

PUBLISHED MARCH 18, 2021

ENVIRONMENT | PLANET POSSIBLE

# Fungi are key to our survival. Are we doing enough to protect them?

For almost a decade, one lone mushroom was classified as an endangered species, and scientists say more could be in trouble.

BY SARAH GIBBENS



The mushrooms we pluck from the ground are just the tips of large fungal networks that live underground and in trees.

PHOTOGRAPH BY REBECCA HALE, NAT GEO IMAGE COLLECTION

When Italian botanist Giuseppe Inzenga first tasted the white ferula mushroom [in 1863](#), he described it as one of the tastiest he had ever had.

Found primarily in Sicily's Madonie mountain range growing in limestone and at elevations of over 1,000 feet, the prized mushroom is sold for around 50 euros for two pounds.

“This mushroom is really delicious. You can eat it raw and also cooked,” says Giuseppe Venturella, a mycologist at the University of Palermo in Sicily. He compares it to a porcini, notes that it's rich in B vitamins, and says the best way to experience the taste is eating it raw, with a little olive oil and parmesan cheese.



*Pleurotus nebrodensis*, White Ferula Mushroom  
PHOTOGRAPH BY GIUSEPPE VENTURELLA

Fast forward 100 years from Inzenga's enthusing, and the same mushroom species, still prized for its taste, is now listed as [critically endangered](#) by the International Union for the Conservation of Nature, an organization that tracks population numbers for many of the world's species.

Picking the mushroom is off limits in protected areas inside the Madonie National Park region, but foragers can pluck mature mushrooms, indicated by a cap with sides growing longer than three centimeters, in surrounding

regions. Unlike most mushroom species, the white ferula fruits in spring, with its season lasting from April to late May.

The white ferula mushroom (*Pleurotus nebrodensis*) grows in the Madonie Mountains of Sicily at an altitude of 1,200-2,000 meters.

The white ferula was the first mushroom to be recognized for the impact humans were having on its survival, and from 2006 to 2015 it was the only one of its kind to be globally recognized as endangered.

“It was so beloved by people in [Sicily] that when the numbers began to decline, it was part of popular conversation,” says [Nicholas Money](#), a mycologist at Miami University in Ohio.

But what about the mushrooms we don’t notice? And how many of them are endangered?

“We think the true biodiversity of fungi is somewhere between one million and six million species,” says [Anne Pringle](#), a University of Wisconsin-Madison mycologist—as fungus experts are called—and a National Geographic explorer. Yet despite their global prevalence, fungi have historically been left out of conservation initiatives.

“Because people eat it,” says Pringle of the white ferula, “they notice and care. There might be more than a thousand stories like that of fungi in trouble that we just don’t know about.”

So how do we conserve organisms we can’t see and don’t understand? And why should we try?

“Life on the planet wouldn’t exist without fungi as we know it,” says [Greg Mueller](#), a mushroom conservation expert and the chief scientist at the Chicago Botanic Garden.

Conserving them, Money says, “is an urgent concern because of their relationship with forests and trees. You can’t have the trees without the

fungi.... We cannot survive without them. In terms of the health of the planet, they're incredibly important.”

## **Fungi, mushroom, mycelium—oh my**

Mushrooms as we know them—the cute buttons and flat caps that pop out of soil—are only a small, reproductive part of a larger fungal organism. The above-ground portion is referred to as the fruit body, but below ground, it's connected to a large network of thin, microscopic threads called mycelium. In 1998, scientists determined that the [largest organism on Earth](#), at least by area covered, was a fungus in Oregon's Blue Mountains whose mycelium spanned over 2,000 acres underground.

Some so-called mycorrhizal fungi form symbiotic relationships with plants. [As many as 90 percent](#) of the common plants we see on land have a beneficial relationship with fungi.

“The fungal filaments penetrate the roots of the plant, forming a placenta-like connection between the fungal colony and the roots,” says Money. “It's like an additional root system for the plant.”

These root networks help plants take in additional water, minerals, and nutrients, and in return the fungus gets a portion of the sugars plants generate from photosynthesis.

Scoop a chunk of dirt out of soil, and you're holding unseen mycelium, says Pringle. Advances in DNA sequencing have helped scientists see that fungal DNA sequences live unseen in everything from dirt to the nectar of a flower.

This, however, also makes them hard to count. Depending on the species, mycelium might sprout anywhere from one to several fruiting bodies, meaning what we see above ground doesn't correspond to how many individuals are living below.

“There might be a mycelium under the ground that sends up one mushroom here and one mushroom here,” says Pringle. “Are they two individuals? Or are they coming from the same individual underground?”

“There are ways to solve it,” she notes, “But they’re time intensive and expensive.” Her work has focused on genetically sequencing fungi to help distinguish them.

## State of the fungi

In a 2018 report assessing the state of the world’s fungi, scientists found that compared to the 68,000 animals and 25,000 plants that had been evaluated to assess whether they were existentially threatened, only 56 fungi had been evaluated. Currently, 168 mushrooms have been assessed as threatened around the world.



Tibetan nomads inspect cordyceps fungi for sale at a market. The fungus is known for its medicinal value and fetches a high price as a result. Environmentalists warn that over harvesting the species could harm local mountain grasslands.

PHOTOGRAPH BY KEVIN FRAYER, GETTY IMAGES

Overharvesting mushrooms, like the white ferula in Sicily, contributes to their decline. In addition to being eaten, many mushrooms are also prized for their medicinal value. [The caterpillar fungus](#) found in Tibet, *cordyceps*

*sinesis*, is used to treat everything from coughing to back pain. [Chaga mushrooms](#), found around the world and [sold as a cure](#) for seemingly everything, are increasingly being [overharvested](#), threatening populations in certain regions.

Mushrooms also face many of the same threats plants contend with. Habitat loss, pollution, and specifically the use of fungicide-laden fertilizer, wipe out mushrooms. [Studies show](#) that climate change also affects mushrooms, changing the temperature and humidity levels that determine [when they pop](#) a fruiting body out of the ground.

Scientists are currently working to understand the effect fungi themselves might have on the climate.

In 2013, Mueller and his colleagues launched the Fungal Red List as a subsection of the International Union for the Conservation of Nature. The initiative was launched when just three fungi—two lichens and the white ferula—were listed as endangered, and it sought to highlight the importance of conserving fungi.

“Another great advance that’s helped is the engagement of the citizen science community,” says Mueller. Mushroom-hunting clubs and websites like [iNaturalist](#) and [Mushroom Observer](#) allow amateur mushroom enthusiasts to log the mushrooms they find and thus generate more field data for scientists.

Pringle, who serves as the vice president of Mushroom Observer, notes that the site has even helped rediscover species previously thought to be extinct, like a fungus called hazel fingers found in the Appalachian mountains and parts of the U.K.

In the past decade, the white ferula has been discovered outside Sicily on a Greek island, and Mueller says it may soon be downgraded from “critically endangered” to “endangered.”

## Why does it matter?

Not only are fungi crucial partners for trees, as Money says, they affect the climate of the whole planet.

Walk through a temperate forest in autumn and everything you see on the ground—leaves, branches—is dead. But beneath that layer of dead material is a thriving world of fungi working to decompose it. Studies show that fungi help break down the carbon stored in plant material, locking it into soil. Around the world, soil is a massive reservoir for carbon pollution, [holding more carbon than the atmosphere](#) and plants combined.

We're still learning exactly how fungi play a role in the carbon cycle, which ones are crucial, and how many we need, says Pringle.

“Say there are 100 species [of fungi] that cycle carbon through a forest,” says Pringle. “Can we lose one of them? Ten of them? Fifty? Sixty? Maybe we can lose 99 of them. How many species can we afford to lose before we reach a tipping point, and we're in some sort of trouble?”



<https://www.nationalgeographic.com/environment/article/fungi-are-key-to-survival-are-we-doing-enough-to-protect-them>