

A FUTURE FOR FUNGI - THE ORPHANS OF RIO

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It's difficult to over-emphasize how important fungi are. Their well-being is necessary for sustainable life on this planet. Without them, we're finished. To take just one example, they are nature's recyclers. Like the municipal refuse collectors employed to remove our rubbish, we don't notice them until for some reason they stop. But - and it's scary - stopping is something they might just possibly do. Scientists have known for over 100 years that, like animals and plants, fungi too are affected by the destructive activities of mankind. There is already evidence that populations of many species are falling: the impact of air pollution on lichen-forming fungi is particularly well documented. Although there is still insufficient information about the conservation status of fungi, there is every reason to suppose they are just as vulnerable as other groups of organisms to habitat loss and climate change.

Misleading descriptions. Public awareness of their importance is, however, very low, not least because biodiversity—the full and wonderful diversity of life—is still widely portrayed as 'flora and fauna' or 'animals and plants'. These lazy and misleading descriptions can even be found on websites of major biological institutions and learned societies which should and do know better. Biodiversity is so much more than 'animals and plants'. The five kingdom classification of life, which recognizes fungi in a kingdom of their own, has been generally accepted by scientists since at least 1970 and, with an estimated 1.5 million species of fungi on this planet and a presence in all major ecosystems—freshwater, marine and terrestrial alike, this kingdom is megadiverse. There are far more fungi than all the plants and vertebrates put together. To ignore them is not a sensible option.

The broader conservation movement, however, remains largely unaware of the need to conserve fungi. Priority habitats for conservation, such as 'biodiversity hotspots', are almost always defined on the basis of bird, mammal and flowering plant diversity. Fungi don't get a look-in. This means that habitats rich in fungal diversity are missed and remain unprotected. Most nature reserve management plans do not take fungi into account. Fungi are often treated as part of the problem, rather than recognized as themselves being in need of protection. In many countries there is no explicit legal protection for fungi.

A daunting task. IUCN has recognized this problem and, in 2009, reorganized and expanded its Specialist Groups which provide coverage of fungi under the Species Survival Commission. Where there were two groups previously, there are now five, and where fungal Specialist Groups were formerly listed under 'Plants' they are now correctly grouped in their own independent category. Collectively, these groups have the daunting task of building an infrastructure for fungal conservation and raising awareness at all levels that fungi need to be protected.

When I came out of university, I was employed in an institution devoted to fungi, and it was my job to identify microscopic species sent in from all over the world. It was a privilege to see the wonderful diversity of these organisms and, with the constant arrival of specimens representing new species, my colleagues and I became increasingly aware that the fungi already known and described form only a tiny proportion of what is probably out there. Now, the generally accepted estimate is that over 90% of all the planet's fungal species still await discovery. Over the same period, a consistent and long-term failure at governmental level to support basic taxonomic research meant that my colleagues were not replaced when they left and, by 1999, the institution itself had ceased to exist. These are not easy conditions in which to promote fungal conservation.

Getting the message across. IUCN's fungal Specialist Groups need to get their message across to the public and their governments worldwide. It is particularly important to get fungi better recognized by the Convention on Biological Diversity (CBD). When it was adopted in 1992 at the Rio Earth Summit, laudibly, the CBD established the right to protection for all forms of life, and "all forms of life" includes fungi. Unfortunately, its text classified biodiversity as "animals, plants and micro-organisms"—two taxonomic kingdoms and a third category defined by size. Fungi belong in neither the animal nor plant kingdom, but they do include in their number some of the largest single living individuals known on earth. One genetically uniform colony of the toadstool *Armillaria ostoyae* in the Malheur National Forest of Oregon covers an area of almost 9 km², making it far bigger than the blue whale or any of the great redwoods. The term micro-organism—that third category—therefore hardly seems appropriate.

Fungi simply do not fit these inadequate CBD definitions, and they are suffering as a result. Their right to protection has been established, but the convention has provided no machinery for ensuring it happens. Many national biodiversity action plans produced in response to the convention fail to consider fungi at all. The few which do usually treat them as 'lower plants'—an obscure corner of botany. The CBD designated 2010 as the International Year of Biodiversity, but the accompanying logo shows only animals and plants, and fungi are nowhere mentioned in the official video made to promote the year. This is a compelling and very public indication that, as presently organized, the CBD is not delivering protection for these critically important organisms. As David Hawksworth, one of the world's leading fungal experts so eloquently put it, fungi are truly "the orphans of Rio".

Cybertruffle. The rapidly declining resources available for work with fungal biodiversity made it clear that, to conserve fungi, the first step was to conserve mycologists—the scientists who work with these organisms—and the second step was to digitize existing information about when and where fungi occur, to provide an objective basis for future work. Outside the developed

world, there are very few countries where mycologists can be found. Over 16 years, with funding from the UK Darwin Initiative, I ran projects which delivered support to those mycologists while digitizing vast numbers of fungal records. The results of that work are now available through the Cybertruffle website. Information about when and where fungi occur is delivered in 10 languages and there is also a digital library for mycology providing free and open access to over 320,000 pages of mycological literature. During those years and despite those efforts, mycologists themselves as a group have in many parts of the world become critically endangered.

The way ahead. The IUCN fungal specialist groups need to learn fast. They have to develop political expertise, where possible by learning from the experiences of other conservation bodies. They must also raise awareness of fungi among the CBD National Focal Points, and engage governments which are not signatories to the CBD, helping them to understand the importance of fungal conservation.

The groups should raise the profile of fungi, in part through a campaign to encourage biological institutions and societies to ensure that the language used in their promotional material properly reflects the true importance of fungi. The groups will work to identify, classify and publicise threats to fungi, and to identify important areas for fungi and impacts on human society which may occur as a result of fungal population declines and extinctions. They will also promote the message that, without taking fungi into account, the ecosystem approach to conservation is so severely compromised as to be invalid.

The groups must promote representation by mycologists on bodies concerned with biodiversity and conservation. If fungi are the "orphans of Rio", then mycology, like an orphan, enjoys little of the family wealth (mycologists are usually hidden away in obscure departments of botanical institutions, getting a very small share of resources), and mycology is rarely consulted on family matters by the biological sciences. Biodiversity initiatives should as a matter of course involve mycologists as equal players from their inception. At present, in general, they don't.

The big collective achievement of the IUCN fungal specialist groups since reorganization has been to play a leading role in establishing a new society for fungal conservation—the International Society for Fungal Conservation. Almost unbelievably, it appears to be the first society anywhere in the world exclusively and explicitly devoted to protecting fungi. Establishing it was an important and historic event for the conservation world, but only a first step. The Society, like the IUCN fungal specialist groups, is new, small and inexperienced. They all now need strong, enthusiastic and generous support from other conservation bodies and from all who understand the pressing need to protect the "orphans of Rio". There is a huge task ahead.