



# How do we effectively conserve the kingdom of fungi?

Liz Charter

Isle of Man Fungus Group





# Introduction

My interest goes back a long way!

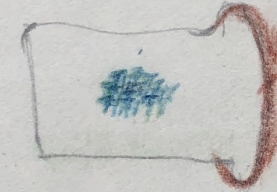
Some types of Fungi. Oct. 19<sup>th</sup>



Mushrooms



Toad stool



Mould on bread



Mould on Jam



Mildew on leaf



Bracket fungus on tree trunk



Mould on damp leather

# Fungi – seriously?

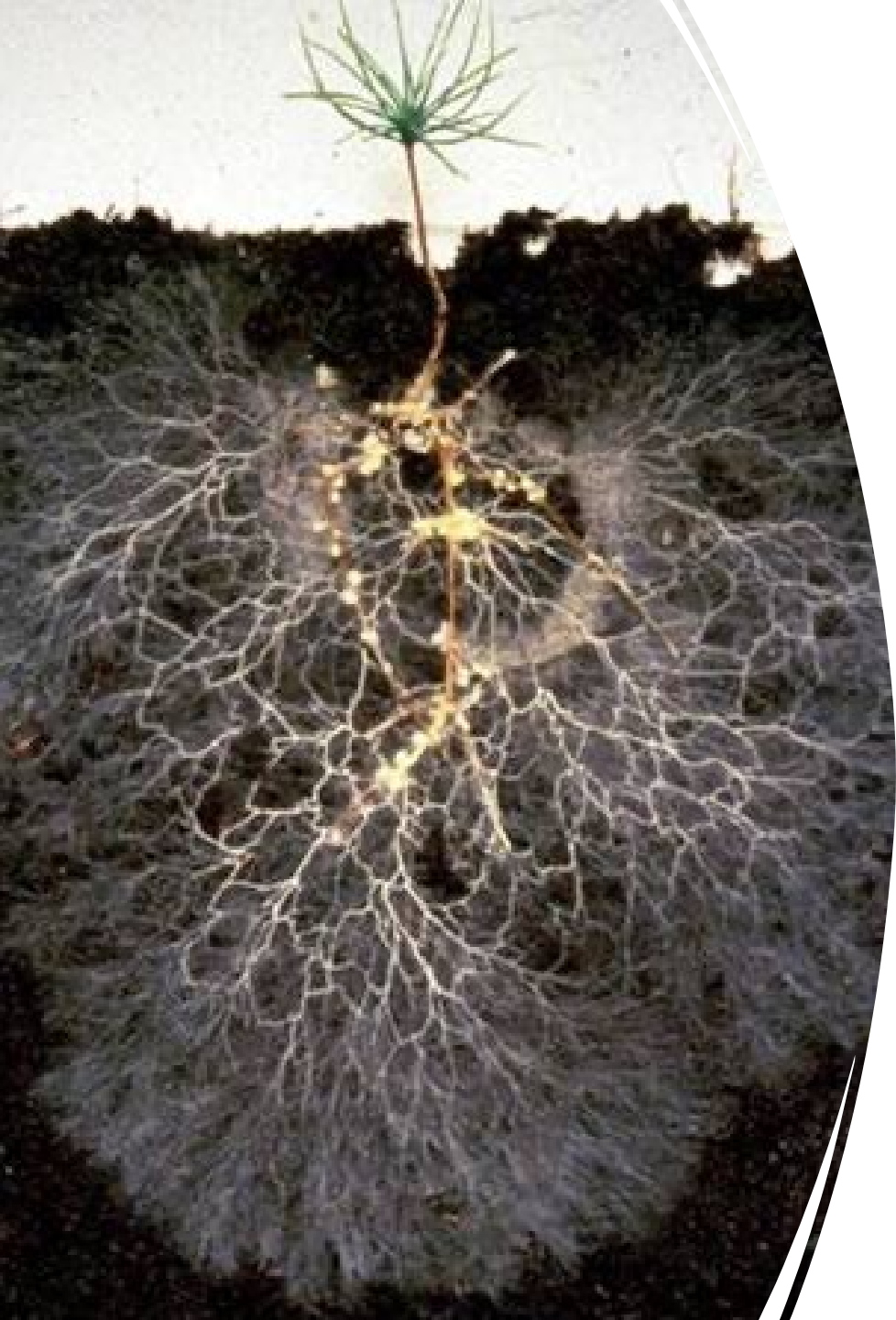
- Source of jokes,
- Novel free food
- Source of dubious mind-bending experiences



**Why did the mushroom go to the party?** 🤔



**Because he's a fungi!** 🤪



# Importance of fungi

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## 1. The collaborators

- 80-90% of all land plant species have symbiotic associations with fungi.

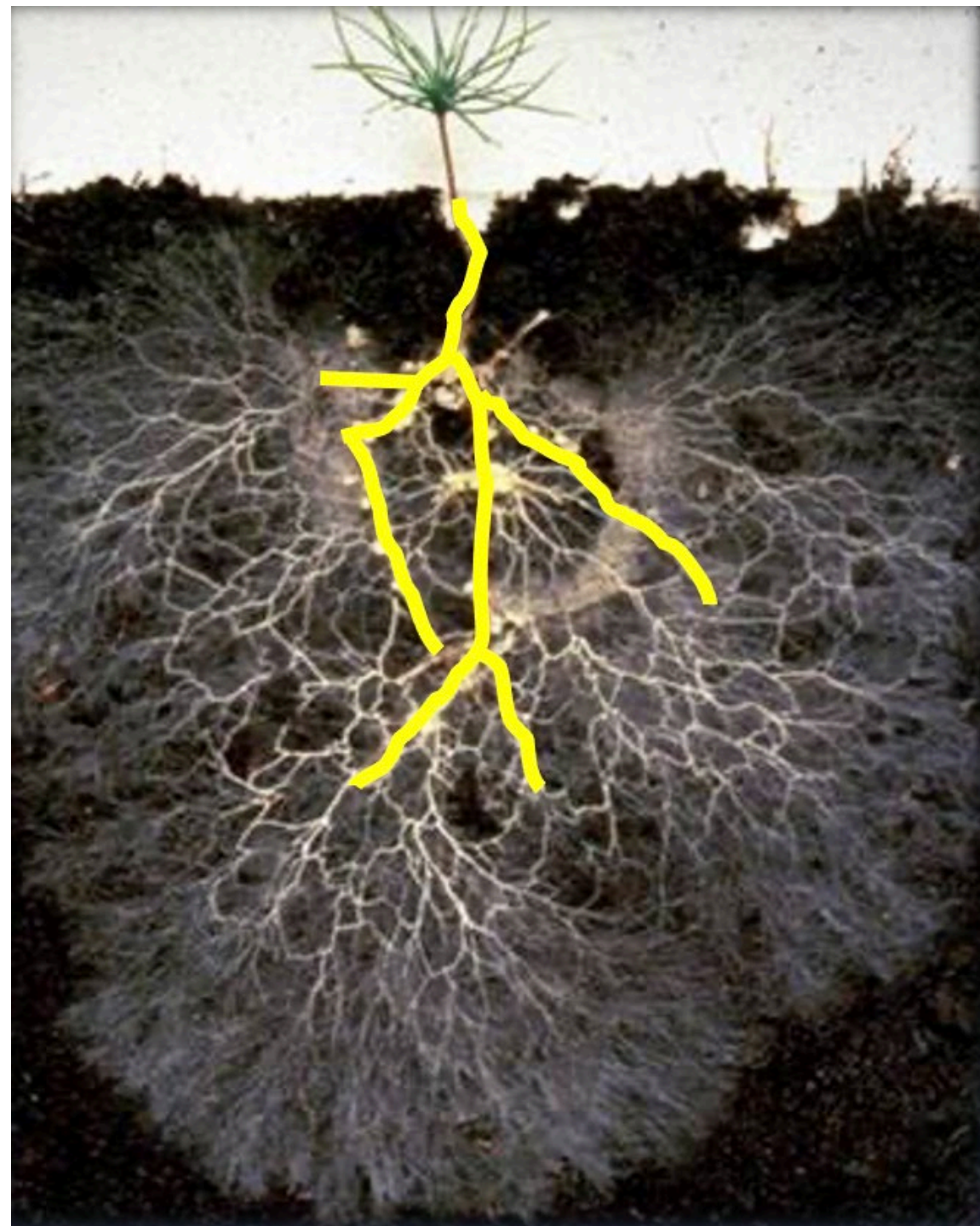


# Importance of fungi

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## Beneficial collaboration between fungi and plants

- Fungal mycelium can multiply the area available for nutrient and water uptake from the soil, for plant roots, **by a factor of 1,000**
- Fungi benefit from sugars made by plants.



What a  
difference  
fungal  
mycorrhiza can  
make!

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## 2. The rotters!

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Without the rotting fungi

- we would be swamped by waste organic matter
- no release of plant nutrients for re-use in growth
- no fertile top soil in which to grow food crops.





# Getting our heads round fungus diversity!

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- 15,000-18,000 fungus species in the UK
- around 4,000 common macro fungi in UK
- at least 1,500 recorded on Isle of Man
- many require microscopy to identify them



# How did we get started on the Isle of Man?

- **Autumn 2012** Fungus identification course with mycologist, Nev Kilkenny
- **2013** Course participants formed the Isle of Man Fungus Group, affiliated to Fungus Conservation Trust.
- **2013** We bought books and microscopes with grants from Manx Lottery Trust.
- **2013-2025** We organized regular forays and recorded what we found
- **2013-2025** We trained with Nev annually with grant assistance from the British Mycological Society and Culture Vannin (charity).
- **2015** British Mycological Society came over for a week (Eef Arnolds introduced us to grassland fungi)
- **Since 2017** We have developed a connection with the NW Fungus Group in England

# Checklist of Fungi of the Isle of Man

## Recording fungi

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We needed to know which fungi we have, where they are and what threatens them.

- Group's 10<sup>th</sup> Anniversary, in 2023, we published a Checklist.
- **1,466 species** in Checklist
- **315 new species** for the island in first 10 years
- Dried specimens go into a “Fungarium”.

Isle of Man Fungus Group  
2023



# Grassland fungi

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- Amenity grassland
- Churchyards
- Farmland
- Gardens
- Roadsides



# Global Fungal Red List

In Global Fungal Red List the Isle of Man has

- 2 species classed Endangered
- 26 Vulnerable
- 1 Near Threatened

The Global Fungal Red List Initiative


Events and Workshops | Species Search | Add New Proposal | Summary and Statistics | About The Initiative | **Activities 2023 (UPDATE)** | IUCN SSC

PROPOSED | UNDER ASSESSMENT | PRELIMINARY ASSESSED | ASSESSED | **VU** PUBLISHED

*Gliophorus europerplexus* Dentinger, A.M. Ainsw. & P.F. Cannon

Search for another species...  
Gliophorus europerplexus Dentinger, A.M. Ainsw....

Scientific name	<i>Gliophorus europerplexus</i>
Author	Dentinger, A.M. Ainsw. & P.F. Cannon
Common names	
IUCN Specialist Group	Mushroom, Bracket and Puffball
Kingdom	Fungi
Phylum	Basidiomycota
Class	Agaricomycetes
Order	Agaricales
Family	Hygrophoraceae
Assessment status	Published
Assessment date	2018-11-01
IUCN Red List Category	<b>VU</b>
IUCN Red List Criteria	A2c+3c+4c
Assessors	Ainsworth, A.M.
Reviewers	Dahlberg, A.



Butterscotch waxcap



## Butterscotch Waxcap

# NBN = National Biodiversity Network

8 records (8 in total)

This map contains both point- and grid-based occurrences at different resolutions



# SSSI selection criteria (2018) for grassland fungi

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In total **17 Manx sites** meet these criteria

- 7 sites have 19 or more waxcap species
- 10 sites have 7 or more clubs, spindles or corals
- 3 sites have 5 or more earthtongues
- 1 site has 3 or more crazed caps, fanvaults and meadowcaps.
- Some sites meet several criteria



## Guidelines for the Selection of Biological SSSIs

### Part 2: Detailed Guidelines for Habitats and Species Groups

#### Chapter 14 Non-lichenised fungi

Authors

Sam Bosanquet, Martyn Ainsworth, Sean Cooch, David Genney & Tim Wilkins



# Other habitats- JNCC criteria

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- Coastal sand dune fungi\*
- Tooth fungi associated with some broadleaved trees
- Caledonian pinewood fungi
- Beech deadwood fungi\*
- Oak deadwood fungi

\*these could be adapted for IOM.



# The fungus-rich grassland database of the Isle of Man

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM				
1	IOM best waxcap sites							High diversity indicators and global red list				In pink																															
2												Includes one or two suspect IDs																															
3	Organised by squares							HDI	HDI	HDI		HDI	HDI	HDI			HDI										HDI			Hygrocybe lepida										HDI	HDI	lepidop	
4		Importance	ranked by number of waxcap	Grid square	Score using IOM weighting	No of high diversity indicators and Global red list	number of species	Porpolomopsis calyptriformis	Hygrocybe spadicea	Hygrocybe punicea	Hygrocybe miniata	Hygrocybe splendissima	Cuphophyllus flavipes	Hygrocybe intermedia	Hygrocybe concolor	Hygrocybe cocinea	Hygrocybe aurantiolepis	Hygrocybe reidi	Hygrocybe glutipes	Hygrocybe quiescens	Glophosus laetus	Hygrocybe helobia	Hygrocybe ceracea	Cuphophyllus pratensis var. pallida	Cuphophyllus pratensis var. pratensis	Neohygrocybe nitrata	Glophosus irigatus	Hygrocybe insipida	Hygrocybe cantharellus	Hygrocybe chlorophana	Cuphophyllus virgineus	Cuphophyllus virgineus var. ochropallida	Cuphophyllus ruscocoriaceus	Glophosus peltatus	Hygrocybe conica	Gloioxanthomyces vitellinus	Cuphophyllus lucmus	Neohygrocybe ovina	Cuphophyllus formica				
5	Global Fungal Red List (2023)							Vulnerable	Vulnerable	Vulnerable		Vulnerable	Vulnerable	Vulnerable			Vulnerable	data deficient		Vulnerable		Near threat				Vulnerable												Endangered	Vulnerable	Vulnerable	Vulnerable		
6	British Red Data Book (2006)							yes																																			
7	Sites																																										
8	Eavystane	International	1 SC27	85	12	25		1		1	1			1	1		0	1	1	1	1		0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
9	Sulby reservoir	International	2 SC38	65	7	23		1	1		1	1		1	1	0																											
10	Douglas head	International	3 SC37	64	7	22		1		1							1	1	1	1	1																						
11	Ballaskyr Fields Kirk Michael	National	4 SC38	67	8	21		1				1							1	1	1																						
12	Glen Rushen fields	National	5 SC27	56	5	20				1	1		1					1	1	1	1																						
13	Douarh Gushen fields	National	5 SC27	56	7	20		1		1							1	1	1	1	1																						
14	Tynwald Green	National	5 SC28	51	6	20							1	1	1			1	1	1	1																						
15	Ayres (including northwards)	National	8 NX40	50	2	18		0	1	0	1	0	0	0		1	1	0	1	0	0	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	
16	Eairy Glas	National	8 SC48	55	5	18				1	1							1	1	1	1		1	1																			
17	Government House	National	8 SC37	43	6	18		1		1							1	1	1	1	1																						
18	Braddan Cemetery	National	8 SC37	43	7	18		1		1				1	1			1	1	1	1																						
19	Inglebreck House fields	National	12 SC38	44	6	18												1	1	1	1																						
20	Point of Ayre fields	National	12 NX30	44	4	17											1	1	1	1	1																						
21	Clype Reservoir	Regional	14 SC38	42	5	16				1	1						1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
22	Rowanby golf club lawn	Regional	14 SC16	33	3	16												1	1	1	1																						
23	Port Erin Promenade	Regional	14 SC16	32	3	16				1								1	1	1	1																						
24	Liaque fields	Regional	14 SC27	34	4	16		1				1						1	1	1	1																						
25	Call	Regional	18 SC16	49	7	15		1		1				1			1	1	1	1	1																						
26	Langness golf course	Regional	18 SC26	36	4	15		0	0		0	0	1	0		0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	
27	Langness - Practice green	Regional	18 SC26	32	3	15											1	1	1	1	1																						
28	St George's churchyard	Regional	18 SC37	33	4	15				1			1				1	1	1	1	1																						
29	Lower Ballabeg	Regional	18 SC48	37	3	15												1	1	1	1																						
30	Eairy Vane	Regional	18 SC38	34	3	15											1	1	1	1	1																						
31	Lower Ballakaghin	Regional	18 SC28	42	3	16		1										1	1	1	1																						
32	Rheaby Moor	Regional	18 SC27	27	2	15												1	1	1	1																						
33	Port y chee meadows	Regional	26 SC37	32	3	14		0	0	1	1	0	0	0	1		1	0	1	0	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	
34	Lhergy Veg	Regional	26 SC38/39	30	3	14		1			1							1	1	1	1																						
35	Rushen mines fields	Regional	26 SC27	33	3	14												1	1	1	1																						
36	Goshen, Ballaugh Curragh	Regional	26 SC39	27	1	14												1	1	1	1																						
37	St Catherine's Port Erin	Regional	26 SC16	13	2	14					7							1	1	1	1																						
38	Glenfaba field no 311836	Regional	26 SC28	40	2	14												1	1	1	1																						
39	Creg y cow	Regional	32 SC38	23	5	13		1				1						1	1	1	1																						
40	Peel headland	Regional	31 SC28	24	2	13		0	0	1	0	0	0	0	0	0	1	0	1	1	1																						
41	Bradda Head	Regional	31 SC16/17	31	3	13		1		1	1							1	1	1	1																						
42	Ballagh Farm, Maughold	Regional	31 SC48	32	3	13													1	1	1																						
43	Ronague Garey fields	Regional	31 SC27	34	5	13		1							1				1	1	1																						
44	Ballaba Dalby	Regional	31 SC27	28	2	13												1	1	1	1																						
45	Eairy Cuthin fields	Regional	31 SC27	28	2	13												1	1	1	1																						
46	Goosenek	Regional	31 SC49	33	4	13		1		1								1	1	1	1																						
47	Peel cemetery	Regional	38 SC28	21	2	11				1								1	1	1	1																						
48	Cregneash	Regional	38 SC16	19	2	11		0	0	1	0	0						1	1	1	1																						
49	Cringie Reservoir	Regional	38 SC27	21	1	12												1	1	1	1																						
50	Patrick churchyard	Regional	38 SC28	22	3	12		1		1									1	1	1																						
51	Eairy Moar	Regional	38 SC38	29	3	12												1	1	1	1																						
52	Cronk y Bing	Regional	43 NX30	27	1	11											1	1	1	1	1																						
53	Braddan field	Regional	43 SC37	19	1	11		1										1	1	1	1																						
54	Erinville Kirk Michael	Regional	43 SC39	28	4	11		1										1	1	1	1																						
55	Santon churchyard	Regional	43 SC37	28	4	11		1										1	1	1	1																						
56	Ballabeg Shevondah	Regional																																									



# Scoring grasslands

## (1) No. of waxcap species.

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- sites with 22 or more species of waxcaps are of international importance
- 3 internationally important sites on the Isle of Man (1 site has 28 waxcaps)
- 10 nationally important sites
- 50 regionally important grasslands

*Rald, 1985; Vesterholt et al., 1999*



# THE FUNGI OF IRISH GRASSLANDS AND THEIR VALUE FOR NATURE CONSERVATION

**Roland McHugh, David Mitchel, Mark Wright and Roy Anderson**

**Table 1—The site classification system of Rald (1985), as adapted by Vesterholt *et al.* (1999).**

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



# Scoring grasslands

## (2) CHEGD score

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- ***Clavarioids*** (clubs, spindles and corals)
- ***Hygrocybe*** spp (waxcaps)
- ***Entoloma*** spp (pinkgills)
- ***Geoglossoids*** (earthtongues)
- ***Dermoloma***,  
*Camarophylloopsis*, *Hodophilus*,  
*Porpoloma* (crazed caps,  
fanvaults and meadowcaps)

IOM max score 44



Dark purple earth-tongue



# Douglas Head ASSI designated for grassland fungi

34.5 ha

22 waxcaps

CHEGD  
score 41





# Farmland fungi conservation incentive

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- Agri-environment Initiatives Scheme
- Option “management of priority habitats”
- £60/acre
- £12,303 was paid to farmers for their management of waxcap grasslands in 2023.
- Many of these important grasslands are sheep grazed and just below the mountain line (edge of moorland)





# Threats to waxcap grasslands

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- Agricultural improvement
- Abandonment
- No-Mow May or No Mow!
- Major engineering works nearby,
- Tree planting

**Waxcaps need grazers or mowers**



# Grassland fungi and development

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Mitigation hierarchy for flower-rich grassland conservation

- a) avoid
- b) move grassland
- c) compensate by creating grasslands elsewhere

Only a) works for waxcap grasslands!

Fungus communities are effectively irreplaceable in any meaningful timescale.





# Mycological impact assessments

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- Survey and assessment – who does it?
- 3 visits in a season, ideally at least 2 seasons.
- Is eDNA analysis better than field survey?
- Can waxcap grassland be moved? Conclusion -not successfully.



Moving large turves of waxcap grassland



# Monitoring- are our conservation measures are working?

- The part we see is only the fruiting body, it is ephemeral
- How many organisms are there? Are they are increasing or decreasing?
- Seasons vary so “same date” surveys not perfect
- Fungi may fruit in some years not others
- Most of the year they are invisible
- eDNA can be used to detect many fungi (most effectively for waxcaps),
- Many drawbacks of eDNA

# Fungi -late-comers to the conservation party!

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- Legislation doesn't recognize the fungi kingdom
- Fungi are treated as honorary plants on Schedule 8 UK WCA 1981 (1 species – hedgehog fungus).
- FCT's UK Red List of fungi has not been adopted
- Habitat surveys tend to miss the fungal diversity

However

- we now have SSSI site selection criteria for fungi
- 60 fungi on Section 41 of NERC Act 2006 UK – “species of principal importance”
- IOM has Wildlife Sites Criteria for fungi (agreed 2025)
- The CBD has recently agreed a Fungal Conservation Pledge







# Challenges of conserving fungi

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- **Lack of knowledge** – difficult kingdom to gather information about
- **Lack of expertise** – people willing to persevere to develop the skills to identify this huge kingdom
- **Lack of appreciation of the importance of fungi**, by the public, policy makers and implementers
- which leads to **lack of fungus conservation legislation** and legal protection for fungi

# Future collaborations to deliver fungus conservation

- A Biodiversity Action Plan for waxcap grasslands
- 16 more waxcap grassland ASSIs (with DEFA)
- Improving our ID skills (joint weekend course with Nev and NWFG UK)
- Talks and walks to raise awareness (public and landowners)
- Protect threatened fungus species on Schedule of Wildlife Act (with DEFA).
- Respond to planning applications (educate planners).
- Compare eDNA results with field survey (collaboration with Aberystwyth University)







## **Fungal Conservation Pledge**

Convention on Biological Diversity calls for parties to integrate fungi into national and international legislation and actions to ensure their unique benefits to ecosystems and people are valued and protected (Oct 2024).

