It's time for a Global Strategy for Plant and Fungus Conservation

Alison Pouliot[1], Tom May[2], Sapphire McMullan-Fisher[3], Peter Buchanan[4], Lyn Allison[5] and Jasmin Packer[6]*

*[1]Australian National University; [2]Royal Botanic Gardens Melbourne; [3]University of Tasmania; [4]Landcare Research, Auckland, NZ; [5]Friends of Westgate Park; [6]University of Adelaide; *Corresponding author email: alison.pouliot@anu.edu.au*

Introduction

The Global Strategy for Plant Conservation (GSPC) was initiated in 2002 to provide a framework for conserving botanical diversity worldwide under the Convention on Biological Diversity (CBD). The five objectives in the 2011–2020 GSPC include that plant diversity be well documented, effectively conserved and used in a sustainable manner. Among 16 specific targets under these objectives are an online flora and assessment of conservation status for known plant species as well as regional measures of conservation achievement. Earlier targets have already led to significant outcomes, such as creation of the *Plant List*, an 'accessible working list of known plant species' and multi-year funded capacity building initiatives.

The only mention of fungi in the GSPC states 'Parties, other Governments and other relevant stakeholders may consider developing conservation strategies for other groups such as algae and fungi...'. Optional development of strategies for fungal conservation, however, underestimates the importance of plant-fungal relationships, and undermines prospects for the GSPC to meet its conservation objectives. Specifically, if the GSPC is to meet its second objective—'Plant diversity is urgently and effectively conserved'—then all plant symbionts should be considered. At the same time, if fungi are incorporated into the GSPC on equal footing, this would turbo boost conservation of the fungal kingdom.

No plant is an island

The GSPC does not adequately acknowledge that all plants exist in beneficial relationships with fungi. Symbioses between plants and fungi are the norm, not the exception. The vast majority of plants form mutually beneficial mycorrhizal relationships with fungi, conferring access to nutrients as well as disease protection. All plants have fungal endophytes, some of which are mutualists, providing benefits to the plant host such as heat tolerance.

This level of dependency is taken to the extreme in the case of orchids. All orchids rely on fungi during the germination phase and many rely on fungi throughout their lives. It is not possible to address the conservation of orchids without proper consideration of their fungal partners.

The GSPC also insufficiently recognises the vital and unique roles of fungi in ecosystem function, providing ecosystem services such as decomposition and nutrient cycling, upon which all plants depend. Further to their roles as symbionts and recyclers, fungi are critically important for maintaining structure and improving water retention of the soils in which plants grow.

Left: Cortinarius austrocinnabarinus *is a mycorrhizal fungus forming mutually beneficial relationships with plants. Right:* Mycena epipterygia *is a saprobic fungus that provides essential ecosystem services through decomposition of plant matter. Photos: A. Pouliot*

Fungi in global and Australian biodiversity conservation

Interest in fungal conservation is growing. The International Society for Fungal Conservation was formed in 2010, with membership from more than 70 countries. The International Union for the Conservation of Nature (IUCN) now has five fungal specialist groups. While only three fungi appear among the 21,286 globally listed species on the 2013 IUCN Red List, a Global Fungal Red List Initiative has recently been implemented (Mueller and Dahlberg, 2013).

Despite growing awareness of fungal biodiversity, the CBD categorises life forms as animals, plants or members of the arbitrary non-taxonomic category of micro-organisms, and hence does not adequately accommodate fungi (Minter 2011). Similar shortcomings exist in Australian conservation strategies (Pouliot and May 2010). Australia's *National Biodiversity Strategy 2010-2030*—a requirement of being CBD signatory—does not explicitly deal with fungi. The one conservation overview specifically dealing with fungi—the 1997 *Conservation overview of Australian non-marine lichens, bryophytes, algae and fungi*—was never implemented.

Australia has 11 846 described species of fungi (Chapman 2009) and the total number is expected to exceed that of the plant kingdom by up to ten times. Conservation status is unknown for all but a handful. There are 1295 species of plants listed under the *Environment Protection and Biodiversity Conservation Act 1999*, but only two species of fungi. However, the fungi are listed not for protection, but as threatening processes. Likewise, the few Australian conservation strategies that include fungi do so mostly in the context of fungi as threatening processes, rather than as organisms themselves requiring explicit protection.

A more inclusive strategy for biodiversity beyond the animal kingdom

How can we improve the conservation of both plants and fungi? Griffith (2012) presented a compelling case for a global conservation strategy for microorganisms, under which he included fungi. However, we consider it better to recognise fungi as the second largest kingdom of life and hence a significant component of biodiversity, rather than lumped among the poorly defined 'microbes' that typically include bacteria and microscopic fungi.

Reinventing the wheel and developing a strategy solely for fungi is probably not the most efficient or best approach. Rather, a strategy that includes plants, algae and fungi is proposed to acknowledge taxonomic, trophic and ecological diversity and incorporate interactions between kingdoms. The *International Code of Nomenclature for Plants, Algae and Fungi* adopted at the Melbourne International Botanical Congress in 2011 is a useful model for explicit inclusion of organisms across kingdoms.

Considering plants, algae and fungi in tandem capitalises on existing programs in key institutions such as botanic gardens and other government biodiversity and research organisations, and avoids introduction of unnecessary duplication of scarce organisational resources. Fungal conservation is way behind plant conservation and future collaborations could bring the treatment of fungi into alignment with that for plants, mirroring the interdependencies of organisms in nature.

Hypocreopsis amplectens *is one of the very few Australian fungi formally listed on conservation schedules (Victorian Flora and Fauna Guarantee Act 1988). Photo: T. May*

The time is nigh

The GSPC drives plant conservation activities at global, regional, national and local levels. If plants and their partners are to be effectively conserved, an integrated strategy is needed. A *Global Strategy for Plant, Algal and Fungal Conservation* implemented from 2020 would combine knowledge and resources in a more systematic and inclusive approach to conserving biodiversity.

Mycologists and fungal conservationists will likely be the driving force in developing a more inclusive strategy. However, broader public and political support is necessary to turn concern into policy. The GSPC vision states that 'Without plants, there is no life'. Without fungi, there is also no life. The importance of plant-fungus relationships can no longer be overlooked and plant conservation needs to become systematically inclusive of fungi if it is to meet GSPC objectives.

References

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