

Republish: Open letter on the crucial role of fungi in preserving and enhancing biodiversity

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When we think of forests we usually think of trees, plants and animals. But forests could not exist without fungi, which lie at the base of the biodiversity webs that support much of life on Earth.

Most fungi live as branching, fusing networks of tubular cells known as mycelium which can make up between a third and a half of the living mass of soils. Globally, the total length of fungal mycelium in the top 10cm of soil is more than 450 quadrillion km: about half the width of our galaxy. These networks comprise an ancient life-support system that easily qualifies as one of the wonders of the living world. Despite that, fungi represent a meagre 0.2% of our global conservation priorities.

Fungi are largely invisible ecosystem engineers that have shaped life on Earth for more than a billion years. In fact, around 500 million years ago, fungi facilitated the movement of aquatic plants onto land, fungal mycelium serving as plant root systems for tens of millions of years until plants could evolve their own. This association transformed the planet and its atmosphere – the evolution of plant-fungal partnerships coincided with a 90% reduction in the level of atmospheric carbon dioxide. Today, most plants depend on mycorrhizal fungi – from the Greek words for fungus (mykes) and root (rhiza) – which weave themselves through roots, provide plants with crucial nutrients and defend them from disease.

Put simply, fungal networks embody the most basic principle of ecology: that symbiosis is fundamental to life on earth. Plants supply carbon to their fungal partners in exchange for nutrients like nitrogen and phosphorus - much of the phosphorus that makes up the DNA in your own body will have passed through a mycorrhizal fungus. In their exchange, plants and fungi engage in sophisticated trading strategies. The influence of these quadrillions of microscopic trading decisions spills out over whole continents. Globally, at least 5 billion tons of carbon dioxide are allocated from plants to mycorrhizal networks each year.

A call to action

A paradigmatic but often forgotten example of the keystone role of fungi is in the world's forests, which are among the most important biological systems on our planet. They are our largest terrestrial carbon sink and the main terrestrial source of precipitation and oxygen. They house much of the planet's biodiversity, serving as irreplaceable libraries of different ways to rise to the challenge of living.

However, current biodiversity, climate change, and sustainable food strategies, including forest restoration efforts overlook fungi and focus overwhelmingly on plants (flora) and animals (fauna). We urgently need to add a third "F" – funga – to create holistic conservation strategies that simultaneously address the triple planetary challenges of climate change, biodiversity loss and food security.

Fungi must be incorporated into law-making and decision-making in international environmental treaties and frameworks, as well as national agricultural and environmental laws and policies, and local conservation and environmental initiatives. We invite the leaders meeting in COP 15 to start this process by adding fungi to the Post-2020 global biodiversity framework. Fungi have long sustained and enriched life on our planet. It's time they receive the attention they deserve.

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Conflict of interest

The authors declare that they have no conflict of interest.

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