

Baseline Information for Better Protection of Fungal Species Within CITES

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Abstract: This paper outlines the need to include fungi within the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) framework. Despite their crucial roles in ecosystems and economic importance, fungi have been largely overlooked in conservation efforts. Recognizing and protecting fungi under CITES will fill this gap and ensure their sustainable use and preservation. We urge CITES Parties to take the outlined steps to strengthen the foundation for fungi conservation and highlight their importance globally.

Keywords: Fungi, conservation, biodiversity, species protection, international trade, Environmental legislation.

1. Global Magnitude of Fungal Diversity

The best scientific estimate suggests that there are between 2.2 and 3.8 million species of fungi on planet earth – as many as 10 times the estimated number of plant species (Hawksworth and Lücking, 2017). At most, a mere 8% of all fungal species have been described. Of these, only 781 have had their conservation priority assessed on the IUCN Red List of Threatened Species. This can be compared with 89,000 animal species and 66,000 plant species.

The importance of fungi to our ecosystems, carbon sequestration, and food production is critical and is being increasingly recognized. However, this scientific recognition is not yet reflected in our international legal instruments. As Conventions shape the direction of biodiversity conservation at all levels and influence funding and research priorities, we believe this needs to change.

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2. Current Oversight of Fungi

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has long been a cornerstone of international efforts to regulate the international trade of wildlife. CITES has focused on fauna and flora, with little attention being paid to fungi. Fungi, widely recognized as occupying their own independent kingdom since this was first proposed in 1969, have remained largely neglected by CITES, and in legal and policy frameworks more generally.

The 12th meeting of the Conference of the Parties (CoP) to CITES held in 2002 recognized fungi as being covered by the Convention. However, no fungal species has ever been proposed for listing, let alone listed, under the Convention. This represents a potential gap in the protection of species of fungi from overexploitation through international trade.

3. Better Recognizing Funga Under CITES

The better protection of fungi is essential to meeting the Kunming-Montreal Global Biodiversity Framework (GBF) targets. How this is achieved includes addressing the threats that could be posed through overexploitation for international trade.

There are several ways for CITES to better recognize funga. For example, species of fungi could be proposed for listing under the Convention, a new and more complete Resolution on CITES and funga could be adopted, decisions could be adopted directing the CITES Plants Committee to explore the issue, and/or the Convention text could be amended to specifically include reference to funga, in addition to flora and fauna.

CITES makes specific provision for amending the text of the Convention, but Parties have historically been reluctant to do so. While this is the route that offers the strongest legal foundations, other options are also available, which should be fully explored before contemplating amending the Convention text.

Draft Resolutions and decisions can be prepared and submitted by any Party or Parties to a CITES CoP. The content of a draft is determined by the submitting Party or Parties, with the final content being negotiated amongst, and adopted by, Parties at the CoP.

A Resolution specifically dedicated to recognizing funga under CITES would provide a stronger foundation than the current short reference found in the Resolution on '*Standard nomenclature*' that simply says Parties agree that '*species of fungi are covered by the Convention*'. Doing so would serve to draw global attention to the importance of fungi and may lead to Parties proposing fungi species for listing that meet the CITES listing criteria.

A Resolution could be complemented by a series of decisions, including to direct the CITES Plants Committee to assess the available science on the exploitation of fungi for international trade, the impact such trade has on the survival of the species, and whether the provisions of Resolution Conf. 9.24 on the '*Criteria for amendment of Appendices I and II*' are appropriate to the biology of fungi.

4. Ecological and Economic Significance of Fungi

Fungi play vital roles in ecosystems, promoting nutrient cycling, supporting plant growth, and maintaining soil health through extensive mycelial networks. Beyond ecological significance, fungi contribute to human sustenance, medicine, and industry. From culinary uses to life-saving medicines, fungi are indispensable to biodiversity and essential for the resilience of ecosystems and human societies. Recognizing and safeguarding the importance of fungi through the international legal framework is crucial for a sustainable and balanced planet.

Fungi are increasingly found in international trade. There has been a 15% annual growth in trade in fungi over the past decade, making them one of the fastest-growing food and medicine commodities.

5. Concluding Statement

When fungi suffer, so do the ecosystems they are an integral part of and all the people who rely upon them. We strongly encourage Parties to CITES, and all observers, to unite in supporting an enhanced recognition of fungi within the CITES legal framework, through adopting an appropriate Resolution and set of decisions, and to consider submitting species of fungi that meet the listing criteria, to an upcoming CITES CoP for consideration.

In the first instance, we encourage a Party or Parties to CITES to submit a draft Resolution on CITES and fungi, and a draft set of decisions directed to the Plants Committee, as referred to above, to CITES CoP20 in 2025.

By taking these measures, we can help ensure that international trade in fungal species does not threaten their survival. It will also open avenues for increased research and a heightened focus on the importance of fungi to ecological health, serve to better protect fungi from over exploitation, and to achieve the GBF.

These international collaborative efforts are pivotal to ensuring that fungi, a fundamental kingdom of life, receive the acknowledgment and conservation effort they clearly merit.

The Fungi Foundation, its special advisors and partners, can offer technical support, upon request, to any CITES Parties or Parties that wish to advance this matter.

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I. Annex: Data

Of the 318 species on the IUCN database that are vulnerable, endangered, or critically endangered, 13 are listed to be used in some edible/medicinal/trade context.

Fungi species	IUCN Category	Trade Context
<i>Phlebopus bruchii</i>	Critically Endangered	<i>Phlebopus bruchii</i> is the only native wild edible species from Cordoba (Argentina) forests sought and collected by local people. It is considered of better quality than exotic species (such as <i>Suillus</i> spp.) that grow in exotic pine forests established in the region. It is under threat from uncontrolled harvesting.
<i>Butyriboletus loyo</i>	Endangered	This culturally significant edible species has a high level of domestic use, high commercial value, and a restricted and fragmented habitat. It is over-exploited, which is inferred to be one of the causes of its declining population.
<i>Calostoma insigne</i>	Endangered	This is an edible species, which is collected particularly in northern Thailand and in Borneo, but this is small scale collection for local consumption.
<i>Grifola gargal</i>	Endangered	Highly prized edible mushroom of cultural importance.
<i>Tricholoma fulvocastaneum</i>	Endangered	In Laos it is heavily harvested due high local and export demand. In Japan it is declining and is listed as Critically Endangered in Ehime prefecture.
<i>Tricholoma mesoamericanum</i>	Endangered	This species is endemic to Mexico. It belongs to the matsutake species complex which is one of the most valued edible mushrooms globally. It has suffered a conservative estimated population reduction of more than 50% in the past 30 years and the causes of that decline have not ceased.
<i>Amanita tuza</i>	Vulnerable	<i>Amanita tuza</i> is an edible species eaten by local people at states like Tlaxcala, Hidalgo and Estado de México, it is used as food or trade during rainy season.
<i>Flammulina mexicana</i>	Vulnerable	This is an edible mushroom locally valued in the center of Mexico with a high potential for its commercial cultivation. However, it is harvested in nature for local consumption without any conservation strategy.
<i>Hygrocybe splendidissima</i>	Vulnerable	This is an edible species and is collected and consumed locally in some areas.
<i>Lactarius chiapanensis</i>	Vulnerable	This ectomycorrhizal fungus is only found in the Central Depression of Chiapas, southern Mexico; Its populations may be under pressure due to changes in land use, and trade and harvesting for local consumption.

Fungi species	IUCN Category	Trade Context
<i>Lactifluus hallingii</i>	Vulnerable	<i>Lactifluus hallingii</i> is starting to be marketed as an edible in some Colombian cities.
<i>Ophiocordyceps sinensis</i>	Vulnerable	<i>Ophiocordyceps sinensis</i> , used for 2000 years, treats lung and kidney diseases, acts as an aphrodisiac, and, despite fermentable strains, lacks commercial cultivation. In Western and traditional Chinese/Tibetan medicine, it's valued for its medicinal properties. In rural Tibet, it contributes over 40% to annual cash income and nearly 10% to GDP.
<i>Tricholoma matsutake</i>	Vulnerable	<i>Tricholoma matsutake</i> , aka Matsutake, and related species are highly valuable, edible fungi sold in both local and international markets.

II. Annex: Two Possible Fungi Species to be Listed

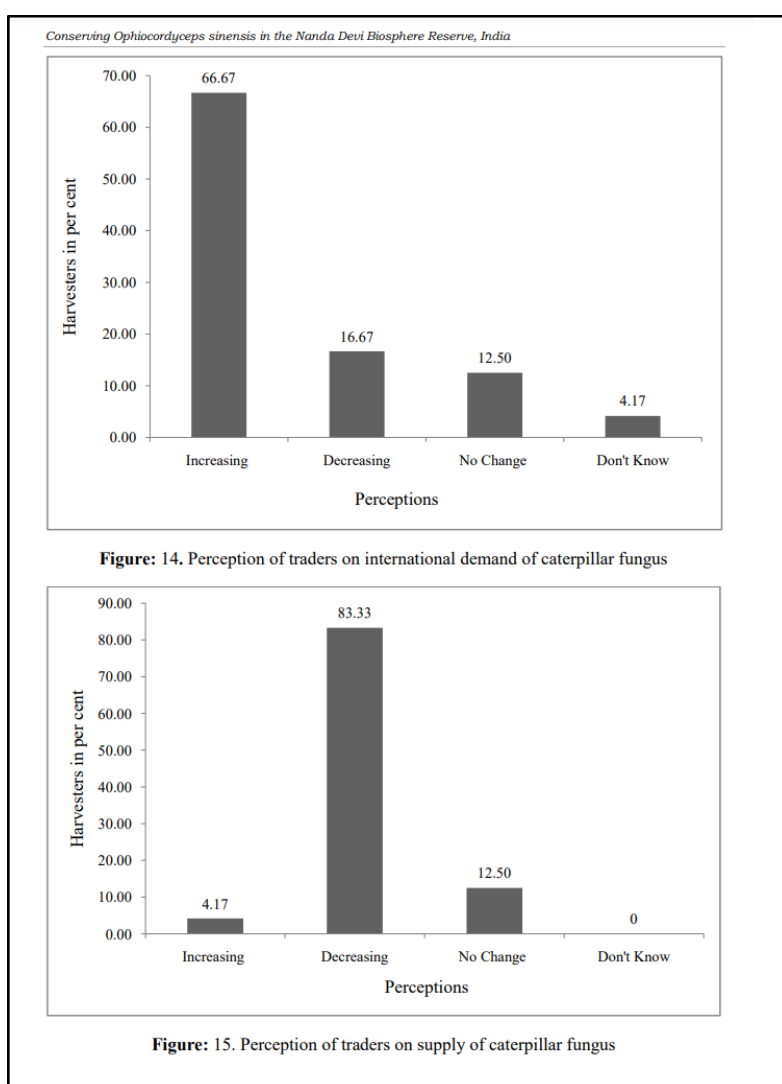
Listing of Fungi under the Convention: If a set of decisions is adopted by CITES, as is proposed above, two species of fungi should be taken into consideration by the CITES Plants Committee: Chinese caterpillar fungus *Ophiocordyceps sinensis* and Matsutake *Tricholoma matsutake*. Both species are known to be highly traded in international markets and are both currently listed as 'Vulnerable' in the IUCN Red List. They could potentially already be proposed for listing by a Party or Parties under CITES, if they meet the listing criteria.

If listed under the current CITES legal framework they would be listed as flora. However, as they belong to a separate Kingdom, they should be separately recognized.

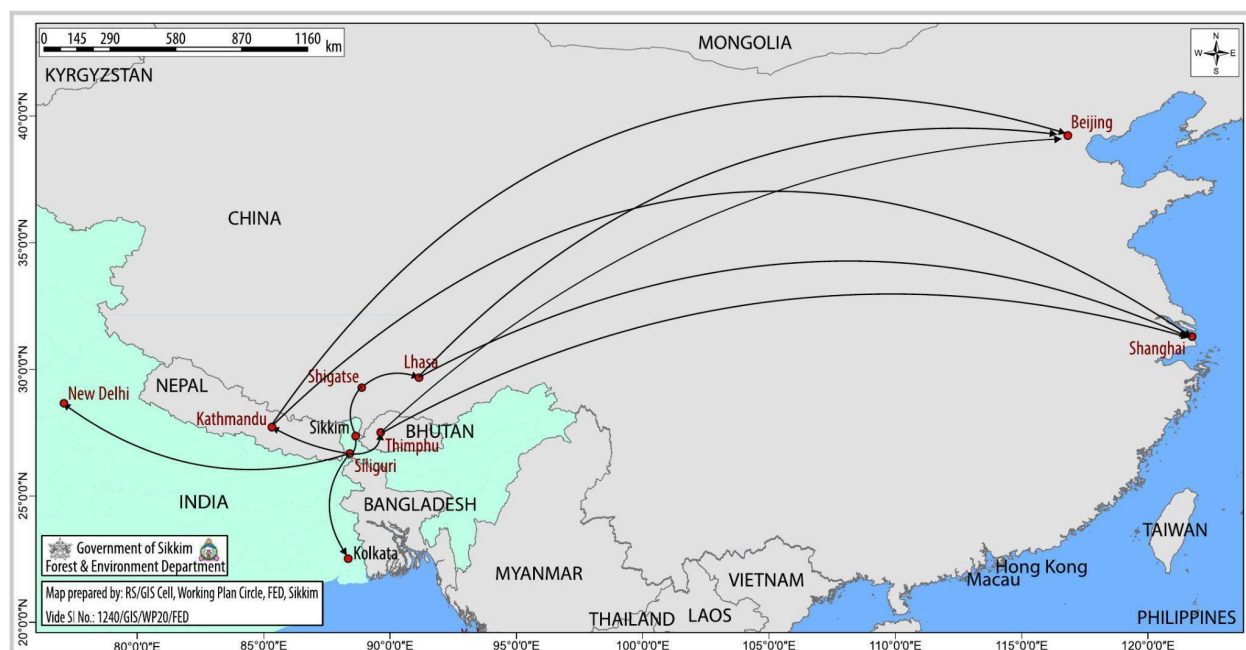
If a Resolution was adopted by CITES, as is proposed above, its content could include agreeing that any species of fungi that is listed under CITES should be included under a new sub-title under flora in the Appendices for listed species of fungi, with an annotation noting the distinction between funga, flora and fauna. This may also require an amendment to Resolution Conf. 12.11 (Rev. CoP19) on 'Standard nomenclature'.

***Tricholoma matsutake*:** The yield of *song rong* (*Tricholoma matsutake*) is declining because of overharvesting in the Yunnan province of China. In the past decade, production has decreased at an estimated rate of 5% per year, especially in the first of the 1990's (Chen, 2004). The scale of trade is international, and the decline of *song rong* has become a serious problem as it risks the livelihood of the people that depend on them, because of the unsustainable way in which it is collected, which reduces the fungal population. This needs to be addressed.

***Ophiocordyceps sinensis*:**



Key perceptions (Yadad et al., 2016).



National and international trade routes of Ophiocordyceps sinensis (based on open-ended interview with sublocal and local traders) (Bharat et al., 2020).

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III. Annex: Data continued – preliminary country “shortlists”

Regions and countries with high fungal biodiversity include:

a. Brazil

Brazil is a megabiodiverse country, home to more than 50,000 native species of plants, fungi, and algae, and over 100,000 species of animals. When it comes to fungal diversity, Brazil has a rich variety of fungi, with previous estimates revealing over 5,000 fungal species, with a predominance of Basidiomycota and Ascomycota. There are also major initiatives for the cataloguing and conservation of fungi, for example Mind.Funga.

b. Ecuador

Ecuador is recognized for its high fungal diversity, particularly in its eastern montane cloud forest, which has been identified as having one of the highest fungal species diversities in the country. Research has also been done on the fungal biodiversity of threatened Andean cloud forests. Additionally, there are large-scale cataloguing efforts like Bioweb’s FungiWEB.

c. West Africa

The numbers of fungal species known for different countries vary widely, with Sierra Leone, Ghana, and Nigeria presenting some of the highest numbers in West Africa.

d. China

As one of the 17 Megadiverse countries, China has among the highest biodiversity assemblages in the world with a wide range of geographic and biological features from mountain chains to deserts, to grasslands, to forests ranging from boreal to tropical evergreen and mangroves. The red list assessment of macrofungi in China has evaluated the threatened status of 9,302 macro-fungal species.

Selected countries that have either existing regulations or significant mycological researchers:

a. Switzerland

The protection of fungi in Switzerland is currently concentrating on restrictions on picking fungal fruiting bodies. Various cantons have restrictions on the collection of wild mushrooms (closed days, quantity restrictions). Mushroom reserves with a general ban on fungi picking exist in Graubünden (e.g. in the village of Bonaduz). In addition, twelve species are under strict national protection.

b. Serbia and Hungary

The Balkans have strict laws on the protection of fungal species, owing to the fact of their mycophilic culture and traditions of foraging

c. Benin

As compared to its neighboring countries, Benin has many researchers and projects in the realm of fungi cataloguing and conservation. More here.

Selected countries that may be vulnerable to overexploitation of fungi through international trade:

a. Nepal

Listed as per the data above, on the trade of *Ophiocordyceps sinensis*.

b. China

Note: the recommended species (*Ophiocordyceps sinensis*) has been listed as an endangered species under the “second class” of state protection since 1999.

c. Japan

Listed as per the data above, *Tricholoma matsutake*.