

Fungi and climate change

The fungal kingdom is one of the oldest and largest groups of living organisms. Originating in water and diverging from a common ancestor with animals up to 900 million years ago, fungi have become particularly diverse on land where they are widely distributed because they are dispersed by airborne spores. Found from the tropics to Antarctica, the distribution and activities of fungi are controlled by their environment. Within the last century, climate change resulting from human activity has altered those environments. The release of greenhouse gases has resulted in an increase in global temperatures, affecting the activities of fungi as well as other organisms. As fungal hyphae grow, their long and branching filaments help to bind soil particles together and improve soil structure. Some hyphae form close relationships with the roots of up to 90% of land plants. Such mycorrhizal associations enhance the plants' growth, providing them with better access to water and nutrients. This enables plants to trap and convert more CO₂ into sugars during photosynthesis. In long-lived trees, captured carbon is stored for up to hundreds of years until they die. Mycorrhizas can therefore temporarily reduce some greenhouse gases, as can certain human activities, e.g. aerobic composting which reduces emissions of methane (CH₄), a potent greenhouse gas, but not CO₂. Fungi break down organic matter in the presence of oxygen by respiration so that carbon, oxygen, nitrogen and other elements are recycled, therefore maintaining soil fertility. Fungi can decompose the cellulose and lignin in plants, activities which generate CO₂. Chytrids, anaerobic fungi living in stomachs of ruminant mammals, provide the energy for resident prokaryotic archaea which produce methane. Fungal physiology, activities and geographical range are themselves affected by climate change, often resulting in the reduction or death of beneficial fungi in some regions, or the invasion of foreign species into new situations. This can cause diseases such as chytridiomycosis of amphibians, tar spot of maize and the human fungal infection by *Candida auris*.



Extreme effects on land of climate change. Image by Mycelia from Canstockphoto.com



Hyphae of mycorrhizal fungi (white hairs) associated with plant roots. Image: Paula Flynn, Iowa State University Extension Canstockphoto.com



Wood decay fungi: decomposition of cellulose & lignin. (Robert L. Anderson, USDA Forest Service, Bugwood.org) CC BY 3.0 US: licensed under a Creative Commons Attribution 3.0 License.

Some useful web sites Where possible, search for phrases such as "Fungi & climate change". <http://misac.org.uk/infoleaflets.html> www.ukfungusday.co.uk; Explore the Resources and Blog tabs including *What are Fungi?* and *Out of sight, out of mind*. <http://www.davidmoore.org.uk> Search Guidebook pages for *fungi and climate change* or go to Chapter 13.7. <https://microbiologysociety.org>