International Society for Fungal Conservation

Muğla Sıtkı Koçman University

THIRD INTERNATIONAL CONGRESS ON FUNGAL CONSERVATION

Gökova Bay, Akyaka, Muğla, Turkey

11-15 November 2013

PROGRAMME & ABSTRACTS

Organizing Committee

Prof. Dr Mustafa Işıloğlu [Chairman]
Dr D.W. Minter [President ISFC, ex officio]
Dr Hayrünisa Baş Sermenli [Congress Secretary]
Dr Hakan Allı [Congress Treasurer]
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Ms Mehrican Yaradanakul, Mr Ferah Yilmaz

1 November 2013

Welcome

Dear Friends and Colleagues,

Mustafa Işıloğlu
Organizing Committee Chair

Welcome to the 2013 *International Congress on Fungal Conservation* – the third in this series, but the first to be organized by our recently-formed Society. Earlier Congresses were all in Europe, but in keeping with the global character of our Society, this Congress has come to Turkey – a country which straddles Europe and Asia, a country with wonderful fungal diversity, and a country with many young and enthusiastic mycologists anxious to learn about fungal conservation. The more experienced among you have the pleasant duty to pass on your expertise not only in fungi, but also in conservation, to these young people. You have the chance to sow some seeds or rather – this is after all a Congress about fungi – to disperse your spores of knowledge!

The objectives of this Congress are to promote fungal conservation by bringing together activists so that they can:

David Minter
President, *International Society for Fungal Conservation*

- meet, and exchange experience and ideas;
- learn about the existing infrastructure for fungal conservation, particularly within the IUCN;
- learn about political issues relating to fungal conservation;
- report on the status of fungal conservation in each region;
- review scientific work relevant to conservation, particularly in respect of threats to fungi;
- identify the challenges facing fungal conservation;
- develop infrastructure, policies and strategies to deal with those challenges;
- receive training in the red listing process, identification of important fungus areas, and techniques for raising awareness of the importance of fungal conservation.
- make formal awards recognizing achievements in fungal conservation;

This programme has four main but interwoven themes: science, education, infrastructure and politics. These themes recognize that there must be a scientific basis to conservation, that people must be educated to use the evidence provided by that science wisely for conservation, that conservation can only take place if there is an infrastructure to support it, and that all conservation work, by its very character, is a political activity. As a result, different sessions will take different forms. Some will be for paper-reading, typical of a scientific meeting, others will be discussion groups, and the remainder will take the form of training workshops.

The *International Society for Fungal Conservation* is profoundly grateful to the various bodies which have supported this Congress, particularly our hosts **Muğla Sıtkı Koçman University** and **Mikoloji Derneği** (the learned society for mycology in Turkey), and the **Mohamed bin Zayed Species Conservation Fund** which has generously assisted many participants from lower income countries to attend. We hope you all contribute to and benefit from an exciting and stimulating week in this beautiful part of the world, and we hope you enjoy the finest hospitality for which Turkey is justly famous.

With best wishes for a great Congress,

Mustafa Işıloğlu & David Minter

PROGRAMME

Registration

The Registration Desk will be open from on Sunday 10 November from 16.00 to 18.00, and again on Monday 11 November from 08.00 to 11.00. If you arrive at the Congress later than that time, please find Dr Hayrünisa Baş Sermenli, the Congress Secretary, and she will organize your registration.

Monday 11 November

Morning

Welcome, Opening Ceremony, and Presidential Address

09.00-10.00	Prof. Dr Mustafa Işıloğlu, Chairman of the Organizing Committee. Prof. Dr Mansur Harmandar, Rector of Muğla Sıtkı Koçman University. Mr Ahmet Çalca (Mayor of Akyaka).
10.00-10.30	Presidential Address. David Minter, International Society for Fungal Conservation.
10.30-11.00	Morning coffee.

Links to external organizations. Chair: Greg Mueller. Speakers from the wider conservation movement and beyond reflect on how fungal conservation should be projected.

11.00-11.30	Simon Stuart. The IUCN and fungal conservation.
11.30-12.00	Lyn Allison. A former politician's view of fungal conservation.
12.00-12.30	Peter Buchanan. Where do fungi fit with the United Nations? GTI, SBSTTA, CBD, and the sometimes missing F-word!
12.30-13.30	Lunch

Afternoon

Species conservation. Chair: Peter Buchanan. Some examples where fungal conservation is focused on one or a few species.

13.30-14.00	Paul Cannon. *Ophiocordyceps sinensis*, highly prized but highly threatened?
14.00-14.30	Zapi Gonou-Zagou. Assessment and conservation of the critically endangered basidiomycete *Pleurotus nebrodensis* in Greece.
14.30-15.00	Nirmal Harsh. Fungi from forests for food, medicine and livelihood: conservation issues in India.
15.00-15.30	Afternoon tea.

Species conservation [continued]. Chair: Peter Buchanan. Some examples where fungal conservation is focused on one or a few species.

15.30-16.00	Stephanos Diamandis. The conservation status of *Hericium* spp. in Greece.
16.00-16.30	Paul Cannon. The diversity of waxcap fungi in the United Kingdom and implications for their conservation.
16.30-17.00	Olga Nadyeina. Two sides of regional lichen red-listing.
17.00-17.30	Afternoon tea.

Evening

17.30-19.00	Posters.
20.00-23.00	Ice-breaker party (food and drink provided), Yücelen Hotel.

Tuesday 12 November

This day is devoted to a review of fungal conservation in different parts of the world, with reports organized by geographical regions. The day begins in Turkey, the country of this Congress, and the place where Europe and Asia meet, with invited speaker Abdullah Kaya setting the scene.

Morning

Regional reports (1). Chair: Mustafa Işıloğlu.

09.00-09.20 **Asia (Southwestern)**: Turkey. Abdullah Kaya.
09.20-09.40 **Asia (South & Southeastern)**: India. K.V. Sankaran.
09.40-10.00 **Asia (South & Southeastern)**: Malaysia. Andrew Ngadin.
10.00-10.20 **Asia (Northern)**: Russia. Tatyana Svetasheva.
10.20-10.30 Discussion.

10.30-11.00 Morning coffee.

Regional reports (2). Chair: Marieka Gryzenhout.

11.00-11.20 **Africa (Northern)**. Fatma Salim (Egypt).
11.20-11.40 **Africa (Southern)**: Zimbabwe. Cathy Sharp (Zimbabwe).
11.40-12.00 **Australasia**: Australia. Sapphire McMullan-Fisher.
12.00-12.20 **Australasia**: New Zealand. Peter Buchanan.
12.20-12.30 Discussion.

12.30-13.30 Lunch.

Afternoon

Regional reports (3). Chair: Vera Hayova.

13.30-13.50 **Europe**: Switzerland. Beatrice Senn-Irlet.
13.50-14.10 **Europe**: Serbia. Boris Ivančević.
14.10-14.30 **Europe**: Estonia. Katrin Jürgens & Indrek Sell.
14.30-14.50 **Europe**: Macedonia. Mitko Karadalev.
14.50-15.00 Discussion.

15.00-15.30 Afternoon tea.

Regional reports (4). Chair: Esperanza Franco-Molano.

15.30-15.50 **The Caribbean, Central & South America**. Teresita Iturriaga.
15.50-16.10 **South America (Southern)**: Chile. Giuliana Furci.
16.10-16.30 **South America (Northern)**: Colombia. Aida Vasco-Palacios.
16.30-16.50 **North America**. Greg Mueller.
16.50-17.00 Discussion.

17.00-17.30 Refreshments.

Evening

17.30-19.00 This time is set aside for meetings of regional groups and of IUCN Species Survival Commission fungal specialist groups.

Wednesday 13 November

Morning

09.00-10.30 Plenary session. International Society for Fungal Conservation, General Assembly.

10.30-11.00 Morning coffee.

11.00-17.00 Excursion to Kazancı area and Çiçekli village (two sites and surrounding forests). This will involve coach rides and some walking (up to 6 km at the second site). The area, which rises to around 400 m above sea level, is not protected. It is, however, rich in fungi, and has typically Mediterranean forest vegetation, including arbutus, heathers, lavender, oaks, pine and thyme. There is a wide range of interesting animals, including ants, bees, birds, wild boar, butterflies, squirrels, scorpions and snakes (not poisonous).

Evening

20.00-23.00 Congress Dinner & Cultural Event, Yücelen Hotel.

Thursday 14 November

This is a day of workshops. All participants are asked to attend the **Mohamed Bin Zayed Red-listing Workshop** led by Michael Krikorev & Greg Mueller, which is the single most important item on the programme of this Congress. To ensure that numbers are manageable, that workshop will be held twice: first in the morning, then again in the afternoon. Each participant will be allocated a place at one of these sessions. Two other smaller workshops entitled **Fungal Conservation: raising awareness** and **Conservation of Myxomycetes** will run in parallel. These two workshops will also be repeated, so that all participants will be able to attend all workshops. In the evening, there will be a further workshop on **Conservation of Desert Truffles: an example of how to use information sources for red-listing**.

Morning (coffee break 10.30-11.00)

09.00-12.30 **The Mohamed bin Zayed Species Conservation Fund Global Fungal Red List Initiative**. Leaders: Michael Krikorev & Greg Mueller [main workshop].

09.00-10.30 **Fungal Conservation: raising awareness**. Leader: David Minter [parallel alternative workshop].

11.00-12.30 **Conservation of Myxomycetes**. Leader: Tatiana Krivomaz [parallel alternative workshop supported by the **Mohamed bin Zayed Species Conservation Fund**].

Lunch (12.30-13.30)

Afternoon (tea break 15.00-15.30)

13.30-17.00 **The Mohamed bin Zayed Species Conservation Fund Global Fungal Red List Initiative**. Leaders: Michael Krikorev & Greg Mueller (repeated).

13.30-15.00 **Fungal Conservation: raising awareness**. Leader: David Minter [parallel alternative workshop].

15.30-17.00 **Conservation of Myxomycetes**. Leader: Tatiana Krivomaz [parallel alternative workshop supported by the **Mohamed bin Zayed Species Conservation Fund**].

Refreshments (17.00-17.30)

Evening

17.30-19.00 **Conservation of Desert Truffles: an example of how to use information sources for red-listing**. Leader: David Minter [workshop supported by the **Mohamed bin Zayed Species Conservation Fund**].

Friday 15 November

Morning

Fungal conservation in culture and education. Chair: Stephanos Diamandis.

09.00-09.30 Alison Pouliot. Myco-entanglement - exploring fungi as a means of inspiring biodiversity conservation.
09.30-10.00 Cathy Sharp. Preliminary results of a survey to determine the perception of a mushroom in Zimbabwean children.
10.00-10.30 Maria Ławrynowicz. The Białowieża Forest - a UNESCO World Heritage Site.

10.30-11.00 Morning coffee.

Ecology of fungal conservation. Chair: K.V. Sankaran.

11.00-11.30 Claudia Perini. Fungi and the action plan for the conservation of biodiversity: What happens in Tuscany (Italy)?
11.30-12.00 Lyn Allison. Inner urban parkland revegetation, biodiversity and the possibilities of fungal conservation.
12.00-12.30 Paola Angelini. Macrofungal diversity and ecology in a Site of Community Importance (SCO) of Umbria (central Italy).

12.30-13.30 Lunch.

Afternoon

In situ and ex situ fungal conservation. Chair: Paul Cannon.

13.30-14.00 Sapphire McMullan-Fisher. Does managing vegetation act as a sufficient umbrella for managing Tasmanian macrofungi?
14.00-14.30 Mary Apetorgbor. Diversity of macrofungi and plant species in two different ecological zones in Ghana.
14.30-15.00 Nirmal Harsh. Ex situ conservation of fungi from forests of India - a national type culture collection.

15.00-15.30 Closing ceremony.

End of meeting

ABSTRACTS OF ORAL PRESENTATIONS

Sessions on 11 November 2013

The International Society for Fungal Conservation Presidential Address [1]

Minter, D.W.

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The movement to conserve fungi can be traced back past Oslo in 1995 (when the *European Council for Conservation of Fungi* was established), to work by pioneer lichenologists and mycologists more than half a century earlier, but compared with conservation of animals and plants, fungal conservation is "the new kid on the block". The first International Congress on Fungal Conservation (Córdoba, Spain, 2007) brought the need to protect fungi onto the world stage. The second Congress (Whitby, UK, 2009) addressed education, infrastructure and politics as necessary components of fungal conservation. That was followed in 2010 by establishment of our Society at an extra-ordinary meeting of about 50 Founder Members at the Royal Botanic Garden, Edinburgh. Three years later, membership of the Society has already increased sixfold, and much has been achieved.

The Society's first success - even before its constitution was agreed - was to convince delegates at the Nagoya Summit of Rio Convention countries that the Global Strategy for Plant Conservation should be changed so that fungi were not confused with plants, and that separate measures to protect fungi should be recognized. Next, a draft constitution was discussed and adopted by Founder Members, and the first elections for officers were held. A debate on policy followed, a website was put together [www.fungal-conservation.org], and the Society's on-line publication, *Fungal Conservation*, launched.

It rapidly became clear that, to achieve the Society's aims, much greater public awareness of fungi was essential. Rather than re-invent the wheel, the Society has studied and learned from other organizations representing undervalued groups. This has led to a campaign to draw attention to phrases such as "flora and fauna", which give the impression of covering all wildlife but are in fact deeply prejudicial and invariably lead to exclusion of the fungi. Among the many impacts of this prejudicial phrase, the neglect of fungi by the Rio Convention is perhaps the most shocking. The Society has therefore initiated an "Orphans of Rio" campaign, to press for fungi to be included in all conservation plans. Promotional material from that campaign appears on the back of this Programme and Abstracts Volume.

The Society has also established simple objective criteria to review national reports by Rio Convention countries from the perspective of fungal conservation. Reports from over 100 countries have so far been evaluated. All have been scored as inadequate at best and, at worst, totally deficient. The evaluations can be seen on the Society's website [www.fungal-conservation.org/micheli.htm]. With no financial resources, the campaign to educate the public about fungi has been carried out on the Internet, notably by editing pages of the English language version of Wikipedia, which, although often disparaged, is in reality the first place most people now go to for encyclopaedic information. Pages devoted to fungi have not been the target. They are written by mycologists and are generally of a high quality. Efforts have instead been directed to pages dealing with individual countries. Many have a section on "Flora and fauna". These are being edited to include fungi. Examples include Bhutan, China, Egypt, Georgia and Venezuela (but there are many others).

Through collaboration with IUCN Species Survival Commission fungal specialist group chairs, and thanks to the enlightened and positive attitude of the IUCN, fungi are now as a matter of policy recognized as central to the aims of that organization. The Society has campaigned to include fungi in the National Curriculum for Schools in England, and strongly supports the IUCN initiative to promote red-listing of fungi, so generously supported by the Mohamed bin Zayed Species Conservation Fund.

Priorities for the future are to develop a sound financial platform for the Society, and to promote closer links with lichenologists, from whom we have much to learn. We must motivate Members to initiate conservation actions in their own countries, and promote establishment of regional, national and local fungal conservation societies. We must also make the public aware of fungi, and promote an understanding that terms like “flora and fauna” are damaging. Fungi need to be recognized as different from animals, micro-organisms and plants. They are a separate, independent biological kingdom.

The IUCN and fungal conservation [2]

Stuart, S.

Chair, Species Survival Commission,
International Union for Conservation of Nature.
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The IUCN is the world’s oldest and largest global environmental organization. Six commissions involving 10,000 volunteer experts from a range of disciplines form a major component of its structure. One of these, the Species Survival Commission, advises the IUCN on technical issues of species conservation, and mobilizes action for those species which are threatened with extinction. The Species Survival Commission itself contains over 120 Specialist Groups. It is also responsible for the IUCN’s red-listing programme. In 2007, the Species Survival Commission had two specialist groups representing the fungi, one for lichen-forming species, the other for everything else. Those two groups were listed among the plants. It now has five groups, covering chytrids, zygomycetes, downy mildews and slime moulds (chair Mayra Camino, Cuba), cup fungi, truffles and their allies (chair David Minter, UK), lichen-forming fungi (co-chairs Christoph Scheidegger, Switzerland and Olga Nadyeina, Ukraine), mushrooms, brackets and puffballs (chair Greg Mueller, USA), and rusts and smuts (chair Cvetomir Denchev, Bulgaria), and these groups are listed as fungi, separate from plants. The five fungal specialist groups provided significant impetus towards formation of the International Society for Fungal Conservation, and they now work closely with that society. IUCN policy is determined by Congresses held every four years. At the 2012 Congress in South Korea, for the first time ever, fungi were discussed, and a motion drawing attention to their importance in conservation was passed by an overwhelming majority. The IUCN is now gradually implementing that policy, and the first appointment of a mycologist to the Steering Committee of the Species Survival Commission has already been made.

Where do fungi fit with the United Nations? GTI, SBSTTA, CBD, and the sometimes missing F-word! [3]

Buchanan, P.K.

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The Global Taxonomy Initiative [GTI] seeks to further the science of taxonomy or systematics across the globe, and recognition of its multiple applications. The GTI arose from the Rio Convention on Biological Diversity [CBD], and covers all groups of organisms including fungi. Its Council (or “Coordinating Mechanism”) meets in conjunction with the Subsidiary Body on Scientific, Technical and Technological Advice [SBSTTA] as part of the CBD’s machinery, often in Montreal but also in other locations around the world. Of the approximately 20 members of the GTI Coordination Mechanism, mycology is represented by two appointees, Kevin McCluskey from USA and myself. Challenges include coping with the jargon of international negotiations and agreements, and gaining approval for initiatives from the 190+ member nations of the CBD. During 2010-2011, the global Capacity-Building Strategy was developed by the GTI, and this strategy was eventually endorsed by CBD delegates. An review of GTI and SBSTTA meetings will be provided, along with a summary of the GTI Capacity-Building Strategy, expectations of national responses to this Strategy, and the relevance of the GTI to mycology and fungal conservation.

A former politician's view on fungal conservation [4]

Allison, L.F.

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Australia's Environment Protection Biodiversity Conservation Act. Australia's world-leading federal environment protection laws require approval for projects that threaten matters of national environmental significance (previously the jurisdiction of state governments). Among other objectives they aim to protect native species and promote conservation of biodiversity. The Act creates a process for listing species and ecological communities as nationally threatened and in the 14 years of operation, 446 species of animals, 1310 species of plants and 66 ecological communities have been listed. However, there is still no trigger for projects with significant greenhouse gas emissions or developments in national parks, forestry is largely exempt and ecosystems of national significance are not protected. The independent 10-year review in 2009 found the Act was meeting its objectives and recommended various improvements. An analysis of the political climate on conservation and threats to federal conservation law will be made and implications drawn for fungal conservation.

Advice on campaigning. Scientists and small conservation groups rarely have the interest, resources or wherewithal to run effective lobbying campaigns and as a result, their time is often wasted. Strategies in running campaigns and an understanding of how parliaments and parliamentarians can be persuaded to assist will be offered.

Ophiocordyceps sinensis, highly prized but highly threatened? [5]

Cannon, P.F.

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Ophiocordyceps sinensis as currently circumscribed is a parasite of ghost moths, and is widely distributed across the southern Tibetan plateau and eastern Himalaya. It is heavily exploited as a prized component of traditional oriental medicinal treatments. Many indigenous peoples depend on its harvest for a major part of their income. Its commercial value has soared in recent years, partly due to its high status among the emerging Chinese middle class, and top-quality stromata have been sold for anything up to US$ 90000/kg in high-end Beijing medicinal emporia.

There are currently several barriers to the development of objective conservation management strategies for this fungus, not least emerging evidence that it represents a species complex with high diversity especially in the southern Himalayan valleys. There have been some attempts to assess population size and trends, using both direct analysis of research plots and indirect assessments of harvest levels. Cultivation has been attempted by many researchers, but no clear evidence has emerged to date of commercially viable methods. There have also been evolving regulatory instruments in the various countries within which *O. sinensis* is native, including laws on harvest dates, number of harvesters and collection methods. However, it is difficult to assess the impact of these measures due to incomplete data and probable widespread circumvention of laws. Anecdotal evidence suggests strongly that populations are in decline, and that habitats have been extensively degraded by the harvest.

There have been recent attempts to assign flagship species status to the fungus, to increase its profile within the conservation world and to emphasize that the species is in need of protection. Coordination between the nations involved has been somewhat problematic, and so far the transition from scientific problem to political issue is incomplete.

Assessment and conservation of the critically endangered basidiomycete *Pleurotus nebrodensis* in Greece [6]

Gonou-Zagou, Z.[1], **Ntertilis, M.**[2], **Triantafyllou, M.**[1], **Vassiliades, D.**[3], **Kouvelis, V.N.**[2]

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Pleurotus nebrodensis is a distinct species of the *Pleurotaceae* (*Basidiomycota*), formerly belonging to the *Pleurotus eryngii* species-complex, the latter comprising taxa with different distributions around the world, at various altitudes and colonizing plant residues of the family *Apiaceae* (*Umbelliferae*). *Pleurotus nebrodensis* was found recently in Greece, in open areas and pastures at high altitudes, growing during spring (May-June) in close relationship with *Cachrys ferulacea* (Gonou-Zagou, 2007). It was collected and recorded for the first time in Greece in 1998, from a mountainous place in northern Peloponessos and some years later was found in two other localities, one from northern Peloponessos and another from central Greece. Before these discoveries, the species was known in Europe only from Madonie mountain in Sicily, Italy, the type locality (Gargano *et al.*, 2011). Worldwide, in addition to European records, the species has been found in only a few localities in Asia (Iran, China). It is highly appreciated and prized as a culinary mushroom. *Pleurotus nebrodensis* was included in the “Top 50” Mediterranean Island Plants (Montmollin & Strahm, 2005), though not a plant, and since 2006, in the IUCN Red List of Endangered Species characterized as Critically Endangered CR (Venturella, 2006).

Although *P. nebrodensis* was discovered quite recently in Greece, it very quickly became well-known for its gastronomic properties, resulting in a sharp increase in numbers of mushroom pickers. No information on the population status of the species and its fluctuation in the three known Greek localities is available. No legislation exists in Greece for protection of this species (or of any other fungal species) from over-collecting or other threats. The aims of our survey are to record and assess the extent of occurrence area and the wild population size of *P. nebrodensis* in its habitats in Greece, to verify the threats that this endangered species faces, and finally to propose measures for its protection and conservation *in-situ* and *ex-situ*. Thorough examination of macro- and microscopical characters of the basidiomata and its pure culture isolates, as well as molecular analysis based on sequences of strains of *P. nebrodensis* and its close species relatives were included in the study for determining intra- and inter-specific variability. In this way, the sequences which present the largest potential will be used as molecular markers for monitoring native populations of *P. nebrodensis* in Greece.

The survey of *P. nebrodensis* is partly financed by the Mohamed bin Zayed Species Conservation Fund.

References

Gargano, M..L., Saitta, A., Zervakis, G. & Venturella, G. (2011). Building the jigsaw puzzle of the critically endangered *Pleurotus nebrodensis*: historical collection sites and an emended description. *Mycotaxon* **115**: 107-114.

Gonou-Zagou Z. (2007). The *Pleurotus eryngii* species complex from Greece. Abstracts of the XV Congress of European Mycologists, St Petersburg, Russia, p. 39.

Montmollin, B. & Strahm, W. (2005). *The Top 50 Mediterranean Island Plants: wild plants at the brink of extinction, and what is needed to save them*. IUCN/SSC Mediterranean Islands Plant Specialist Group. IUCN, Gland, Switzerland & Cambridge.

Venturella, G. (2006). *Pleurotus nebrodensis*. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. [www.iucnredlist.org downloaded on 15 October 2013].

Fungi from forests for food, medicine and livelihood: conservation issues in India [7]

Harsh, N.S.K.

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Many wild fungi are collected for food, medicine and as a livelihood by people living in and around Indian forests. This can lead to over-exploitation and possibly negative impacts on populations. In 15 central Indian tribal markets surveyed betwen 1995 and 2000, nearly 2.5 tonnes of basidiomata of *Termitomyces* species (associated with termite fungal combs and mounds) were sold annually during the growing season (monsoon months). We observed that during these years the quantity being brought to the market is in decline. Another edible fungus collected from hills of north India is the morel (*Morchella esculenta*), valued globally for its culinary qualities. Nearly 65 tonnes of dried morels are exported annually to international markets from India. Recent reports suggest that this quantity is declining. The decline is attributed to climate change, but over-exploitation and habitat destruction cannot be ruled out. The caterpillar fungus (*Ophiocordyceps sinensis*) is an important nutraceutical fungus. It is collected from alpine meadows of the Himalaya for the Chinese market where prices can reach US$ 10000 per kilogram. Excepting the elderly and very young, whole villages relocate to alpine meadows taking makeshift tents, bedding and food for nearly three months as soon as snow starts melting in March or April in the collecting areas. Before 1995 there were few collectors, but numbers are now greatly increased. Harvests have declined since 2007, possibly as a result of collecting pressure and disturbance of the fragile montane habitat. State governments in affected areas now regulate collection through village co-operative bodies. In central India wood decay fungi (*Lenzites acuta*, *L. vespacea*, *Microporus xanthopus*, *Trametes cingulata*, *T. elegans*, *T. lactinea* etc.) are collected in bulk from forests by local tribes and fetch about US$ 20 per kilogram on the international market. Ever since our first report in 1995, the harvests of these fungi have gradually declined. The decline has again been attributed to over-exploitation leading to habitat destruction, and the state government has taken steps to ban collection of these fungi. Human activities have caused an unprecedented decline in biodiversity. Species are becoming extinct a thousand times faster than the natural rate, and this is compounded by climate change. Growth of large urban areas, construction of dams, buildings and roads, encroachment on forests for arable farming and mining operations are depleting biodiversity. Over-exploitation of biological resources aggravates the situation. To conserve and use fungal diversity sustainably, prevailing policies must be understood. Conservation needs legal support to frame appropriate regulatory mechanisms for collection and trade in wild mushrooms.

The conservation status of *Hericium* spp. in Greece [8]

Diamandis, S.

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The genus *Hericium* includes 3 species in Greece. *Hericium erinaceus* occurs mainly on old, living trees and dead wood of native Hungarian oak (*Quercus frainetto*) and introduced Persian silk trees (*Albizia julibrissin*) which are planted in cities for amenity purposes. *Hericium clathroides* also grows on old, living trees and dead wood of Hungarian oak, as well as beech (*Fagus sylvatica*), while *H. coralloides* grows on dead wood of Norway spruce (*Picea abies*). Carpophores of all 3 species are well known among mushroom lovers for their culinary properties and, although considered rare, are picked enthusiastically.

Old oaks are felled during management operations drastically limiting the habitat of *H. clathroides* and *H. erinaceus*. *Albizia julibrissin* trees in the cities are heavily pruned on an annual basis assisting in the dissemination of the fungus which forms its carpophores on pruning sections. Unfortunately, in the last 10 years, *A. julibrissin* has been heavily infected by *Fusarium oxysporum* fsp. *perniciosum* which kills the trees within 1-2 years. The disease has spread rapidly in several cities of Greece, apparently by means of infected planting material and pruning tools. City authorities remove dead and diseased trees and, furthermore, have ceased planting new trees of this species.

Heavy picking of carpophores of *H. erinaceus* and *H. clathroides* and the loss of their habitat threaten these 2 species in Greece. *Hericium coralloides* seems to be the only species not obviously threatened in this way; however, restriction of picking should be imposed. Cultivation of *H. clathroides* may help ameliorate the conservation status of the three *Hericium* spp. in Greece. The long-term strategy of the Forest Service should be to keep intact old, Hungarian oaks as valuable habitats for biodiversity.

The diversity of waxcap fungi in the United Kingdom and implications for their conservation [9]

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Waxcaps (*Hygrocybe* species and their relatives) have a relatively high conservation profile in Britain and many other countries of Europe, due to their attractive coloration and their typical habitats in fragile nutrient-poor grasslands. They are threatened especially by agricultural fertilizers, applied to “improve” the grasslands for grazing, and possibly by other human-mediated N sources. The number of waxcap species present in a particular site has been used as an indicator of environmental quality, potentially leading to statutory protection of sites with high waxcap diversity.

Despite this high profile, molecular methods have hardly been used to review species concepts and facilitate diagnosis. With the assistance of around 80 UK fungus recording groups and experts, we carried out an ITS-based survey of waxcap diversity within Great Britain and Northern Ireland. Nearly 400 collections from most of the 51 recognized morphotaxa were sequenced. We found that many of the morphotaxa masked significant cryptic speciation, and at least 96 species are now thought to occur in the UK. That number may well increase further with additional sequencing. The process of analyzing these cryptic species and correlating molecular diagnostic data with morphological and ecological data has only just begun, but we have recently introduced two novel species within the *Gliophorus psittacinus* clade using a combination of molecular and morphological evidence. Additionally, it appears that some of the taxa currently recognized in the UK are different from those encountered in central Europe, based on comparison of our sequences with those published by a group from Hungary.

Molecular methods provide powerful new tools for analyzing fungal diversity, but the results are not always easy to correlate with traditional species concepts accepted by the citizen science community. There is however some further potential for recognition of new taxa using field- and microscope-based techniques. Whether or not the new taxa are easily recognizable from external phenetic characters, they are valid evolutionary units with their own ecology, distribution and conservation needs. Site assessment methods using species numbers as indicators of quality will need to be reviewed.

Two sides of regional lichen red-listing [10]

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IUCN red lists at global and regional levels have become a scientifically objective and widely accepted instrument for prioritizing species conservation of various groups of organisms. The criteria that enable assessment of red-list categories can be applied to animals, fungi (including lichens) and plants.

National red lists of lichens have now been published in many Asian and European countries, but continental and global assessments of lichens are still lacking. There are three major obstacles that make red-listing of lichens a problem at local as well as at larger geographic levels: incomplete floristic and taxonomic knowledge of taxa, a lack of data on species populations and an often unfathomable reluctance of some funding agencies when it comes to support conservation projects outside the standard pets and petioles. We will discuss two case studies addressing the first two problems.

Cetraria aculeata and *C. steppae* are two closely related species. The taxonomic status *C. steppae*, a taxon of arid regions has been questioned, as its morphology varies greatly and its distribution range overlaps with the globally distributed *C. aculeata*. Numerous doubtful records made a national red list assessment of both taxa difficult. Our recent study considered *C. steppae* to be conspecific with *C. aculeata* based on morphology, secondary chemistry and ecology. Based on local population studies, as well as current and historical distribution data, we have recently assessed the national Red List status of *C. aculeata* s.l. in Ukraine according to the IUCN criteria.

Another taxon, *Lobaria pulmonaria* is charismatic and taxonomically certain. The species is widespread in Europe and elsewhere in the northern hemisphere. Although it has declined tremendously in most European countries, red-listing at a continental level has so far been difficult because information on historical decline of population size, extent of occurrence and the area of occupancy is incomplete for large parts of its geographical distribution. Recent molecular studies revealed several distinct genepools with different geographic distribution and ecological niche differentiation. These studies enable us to consider genepools as distinct evolutionarily significant units and thus to evaluate distinct genepools against Red List criteria.

ABSTRACTS OF ORAL PRESENTATIONS

Sessions on 12 November 2013

Macromycetes from Yavuzeli (Gaziantep-Turkey) District [11]

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In a preliminary study into diversity of larger fungi in Gaziantep province of Turkey, 117 samples were collected within the boundaries of Yavuzeli district between 2009 and 2013. Each sample was photographed in its natural habitat and then identified using available literature and standard mycological techniques: 41 taxa belonging to 36 genera and 21 families were identified. All were new for the region. They included 3 Ascomycota and 38 Basidiomycota. The *Tricholomataceae* was the most frequent family, with 6 taxa. Two families (*Agaricaceae* and *Marasmiaceae*) were represented by 5 taxa, were followed by *Psathyrellaceae* and *Strophariaceae* with 4 taxa each.

The area has a Mediterranean climate and falls mainly in Irano-Turanian phytogeographical sector within the holoarctic floral kingdom. Although naturally growing woody plant cover is almost entirely *Quercus* L. spp., members of *Populus* L. and *Salix* L., and planted *Pinus brutia* Ten. also occur. This scarcity of woody plants may limit diversity of larger fungi in the region. Destruction of forests seems to be the most important threat to the region's fungi. Though such impacts affect the IUCN red data category of many taxa, there is still no study of the conservation status of Turkish fungi.

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Attempts at fungal conservation in India – where do we stand? [12]

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Tropical countries are grossly underexplored for fungi. In India, parts of which are considered as biodiversity hotspots, only 27,000 species of fungi have been recorded so far. If the fungus-plant ratio of 6:1 proposed for the tropics by Prof. Hawksworth is applied, the number of fungal species in India can be estimated as greater than 250,000 (colonizing the approximately 42,000 plant species known to occur). This means that hardly 10% of the country's fungi are known. Of the recorded fungi, some groups such as endobionts, entomogenous fungi and hypogeous fungi, and chytrids and zygomycetes are poorly represented due to a shortage of specialists. Beyond this, the main constraints to study fungal diversity in India include lack of training in fungal identification using classical and molecular methods, shortage of fungal repositories and reference books, non-availability of funds for taxonomic studies and difficulty in convincing politicians and policy makers of the importance of conserving fungi. At the same time, species are being lost at an alarming rate due to destruction and degradation of habitats, grazing, and incidence of fire, pollution, application of pesticides and fertilizers and invasion by alien species. At this juncture, conservation of species has become a 'now or never' challenge.

A review of conservation strategies adopted in the country show that attempts *in situ* such as protection of natural habitats and ecological niches from degradation and destruction, fire protection measures, control of air and soil pollution, management of invasive alien species are grossly inadequate to conserve any species, let alone fungi. And, the 'so-called' rules and regulations for biodiversity

conservation have not been successfully implemented anywhere. This situation will continue unless there is an urgent awakening among all concerned and resultant action for conservation of species. *Ex-situ* conservation should ideally complement *in situ*. There are different methods for storing fungal cultures and India has 3 main culture collection centres, the MTCC based at Chandigarh, the ITCC at IARI, New Delhi and the NFCCI based at Agharkar Research Institute at Pune. Each these centres holds several thousand fungal cultures. Reference collections of plant pathogens, agarics, polypores and lichens are also maintained in those institutions and in several universities, and most are in good shape. However, additional well maintained culture collections and reference collections would undoubtedly aid basic biodiversity research and concomitant conservation work.

In summary, Indian forests and other habitats are rich in diverse fungi, many still unknown to science. The expertise of Indian mycologists is, however, limited and scattered; confusion is rampant on what is already known, which names are correct, how to ascertain novelty of a species and what is new in taxonomic ranking. There are no concerted efforts to unravel the rich fungal diversity and conserve it before unknown species are lost forever. In this connection, the International Society of Fungal Conservation can play a big role by setting a stage for collaborative efforts between countries to share expertise and knowledge. Indian Scientists have already made a move in this direction. An India-UK networking seminar on “Providing a Scientific Basis for Fungal Conservation” was held in Kerala, India during 21-23 November 2011. It discussed areas for collaboration between Indian and British scientists. Work on some of the joint efforts agreed upon during the seminar such as creating new websites for ‘Fungi of India’ and ‘Fungi recorded on Eucalypts’ are nearing completion. Establishing an Indian Society for Fungal Conservation will hopefully help in promoting fungal conservation in India.

Fungal diversity and conservation in Malaysia [13]

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Although a hugely diverse biological kingdom, only 3804 fungi and fungal-like organisms are listed in the checklist of Malaysian fungi (Lee *et al.*, 2012). This is still a small figure, indicating that Fungi have not been reported or studied well in Malaysia. There is now increasing concern about fungal conservation: impacts of environmental change and land management, including habitat loss, pollution and climate change all affect fungi. The diversity and distribution of fungi in peninsular Malaysia is currently being studied through collecting in several areas. As a result the checklist is being updated. In particular, a comparison is being made between fungal collections of peninsular Malaysia and those from east coast islands. There is also now some *ex-situ* conservation of fungi in Malaysia, with cultures deposited in the Microbial Culture Collection Unit (UNiCC) and the Forestry Research Institute Malaysia (FRIM) for long-term preservation, security, and accessibility. There are vast areas still unexplored in Malaysia, particularly in the states of Sabah and Sarawak on the island of Borneo. Doubtless many more fungi will be discovered to be added to the checklist. To do this will need many mycologists and funds to explore and develop appropriate conservation strategies including promoting awareness about conservation programmes in Malaysia.

Some approaches to fungal conservation in Russia [14]

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As the world’s largest country, Russia’s size makes it difficult to assess adequately what is being done there in fungal conservation. Of its 83 administrative regions, 80 have regional Red Data Books [RDB].

A second edition of these books exists in 20 of those regions. In the remaining 3 regions red data lists have been prepared and are awaiting publication. Over the past ten years, there was significant progress: in 2003 there were 38 RDBs, now there are 75 and 3 approved lists, with 19 regional RDBs being published from 2010 to 2013. Five of the books contain no fungi, while the remaining 75 have special sections devoted to fungi. To date, in total, nearly 700 species of fungi (compared with 340 in 2003) and 22 species of myxomycetes are listed in Russia's regional RDBs.

More than 20 monographs on regional fungal diversity were published over the last five years. Some cover large geographical areas, for example the *Mycobiota of Belarus-Valday Lakeland* (2013), *Mycobiota of Arid Areas of the Russian South-West* (2012) and *Fungi of Ussuri River Valley* (2011). Besides inventorial works, mycologists in 38 regions are monitoring rare species. About 70 publications during 2010-2013 were focused on monitoring, and the total number of publications in that period (monographs, articles, abstracts) dedicated to fungal diversity, monitoring, and recording of new and rare species is more than 250.

There are very few mycologists actively working with conservation of fungal diversity in Russia. Only about 80 people regularly published findings and new data (about 1 person/200000 km^2), and even these scant mycological resources are unevenly distributed. There are "hot-spots of mycologists" in northwest Russia, in several regions around Moscow, and in regions of the southwest, around the Volga, the Urals, the south of western Siberia, and the Far East. These groups have established scientific schools and developed their own views on fungal conservation. As a result, there are several approaches to inclusion of fungi in RDBs. Here are some examples.

1. RDBs of 7 regions contain 1–5 fungal species. Reasons: lack of regional mycologists; lack of data.
2. RDBs of 27 regions contain 5–15 species of fungi. Reasons: insufficient data; often the lack of mycologists; persistence of the tradition to include only species perceived as "beautiful". More often and very important, bureaucratic obstacles ("you can prove anything you like and include any species you like, but not more than 5 units").
3. RDBs of 28 regions contain 16–29 species. In most cases there are mycologists in these regions. They accept the current norm that RDBs do contain many species of fungi. They include only species having accurate information about rarity. Their stance may also reflect a timidity to exceed the standard adopted at national level (Red Data Book of Russian Federation, 1988, 2008).
4. RDBs of 14 regions contain 30–65 species, often with separate lists of species in need of monitoring. Mycologists of these regions are usually very active, with their own point of view. They are able, on the one hand, to investigate fungi on their territories in detail and, on the other hand, to establish the necessary relationships with officials. These mycologists usually use a range of different criteria for selection of RDB species, including traditional national approaches (the "Strategy for the conservation of rare and endangered species" officially recommended and noted in the RDB of Russia) and IUCN criteria.
5. Only the RDB of Leningrad oblast' contains more than 100 species (134 fungi and 20 myxomycetes). The driving concept for this book is that RDBs should include all threatened species, independently of the organism's size or perceived beauty, because the RDB should be a tool for authorities and scientists in developing the protected area network, and in evaluating territories designated for reclamation. Although this concept is surely the most appropriate for protection of living organisms, no other Russian region has followed its lead. Why?

The key phrase of the concept is *include all threatened species*. With current knowledge, it is very often impossible to assess objectively and adequately which species are threatened. IUCN categories and criteria require sufficient information, but in most cases the more rare a fungus the less is known about it. What to do in such a closed circle? To acquire knowledge! To collect all possible information about species and, besides traditional long-term field data (distribution, habitat associations, ecological amplitude, connectivity between populations), modern results in fungal genetics (the individual and population size of different species, generative time, relationships between genetic structure and environment condition etc.) must be used to produce a kind of species passport. In short, we have to work and work.

Fungal conservation in northern Africa and the Arab Society for Fungal Conservation [15]

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Countries of northern African [NA] comprise an arid to semi-arid region with a Saharan climate in the south, an oceanic climate in the west, and a Mediterranean climate in the north, with an area of 7.5 million km^2 and a population of 195 million people. Nature conservation increased in the last two decades with much international interest: active programmes for conservation training have been actively pursued, and 65 protected areas designated. There is, however, little awareness of fungi, of their importance, their uses, their unexplored diversity and the need to protect them. The *Micheli Guide to Fungal Conservation* reviews national Rio Convention biodiversity action plans and reports [http://www.fungal-conservation.org/micheli.htm], evaluating the performance of different countries from the perspective of fungal conservation. Every NA country reviewed to date has been found to be at best inadequate and at worst totally deficient. Fungi have been described as the “orphans of Rio”, a reflexion of how ineffective the Rio Convention on Biological Diversity has been in protecting them. The countries of NA exemplify this. Only two culture collections for fungi are listed for NA [www.wfcc.info/ccinfo/collection/by_country].

There is, however, a clear need for fungal conservation in NA. Desert truffles provide a good example of this. These are widely collected from the wild for food and for their medicinal properties. Collection is unregulated. Economic hardship and social upheaval following the “Arab spring” revolutions has resulted in unsustainable collection of these fungi. For conservation, some threats are evident: climate change, human population growth, the vulnerability of rivers to pollution, bioprospecting and the fragility of desert ecosystems (scanty plant coverage encourages the misleading idea that deserts lack biodiversity). In most cases, the lack of information about fungal populations makes conservation status evaluations beyond “data deficient” difficult or impossible. There have been some efforts to carry out inventories and produce fungal checklists, notably in Egypt and Morocco, but for most NA countries these are almost totally lacking. In Egypt the Ministry of Environment still treats fungi as plants [www.eeaa.gov.eg/English/main/protect_bio.asp] decades after their recognition as a separate biological kingdom. Public awareness of fungal conservation in NA remains very low. Much education is necessary. There is a need to integrate fungal diversity and conservation into the science curricula and extra-curricular activities of schools and colleges, a vital issue for REAL educational reform in NA. The challenges for fungal conservation in NA are predictably daunting, and are undoubtedly duplicated in countries of southwest Asia. This highlighted the need for a regional fungal conservation society specifically aimed at the Arab world.

In 2010, Abdel-Azeem with co-worker and volunteers launched a series of activities to promote fungi and fungal conservation, with workshops raising national and international awareness in universities, schools, research centres and NGOs. In 2013, at the Faculty of Science of University of Suez Canal, the first society for fungal conservation in NA and the Arab world was established as a private, voluntary NGO by decree no. 699/2013 of the Ministry of Insurance & Social Affairs. The activities of the *Arab Society for Fungal Conservation* need to be advertized and supported internationally.

Status of fungal conservation in Zimbabwe [16]

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Southern Africa is a vast area of varied habitats and representation of the fungal conservation within this Region is a huge task. Zimbabwe is familiar territory and good a place to begin particularly as efforts made there may well be applicable to other countries in the Region. Zimbabwe is a signatory to the 1992 Convention on Biological Diversity (CBD) but conservation policies seem to focus on the 'big and beautiful' and anything 'less interesting' than a rhino or elephant is deemed unimportant. There are three major players in the management of forest biodiversity. Two principal pieces of legislation govern the exploitation and protection of these forests but neither makes any mention of mushrooms let alone their conservation. The challenge in Zimbabwe is to try and change that 'big and beautiful' attitude among policy-makers and help them realise that there is more out there than 'fauna and flora' and that animals and plants are actually totally dependent upon fungi and micro-organisms in the environment.

An attempt is being made to compile what is known about the habitats and populations of fungi, their socio-economic importance, their ecology and what threats they face in Zimbabwe. This knowledge will then provide a foundation on which future conservation policies for fungi can be developed.

Before embarking on any fungal-conservation programme it is important to know the current level of awareness of fungi amongst the country's population. To this end, a national survey of primary and secondary schools was initiated in 1999 and is still in progress. To date, over 20 000 drawings from children all over Zimbabwe have been collected and are in the process of being analysed. Results are reported elsewhere.

In another project involving the Ministry of Education, fungi have been given greater attention in the Environmental Science Curriculum for primary schools. New teachers' manuals have been designed and await publication and distribution.

There have been two separate, nation-wide distributions of colourful posters to increase public awareness of poisonous and edible mushrooms. These publications followed seasons of particularly high numbers of poisoning cases.

Miombo woodland is characterized by the presence of ectomycorrhizal trees in the *Caesalpinioidae* group of the *Fabaceae*. Forests cover about 40% of Zimbabwe but between 1990 and 2010, almost 30% of this was lost! This rate of deforestation of close to 2% per annum is unsustainable and is therefore the main pressure on Zimbabwe's fungi. Measures to address this issue are currently being undertaken by the appropriate authorities.

Conservation report for Australia [17]

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Australia has a poor history of fungal conservation with no fungi (including lichenised fungi) formally protected at the federal level to date. Australian state and federal conservation efforts to date are summarized and compared with conservation efforts for "charismatic" species.

Estimates of biodiversity (species richness) for Australian fungi, and important fungal roles in ecosystem function are highlighted. Conservation and data collection efforts made by Fungimap citizen scientists are also summarised.

An overview of fungal conservation in New Zealand, and some proposed new criteria for threat status assessment [18]

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Fungi were first included in New Zealand government conservation threat assessments in 2002. At that point 49 species were classified as Nationally Critical, 16 species in other threat categories, and over 1440 species as data deficient. The designation of data deficient stimulated funded studies to provide meaningful assessment of some of these fungi. Conservation status of only specific groups of fungi have been assessed, however, focusing on macrofungi and host-specific microfungi among the approximately 7,500 fungal species so far recorded in New Zealand. Revisions of threat classification lists are invited every four years, and mycologists have pragmatically reassessed species to reflect new knowledge, collection, and distribution records. In the latest assessment, we have removed several species from Nationally Critical status because of uncertain taxonomic status and distribution, included over 100 species in other threat categories, and considered over 1200 species to be data deficient.

Examples will be given of species for which threat classification has significantly altered following research that was stimulated by their conservation status. Some revised criteria are proposed to assess threat status, tailored specifically for fungi in an island nation with high levels of endemism. Common names for iconic threatened species are suggested to assist non-mycologists to develop an affinity for these otherwise overlooked taxa.

Activities of the European Council for Conservation of Fungi and current status of fungal conservation in Europe [19]

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The European Council for Conservation of Fungi (ECCF) founded in 1985 was the world's first organization specifically devoted to promoting fungal conservation at continental and national levels. Since 1985, ECCF representatives from almost all European countries have participated in regular meetings during and between Congresses of European Mycologists. These meetings provided opportunities to exchange best practice in evaluating threatened species of fungi, producing national fungal Red Lists and realizing conservation measures through environmental action plans locally and regionally. Over an almost 30 year period, ECCF have members contributed to fungal diversity studies, advanced general awareness of endangered fungal species and their habitats, and made progress in encouraging national authorities to adopt legislation on fungal conservation. As the conservation wing of the European Mycological Association since 2003, the ECCF has enhanced mycological infrastructure within Europe through a network of experts in mycology dedicated to conservation.

National Checklists and Red Lists of fungi. To date, over 30 European countries have compiled fungal checklists; about the same number of countries have produced databases of fungal records including data on species distribution; and half of these databases are available on-line. Currently, 35 European countries have official or unofficial fungal Red Lists; of them nearly a half are based on evaluations using the IUCN Red List categories and criteria. Regular updates to existing national Red Lists are required. Red Lists not yet approved nationally need to have official status.

European-level input. Lack of resources and funds has made production of a European fungal checklist a challenging task. Much effort has already been spent to outline the project, to compile all national European fungal Red Lists (about 5,500 species) and to make a brief evaluation of potentially threatened species. A preliminary version containing about 1,700 species of fungi relevant for the Red

List assessment at a European level is available on the ECCF website [www.wsl.ch/eccf]. Were financial support to be specifically allocated, this project could be a great example of co-operation in fungal conservation at a continental level. In the meanwhile, extensive information on ecology, conservation status and distribution throughout Europe of 51 selected fungal species is accessible as a draft version for comments [www.wsl.ch/eccf/activities-en.ehtml].

Fungi in National Biodiversity Strategic and Action Plans. The *Micheli Guide to Fungal Conservation* [www.fungal-conservation.org/micheli.htm] currently states that in respect of fungi no country worldwide is rated as "good" or even "adequate" in its Rio Convention reports. Only three European countries (Finland, Serbia, UK) have been evaluated as "nearly adequate" (the highest rating awarded to date), followed by another four at next level (Bosnia and Herzegovina, Croatia, Lithuania, Sweden). The evaluation is mostly based on the fourth national reports and action plans received by the CBD. Since the COP meeting in Nagoya, 2010 (decision X/10) called for fifth national reports and action plans by 31 March 2014, there is still time for countries to improve their rating by incorporating fungi into national conservation strategies.

From red lists to conservation actions: how to deal with 3700 endangered species in Switzerland [20]

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Red listed species. Red lists for endangered species of Switzerland contain more than 3700 species including animals (amphibians, breeding birds, fish, mammals, molluscs, reptiles and some insects), fungi (epiphytic and terricolous lichens and macrofungi), and plants (ferns, flowering plants and mosses). An evaluation of the international responsibility for each species helped to condense this list to 3200 species, the so-called national priority species list. The list contains 937 fungi. Facilitation and conservation of such a huge number of species remains a challenging task.

Evaluation of conservation measurements. In a next step the immediate need for conservation measurements is evaluated, using a four categories scheme. Information about monitoring needs, available conservation techniques and human resources is added, again categorized. As this procedure should be processed in the same way for all threatened species, intense collaboration among specialists for various organisms is indispensable. During this process it became clear that macrofungi, lichens and mosses as sessile organisms, in some respects together with xylobiontic insects often share the same microhabitat and similar threats. Modelling co-occurrences of threatened species of various groups of organisms may help to bundle future conservation measurements and locate immediate demands. It became clear that the existing nature and forest reserves cannot guarantee survival of all threatened species. A current project seeks to assign threats out of a common list of over 200 possible impacts to all national priority species. Each intervention can then be checked for consequences to individual species. In addition facilitation measurements can be deduced and bundled.

Realisation of conservation measurements. The political system in Switzerland includes a federal level with national legislation and a cantonal (regional) level with legal execution responsibilities. Whereas Red lists are primarily an instrument at the national level, the conservation measurements of endangered species are assigned to the 26 cantons. To establish action plans, therefore, each canton wants precise information about the threatened species on its territory taking into account local traditions, local resources, and fiscal consequences. Volunteers and biologists as local specialists form an important link in these action plans integrating the claims of Red lists into forestry, agriculture, urban landscaping and nature conservation. Continuous and concise information about each threatened species is crucial. The network of all national databases – Info Species – provides a new modern digital platform for this purpose with the possibility of reciprocal data flux. SwissFungi and SwissLichens are part of Info Species.

Standardized assessment of fungal component of biodiversity in areas anticipated for protection in Serbia [21]

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It was only recently that an assessment of the value a certain area holds for its fungal populations was included in regular procedures performed by state agencies dealing with nature conservation and protection in Serbia. Already in the 1990s, mycologists asserted the need for conservation of nature and biodiversity to embrace fungi, in addition to plants and animals. The conservation was supposed to involve primarily the sensitive species threatened due to disappearance and contamination of their habitats. The first legal provisions pertaining to fungal protection in Serbia came into effect in 1991. Unfortunately, the law provided for only a small number of quality edible species (*Boletus*, *Cantharellus*, *Morchella* etc.), but the state administration was early in making an effort about fungal conservation. The law on Environmental Protection from 2009 made provisions for non-commercial fungi for the first time. The state administration finally accepted the stand espoused by mycologists that rare and threatened fungi need to be included in the environmental protection programmes. Fungi were listed as a separate group of organisms, different from and on a par with plants and animals. This Law finally allowed for evaluation of fungi to be officially included in environmental protection procedures. The Law provided that fungi on their merit alone could be a reason to single out and protect a certain area, even though other biodiversity components were not under threat.

Decisions pertaining to conservation are reached by the state authorities, and it was necessary to develop formal criteria and tools for assessment of fungi easily comprehensible to the administrative services. Therefore a fairly simple system was devised, involving a quantitative evaluation where the score for a certain area is comparable to the scores for other areas. Elements of evaluation procedure are defined based on a number of criteria and include the following steps: assessing total diversity of larger fungi; making a list of important fungi species; making a list of key species; qualitative evaluation of habitats; designating zones of the area in respect to spatial distribution of the species and rating those zones based on relative importance of fungi in each zone; defining specific measures to manage the area in terms of fungal protection.

In the past three years, four areas in Serbia have been designated for formal protection and for establishing a reserve, by applying this procedure for the requirements of state authorities, based on protocols for each of the steps, bearing in mind concurrent evaluation of other biodiversity components. One of these, the area of Ada Ciganlija river island, was entered into the procedures for protection because this valuable and important fungi habitat was evaluated as the Prime Mushroom Area. The author applied the same methodology in the evaluation of national parks of Galičica in Macedonia and Prespa in Albania, which proved to be acceptable and appropriate solution for the requirements of those parks' management.

Fungal conservation in Estonia [22]

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Fungal conservation in Estonia is based mainly on indirect habitat conservation in nature conservation areas. Known localities of protected species get more attention. Most work is done or organized by the Environmental Board and financed by the state. Mycologists are contracted to produce inventories, monitoring, compiling action plans and other documents. The 2008 Estonian Red List includes 180 fungal species: 5 RE, 45 CR, 38 EN, 34 VU, 43 NT, 1 NA [http://elurikkus.ut.ee/prmt.php?lang=eng]; it has no legal status, but 28% of its threatened species are legally protected. As the habitat of most species (ca 80%) is forest, the main threat is unsympathetic forest management (cutting, drainage); destruction of meadows and drainage of wetlands are also threats.

30 fungi species were taken under legal protection in 1994–1995. The list was renewed in 2004 and there are now 46 legally protected species in 3 categories: I – 9, II – 27 and III – 10. The principles of species conservation are defined by the Nature Conservation Act. All known localities of category I, 50% of category II and 10% of category III species have to be protected as some kind of nature conservation area or special species protection site. These requirements are almost fulfilled. Damaging and gathering of category I and II fungi is prohibited. In the case of category III fungi it is not allowed to destroy or gather them to the extent that the habitat is likely to be endangered. Specimens of protected fungi may be removed from the wild only for educational or research purposes with permission from the Environmental Board. It is prohibited to make transactions with specimens of protected species and to disclose the habitat locations of category I and II species in the media. These requirements are difficult to follow as supervision is deficient and rare species poorly known. In the case of category I species, a protection obligation notice must be produced and sent to each landowner.

31 special species protection sites were formed for 19 species in 2006 (total area 59.2 ha, mean area 1.9 ha). The process of establishing another 8 sites is ongoing. Action plans were compiled for 10 species in 2013 and include descriptions of habitat, threats and conservation situation, action plans for the next 15 years, and a budget for the next 5 years (see: Sell, I). They need first to be approved by the Ministry of Environment. There have been only few inventories in some protected areas. New locations of easily recognized species have been found occasionally. Monitoring of protected species started in 2005. Number of species and localities has varied, in total 25 species in 55 areas (*sensu lato*) have been monitored. Methods must be updated as only fruitbodies are counted, area is not determined, habitat characteristics are not described. An electronic GIS-based database of Nature Conservation Registry is used in conservation decisions. Now, there are 540 entries (384 locations *s.l*). Old or poorly described records are excluded. Some entries are still not GPS-accurate and should be polygons instead of symbols. The problem in species focused conservation is that information about locations and species habitat requirements is poor. There is a lack of mycologists and resources to specify and update the data and study potential habitats. Collaboration between scientists and nature conservationists should be better. Most of the protected species are poorly known. Any kind of fungal education both for public and specialists is therefore very important, and should include exhibitions, books, articles, webpages and training courses.

Current status of fungal conservation in Estonia [23]

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The Estonian Red Data Book contains 160 fungal species. 46 are protected by law according to the Conservation Act. These are divided into three categories. Category 1 includes nine endangered fungal species. All the localities of category 1 species should be protected (when the habitat is outside an existing nature conservation area, a special area for species protection needs to be established). Category 2 contains 27 species which occur in only a few habitats or in a limited area where the abundance is decreasing or the area is becaming narrow. At least of 50% of the habitats of each category 2 species should be protected. Category 3 consists of species with threats which could cause population decrease. At least of 10% of the habitats of category 3 species should be protected.

Annual monitoring of protected species covers 60 habitats of 25 species. To manage the conservation of the protected species, and to plan and prioritize the activities for improving their situation, action plans have been compiled for 10 species. According to law, an action plan is compulsory for each category 1 species. It has been my work to compile action plans (for 2013 to 2017) for all category 1 species:

Amylocystis lapponicus, *Grifola frondosa*, *Hapalopilus croceus*, *Inonotopsis subiculosa*, *Leucopaxillus salmonifolius*, *Pachykytospora tuberculosa*, *Rhodotus palmatus*, *Sarcosoma globosum* and *Sarcodon fuligineoviolaceus*, and for *Sarcosphaera coronaria* (a category 2 species).

Macedonian red list of fungi [24]

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The Red List of fungi in Macedonia, which uses current IUCN Red List categories and criteria, includes 213 species of Ascomycota and Basidiomycota. The following IUCN categories were used: Critically Endangered, (CR) – 21 species, Endangered (EN) – 30 species, Vulnerable (VU) – 71 species, Near Threatened (NT) – 40 species, Least Concern (LC) – 9 species and Data Deficient (DD) – 42 species. Data sources used are as follows: exsiccati and notes from personal studies, the Macedonian collection of Fungi (MCF), a data base (MAK FUNGI), and specimens from other collectors. The main goals of this work are to upgrade the preliminary red list of macromycetes in the Republic of Macedonia (Karadelev, 2000), to improve fungal conservation status and to accelerate proposals for legal measures to conserve fungal diversity.

Current status of fungal conservation in Latin America and the Caribbean [25]

Fungal Conservation Group (FCG)
Grupo para la Conservación de la Diversidad Fúngica en Latinoamérica

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In March 2011 the Latin American Mycological Association (ALM) joined the International Society for Fungal Conservation (ISFC) for the following reasons: 1) The ISFC Constitution states that regional scientific societies for mycology (such as the ALM) who join may nominate Regional Delegates to the ISFC's Council; 2) Joining gives the ALM's Fungal Conservation Group (FCG) or Grupo para la Conservación de la Diversidad Fúngica en Latinoamérica an influence and voice in the ISFC. In the case of the ALM the relevant Regional Delegates are (A) Central America and the Caribbean, (B) Temperate South America, and (C) Tropical South America.

The FCG has reviewed current knowledge of fungal diversity and conservation measures taken in countries located in the Caribbean and Central and South America. The basis of this review has been an assessment of the strengths, weaknesses, opportunities and threats to which fungi are subject.

The goal is for information obtained from the review to serve as a baseline for the ALM regarding the current status of fungal conservation in the region. This will serve as the source of information to prepare a common matrix to be applied to each of these countries to obtain more refined data regarding fungal conservation present status in each of the countries and, together, in each area of its three ISFC Regional Delegates. Each Regional Delegate is expected to prepare a presentation for a symposium on this topic proposed to the Organizing Committee for the next Latin American Congress of Mycology, VIII CLAM in Medellín, Colombia, in November 2014. Ideas that can contribute to the dissemination of our actions as a group should be discussed between the representatives, and later communicated to everyone, to be discussed on-line, and published in local media so to make "fungi" present to everyone.

Awareness of the role and importance of fungi in ecosystems is clearly growing, but their impact on life on this planet is still generally underestimated and unknown by the general public. Precise actions should be defined, agreed and applied, to counteract lack of information regarding fungal uniqueness and diversity. These actions should be taken in all countries belonging of the FCM-ALM-ISFC regions, so that impact is greater, and common policies regarding their conservation should be reached, since fungi do not have geographical or political boundaries.

The inclusion of Fungi in Chile's environmental legislation what it took, where we are, and challenges from here on [26]

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Chile is a country with an array of unique and diverse ecosystems: the Atacama Desert in the north, glaciers in the south, the Andes mountains to the east, and the Pacific Ocean to the west. The country houses some of the finest forests in the southern hemisphere. They include pristine temperate rainforests, which in turn are home to magnificent fungi. In 2012, Chile included fungi in its General Environmental Law No. 19.300, and its modification No. 20.417. The Government – through the Ministry of the Environment – is now obliged to find mechanisms to inventory fungi and generate a public information system. The mechanism used is the obligation to do mycological baseline research in every Environmental Impact Assessment Study as of 24th December 2013. Fundación Fungi has led this process which continues through its work with Chilean Government agencies.

Colombia: what is going on about fungal conservation? [27]

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"Progress in mining going faster than the study of biodiversity" is the headline which recently appeared in one of Colombia's top newspapers. The article reported that to date 9,000 licences have been awarded and another about 15,000 applications are pending for mining in protected areas or páramo areas of the country (*El Espectador*, www.elespectador.com/noticias/medio-ambiente/avance-de-mineria-va-mas-rapido-el-estudio-de-biodivers-articulo-452668). Despite Colombia being the world's fourth most biodiverse country, and the most megadiverse per square kilometre with 27,881 flowering plant species (Stuessy, 2007) there is still no complete fungal inventory; but because of close ecological relationships between fungi and plants, they too can be expected to be highly diverse.

Larger fungi: a trawl of the literature has shown that 1239 species, 181 from the phylum *Ascomycota* and 1058 from the *Basidiomycota* have been reported from Colombia (Vasco-Palacios & Franco-Molano, 2013). Of these, 189 species have been described as new (15.25%), 3 belonging to the *Ascomycota* and 186 to the *Basidiomycota*. Recent studies in ectotrophic forests dominated by *Pseudomonotes tropenbosii* (*Dipterocarpaceae*), *Aldina* spp. and *Dycimbe* spp. (*Fabaceae*) in Colombian Amazonia, showed a high diversity of ectomycorrhizal species (Vasco-Palacios, unpublished data), many new for science, or new for the country. This study also shows similarities between fungi of Colombian Amazonia and Guyana. **Rust fungi (Uredinales)**: to prepare a red book of Colombia's rust fungi, scientific knowledge of the Uredinales, one of the most diverse and economically important plant pathogens of crops world-wide, was reviewed with emphasis on species recorded for the country (Garcia *et al.*, 2007). The results showed that most were found on weeds, with few on wild or endangered plants. Based on the total number of plant species reported for Colombia, Pardo-Cardona (2001) predicted that nearly 3,125 species of rust fungi could be found for the country. Up to 2007, only 10% of those species were reported (Garcia *et al.*, 2007). **Smut fungi (Ustilaginales)**: Piepenbring (2002) cited 71 species of smut fungi known for Colombia, 20 of them new records. The study carried out during preparation of a Flora Neotropica volume includes complete descriptions and illustrations of the species. Although the checklist of smut fungi for Colombia is larger than those recently published for Costa Rica (54 species), Panama (23), and Cuba (39 species) it is certainly far from complete (Piepenbring 2006). **Smaller Ascomycota**: no single work encompasses present knowledge of the diversity of smaller *Ascomycota* and their anamorphs for Colombia, although there are various publications dealing with the taxonomy, pathology and ecology or some groups.

In Colombia efforts have been made to gather biodiversity information, to identify endangered species or species threatened with extinction, and to define conservation priorities, but government policies and permits to exploit natural resources (for example through mining) more than neutralize these efforts, above all when licences are given to destroy often little-known areas of high biodiversity.

References

García-G., D., Buriticá-C., P. & Henao-M., L. (2007). Elementos para la elaboración del Libro Rojo de hongos royas de Colombia. *Rev. Acad. Colomb. Cienc.* **31**: 449-468.

Pardo-Cardona, V.M. (2001). Historia, estado actual y perspectivas de la investigación de los Uredinales en Colombia. *Rev. Fac. Nal. Agr. Medellín* **54** (1-2): 1333.

Piepenbring, M. (2002). Annotated checklist and key for smut fungi in Colombia. *Caldasia* **22**: 103-119.

Stuessy, T. (2007). Plant systematics world. Plant diversity of Colombian catalogue. *Taxon* **56**: 273-274.

Vasco-Palacios, A.M. & Franco-Molano, E. (2013). Diversity of Colombian macrofungi. *Mycotaxon* **121**: 499.

Fungal conservation in the USA [28]

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Formal fungal conservation efforts in the United States began in the early 1990s with development of the *Northwest Forest Plan* aimed at preserving the remaining old growth forests in northwestern states. Several fungi were listed as part of this plan. Additionally, protocols were developed to facilitate monitoring listed fungi as mandated by the plan. The *Mycological Society of America* established a Fungal Conservation Committee in 1998. Several new initiatives are now in development. “The Macrofungi Collection Consortium: Unlocking a Biodiversity Resource for Understanding Biotic Interactions, Nutrient Cycling and Human Affairs” is a large, multi-institutional project funded by the National Science Foundation to digitize macrofungal collections in US herbaria. This project was initiated in 2012. Implementing a “North American Mycoflora for Macrofungi” is being discussed. There have been several workshops and planning meetings, but as yet the initiative has not moved beyond the planning stage.

ABSTRACTS OF ORAL PRESENTATIONS

Sessions on 15 November 2013

Myco-entanglement - understanding public perceptions of fungi as a means to advancing fungal conservation [29]

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Since the early 1980s there has been appreciable advance in fungal knowledge and conservation in many European countries as well as in Australia. Listing of species for protection, public participation in fungal interest groups, production of field guides and other efforts have all raised awareness of the vital importance of fungi. Despite these achievements, many people and governments still largely fail to acknowledge the significance of fungi in ecosystem function and their direct implications for human well-being. Thirty years after the start of this 'fungal enlightenment' do we need to reassess our approach to raising the profile and conservation of fungi? Are fungi being adequately conserved by surrogate approaches? Should we more actively engage the approaches and perspectives of other disciplines to inspire greater public interest and participation in fungal conservation efforts?

This paper reports initial findings of a PhD project examining the discrepancy between the diversity and ecological significance of fungi, and the amount of attention they receive in biodiversity conservation. A recent assessment of an historical archive of over 400 newspaper representations of fungi aims to unravel clues about how fungi have been perceived historically. Survey and interview techniques were also used to assess perception of fungi by the general public and by those working in biodiversity management and policy. An examination of 40 Australian National Park management plans and various state and national level biodiversity strategies found fungi to be either excluded or grossly under-represented. Initial findings will be discussed and alternative approaches to catalyse fungal conservation that consider both Australian and European perspectives proposed.

The immense efforts of mycologists advocating fungal conservation have revealed the complexities of the kingdom. But can all the knowledge we need to progress fungal conservation come from mycologists alone? Certainly, we need more expertise, more taxonomic and distribution data, as well as threat status information. But how do we meld this knowledge with the great spectrum of other ways in which fungi are translated, understood and valued? For example, how do we incorporate the affective dimension of fungal conservation? Many writers and thinkers have discussed the fundamental human need to interact with nature in an other than cognitive way - to *re-enchant* our relationship with nature. Perhaps fungal conservation could give greater focus toward re-enchanting our relationship with fungi.

Fungal conservation requires mycological expertise but also public support. It requires a solid understanding of the many ways in which fungi are valued. We may also need to question how fungal conservation can adopt a more critical and inclusive approach to its role in society. This may include understanding how to embed social and ethical values into fungal conservation. Finally, this paper will make a brief comparative analysis of other overlooked groups of organisms such as invertebrates and whether fungal conservation can borrow from their conservation successes.

Preliminary results of a survey to determine the perception of a mushroom in Zimbabwean children [30]

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The diversity of fungi in any area is important to the local population since indigenous mushrooms often provide a seasonal source of food. A survey conducted in Europe showed that most school children knew of *Amanita muscaria* but had little knowledge of other mushrooms. This inspired an investigation into the knowledge of mushrooms amongst Zimbabwean children, since indigenous mushrooms, especially edible ones, are very much part of their culture. Surveys were conducted in both primary and secondary schools around the country, involving all ethnic groups. Using English and the relevant language/dialect, the children were asked to draw the first mushroom that came to their mind, providing its name where possible. Over 20 000 drawings have been collected so far and details are currently being entered into an Excel database awaiting further analysis using SPSS software.

Preliminary results from almost 4000 drawings already show a marked difference in mushroom knowledge between urban and rural children. This was expected because one of the costs of urban migration world-over is the loss of indigenous knowledge. Another difference was found between different ethnic groups whose geographic distribution is intricately correlated to the vegetation which in turn, determines which mushrooms are familiar to the children.

Shona children living in true miombo areas of *Brachystegia* and *Julbernardia* trees had a very rich knowledge of mushrooms, particularly those which are ectomycorrhizal (*Amanita*, *Cantharellus*, *Lactarius*, *Russula* and some boletes). The Ndebele people living in mopane and *Acacia* (*Vachellia*) habitats had a greater knowledge of *Termitomyces* species but their mushroom knowledge broadened wherever their home areas extended into miombo woodland.

The perception of mushrooms amongst Zimbabwean children is well-entrenched, very varied and most encouraging. This base-line data will go a long way in formulating future educational and environmental policies.

The Białowieża Forest - a UNESCO World Heritage Site [31]

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Białowieża Forest lies at the boundary of eastern and western Europe, between longitudes 23^{o}31’ and 24^{o}21’ E and latitudes 52^{o}29’ and 52^{o}57’ N. It covers 1250 km^2 and extends over 55 km from east to west and 51 km from north to south. The forest exemplifies a lowland ecosystem specific for the boreal-nemoral zone, characterized by the simultaneous presence and even a certain mixing of deciduous forest and evergreen coniferous forest. Europe’s largest terrestrial mammal, the European bison, survived here in the wild – its last stronghold – until the beginning of the 20th century.

The Białowieża National Park (BNP) was established in 1921 and is the oldest in northeast Europe and Poland. It protects the best preserved fragment of Białowieża Forest – the last natural forest of the European Lowland Area, maintaining its primaeval character, unchanged from the one which covered the area with deciduous and coniferous forests years ago. The characteristic feature of the park is its biological diversity: over 8000 species of invertebrates, about 1900 fungi (almost 300 lichen-forming), 1400 cryptogams, almost 200 mosses, over 800 vascular plants, about 120 species of breeding birds, and 52 mammals have been recorded to date.

Old, primeval forest stands in Białowieża National Park are characterized by large amounts of dead wood at various stages of disintegration, and by the presence of typical natural forest species. Dead wood appears in many forms, sizes and positions including standing dead trees, dead branches in the canopy trunks and branches on the ground. In boreal and boreo-nemoral forests, polypores are the most important decomposers of dead trees. The undisturbed forest of Białowieża is a perfect site for fungi, with dead wood inhabiting fungi in particular.

In 1979 during the third session of the World Heritage Committee, nomination of the Białowieża National Park was the fourth examined and the first for a natural environment. The Białowieża National Park was the fifth natural property added to the World Heritage List.

Fungi and the action plan for the conservation of biodiversity: what happens in Tuscany (Italy)? [32]

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Fungi are well-known for their gastronomic value. They are also often accused of having a negative impact on the environment. Our group has attempted to emphasize the importance of fungi as key-players in biological processes to a wider audience and to make different communities from the scientific world to governmental bodies aware of the importance of including them in nature conservation. The Important Plant Areas (IPA) programme, a target of the two European Plant Conservation Strategies (2002–2007 and 2008–2014) included fungi with plants. To recognize an IPA, good information on distribution, ecology and threat status is needed in meet the 3 IPA criteria: threat, richness, and habitat. In Tuscany the first attempts to describe key-sites interesting because of the presence of rare fungi and/or because of the high fungal diversity date back to the first years of the new millennium. Participation in the Italian IPA project and publication of a Tuscan Red List, up to now the only one at a national level, has been fundamental. Further attempts to emphasize the value of habitats by means of larger fungi have been made and we now need to include fungi in biodiversity conservation action plans at least at regional level within Italy. This experience and some examples of mycological key-sites with AFP (Animals, Fungi and Plant) target species for some habitat types are reported.

Inner urban parkland revegetation, biodiversity and the possibilities for fungal conservation [33]

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Westgate Park – a case study. Fourteen years ago the *Friends of Westgate Park* (Melbourne, Australia) commenced revegetating Westgate Park – 34 ha of land left over after a major bridge construction, surrounded by port and inner city industrial activities. It was a massive undertaking for volunteers to remove sparse but invasive weedy species and create a showcase for 300 locally indigenous plant species in ten plant communities with trees, shrubs, perennial herbs, groundcovers and climbers. The transformation is not yet complete but already remarkable. Resident and visiting bird species numbers have grown to 50 on any one day and 150 since work started, indicating a now robust food chain.

Less anticipated was the diverse array of fungi. Over 60 species of agaric, toothed, stinkhorn, gasteroid, bird's nest, jelly, polyporoid, leathery and coral fungi have been observed since 2011, many as yet unidentified. A fungal foray last September was attended by 25 keen novices, and formal records of their observations kept. The website, www.friends-of-westgatepark.org, features fungi as a distinct and important part of the park's biodiversity and fungal pages are accessed at least as often as those for animals and plants.

Ignorance about fungi is widespread in Australia. Westgate Park demonstrates the possibilities in urban parks for educating citizens about the wonder of fungi and their place in and importance for biodiversity. Public engagement like this makes conservation of fungi a much more likely outcome.

Macrofungal diversity and ecology in a Site of Community Importance (SCI) of Umbria (central Italy) [34]

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The forest of Collestrada in Umbria (central Italy) covers approximately 136 ha (250-306 m a.s.l.). It was declared a Site of Community Importance (SCI) (IT5210077) in 2008. Recent studies have shown it to have rich biodiversity, but systematic studies on larger fungi are few and small. This paper attempts to assess diversity and distribution of larger fungi in seven Collestrada woodland types characterized by a prevalent plant species. The study was made from January 2011 to July 2013. The number of woodlands visited and the number of surveys per woodland were higher during the fruiting season, which was from April to May until late July and from September to November for the 31 months of sampling. Throughout the fruiting season each woodland type was visited at least once every two weeks. Out of season, a subset of seven woodlands was surveyed once per month. The surveys were limited to fungi visible to the naked eye (greater than 1 mm in size).

Species recorded were split into functional groups based on primary mode of nutrition. To determine dominant species, abundance and relative abundance were assessed. Abundance is the total number of ascomata or basidiomata collected per species, whereas relative abundance is the proportion of ascomata or basidiomata from each species in relation to the total number of ascomata/basidiomata recovered (×100). Species accumulation curves, bootstrap estimates of total richness (S), and diversity indexes (Fisher's α, Shannon J', Simpson 1/D) were inferred using EstimateS 8.2 (R.K. Colwell, http://purl.oclc.org/estimates).

A total of 4975 ascomata and basiomata were harvested, with 305 species belonging in 61 families and 121 genera. Bootstrap analysis estimated a total of 378 species, indicating that sampling detected 80.7% of the richness. Most (97%) were *Basidiomycota*, including a high relative abundance of *Agaricomycetes* (99.6%). Families containing most species were *Russulaceae* (27), *Mycenaceae* (25), *Tricholomataceae* (25), *Marasmiaceae* (18), and *Amanitaceae* (17). *Mycena* (24 species) was the most diverse genus, followed by *Amanita* (17), *Russula* (17), *Cortinarius* (14), and *Lactarius* (10). In the entire dataset, *Marasmius rotula* (Scop.) Fr. and *Gymnopus foetidus* (Sowerby) J.L. Mata & R.H. Petersen were the most abundant taxa. Total numbers of ascomata and basidiomata, species richness and relative abundance of dominant species differed among woodlands. Most species were found in *Quercus frainetto* woodland (186), with fewer (22) *Pinus* spp. plantations. Diversity ranged from 48.34 to 9.48 (Fisher's α), 4.2-2.47 (Shannon index), and 34.97 to 7.31 (Simpson index) depending on woodland types.

This study is incomplete: bootstrap analysis indicated that less than 86% of the larger fungi species for Collestrada have been found. Our results show differences in species richness, abundance and diversity patterns between Collestrada woodland types. The existence of distinctive communities of larger fungi related to dominant tree species of the forest has been confirmed in other studies. The diversity indexes (Fisher's α, Shannon, Simpson) indicated clearly that the community of larger fungi in *Q. frainetto* woodland was richer and more diverse than in other woodland types. 81 of the fungal species which appear relatively common in Collestrada forest, are known to be endangered or even at risk of extinction in other European countries (www.wsl.ch/eccf). Collestrada forest may therefore be important for *in situ* conservation of these species.

Does managing vegetation act as a sufficient umbrella for managing Tasmanian macrofungi? [35]

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Most natural area management has a coarse scale conservation approach, which assumes that if adequate amounts of each vegetation type are conserved the many unknown species within these areas are also conserved. My research into the larger fungi of four Tasmanian vegetation types found that when 30% of each vegetation type (usually equivalent to regional ecosystem) was used to select sites in reservation scenarios, 80%, namely the common larger fungi, were also reserved. The remaining 20% were uncommon and possibly rare species. Vascular plant and woody plant taxon composition, vegetation type, and environmental and structural characteristics all have promise as surrogates for capturing common fungi and cryptogamic plants in reserve systems. Issues and difficulties of vegetation management for fungal conservation are considered.

Diversity of macrofungi and plant species in two different ecological zones in Ghana [36]

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Forests are under pressure as a result of expansion of agricultural lands, urban settlement development and over-exploitation of timber. As a result, genetic resources of animals, fungi and plants are disappearing, often without being noticed. This has made forest reserves important centres for *in situ* conservation of the world's biological diversity. A survey was undertaken to assess diversity of larger fungi used for various purposes in the Bobiri Forest Reserve in the moist semi-deciduous forest zone and the Bui National Park in the savanna woodland. Sporocarps and plants were sampled along transects in three one-hectare plots for species richness and abundance. Thirty-one fungal species belonging to 23 families were identified in the Bobiri forest reserve while forty-one belonging to 18 families were recorded in the Bui National Park. The family *Polyporaceae* was the highest followed by the *Tricholomataceae* in both ecological sites. *Xylariaceae*, *Agaricaceae* and *Lycoperdaceae* were abundant in the Bobiri Forest while *Amanitaceae*, *Agaricaceae*, *Cantharellaceae* and *Boletaceae* occurred more frequently in the Park. Edible fungal species, namely *Schizophyllum commune*, *Termitomyces macrocarpus* and *Auricularia* spp. were recorded in Bobiri Forest while only *Termitomyces macrocarpus* and *T. schimperi* were recorded in the Park. *Ganoderma lucidum* and *Auricularia* spp. which are medicinal were recorded in both zones. Ectomycorrhizal fungi were rare in the Bobiri forest with only *Leucopaxillus*, *Boletus* and *Amanita* spp. encountered while fifteen species in the genera *Amanita*, *Russula*, *Boletus* and *Cantharellus* were encountered in the Park.

There were 348 plant species recorded in Bobiri Forest with the family *Meliaceae* dominating followed by *Sterculiaceae*, *Euphorbiaceae*, *Moraceae*, *Rubiaceae* and *Caesalpiniaceae*. Most were endomycorrhizal. The ectomycorrhizal trees were *Gilbertiodendron splendidrum*, *Berlinia* and *Anthonotha* species. In the National Park, 60 plant species were recorded with trees in the families *Caesalpiniaceae*, *Combretaceae*, *Papilionaceae* and *Mimosaceae* dominating. *Isoberlinia* and *Afzelia* species were ectomycorhizal. Given the assessment by Prof. Hawksworth that, in tropical areas, there are likely to be as many as six fungal species, on average, for every plant species, it is clear that much more exploration of these locations will be necessary before the true fungal diversity is established. Enough is already known, however, to indicate that these protected areas are important not only for animals and plants, but also for fungi.

Ex situ conservation of fungi from forests of India: a national type culture collection [37]

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Culture collections are important for *ex situ* conservation of fungi. The World Federation of Culture Collections provides an online searchable database of over 400 registered collections in more than 50 countries worldwide. One is housed at the Forest Pathology Division of the Forest Research Institute, Dehradun, India. It is the National Type Culture Collection (NTCC) of wood rotting fungi and forest pathogens. The NTCC has 988 fungal cultures representing 140 genera and 298 species, and is of great importance for fungi of forest ecosystems. The oldest culture, from 1939, is of a *Stereum* sp. (No. 220/S) isolated from *Shorea robusta* wood collected from the Institute campus. Systems are in place to store information about each culture, and to ensure that each culture is correctly maintained.

Wood rotting white-rot fungi (*Basidiomycotina*) account for 443 of the cultures in NTCC, distributed among 57 genera and 115 species. Some have immense value in biotechnology such as bioremediation, enzyme (laccase, cellulases, xylanase) production, biodeinking, biopulping and medicinal uses. The NTCC is the only source of such isolates in India. Wood rotting brown-rot fungi (*Basidiomycotina*) account for 148 cultures, distributed among 21 genera and 32 species. Some of these have potential for bioremediation and are a source of enzymes (cellulases, xylanases). 36 cultures have established nutritional and pharmaceutical value. These have industrial applications as nutriceutical products. Nutriceuticals of one, *Ganoderma lucidum*, are used to treat more than 20 different illnesses including migraine and headache, hypertension, arthritis, bronchitis, asthma, gastritis, hypercholesterolaemia, hepatitis, cardiovascular problems, and cancer including leukemia. Other important fungi in the NTCC are *Ophiocordyceps sinensis*, found in the alpine meadows of the Himalaya and with ascomata fetching US$ 10000 per kilogram, *Echinodontium tinctorium* which infects living trees of *Taxus baccata* and is reported to have anticancer properties, and *Phellinus linteus*, known as phansomba in Maharshtra (western India), also known to contain anticancer drugs. There are 109 cultures in NTCC of pathogenic and saprobic ascomycetous fungi collected from forest areas and tree substrata.

The search for novel antibiotics and enzymes needs fungi available for thorough screening. For this culture collections are essential. China, the USA and most countries in Europe patent their discoveries of novel compounds and enzymes. The Converntion on Biodiversity (Rio de Janeiro, Brazil, 1992) has not only created an awareness of the importance of biodiversity but also initiated laws to protect biodiversity resources in each country, and culture collections therefore form an important element of national biodiversity conservation strategies. The NTCC is thus an invaluable resource of national and international importance as a repository for forest fungi. This role can only become more important as the impacts of habitat destruction and climate change increase.

POSTERS

A new family record (*Orbiliaceae*) for Turkish *Ascomycota* [38]

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Orbilia curvatispora, *O. sarraziniana* and *O. xanthostigma* were collected on *Alnus* sp. and *Carpinus* sp. in the East Black Sea Region of Turkey. As there were no previous records for the *Orbiliaceae*, these three taxa add a new family to the Turkish mycobiota. These *Orbilia* species are characterized by thin ascospores and small ascomata. Some literature suggests they may be very rare in Europe and need to be protected.

This report of a fungus family previously unrecorded from Turkey emphasises how little is known still about the country's mycobiota. Until more information becomes available, the conservation status of these species in Turkey must be assessed, using IUCN Criteria, as Data Deficient.

Notes on Turkish *Rosellinia* [39]

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Rosellinia (*Xylariaceae*, *Xylariales*) includes approximately ninety taxa. The genus is characterized by superficial perithecia, usually seated on a blackish or brownish subiculum. The perithecia are black, smooth, and globose to subglobose, with papillate ostioles, stipitate, cylindrical asci each with a well-developed amyloid apical ring, and uniseriate, dark brown to black, smooth, elliptical to fusoid ascospores. Most are saprobes, some occurring as endobionts which are occasionally turn into pathogens. A few are known to be root pathogens. *Rosellinia* species have been reported mostly from deciduous woods, herbaceous plants, and more rarely from coniferous remmants in various parts of the world, and they are widespread in both temperate and tropical regions including Europe, Central and South America, New Zealand and Asia.

To date only three species (*R. necatrix* Berl. ex Prill., *R. mycophila* (Fr.) Sacc., *R. thelena* (Fr.) Rabenh.) have been reported from Turkey. We report a fourth, *Rosellinia corticium* (Schwein.) Sacc., as a new species for Turkey, with a short description, information about distribution and ecology, and photographs showing macroscopic and microscopic morphology.

Establishing which fungi are endangered is a very important step towards protecting them and their habitats. National red-lists are very useful tools for national conservation and for understanding the status of organisms. Although Turkish ascomycetes have been studied for at least 100 years and approximately 180 taxa have been recorded to date, the country still has not fungal red-lists. The main threats to *Rosellinia* species include destruction of forests, fragmentation of habitat, anthropogenic climate change and pollution.

A note on the genus *Lachnum* Retz. in Turkey [40]

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Lachnum Retz. is a widely distributed saprobic genus of the family *Hyaloscyphaceae* Nannf. within the order *Helotiales*. More than 250 species of this genus currently exist all over the world. They are characterized by small, disc shaped apothecia with whitish hairs on the receptacle surface, eight spored, subcylindrical or cylindrical to clavate asci with a iodine-blue pore, mostly aseptate, hyaline, narrowly ellipsoid, elongate or fusiform ascospores, and lanceolate to subcylindrical paraphyses, generally longer than the asci.

During routine field trips in Trabzon and Gümüşhane in 2012, two members of the *Helotiales* were collected. Using standard mycological techniques, they were identified as *L. brevipilosum* Baral and *L. pygmaeum* (Fr.) Bres. *(Hyaloscyphaceae*). Tracing current literature, only two members of the genus *Lachnum* (*L. bicolor* (Bull.) P. Karst. var. *bicolor* and *L. virgineum* (Batsch) P. Karst.) have previously been reported from Turkey. *Lachnum brevipilosum* and *L. pygmaeum* are therefore presented here as new for the mycobiota of Turkey.

Members of the *Helotiales*, like most other fungi form an important part of terrestrial ecosystems. Protection of natural habitats is one of the most important steps to conserve them. Threatened fungi should be listed and protected by law. Although Turkey has red lists of some animals and plants, there are still no fungal red lists.

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Sarcodon martioflavus, a new species (Basidiomycetes) record for Turkish mycota [41]

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Muğla, in the southwest of Turkey, is rich in fungal species because of its suitable climate and vegetation. The Turkish mycobiota has been studied increasingly intensively in recent years, but there is still much work remaining. The present study contributes to knowledge of Turkey's larger fungi by adding new records. During routine field studies in 2011, *Sarcodon martioflavus* (Snell, K.A. Harrison & H.A.C. Jacks.) Maas Geest. was collected from Ula (Muğla). Morphological and ecological characteristics were recorded and the basidiomata photographed in their natural habitats. A specimen was then taken to the laboratory, identified, and deposited in the Fungarium of Muğla Sıtkı Koçman University: *Sarcodon martioflavus*, Ula, Muğla, in pine forest, 02.12.2011, N8. *Sarcodon martioflavus* does not appear in any existing checklist, and seems not to have been recorded previously from Turkey. Until more information becomes available, the conservation status of this species in Turkey must be assessed, using IUCN Criteria, as Data Deficient.

We thank BAP (the Scientific Research Projects of Muğla Sıtkı Koçman University) for supporting this project (11/41) financially.

Bioprospecting as a conservation tool: the genus *Aspergillus* (*Eurotium*) in Egypt [42]

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The search in nature for useful biochemical compounds and other potentially valuable biological products is a very old practice now sometimes described as "biodiversity prospecting" or "bioprospecting". Recent advances in biotechnology have generated bioprospecting interest in the fungi as organisms important not only for the crucial roles they undertake in nature but because many human activities depend on them. We report a bioprospecting study involving *Aspergillus* section *Aspergillus*, which contains economically important xerophilic fungi widely distributed in nature and the human environment and known for their ability to grow on substrata with low water activity. A range of soils (desert, cultivated, salt marsh), stored materials (seeds and grains, spices, dates) and medicinal plants were screened to give a picture as true as possible about the ecology and distribution of these fungi. The six taxa isolated from the different sources were identified and are now conserved in the Fungarium of Suez Canal University. They were screened for novel metabolites.

Projects like this raise interesting and often difficult questions about how management and exploitation of fungal diversity (with industrial and commercial applications potentially worth millions of dollars) can be kept sustainable and reconciled with conservation. Given the enormous potential of fungi to provide novel pharmaceuticals, chemicals and new technologies, the biotechnology industry has a vast, largely untapped resource for discovery of new chemicals and novel processes. It is important to protect the ecosystems and the organisms which provide that resource, and to ensure that rights of indigenous people to an appropriate share in resulting benefits are recognized. At present, desert ecosystems are typically viewed as economically worthless. This has led to extensive destruction of their natural habitats and over-exploitation of their biological resources. Egyptian mycologists have a responsibility to communicate these issues to public and politicians. This is difficult, as even the scientific community rarely acknowledges the true importance of fungi and their fundamental role in the conservation and protection of ecosystems. Obtaining the attention of politicians is even more difficult. Egyptian conservation legislation is strongly focused on protecting animals and plants and their habitats. Fungi are still neglected. To solve such problems there should be collaboration between mycologists, amateur fungal groups, fungal conservation societies, regional natural parks and environmental agencies.

Effect of plant-derived smoke on mycelial growth of six macrofungi [43]

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Wildfires are a common disturbance with important impacts on vegetation structure and function in many ecosystems. With climate change, their incidence is increasing in many parts of the world. Studies have shown that post-fire germination of a wide range of plant species is regulated by plant-derived smoke. Smoke also stimulates seedling growth of both native and economically important plants. Larger fungi are integral to forest ecosystems, playing a key role in nutrient cycling and decomposition. They are also widely used in the pharmaceutical industry and food production. Impact of fire on fungal communities has received less attention than for plants, but several recent studies have examined the effect of fire on macrofungal species richness. There is still, however, almost no information about the effect of smoke on mycelial growth. The present study aimed to determine the effect of smoke treatments on mycelial growth of six fungi (*Amanita strobiliformis*, *Armillaria mellea*, *Geopora sumneriana*, *Lactarius deliciosus*, *Omphalotus olearius* and *Sarcosphaera coronaria*). We hypothesized that at least some of the study species should have smoke-stimulated mycelial growth. To test this hypothesis, fresh mycelial discs of the six species were placed in PDA media with different concentrations of smoke solution (0, 4, 10, 100 ml/L). At least one smoke treatment promoted mycelial growth of three species (*A. strobiliformis*, *A. mellea* and *O. olearius*). No smoke treatment adversely affected mycelial growth of the other species. Results suggest that smoke may help maintain some fungal populations in fire-prone environments.

Some critically endangered species from Turkey [44]

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Turkey has a rich diversity of larger fungi due to its varied climates and topographical features. In ongoing taxonomic studies, approximately 2500 species have already been described. Among these species, 9 are classified as critically endangered. In this study; 6 of those critically endangered species of larger fungi (*Disciotis venosa* (Pers.) Arnould; *Geopora cooperi* Harkn.; *Myriostoma coliforme* (Dicks.) Corda; *Pseudohydnum gelatinosum* (Scop.) P. Karst.; *Sarcoscypha coccinea* (Gray.) Boud.; *Tricholoma sulphureum* (Bull.) P. Kumm.), all nationally rare, are described, with information about their habitats and distribution in Turkey.

Diversity of macrofungi in the north Nile delta [45]

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Collection and identification of wild fungi is important for the study of fungal diversity and their ecological role. Although mushrooms were known to the ancient Egyptians, information about the diversity, community organization, and variation of larger fungi belonging to the *Basidiomycota* and *Ascomycota* remains very scanty and poorly documented in Egypt.

During recent years, the diversity of larger fungi has been studied in the Nile delta (northern Egypt). This is a rich agricultural region and its environment seems suitable for the occurrence of larger fungi. This study was done in two major habitats: trees and gardens. Fruitbodies were collected and identified by macroscopic morphology and microscopic examination and information was gathered about the diversity and frequency of the recorded species. The more than 676 fruitbodies collected belonged in 44 species of 25 genera and 15 families distributed through four orders, the *Agaricales*, *Polyporales*, *Boletales* and *Hymenochaetales*. *Agaricales* in the agaric morpho-group were the best represented taxa (77%) with most (29.5%) belonging in the *Agaricaceae* and fewest (2%) in the *Tricholomataceae*, *Pysathyrellaceae* and *Nidulariaceae*. The *Ganodermataceae* was the most important family in the *Polyporales*. The most representative family of the *Boletales* was the *Sclerodermataceae*.

The implications of this work for fungal conservation have not yet been considered. The *Ganodermataceae* could be regarded as a threat to trees because the R.F. of *Ganoderma* is 100% on palms and citrus. Discovery of new species could lead to exploitation by an expanding mushroom industry.

Rare species of larger fungi in the south of western and central Siberia [46]

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Rare species of larger fungi found in the southern regions of western (Novosibirsk oblast' and Kemerovo oblast', the Altai Republic, Altai Krai) and central (the Khakass Republic, the Western Sayan, the Tuva Republic) Siberia are presented. Ecology, distribution and methods of protection of *Gyromitra gigas* (Krombh.) Cooke, *Pseudorhizina sphaerospora* (Peck) Pouzar, *Sarcosoma globosum* (Schmidel) Casp., *Verpa conica* (O.F. Müll.) Sw., *Bovista acuminata* (Bosc) Kreisel, *Cortinarius bulliardii* (Pers.) Fr., *Dictyophora duplicata* (Bosc) E. Fisch., *Phallus flavocostatus* Kreisel, *Lysurus gardneri* Berk., *Entoloma abortivum* (Berk. & M.A. Curtis) Donk, *Mycena oregonensis* A.H. Sm., *Leucopholiota lignicola* (P. Karst.) Harmaja, *Leucopaxillus rhodoleucus* (Romell) Kühner, *Floccularia luteovirens* (Alb. & Schwein.) Pouzar forma *luteovirens*, *Chromosera cyanophylla* (Fr.) Redhead, Ammirati & Norvell, *Rhodocybe stangliana* (Bresinsky et Pfaff) Riousset & Joss., *Leucopaxillus tricolor* (Peck) Kühner, *Pluteus fenzlii* (Schulzer) Corriol & P.-A. Moreau, *Melanophyllum eyrei* (Massee) Singer, *Sparassis crispa* (Wulfen) Fr., *Polyozellus multiplex* (Underw.) Murrill and an undescribed species of *Amanita* are discussed. These species are characterized by narrow ecological adaption, sporadic distribution, discontinuous or limited area, and few fruitbodies in known populations. A real danger of extinction of these species may arise under changing environmental conditions. As a result they are classified as belonging in the 3rd category of threatened species (R).

Two new ascomycete records for Turkey [47]

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The climate and vegetation of Turkey make it a country rich in fungal diversity. Studies of the Turkish mycota have been intensified in the last 30 years, but much remains to be discovered. The present work reports collection of larger ascomycetes from Aydın and Muğla provinces in spring 2013. Spring fungi are even less surveyed in Turkey than autumn fungi. The morphological and ecological characteristics of the samples were recorded in the field, and they were photographed. Specimens were then taken to the laboratory.

Using available literature, two of the specimens were identified as *Geoglossum umbratile* Sacc. and *Peziza lobulata* (Velen.) Svrček respectively. Both are species previously unreported from Turkey. *Geoglossum umbratile*, Aydın, Koçarlı, Koçarlı-Mersinbeleni way 22 km, in pine forest, 25.03.2013. H 223. *Peziza lobulata*, Muğla, Fethiye, Fethiye - Babadağ way 10 km, in pine forest, 29.03.2013. H 227.

These reports of fungal species previously unrecorded from Turkey emphasise how little is known still about the country's mycobiota. Until more information becomes available, the conservation status of these species in Turkey must be assessed, using IUCN Criteria, as Data Deficient.

We thank BAP (the Scientific Research Projects of Muğla Sıtkı Koçman University) for supporting this project (12/67) financially.

New *Crepidotus* spp. records for Turkey [48]

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The genus *Crepidotus* includes species producing basidiomata ranging in breadth from 2 mm to about 8 cm, but with most species falling in a range of 10-30 mm. In most species the pileus is attached laterally to the substratum, with or without a lateral basal extension. This growth habit results in a fan-shaped, semi-orbicular, reniform, or spathulate pileus, depending to some extent on how much the cap is tapered towards the point of attachment. Basidiomata grow on stumps, logs, fallen branches, twigs, woody debris, and occasionally on mosses or herbaceous debris.

We report two new records of *Crepidotus* for Turkey. Specimens were collected during routine field trips in Muğla and İzmir provinces. Morphological and ecological characteristics of the fungi were recorded and they were photographed in their natural habitats. The samples were then taken to the laboratory. Using available literature, they were then identified as *C. applanatus* and *C. cinnabarinus*. Both appear to be new for Turkey.

The specimens are deposited in the Fungarium of Muğla Sıtkı Koçman University, with the following collection information: *Crepidotus applanatus* (*Inocybaceae*), Muğla, Fethiye, on *Liquidambar orientalis* Mill. stump, 26.03.2011, H 77; *C. cinnabarinus* (*Inocybaceae*), İzmir, Selçuk, Çamlık village, on broadleaved tree stump, 23.03.2013. H 201. Until more information becomes available, the conservation status of these species in Turkey must be evaluated as Data Deficient.

We thank BAP (the Scientific Research Projects of Muğla Sıtkı Koçman University) for supporting this project (12/67) financially.

Ascodesmidaceae J. Schröt., a new family (Ascomycota) record for the Turkish mycota [49]

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The *Ascodesmidaceae* are characterized by small apothecia with brown tuberculate, spiny, or reticulate ascospores and an almost complete absence of the excipulum. The family comprises three genera: *Ascodesmis* Tiegh., *Lasiobolus* Sacc. and *Eleutherascus* Arx, none of which has previously been reported from Turkey. This study reports the first record of the *Ascodesmidiaceae* from Turkey: a species of *Lasiobolus* Sacc. Members of this genus are small (usually <1.0 mm diam.) coprophilous discomycetes with bristly, usually yellowish, setose apothecia, generally non-septate setae, operculate, non-amyloid, eight-spored to multispored asci, and hyaline to yellowish, smooth, unicelled, thin-walled ascospores which contain gas bubbles.

Lasiobolus papillatus (Pers.) Sacc. was collected from Aydın province during routine field trips. Morphological and ecological characteristics of the samples were noted and they were photographed in their natural habitats before study in the laboratory. The specimen is deposited at the Fungarium of

Muğla Sıtkı Koçman University. *Lasiobolus papillatus*, Aydın, Söke, Sofular village, on cow dung, N37°661545′, E27°683952′, 25.03.2013, H 218.

This report of a fungus family previously unrecorded from Turkey emphasises how little is known still about the country's mycobiota. Until more information becomes available, the conservation status of this species in Turkey must be assessed, using IUCN Criteria, as Data Deficient.

We thank BAP (the Scientific Research Projects of Muğla Sıtkı Koçman University) for supporting this project (12/67) financially.

New ascomycete records for the Turkish mycota [50]

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The climate and vegetation of Turkey make it a country rich in fungal diversity. Studies of the Turkish mycota have been intensified in the last 30 years, but much remains to be discovered. In this study specimens of larger ascomycetes were collected from Isparta and Aydın Provinces. The specimens were photographed in the field, and macroscopical, microscopical and ecological characters were recorded. They were then dried, identified and are now stored in the Fungarium of Muğla Sıtkı Koçman University.

Using macroscopical, microscopical and ecological characters, together with available literature, specimens were identified as *Trichoglossum variabile* (E.J. Durand) Nannf. and *Helvella helvellula* (Durieu & Mont.) Dissing. Both are species previously unrecorded from Turkey, and *Trichoglossum* Boud. is also new at generic level. *Helvella helvellula*, Aydın, Bozdoğan, Örentaht village, in pine forest, 26.04.2013. H 382. *Trichoglossum variable* Isparta, Isparta-Antalya way 50. km, Yanıklar site, in pine forest, 21.04.2013. H 306.

These reports emphasise how little is known still about the country's mycobiota. Until more information becomes available, the conservation status of these species in Turkey must be assessed, using IUCN Criteria, as Data Deficient.

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Is a species rare or overlooked? *Hapalopilus croceus* in Lithuania [51]

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Species known only from a few records always represent a conservation challenge, because their habitat requirements and necessity for site protection cannot be adequately assessed. We suggest that a first step in such cases is to consider species-specific detection probabilities and survey bias, to understand the possibility that lack of records may be due to the species being overlooked. We present an analysis based on a series of inventories of the rare European polypore *Hapalopilus croceus* growing on old oaks in Lithuania. During this study 56 trees inhabited by this fungus in 51 stands in 16 different forests were discovered in Lithuania.

The localities of the fungus identified during woodland key habitat (WKH) inventories and other forest studies in 2000–2006 were used in the analysis. Exact descriptions of the earlier localities were not available, except in a few cases. These areas were surveyed in 2007-2010 with the aim of locating substratum trees of the fungus. If presence of the fungus (fresh or old fruit bodies) was confirmed they were included in the analysis. Known substratum trees or their fragments were monitored at least once per year in August–November in 2001-2012. A digital forest inventory map was used in the analysis. Around each locality with the fungus a 1 km wide buffer was created using ArcView 3.2. All stands with oak entirely or partially falling within the buffer were surveyed in August-October to locate new host trees of the fungus. The probability of finding a *Hapalopilus croceus* site and the probability of finding the fungus on another, previously unknown tree in the same stand, were calculated.

Probability of fruiting. Of the 56 host-trees, 11 were not re-checked in the seasons subsequent to finding. For the remaining 45 trees re-checked for fresh fruit-bodies up to nine years post discovery, we treated the re-recording probabilities based on at least 3 years separately and pooled the 1-2-year re-checkings. The mean re-recording probability of the fungus on a host tree previously known was 65% ± 10% (95% CI; n = 34), ranging from 60% in downed trees and 64% in live trees to 78% in snags, but the substratum differences were not statistically significant. During routine checking of 19 of those forest stands by WKH personnel recording conservation values, the fungus was found in 58% cases. This suggests over 90% detection rate for the species when fruiting in a forest stand. Thus, annual fruiting probability is the main detectability problem for this species, and visits to potential habitats provide a reliable index of study effort for comparison between years.

Probability of recording in the same stand. In each of the 43 stands, the species was discovered on one tree only. Despite a total of 161 re-checks, it was found on a second tree in only 2 stands in later years. The rarity of finding another inhabited tree, given the fruiting probability 65% in any given year and detection probabilities in the re-checked stands over 90% even during ordinary WKH inventories, indicates that the fungus indeed was in a fruiting condition in single trees only. Moreover, if the surrounding trees had been extensively infected with mycelium of the species, even low probabilities of fruiting should have resulted in more trees carrying fruit-bodies in larger stands with more suitable oaks. As this was not observed, we argue that the registered host-trees may have been the first to be colonized either by spore dispersal or the continuity of mycelia in the stand, and the rare appearance of fruit-bodies in the surrounding trees suggests slow growth and/or dispersal limitation in *H. croceus*. Development of oaks of suitable age in the forest landscapes may therefore not be sufficient on its own for conservation of this species, and protection of the individual trees known to host the species should be given top priority.

Mycological conservation research in national parks of Albania [52]

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There is very little information about larger fungi in Albania, and in the mycological map of Europe it is still uncharted territory. Resources from mycological collections are likewise scant. There is no fungal protection legislation despite the fact that huge quantities of mushrooms are exported. The country has neither a fungal checklist nor a red list. Only lichens have been investigated to some extent and slightly more information is available about them. In autumn 2012, the first applied study and review of fungi in the National Park Prespa, Albania, took place, aimed at improving habitat management in the Park. This investigation established a high fungal diversity, and a number of rare, endangered and sensitive species were recorded. Park zones of special significance for fungi were defined.

The promising results and lack of earlier data on Albanian fungi triggered the decision to continue this pioneer methodical investigation. The aim was to complete a fungi inventory of Albania as a prerequisite for creating conservation and monitoring plans, as well as the first preliminary red list of fungi, where species categorization would be in compliance with IUCN category system, and finally for defining and introducing protection measures. Another aim was for certain areas to be defined and proposed as Important Fungus Areas, using criteria based on the presence of rare and threatened species, richness and mycological significance of the habitats. We have identified National Parks as priority areas for both systematic research and conservation in Albania since habitats outside Parks are very damaged, particularly forest vegetation which is to a large extent devastated. In 2013, field work was carried out in Tomorri Mountain National Park, Llogora National Park, Prespa National Park, Valbonë Valley National Park and Korab-Koritnik Natural Park, resulting in records of some very interesting species, such as: *Pyrofomes demidoffii*, *Antrodia juniperina*, *Lysurus cruciatus*, *Suillus sibiricus*, *Hexagonia nitida* and *Pisolithus arhizus*.

Conservation problems of hypogeous fungi [53]

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Hypogeous fungi form a special ecological group of larger fungi because their fruit bodies originate and remain underground until they break down naturally. They grow in a large variety of habitats from virgin forests to sites in city centres (Hawker 1954, Ławrynowicz 1988). Information about their occurrence and distribution is still limited to scarce collections in various regions of Europe (Ławrynowicz 1989, 1990). Their real conservation status has not been established because there are so few people able to find and identify them, and random collection cannot be the sole basis for the evaluation. At present they are placed in national red data lists of endangered fungi usually simply on the basis of rarity. Red listed hypogeous fungi (on the basis of European red data lists of larger fungi) comprise 14 genera of ascomycetes and 17 basidiomycetes genera. Altogether, 118 species are recorded: 56 ascomycetes and 62 basidiomycetes are on the lists. This means that about 50% of all existing hypogeous fungi are threatened in at least some part of Europe.

Analysis of national red data lists shows that strategies for including hypogeous fungi vary between two extremes. Some national lists contain almost all hypogeous fungi recorded in the country as threatened on the basis of rarity. The second case is that no hypogeous fungi are included. These extreme viewpoints emphasise the deficiency of current knowledge. Are larger fungi listed as rare species really rare or do they only appear so because of deficiency of data? This has been the starting point for field surveys of rare hypogeous basidiomycetes. *Chamonixia caespitosa*, known in Poland from a single locality discovered in the 1920s, is a good example. Lack of new information in the subsequent 80 years resulted in it being evaluated as extinct in the Polish national red data list (2006). After three years of searches (2009-2012), it is now known from 49 localities mostly, but not exclusively mountain sites: it was a matter of intensive searching in the proper places (Mleczko *et al.*, 2009). Three now common species of *Elaphomyces*: *E. muricatus*, *E. granulatus* and *E. asperulus* were considered as very rare in Poland until the 1970s, because for a long time nobody was interested in hypogeous fungi.

The most frequently recommended method to conserve red list fungi is to protect their habitat. In the case of hypogeous fungi, mycologists should pay special attention to their ecological requirements which are often different of that for plants and epigeous fungi. *Barssia oregonensis*, *Tuber aestivum*, *T. mesentericum* and *Melanogaster* species are examples of such fungi. The special ecological conditions they need are discussed. Mycologists should be aware that sometimes habitats rich in hypogeous species are not hotspots for other organisms, in particular plants.

Activity of the European Council for Conservation of Fungi [54]

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Since its establishment in 1985, the European Council for the Conservation of Fungi (ECCF) has aimed to promote attention to the conservation of Fungi among mycologists, nature conservationists and politicians, and international cooperation in research, monitoring and mapping programs. A document, proposing 33 fungal species for inclusion in the Bern Convention was prepared and presented at its 19th meeting in 1999 and again at its 21st meeting in 2001. This unique document gathering together extensive information from the whole of Europe about the presence, status and habitats of 33 fungal species, was published by the Council of Europe (Nature and Environment, 136 - March 2006). The network used to gather the huge amount of data for that work demonstrates that European mycologists are ready and able to collaborate and share their experience and that great resources of scientific knowledge, more or less computerized, are available.

In 2003 the ECCF strengthened its role by becoming the Conservation Body of the newly founded European Mycological Association (EMA) and started to work on production of a European Red List for larger fungi using IUCN categories and criteria. Starting as a small group of volunteers, the ECCF is now co-operating with various regional organizations such as the network of Planta Europa, and at a global level with the IUCN. The Important Plant Areas programme, a target of the European Plant Conservation Strategies (2002-2007 and 2008-2014) provides protection for all organisms in the selected sites, and these areas are of great conservation value for fungi. Consideration of fungi in their own right is now also beginning, and the first Important Fungal Areas are starting to be recognized. Last but not least, exciting progress has been made within the IUCN which, since 2009 has recognized fungi as a separate group on a par with animals and plants. In 2010, during the International Mycological Congress in Edinburgh, the International Society for the Conservation of Fungi was established.

An exhibition about fungi [55]

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As part of its centenary celebrations, the Whitby Naturalists' Club has staged an exhibition to raise awareness about fungi. This is possibly first exhibition about fungi in England, and certainly the first since at least 1974: fungi are not exhibited at the Natural History Museum in London. There are forty panels. Each takes a different aspect of the fungi and explores and explains it in terms understandable to lay people. In keeping with Whitby's famous association with Dracula, some of the panels celebrate gothic themes, including fungi on Egyptian mummies and other dead bodies, fungi on amphibians and bats, and zombie ant fungi. In addition, there are displays of fungal artefacts, of books about fungi (identification guides, novels and children's books), and of products which can only be produced through the involvement of fungi. Live fungi, particularly fruitbodies of *Pleurotus ostreatus* growing on old paperback books, and hyphomycetes and zygomycetes colonizing food are also on display. A large model of an *Amanita muscaria* basidioma, constructed by children from a local school, forms the centrepiece of the exhibition, which is accompanied by music inspired by fungi and written by the Czech composer Vaclav Halek. Poster-sized reproductions of a selection of the panels will be displayed at the Congress.

Diversity and conservation of Egyptian endophytic mycobiota: surveying and exploitation of some taxa for extracellular biosynthesis of silver nanoparticles [56]

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Nanoparticles are currently of intense scientific interest due to the wide variety of potential applications in biomedical, optical and electronic fields, and silver nanoparticles (AgNPs) are of particular interest in cosmetics and food packaging. Development of a reliable and ecofriendly process for synthesis of metallic nanoparticles is an important step in application of nanotechnology. One approach with immense potential is based on biosynthesis of nanoparticles using fungal endobionts.

Our work on this topic enabled us to isolate fungal endobionts from six wild species of medicinal plants in Wadi Al-Arbaein, Saint Katherine Protectorate, Egypt. Our aim was to study possible extracellular synthesis of AgNPs by these fungi. Three hundred samples of *Achillea fragrantissima*, *Artemisia herba-alba*, *Chiliadenus montanus*, *Origanum syriacum*, *Tanacetum sinaicum* and *Teucrium polium* were collected from 10 different sites throughout the Wadi from different altitudes (1498 to 1788 m). A total of 21 endobiont species belonging to 17 genera were isolated. These species belonged in 2 phyla, 3 classes, 7 orders, and 10 families. The *Pleosporaceae* had the highest number of isolated fungi (5 species out of 21) followed by the *Trichocomaceae* (4 species) and *Mucoraceae* (2 species). Prevailing genera were *Aspergillus* (3 species) and *Alternaria* (2 species). The most abundant species were: *Alternaria alternata* (42%), *Nigrospora oryzae* (38%) and *Chaetomium globosum* (11%). A total 13 species from 11 genera were screened for the production of AgNPs. In the biosynthesis of AgNPs by these fungi, each fungus mycelium is exposed to silver nitrate solution. That prompts the fungus to produce enzymes and metabolites for its own survival. In this process, toxic $Ag+$ ions are reduced to non-toxic metallic AgNPs through the catalytic effect of the extracellular enzymes and metabolites of the fungus. Out of 13 fungal isolates screened, eight (*Aspergillus flavus*, *Trichoderma viride*, *Aspergillus niger*, *Alternaria alternata*, *Nigrospora oryzae*, *Eurotium chevalieri*, *Curvularia lunata* and *Chaetomium globosum*) produced AgNPs by a nitrate reductase enzyme. *Trichoderma viride* isolated from *Chiliadenus montanus* was the taxon most effective in producing AgNPs and our measurements indicate that the diameters of AgNPs in the range of 5-52 nm and were exceptionally stable. *Trichoderma viride* is well known for its abundant formation of extracellular enzymes and metabolites, and the present process seems to be an excellent candidate for industrial scale production of AgNPs.

The present work contributed to the inventorying and conservation of fungal endobionts in Egypt in three ways. More is known about the diversity of fungal endobionts in medicinal plants of the Sinai desert, there is now a greater appreciation of the potential value of some habitats in Saint Katherine Protectorate for bioprospecting, and isolated fungi are now conserved in the Fungarium of Suez Canal University. Our work is also interesting from a conservation point of view, because it is an example of an exciting use of fungal technology to generate potentially valuable products - in this case nanoparticles - which do, however, themselves come with a range of new potential environmental threats of their own.

Some endangered taxa from Turkey [57]

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Fungi are one of the largest and most species rich groups of organisms. Their ability to degrade organic substances makes them extremely important to humans, and their conservation is vital for the health of earth's ecosystems. In recent years, some studies have shown a noticeable decrease in populations of some larger fungi following exposure to threats like acid rain and air pollution. As a result, some countries have established national fungal red-lists to document the threats and loss of fungal diversity. In recent decades, fungal red-lists using IUCN categories and criteria have appeared in many European countries. In most countries at least some species were classified as endangered. That category, determined according to standard criteria (reduction in population, area of occupancy, population size estimated at fewer than 250 mature individuals), means the species faces a very high risk of extinction in the wild. Using such criteria, Turkish mycologists prepared a preliminary national red-list in 2004. It identified endangered species of larger fungi. In the present study, some endangered, Turkish larger fungi (*Abortiporus biennis* (Bull.) Singer, *Lactarius luteolus* Peck., *Leucocoprinus brebissonii* (Godey) Locq. and *Pithya vulgaris* Fuckel) are described with information about their geographical distribution.

Conservation of medically important fungi: current status and future perspective [58]

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Fungal conservation is a key component of the movement to protect animals, fungi, plants and their habitats. Pathogenic fungi are an important group of organisms involved in the aetiology of fungal diseases in human, animals and plants. They too need conservation, as they have an important role as natural checks and balances. Of the approximately 100,000 fungal species so far identified, 400 are known as causative agents of a wide array of mycoses in human. As a central laboratory working on different mycotic diseases, the Mycology Department of the Pasteur Institute of Iran preserves around 2,000 fungal strains which have been isolated from patients with different type of mycoses from superficial to systemic. These microscopic fungi are mainly yeasts (*Candida albicans*, *Candida* species and *Malassezia* species) and moulds (species of interest in dermatology from three genera *Trichophyton*, *Microsporum* and *Epidermophyton*, and saprobes of the genera *Aspergillus*, *Fusarium*, *Acremonium*, *Scopulariopsis* and *Scytalidium*). All the fungal strains are maintained in our laboratory by different methods from serial transfer in glass tubes to preservation on liquid nitrogen. A list of preserved fungi is available from http://fa.pasteur.ac.ir/MBankResult.aspx. The details of preserving microfungi are discussed.

Edible fungi determinet in Karz Mountain (Bitlis) and its surroundings [59]

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Specimens of larger fungi were collected Karz Mountain (Bitlis) and surrounding districts between the 2010 and 2012. All specimens were photographed in their natural habitat. The ecological and morphological features of specimens, and local knowledge about larger fungi of the area were recorded. 37 taxa of edible fungi were identified. *Pleurotus eryngii* (DC.) Quél., *Pleurotus ostreatus* (Jacq.) P. Kumm. and some *Agaricus* species are well known in the area. *Pleurotus eryngii* (DC.) Quél. known locally as “kiverk” or “kari” is collected and sold in spring. If there is a risk of over-exploitation, control of collecting and education of local people may be needed.

Bioprospecting and conservation of Egyptian endophytic mycobiota: taxa producing anticancer metabolites [60]

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Bioprospecting is the search for naturally occurring chemical compounds and biological material, especially in extreme or biodiversity-rich environments. In a search for anticancer metabolites, we isolated 49 fungal endobionts taxa from 8 dominant plant species at different altitudes in Saint Katherine Protectorate, South Sinai. There were 36 endobionts species from low elevation wadis (1300-1431 m), 51 species from mid elevation wadis (1498-1788 m), and 25 species from high elevation wadis (1847-1970 m). *Zygomycota* represented by one species, teleomorphic *Ascomycota* by 17 species, and anamorphic *Ascomycota* by 31 species. Two endobionts, *Stachybotrys chartarum* (Ehrenb.) S. Hughes and *Trichothecium roseum* (Pers.) Link recovered from *Origanum syriacum* L. and *Achillea fragrantissima* (Forssk.) Sch. Bip., identified morphologically and using molecular techniques, were then used for the screening itself. Results showed that fungal endobionts from medicinal plants are a significant potential source of novel bioactive compounds. The present work contributed to the inventorying and conservation of fungal endobionts in Egypt in three ways. More is known about the diversity of fungal endobionts in medicinal plants of the Sinai desert, there is now a greater appreciation of the potential value of some habitats in Saint Katherine Protectorate for bioprospecting, and isolated fungi are now conserved in the Fungarium of Suez Canal University. Our work is also interesting from a conservation point of view, because it is an example of an exciting use of fungal technology to generate potentially valuable products.

Monitoring fungal species protected by law in Estonia, 2013 [61]

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The aim of the present study reviews the occurrence of basidiocarps of rare Estonian fungi. The initial objective of this monitoring was surveillance of habitats of protected fungi in Estonia: 9 category 1 species, 8 category 2 species, 3 category 3 species and 4 rare species not protected by law (*Ceriporia tarda*, *Pycnoporellus alboluteus*, *Polyporus umbellatus* and *Polyporus melanopus*). The main results of the study were as follows:

1. Fruitbodies were not found in the case of 11 species (*Leucopaxillus salmonifolius*, *Pachykytospora tuberculosa*, *Inonotopsis subiculosa*, *Boletopsis leucomelaena*, *Boletus radicans*, *Inonotus dryophilus*, *Lactarius chrysorrheus*, *Sarcosphaera coronaria*, *Bankera violascens*, *Tricholoma colossus* and *Pycnoporellus alboluteus*), and in the case of three species (*Sparassis crispa*, *Tricholoma apium* and *Polyporus umbellatus*) basidiomata were found but in habitats not included in the current monitoring.
2. *Hapalopilus croceus* in its habitats in Paralepa, Lääne County and Kuldre, Võru County had an exceptionally good year. Years when basidiomata occur in both habitats of the species are rare in Estonia.
3. Basidiomata of *Pachykytospora tuberculosa* were not found from its monitoring area: the branches of the oak-tree where it was growing have decayed in its only station in Estonia.
4. Compared with previous years, basidiomata of *Sarcosoma globosum*, *Rhodotus palmatus* and

Sarcodon fuligineoviolaceus occurred less frequently.

5. The situation of *Ceriporia tarda* remains good in its only Estonian and Europe station, where it grows on three fallen spruce trunks.

Monitoring data in 2013 indicates that for several (rare) fungal species, it is not possible to assess their occurrence or non-occurrence in a habitat based on evidence from only one or a few years. Lack of fruitbodies in a specific habitat does not necessarily mean the species has become extinct at that site. The prime reason for this is that several protected fungal species are at their southern or northern habitat limit, and annual fungal species do not necessarily produce basidiomata every year.

Tricholoma (Fr.) Staude in Turkey [62]

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Tricholoma (Fr.) Staude is one of the large and classic genera in the *Agaricales*. Over 1200 taxa have been described in this genus from different places of the world, although the identity of many, perhaps most remains uncertain. In the field *Tricholoma* species can be easily recognized by the fleshy, fibrous fruitbodies with smooth to suede-like, fibrillose or scaly caps and emarginate lamellae. Many species, however, are very similar, making identification within the genus difficult. In Turkey 68 members of *Tricholoma* have been reported, but further study is likely to increase this number because the endemic Turkish forests of *Liquidambar orientalis* Mill. and *Abies nordmanniana* (Stev.) Spach. subsp. *equi-trojani* (Aschers & Sint. ex Boiss) Coode & Cullen are likely to be rich in this genus.

IUCN-compatible evaluations of some Turkish *Tricholoma* species have been published recently. *Tricholoma sulphureum* (Bull.: Fr.) P. Kumm. has been rated as critically endangered, and *Tricholoma equestre* (L: Fr.) Kumm., *Tricholoma sejunctum* (Sow.: Fr.) Quél., *Tricholoma stans* (Fr.) Sacc. and *Tricholoma ustaloides* Romagn. as vulnerable. These species therefore need protection. *Tricholoma anatolicum* H.H. Doğan & Intini, reported first from Turkey is commercially valued and exported. It too therefore needs protection.

Conservation of human pathogenic yeasts [63]

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Pathogenic yeasts from the genera *Candida* and *Malassezia* are important unicellular fungi involved in the aetiology of nosocomial fungal infections. *Candida albicans* and other *Candida* species cause superficial to deep mycoses in suspected individuals, while *Malassezia* species are transmittable fungi responsible for cutaneous infections of skin and hair. As part of key laboratory work on different mycotic diseases, the Medical Mycology Department of the Tarbiat Modares University preserves around 300 yeast strains isolated from patients referred to the laboratory. These microscopic fungi are mostly *Candida albicans*, *Candida* species and *Malassezia* species. All fungal strains are maintained in our laboratory by different methods from serial transfer in glass tubes to preservation on liquid nitrogen. Challenges and opportunities for preservation of pathogenic yeasts are discussed. This work can be regarded as *ex situ* conservation of organisms which can function as natural checks and balances.

Cybernetics and fungal conservation: an interdisciplinary approach to management of fungal conservation using desert truffles as an example [64]

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"Human evolution cannot be understood as a purely biological process, nor can it be adequately described as a history of culture. It is the interaction of biology and culture with feedback between biological and cultural processes" (E.O. Wilson). As fungal conservation is a mixture of science and politics, orchestrating a positive attitude to it involves a sort of partnership between the biological and social sciences. Managing this complex process involves cybernetics.

Cybernetics deals with communication in complex systems. It has been described as "the art of steersmanship" or "the art of creating equilibrium in a world of constraints and possibilities" and is applicable when a system is in a closed signalling loop; that is, where action by the system generates some change in its environment and that change is reflected in some manner that triggers a system change. In fungal conservation, a cybernetically controlled environment entails creating an input which triggers a positive attitude towards fungal conservation and generates a feedback which develops fungal conservation itself in a 'closed signalling loop'.

Conservation of desert truffles is a case in point. In southwest Asia and northern Africa there are cultural traditions which go back to ancient times. In many parts of these regions, fruitbodies of these fungi are still described as "manna", a word meaning "the gift of God" which has been used in this sense for thousands of years, back to what was arguably the first recorded act of fungal conservation (Exodus 16: 32). Desert truffles are mentioned in the religious texts of Christianity, Islam and Judaism alike, and are universally favourably regarded in these writings, as food and for their medicinal value. In addition to the religious traditions, these fungi are widely used in the region as aphrodisiacs.

Such cultural value might be expected to generate a tradition to conserve these fungi, but because they are regarded as 'miraculous', there is a deeply subliminal view that they are protected by God: "it's a free gift; no work is required to enjoy it and no protection either". This simultaneously encourages over-exploitation and a laissez-faire attitude to their conservation, exacerbated by land-ownership issues and a feeling that information about the location of desert truffles, as such a precious gift from God, should be concealed: gatherers have been described as downright secretive. These deeply-rooted traditions hinder research on the fungi. Moreover, scientific knowledge may get distorted when communicated to the public by non-specialists: examples of this can be found among YouTube videos of clerics preaching on this subject. A lot of co-ordination, correlation, communication, and organization are thus required to enable the prominent cultural value of desert truffles to be used for conservation.

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Two new macrofungi records from Turkey [65]

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A review of the national fungal checklist and publications up to January 2013 showed records of 6 taxa in *Parasola* Redhead, Vilgalys & Hopple and one in *Leptoglossum* P. Karst. known from Turkey. On that basis, *Leptoglossum polycephalum* (Bres.) M.M. Moser and *Parasola misera* (P.

Karst.) Redhead, Vilgalys & Hopple are reported here as new records for Turkey. Samples of larger fungi were collected from Van and Diyarbakır (Hani) provinces between 2010 and 2012. Morphological and ecological features were noted during field trips and digital photographs taken. Macroscopic and microscopic investigations were then made. Microscopic structures were observed in dried material. The spores were studied in water and 3% KOH separately. Identifications were made using available literature. All specimens are deposited in the Fungarium of Yüzüncü Yıl University (VANF), Van, Turkey. The following year a search was made for further samples. There were none found. The area in which these species occur seems limited and narrow. This may justify protection measures.

Genetic diversity of some ectomycorrhizal species associated with fragmented oak forests (*Quercus humboldtii*) in Colombia [66]

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Population genetics dynamics of ectomycorrhizal fungi [EMF] and the diversity of these symbiotic organisms have not previously been carried out in *Q. humboldtii* forests in Colombia. Our hypothesis is that if there is a modest impact on host mating patterns because of habitat fragmentation, there could also be similar dynamics of population structure and loss of genetic diversity in EMF species. We have taken multi-species approach to see the overall polymorphism and divergence within species among sampled fragmented forests. A total of 222 fruiting bodies distributed in 11 patches were collected: seven in the department of Boyacá, two in Antioquia and two in Santander. According to the diversity indices, the fragmented forest with presence of footpaths has the lowest Shannon diversity and Margalef richness values. *Cortinarius*, *Lactarius*, *Amanita*, *Laccaria* and *Russula* were the most abundant genera in the sampled forests. We analyzed the Internal Transcribed Spacer (ITS) and the nuclear Large Subunit (nLSU) within some common species (*C. iodes*, *L. deceptivus*, *A. flavoconia*, *A. fuligineodisca*, *Laccaria* sp.1 and *R. cyanoxantha*) using the software dnaSP to obtain summary statistics related to genetic diversity. Most species showed more genetic distance and differences in the genetic diversity statistics between regions, than between forest fragments from the same region. According to the *Tajimas´D* statistic with a statistical significance $P<0.05$, calculated using the total number of segregating sites, some EMF species populations present in different fragmented forest showed values far from 0 ($D_T<0$ or $D_T>0$), rejecting the hypothesis of a neutral Wright-Fisher model in these populations. The results are very promising as a first multi-species approximation to the EMF population genetic structure, demographic history and genetic diversity in white oak forest in Colombia.

Species richness and diversity of ascomycetes from a relict forest in central Italy [67]

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Collestrada forest of Umbria has outstanding semi-natural and relict natural woodlands exceptionally rich in biological diversity, but studies for fungi, particularly the *Ascomycota*, are still few or completely missing. We studied composition and distribution of *Ascomycota* visible to the naked eye (greater than 1 mm in size) in coniferous plantations and broad-leaved deciduous natural woodland of this forest from the beginning of January to the end of July 2013. Particular attention was paid to large trunks in advanced stages of decomposition with soft and damp wood. Other dead wood, including stumps of fallen trees, twigs, branches, rotten pieces of wood lying in the litter and peeled off bark were also examined. Specimens were dried and examined microscopically for identification. A sample of each species was deposited in the DAB (Department of Applied Biology, University of Perugia, Italy) fungarium. Species of *Sarcoscypha* also received molecular analysis of the internal transcribed spacer (ITS) region. Sequence were aligned using ClustalW software and phylogenetic analysis was performed using MEGA v.5.2 software. Richness (S) and diversity indexes (Fisher's α, Shannon J', Simpson 1/D) were inferred using EstimateS 8.2 (Colwell R.K., http://purl.oclc.org/estimates).

Twenty four species were recorded, belonging to 5 classes, 7 orders, 13 families, and 20 genera. These were grouped by nutritional category. The most represented taxonomic group was *Pezizomycotina*. Its diversity ranged from 0.84 to 8.12 (Fisher's α), 0 to 8.53 (Shannon index), and 1 to 13.49 (Simpson index) depending on woodland types (Table 1). The macrofungal community in the *Quercus frainetto* woodland displayed the highest richness and diversity with 13 species among 63 ascocarps collected. *Sarcoscypha* specimens showed very similar ITS sequences (99% of sequence identity) and blast analysis showed the best match with samples classified as *S. coccinea* in the GenBank database. Our sequences were aligned with those of *S. coccinea* and other phylogenetically related species present in GenBank and a phylogenetic tree was built. The tree confirmed that our samples belong to the *S. coccinea* clade, where they formed a distinctive, well supported, sub-clade separate from other samples.

Our results indicate differences in ascomycete species richness and diversity patterns between Collestrada woodland types. The diversity indexes (Fisher's α, Shannon, Simpson) clearly showed that the *Pezizomycotina* community of the *Q. frainetto* woodland type were richer and more diverse than the other types, and in the following decreasing order: *Quercus* spp. > *Q. ilex*, *C. betulus* > *Q. cerris* > *Pinus* spp. > *Q. petraea*. *Pezizomycotina* communities also appear to be structured by host species. These include vegetational types of the "forests, wood and scrubs" category of the Directive's habitats (92/43/EEC) and its interpretation manual for Italy (Biondi *et al*., 2009; Biondi *et al*., 2012). Of the 24 species reported, 10 appear in Red Lists (or proposals for Red Lists) of other European countries (www.wsl.ch/eccf), such as *Sarcosphaera coronaria* (Jacq.) J. Schröt. and *Sarcoscypha coccinea* (Gray) Boud., probably due to habitat loss. *Sarcosphaera coronaria* is also one of 33 fungal species threatened at the European level (www.wsl.ch/eccf). Our molecular analyses of *S. coccinea* showed that ITS sequences from central Italy differ from those in GenBank for this species. In Italy reports about *Ascomycota* from different environments are few. Compilation of regional and national level check-lists which would allow characterization of declining, rare and threatened populations do not yet exist. This study contributes to check-lists for Umbria and Italy as a whole.

Fungal diversity in forests of central India and its conservation [68]

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We recorded diversity of forest fungi of central India (Chhattisgarh and Madhya Pradesh). 908 fungal species belonging to 349 genera (201 genera of ascomycetes, 134 basidiomycetes, 11 phycomycetes and 3 myxomycetes) were recorded on different substrata. Among them, 536 species of fungi were ascomycetes, 346 basidiomycetes and 14 other fungal groups. 348 fungi were recorded on leaves, 294 on stem/branches and twigs, 47 on wood/logs/stumps, 55 in soil, 89 on ground, 54 in litter, 17 on roots, 21 on seed/ seedlings and 4 on insects. Two new genera and 30 new species were described from central India. *Asterostomella shoreae*, *Passalora emblicae* and *Phlyctaeniella indica* are among the recently published new species. *Astraeus hygrometricus*, *Boletus edulis*, *Boletus fallax*, *Clarkeinda trachodes*, *Cystolapiota moelleri*, *Geastrum triplex*, *Gloiocephala resinopunctata*, *Macrocybe labayensis*, *Phallus merulinus*, *Russula adusta*, *R. cinerella*, *R. delicula*, *R. leelavathyi*, *R. michiganensis*, *Scleroderma bovista*, *S. geaster* and *Sporotrichum versisporum* are among the recently recorded fungi from central

India. In most countries, fungi are insufficiently considered in conservation initiatives, and mycologists have to date made only little effort to promote conservation of fungi. In central India we have been studying forest fungi for the last two decades. On perusal of the fungal collection (over 3100 specimens) in our division's Mycology Fungarium, 12.3% of species were collected only once during the last 15 years and could be considered threatened and in need of conservation; 5.6% were collected 2-5 times; 1.6% were collected 6-10 times; 1.1% were collected 11-20 times; only 0.7% fungi were collected more than 20 times. The data indicate the populations of most of fungi occurring in this part of the world are dwindling with time. These fungi need *ex situ*, *in situ*, and habitat conservation.

Engleromyces sinensis: a medicinal fungus in urgent need of protection [69]

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Engleromyces sinensis (*Xylariaceae*, *Ascomycota*) is valued medicinally by local people in southwestern China. They use fruitbodies to treat gastritis, laryngitis, ulcers, tonsilitis, mumps, acute nephritis, purulent skin inflammation and even cancer (Zang *et al.*, 2005). More than twenty types of cytochalasin compounds have been reported from fruitbodies of this species (Wang *et al.*, 1978; Liu, 2004). Cytochalasin D has an inhibitory effect on human tumour cells (Liu, 2006). Liu *et al.* (2002) isolated neoengleromycin from them. This is known to have a strong inhibitory effect on viruses (Pedersen *et al.*, 1980; Liu *et al.*, 2002).

This fungus is a rare medicinal resource, scattered only in high altitude areas, found only on bamboo (*Sinarundinaria* sp.) and reported from Yunnan, Sichuan and Tibet, with recent records only from Yunnan. Environmental damage has resulted in decrease of bamboo forest, so protection of *E. sinensis* is becoming urgent. Because the fruitbodies are rare, mycelium isolated artificially from them is an essential resource for future research. In this study, we successfully isolated mycelium in artificial culture, analyzed its amino acids content under the condition of solid culture, and examined the antibacterial and anti-tumour activity of its secondary metabolites after isolation and purification. The result shows mycelia of *E. sinensis* contain many kinds of amino acids beneficial for health, such as Phe, Glu, Tyr, Trp, etc. Ethanol extracts of mycelia of *E. sinensis* can significantly inhibit growth of seven indicators. The anti-tumour experiment showed that ethanol extracts can significantly inhibit growth of tumour cells.

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References

Liu, J.K. (2004). *Higher Fungi Chemical* [M]. China Science and Technology Press.
Liu, J.K., Tan, J.W., Dong, Z.J. *et al.* (2002). Neoengleromycin, a novel compound from *Engleromyces goetzii* [J]. *Helv. Chim. Acta* **85** (5): 1439-1442.
Liu, Y.F. (2006). *In Vitro Anticancer Activity Evaluation and Active Ingredients Research of 90 Poisonous Mushrooms in Yunnan Province* [D]. Zhejiang University.
Pedersen, E.J., Larsen, P. & Boll, P.M. (1980). Neoengleromycin, a new cytochalasin from *Engleromyces goetzii* [J]. *Tetrahedron Letters* **21** (52): 5079-5082.
Wang, J., Wang, S.L., Liu, X.Y., Wan, X.Y. & Chen, Y.T. (1978). Isolation and identification of cytochalasin D from *Engleromyces goetzii* [J]. *Acta Microbiologica Sinica* **18** (3): 248-252.
Zang, M., Jiang, L.X. & Zhou, Y.K. (2005). Biodiversity and conservation of edible fungi in Yunnan Province [J]. *Edible fungi of China* **24** (6): 3-4.

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Numbers refer to abstracts, not pages.

Orphans of Rio

The 1992 Rio Convention on Biological Diversity [CBD] recognized the right of all species to live on this planet. More than 190 nations are signatories. All are failing to provide even basic protection for fungi.

The Convention's current logo (below) is a vivid example of that failure: it has birds, fish, mammals, plants, an insect, but no fungi.

Country	Animals	Fungi	Plants
Austria	104	26	85
Belgium	201	18	145
Bulgaria	193	23	221
Cyprus	130	5	94
Czech Republic	213	11	140
Denmark	309	21	144
Estonia	100	20	76
European Union	296	2	58
Finland	222	90	245
France	22	2	16
Germany	140	5	153
Greece	119	1	138
Hungary	126	6	126
Ireland	126	2	26
Italy	183	8	110
Latvia	103	11	96
Lithuania	464	95	266
Luxembourg	46	0	50
Malta	435	8	319
Netherlands	80	6	53
Poland	47	11	45
Portugal	400	4	318
Romania	166	5	79
Slovakia	183	26	188
Slovenia	387	10	126
Spain	221	0	42
Sweden	282	28	175
UK	292	94	347

Number of times animal, fungal and plant words occurred in CBD country reports from European Union countries

2011-2020

United Nations Decade on Biodiversity

Every member country of the Convention has to submit reports about its work to protect the natural world. You can read these reports on the Internet.

The table (left) lists European Union countries, with a count for each of the number of times words for animals (like bird, fish, mammal or reptile), for fungi (like mushroom, mould or truffle), and for plants (like moss, flower or tree) occur.

In every case, fungi are grossly underrated. The failure to protect fungi is not only widespread, it is also institutional.

Fungal conservationists have adapted the logo of the UN Decade on Biodiversity (right), in a way which supports its aim to protect wildlife, but also draws attention to the huge inadequacy of current provisions for nature conservation.

It's not just animals and plants ...

Fungi are Biodiversity too!

2011-2020

United Nations Decade on Biodiversity

For more information go to www.fungal-conservation.org