Developing an Inventory and Monitoring Protocol for Commercially Harvested Forest Mushrooms

Randy Molina, David Pilz, Christine Fischer, PNW Research Station, USDA Forest Service, & **Daniel Luoma**, Oregon State University

Abstract

The commercial harvest of edible, forest fungi has mushroomed into a multi-million dollar industry with several thousand tons harvested annually. The development of this special forest product industry has raised considerable controversy about how this resource should be managed, especially on public lands. Concerns center around destruction of forest habitat by repeated entry and harvest, gradual loss of the mushroom resource by potential overharvest, conflict between recreational users and commercial harvesters, and regulation and monitoring of future harvests.

Forest resource managers need reliable knowledge about mushroom productivity on their lands, yields of commercially harvested species, and how these yields may change with variations in forest community composition, climatic conditions, soil types, timber harvest activities and mushroom harvest. Ongoing cooperative studies will provide baseline inventory of mushroom productivity and ecological data on required habitat so that informed decisions can be made in managing these special forest products.

Introduction

The commercial harvest of edible forest fungi has raised considerable controversy about how this resource should be managed, especially on public lands. Concerns center around potential destruction of forest habitat by repeated entry and harvest, gradual loss of the mushroom resource by potential overharvest, conflict between recreational users and commercial harvesters, and regulation and monitoring of future harvests. The lack of long-term data on the ecology and productivity of valuable forest fungi makes resolution of these concerns difficult. Forest managers need reliable knowledge about mushroom productivity on their lands, yields of commercially harvested species, and how these yields may change with variations in forest community composition, climatic conditions, soil types, timber harvest activities and the mushroom harvest itself. To close these knowledge gaps, cooperative studies between public and private landowners are needed. Most imperative are baseline inventory data on mushroom productivity and ecological data on habitat requirements.

Molina and others (1993) reviewed the biology of forest fungi and discussed the various types of monitoring needed for commercially harvested forest fungi. **Detection monitoring** would assess the variability of fungus productivity in space and time. **Evaluation monitoring** would examine disturbance effects such as mushroom harvest activities or timber removal (e.g. thinning) on mushroom productivity. **Research monitoring** would investigate the ecosystem function and specific ecological features of fungus species. By combining these three monitoring approaches, researchers and land managers can most quickly

assemble the mushroom data base for predicting future yields and developing management options. We describe below one such study approach and then discuss other options. Readers should view this information as developmental in character rather than conclusive in design.

Matsutake inventory monitoring plots on the Winema and Siskiyou National Forests and Medford District of the Bureau of Land Management

Some forest sites are well known for high matsutake mushroom productivity. The large number of harvesters and intensity of harvest on these sites have prompted managers to immediately begin monitoring their mushroom resource. After discussing the various information needs with managers of the above forests, we developed cooperative studies to address the following objectives: 1) To determine sporocarp biomass production of matsutake sporocarps from long-term study plots in selected areas; 2) to correlate sporocarp production with environmental conditions such as temperature, moisture, and soil type; and 3) to correlate sporocarp production with forest structure and vegetation community factors. A brief summary of the design follows (copies of the study plan are available upon request from the authors).

For each study area, vegetation and soils data were used to determine the three most extensive plant communities known to produce matsutake mushrooms. Three long-term study sites were then established in each of those community types, for a total of nine study sites in each study area. The study sites were located on different aspects within each chosen community type so that results could be more broadly extrapolated in a landscape context. In order to minimize bias in site selection and provide data on mushroom production on these community types, sites and plots were located prior to mushroom productivity. Each study site was approximately five hectares in size and carefully posted with signs to restrict commercial or recreational mushroom harvest. Six rectangular strip plots, 2 x 50 meters, were permanently located on each site.

The narrow strip-plot approach was selected to reduce trampling effects; mushrooms could be easily accessed for measuring without stepping into the plot. To avoid mushroom harvest effects, each mushroom in the plot was measured (cap and stem diameters, and vertical distance from the veil to the cap) in place without picking and a regression equation used to estimate biomass. The regression equation was developed by correlating the dry weights and sporocarp measurements of matsutake mushrooms from outside the permanent plots. Once measured, each mushroom within the plots was marked so as not to be remeasured. Plots were surveyed weekly for new individuals throughout the fruiting season. Distance to the nearest tree or shrub was also noted for each mushroom.

Vegetation composition and soil characteristics were also noted for each site. Temperature and rainfall data were obtained from the nearest weather station. Compatible data will be entered into a geographic information system (GIS) so that results can be correlated with landscape and forest features. First year data are now being analyzed.

Future studies and direction

An important feature of the above study is the installation of permanent, long-term monitoring plots. Capturing within year and between year variation in mushroom productivity over the landscape is essential to monitoring sustainability. Many other questions regarding mushroom productivity, however, will require modification of this design or completely different approaches. For example, to assess the effects of mushroom harvesting on future productivity (especially within the same mushroom patch), we plan to install plots wherein one-half of the plot is picked and the other half left unpicked. If cutting versus pulling the mushroom is questioned, then different harvest method treatments can be compared in a similar experimental approach. Another major concern is the raking of the duff (or use of leaf blowers) to

expose immature, valuable mushrooms. We envision developing experimental plots where raking and no raking effects are directly assessed by measuring the growth of the fungus mycelia in the soil in these treated plots.

A disturbance concern at a larger scale than above is the effect of timber harvest or other silvicultural prescriptions such as thinning or burning on mushroom production. We currently are installing a chanterelle inventory study as part of a large-scale young stand density (thinning) study on the Willamette National Forest. Integrating mushroom inventories, as well as inventories of other special forest products, into such ongoing and planned experimental silvicultural experiments is important to the future development of ecosystem management.

Most fungus species occur as scattered colonies in the forest landscape. This "patchiness" occurs at a variety of scales (stand, watershed, landscape) and the variable distribution creates a major obstacle for the sampling and inventorying of fungi. Thus, developing sampling schemes and statistical analyses that accurately measure this patchiness and variation is requisite to mushroom productivity analysis. Our research agenda currently features studies that will focus on comparative methods for locating and measuring mushroom productivity at the stand or watershed scales. An early goal is to develop a relatively simple method to "cruise" forests for commercially valuable mushrooms during the peak fruiting season. Productive mushroom areas would be identified from such cruising so that permanent monitoring plots could be established.

Central to the success of developing a mushroom monitoring program for the region is cooperation by resource managers across land ownerships, sharing of knowledge by mushroom harvesters and mycologists of all backgrounds, and implementing cooperative studies with participation by all concerned publics.

Reference

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Randy Molina

Research Botanist and Team Leader, Soil Microbial Ecology, USFS PNW Research Station

1973 B.A., Botany, University of California, Santa Barbara

1980 Ph.D., Botany, Oregon State University

Spent 20 years of research on the ecology and application of mycorrhizal fungi in forestry. Currently involved in biodiversity studies of forest fungi and biology, inventory and management of commercially harvested forest fungi.

USDA Forest Service
Forestry Sciences Lab
3200 Jefferson Way
Corvallis OR 97331
Telephone: (503) 750-7391
FAX: (503) 750-7329