European Council for Conservation of Fungi
(European Mycological Association)

International Society for Fungal Conservation

Ss. Cyril and Methodius University, Skopje

Macedonian Mycological Society

FUNGAL CONSERVATION IN A CHANGING EUROPE

Ohrid, Republic of Macedonia

1-6 October 2017

PROGRAMME & ABSTRACTS

Organizing Committee

Prof. Mitko Karadelev [Chair]

Assistant Prof. Katerina Rusevska [Congress Secretary]

Ms Daniela Mitic-Kopanja [Local Organizer]

Ms Kristina Zimbakova [Local Organizer]

Prof. Gerhard Kost [Field Trips]

Dr Su Gonçalves [Co-chair ECCF, ex officio]

Dr Beatrice Senn-Irlet [Co-chair ECCF, ex officio]

Dr David Minter [President EMA, ex officio]

Scientific support of the meeting: European Council for Conservation of Fungi; IUCN Species Survival Commission (Chytrid, Zygomycete, Downy Mildew and Slime Mould Specialist Group; Cup-fungi, Truffles and Allies Specialist Group; Lichen Specialist Group; Mushroom, Bracket and Puffball Specialist Group; Rust and Smut Specialist Group) and the Macedonian Mycological Society.

Financial support of the Meeting: British Mycological Society; Cybertruffle; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ); Regional Rural Development Standing Working Group (SWG) in South-East Europe; Soloprom; Sofija - Printing House and Soloprom Company.

European Council for Conservation of Fungi [www.eccf.eu]

Established in 1985, the **ECCF** is the world's oldest body devoted entirely to conservation of fungi. It aims to promote fungal conservation in Europe by stimulating production of continental-level, national and local red lists, by monitoring changes in and threats to fungal populations, and by drawing those changes and threats to the attention of decision makers, politicians and the public. Since 2003, it has been the conservation wing of the European Mycological Association and, since 2010, the voice of fungal conservation for Europe in the *International Society for Fungal Conservation*.

European Mycological Association [www.euromould.org]

Established in 2003, the **EMA** is the voice for European mycology in the International Mycological Association. It aims to promote all aspects of mycology within Europe, and oversees organization of the quadrennial *Congress of European Mycologists*, which is the longest continuously-running series of international meetings devoted to mycology. The eighteenth congress [www.xviiicem.org] will be held in Poland (Warsaw and Białowieża Primeval Forest) from 16-21 September 2019.

International Society for Fungal Conservation [www.fungal-conservation.org]

Following a resolution at the second *International Congress for Fungal Conservation* (UK, 2009), the **ISFC** was set up in 2010 as the first global society explicitly and exclusively dedicated to fungal conservation. It has helped establish, and maintains links with regional and national fungal conservation societies throughout the world. Its publication, *Fungal Conservation*, issued digitally, is freely available from the Society's website.

Macedonian Mycological Society [http://macfungi.webs.com]

The **MMS**, established in 1990, promotes study and conservation of fungi in Macedonia. It was established to unite field mycologists in Macedonia to deal more effectively with ecological and environmental issues connected with fungi. The Society has both amateur and professional members, and teaching is an important component of its work.

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

Welcome

Dear Friends and Colleagues,

Mitko Karadelev
Chair, *Organizing Committee*

David Minter
President, *European Mycological Association*

Welcome to the beautiful and historic city of Ohrid in the Republic of Macedonia, and to the 2017 meeting of the *European Council for Conservation of Fungi* [**ECCF**]. This event, held under the auspices of the *European Mycological Association* and the *International Society for Fungal Conservation*, has been organized and is hosted by the *Macedonian Mycological Society* and the *Ss. Cyril and Methodius University*, Skopje. Full meetings of the **ECCF** have traditionally been held halfway between successive Congresses of European Mycologists so, although that tradition lapsed a little in recent years, it is very encouraging to have such good support for the present gathering, and particularly valuable that it is being held in the Balkans which, in the last few years has seen impressive activity and progress in fungal conservation.

We are grateful to the Organizing Committee and the Scientific Advisors who have put so much effort into making this meeting a success. We also acknowledge with thanks the generous financial support of our donors, listed on the inside front cover. Finally, we wish you all a very successful meeting.

PROGRAMME

Registration

The Registration Desk will be open on Sunday 1 October from 18.00 to 20.00, and again on Monday 1 October from 08.00 to 09.00. If you arrive at the Congress outside these times, please find Katerina Rusevska, Secretary of the Organizing Committee, and she will arrange your registration.

Exhibition

Throughout the week, there will be an exhibition of paintings by Kristina Zimbakova entitled *Fungi in Contemporary Art*.

Monday 2 October

Morning

Opening ceremony

09.00-09.30 *Welcome*: Mitko Karadelev, Chair of Organizing Committee.
Welcome: University Rector / Dean of the Faculty of Natural Sciences.
Welcome: Official Representative, Macedonian Ministry of Environment and Physical Planning.
Response of thanks on behalf of participants: David Minter, European Mycological Association President.

Fungal conservation in Europe. Chair: Stephanos Diamandis.

09.30-10.00 Opening address: David Minter, *Fungal conservation: progress*.
10.00-10.20 Wim Ozinga, *Fungal Conservation in the Netherlands, Challenges and Opportunities*.
10.20-10.40 Cvetomir Denchev, *Assessment of threat status of smut fungi*.
10.40-11.00 Izabela Kałucka, *Legal protection of macrofungi in Poland. Current state of the art and dilemmas*.

11.00-11.20 Refreshments.

* presenting author; [L] lecture; [P] poster

Fungal conservation in Europe [cont.]. Chair: Claudia Perini.

11.20-11.40 Mitko Karadelev, *Conservation of fungi in Macedonia*.
11.40-12.00 Tine Grebenc, *Molecular diversity of truffles in countries of southeast Europe. How much diversity is hidden there?*
12.00-12.20 Boris Ivančević, *Red list project in Serbia: official fungal red list*.
12.20-12.40 Armin Mešić, *Fungal conservation activities in Croatia, 2006-2017*.
12.40-13.00 Kalliopi Stara, *The taste of the wild. Conceptualizations of mushrooms in modern Greece*.

13.00-14.00 Lunch.

Afternoon

Fungal conservation in Europe [cont.]. Chair: Katerina Rusevska.

14.00-14.20 Paola Angelini, *Pezizomycotina and their conservation status in Umbria (Italy): an evaluation at regional level*.
14.20-14.40 Rigas Tsiakiris, *Steps forward for a new ministerial proposal for mushroom legislation in Greece: challenges and opportunities*.
14.40-15.00 Hayrünisa Baş Sermenli, *Morels of Turkey and their conservation*.
15.00-15.20 Tatyana Svetasheva, *Fungal Conservation in Russia: an update*.

15.20-15.40 Refreshments.

Fungal conservation beyond Europe. Chair: Vera Hayova.

15.40-16.00 Yi-Jian Yao, *Red-list assessment for larger fungi in China*.
16.00-16.20 Edward Mwavu, *Macrofungi conservation in Albertine rift forests*.
16.20-16.40 Andrew Ngadin, *Efforts to approach public on fungal conservation in Gunung Gading national park of Sarawak on the island of Borneo*.
16.40-17.00 N.S.K. Harsh, *A preliminary red list of fungi in India*.

17.00-18.00 An introduction to Macedonian wines.

19.00 Dinner.

Tuesday 3 October

Morning

Red listing fungi. Chair: Tatyana Svetasheva.

09.00-09.30 Plenary lecture: Anders Dahlberg, *The Global Fungal Red List Initiative*.

09.30-11.00 Plenary workshop.

11.10-11.30 Refreshments.

11.30-13.00 Plenary workshop [continued].

13.00-14.00 Lunch.

Afternoon

14.00-17.00 Excursion to St Naum Monastery and springs of the Crni Drim River.

17.00-19.00 Poster session.

19.00 Dinner.

Evening

20.30-21.30 ECCF meeting. Su Gonçalves (Co-chair) & Vera Hayova (Secretary) will lead discussion about future directions of the *Council*, the conservation wing of the *European Mycological Association*. Please attend and contribute your views about the way forward.

Wednesday 4 October

Morning

Fungal conservation in Europe: specific projects. Chair: Mitko Karadelev.

09.00-09.20 Irmgard Krisai-Greilhuber, *Are current environmental programmes adequate for conservation of fungal biodiversity? Exemplary experiences from the protection of oak-dominated woodlands in eastern Austria*.

09.20-09.40 Gerhard Kost, *Fungi in nature conservation in Germany*.

09.40-10.00 Carolina Girometta, *The return of* Fomitopsis officinalis *to the Italian Alps: preliminary assessment of strategies for conservation and sustainable use*.

10.00-10.20 Sergey Volobuev, *Host preferences and distributional patterns of rare and protected species of aphyllophoroid fungi in the Middle Russian Upland*.

10.20-10.40 Claudia Perini, *Soil biota and innovative forest management: a Life Project*.

10.40-11.00 Irmgard Krisai-Greilhuber, *Red list of macromycetes of Austria 2016*.

11.00-11.20 Refreshments.

Parallel workshops.

These continue Tuesday's workshops, as parallel sessions enabling specialist consideration of fungi covered by three of the IUCN Species Survival Commission's Specialist Groups.

11.20-13.00 Anders Dahlberg, *Red-listing larger basidiomycetes*.

11.20-13.00 Cvetomir & Teodor Denchev, *Red-listing rusts & smuts*.

11.20-13.00 David Minter, *Red-listing non-lichen-forming ascomycetes*.

13.00-14.00 Lunch.

Afternoon

Parallel workshops [continued].

14.00-16.00 Anders Dahlberg, *Red-listing larger basidiomycetes*.

14.00-16.00 Cvetomir & Teodor Denchev, *Red-listing rusts & smuts*.

14.00-16.00 David Minter, *Red-listing non-lichen-forming ascomycetes*.

16.00-16.30 Refreshments.

16.30-20.00 Ohrid sightseeing.

Evening

20.00 Gala Dinner in Ohrid.

Thursday 5 October

Morning

09.00-14.00 Excursion to Pelister National Park (visiting five-needle molika pine forest - *Pinus peuce*).

14.00-15.00 Lunch.

Afternoon

Citizen science, databases and new technology for fungal conservation. Chair: Gerhard Kost.

15.00-15.20 Oli Ellingham, *The powdery mildew survey: citizen science for improving fungal identification*.

15.20-15.40 Carrie Andrew, *Large-scale meta-databases, a new tool for fungal conservation*.

15.40-16.00 Marieka Gryzenhout, *DNA approaches to aid the deficit in fungal biodiversity and conservation in Africa*.

16.00-16.20 K.V. Sankaran, *India-UK collaborative ventures creating databases on fungi*.

16.20-16.40 Paul Cannon, *Rare or under-recorded? Activities to reduce the Data Deficiency mountain for fungal species in the UK*.

16.40-17.00 Conclusions and discussion of future directions, followed by close of formal part of meeting.

17.00-19.00 Exhibition of freshly collected fungi.

19.00 Dinner.

Friday 6 October

Morning

09.00-14.00 Optional excursion to Snake Island Golem Grad on Prespa Lake (dependent on weather conditions).

End of programme

* presenting author; [L] lecture; [P] poster

ABSTRACTS

Large-scale meta-databases, a new tool for fungal conservation [L]

Carrie Andrew[1*] & Håvard Kauserud[2]

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Species occurrence observations from citizen science projects, reference collections, and the digitization of museum records represent a largely under-utilized ecological resource in conservation. Yet there is unparalleled potential for understanding many aspects of the ecology of organisms with these data, and especially when combined across country scales. From such results, conservation research can better understand fungal phenological responses and range distributions in light of global change. This talk demonstrates how such continental-scale meta-databases, in this case ClimFun, a pan-European mycological one (ANDREW ET AL., 2017), offer unique insights into climate change effects on phenology in recent decades.

Reference

ANDREW, C., HEEGAARD, E., KIRK, P.M., BÄSSLER, C., HEILMANN-CLAUSEN, J., KRISAI-GREILHUBER, I., KUYPER, T.W., SENN-IRLET, B., BÜNTGEN, U., DIEZ, J., EGLI, S., GANGE, A.C., HALVORSEN, R., HØILAND, K., NORDÉN, J., RUSTØEN, F., BODDY, L. & KAUSERUD, H. Big data integration: Pan-European fungal species observations' assembly for addressing contemporary questions in ecology and global change biology. *Fungal Biology Reviews* **31** (2): 88–98 (2017).

Pezizomycotina and their conservation status in Umbria (Italy): an evaluation at regional level [L]

Paola Angelini[1]*, Robert P. Wagensommer[1], Giancarlo Bistocchi[1], Andrea Arcangeli[1], Andrea Rubini[2], Claudia Perini[3], Roberto Venanzoni[1]

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The first Red List of Pezizomycotina (Ascomycota) species recorded in Umbria Region (central Italy) is presented. It includes 108 species, as follows: 1 Critically Endangered (CR), 30 Endangered (EN), 34 Vulnerable (VU), 14 Near Threatened (NT), 2 Least Concern (LC) and 27 Data Deficient (DD).

Morels of Turkey and their conservation [L]

Hayrünisa Baş Sermenli

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Morchella species, commonly known in English as morels, are spring-fruiting edible ascomycetes prized for their flavour. In Turkey they occur mostly in conifer forests, and there are many vernacular names for them, including ‘lamb’s belly’ and ‘belly’. Like many larger basidiomycetes, they form an important component of the diet of rural

people in many parts of Turkey, and are collected for private use and sold in local and national markets. There is also an international trade in all of these fungi. Taking morels as an example, this presentation reviews that local, national and international trade in this commercially valuable commodity, including the scale of collecting activities in different parts of the country, the impacts of collecting on the fungi themselves and the ecosystems surrounding them, the significance of the fungi for local, national and international trade. It also considers whether such collecting, particularly for national and international trade, is sustainable, and raised the question of regulation of that trade.

Contribution to knowledge of the distribution of *Battarrea phalloides* in the Republic of Serbia [P]

Eleonora V. Bošković[1,2*] & Bojan D. Šeguljev[1]

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[2]*University of Novi Sad, Faculty of Sciences, Department for Biology and Ecology, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia*

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Recent molecular data places the genus *Battarrea* in the family Agaricaceae. *Battarrea phalloides* is a cosmopolitan species recorded in at least 64 countries, but considered rare throughout its distribution due to specific habitat requirements (deserts, semi-deserts, steppes and dry savannas). It is a saprotroph characterized by sequestrate development of sporocarps which mostly occur on sandy soil with scarce ground vegetation. In the Republic of Serbia it is strictly protected by law. In Serbia, *B. phalloides* basidiomata were prevously found in the Subotica Sands area, and in this work we present two new records. One specimen was found in a typical sandy habitat within the special nature reserve, Deliblato Sands; the other was collected from sand at a construction yard in an urban environment in the city of Niš. Dried sporocarps of

both samples are stored in the reference collection of the Union of Mycological Societies of Serbia. Both specimens were found by amateur mycologists, emphasizing the importance of amateur mycological societies in monitoring the diversity of mushrooms and in their protection.

Rare or under-recorded? Activities to reduce the Data Deficiency mountain for fungal species in the UK [L]

Paul Cannon*, Brian Douglas & Martyn Ainsworth
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The *Lost and Found Fungi Project* is a five-year programme of fieldwork and conservation assessment in the UK, funded by the Esmée Fairbairn Foundation [http://fungi.myspecies.info/content/lost-found-fungi-project]. This partnership between mycologists of the Royal Botanic Gardens, Kew and a large number of specialist volunteer recording groups and individual researchers aims to distinguish genuinely rare species from those that are under-recorded, enabling more rigorous conservation assessments and promoting protection where needed. An initial target list of 100 species was selected. They mostly qualify due to small numbers of known sites (five or less) and/or length of time since the last sighting (50 years) – the latter measure being used informally in the UK to denote presumed extinction. Several thousand UK fungi fall into one or both of these categories, so further selection criteria were employed, including ease of identification by non-specialists and requests from recording groups.

The first task was to provide detailed data on the target species, many of which are not featured in standard identification manuals. In addition to descriptions, illustrations, ecology and look-alikes, their known distribution was reviewed and mapped using an interactive package from Google. Fruiting period was also researched, to assist in searching at the right time of year. Of the hundred original target species, most

have been searched for actively by volunteers and individual field mycologists, sometimes independently and sometimes in joint operations with Kew staff. To date, we have had further sightings for around 70 of the 100 target species, in some cases rediscovering the populations originally recorded, but in a substantial number of cases with new populations detected. After the first three years of the project, we have received nearly 1000 records of one or other of the target taxa, including some subject to existing and prior conservation management exercises. There have also been numerous new British records of other species observed while searching for the original targets.

For some of our volunteers, searching for particular species rather than making general collections has been a substantial departure from their usual practice, and there have been varying levels of enthusiasm for the work. Nevertheless, we have been heartened by the broad response to our requests for searches, and a substantial proportion of the hundred or so volunteer mycology groups in Britain have taken part. We have also been encouraged to find that quite inexperienced volunteers are able to make new records, extending the skills base amongst the field mycology community.

We have always considered the 100 target species as a strategy for broadening the ambitions of the recording community rather than an end in itself. Now that the initial phase of the project is over, our work has changed emphasis to provide training and mentoring for individual volunteers and small groups, usually with joint fieldwork activities centred around searching for one or other of the target species. We have provided small grants for travel and subsistence, equipment etc. and are now starting to provide sequencing support for our groups. One group is already extracting and amplifying DNA for barcoding and we hope that several others will have these skills by the end of the project.

The project focuses on baseline data which will be used for conservation assessments, but we are also anxious that our work results in practical conservation outcomes. In this respect we are increasingly focusing on raising awareness amongst the broader natural history community, including nature reserve wardens, wildlife trusts and

national parks staff. In many cases our work has been of considerable interest to these groups, with offers of monitoring existing known populations and searching for new ones. We are some way from fungi receiving parity with animals and plants amongst the conservation community, but definite progress is being made.

Assessing the Global Conservation Status of Fungi: a Practical Workshop within the Global Fungal Red Listing Initiative [L]

Anders Dahlberg*

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[e-mail: anders.dahlberg@slu.se]

To carry out their work, conservation scientists, land managers, and other decision makers need information on the conservation status and trends of organisms, their ecology and how to counteract negative trends. The *IUCN Red List* provides this information. However, the conservation status of the vast majority of fungal species has not been assessed. The *Global Fungal Red List Initiative* aims to assess and document at least 1500 fungi by 2021. A concentrated effort by mycologists is needed to address this problem. The workshop presentations, discussions and hands-on assessments will include:

1. Reasons for fungal conservation; the need and usefulness to integrate fungi into nature conservation in general, considering discussion, research and decisions.
2. The *Global Fungal Red List Initiative*; background, the ongoing process, the roles of professional and amateur voluntary contributions and, in particular, the procedure for assessments.
3. Hands-on working with the *Global Fungal Red List Initiative*; (a) if possible, assessment exercises with species with data prepared by the participants and others before the workshop, and (b) revision of pre-assessed species.

Protected fungi species in the collection of the Latvian Museum of Natural History [P]

Inita Daniele* & Diana Meiere

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The Latvian Museum of Natural History maintains a collection of the local mycoflora and works to raise public awareness on biological diversity and conservation in general, and mushrooms in particular. The fungal collection of the museum is biggest in our country, containing about 8000 specimens representing most taxonomic groups of fungi. Information from the collection is very important for estimating the current conservation status of fungi and planning their future protection.

The main source of fungi in the museum collection is specimens collected its mycologists during field trips including those connected with mushroom exhibitions. The museum mycologists and some other professional mycologists have collected around 56% of all specimens of protected fungi species.

Many specimens of protected fungi are brought to the museum by amateur mycologists, either working in some related area (e.g. forestry and ecology) or by members of Latvian Mycological Society (around 30%). The Latvian Mycological Society was founded 15 years ago, and its regular activities (field trips, forays, local mushroom exhibitions, 'fungus of the year' and other events) help to educate not only society members but also the general public.

Public interest in mushrooms (mostly edible) is very high in Latvia, and the museum is the main place where people can get mushrooms identified (by samples, photos, descriptions on 'phones etc.). Public interest grows considerably during the muesum's annual mushroom exhibition, and the museum gets numerous additions for its mycological collection from exhibition visitors.

Conservation status assessment of *Sporisorium elionuri-tristis* (Ustilaginaceae) [P]

Cvetomir M. Denchev[1,2*] & Teodor T. Denchev[1,2]

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Sporisorium elionuri-tristis is a host specific smut fungus which develops sori in ovaries of *Elionurus tristis* (Poaceae). It is only known from the type collection (south of Ambositra, a city in central Madagascar) where it was collected in 1964. The host plant, *Elionurus tristis,* is endemic to Madagascar and has a restricted distribution area, in the Malagasy Highlands (extent of occurrence less than 20,000 km^2). It is recorded only from a few localities in three regions: Analamanga, Amoron'i Mania, and Haute Matsiatra. *Sporisorium elionuri-tristis* and its host plant are threatened by habitat loss and transformation due to logging, clearance for agricultural or urban development, agricultural intensification, and cattle-grazing. Using IUCN criteria, *S. elionuri-tristis* is assessed globally as Endangered.

Conservation status assessment of *Entyloma maroccanum* (Entylomataceae) [P]

Cvetomir M. Denchev[1,2*] & Teodor T. Denchev[1,2]

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Entyloma maroccanum is a host specific smut fungus which develops sori in leaves of *Eryngium maroccanum* (Apiaceae). The host plant, an endemic to Morocco, is included in the IUCN Red List of Threatened

Species. It is a rare species with a very restricted distribution area in the central part of the Middle Atlas. The extent of occurrence of *Eryngium maroccanum* is about 1,500 km^2, within which the area of occupancy is less than 150 km^2. This plant is distributed in a habitat type (temporary wetlands) which is declining in Morocco and it might undergo a decline in population size in the future. The plant species is listed as Near Threatened but merits re-assessment. Because the smut fungus is host specific, it cannot exceed the extent of occurrence of its host plant. The smut fungus, *Entyloma maroccanum*, is known only from the type collection, collected in 1923 near Azrou (the Middle Atlas). It fulfills Criterion B, using Area of occupancy, and is assessed globally as Endangered.

Conservation status assessment of *Ustilago suddiana* (Ustilaginaceae) [P]

Cvetomir M. Denchev[1,2*] & Teodor T. Denchev[1,2]

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Ustilago suddiana is a host specific smut fungus in the ovaries of *Suddia sagittifolia* (Poaceae). The host is a remarkable aquatic plant with a restricted distribution in northeast and east tropical Africa. It is known only from South Sudan (the Sudd Swamps) and Uganda (three localities). This plant itself is included in the IUCN Red List of Threatened Species, assessed as Vulnerable (VU D2). The only known locality of *Ustilago suddiana* in South Sudan is situated in the Sudd Swamps, near Jonglei village. The only Ugandan locality of this smut fungus is in the easternmost part of Lake Nakuwa. In both locations, the host plant and its parasitic fungus are threatened by drought. This is an endangered parasitic fungus on a threatened plant species. Using IUCN criteria, *Ustilago suddiana* is assessed globally as Endangered.

Assessment of threat status of smut fungi [L]

Teodor T. Denchev[1,2*] & Cvetomir M. Denchev[1,2]

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The smut fungi are a key group for understanding the main problems in assessing the conservation status of microscopic fungi. In this presentation, various difficulties in assessing the threat status of smut fungi are discussed. Examples of threatened species of smut fungi, globally assessed with IUCN criteria, are provided.

Checklist of the smut fungi in Greenland [P]

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A checklist of the smut fungi in Greenland is presented. It contains 34 species in 10 genera. Five species, *Anthracoidea capillaris* on *Carex capillaris*, *A. limosa* on *Carex rariflora*, *Microbotryum stellariae* on *Stellaria calycantha*, *M. pustulatum* on *Bistorta vivipara*, and *Schizonella elynae* on *Kobresia myosuroides*, are recorded for the first time from Greenland. This work is a step towards a monograph of the smut fungi in Greenland. This study was funded by the Program for Support of Young Researchers and PhD Students at the Bulgarian Academy of Sciences.

Conservation status assessment of *Ustilago neurachnes* (Ustilaginaceae) [P]

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Ustilago neurachnes is a host specific smut fungus which destroys inflorescences of *Neurachne tenuifolia* (Poaceae). The host plant, *Neurachne tenuifolia*, is endemic to Australia, with a very restricted distribution area in Northern Territory. It occurs only in the MacDonnell Ranges (from Alice Springs to Mt Liebig), and in an isolated locality in Queensland (in Palmgrove National Park). At a state level, *N. tenuifolia* is assessed as Near Threatened. The smut fungus, *Ustilago neurachnes*, is known only from the type collection (Northern Territory, western MacDonnell Ranges, Mt Conway) where it was collected in 1989. The threats (invasive plant species, feral animals, and bush fires) for *Neurachne tenuifolia* and its smut fungus are discussed. *Ustilago neurachnes* is an endangered parasitic fungus on a near threatened plant species that has a very restricted distribution area. Using IUCN criteria, *U. neurachnes* is assessed globally as Endangered.

The powdery mildew survey: citizen science for improving fungal identification [L]

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The powdery mildews (Ascomycota, Erysiphales) are a diverse group of biotrophic, plant pathogenic fungi found on nearly 10,000 angiosperm hosts globally, including many important horticultural and agricultural plants. Infection can greatly reduce the appearance and vigour of the host thereby significantly reducing attractiveness and yields. These fungi are, however, regularly overlooked and hence species boundaries are poorly understood. A reliable and efficient method is required for unambiguous identification of these often cryptic species so that spread to new areas and/or new hosts can be detected rapidly and, if appropriate, controlled early. A citizen science scheme was developed to motivate and educate its participants, while concurrently providing distributional data for powdery mildews in the UK and improving accuracy and efficiency of identification techniques through sequencing of variable gene regions. Implications for efforts to conserve fungal plant pathogens are discussed.

Activities for conservation of fungi in Hungary [P]

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Fungal conservation can be promoted by a range of activities. Legal protection restricts gathering and protects the habitats of certain fungi species. Dissemination of information about the diversity and essential rôle of fungi in ecosystems, and possible activities to conserve various target groups can also be an effective way to protect mushrooms and ensure sustainable use.

In Hungary the protection of mushrooms is based on Act No. 53 on Nature Conservation of 1996. It prohibits unauthorized jeopardizing, destroying or damaging of individuals of protected plant species. It also prohibits endangering or damaging their habitats. In Hungary 35 species of macrofungi became protected in 2005, and in 2013 the list was expanded by 23 species, so now there are 58 protected species of fungi in Hungary [listed in the appendix of Decree No. 13/2001 (V. 9.) KvVM]. In 2005, the *Hungarian Mycological Society* published a volume (authored by SILLER ET AL.) about the first 35 protected species; another volume is under preparation about the next 23 species.

There are already several legal instruments connected with picking rules. The regulation for collecting forest goods (what you can get from the forest, eg. mushrooms) can be found in the Act No. XXXVII of 2009 on "forests, on the protection and management of forests" and the relating ministerial decree [No. 153/2009 (XI.13.) FVM decree]. These regulate when and how much pickers may collect: the decree says that the collected amount for personal need is a maximum 2 kg/day. Decree No. 24/2012 (III. 9.) VM lays down rules for harvesting subterranean mushrooms (truffles).

Besides legal protection there is the "Draft Red List of Hungarian Macrofungi", developed after a long process of consultation with Hungarian mycologists, and published in 1999. It contains 118 genera, 280 species and 5 subspecies classified using the IUCN's categories and criteria (1994 edition). It is helping the country's nature conservation evaluation processes.

During the preparation of the summary about protected species the *Hungarian Mycological Society* realized how little information was available, and therefore set about encouraging field biologists to collect and contribute as much distributional data on protected species as possible. The Protected Mushrooms Data Collecting Network [**VGOAH**] was launched under the auspices of the *Hungarian Mycological Society*. The online data collecting system became available in May 2010 and has now been continuously operating for 7 years. Between 2010 and 2017, 165 participants have uploaded into the database 596 records about a total of 41 species. As a result of this data collection our knowledge about the range and distribution of the protected species has been significantly expanded, making it possible to prepare distribution maps. The amount of data of several species was increased to a large extent, and for some even doubled.

Leaflets were published for pickers and land owners explaining best practice for protection and sustainable use of fungi, with information about the causes of population decreases, and with advice about ways to conserve fungi.

In the frame of the Hungarian Biodiversity Monitoring System, fungal surveys cover parallel sampling in the areas and buffer zones of forest reserves and planted forests nearby. The aim is to analyse the effects of forest management on communities of macrofungi.

The return of *Fomitopsis officinalis* to the Italian Alps: preliminary assessment of strategies for conservation and sustainable use [L]

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Fomitopsis officinalis (Batsch) Bondartsev & Singer (Fomitopsidaceae, Polyporales) is a holoarctic species developing perennial basidiomata on old conifer stems and, in the Alps, strictly connected with *Larix decidua*. Since the first century AD it has been known as a natural medicinal product against several ailments, particularly pulmonary diseases. Similar uses have been documented among native peoples of America, the Urals and the Alps, and the fungus is still used in traditional medicine in eastern Asia.

This species is now known to contain antibiotic and antiviral molecules (mostly chlorinated coumarines and agaricinic acid) particularly efficient against the *Mycobacterium tuberculosis* complex, Gram-negative bacteria, Herpes virus, H5N1, H3N2, Poxviridae and Orthopox virus. By the start of the 20th century, *F. officinalis* had attracted the interest of the pharmaceutical industry in Europe, and this induced unsustainable harvesting which almost led the species to extinction, and which continues today. In addition to restrictions preventing harvesting in natural reserves and parks, *F. officinalis* has been included in red lists by at least 6 European countries. Based on population decline and habitat loss, it has been proposed for the global red listing with, respectively, endangered or vulnerable status [http://iucn.ekoo.se]. *Fomitopsis officinalis* and its habitat have been successfully protected

in Switzerland [www.wsl.ch/notice_champignons]. Together with small local reservoirs, this is likely to play a major role in restoring populations beyond Swiss borders.

Our present work aimed to generate preliminary maps of fruiting individuals, to isolate mycelium into pure culture, and to characterize the species both morphologically and at a molecular level. Basidiomata were sampled from Graian, Pennine, Lepontine and Retic Italian Alps (mostly in protected areas) and identified by morphological characters. Mycelium was characterized morphologically, isolated into pure culture and subsequently processed through molecular analysis to confirm the identification. All 20 isolates were confirmed to be *F. officinalis*. Almost all analysed cultures had roduced chlamydospores and/or conidia within a few weeks on 2% MEA (Biokar Diagnostic) despite slow growth; brown pigmentation on the reverse was often present. We confirmed that the species is related to old stems of *L. decidua*, where *F. officinalis* provokes a very slow brown rot; only living trees were found to host basidiomata.

Despite excessive and unregulated harvest, *F. officinalis* has survived in small reservoirs which are now restoring populations in Alpine valleys, more so close to Swiss borders, probably as a consequence of the protection status there in force. Habitat conservation (old larches) is critically important. This species represents a resource for Alpine areas, but its slow growth and the limited basidiomatal production means harvesting of wild specimens should be abandoned, and cultivation strategies and sustainable use of mycelium should be explored as an alternative to using basidiomata.

Molecular diversity of truffles in countries of southeast Europe. How much diversity is hidden there? [L]

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Tuber ("truffles" sensu stricto) is the most important genus of ectomycorrhizal fungi producing hypogeous ascocarps within the Tuberaceae (Pezizales). As a result of its underground life cycle, special features have evolved in the ascocarps, including release of an intense odour. This gives them a high commercial value and makes them of great interest to the public. The genus has a circumboreal distribution with highest diversity in Mediterranean and temperate areas. Several species of truffles were hunted for decades throughout southeast Europe but mainly focusing on "traditional" sites such as Mediterranean areas in Italy, France and Croatia. Other areas remained understudied. Over the last decade, by systematic sampling, we investigated most southeast European countries for truffles occurrence and ecology trying to include all available climates, soil types and ectomycorrhizal vegetation communities. Molecular tools (DNA barcoding based on the ITS marker) revealed high diversity among collections after a phylogenetic

species concept was applied. The outcome can be regarded also as an intraspecific differentiation (after species delineation following a morphological species concept) which is well correlated with the ecology of collections. We also revealed significant truffles diversity in higher altitudes, e.g. above 1000 m a.s.l. That remains a hidden pool of potential diversity and new species. Out decade of observations will be presented in terms of the scope of potential diversity, the need for further exploration of marginal areas, and the potential measures that should or should not be taken to protect this diversity.

DNA approaches to aid the deficit in fungal biodiversity and conservation in Africa [L]

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For most African countries, information about fungal diversity is incomplete, fragmented or non-existent. Even in South Africa with its long history of mycological research, known diversity is far from representing true levels. The many novel, undescribed taxa also make it hard to present diversity data to end-users who need names. A lack of biosystematic capacity means outstanding fungal diversity will not be characterized in time. DNA sequence-based tools can, however, build a strong species foundation and yield data useful to plant focused morphological approaches. They include environmental sequencing, where fungal molecular operational taxonomic units from any substratum or locality can be characterized for ecological analyses and comparisons. A rudimentary identity can be obtained for these units. Phylogenetic diversity analyses can also be used to estimate diversity from available samples even if full diversity is not yet sampled. Such information can be used in conservation activities and planning to identify priorities, strengths and gaps, where previously data could be produced only by experts using fruitbodies and field isolates. A

complimentary approach of environmental sequencing, phylogenetic diversity and morphological characterization is useful to detect previously encountered taxa from environments without visible fruiting bodies or meticulous isolations. Responsible parallel morphological studies, including novel species description, will strengthen the data but not impede rapid progress. If activities are linked to and stimulated by public actions such as 'MushroomMap' (an online tool for South African fungi), biogeographical reach can be substantially expanded. Using such a targeted approach ensures better impact and faster progress in championing African fungal diversity and conservation.

Roadside *Fusarium* species from South Africa [P]

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Fusarium is a common inhabitant of soils. The use of selective media for *Fusarium* makes soil an ideal medium to explore the diversity and geography of this group of microfungi since isolation of species is guaranteed and a large number of other fungi and microbes can be eliminated. Surveys from soils will also very probably yield novel geographical reports for South Africa, and a number of novel species or multi-locus sequence types for *Fusarium*. Representative sampling across South Africa will also yield a rudimentary geographical map of species occurrences across South Africa for the first time. Such records can be improved in future and linked to other similar collection initiatives. Through the years a number of samples have been taken from soils next to national roads in various regions of South Africa. These localities are disturbed and directly along routes linking various areas of South Africa. Preliminary results already yielded a high

diversity of species, including novel reports and possible novel species. A number of species or MLST groups that were isolated are also known from other niches such as animals, humans and plants. Additional surveys will be needed to support initial observations on possible geographical patterns. Furthermore, where many species or MLST types have a widespread occurrence even across continents, it is possible that potential endemic species to South Africa may be identified.

A preliminary red list of fungi in India [L]

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A first Red List of Fungi has been prepared for India using IUCN categories and criteria. It includes 33 species of which 5 are evaluated as Endangered, 23 as Vulnerable, 4 as Least Concern and 1 as Data Deficient. While this list is preliminary, tentative and very incomplete, it is nevertheless a hugely significant first step. The immediate aim is to provide a foundation and stimulate mycologists in India to develop a much fuller red list of fungi for the country, and further red lists at state and local levels. The longer term objectives are to raise awareness in government and among policy makers that protection of fungi is an essential component of biodiversity conservation at all levels within the country, and to provide them with a basic but essential tool to achieve that aim.

Fungal conservation in Ukraine: challenges and prospects [P]

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The foundation of fungal conservation within any country is a national red list. In Ukraine this document, which includes animals, fungi and plants, has the status of a national law. However, up to now the red-listing process in Ukraine is still partly based on a traditionally used but rather outdated evaluation system. As a result, in the third edition of the Red Data Book of Ukraine (2009) species are not completely classified according to internationally recognized practice.

Since publication of that edition, various proposals have been discussed concerning ways to apply the IUCN Red List categories and criteria in assessing the conservation status of species, including fungi, in Ukraine, and how Ukrainian legislation could be harmonized with IUCN documents. While these issues are still mostly under consideration, a very important step has been made to facilitate the required changes. In 2017, under guidance of the National Commission on the Red Data Book of Ukraine, one of the IUCN Red List key documents, the IUCN Red List Categories and Criteria: Version 3.1. Second edition (2012), has been translated into Ukrainian [www.iucnredlist.org/technical-documents/red-list-training/translations].

The Ukrainian law on the Red Data Book requires a new edition to be prepared and published every 10 years. The forthcoming edition is therefore currently under preparation. However, the very unstable situation in the country since 2014, with occupation of eastern Ukraine, annexation of Crimea, and consequential military action, means the Government has allocated no funds for its production.

Moreover, since 2014, national conservation practice has been deeply affected by the physical impact of military operations. The natural

environment in the eastern region of Ukraine, with the oldest and largest steppe protected areas in the country (the Ukrainian Steppe Nature Reserve and Luhansk Nature Reserve), has been damaged by artillery shelling using heavy weaponry, fires triggered by military blasts, large-scale casualties, infrastructure devastation, etc. In the early 2000s, Ukrainian mycologists contributed to environmental protection efforts through a Ukraine-UK joint project *Recovering Ukraine's Lost Steppe* [www.cybertruffle.org.uk/darw2002] but, unfortunately, some of those sites are now deeply located in occupied territory. At present it is not possible to evaluate resulting biodiversity loss (for example, eight species of red-listed fungi occur exclusively in the east and Crimea) or the scale of damage to unique virgin steppe ecosystems.

There have, however, also been some positive developments. Through social networks and specialized groups, like *Fungi of Ukraine* [www.facebook.com/groups/Hryby.Ukrayiny] and others, a knowledgeable community of amateur mycologists has emerged, which even under the currently restricted possibilities for travel across this large country, results in increasing knowledge of the ecology and distribution of macrofungi, and sometimes about microfungi. There is also growing awareness among various experts that conservation should be directed more towards habitats rather than individual fungal species.

Red list project in Serbia: official fungal red list [L]

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The early 1990s saw a start to conservation of the fungal component of Serbia's biodiversity. Several official regulations and laws on conservation of fungi were adopted, although they provided chiefly for edible fungi collected from nature. The real conservation effect of these legal provisions was mostly quite modest. This approach has changed over the past 5-6 years and fungi conservation is now more focused on sensitive species threatened due to disappearance and contamination of their habitats. Evaluation of fungi has been included in nature conservation procedures, particularly for evaluation of protected areas.

Although the first preliminary red list of Serbian fungi was published in 1998, and a project to draft an official red list was proposed to the government in 2007, it was only in 2016 that the state began financing activities related to evaluation of threat categories for individual fungal species. A large project of collecting and analysing data was launched with the aim of establishing a huge database, ecological network and evaluation of threat to biodiversity. It included animals, fungi and plants. Project implementation involved setting up several complex protocols for collecting data and developing software tools for a preliminary evaluation of IUCN threat category for each species. The first phase of the project consisted of collection and evaluation of data relating only to fungi (including lichen-forming species) already protected by law, and plans were made to include other fungal species in future. During project implementation, several factors emerged that impacted on the established picture of the threat to fungi, primarily due to the quality and quantity of available data.

This process brought to the surface old dilemmas about the nature, real purpose and objective of red lists, as well as the optimal level of scientific verification of the categorisation of the species contained in

such lists. New questions were raised about reliability, the method of using unpublished data, and assessment of their economic value i.e. price. This issue showed certain parallels with the already debated concept of putting a price on nature. The issues of the desirable method of data acquisition, data processing and usage of the obtained databases in future also presented themselves. Some problems were illustrated by analysed data on hypogeous fungi. Those experiences and examples will help modify future work and may be useful for those implementing similar large projects.

New data on ascomycetes listed in the Macedonian red list of fungi [P]

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The Macedonian Red List of Fungi contains 213 species including 18 ascomycetes. Recent collections are reported which add additional distributional data for those ascomycetes. Ecological remarks and detailed macro- and microscopic features are provided, together with brief descriptions of new collections from Macedonia for rarely recorded European species such as: *Microstoma protractum*, *Poronia punctata* and *Microglossum viride*. New localities are listed for *Cudonia circinans*, *Disciotis venosa*, *Helvella atra*, *Heyderia abietis*, *Microglossum viride*, *Microstoma protractum*, *Mitrula paludosa*, *Morchella elata*, *Pithya cupressina*, *Rutstroemia bulgaroides*, *Sarcosphaera crassa*, *Trichoglossum hirsutum*, *Urnula craterium* and *Verpa conica*. Important data (localities, plant associations and substrates) and distribution maps are presented for the all red-listed

ascomycete species. In addition, notes on conservation priorities are given for the critically endangered (CR) and vulnerable (VU) species.

Keywords: Ascomycetes, Macedonian Red List, distribution.

Diversity of lichenized fungi in the FYR Macedonia [P]

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KUŠAN (1953) reported only 185 lichens from Macedonia in his famous "Prodromus flore lišaja Jugoslavije". The country's currently known lichen biota comprises 675 species, based on evaluation of 147 published sources by MAYRHOFER ET AL. (2013) and additions by MALÍĆEK & MAYRHOFER (2017) from recent field work and evaluation of ten further publications.

Due to the immense field work of Murat Murati in the 1970s, the best known region of the country is the Šar Planina mountain range with 384 species (PAVLELTIĆ & MURATI, 1977; KOBALD, 2016, MALÍĆEK & MAYRHOFER, 2017), including 95 species only known from the subalpine and alpine belts of the Kosovar side of the mountain range which are partly treated in MAYRHOFER ET AL. (2016). STRASSER ET AL. (2015) reported a similar diversity (381 species) from the Prokletije mountain range of Montenegro and Kosovo, although nearly all collections were made at subalpine and alpine altitudes.

To improve the still insufficient knowledge of lichen diversity in this area, extensive field work was carried out by the first author this summer, with logistic support by the second author. The following mountain ranges were investigated, with special emphasis on subalpine and alpine belts: Solunska Glava (Jakupica), Korab, Pelister, Kožuf, Kajmakchalan (Voras), and Šar Planina.

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* presenting author; [L] lecture; [P] poster

Legal protection of macrofungi in Poland. Current state of the art and dilemmas [L]

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Poland was the first European country where, in 1983, fungi were included in the species legal protection system; the government order mentioned 21 species of macrofungi included in the list of protected plants. At that time, the law focused mainly on protection of specimens through a ban on picking or destroying them in any way. Destroying any fungal species growing in a natural habitat and not collected for consumption was forbidden, as was digging up forest litter when mushroom hunting – a first harbinger of habitat protection. Since 2004, protection of fungi (i.e. macrofungi and lichen-forming species) in Poland has been separate from protection of plants. The current (2014) list of protected macrofungi comprises 117 species: 54 under strict and 63 under partial protection. Strict protection covers species ascribed the highest category of threat (according to IUCN: EXP, EW, CR, EN). The list includes all species proposed for the Bern Convention and known to be present in the country. The law is more focused on protection of habitats and conservation of fungal populations in their proper state, thereby continuing legal solutions already developed, but it also raises many questions and controversies. The list of protected species is far shorter than the 256 species proposed after study of current needs. Compared with the previous directives (2004), it changes the status of many species from strictly to partially protected, which may result in unfavourable changes especially in populations of saproxylic species inhabiting large woody debris. Furthermore, some bans protecting fungal habitats were repealed or weakened, while other proposals to make the law more reasonable were not introduced. Major questions about the aim of the fungal conservation and ways of its implementation arise.

Conservation of fungi in Macedonia [L]

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From a mycological perspective, Macedonia is rather well studied (2,200 species), but it does not have an official IUCN Red List of Fungi. The main aim of the RSG project was to establish a National Red List of Fungi and Important Fungal Areas in Macedonia. As a result of project activities a National Red List of Fungi was compiled for the first time, following IUCN categories and criteria 3.1. A total of 213 species have been included as follows: 21 Critically Endangered (CR); 30 Endangered (EN); 71 Vulnerable (VU); 40 Near Threatened (NT); 9 Least Concern (LC); 42 Data Deficient (DD). The Red List, submitted to the Ministry of Environment and Physical Planning, has been a base for preparation of the rulebook on strictly protected and protected wild fungal species, with adoption pending since 2016. Important Fungal Areas [**IFA**s] in Macedonia have been established for the first time. **IFA** criteria have been developed based on the presence of rare and threatened species, overall species richness, and mycological significance of the habitat. Twenty areas (Pelister, Osogovo, Prespa, Kozuf, Nidze, Jasen, etc.) meet the criteria for nomination as **IFA**s. These are being promoted to raise public awareness among the local population and stakeholders via a media campaign, and wide-range distribution of promotional material comprising a brochure of protected and strictly protected fungi from the Red List, and a countrywide map of **IFA**s. The workshop with stakeholders (the Ministry of Environment and Physical Planning, local government, and nature conservation NGOs) resulted in a decision to initiate the formal procedure for official adoption of the Fungi Red List of Macedonia. In addition, auxiliary documents like the *National Catalogue (Checklist) of Macedonian*

 * presenting author; [L] lecture; [P] poster

Fungi and *Mapping of Macromycetes of Macedonia* have been published.

Results from the RSG project have significant impact on the contribution legislation can make to fungi conservation in Macedonia. Different documents have been officially adopted and published in the Official Gazette of the Republic of Macedonia, such as the *List of Concerned and Threatened Fungi Species*, the *Permit on Export of Threatened and Protected Plants, Fungi and Animals and Parts of Them*, the *Order on Prohibition of Trading Autochthonous Fungi – Morels (Morchella, Verpa and Ptychoverpa)*, and the *Ordinance on the Customs Authorities' Procedure in Trading Concerned and Protected Wild Species of Plants, Fungi and Animals*. The results from our RSG project have also been entirely encompassed in the new *Biodiversity Strategy an Action Plan of the Republic of Macedonia*.

Key words: Fungi, Macedonia, IUCN Red List, Important Fungal Areas.

Fungal conservation in Montenegro: present situation and future plans [P]

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Fungi (macrofungi) are among the least explored groups of organisms in Montenegro, with around 1,100 species recorded to date, and efforts to conserve them have only very recently begun. Since 2010, 111 fungal species have been protected by law in Montenegro. A red list of fungi in Montenegro, based on IUCN categories and criteria has not yet been made. There is only a preliminary red list, and that does not use IUCN categories and criteria. Since 2000, there has been a programme of biodiversity monitoring in Montenegro, and fungi are included. Now, we are working on review of the status of fungal conservation in

Montenegro, and it is clear that further development and implementation of measures to conserve fungi are needed to meet global efforts in this arena. This poster displays the present situation and future plans for fungal conservation in Montenegro.

Key words: conservation of fungi, red list, monitoring of biodiversity, Montenegro.

The mycobiome of cowpea (*Vigna unguiculata*) using environmental sequencing [P]

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The term phytobiome is defined as the microbes associated with a particular plant, including those from external and internal areas, and from all plant parts. Such a collection of organisms may interact with each other, and may have beneficial or detrimental effects on the plant. Environmental sequencing using next generation sequencers enables intensive characterization of plant phytobiomes. In this study we focused on the fungal component occurring as endophytes from all plant tissues of cowpea (*Vigna unguiculata*). This crop is often used in rural agriculture, but is also currently being developed for more commercial agricultural use in South Africa. However, little is known

about the phytobiomes of this crop. Complete plants were sampled from Potchefstroom, South Africa, surface sterilized and processed for environmental sequencing of the ribosomal internal transcribed spacer regions using the MiSeq Illumina sequencer. Results from a bioinformatics pipeline revealed that the highest fungal species richness was recorded from roots while the main stem hosted the least. Some fungal endophytes showed tissue specificity and there was a difference between fungal endophyte diversity in above ground and below ground parts. *Fusarium*, *Cladosporium* and *Phoma* were among the most dominant fungal genera. Other groups containing pathogens such as *Colletotrichum* and *Ustilago* were also detected. Using environmental sequences, these taxa can be monitored more easily over time and their interactions with agricultural practices and environmental factors can be characterized.

Red list of macromycetes of Austria 2016 [L]

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The recently published book, DÄMON, W. & KRISAI-GREILHUBER, I. *Die Pilze Österreichs. Verzeichnis und Rote Liste 2016*. Teil: Makromyzeten (2017), presents a list of almost all basidiomycetes (except rust and smut fungi), and some discomycetes (Pezizales), which have been found in Austria; in total 4,450 taxa. It is the first species catalogue for macromycetes in Austria to this extent.

It is based on the *Database of Fungi in Austria* with 475,013 fungal records from 13,652 localities and 443 data sources (September 2016). Less than 1,000 species (21%) are 'frequent to very frequent', *ca* 1,700 species (38%) are widespread to moderately frequent, *ca* 1,300 species (30%) are rare, and almost 500 species (11%) are known from only a

single record. For each species the following information is given: scientific name, German vernacular name, systematic group s.l., trophic guild, associations to plant genera, frequency within or outside the Alps, occurrence in federal states, number of older and recent localities (before/after 1990), list of synonyms, and literature. The red list of endangered fungi in Austria is integrated into this list. Of the 4,450 species, *ca* 1,300 species (29%) are vulnerable, endangered, critically endangered or regionally extinct, while 790 (17%) are near threatened. The red list thus comprises a total of 2,086 species (46%). For each endangered species, the habitats (regions in Austria) are listed, for each endangered or critically endangered species there is comment on the records and the threat situation in Austria. Many endangered species and their habitats are illustrated.

Categories are indicated by both a conventional system from 0 to 4, and by IUCN categories. The main criteria for the assessment of potential threat are distribution density in Austria (number of recent localities) and associations with to endangered habitats (based on the 'list of endangered biotope types in Austria'). Species in categories 0 to 3 are distributed among nine groups of habitat types: 1. Habitats of the floodplain (180 species); 2. Bogs and other moist habitats (230 species); 3. Grasslands and open land habitats (200 species); 4. Deciduous forests of the colline and submontane altitudinal zone (200 species); 5. Mixed forests of the montane zone (140 species); 6. Habitats of the upper montane and subalpine zone (110 species); 7. Habitats of the alpine zone (100 species); 8. 'Synantrop bosk' habitats (few species); 9. Other habitats (80 species).

The main risks for Austria's fungal species are eutrophication, habitat destruction, reduced ecological value of habitats, random events and effects of climate warming. Protection of endangered fungi requires a range of activities: structural measures at the site (especially in forests), species awareness, education, public relations, and international conservation efforts. With regard to edible mushrooms, and with the exception of *Amanita caearea*, the most popular mushrooms are, in the sense of the red list, Least Concern.

The number of fungal species and the number of red list species is analysed statistically according to systematic groups, decades, years, federal states, biogeographical regions, nature regions, altitudinal zones, altitude, climate types, rainfall, temperature, bedrock (carbonate or silicate), ecological groups, associated plant genera in general (and particularly for substratum-bound fungi), and months and weeks in the course of the year. Using the example of protected areas, it is shown to what extent the number of species reported (especially the number of endangered fungal species known from a locality) depends on a high or low intensity of investigation. More than 100 significant contributors are listed. Support by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management and the European Union is gratefully acknowledged.

Fungi in nature conservation in Germany [L]

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In densely populated, highly industrialized Germany with its intensive agriculture and stock-keeping 13% of 6,120 macrofungi evaluated in the recently published Red List of Macrofungi are threatened and 12% are extremely rare. Fungal groups specialized on open-land habitats, old-growth forests and aquatic habitats are the most endangered. This applies also to fungi in protected areas as nature reserves, national parks and Natura-2000-areas because of emissions and eutrophication via air and water. For the Red List of Macrofungi published in 2016, more than 3·5 million data-sets were compiled by the *German Mycological Society*. For the first time, the list is embedded in a check-list of 9,259 asco- and basidiomycetes (lichens and classical phytoparasites excluded). Data for 6,120 species of macrofungi were evaluated according to recent procedures effective for red lists in Germany. Approximately 50% of fungi were data deficient. Approximately 50

species were regarded as neomycetes. Separate lists for lichen-forming fungi and myxomycetes show that 51% of 2,380 lichen-forming fungi and 12% of 373 myxomycetes are threatened. In total approximately 8,900 of an estimated 14,000 fungal species in Germany are presently covered by red lists. A new list of phytoparasites is being compiled at the moment. To improve the situation for fungi in Germany changes in land use, especially conservation of extensively managed open-land areas and old-grown forests are necessary, supported by reducing eutrophication from sources like animal waste and emissions of industry and traffic. Funding for biodiversity research and training for professional and amateur mycologists is required.

Fieldwork optimization for monitoring NATURA 2000 lichens (genus *Cladonia*, subgenus *Cladina*) [P]

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The Republic of Croatia, on its accession in 2013, became the European Union's youngest member. To fulfil objectives of both the *Habitats* and the *Birds Directives*, Croatia plans to establish monitoring of species listed in the Directives and their Annexes. The only lichen-forming fungi in the *Habitats Directive* (Annex V) belong to the genus *Cladonia*, subgenus *Cladina* (AHTI, 1961). Unfortunately, due to sparse and uniform lichen surveys in Croatia, information on these species is mostly more than 60 years old, with locations only broadly defined. To conduct a survey of the current distribution and status of these protected species and to apply adequate monitoring, fieldwork optimization is needed, as funds are limited. Based on species ecology, we have devised a system that classifies potential distribution areas in three classes (optimal, suboptimal and unlikely). The input data for

performing this desktop study using GIS software is: historic data, a habitat map, a pedology map, a digital elevation model, hydrology data and remote sensing satellite data (Sentinel-2 and LANDSAT data). This methodology will be tested in the field in the next development stage of the project.

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Fungal conservation activities in Croatia, 2006-2017 [L]

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Legislation. Fungal conservation in Croatia is currently regulated by the *Ordinance on Protection of Fungi* which was adopted in 2002. It is based on the *Nature Protection Act* from 1994. The next significant step in conservation of fungi in Croatia was the production of a first official *Red List of Croatian Fungi* in 2005, made by mycologists from the *Ruđer Bošković Institute* in co-operation with the *State Institute for Nature Protection*. The red list, based on IUCN Categories and Criteria, comprises 349 species, 55 of which were evaluated as Critically Endangered (CR), 77 as Endangered (EN), 119 as Vulnerable (VU), 35 as Near Threatened (NT), and 63 as Data Deficient (DD). As a result, 314 species from the *Red List of Croatian Fungi* were designated as strictly protected by the *Ordinance on Designation of Wild Taxa as Protected or Strictly Protected* in 2006. The *Red Book of Croatian Fungi* based on the official red list was published by TKALČEC & AL. (2008). A new national *Nature Protection Act* was adopted in 2013 and all subordinate legislation needs to be coordinated accordingly. The

Ministry of Environment and Energy therefore established a special commission experts from different areas of nature protection in 2016. The commission made a proposal for *Ordinance on the Collection of Native Wild Species* and its adoption is planned by the end of 2017.

Specific activities on conservation of fungi. A series of scientific and fungal conservation projects were conducted in protected areas, mostly in national parks (Sjeverni Velebit, Krka, Mljet, Plitvička Jezera, Brijuni) and nature parks (Medvednica, Papuk, Žumberak - Samoborsko Gorje). These projects included fungal diversity research and proposals to implement measures for conserving fungi and their habitats in protected areas. Two important localities for conservation of fungi in Croatia are currently actively managed due to the joint efforts of mycologists, public institutions, and local authorities.

- Grasslands Vrhovec in Zagreb comprises valuable unmodified grassland hosting the greatest known number of endangered and protected grassland fungal species in Croatia. 18 species of waxcaps (*Hygrocybe* species) have been recorded there. Management guidelines for active maintenance of this site, including mowing twice a year, were proposed by mycologists and consequently implemented by the local authorities (from 2006 on).
- Special Botanic Reserve Dubravica is one of Croatia's few remaining peat bogs. Measures for conservation of this locality, including removal of invading trees and mowing of vegetation each year, were proposed and implemented by Croatian mycologists (from 2001 to 2006). After 2007, local authorities have continued with active management of this site.

Fungi as ecologically important organisms were exhibited in the Visitor Centre Krasno of Sjeverni Velebit National Park (opened in August 2017). The visitor centre displays important natural and cultural resources of the Park to a wide audience. Croatian mycologists contributed to the mapping programme of the *European Council for the Conservation of Fungi*, and FRAITURE & OTTO (2015) published distribution maps of 51 threatened macrofungi in Europe, with comments on the species distribution, ecology and conservation status.

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Fungal conservation: progress [L]

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Ten years ago, through the International Code of Botanical Nomenclature, science treated fungi as an obscure corner of botany. The IUCN Species Survival Commission had only two specialist groups devoted to fungi, and they were treated as plants. No global-level meeting had been organized to consider fungal conservation, there was no global-level society to promote fungal conservation, there was no organized effort to red-list fungi at a global level, and fungi were almost totally ignored by the Rio Convention on Biological Diversity. Since then, the International Code of Botanical Nomenclature has been replaced by the International Code of Nomenclature for algae, fungi and plants, thereby forcing science to recognize the separate identity of fungi. The IUCN Species Survival Commission now has five fungal specialist groups, and they are treated separately from plants. There have been three international congresses for fungal conservation (Spain, 2007; UK, 2009; Turkey, 2013). The International Society for Fungal Conservation was established in 2010, the Global Fungal Red List Initiative followed soon after, and Rio Convention national reports and plans have begun to include fungi, and the frequency with which fungi are being mentioned is increasing. The *Esmée Fairbairn Foundation* and the *Mohamed bin Zayed Species Conservation Fund* are pioneering support for fungal conservation projects. Regional and national NGOs

and societies are being established to promote fungal conservation (e.g. the *Arab Society for Fungal Conservation*, and *Fundación Fungi* in Chile), and it is now normal to see fungal conservation as a component of mycological congresses. This presentation reviews these encouraging developments, and considers the challenges faced by fungal conservation in Europe and internationally over the next decade.

Macrofungi conservation in Albertine rift forests [L]

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Tropical Africa is endowed with a rich diversity of macrofungi, and their sustainable management could play a significant role in development of sustainable agricultural development practices and strategies against malnutrition and ill health. Although fungi have a high potential in enabling and attaining sustainable development, in the Albertine Rift, very little is known about them compared with many animals and plants; and no wonder they are as the Orphans of Rio. Many of the region's past National Biodiversity Action reports produced in response to the Rio Convention on Biological Diversity fail to consider fungi at all. In this region there is limited taxonomic characterization of macrofungi, and this could contribute to the failure to realize their potential in sustainable use and conservation. There is thus a need to identify, classify and publicise threats to macrofungi and to identify important areas for macrofungi and understand the impacts on human society which may occur as a result of declines and extinctions in fungal populations. Taxonomic solutions to species conservation require more trained taxonomists with relevant high-quality skills. Such resources are limited in the Albertine eco-region countries. In this regard significant advances in scientific knowledge as well as building of human capacity are necessary to promote conservation and sustainable use of macrofungi diversity.

Efforts to approach public on fungal conservation in Gunung Gading national park of Sarawak on the island of Borneo [L]

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The vast forest of Gunung Gading National Park in Sarawak state of Borneo island is well known for macrofungal diversity, but species richness is still poorly unexplored or studied. We have therefore started providing basic information to visitors on how to recognise the fungi present, including their rôles and interactions with other organisms. This will help develop fungal resource conservation, to sustain health and productivity of Gunung Gading forest. As a start, over 70 specimens were collected from block B trail and Lintang trail. There remains, however, the challenge to discover fungi from other areas in this national park. Additionally, we recorded any fungi seen on different substrata (e.g. dead wood, leaf litter and soil) particularly in the wet season when tropical rainforest conditions. Providing this quick guide to fungi of Gunung Gading national park will enhance awareness of fungal conservation among locals and tourists, and will encourage visitors to contribute in updating fungi information. This effort has been initiated since 2016 to implement online surveying that will benefit in developing appropriate fungal conservation strategies in Sarawak.

Fungal Conservation in the Netherlands, Challenges and Opportunities [L]

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The Netherlands has a long history in ecological research on macrofungi. It was one of the first countries where the decline of many fungal species was documented. As a result there have been many attempts, mainly initiated by amateur mycologists from the *Dutch Mycological Society*, to include fungi in conservation policies. Compared with other groups, such as vascular plants, birds, and butterflies, however, they lag behind in the Netherlands and in many conservation projects fungi are largely neglected. How can this situation be improved? I will focus on the main challenges we face and opportunities that emerge. This will be illustrated with examples from a project for the Dutch government: OZINGA, ARNOLDS, KEIZER & KUYPER, *Macrofungi in Conservation Management* (2013). This project was embedded in the *OBN Knowledge Network for Restoration and Management of Nature*. In this network, scientists and conservation managers jointly work on development and transfer of knowledge about sustainable conservation and restoration of ecosystems in the Netherlands. The aim of the project was to survey: 1. Important habitats for fungi and ecological requirements per functional group; 2. Opportunities for the sustainable conservation and restoration of fungal diversity; 3. Knowledge gaps.

Feedback from stakeholders suggests that managers of nature areas are often willing to take more account of fungi, but they indicated that information about fungal habitat requirements and therefore options to provide 'fungus-friendly' management is very scattered and difficult to

access. With better information access there is probably much to be gained. To facilitate this, the 2-volume report which resulted from this project (in Dutch) was widely distributed among stakeholders. Part of the neglect of fungi in conservation projects is probably a result of the different jargon / language used by mycologists and conservation managers, like the proverbial Tower of Babel. The target group of the project was therefore twofold: in the first place, ecologically skilled site managers and in the second place amateur mycologists with an interest in nature conservation. Information on the 'ecological story behind the species' can contribute to better-targeted advice to local conservation managers. To enhance accessibility of the information one volume was devoted to a survey of the mycota of the main Dutch habitat types. The habitat classification is based on a Dutch system of 'nature types' with a link to the international system of 'Natura 2000 habitat types' as used in the European Union. For each habitat type a table with characteristic fungal species is given and possibilities for conservation and restoration are discussed. Despite the potentially large effects of fungi on ecosystem functioning, there are still many gaps in our knowledge about the impact of management measures on the mycota. It is expected that addressing these issues would strongly profit from international and interdisciplinary cooperation.

Soil biota and innovative forest management: a Life Project [L]

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Soil hosts approximately a quarter of Earth's biodiversity. Soil organisms, including microscopic species (e.g. bacteria, fungi, nematodes and protists), meso-fauna (e.g. mites and springtails) and macro-fauna (e.g. earthworms and termites) play a fundamental role in supplying the environment with important ecological processes and interactions. This biodiversity provides a vital habitat, regulating the dynamics of soil cycles of essential elements modifying soil physical structure and water regimes, enhancing fertility and plant growth.

Excluding some recent policy attempts to safeguard soil biodiversity across Europe, effects of soil biota changes on ecosystem processes are mostly unknown, and research investigating the many interactions between above and below ground subsystems is still lacking.

In a forest, energy enters the soil system mainly through degradation of dead organic matter, i.e. animal and plant residues. Fertility and sustainability of a natural soil therefore depends significantly on the

transformation speed of organic matter, mediated by animals, bacteria and fungi. That is why it is crucial to protect this resource with appropriate management. Modern forestry management techniques must be able to meet the compromise between the economic needs of public and private entities and the conservation and increasing of biodiversity.

In this context, a multidisciplinary EU-Life project (SelpiBioLife, LIFE13 BIO/IT/000282) evaluated the application of an innovative forest management technique along with its effects on six different soil taxa: animals (mesofauna, microarthropods, nematodes), bacteria, fungi and plants. The study took place in black pine forests in two mountain areas of Tuscany, Italy.

The goal of the project was to demonstrate positive effects of an innovative silvicultural treatment compared to traditional thinning (selecting trees from below leaving well-spaced and highest-quality trees) and no thinning, not only on stand growth rates and stability as usual, but also on the overall level of soil biodiversity. This new approach is in line with the EU Biodiversity Strategy to 2020 and the Global and European Atlas of Soil Biodiversity.

The 'before treatment' research activity guaranteed a high quality dataset, comparable to those used in high profile journals, and a complete and objective inventory of various environmental variables. The latent potential of this research is incredibly high since to date few other works have treated soil biodiversity in an informative and practical way; and no other research has taken into account the same soil taxa as those used in SelpiBioLife. Future perspectives concern cross-taxon congruence analysis, i.e. to evaluate when diversity and/or composition patterns of different biological groups co-vary spatially, giving new insight into the relative contribution of environmental abiotic drivers and biotic interactions processes structuring the distribution of other taxa. My offered presentation will discuss some of the faced problems and obtained results.

Conservation of fungi in Lithuania: various aspects [P]

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There are about 6,000 species of Fungi in Lithuania. The first national red list, containing 81 threatened species, was compiled and declared only in 1992. In 2007 the redlist was expanded, and now 112 species of non-lichen-forming fungi and 63 species of lichen-forming-fungi are under official protection, out of which 4 species of non-lichen-forming fungi and 3 species of lichen-forming fungi are included on the 'strictly protected species' list.

The main threats for fungi in Lithuania are habitat loss, fragmentation or degradation, caused by too intensive forest management. Amounts of deadwood are low in both protected and commercial forests. Foraging for wild mushrooms is very popular in the country, but it does not seem to cause any larger impact to threatened species. The best quality habitats remaining are in strict nature reserves and Woodland Key Habitats, where old-growth forest predominates with large amounts of deadwood, but they comprise only about 2% of all forests. 132 species of non-lichen-forming fungi and 69 species of lichen-forming-fungi are used for inventories of Woodland Key Habitats. These habitats are preserved on a voluntary basis through a forest certification system, where all state-owned and a small number of private-owned forests are certified.

The genus *Suillus* in Macedonia: valorisation of molecular tools in fungal conservation [P]

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Macedonia is a fungal diversity hot-spot, but up to now identification of boletoid fungi has been mainly based on morphology and use of central European names. Recent studies focusing on selected groups of Boletales at a European or even global scale have demonstrated that species diversity is much higher than previously estimated: many boletoid taxa should rather be considered as a species complex than as individual species. Molecular tools have proved very useful for resolving species complexes, and are now an indispensable tool for meaningful and unambiguous definition of taxa (species).

Fungi are generally still widely under-explored in Macedonia, and only two publications have focused on systematics of the boletoid genera *Boletus*, *Chalciporus*, *Gyrodon*, *Leccinum*, *Phylloporus*, *Suillus*, *Tylopilus*, *Xerocomus*. However, all data are based only on morphological identification, distribution and ecology of boletoid fungi. Molecular analyses for boletoid species from the Republic of Macedonia have not been conducted till now. The aim of this study is thus to present first results of sequence-based analyses of *Suillus* species from Macedonia in comparison with presumably identical and closely related taxa from other European countries. A total of 11 *Suillus* taxa are known for Macedonia (*Suillus bovinus*, *S. flavidus*, *S. collinitus*, *S. granulatus*, *S. grevillei*, *S. luteus*, *S. mediterraneensis*, *S.*

plorans, *S. sibiricus* subsp. *helveticus*, *S. tridentinus* and *S. variegatus*). For molecular analyses, 35 voucher samples from *S. flavidus*, *S. collinitus* and *S. sibiricus* subsp. *helveticus*, and from unidentified collections were selected. Sequencing of genomic rDNA (ITS spacer and LSU) was carried out. Phylogenetic analyses resulted in at least 6 different lineages, which were partly in accordance with European species concepts (*Suillus collinitus*, *S. flavidus*, *S. granulatus*, *S. grevillei*, *S. luteus* and *S. sibiricus* subsp. *helveticus*).

Two *Suillus* species are included in the Macedonian Red List of Fungi, *S. flavidus* in the category of vulnerable and *S. sibiricus* as endangered. Introduced ectomycorrhizal host plants, like *Larix decidua*, have resulted in occurrence of associated species like *Suillus grevillei*. Moreover, the scientific names of many boletoid taxa including *Suillus* spp. have changed in recent years with large consequences for biodiversity databases and red lists. All these facts are important when considering the conservation status of the Macedonian mycobiota, and will be discussed in detail.

India-UK collaborative ventures creating databases on fungi [L]

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The claim that one third of all global fungal diversity occurs in India may be debatable, but scientific evidence shows that the mycota of India is extremely rich. An estimated 90% of this diversity is yet to be recorded and named. The main reason for this shortfall is a lack of mycologists. In this context, an India-UK seminar was held in Kerala in 2011 to initiate fungal conservation in India. The seminar recommended establishing a comprehensive database on fungi of India as a first step. This presentation describes the subsequent attempts to establish that

database and populate it with as many as possible of the existing records of Indian fungi from 1794 to the present.

The 'Fungi of India' database is available online on the *Cybertruffle* server [www.cybertruffle.org.uk/robigalia/eng], and currently contains around 100,000 records of fungi and associated organisms, plus over 1700 records of chromistan and protistan fungal analogues (downy mildews, myxomycetes etc.). The records, which go to 2000, came from over 18,000 sources. Over 100,000 additional records from various sources, many more recent, have been keyboarded by Indian collaborators and are currently being edited. There are a further over 60,000 records of fungi from India in the database of the former International Mycological Institute, and these have also been digitized and are being edited. A similar attempt is being made to update another existing database, 'Fungi recorded on *Eucalyptus*', also available on *Cybertruffle*, for which records available on-line currently go up to 1994. The paper will present the structure and scope of these databases and discuss how they could be put to wider use by mycologists, plant pathologists and conservationists across the globe.

The taste of the wild. Conceptualizations of mushrooms in modern Greece [L]

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Mushrooms have a special position in human imagery as elements of ritual praxis, spiritual enlightenment or entrances to the world of spirits. They are also used in everyday life as medicine, tinder, but most notably as food from the wild and recently as a fascinating experience in nature. Attitudes to mushroom edibility are culturally dependent, and in different cultures or time periods mushrooms have been

conceptualized as desirable or forbidden, and as luxurious or famine food. In 1957, Gordon Wasson, the ethnomycologist, categorized countries as mycophilic or mycophobic. Greece is usually regarded as mycophobic. A study of local mushroom names in literature, however, revealed that some species have more that 30 names each. These are the ones preferred in the past by local people and include *Agaricus campestris*, *Macrolepiota procera*, *Morchella conica*, *Terfezia* spp. and *Pleurotus ostreatus*. In recent years, ubiquitous mushroom species which are traded across Europe, such as *Boletus* spp. and *Cantharellus cibarius* are the ones most preferred by collectors. Consumption of mushrooms by rural populations in the past could be underestimated as everyday dishes and famine food were often not recorded and described as much as ceremonial dishes. In modern times 'the poor man's food' has become the 'rich man's delicacy'. There is a global trend towards wild or traditional foods advertised as healthy and organic, conceived as coming from 'pristine forests', and offering an opportunity to be in contact with nature and to live an 'authentic experience'. In the last 15 years, nine active mushroom associations have been established in Greece and this modern mycophilia is challenging because Greece, like other past mycophobic countries, lacks specific guidelines or legislation concerning wild mushroom management and marketing. As there are no lists defining edible, poisonous and rare species, important public health issues arise. This situation does, however, gives us a unique opportunity to design, in accordance with the experience from other countries, specific regulating policies in a new participatory way.

* presenting author; [L] lecture; [P] poster

Fungal Conservation in Russia: an update [L]

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The main trend of fungal conservation in the Russian Federation is to review previous opinions and approaches from the perspective of new global tools and achievements in selection, assessment and representation of threatened species of fungi, and involvement of a wide circle of people able to discuss the topic.

New generation Red Data Books [**RDB**] cover many administrative regions. About 40 regional **RDB**s have appeared since 2010, and most are second revised editions, so that to date 82 of the 85 federal subjects have **RDB**s collectively containing over 800 fungal species. Some reflect truly modern views on fungal conservation, taking in account new knowledge on global distribution and rarity of species and using IUCN criteria. The third edition of the federation-level **RDB** is now in preparation and, with this important task in mind, the Komarov Botanical Institute and Moscow State University have organized a country-wide cooperative selection and exchange of data regarding fungal candidates for red-listing between amateur and professional mycologists. This will be followed by a preliminary assessment of species. For that step, special procedurs uniting the basic rules of federation-level second edition **RDB** (2008), IUCN criteria, and specific recommendations for evaluating fungi (DAHLBERG & MUELLER, 2011) were prepared (SVETASHEVA, 2015) and sent to regional mycologists. These procedures apply to whole federal territory and include four main categories corresponding to the most appropriate variants of criteria A,B,C and D for fungal organisms. There are in addition some preferences for species selection taking in account

generation time for different ecological groups of fungi, population size and data on strict ecological requirements. There are also recommendations not to select certain fungal groups for red-listing: a) little known species of unclear biology, ecology or taxonomy; b) species able to survive and reproduce in disturbed biotopes; c) species associated with a wide range of biotopes, substrata and symbionts; d) coprotrophs and carbotrophs; e) species associated with introduced and adventive plants; f) species identifiable only by sophisticated techniques, e.g. molecular methods or cultural analysis. As a result, the 25 threatened species from the second edition were revised: 2 species were excluded since they appeared not to be rare or had a doubtful taxonomic position; the status of 2 changed because new distributional data was available; 1 was removed to the monitoring list. In addition, 40 previously unevaluated species were proposed for addition to the main **RDB** list based on preliminary assessments. The challenge now is to convince officialdom to add this list to the forthcoming third edition.

The Internet provides excellent resources for conservation work. The online project *Global Fungal Red List Initiative* is well known to Russian mycologists and actively used to promote rare fungi for **RDB**s at all levels and for organizing new protected areas. At least half of all new suggestions for the federal **RDB** third edition are based on information from that website. Many federal subjects have their own websites, e.g. Moscow oblast [http://old.darwinmuseum.ru/redbook] and Tula oblast [http://redbooktula.ru/krasnaya-kniga], and they provide data on endangered species, including **RDB** articles, pictures, distributional maps etc. For many years we have maintained offline a spreadsheet table combining all data on regional **RDB**s of Russia, but from 2017 we have a new online resource, the 'Russian **RDB**' prepared by Sergey Bolshakov of the Komarov Botanical Institute, St Petersburg [https://goo.gl/Hdsa6L], which contains several tables for different data and tasks: summaries on fungi from all regions of Russia, general and detailed information, laws, bibliography, and 'service' pages for nomenclature, searching and statistics. We hope this resource will be useful for all mycologists interested in fungal conservation globally.

Steps forward for a new ministerial proposal for mushroom legislation in Greece: challenges and opportunities [L]

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Greece's varied landscapes, unique geology, vegetation diversity and position at the end of the Balkan peninsula, along with its historical connectivity with Asia and Africa during several glacial and interglacial periods, has created a high diversity of habitats all shaped by a long human presence. The country is a global biodiversity 'hotspot', but mushroom diversity has only recently attracted attention from the scientific community and international mushroom trade. Greek Forestry legislation is old and considers all "non-timber forest products" as "secondary products" including them in an annual catalogue of prices, where mushrooms are placed with lichens and moss! Forest law regulates local collection of mushrooms (most *Local Harvest Forest Decisions* were set up after 2010) and amounts are based mainly on empirical data (3-5 kg). Truffle collection is actually prohibited in some places (e.g. Ioannina). Commercial collections should go for auction, but pickers have no training and unknown quantities are unofficially harvested. Some are sold via internet, or in shops or gourmet restaurants as the rapid growth of a 'mycophilia movement' is observed. A multidisciplinary working group was set up in 2016 by ministerial decree, including mushroom associations, the scientific community and forest authorities, to propose a new legislation approach based on: traceability and authorization via existing legislation for agricultural products, the creation of a national database under the management of a scientific committee in the ministry, the creation of a specific 'picking licence' with different licences allocated for commercial use and

amateur pickers, and different quantities allowed for amateur pickers according to area of origin, training seminars to specific social groups, official training of forest employees and creation of a national 'Non timber Forest Product Certification Scheme'. Active involvement of mushroom associations and the scientific community is needed, as are pilot tests to find the best way to implement proposed legislation.

Are current environmental programmes adequate for conservation of fungal biodiversity? Exemplary experiences from the protection of oak-dominated woodlands in eastern Austria [L]

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During a regional project to protect ecologically valuable woodlands and veteran trees (Waldumweltprogramm Burgenland) 28 new natural forest reserves with a total size of 336·43 ha were designated. Five of these are well documented hotspots of rare and red-listed species of macrofungi and were proposed by members of the *Austrian Mycological Society*, through informal cooperation with the nature protection NGO commissioned to manage the project, resulting in the first Austrian nature reserves explicitly created for fungal diversity. Two more reserves on serpentine soils are close to and share edaphic conditions with a site nominated by mycologists, which was, unfortunately, not included in the final selection.

A revison of the programme without involving mycologists resulted in a decision to stop funding two of the reserves and in reducing the area of a third reserve, concerning exclusively sites proposed by mycologists outside current Natura2000 areas. The two cancelled natural forest reserves comprise different types of forest communities dominated by *Quercus petraea* (oak-hornbeam forest and thermophilic oak forest with

 * presenting author; [L] lecture; [P] poster

Scots pine on acidic sediments) with highly diverse and complementary assemblages of rare and red-listed macrofungi. One location (Gornja Loza) is the type locality of two species recently described as new: *Russula nausea* and *Neoboletus xanthopus*. Furthermore, this location is the only recently confirmed site where the rare bolete *Lanmaoa fragrans* occurs in Austria.

It was a big advance for mycological data to be considered in delineating the new forest reserves, but subsequent cancellation of two reserves demonstrates the weakness of fungal conservation efforts when mycologists are not properly consulted. Possible reasons for failure to recognise fungal biodiversity as an equally important part of our natural heritage and as an asset of nature conservation are discussed.

An assessment of Red List data for the Pezizomycotina (Umbria - Italy) [P]

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The Umbrian Red List of Pezizomycotina (Ascomycota) includes 108 species, as follows: 1 Critically Endangered (CR), 30 Endangered (EN), 34 Vulnerable (VU), 14 Near Threatened (NT), 2 Least Concern (LC) and 27 Data Deficient (DD).

The conservation status of all species was assessed using the *IUCN Red List Categories and Criteria* (IUCN, 2012a), which is the most widely accepted system for measuring extinction risk around the world. All assessments followed the *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels* (IUCN, 2012b). Assessments were compiled through an extensive literature review, and with contributions from a large network of experts.

The largest number of threatened species of this group in Umbrian forests is terrestrial (saprotroph or symbiont), with a surprising number of threatened taxa belonging to saprotrophic fungi living on sandy and humus soils (St) adversely affected, like mycorrhizal species by harmful atmospheric deposits (fertilizers, pollutants). Among lignicolous saprotrophs (Sh) the proportion of vulnerable species is also considerable. The major cause of change and decline of Pezizomycotina diversity in Umbria is intensification and change in land-use and management, particularly in forestry and agriculture.

The IUCN protocol for assessing the conservation status of species is not legally binding, but, despite possible errors that have been identified, the scientific community has endorsed its use. In many other regions and countries, species are legally protected, and we agree with ANTON ET AL. (2013) that this approach may represent a starting point for the similar protection of these fungi in Umbria. Nevertheless, as pointed out by ROSSI ET AL. (2016), legal protection alone is not sufficient to guarantee good conservation status of protected species.

To date, this fungal group has been mostly overlooked in conservation strategies. The present work is the first to represent a complete regional red list of Pezizomycotina in Italy and could therefore be considered as a case study for other Italian regions, as well as for other European countries, with the aim of compiling a national and European red list.

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Host preferences and distributional patterns of rare and protected species of aphyllophoroid fungi in the Middle Russian Upland [L]

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Aphyllophoroid fungi, primarily polypores and corticioids, are a leading group of xylobiontic organisms, especially in forest ecosystems. The Middle Russian Upland occupies approximately 480,000 km^2 in the southwestern part of the East European Plain, and is distributed among seven oblasts (Belgorod, Bryansk, Kaluga, Kursk, Lipetsk, Oryol, and Tula). Forest vegetation, including forest habitats, in the Middle Russian Upland is stressed by both long-term human activity and location close to the southern limit of the forest zone.

Based on literature and collection data, 569 species are known from the Middle Russian Upland. Among them, 231 species are recorded from one oblast, 119 from two, and 61 from three. In all, 24 protected fungal species are listed in seven regional Red Data Books. Several rare and threatened species of aphyllophoroid fungi, however, were overlooked for conservation purposes. We analyzed data on these species based on reference collection specimens and field observations with respect to occurrence and habitat requirements.

The main criterion for selecting species was fewer than three records from the Middle Russian Upland. Following expert assessment, we recommended 46 species of aphyllophoroid fungi for protection. The first group is formed by species associated with dead wood of *Picea abies*, growing here on the southern limit of its distribution and in a poor condition because of water deficiency and the absence of reproduction. Those species are *Amylocorticiellum molle*, *Amylocorticium cebennense*, *Antrodia cretacea*, and *Steccherinum collabens*. The second group is species which develop fruitbodies on massive logs of *Quercus robur* such as *Aurantiporus croceus*, *Buglossoporus quercinus*, and *Xylobolus subpileatus*. Old-growth oak trees have been saved on reserves but only as isolated individuals. The rate of oak reproduction is slow and other broad-leaved trees (e.g. *Acer platanoides*) become more competitive as forest-forming dominants. The third group comprises by soil-dwelling fungi of broad-leaved forests (*Craterellus melanoxeros*, *Ramaria broomei*, *R. curta*, *R. fennica*, *Ramariopsis crocea*, and *R. pulchella*) and mixed coniferous-deciduous forests (*Albatrellopsis confluens*, *Phellodon connatus*, *P. niger*, and *Sarcodon imbricatus*). The fourth group consists of aphyllophoroid fungi known only from a few locations in the European part of Russia and associated with long-established unmanaged forests (*Candelabrochaete septocystidia*, *Chaetoporellus latitans*, *Favolus pseudobetulinus*, *Gloiodon strigosus*, *Rhizochaete sulphurina*, *Terana coerulea* etc.).

Species known in Russia only from the Middle Russian Upland (*Lindtneria panphyliensis*, *Phanerochaete aculeata* and *Subulicystidium perlongisporum*) deserve special attention. *Polyporus rhizophilus*, a pathogen of *Stipa* spp., occurs only in virgin unploughed steppe, the area of which is extremely reduced.

To summarize, these species of aphyllophoroid fungi should be included in new editions of the regional Red Data Books so that protection can be provided.

The study was funded by RFBR research project No. 15-04-06211.

Red-list assessment for larger fungi in China [L]

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[Abstract not received in time for publication]

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