Fungal Diversity Survey and Management Recommendations for Duchess Wood Local Nature Reserve

Piptoporus betulinus, Duchess Wood 2008 PHOTO:Neville Kilkenny

Report to the Friends of Duchess Wood

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Glossary of Mycological Terms

Agaric	name applied to most fungi with a 'mushroom' shaped fruit body, with a cap bearing gills underneath, supported by a stem.
Ascomycete	a fungus in which the sexual spores are produced in an ascus.
Ascus	an ascomycete hyphal tip, flask or sac shaped, in which ascospores develop, often in columns of eight.
Basidiomycete	a fungus in which the sexual spores are produced on a basidium.
Basidium	a basidiomycete hyphal tip with sterigmata on which basidiospores develop.
Coprophilous	describing fungi which derive their nutrients from dung.
Ectomycorrhizal	a partnership in which a fungus sheaths the roots of a plant and absorbs plant nutrients while the root absorbs fungal nutrients obtained from the surrounding soil.
Endomycorrhizal	a partnership in which a fungus forms structures inside the root cells of a plant and absorbs plant nutrients while the root absorbs fungal nutrients obtained from the surrounding soil.
Fruit body	conspicuous reproductive structure of a fungus sexually producing spores and commonly known by such names as mushrooms, toadstools, brackets, puffballs, jellies, elf cups and truffles.
Hyphae	fine filaments from which fungi are constructed.
Humicolous saprotroph	a fungus that is gaining carbon compounds from plant material that is already dead, such as fallen leaves or humus.
Lignicolous saprotroph	a fungus that is gaining carbon compounds from woody material that is already dead.
Macrofungus	a fungus that produces a conspicuous fruit body.
Microfungus	a fungus that remains inconspicuous throughout its life and has microscopic spore producing structures.
Mycelium	inconspicuous 'feeding body' of a fungus composed of hyphae.
Mycorrhizal	a symbiotic association between a fungus and a tree or higher plant, involving the mycelium of the fungus and the root system of the plant.
Mycota	the fungi of a particular location.
Parasite	in this context, where the fungus is living at the expense of another living organism, to its detriment.

Summary of main findings

This interim report demonstrates that Duchess Wood Local Nature Reserve (LNR) is potentially a site of interesting mycological diversity. An initial survey of the reserve was carried out at the end of November 2008 and identified 47 species of macrofungi and a further survey in the autumn will give an even broader representation of the fungal diversity.

The reserve was found to support 2 species that were particularly noteworthy, *Fomes fomentarius* (Hoof Fungus/Tinder Bracket) and *Schizophyllum commune* (Split Gill). The former is unusual for the locality of the site and the latter for the substrate it was found on.

Hymenochaete corrugata (Glue Crust) was also recorded and some discussion is included on the importance of this fungus. *Scutellinia crinita*, an Eyelash fungus that is not often recorded, was also collected within the site.

The majority of species recorded were found on lignicolous substrates, as one would expect for the time of year when the survey was undertaken, but also reflects a favourable quantity of dead wood habitat being available within the site.

Recommendations are made relating to management of the site, which should assist in the continuity and development of the diverse mycota associated with well established native woodland.

No species were found with designations for conservation.

Introduction

Duchess Wood LNR (NS2883) is a 23 hectare area dominated by variously aged, mixed-broadleaf woodland, but includes occasional non-native conifer components, an area of Scots Pine plantation and some unimproved grassland. The current management plan recognises the woodland as essentially semi-natural and a good example of a less modified, and therefore less typical, mosaic of Atlantic Oakwood, Upland Mixed Ashwood and Wet Woodland, although the recorded history is a little vague (Luukas, 2006). Duchess Wood is owned by Luss Estates Company and managed by Argyll and Bute Council, which created the Duchess Wood LNR Committee to assist in the management of the LNR.

This survey and report was commissioned by the Friends of Duchess Wood as part of a wider biodiversity survey programme and to reflect the interests of fungi within future management plans for the reserve.

Aims and objectives

Aim: To investigate the mycological interest of the reserve

Objectives: To assess, as far as possible, the diversity of the mycota of the site

To identify areas of particular fungal interest

To ascertain conservation designation on all species recorded

To make recommendations to conserve and promote further fungal interest, for consideration within the management plan of the site

To promote awareness of ecological requirements of fungi

Methodology

The site was surveyed on the 24th November 2008 and a second visit is planned in the autumn of 2009, when conditions will be favourable to fruiting for many species of macrofungi. The survey was, and will be, limited to recording fruiting bodies of macrofungi and does not cover myxomycetes, microfungi or mycelial structures. The survey was based on a general walk-through, rather than any plot or transects based methodology and therefore it should be noted that it will not be possible to objectively compare these results with information generated from future mycological survey work. Where possible, species were identified in the field; otherwise collections were taken back to the laboratory for microscopic examination. All records will be forwarded to the Fungal Records Database of Britain and Ireland (managed by the British Mycological Society, BMS) and collections of species of interest were dried and deposited in the herbarium of the Royal Botanic Garden Edinburgh. Basidiomycete nomenclature was taken from the British and Irish Checklist (Legon & Henrici, 2005), English names from the BMS Website[1] and national conservation designations from the UK Biodiversity Action Plan Website[2].

It is hoped that some members of the local community will be able to accompany the author on the second visit, with the aim that they may be able to pick up some fungi identification skills. Although some commitment is required and further workshops on identification of fungi would need to be attended, it should be possible that the local community are able to continue this survey. To build a good baseline of the diversity, it is generally accepted that a site be visited at three separate times in a year, to cover the fruiting range of different species, and to do so for a minimum of five years. Evidence suggests that recorded diversity of some sites would continue to rise for over twenty years, as some species fruit irregularly and often not annually (Tofts & Orton, 1998).

Analysis by compartment

Compartments 8 & 9

Several lignicolous saprotroph and parasitic species were found in these compartments positively reflecting the amount of large diameter dead wood habitat available. These included *Laetiporus sulphureus* (Chicken of the Woods) commonly found on Oak, but found here growing on a fallen Sweet Chestnut, *Xylaria hypoxylon* (Candlesnuff) of which there were several communities through

[1] http://www.britmycolsoc.org.uk/files/ENGLISH_NAMES.pdf

[2] http://www.ukbap.org.uk/

out the wood on various substrates and some late fruiting *Mycena inclinata* (Clustered Bonnet), which again was found on Sweet Chestnut but is more common on Oak. Alder trees fringing the water will support an associated mycota, especially when allowed to develop in wet riverine situations. No representatives of this mycota were found, but further development of riverine woodland with Alder and Willow would benefit fungal diversity on the site (Holden, 2007). There were several mature broadleaf trees found in these compartments, suggesting mycorrhizal opportunities that may become evident from fungal fruiting in the autumn.

Compartment 7

Scleroderma citrinum (Common Earthball) was recorded several times in this compartment as well as *Mycena galericulata* (Common Bonnet). This compartment also supported some Hazel upon which was recorded *Hypoxylon fuscum* (Hazel Woodwart) and *Hymenocaete corrugata* (Glue Crust). *H. corrugata* represents an important microhabitat as it is thought to be parasitized by the rare fungus *Hypocreopsis rhododendri* (Hazel Gloves), which is subject to a UK Biodiversity Action Plan and for which Scottish Natural Heritage have recently found funding for a PHD. *H. corrugata* is a fascinating fungus that sticks dead wood to living by producing mycelial pads, which actively glue twigs and branches together giving the fungus an advantage as it does not have to compete with other wood decomposers on the woodland floor (Ainsworth & Raynor, 1990). This is also seen in some fungi in tropical forests, but is otherwise thought to be unique to Britain.

It is unlikely that *H. rhododendri* would be found on this site, as it has mainly been associated with ancient Atlantic Hazel woods that have never been rotationally coppiced, and as the management report suggests, there is evidence of historical coppicing management within the woodland.

Compartments 2, 3 & 4

The most notable record in these compartments was *Schizophyllum commune* (Split Gill), which although quite a common fungus, is rarely recorded on a natural, unmodified substrate. The majority of recordings of this fungus are on silage and straw bales or exotic imported timber. In fact it is likely that this is only the third record of this fungus on a natural substrate in Scotland, although there could perhaps be some discussion as to how natural a microhabitat such as a large felled Sycamore tree, upon which the fungus was recorded, might actually be. The felled 'Glade' area where this was recorded also supported five other species on the tangle of Sycamore trunks, including the winter fruiting *Flammulina velutipes* (Velvet Shank).

Some mature beech trees at the northern extreme of Compartment 2, although not native to Scotland, dominated a fungal hotspot which significantly contributed to the diversity of the site. Three ectomycorrhizal species were recorded: *Cortinarius obtusus, Laccaria laccata* (Deceiver) and also an old fruit body of *Russula nigricans* (Blackening Brittlegill). These trees also supported four associated wood rotting species and one humicolous saprotroph, *Mycena filopes* (Iodine Bonnet).

In the autumn, one would expect to find several ectomycorrhizal species associated with the Birch trees across these compartments. This will reflect the successful manner in which this species of tree has become established, advantaged not only by the mycorrhizae in gaining access to important nutrients but also by the fungi recycling the tree's own leaf litter (Nehls, 2008). These could be a valuable source of natural fungal inoculum.

The southern area of Compartment 4 also includes an area of unimproved grassland. Several fungi characterise this type of grassland, which is now of international importance for fungal conservation. These include genera such as *Hygrocybe* (waxcaps), *Dermoloma, Porpoloma,* members of the

Geoglossaceae (earth tongues), clavarioid species (fairy clubs) and members of the *Entolomataceae* (pink gills). It is likely that this habitat would benefit from a mowing regime, including the removal of clippings, as the management plan indicates that grazing would not be permitted. However, the dung from grazing animals would support a range of coprophilous fungi and add to the general fungal diversity of the site. It is suspected that fungi may not be able to persist under a heavy 'thatch' of rank vegetation which restricts the organism's ability to produce fruit bodies. Management to maintain a short sward would encourage fruiting of these specialist grassland fungi, allowing them the best opportunity to cope with climate change through genetic diversity, by reproducing sexually. Scotland and some areas of Wales are relatively rich with this habitat and remain as some of the last refuges in the world for these species (Newton et al, 2003).

Compartment 1

One particular species of note that was recorded in this compartment was *Fomes fomentarius* (Hoof Fungus/Tinder Bracket) which, although being quite a common Scottish fungus, has a predominantly North-Eastern distribution and is unusual for this locality. There is in fact only one other record for the species in the Vice County, which is from Loch Lomond 28 years ago. The fungus is recorded south of the border, but it is suspected that these records could represent a different genetic community and the Duchess Wood material may well belong to this latter group (Watling, pers comm.)

Compartments 5 & 6

There were no species of particular note recorded in these compartments, although there were records of species common in other compartments such as *Xylaria hypoxylon* (Candlesnuff). It is likely that more species will be represented in this compartment when observed at a time of year more suited to the fruiting of macrofungi. It was however interesting to record *Scutellenia crinita* on an old stump in Compartment 5. This fungus has only been recorded three times before in Scotland and on all three occasions from Perthshire. It is likely that this is due to complications separating species within the genus rather than the rarity of the fungus.

Compartment 10

On the Southern bank of the burn, *Heterobasidion annosum* (Root rot) was recorded on Hawthorn. Although this fungus is often recorded on broadleaf trees, it is more commonly found on conifers. There was also a strong fruiting of *Stereum rugosum* (Bleeding Broadleaf Crust) on Hazel. There is again potential in this compartment for further development of riverine woodland with Alder and Willow, which would benefit fungal diversity.

A log pile in the North-Western corner of the compartment at an intersection of the paths supported several species, including *Ganoderma applanatum* (Artist Fungus) and *Crepidotus mollis* (Peeling Oysterling), representing the value of large diameter deadwood as a microhabitat for fungi.

Luzula sylvatica was noted as quite abundant in this compartment and was also noted elsewhere in the reserve. In order to manage for fungal fruiting, and therefore genetic diversity within species, expansion of this type of ground cover should be kept in check, as it is not known how long organisms can persist under such dense cover without the opportunity to reproduce sexually. If the apparent expansion of *L. sylvatica* is the result of a management change in the recent past, for example possibly a reduction in grazing (Rodwell, 1991) then consideration might be given to future management with a view to reducing its dominance.

Compartment 11

Scots Pine has a diverse associated mycota and it's dominance of this compartment will add to the diversity of the reserve. There are many ectomycorrhizal species associated with *Pinus sylvestris*, although none were observed on this visit. Several buried cones within the compartment supported *Baeospora myosura* (Conifercone Cap), and *Tremella foliacea* (Leafy Brain) was recorded on a fallen Scots Pine branch, likely to be parasitizing the mycelium of a species of *Stereum.*

Discussion

There are several recommendations within the management plan that deserve comment to reflect mycological interest within the site.

- It is evident that a strategy is likely to be adopted to remove the Sycamore trees within the reserve over time, with a view to restoration of more appropriate Oakwood. Although it has been shown within this survey that some of the large diameter deadwood retained within the site after felling of Sycamore trees supports a diverse mycota, it is nevertheless a non-native species and any further material from felling should be removed from site, perhaps sold or given away as firewood. Burning is normally considered to be the worst of all possible dead wood management as this in effect shortens the woodland nutrient cycle and leads to a depletion of material available for recycling by decomposition, thereby diminishing the fungal diversity of the woodland (Hodgetts, 1996). However, there could be some benefit from expanding the mosaic of microhabitats by creating some small burn sites from some of this felled timber. Fire and wind blow are both considered natural events within woodlands (Callander, 1985) and a group of fungi have evolved to take advantage of the unique succession of mineral availability following a fire. Although temperatures in the centre of a bonfire may be very high and there is often an accumulation of wood ash, the fungi recorded around the edge of bonfire sites may represent a snapshot of the fungi that would be associated with the aftermath of a naturally occurring fire (Watling et al, 1994). In naturally occurring fires, the depth of penetration of the fire and its effects on the soil may not be very great (Dix & Webster 1995). The occasional bonfire might therefore benefit the overall fungal diversity of the site, although these comments should not be seen as a reason to burn all dead wood (Holden, 2007).

- There are several references within the report to the establishment of native broadleaves. If this recommendation was adopted it would be prudent to consider the impact of fungal inoculum in such a management activity. The mycorrhizal association between tree and fungus is known to assist seedlings in their growth; the fungus hugely improves the tree's access to water and mineral salts, particularly in poor soils. In some instances the presence of a mycorrhizal fungus will also give protection to the developing roots from nematodes and other potentially damaging organisms (Holden, 2007).

  Seedlings growing in close proximity to mature trees are able to take up a large range of fungal genera that are associated with well established woodland, directly utilising available mycelial inoculum on the existing tree roots. Seedlings established in areas with no existing tree cover will develop mycorrhizae within 2-3 years but will initially associate only with a limited group of 'pioneer' mycorrhizal fungi. The reason for finding only 'pioneer' species at a distance from existing woodland is thought to be because these species are easily able to

establish themselves from spore germination, where other fungi more readily transfer via existing rootstock (Newton 1992).

Research by Dickie et al (2005) suggests that the beneficial influences of trees on seedling growth, via increased ectomycorrhizal infection, were apparent where seedlings were growing between 12 and 20 m from the trees: closer than 12 m and seedling growth is negatively correlated with canopy cover; further away than 20 m and ectomycorrhizal infection ceases. Thus to benefit from mycelial inoculation from existing tree roots, seedlings would probably need to be planted in close proximity to this source. It might be possible to under plant existing areas of native woodland known to support a diverse mycota with seedlings; some of which can then be transplanted, with as complete a root ball as possible, into areas of newly planted woodland to act as a source of inoculum to the other young trees. Alternatively, the woodland can be expanded by planting in progressive phases in order to keep within the range of potential infection.

The report highlights the potential to connect Duchess Wood with broadleaf woodland directly to the West, above Torwoodhill. If this potential was exploited, such management plans ought to consider, as suggested by Dr. Philip Mason in a recent address to the Botanical Society of Scotland, phased planting of inoculated seedlings in columns up to 30 m apart, so that any seedlings planted between might benefit from ectomycorrhizal infection.

If any clear felling is proposed prior to planting it should be noted that it is estimated that within one year of a clearfell, the ectomycorrhizal fungi will have been lost completely.

Recommendations

- Further survey should be carried out within an optimum period (Aug/Sept) for fungal fruiting to get a broader picture of the diversity and value of the mycological interest of the site. However, any future survey work, unless part of a long term monitoring programme after establishing baseline data, would only provide a snap-shot of the mycological interest of the reserve.

- Encourage a mosaic of habitats to develop within the planned woodland regeneration areas.

- Replant areas of clear fell within a year to utilise any existing fungal diversity left in the ground as mycelium on the roots of felled trees.

- Monitor any expansion of dense ground vegetation such as *Luzula sylvatica*

- Where appropriate consider under planting some of the existing broadleaved areas with same species seedlings and later transplanting these seedlings into the new areas of planting.

- Encourage dead, standing and fallen wood in all woodland habitats. Wherever possible allow the regeneration of trees to develop with a minimum of interference. Brashing and thinning are not a part of the natural process of woodland development and can interfere with the natural development of the fungal wood rotting succession.

- If bracken control is proposed at any time, careful consideration should be given to the method of its removal. The use of water rather than detergent is recommended as a wetting agent should the use of Asulam be considered.

- Encourage fungal recording groups to visit the site to both increase the number of fungal records on the site and to introduce members of the community to the fungal kingdom.
- Wherever possible monitor the result of interventions.
- Do not apply fungicides or any nitrogen rich substance within the site without consultation with species specialists.

References

Ainsworth, A.M. & Rayner, A.D.M. (1990). Aerial mycelial transfer by *Hymenochaete corrugata* between stems of hazel and other trees. *Mycological Research* 94(2) pp 263-288

Callander, R. (1985). The history of native woodlands in the Scottish Highlands. In *Trees and Wildlife in the Scottish Uplands*. ITE

Dickie, I.A. Schnitzer, S.A., Reich, P.B. & Hobbie, S.E. (2005). Spatially disjunct effects of co-occurring competition and facilitation. *Ecology Letters* 8, 1191-1200

Dix, N.J. & Webster, J. (1995). *Fungal Ecology* Chapman & Hall

Hodgetts, N.G. (1996). *The Conservation of Lower Plants in Woodland*. Joint Nature Conservation Committee

Holden, E., (2007). Fungal scoping survey of Slewdrum Forest, Aberdeenshire. Report to Birse Community Trust, January 2007.

Legon & Henrici. (2005). *Checklist of the British & Irish Basidiomycota*. RBG Kew, Richmond.

Luukas, E., (2006). Duchess Wood LNR Woodland & Access Management Plan. Scottish Origins, Kinross

Nehls, U., (2008). Mastering ectomycorrhizal symbiosis: the impact of carbohydrates. *Journal of Experimental Botany* Vol 59, No. 5, Pp. 1097-1108. Oxford University Press.

Newton, A.C., (1992). Towards a functional classification of ectomycorrhizal fungi. *Mycorrhiza* 2:75-79.

Newton, A.C., Davy, L., Holden, E., Silverside, A., Watling, R. & Ward, S.D. (2003). Status, distribution and definition of mycologically important grasslands in Scotland. *Biological Conservation* 111, 11 – 23.

Rodwell, J.S. (1991). *British Plant Communities Volume 1: Woodlands and Scrub*. Cambridge University Press.

Tofts, R.J. & Orton, P.D. (1998). The species accumulation curve for Agarics and Boletes from a Caledonian pinewood. *Mycologist* 12, 98 – 102.

Watling, R., Coppins, B., Munro, I. (1994). Fungi of Doune ponds, Stirlingshire, with special reference to confire-site species. *The Naturalist*; v.119(1010) 117-125)

Appendix A

Fungal species list for Duchess Wood 24.11.08 See attached file

Maps as per management plan (Luukas, 2006).