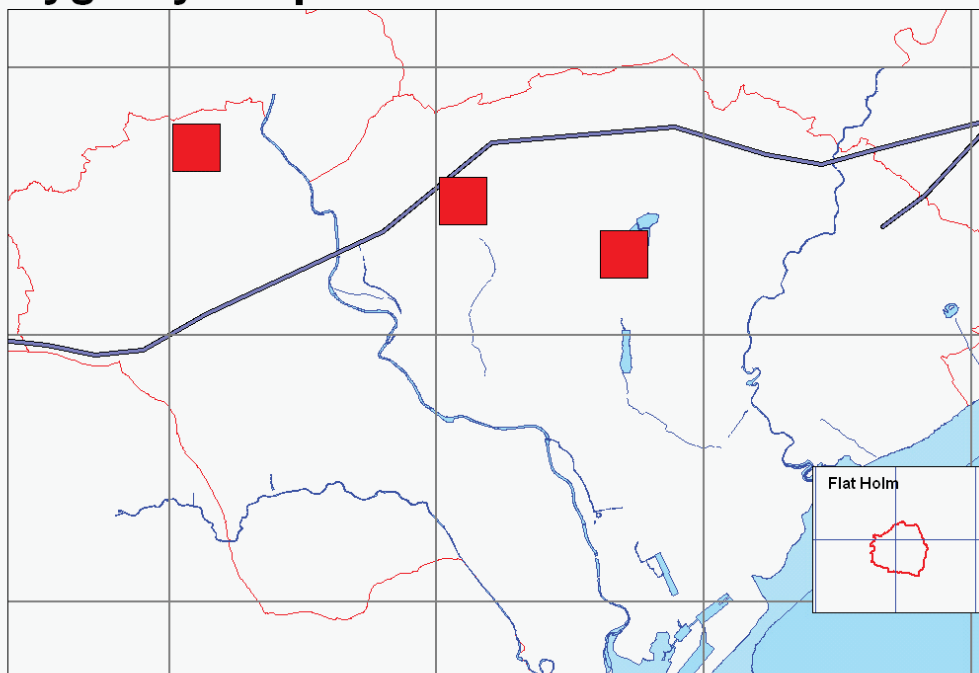
Hygrocybe russocoriacea



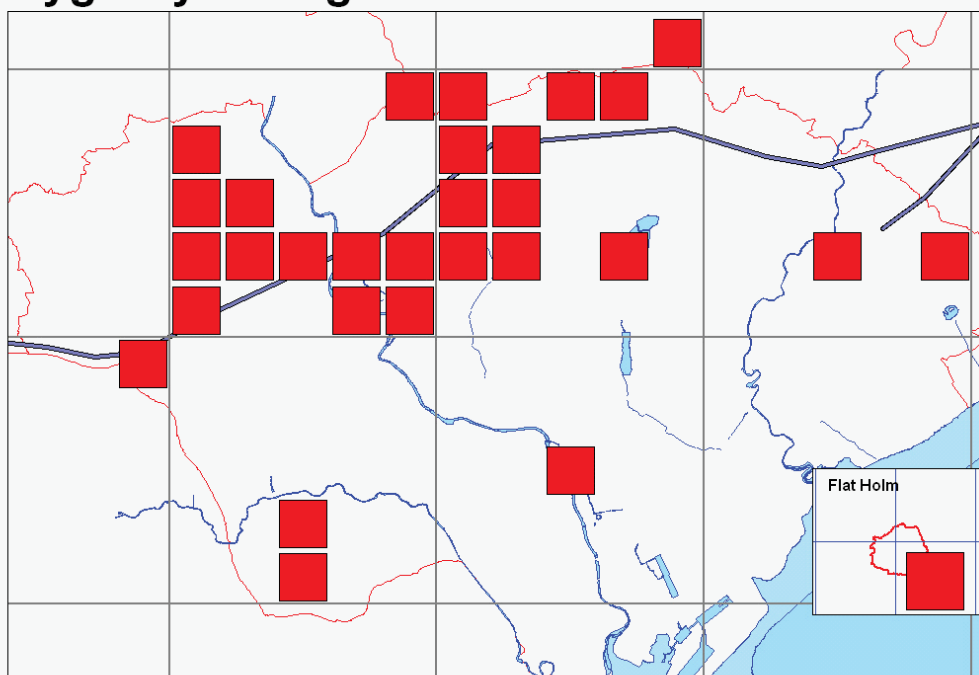
Hygrocybe spadicea



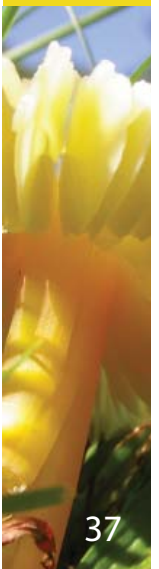
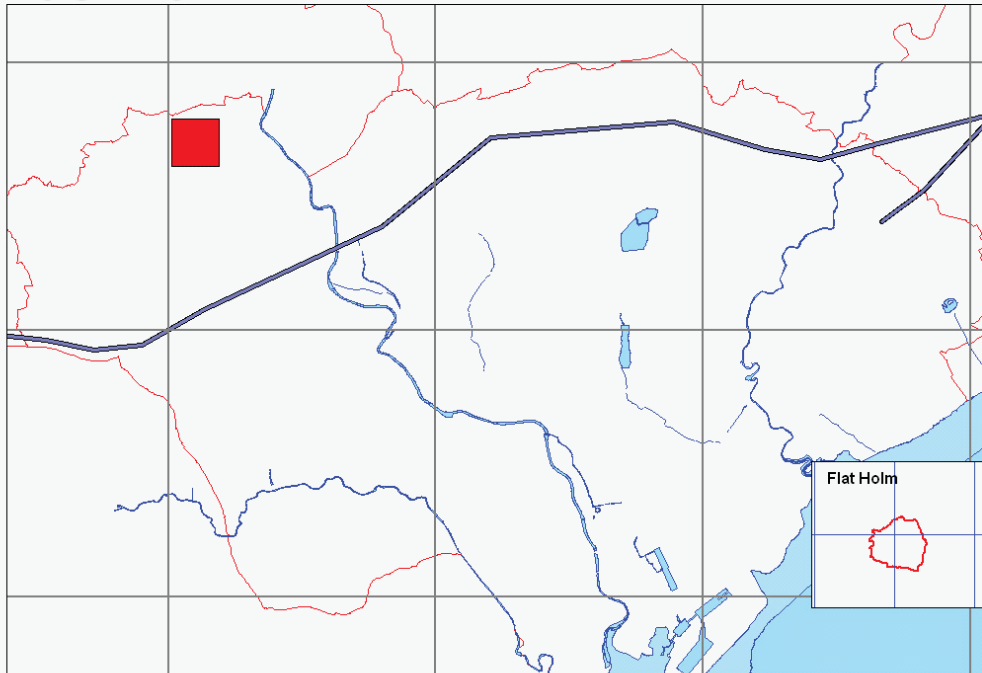
Hygrocybe splendidissima



Hygrocybe virginea

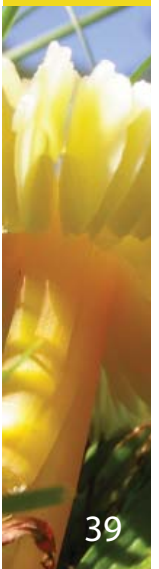


Hygrocybe vitellina





Photographs of Waxcap Species in Cardiff



Hygrocybe calyptriformis



Hygrocybe cantharellus



Hygrocybe ceracea



Hygrocybe chlorophana



Hygrocybe coccinea



Hygrocybe conica



Hygrocybe flavipes



Hygrocybe insipida



Hygrocybe intermedia



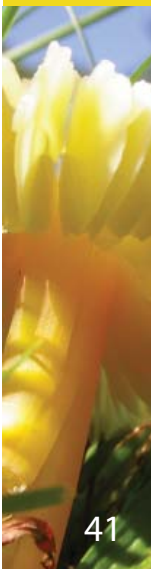
Hygrocybe pratensis



Hygrocybe psittacina



Hygrocybe punicea



Hygrocybe reidii



Hygrocybe russocoriacea



Hygrocybe spadicea



Hygrocybe virginea





