A9 DUALLING
PERTH TO INVERNESS

Appendix A12.7
Fungi

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

ATKINS mouchel

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Tables

1. Introduction and Background

1.1.1. This technical appendix provides details of the assessment of fungi within the vicinity of the Proposed Scheme. The information in this appendix has been used to inform the Design Manual for Roads and Bridges (DMRB) Stage 3 Assessment.

1.1.2. Studies reported in this technical appendix relate to the gathering of baseline information. This comprised:

- collation of existing records of fungi
- field survey
- an assessment of the conservation importance of fungal species recorded

1.1.3. The Scottish Highlands are known to contain rare and interesting fungi associated with waxcap grasslands (Holden, 2013[i]), Caledonian pinewood and other specific fungal niches including oak wood, willow carr and bearberry heath. There are no fungi listed in the citations of Sites of Special Scientific Interest (SSSI) within 5km of the Proposed Scheme. The nearest SSSI that has fungi listed as part of its citation is Kinveachy Forest, which is 7km to the south of the Scheme. It is known that many of the conifer plantations that surround old pinewoods contain old forest fungi, such as the four genera of UK Biodiversity Action Plan (UKBAP) (Anon, 2008[ii]) stipitate tooth fungi (Bankera, Hydnellum, Phellodon and Sarcodon) (Holden, 2011[iii]). Unimproved / semi-improved grasslands and mature conifer plantations are present along the Proposed Scheme.

2. Methodology

2.1. Desk Study

2.1.1. The Fungal Records Database of Britain and Ireland (managed by the British Mycological Society) was searched for records within 1km of the Proposed Scheme and data was requested from the Highland Biological Recording Group (HBRG).

2.1.2. The 2014 Phase 1 habitat survey results (CH2MHill, June 2015[iv]) were assessed for potentially suitable fungal habitat. These habitats were then ground 'truthed' during the field survey, as a Phase 1 habitat survey does not give enough detail to be sure of their suitability for fungi.

2.1.3. The Cairngorms National Park Authority (CNPA) provided a list of priority species for consideration within the DMRB Stage 3 Assessment. This list was created using the priority species list within the Cairngorm Local Biodiversity Action Plan (LBAP)[v]. The list contained 1200 species, and was filtered down by the CNPA to 360 species based on rarity. The CNPA provided records for these species, alongside details of areas with potential to support such species based on a review of the Phase 1 habitat survey results.

2.1.4. The records provided were classed as prioritised either “Red” or “Amber” as follows:

- The Red species/surveys are those of highest priority, were there are records in the corridor and they are species and habitats which are particularly vulnerable and high priority for conservation. This includes for example aspen trees or confirmed records of a Cairngorms Nature Action Plan species.
- Amber species are still considered high priority, but they are instances where there are no confirmed records but indication of habitat suitability had been provided by an expert in that particular group.

2.1.5. The Proposed Scheme is outwith the Cairngorms National Park, however there is potential for species to be present in similar suitable habitats outside protected areas.

2.1.6. The detailed locations of red and amber species has been reviewed against the field survey information recorded in September and October 2015.

2.2. Field Survey

2.2.1. Field survey was undertaken on September 29th, 30th and Oct 1st 2015. Suitable habitats were walked over, based on the results of the desk study and further refined by the fungal surveyor's experience.

2.2.2. Fruiting fungi were recorded and, where necessary, collected for further identification with a microscope and keys. This is normal practice as many species cannot be distinguished by field characters alone. All assessments are based entirely on fruiting structures; no recording of below ground features has been undertaken. Although a single visit is rarely adequate to fully assess fungal communities, it can highlight areas of potential high mycodiversity.

2.3. Assessment of Conservation Importance

2.3.1. The conservation importance of fungal species in general is assessed by reference to the 'Preliminary assessment: the red data list of threatened British fungi' (Evans, 2007[vi]) and those species listed in the 2008 UKBAP (Anon 2008[ii]). Additional information about distribution and rarity has been taken from the 'Checklist of the British and Irish Basidiomycota' (CBIB) (Legon & Henrici 2005[vii]) and its updates and also from the revised and updated 'Mycologia Scotica' (Watling, 2010[viii]) and the Cairngorms LBAP (Cosgrove, 2002[v]). The CNPA has also provided a priority species list for reference and fungal species are shown in Annex A.

2.3.2. A further relevant publication is Cairngorms Nature (Anon 2013[ix]) which lists two fungal species as key species for focused action: *Cytidia salicina* (on dead branches of willow in damp situations) and *Hygrocybe punicea* (a waxcap typical of short sward, unimproved grasslands). Habitat suitable for both of these species occurs within the Proposed Scheme.

2.3.3. It is estimated that some 400 species of fungi in North-Western Europe are found in grasslands (Arnolds & de Vries 1989[x]). A particular subset of grassland species has been associated with less disturbed, unfertilised, short sward grassland, the CHEGD fungi. CHEGD is an acronym of Clavariaceae (the 'fairy club' and 'coral' fungi), *Hygrocybe* (waxcaps), *Entoloma* (grassland species of this genus 'pink gills'), Geoglossaceae ('earthtongues') and *Dermoloma* (which also includes the genera *Camarophyllopsis* and *Porpoloma*). For ease of reference, habitats that support a high diversity of CHEGD species are known as 'waxcap grasslands'. This particular habitat, largely the result of traditional grazing management in the UK (although it can also be maintained by mowing), is thought to have declined by 90% since 1940 (Hewins et al 2005[xi]), mostly as a result of agricultural intensification.

2.3.4. It should be noted that a high diversity of waxcap fungi has been suggested as an indicator of the high diversity of other soil micro-organisms (Bardgett & McAlister, 1999[xii]). The need for an undisturbed soil profile (in both mechanical and nutrient terms) appears to be common to both. Continuous low input land management is required to establish an undisturbed soil profile and enable a diverse biodiversity of soil micro-organisms and fungi to develop, with the fungi additionally requiring a short sward in which to fruit.

2.3.5. Assessment of areas of waxcap grassland interest has been undertaken using advice from the Joint Nature Conservation Committee (JNCC) (Genney et al. 2009[xiii]) and the surveyor's professional expertise. The JNCC guidelines are intended to remedy the deficiency of fungal references in existing guidance for the selection of SSSIs. Table A2.1 sets out the JNCC thresholds for waxcap grasslands.

Table A2.1: JNCC CHEGD species thresholds (Genney et al. 2009[xiii]) for waxcap grassland sites

	Clavariaceae **(Corals and Fairy Clubs)**	***Hygrocybe*** **(Waxcaps)**	***Entoloma*** **(Pinkgills)**	***Geoglossaceae*** **(Earthtongues)**	***Dermoloma*** **(Crazed Caps)**
	Total number of species recorded				
Single visit	0	12	0	0	0
Multiple visits	5	18	12	3	2

2.3.6. In addition to the thresholds, the JNCC guidelines recommend consideration of the conservation 'value' of the species recorded and 'expert opinion' to set them into a regional context. It is made clear that these threshold values are for guidance only, to indicate when a site should be 'considered' for SSSI designation.

2.3.7. Suggestions for the weighted indicator *Hygrocybe* species would include high interest species as given by McHugh et al. (2001[xiv]) – *Hygrocybe ingrata, H. lacmus* (grey waxcap), *H. nitrata* (nitrous waxcap), *H. ovina* (blushing waxcap), *H. punicea* (crimson waxcap), *H. spadicea* (date waxcap), *H. splendidissima* (splendid waxcap). Newton et al. (2003[xv]) list H. *aurantiosplendens* (orange waxcap), *H. chlorophana var. aurantiacum*, *H. ingrata, H. ovina* and *H. spadicea* as possible indicator species for a site of high conservation importance. In a recent revision of his monograph, Boertmann (2010[xvi]) also suggests that *H. punicea* is likely to be found in grasslands that have long continuity of low input management and can also be considered an indicator that a site is of conservation interest.

2.3.8. Other grassland species that would be of conservation importance include the UKBAP grassland fungi species *Entoloma bloxamii* (big blue pinkgill), *Geoglossum atropurpureum* (dark-purple earthtongue), *Hygrocybe spadicea* and *Microglossum olivaceum* (olive earthtonge) and any additional grassland species listed in the preliminary assessment fungal red list (Evans 2007[vi]).

2.3.9. Four species of fungi are listed on the Wildlife and Countryside Act Schedule 8 (JNCC, 2016[xvii]). Only one of these, *Piptoporus quercinus*, is known to occur in Scotland, usually on the coarse woody debris of oak. This species has only been found in the Scottish borders region of Scotland. Whilst there are mature oaks within the Proposed Scheme, they are not suitable to support this species and it is therefore considered highly unlikely that the species is present within the Proposed Scheme.

Nature Conservation Evaluation

2.3.10. The general approach to defining the importance of fungi follows that of CIEEM (2016)[xviii]. The approach is also in line with advice given in DMRB Interim Advice Note 130/10 'Ecology and Nature Conservation: Criteria for Impact Assessment'[xix]. The level of importance for nature conservation of fungi within the Study Area is based on the criteria set out in Table A2.2. The rarity, ability to resist or recover from environmental change, and uniqueness of an ecological feature, function/role within an ecosystem, and level of legal protection or designation afforded to a given ecological feature are all factors taken into account in determining its importance.

Table A2.2: Importance Criteria

Importance	Criteria
International	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of: • internationally designated areas or undesignated areas that meet the criteria for designation; and/or • viable populations of species of international conservation concern. **Species** Species whose presence contributes to: • the maintenance of qualifying habitats, communities and assemblages that occur within internationally designated sites or within undesignated areas that meet the criteria for such designation.
National	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of:

Importance	Criteria
	• qualifying communities and assemblages that occur within nationally designated sites or within undesignated areas that meet the criteria for such designation; and/or • viable populations of species of national conservation concern. **Species** Species whose presence contributes to: • the maintenance of qualifying habitats, communities and assemblages that occur within nationally designated sites or within undesignated areas that meet the criteria for such designation; or • the maintenance and restoration of biodiversity and ecosystems at a national level, as defined in the Scottish Biodiversity Strategy (SBS) (Scottish Government, 2013, 2015).
Regional	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of: • communities and assemblages that occur within regionally important sites or localities listed as being of conservation importance in the Highland Biodiversity Action Plan (BAP) or Cairngorms Nature Action Plan (CNAP) (including Local Nature Reserves) or within undesignated areas that meet the criteria for such designation ; and/or • viable populations of species of regional conservation concern. **Species** Species whose presence contributes to: • the maintenance and restoration of biodiversity and ecosystems at a regional level, as defined in the Highland BAP or CNAP.
Authority Area	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of: • populations of species of conservation concern within the authority area. **Species** Species whose presence contributes to: • the maintenance and restoration of biodiversity and ecosystems within a relevant area such as Inverness and Nairn Local BAP
Local	**Ecosystems and Habitats** Ecosystems or habitats essential for the maintenance of: • populations of species of conservation concern within the local area (for example a Local Nature Reserve (LNR)). **Species** Species whose presence contributes to: • the maintenance and restoration of biodiversity and ecosystems at a local level.
Less than Local	**Ecosystems and Habitats** • Ecosystems or habitats that do not meet the above criteria, i.e., supporting at least populations of species of conservation concern within the local area **Species** • Features that are considered to be absent or do not meet any of the above criteria.

2.4. Limitations and Deviations

2.4.1. Ecological surveys are limited by factors which affect the presence of plants and animals such as the time of year, migration patterns and behaviour. The absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it will not be present in the future. The survey was undertaken in autumn, which is the optimal time for survey of most macrofungi[1]. However, some early fruiting species such as the tooth fungi and some waxcap species would not be obvious at this time of year.

2.4.2. Detailed surveys for fungi have not been undertaken. The impact assessment has been based on the data provided by CNPA (ref data list) and from the walkover surveys described above. This approach has been agreed with the CNPA on the basis that mitigation will be provided as follows:

- red species – assumed to be present in locations identified on records provided by CNPA and appropriate mitigation provided
- amber species – acknowledgement that suitable habitat is present to support species in locations identified on records provided by CNPA and habitat requirements will be taken into consideration in mitigation measures

3. Results

3.1. Desk Study

3.1.1. The list of previously recorded species is shown in Annex BB. None of the species were of conservation interest although *Phellinus tremulae* (aspen bracket), whilst widespread in the Central Highlands on mature aspen, is less frequent elsewhere in Scotland and not recorded yet from the rest of the UK. It is listed in the Cairngorms LBAP priority species spreadsheet[v]. The location is within 1km and is outwith the likely construction area, being on the east side of Loch Moy.

3.1.2. The following habitats were identified from the Phase 1 habitat survey maps during the desk study as being present within the Proposed Scheme and with potential for fungal interest:

- grassland: unimproved and semi improved acid grassland, unimproved and semi improved neutral grassland and unimproved calcareous grassland
- woodland: broadleaf semi-natural, coniferous semi-natural, coniferous plantation where target notes indicated the presence of mature *Vaccinium* understory, mixed semi-natural

3.1.3. The CNPA provided records of eight locations considered to have potential for Cairngorms LBAP priority fungi species which fall within the Proposed Scheme. These records are shown on Figure 12.6f-h and detailed in Table A3.1. All of these records are classed as Amber, with four of them (365, 366, 368, 377) recorded as having waxcap potential and the others noted as locations where fungi of interest may be present. There are a further 11 records within 50m of the Proposed Scheme; all of these are classed as Amber.

[1] Macrofungi are those fungi that form large fructifications visible without the aid of a microscope. This artificial but convenient grouping includes fungal families or genera where the majority of included species produce fruit bodies greater than 1cm in diameter.

Table A3.1: CNPA Priority Records located within the Proposed Scheme

CNPA Priority Record	Grid Reference	Priority	Interest
365	NH7929431778	Amber	Acid unimproved grassland. Species rich sward. Waxcap potential.
366	NH7890232190		Acid unimproved grassland. Waxcap potential.
368	NH7857532311		Acid unimproved grassland. Waxcap potential.
373	NH7814033019		Semi natural woodland. Fungi potential.
377	NH7774433337		Neutral unimproved grassland. Waxcap potential.
379	NH7747733727		Conifer woodland. Fungi potential.
376	NH7776733428		Semi natural woodland. Fungi potential.
383	NH7683033961		Conifer woodland. Fungi potential.

3.2. Field Survey and Assessment of Conservation Importance

3.2.1. A full list of the species recorded during the field survey is provided Annex C. Table A3.2 lists areas of fungal interest, as shown on Figure 12.6a-k as areas of fungal interest. Locations that fall within the Proposed Scheme are shaded grey.

Table A3.2: Areas of Fungal Interest Recorded during the Habitat Survey

Site Location and Target Note (TN)	Grid Reference	Distance and Direction from the Scheme	Interest
Waxcap grasslands			
Tomatin TN 1 (Figure 12.6d)	NH79622996	0	Neutral unimproved grazed grassland supporting large numbers of *Hygrocybe punicea* (crimson waxcap). The CHEG score for this visit to the site was 1-5-1-0 and thus well below any thresholds suggesting an important waxcap site. However, *H. punicea* is believed (Boertmann 2010[xvi]) to be an indicator of waxcap habitat of potential conservation interest, so the CHEG score recorded on this occasion might not be representative of the true mycodiversity of the grassland. The presence of rarely recorded species *Gamundia striatula* (lined meadowcap) also supports the potential interest of the site. Identified by CNPA as having potential for Cairngorms LBAP amber priority fungi species (see Figure 12.6).
South of Dalmagarry Farm, Dalmagarry TN2 (Figure 12.6f)	NH787322	0	Semi-improved neutral grassland supporting a limited number of waxcaps (CHEG = 1-3-0-0). The field was heavily grazed at the time of the visit and the CHEG score might not be representative of the mycodiversity of the grassland. Identified by CNPA as having potential for Cairngorms LBAP amber priority fungi species (see Figure 12.6).

Site Location and Target Note (TN)	Grid Reference	Distance and Direction from the Scheme	Interest
North of Dalmagarry Farm, Dalmagarry TN3 (Figure 12.6f)	NH78403265	0	Unimproved acid grassland. Waxcap interest was confined to a narrow strip of drier grass adjacent to the B9154. The CHEG score was 1-2-1-0 and the species present were unremarkable apart from the fact that one of the two *Hygrocybe* species recorded was *H. splendidissima* (splendid waxcap). This is considered an indicator of habitat continuity. Overall, the field was too wet to be of significant interest for waxcap species.
Moy TN4 (Figure 12.6i)	NH75663482	0	Semi-improved acid grassland, rank and currently unsuitable for fruiting waxcaps in its under-grazed condition. Some of the stream banks supported a shorter sward with some floral diversity alongside a small number of waxcap species including *Hygrocybe punicea*, which is one of the indicators of habitat continuity. The CHEG score was 0-5-0-0. This score is considered to be representative of the mycodiversity of the grassland.
Broadleaved woodland			
Porter's Lodge, Tomatin TN5 (Figure 12.6d)	NH79982959	0	Broadleaved semi-natural woodland supporting a number of interesting fungi associated with the old willow and birch present along a small stream. Of most interest was *Phellinus lundellii* (birch bristle bracket) at NH7998129593, currently recorded from only 17 other sites in Scotland and unsubstantiated elsewhere in the UK. It associates with old birch trees and its presence suggests continuity of the birch wood habitat. The area immediately adjacent to this has been identified by CNPA as having potential for Cairngorms LBAP amber priority fungi species (see Figure 12.6).
North of Tomatin TN6 (Figure 12.6d)	NH797300	0	A steep, northeast facing bank, most likely on an old river feature, supported several old birch trees and dense thickets of *Salix aurita* (eared willow). A number of birch associating fungi were present and it is considered that this area will act as a refuge[2] for mycodiversity.
Near Invereen TN7 (Figure 12.6e)	NH796312	1.86491052	A steep, northeast facing bank, most likely an old river feature, supported a number of old birch trees. Birch associating fungi were present and it is considered that this area will act as a refuge for mycodiversity.
South of Loch Moy TN8 (Figure 12.6g)	NH780331	0	A steep, northeast facing bank on what is probably, in part, an old river feature, supported a good number of old birch and willow. A number of interesting species were recorded such as *Tarzetta cupularis* (toothed cup), *Amanita betulae*, *Russula exalbicans* (bleached brittlegill) and *Helvella macropus* (felt saddle). This area will act as a

[2] "Refuge" here means that the conditions within the woodland suggest that there has been continuity of habitat, which provides suitable conditions to support dispersal and colonisation of surrounding habitats. This facilitates fungal diversity.

Site Location and Target Note (TN)	Grid Reference	Distance and Direction from the Scheme	Interest
			refuge for mycodiversity. Identified by CNPA as having potential for Cairngorms LBAP amber priority fungi species (see Figure 12.6).
Coniferous woodland			
Moy TN9 (Figure 12.6h)	NH769339 and NH770338	0	Two areas of mature pine to the south of the existing A9. The presence of *Vaccinium myrtillus* (blaeberry) and *Goodyera repens* (creeping lady's tresses) indicates that the woodland has characteristics associated with semi-natural woodland. The mycorrhizal fungi were not fruiting well under any of the conifers visited during the survey but wood rotting species *Tricholomopsis decora* (prunes and custard) and *Pleurocybella porrigens* (angels wings) were recorded on fallen pine trunks. These latter two species, although not uncommon in the Highlands, are both considered to be confined to Scotland and the former is characteristic of natural pine woods. Exposed soils at track sides was predominantly mineral and would thus be suitable for the four genera of UKBAP toothed fungi (*Bankera*, *Hydnellum*, *Phellodon* and *Sarcodon*). None were recorded during the visit but as noted earlier, these fungi fruit early in the season. Identified by CNPA as having potential for Cairngorms LBAP amber priority fungi species (see Figure 12.6).
Moy TN10 (Figure 12.6h)	NH767341	0	An area of mature pine to the north of the existing A9. Fungal interest is similar to the two areas of coniferous woodland described above.

3.3. Valuation

3.3.1. During the habitat survey 10 areas of fungal interest were recorded (see Table A3.2), five of which have suitability to support Cairngorms LBAP amber priority fungi species within or immediately adjacent to the sites. Two areas were found to support a small number waxcap species, including *Hygrocybe punicea* (listed as a 'key species for focussed action' in the Cairngorms Nature Action Plan[xx]), and have suitability for other waxcap species, such as *H. lilacina* (Cairngorms LBAP amber priority species). Two areas of broadleaved woodland were identified as potential refuges for mycodiversity.

3.3.2. None of the areas of fungal interest recorded during the habitat survey were found to support Cairngorms LBAP red priority fungi species and no CNPA red priority fungi species records are located within 250m of the Proposed Scheme.

3.3.3. The locations recorded with suitability for amber priority species and where waxcaps have been recorded are considered to be of Authority value for fungi (TN 1, TN2, TN3, TN4, TN5, TN8, TN9). Other locations identified to be of interest for fungi at TN6, TN7 and TN10 are considered to be of Local value for fungi. Other areas within the Study Area are considered to be of less than Local value.

4. Conclusions

4.1.1. None of the sites visited during this survey supported outstanding habitat for fungi.

4.1.2. 10 sites are of interest for their value as refuges (see Table A3.2).

4.1.3. The four waxcap sites held the most potential interest for fungi (TN 1, 2, 3, 4) and four locations (TN 5, 8, 9, 10) identified were found to have suitability to support Cairngorms LBAP amber priority fungi species, these locations are of Authority value for fungi. Two other locations were identified to be of Local value for fungi.

5. References

[i] Holden, L. (2013) Can higher plant surveys be used to pick out important waxcap grassland sites in conservation assessment projects? *Field Mycology* 14(4), 120-123.
[ii] Anon (2008) UK List of Priority Species UK Biodiversity Action Plan Website www.ukbap.org.uk/PrioritySpecies.aspx?group=3
[iii] Holden, E. (2011) Fungal survey of An Camus Mor. Unpublished report to Rothiemurchus Estate.
[iv] CH2MHill (2015) Preliminary Ecological Appraisal. North Scheme – Dalraddy to Moy
[v] Cosgrove, P. (2002) The Cairngorms Local Biodiversity Action Plan. Cairngorms Partnership.
[vi] Evans, S.E. (2007) Preliminary assessment: the red data list of threatened British fungi British Mycological Society website - www.britmycolsoc.org.uk
[vii] Legon, N.W. & Henrici, A. (2005) Checklist of the British & Irish Basidiomycota. Royal Botanic Gardens, Kew.
[viii] Watling, R. (2010) Mycologia Scotica. Scottish Fungi website - https://sites.google.com/site/scottishfungi/mycologia-scotica-1
[ix] Anon (2013) Cairngorms Nature: Action Plan 2013-2018. Cairngorms National Park Authority.
[x] Arnolds, E. & de Vries, B. (1989) Oecologische statistiek van de Nederlandse macrofungi. Coolia 32, 72-86.
[xi] Hewins, E.J., Pinches, C., Arnold, J., Lush, M., Robertson, H. & Escott, S. (2005) The condition of lowland BAP priority grasslands: results from a sample survey of non-statutory stands in England. English Nature Research Report 636. English Nature.
[xii] Bardgett, R.D. & McAlister, E. (1999) The measurement of soil fungi: bacterial biomass ratios as an indicator of ecosystem self-regulation in temperate meadow grasslands. Biology and Fertility of Soil 29(3) 282-290.
[xiii] Genney, D.R., Hale, A.D., Woods, R.G. & Wright, M. (2009) Grassland Fungi. JNCC Guidelines for selection of biological SSSIs Rationale Operational approach and crierial. Detailed guidelines for habitats and species groups. Chapter 20. http://www.jncc.gov.uk/page-2303.
[xiv] McHugh, R., Mitchel, D., Wright, M. & Anderson, R. (2001) The fungi of Irish grasslands and their value for nature conservation. Biology and Environment Proceedings of the Royal Irish Academy, Vol. 10B, 3:225-242.
[xv] Newton, A.C., Davy, L.M., Holden, E., Silverside, A., Watling, R. & Ward, S.D. (2003) Status, distribution and definition of mycologically important grassland in Scotland. Biological Conservation 111, 11-23.
[xvi] Boertmann, D. (2010) The genus Hygrocybe, 2nd revised edition. The Danish Mycological Society, Svampetryk.
[xvii] Joint Nature Conservation Committee (2016) Conservation Designations for UK Taxa. Accessed via: http://jncc.defra.gov.uk/page-3408. Accessed on 05/07/2016.

Not referenced in text
Arnolds, E. (1982) Ecology and coenology of macrofungi in grassland in Drenthe, the Netherlands. Autecology and Taxonomy, Vol. 2. Parts 2 & 3. Ganter Verlag K.G., Vaduz, Germany

[xviii] Chartered Institute of Ecology and Environmental Management (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Second Edition. CIEEM, Winchester.
[xix] The Highways Agency et al. (2010) DMRB Interim Advice Note 130/10. Ecology and Nature Conservation: Criteria for Impact Assessment.
[xx] Cairngorms National Park Authority (2013) Cairngorms Nature Action Plan 2013-2018.

Annex A.

A.1. CNPA Priority Fungi Species

Species common name	Species Latin name	Cairngorms importance - UK or national stronghold	UK BAP priority	Scottish Biodiversity List
Aspen bracket fungus	*Phellinus tremulae*	Very high	No	No
Tooth fungi (15 species)	*Bankera fuligineoalba, Hydnellum aurantiacum, H. caeruleum, H. concrescens, H. ferrugineum, H. peckii, H. scrobiculatum, H. spongiosipes, Phellodon confluens, P. melaleucus, P. niger, P. tomentosus, Sarcodon glaucopus, S. scabrosus, S. squamosus.*	High	Yes	Yes
Mountain grisette	*Amanita nivalis*	Unknown	Yes	Yes
Rose spindler	*Clavaria rosea*	Unknown	Yes	No
Violet coral	*Clavaria zollingeri*	Unknown	Yes	No
Scarlet splash	*Cytidia salicina*	Unknown	Yes	Yes
Big blue pinkgill	*Entoloma bloxamii*	Unknown	Yes	Yes
Northern bilberry redleaf	*Exobasidium expansum*	Unknown	Yes	Yes
Snowbed mossbell	*Galerina harrisonii*	Unknown	Yes	Yes
Star earthtongue	*Geoglossum starbaeckii*	Unknown	Yes	Yes
Mountain cup	*Geopora arenosa s.s*	Unknown	Yes	No
Lilac waxcap	*Hygrocybe lilacina*	Unknown	Yes	Yes
Litter decomposing fungi (23 species)	-	Unknown	Yes	
Darkpurple earthtongue	*Microglossum atropurpureum*	Unknown	Yes	No
Sideshoot bonnet	*Mycena latifolia*	Unknown	Yes	No
Rooting bonnet	*Mycena megaspora*	Unknown	Yes	No
Mycorrhizal fungi (43 species)	-	Unknown	Yes	
Mealy meadowcap	*Porpoloma metapodium*	Unknown	Yes	No

Species common name	Species Latin name	Cairngorms importance - UK or national stronghold	UK BAP priority	Scottish Biodiversity List
Willow brittlegill	*Russula laccata (norvegica)*	Unknown	Yes	No
Alpine brittlegill	*Russula nana*	Unknown	Yes	No
Bog jellydisc	*Sarcoleotia turficola*	Unknown	Yes	No
Contorted strangler	*Squamanita contortipes*	Unknown	Yes	No
Powdercap strangler	*Squamanita paradoxa*	Unknown	Yes	Yes
Strathy strangler	*Squamanita pearsonii*	Unknown	Yes	Yes
Wood decomposing fungi (7 species)	-	Unknown	Yes	

Annex B.

B.1. Previously recorded species

Scientific Name	Locality	Grid Reference	Year	Associated Organism	Ecosystem
Gyromitra esculenta	Lynebeg	NH769338	2008		
Lepista nuda	Moy: old A9 road: near	NH760349	1997		
Triphragmium ulmariae	Moy: old A9 road: near	NH760349	1996		wetland
Mollisia discolor	Moy Castle	NH7635	1949	*Sorbus aucuparia*	
Septosporium bulbotrichum	Moy Castle	NH7635	1949	*Sorbus aucuparia*	
Puccinia urticata var. urticata	Moy Hall: game fair field	NH76693506	2013	*Urtica dioica*	field
Amanita muscaria var. muscaria	Moy school	NH7733	2004	*Pinus sylvestris*	coniferous plantation
Hygrophoropsis aurantiaca	Moy school	NH7733	2003	*Pinus sylvestris*	coniferous plantation
Hygrophorus hypothejus	Moy school	NH7733	2004	*Pinus sylvestris*	coniferous plantation
Suillus bovinus	Moy school	NH7733	2004	*Pinus sylvestris*	coniferous plantation
Claviceps purpurea	Moy	NH7733	2011	*gramineae*	
Rhytisma salicinum	Moy	NH7733	2011	*Salix caprea, S. aurita*	
Taphrina betulina	Moy	NH7733	2011	*Betula sp.*	
Arrhenia obscurata	Loch Moy	NH7734	1955	*Sphagnum*	
Phellinus tremulae	Loch Moy	NH78233415	2010	*Populus tremula*	

Annex C.

C.1. Species recorded during the field survey

Scientific Name	Site Name	Grid Reference	Ecosystem	Other Notes
Amanita betulae	Moy	NH78073315	semi-natural broadleaf	A newly established taxon not previously recognised in the UK. The lack of records reflect this and it is probably a widespread species in Scotland.
Amanita citrina var. citrina	Tomatin	NH79613127	semi-natural broadleaf	
Amanita fulva	Moy	NH76763415	conifer plantation: mature	
Amanita fulva	Moy	NH76413433	mixed roadside plantation	
Amanita muscaria	Tomatin	NH79443117	roadside verge	
Amanita muscaria	Tomatin	NH79613128	semi-natural broadleaf	
Amanita muscaria	Moy	NH76233433	mixed roadside plantation	
Bisporella citrina	Tomatin	NH79982959	semi-natural broadleaf	
Boletus badius	Moy	NH76843397	conifer plantation: mature	
Boletus ferrugineus	Moy	NH77703348	mixed woodland	
Boletus ferrugineus	Moy	NH76393437	mixed woodland	
Calocera furcata	Moy	NH78223298	semi-natural broadleaf	
Cantharellus tubaeformis	Moy	NH76763410	conifer plantation: mature	
Chalciporus piperatus	Moy	NH78083313	semi-natural broadleaf	
Chalciporus piperatus	Moy	NH76233433	mixed roadside plantation	
Chroogomphus rutilus	Moy	NH76713411	conifer plantation: mature	
Claviceps purpurea	Tomatin	NH79773000	semi-natural broadleaf	
Clavulinopsis	Tomatin	NH79582996	semi-improved	CHEG species. In heavily

Scientific Name	Site Name	Grid Reference	Ecosystem	Other Notes
helvola			grassland	grazed pony field.
Clavulinopsis laeticolor	Dalmagarry	NH78763221	acid unimproved grassland	CHEG species. In heavily grazed sheep field.
Clavulinopsis luteoalba	Dalmagarry	NH78453268	acid unimproved grassland	CHEG species.
Clitocybe ditopus	Moy	NH78083313	semi-natural broadleaf	
Clitocybe ditopus	Moy	NH77703348	mixed woodland	
Clitocybe phyllophila	Tomatin	NH79773005	semi-natural broadleaf	In ring. Generally a southern mainland Britain species.
Collybia cookei	Moy	NH78173305	semi-natural broadleaf	
Coprinopsis nivea	Tomatin	NH79693147	grassland	
Coprinopsis semitalis	Tomatin	NH79693146	grassland	
Cortinarius anomalus	Tomatin	NH79473136	roadside verge	
Cortinarius anomalus	Tomatin	NH79613128	semi-natural broadleaf	
Cortinarius cinnamomeus	Moy	NH76783409	conifer plantation: mature	
Cortinarius flexipes var. flexipes	Moy	NH77703348	mixed woodland	
Cortinarius rubellus	Moy	NH76773410	conifer plantation: mature	
Cystoderma amianthinum	Tomatin	NH79433100	roadside verge	
Cystoderma amianthinum	Moy	NH77893342	acid unimproved grassland	
Cystoderma amianthinum	Moy	NH76273438	mixed woodland	
Entoloma cetratum	Tomatin	NH79773000	semi-natural broadleaf	
Entoloma cetratum	Moy	NH76763410	conifer plantation: mature	
Entoloma conferendum	Tomatin	NH79622996	semi-improved grassland	CHEG species. In heavily grazed pony field.
Entoloma conferendum	Moy	NH77733347	mixed woodland	CHEG species.

Scientific Name	Site Name	Grid Reference	Ecosystem	Other Notes
Entoloma rhodopolium	Moy	NH78043320	semi-natural broadleaf	
Entoloma sericellum	Dalmagarry	NH78453263	acid unimproved grassland	CHEG species.
Fomes fomentarius	Tomatin	NH79992959	semi-natural broadleaf	
Fomes fomentarius	Moy	NH78033319	semi-natural broadleaf	
Galerina mniophila	Moy	NH78233297	semi-natural broadleaf	
Gamundia striatula	Tomatin	NH79582996	semi-improved grassland	CBIB suggest widely distributed but rarely reported. In heavily grazed pony field.
Gymnopilus penetrans	Tomatin	NH79932962	coniferous plantation	
Gymnopus confluens	Moy	NH78173306	semi-natural broadleaf	
Hebeloma velutipes	Moy	NH78173304	semi-natural broadleaf	
Helvella macropus	Moy	NH78043320	semi-natural broadleaf	
Hydnum repandum	Moy	NH76713396	conifer plantation: mature	
Hygrocybe cerecea	Tomatin	NH79622996	semi-improved grassland	CHEG species. In heavily grazed pony field.
Hygrocybe cerecea	Tomatin	NH79373109	semi-improved grassland	CHEG species.
Hygrocybe cerecea	Dalmagarry	NH78763221	acid unimproved grassland	CHEG species. In heavily grazed sheep field.
Hygrocybe chlorophana	Moy	NH75623475	semi-improved grassland	CHEG species.
Hygrocybe coccinea	Tomatin	NH79612296	semi-improved grassland	CHEG species. In heavily grazed pony field.
Hygrocybe coccinea	Moy	NH75593473	semi-improved grassland	CHEG species.
Hygrocybe conica	Tomatin	NH79493113	roadside verge	CHEG species.
Hygrocybe laeta	Tomatin	NH79612296	semi-improved grassland	CHEG species. In heavily grazed pony field.
Hygrocybe laeta	Dalmagarry	NH78403270	acid unimproved grassland	CHEG species.
Hygrocybe laeta	Dalmagarry	NH78603215	acid unimproved grassland	CHEG species.

Scientific Name	Site Name	Grid Reference	Ecosystem	Other Notes
Hygrocybe laeta	Tomatin	NH79413073	roadside verge	CHEG species.
Hygrocybe laeta	Moy	NH78163315	acid unimproved grassland	CHEG species.
Hygrocybe laeta	Moy	NH75523470	semi-improved grassland	CHEG species.
Hygrocybe miniata	Moy	NH76333434	acid unimproved grassland	CHEG species.
Hygrocybe pratensis	Dalmagarry	NH78773220	acid unimproved grassland	CHEG species. In heavily grazed sheep field.
Hygrocybe punicea	Tomatin	NH79622996	semi-improved grassland	CHEG species. Large numbers of fruiting bodies in heavily grazed pony field. Considered an indicator species of good quality waxcap grassland. Listed as an action species in Cairngorms Nature (2013).
Hygrocybe punicea	Moy	NH75663482	semi-improved grassland	CHEG species. Considered an indicator species of good quality waxcap grassland. Listed as an action species in Cairngorms Nature (2013).
Hygrocybe reidii	Tomatin	NH79612296	semi-improved grassland	CHEG species. In heavily grazed pony field.
Hygrocybe reidii	Tomatin	NH79373109	semi-improved grassland	CHEG species.
Hygrocybe reidii	Dalmagarry	NH78603215	acid unimproved grassland	CHEG species.
Hygrocybe reidii	Moy	NH75663484	semi-improved grassland	CHEG species.
Hygrocybe russocoriacea	Dalmagarry	NH78763221	acid unimproved grassland	CHEG species. In heavily grazed sheep field.
Hygrocybe splendidissima	Dalmagarry	NH78403265	acid unimproved grassland	CHEG species. Considered an indicator species of good quality waxcap grassland.
Hygrocybe virginea	Dalmagarry	NH78603218	acid unimproved grassland	CHEG species.
Hygrocybe virginea	Tomatin	NH79403045	roadside verge	CHEG species.
Hygrophoropsis aurantiaca	Moy	NH77763345	mixed woodland	
Hypomyces chrysospermus	Moy	NH78083313	semi-natural broadleaf	

Scientific Name	Site Name	Grid Reference	Ecosystem	Other Notes
Inocybe albovelutipes	Moy	NH78183303	semi-natural broadleaf	This appears to be a second record for Scotland although there has been some taxonomic confusion around the species and it is possibly more widespread than this would suggest.
Inocybe hystrix	Tomatin	NH79992959	semi-natural broadleaf	CBIB describe this as 'occasional' in Scotland.
Inocybe napipes	Moy	NH76813407	conifer plantation: mature	
Inonotus obliquus	Tomatin	NH79992959	semi-natural broadleaf	
Inonotus obliquus	Tomatin	NH79673138	semi-natural broadleaf	
Laccaria bicolor	Tomatin	NH79932962	coniferous plantation	
Laccaria laccata	Tomatin	NH79443118	roadside verge	
Laccaria laccata	Moy	NH78233297	semi-natural broadleaf	
Laccaria laccata	Moy	NH76973398	conifer plantation: mature	
Laccaria laccata	Moy	NH76273438	mixed woodland	
Lactarius fulvissimus	Moy	NH78073315	semi-natural broadleaf	
Lactarius glyciosmus	Tomatin	NH79443117	roadside verge	
Lactarius glyciosmus	Moy	NH78243273	semi-natural broadleaf	
Lactarius glyciosmus	Moy	NH76253432	mixed roadside plantation	
Lactarius lacunarum	Moy	NH78083313	semi-natural broadleaf	
Lactarius pubescens	Tomatin	NH79433099	roadside verge	
Lactarius rufus	Tomatin	NH79443119	roadside verge	
Lactarius rufus	Moy	NH78173305	semi-natural broadleaf	
Lactarius tabidus	Moy	NH78043320	semi-natural broadleaf	
Lactarius torminosus	Tomatin	NH79433099	roadside verge	
Lactarius torminosus	Moy	NH78173306	semi-natural broadleaf	

Scientific Name	Site Name	Grid Reference	Ecosystem	Other Notes
Lactarius torminosus	Moy	NH76813407	conifer plantation: mature	
Lactarius turpis	Tomatin	NH79653134	semi-natural broadleaf	
Lactarius vietus	Tomatin	NH79783003	semi-natural broadleaf	
Lactarius vietus	Moy	NH78183303	semi-natural broadleaf	
Lactarius vietus	Moy	NH76813407	conifer plantation: mature	
Lactarius vietus	Moy	NH76973398	conifer plantation: mature	
Leccinum scabrum	Tomatin	NH79433099	roadside verge	
Leccinum scabrum	Moy	NH76833405	conifer plantation: mature	
Leccinum scabrum	Moy	NH76223434	mixed roadside plantation	
Lycoperdon molle	Moy	NH78173304	semi-natural broadleaf	
Lycoperdon perlatum	Tomatin	NH79443118	roadside verge	
Lycoperdon perlatum	Moy	NH78053316	semi-natural broadleaf	
Lycoperdon utriformis	Dalmagarry	NH78893216	acid unimproved grassland	
Melanoleuca polioleuca	Moy	NH76843402	roadside verge	
Mycena amicta	Moy	NH78073315	semi-natural broadleaf	
Mycena amicta	Moy	NH77773339	mixed woodland	
Mycena epipterygia	Tomatin	NH79723001	semi-natural broadleaf	
Mycena epipterygia	Moy	NH78233297	semi-natural broadleaf	
Mycena filopes	Moy	NH78173305	semi-natural broadleaf	
Mycena leptocephala	Moy	NH78083313	semi-natural broadleaf	
Mycena pura	Moy	NH78033317	semi-natural broadleaf	

Scientific Name	Site Name	Grid Reference	Ecosystem	Other Notes
Mycena sanguinolenta	Moy	NH77773339	mixed woodland	
Mycena stipata	Moy	NH76993386	conifer plantation: mature	
Oxyporus populinus	Tomatin	NH79982959	semi-natural broadleaf	
Panaeolus acuminatus	Tomatin	NH79773000	semi-natural broadleaf	
Panaeolus papillionaceus	Tomatin	NH79693147	grassland	
Paxillus involutus	Tomatin	NH79942958	semi-natural broadleaf	
Paxillus involutus	Tomatin	NH79443115	roadside verge	
Paxillus involutus	Moy	NH78183303	semi-natural broadleaf	
Phaeolus schweinitzii	Tomatin	NH79932962	coniferous plantation	
Phellinus lundellii	Tomatin	NH79982959	semi-natural broadleaf	At base of trunk on old birch tree. Known from only 17 other sites in Scotland this is considered an indicator of birch wood habitat continuity.
Pholiota scamba	Moy	NH78043317	semi-natural broadleaf	
Pholiota squarrosa	Tomatin	NH79922957	semi-natural broadleaf	
Piptoporus betulinus	Tomatin	NH79643132	semi-natural broadleaf	
Pleurocybella porrigens	Moy	NH76983385	conifer plantation: mature	Common in Scotland but hardly recorded in other areas of the UK.
Polyporus durus	Moy	NH77823334	mixed woodland	
Polyporus leptocephalus	Tomatin	NH79023004	semi-natural broadleaf	
Psathyrella artemiseae	Moy	NH78173305	semi-natural broadleaf	
Psilocybe semilanceata	Tomatin	NH79773000	semi-natural broadleaf	
Psilocybe semilanceata	Tomatin	NH79622996	semi-improved grassland	Heavily pony grazed.
Rhodocollybia butyracea	Moy	NH77803339	mixed woodland	
Russula aeruginea	Moy	NH76203434	mixed roadside plantation	

Scientific Name	Site Name	Grid Reference	Ecosystem	Other Notes
Russula aquosa	Moy	NH78093311	semi-natural broadleaf	
Russula emetica	Moy	NH76813407	conifer plantation: mature	
Russula emetica	Moy	NH76303446	mixed woodland	
Russula exalbicans	Moy	NH78043320	semi-natural broadleaf	
Russula graveolens	Moy	NH76973398	conifer plantation: mature	
Russula nobilis	Tomatin	NH79992959	semi-natural broadleaf	
Russula ochroleuca	Tomatin	NH79982959	semi-natural broadleaf	
Russula ochroleuca	Moy	NH78103311	semi-natural broadleaf	
Russula sardonia	Moy	NH76893404	conifer plantation: mature	
Russula sardonia	Moy	NH76303436	mixed woodland	
Spinellus fusiger	Moy	NH78233297	semi-natural broadleaf	
Stropharia semiglobata	Tomatin	NH79773000	semi-natural broadleaf	
Stropharia semiglobata	Moy	NH77893342	acid unimproved grassland	
Stropharia semiglobata	Moy	NH75493471	semi-improved grassland	
Suillus bovinus	Tomatin	NH79443119	roadside verge	
Suillus grevillei	Tomatin	NH79713000	field edge	
Suillus grevillei	Tomatin	NH79493113	roadside verge	
Suillus luteus	Tomatin	NH79453110	roadside verge	
Suillus variegatus	Moy	NH76273438	mixed woodland	
Taphrina alni	Tomatin	NH79672995	broadleaved plantation	Non-native alder species probably planted during previous construction works.
Tarzetta cupularis	Moy	NH78173304	semi-natural broadleaf	
Trichaptum abietinum	Moy	NH78223298	semi-natural broadleaf	
Trichaptum abietinum	Moy	NH77833333	mixed woodland	

Scientific Name	Site Name	Grid Reference	Ecosystem	Other Notes
Trichaptum abietinum	Moy	NH76963399	conifer plantation: mature	
Tricholoma fulvum	Moy	NH76473442	mixed woodland	
Tricholoma fulvum	Moy	NH76193434	mixed roadside plantation	
Tricholoma terreum	Moy	NH76413433	mixed roadside plantation	
Tricholomopsis decora	Moy	NH76993386	conifer plantation: mature	CBIB list as occasional in Scotland. Almost unrecorded in other areas of the UK. Thought to be an indicator of semi-natural pine woods.
Tricholomopsis rutilans	Moy	NH76873410	conifer plantation: mature	
Tricholomopsis rutilans	Moy	NH76323447	mixed woodland	
Xylaria hypoxylon	Moy	NH77753347	mixed woodland	