# Valuing Medicinal Fungi in Forest Management

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Numerous species of medicinal fungi evolved in forests, and humanity has long harvested these fungi from their native arboreal habitats. Many of these species are now being cultivated; however, some are still harvested from forests. For instance, nutraceutical ectomycorrhizal mushrooms are difficult to cultivate. *Inonotus obliquus* (Ach. ex Pers.) Pilát (Chaga) does not produce the betulin-containing sclerotia known as chaga without infecting live birch trees, and among customers that value natural products, wild-harvested *Ganoderma* species can command premium prices. Lastly, cultivated species can be improved by isolating new cultivars from wild strains to replace senescing mycelia, to obtain strains that have better medicinal properties, or to select clones with superior growth characteristics in cultivation.

Scientists and foresters have a broad appreciation of the innumerable functional roles that fungi play in sustaining healthy, productive, resilient, and diverse forest ecosystems, but quantifying the value of these functions is often difficult because the roles that fungi play are so fundamental and all-encompassing that forests would not even exist without fungi. Focusing more specifically on the monetary value of medicinal fungal species in forests is also difficult because such fungi are expensive and time-consuming to study *in situ*, the products that humans derive from fungi are often harvested sporadically or opportunistically, and much potentially useful information is proprietary. Fungi are too often overlooked in forest management plans because their value is harder to quantify than amenities such as trees or water and because some foresters have a cultural bias that fungi are unimportant.

The goal of this study is to examine how the value of selected forest fungi might be quantified so that foresters can better justify management plans that sustain their wild populations in forested ecosystems.

We begin by examining the relative value of several edible forest fungi and timber in scenarios in which forests are managed for the production of both. Assumptions about how to compare these annually (mushrooms) and periodically (timber) harvested forest products are made and explained, along with

how these comparisons vary by mushroom species, forest type, and forest management plans.

Next, we discuss how the assumptions of these comparisons might differ for medicinal fungi that are harvested from forests, rather than cultivated. Differences include mode of nutrition, distribution and abundance on the landscape, periods between sporocarp harvest, inoculation methods, and forest management goals. Examples will include chaga harvesting in boreal birch forests and *Ganoderma* spp. harvesting in the temperate rain forests of western North America.

We conclude by considering the value of genetic diversity among and within wild populations of medicinal fungi. Advances in pharmacology, fungal biotechnology, genetic analyses, and genetic manipulation might ameliorate some of the need for genetic diversity in wild populations, but these technologies could still pose unknown perils to human or ecosystem health.

Regardless of the actual risks, the public is likely to remain fearful of genetically modified fungi, as evidenced by substantial markets for organically grown mushrooms and derivative products. We explore similar efforts to quantify the value of genetic diversity in other biotic resources and how these approaches could apply to populations of medicinal fungi in forests. Such information will likely improve the ability of foresters and policy makers to ensure the fungal populations are adequately considered in forest management plans and that this resource remains available to the medicinal mushroom industry.