

## Adding North American mushrooms to the IUCN Global Red List

We all are aware of the importance of fungi for ecosystem health and the biosphere in general, but they are rarely included in conservation discussions or actions. In the USA, only two fungi (*Cladonia perforata* and *Gymnoderma lineare*) are listed as ‘Endangered’ under the US Endangered Species Act, but the Act does not explicitly provide protections to fungi (Davoodian 2015). Numerous fungal species receive protection under the Survey and Manage Standards and Guidelines of the Northwest Forest Plan (SMNFP), but protection into the future is uncertain.

A critical way to help politicians and citizens be more aware of the importance of fungi, and the fact that they face the same threats as plants and animals, is to have mushroom species included in the official IUCN (International Union for Conservation of Nature) Global Red List. Anders Dahlberg and Greg Mueller have extensively written about this initiative (Dahlberg & Mueller 2011; Mueller & Dahlberg 2013), and have made



*Leptonia carnea*, one of the species proposed for the IUCN Global Red List. Photo by Christian F. Schwarz

*Continued on following page*

presentations on fungal conservation at MSA and other meetings. The IUCN Global Red List is a compilation of rigorous assessments of the extinction risk for individual species made using strict universal (across kingdoms) criteria and categories ([www.iucnredlist.org](http://www.iucnredlist.org)).

The 2014 update of the IUCN Global Red List includes only five fungi (four lichens, and one mushroom, viz. *Pleurotus nebrodensis*) out of over 20,000 species from the other kingdoms. The Global Fungal Red List Initiative is aiming to change this (<http://iucn.ekoo.se/en/iucn/welcome>). During a recent international workshop, assessments were prepared for publication in the IUCN Global Red List of 14 easy to recognize, beautiful and striking, (very) rare and endangered mushroom species that are found in the USA and Canada. These 14 species are listed in Table I, with notes on the main threats and population trends for each of them.

**Table I. USA and Canadian mushroom species proposed for listing in the IUCN Global Red Data List**

*Agaricus pattersoniae* Peck – restricted to old Monterey cypress groves in coastal California, USA, threatened by urban development and cypress diseases.

*Bridgeoporus nobilissimus* (W.B. Cooke) T.J. Volk, Burds. & Ammirati – reproducing only on very large stumps and living true fir trees in Washington, Oregon, and northern California, USA, with high chance of extinction because of the absence of old enough host trees, and vandalism of the long-lived basidiocarps.

*Cortinarius pavelekii* (Trappe, Castellano & P. Rawl.) Peintner & M.M. Moser – only found in coastal Oregon growing with Sitka spruce; its population has declined over the last 30 years due to urban encroachment into potential habitat.

*Destuntzia rubra* (Harkn.) Fogel & Trappe – only known from the San Francisco Bay Area (over 110 years ago) and the Sierra and Cascade foothills, but not recollected in 8 of the 13 known sites.

*Echinodontium ballouii* (Banker) H.L. Gross – only fruiting on very old trees of Atlantic white cedar, a swamp-inhabiting conifer found along the coast of the eastern USA. Recently only reported from one site in New Hampshire, though all other potential habitats have been extensively surveyed. The extinction risk for this species is very high, because of the lack of old trees.

*Fevansia aurantiaca* Trappe & Castellano – occurring in high-altitude true fir and hemlock forests of western North America, and only known from a handful of isolated sites.

*Gastrolactarius camphoratus* (Singer & A.H. Sm.) J.M. Vidal – found mainly in one county in Oregon, USA where recent forest fires have impacted its occurrence.

*Gloeocantharellus purpurascens* (Hesler) Singer – ectomycorrhizal fungus emblematic for the mixed low-altitude forests of the western part of the Great Smoky Mountains National Park, but also recorded from cloud forests in Mexico. All these habitats are undergoing alterations because of climate change and habitat destruction is a serious threat for the Mexican populations.

*Hygrocybe flavifolia* (A.H. Sm. & Hesler) Singer – restricted to coastal redwood forests in California, USA, and known from a handful of localities. Changes in summer fog patterns are already causing drought stress for these redwood forests.

*Lepiota viridigleba* (Castellano) Z.W. Ge & M.E. Sm. – known from two high altitude forests in the Sierras and southern Cascades of California, USA.

*Leptonia carnea* Largent – like *Hygrocybe flavifolia* in coastal redwood forests of California, USA, which have been severely logged in the past, and which are now under drought stress, because of climate change.

*Phaeocollybia oregonensis* A.H. Sm. & Trappe – one of the rarest *Phaeocollybia* species, known from a small number of sites in Oregon, Washington (USA), and coastal British Columbia (Canada). Protecting one *Phaeocollybia* species means protection for several, as they tend to grow in the same kind of old-growth forests.

*Rhizopogon alexsmithii* (Trappe) Vizzini & Zotti – only known from six sites in the Cascade mountains in Oregon, USA, where it grows in mid to high elevation hemlock forests.

*Sarcodon fuscoindicus* (K.A. Harrison) Maas Geest. – limited to the Pacific northwestern USA, and one locality in central of Mexico, where it has declined over the past 50 years.

Other USA and Canadian fungal species have been proposed, but these have or had a wide distribution throughout the northern hemisphere. In addition to these mushroom species, several NA lichenized fungi and other ascomycetes, rusts and smuts are being assessed.

The complete world-wide list of fungal species that have been proposed for the Red List can be seen at [http://iucn.ekoo.se/iucn/species\\_list/](http://iucn.ekoo.se/iucn/species_list/)

One may notice that nearly 50% of the 14 species of Table I are hypogeous. This must not lead to the conclusion that hypogeous fungi are more threatened or rarer than epigeous species. This is the result of the effort of dedicated mycologists, who specialize in hypogeous fungal species, who extensively and systematically surveyed for them for 50 years, yielding the necessary data critical to assess them against IUCN criteria.

There are undoubtedly many more rare and threatened fungal species in North America than the handful we have proposed so far, and would love to hear about them from other mycologists.

There are a few things to remember when proposing a species for the Red List. The strongest arguments for conservation are those that are based on hard data, e.g., a fungal species with a documented decline in numbers of mature (reproducing) individuals or a species found only on one host or a very specific habitat that has declined or is declining. Ensure that the species concept is clear and that your species is not a species complex. Have information on search intensity, e.g., a species known only from the type locality, that has not been intensively searched for elsewhere, would be treated as “Data Deficient”. The article by Dahlberg & Mueller (2011) provides important information on criteria for listing, and the different categories species can be listed under.

Good candidates are species that are only known from a specific habitat that may be threatened or a very limited number of localities, or like *Bridgeoporus* and *Echinodontium ballouii* fruit only on very large trees that have severely declined in the last 50–100 years.

We are looking forward to hearing from you!

## References:

- Dahlberg A, Mueller GM. 2011. Applying IUCN red-listing criteria for assessing and reporting on the conservation status of fungal species. *Fungal Ecology* 4: 147–162.
- Davoodian N. 2015. Fungal conservation in the United States: current status of federal frameworks. *Biodiversity and Conservation* DOI 10.1007/s10531-015-0935-3
- Mueller GM, Dahlberg A. 2013. The Global Fungal Red List Initiative. *Inoculum* 64(6): 1–2.

—Else C. Vellinga  
Jean A. Bérubé  
Michael A. Castellano  
Gregory M. Mueller