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Title: Conservation and development of nontimber forest products in the Pacific Northwest: an annotated bibliography

Author: Von Hagen, Bettina; Weigand, James F.; McLain, Rebecca; Fight, Roger; Christensen, Harriet H.

Date: 1996

Source: Gen. Tech. Rep. PNW-GTR-375. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 246 p.

Station ID: GTR-PNW-375

Description: This bibliography encompasses literature on the historic and current scope of nontimber forest product industries in the Pacific Northwest and includes references on international markets and trade that bear on these industries. Key themes in the bibliography are biological and socioeconomic aspects of resource management for sustainable production; procedures for identifying, monitoring, and inventorying important resources; means for technical innovation and resource development; and public education about nontimber forest resources. Social policy issues address the role of nontimber forest products in rural development and the spectrum of ethical considerations required for socially acceptable policy formulation. Economics literature covers estimating the contribution of nontimber forest products to a whole ecosystem economy, analyzing and planning for joint production of agroforestry systems, and enhancing the performance of nontimber forest product sectors.

Key Words: Bibliography, conservation, sustainable development, economic analysis, wild edible mushrooms, floral greens, medicinal plants, conifer greens, forest policy, nontimber forest products, trade.

http://www.ifcae.org/ntfp/

Internet Links Database

Welcome! A website with tools for the conservation and management of nontimber forest products (NTFP).

http://toby.library.ubc.ca/subjects/subjpage1.cfm?id=640

Subject Resources for
Non Timber Forest Products

Article Indexes:
* NTFP Bibliography Database
* CAB Abstracts
* AGRICOLA | Journals Indexed in AGRICOLA
* Environmental Sciences & Pollution Management
* FAO AGRIS | Forestry
* Social Sciences in Forestry
* US Forest Service Research Publications
* Key Databases: Forestry & Agricultural Sciences

Other Reference Tools:
* Full Text Managing the "other" Forest: Collecting and Protecting NonTimber Forest Products.
* Stregthening Global Partnerships to Advance Sustainable Development of Non Wood Forest Products
* other full text publications

Selected Publications - MacMillan Library
* Non-Timber Forest Products: Medicinal herbs, fungi, edible fruits & nuts, & other natural products from the forest.
* Tapping the Green Market: Certification and Management of Non-Timber Forest Products.
* FAO Series Non-Wood Forest Products
* Non-timber forest products from the Canadian boreal forests: an exploration of aboriginal opportunities / P.C. Boxall et al in J. Forest Economics 9(2) 2003 pp.75-96.
* Ecological implications of harvesting non timber forest products/T.Ticktin 41(1)2004 pp.11-21. Journal of Applied Ecology Volume 41 Issue 1 Page 11 - February 2004
* Sustainable development of non-timber forest products: implication for forest management in India / A.Mahapatra & C.P.Mitchell in Forest Ecology and Management June 1997 94(1-3)pp.15-29

Conferences/Papers:
* Harvester Participation in Inventory & Monitoring of Nontimber Forest Products 2004

Current Research:
* IFCAE Project: Assessing U.S. Nontimber Forest Product Management and Biodiversity Conservation

http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=12053246&dopt=Abstract

Mushrooms, trees, and money: value estimates of commercial mushrooms and timber in the pacific northwest.

http://www.springerlink.com/(23btjqiyri1mhc2llvf3an45)/app/home/contribution.asp?referrer=parent&backto=issue,12,14;journal,46,97;linkingpublicationresults,1:100370,1

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Mushrooms, Trees, and Money: Value Estimates of Commercial Mushrooms and Timber in the Pacific Northwest

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Abstract

Wild edible mushrooms are harvested in the forests of the Pacific Northwest, where both trees and mushrooms grow in the same landscape. Although there has been some discussion about the value of trees and mushrooms individually, little information exists about the joint production of, and value for, these two forest products. Through four case studies, the information needed to determine production and value for three wild mushroom species in different forests of the Pacific Northwest is described, and present values for several different forest management scenarios are presented. The values for timber and for mushrooms are site- and species-specific. On the Olympic Peninsula in Washington, timber is highly valued and chanterelles are a low-value product by weight; timber has a soil expectation value (SEV) 12 to 200 times higher than chanterelles. In south-central Oregon, timber and American matsutake mushrooms have the potential to have about the same SEV. In eastern Oregon, timber is worth 20 to 110 times as much

as the morels that grow in the forest. Production economics is concerned with choices about how much and what to produce with what resources. The choices are influenced by changes in technical and economic circumstances. Through our description and analysis of the necessary definitions and assumptions to assess value in joint production of timber and wild mushrooms, we found that values are sensitive to assumptions about changes in forest management, yields for mushrooms and trees, and costs.

Keywords:

KEY WORDS: Joint production; Resource value; Economics; Mushrooms; Nontimber forest products

The references of this article are secured to subscribers.

http://www.google.com/scholar?hl=en&lr=&client=firefox-a&q=cache:LsoYSPertK4J:www.public.iastate.edu/~tcharrin/Pine.pdf+ecology+of+fir+trees+and+mushrooms

* Article on pine forest decline

http://www.fsl.orst.edu/mycology/ss/Index.htm

SilviShrooms
Predicting edible mushroom productivity using forest carbon allocation modeling and immunoassays of ectomycorrhizae

A proposed research project of the Forest Mycology Team

http://www-mykopat.slu.se/Newwebsite/mycorrhiza/kantarellfiler/texter/list.phtml

People Involved in
Cantharellus Research Worldwide

The purpose with this list (see below) is to facilitate contacts, and to coordinate research efforts. The list includes scientists currently involved in (or preparing for) research on chanterelles, or scientists that made important contributions earlier.

If you learn about scientists currently involved in research on Cantharellaceae, or find an exciting article, please send me a note.

http://www-mykopat.slu.se/Newwebsite/mycorrhiza/kantarellfiler/texter/rtf.htm

Cantharellus cibarius:
Mycorrhiza formation and Ecology

Eric Danell

Danell, E., 1994. Cantharellus cibarius: Mycorrhiza formation and Ecology. Acta Univ. Ups., Comprehensive Summaries of Uppsala Dissertations from the Faculty of Science and Technology 35. 75 pp. Uppsala. ISBN 91-554-3273-5, ISSN 1104-232 X.

Abstract

Axenic mycelia of Cantharellus cibarius were derived from spores and tissues. Hyphal suspensions were added to sterile pine and spruce seedlings in a culture system called CUS (Culture unit system). Automatic addition of a diluted mineral solution supplemented with glucose and a filtered air flow with 0.2% carbon dioxide was essential for C. cibarius growth and mycorrhiza formation. Successful mycorrhiza formation was repeatedly observed after 8-12 weeks. The need for carbohydrate addition probably reflected a high carbohydrate demand in nature, where new roots are mainly colonized by vegetative hyphae from a mycorrhizal mycelium. Transfer of mycorrhizal plants to a greenhouse led to successful establishment in soil and C. cibarius continued to colonize new roots. The identities of the vegetative mycelia, and the axenic and greenhouse-established mycorrhizae were confirmed by comparing their PCR products of rDNA and their RFLP patterns with those of C. cibarius fruit bodies. Field studies on C. cibarius showed that it has a broad host and biotope range, but in vitro experiments indicated a more narrow range on a strain basis.

The aerobic bacterial population size in C. cibarius was 100-1000 times greater than that of the agarics investigated. The dominating microorganism in C. cibarius fruit bodies was Pseudomonas fluorescens. Based on the inability of P. fluorescens to penetrate mycorrhizae, it was suggested that bacteria were incidently embedded in fruit bodies. This occurrence probably reflects its existence on vegetative hyphae. It was suggested that bacteria are attracted to exudates of the hyphae. C. cibarius did not appear to benefit from this association.

Different analytical methods for determining protein content of fungi were tested. The protein content in C. cibarius, based on total amino acid analysis, was 10% of the dry weight. This was in contrast to the higher values earlier reported. The nutritional value should not be over emphasised.

The results in combination with field observations and a review with comments on physiology, taxonomy, and ecology, make the thesis a comprehensive synthesis of our present knowledge on C. cibarius. The successful transfer to the greenhouse and the increasing understanding of the biology of C. cibarius might lead to a full control over the life cycle, thus allowing genetic, molecular and commercial applications.

Eric Danell, Doctoral dissertation at Uppsala University 1994

http://www.agroforestry.net/overstory/overstory86.html

The Overstory #86

The Role of Mushrooms in Nature

Author:
Paul Stamets

Contents:

Fungi have vital roles in ecosystem health. There are numerous fungi that produce fleshy fruiting bodies known as mushrooms, many of which are prized for their edible and medicinal uses. In this edition of The Overstory, special guest author Paul Stamets explores the role of mushroom-producing fungi (commonly referred to as mushrooms) in the health of forests and other landscapes.

The article covers three basic ecological groups of mushrooms: those that form a symbiosis with host plants called mycorrhizal mushrooms; those that act on living plants called parasitic mushrooms; and those that recycle dead plant material, the saprophytic mushrooms.

http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=316503

High-elevation gray morels and other Morchella species harvested as non-timber forest products in Idaho and Montana

ERIKA M. McFARLANE a1, DAVID PILZ a2 and NANCY S. WEBER a2

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Abstract

We investigated post-fire morels (Morchella species), especially the “gray” morels of Idaho and Montana, by collecting ecological and genetic data and by interviewing commercial mushroom harvesters and buyers. Gray morels fruited exclusively in high-elevation Picea/Abies forests that had burned the preceding summer, predominantly in zones of moderate fire intensity as indicated by a layer of dead conifer needles on top of the fire ash. Genetic analysis revealed five varieties of morels among our specimens. Mushroom harvesters confirmed that gray morels are economically crucial to their business because they are typically large, heavy, and durable. Harvesters and buyers described the varieties of morels they encountered differently than mycologists did, but cooperative research could facilitate mutual understanding of morel diversity and benefit everyone involved.

http://www.ingentaconnect.com/content/nrc/cjb/2002/00000080/00000002/art00010

Species richness, abundance, and composition of hypogeous and epigeous ectomycorrhizal fungal sporocarps in young, rotation-age, and old-growth stands of Douglas-fir (Pseudotsuga menziesii) in the Cascade Range of Oregon, U.S.A.

Authors: Smith J.E.; Molina R.; Huso M.M.; Luoma D.L.; McKay D.; Castellano M.A.; Lebel T.; Valachovic Y.

Source: Canadian Journal of Botany, Volume 80, Number 2, February 2002, pp. 186-204(19)

Publisher: NRC Research Press

Abstract:

Knowledge of the community structure of ectomycorrhizal fungi among successional forest age-classes is critical for conserving fungal species diversity. Hypogeous and epigeous sporocarps were collected from three replicate stands in each of three forest age-classes (young, rotation-age, and old-growth) of Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) dominated stands with mesic plant association groups. Over four fall and three spring seasons, 48 hypogeous and 215 epigeous species or species groups were collected from sample areas of

6300 and 43 700 m2, respectively. Cumulative richness of hypogeous and epigeous species was similar among age-classes but differed between seasons. Thirty-six percent of the species were unique to an age-class: 50 species to old-growth, 19 to rotation-age, and 25 to young stands. Seventeen species (eight hypogeous and nine epigeous) accounted for 79% of the total sporocarp biomass; two hypogeous species, Gautieria monticola Harkn., and Hysterangium crassirhachis Zeller and Dodge, accounted for 41%. Average sporocarp biomass in young and rotation-age stands compared with old-growth stands was about three times greater for hypogeous sporocarps and six times greater for epigeous sporocarps. Average hypogeous sporocarp biomass was about 2.4 times greater in spring compared with fall and for epigeous sporocarps about 146 times greater in fall compared with spring. Results demonstrated differences in ectomycorrhizal fungal sporocarp abundance and species composition among successional forest age-classes.Key words: ectomycorrhizal fungi, sporocarp production, forest succession, Pseudotsuga menziesii, Tsuga heterophylla zone, biodiversity.

Keywords: ectomycorrhizal fungi; sporocarp production; forest succession; Pseudotsuga menziesii; Tsuga heterophylla zone; biodiversity; champignons ectomycorhiziens; production de sporocarpes; succession forestière; Pseudotsuga menziesii; zone du Tsuga heterophylla; biodiversitée

http://www.blackwell-synergy.com/links/doi/10.1111/j.1469-8137.2004.01216.x/abs/

New Phytologist
Volume 165 Page 305 - January 2005
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Volume 165 Issue 1

Evidence of species interactions within an ectomycorrhizal fungal community

Roger T. Koide1,2,3, Bing Xu1, Jori Sharda2, Ylva Lekberg3 and Nancy Ostiguy4

Summary

- Ectomycorrhizal fungal communities can be structured by abiotic and biotic factors. Here, we present evidence for community structuring by species interactions.
- We sampled ectomycorrhizas and forest floor seven times during a 13-month period. The presence of various ectomycorrhizal fungal species was determined for each sample, and species co-occurrence analyses were performed.
- For both ectomycorrhizas and forest floor samples there was significantly less co-occurrence among species within the community than expected by chance, mostly because of negative associations involving Cenococcum geophilum or Clavulina cinerea. For some species pairs, there was significantly more co-occurrence than expected by chance. Both nitrogen and tannin additions to the forest floor altered some interactions among species.

•	The causes of these nonrandom distributions are currently unknown. Future investigations on competition, antibiosis, parasitism and facilitation among ectomycorrhizal fungal species appear to be warranted.

New Phytologist (2004) doi: 10.1111/j.1469-8137.2004.01216.x

http://rparticle.web-p.cisti.nrc.ca/rparticle/AbstractTemplateServlet?journal=cjb&volume=82&year=&issue=&msno=b04-077&calyLang=eng

Can. J. Bot. 82(7): 983–991 (2004) | doi: 10.1139/b04-077 | © 2004 NRC Canada

Ectomycorrhizal community effects on hybrid spruce seedling growth and nutrition in clearcuts

J. M. Kranabetter

Abstract: A diverse community of ectomycorrhizal (ECM) fungi is generally considered beneficial to forest ecosystems, but the function of ECM communities should be considered within an ecological context. The growth of hybrid spruce (Picea glauca (Moench) Voss _ Picea sitchensis (Bong.) Carrière) seedlings was compared after transplanting into recent clearcuts, where soil moisture and nitrogen are typically readily available. The seedlings had either a "forest" ECM community (taken from forest gap edges) or a "pioneer" ECM community (taken from disturbed road edges) and were planted at wide and close spacing. After 3 years, morphotype distribution and abundance (64% community similarity between "forest" and "pioneer" seedlings) overlapped considerably, but height growth was 25% greater for the "pioneer" seedlings. There was a reduction in diameter at close spacing, with little difference in competition effects between ECM communities. There were no differences detected in foliar nitrogen concentrations and no evidence of nitrogen or phosphorus deficiencies. The advantage of fungi such as Amphinema byssoides, Thelephora terrestris, and Laccaria laccata might be the proliferation of fine roots that allows for the fullest utilization of abundant soil resources. The results suggest that the ECM communities arising after clearcut disturbances are well adapted to these initial soil conditions.

Key words: ectomycorrhiza, disturbance, diversity, productivity, competition, Picea glauca.

http://www.blackwell-synergy.com/doi/abs/10.1111/j.1469-8137.2004.01162.x?cookieSet=1&journalCode=nph

Patterns of nitrogen and carbon stable isotope ratios in macrofungi, plants and soils in two old-growth conifer forests

Steven A. Trudell1, Paul T. Rygiewicz2 and Robert L. Edmonds1

Summary

- To further assess the usefulness of stable isotope ratios for understanding elemental cycling and fungal ecology, we measured _15N and _13C in ectomycorrhizal and saprotrophic macrofungi, plants, woody debris and soils from two old-growth conifer forests in Olympic National Park, Washington, USA.
- Ecosystem isotope patterns were similar at the two forests, but differences existed that appear to reflect soil nitrogen availability and C allocation within the ectomycorrhizal symbioses. _15N and _13C of ectomycorrhizal and saprotrophic fungi differed in both forests, and a dual _15N/_13C plot provided the best means of distinguishing them. Within both groups, _15N and _13C differed among genera and species, and the difference in species composition was an important determinant of the different overall _15N of the ectomycorrhizal fungi at the two forests.
- Variation in multiple ecophysiological traits such as organic N use, mycelial morphology and transfer of N to phytobionts appears to underlie the variation in the isotope signatures of ectomycorrhizal fungi.
- The varied isotope signatures of ectomycorrhizal fungi suggest considerable functional diversity among them. Life-history strategies could provide a framework for interpreting these patterns.

New Phytologist (2004) doi: 10.1111/j.1469-8137.2004.01162.x

http://rparticle.web-p.cisti.nrc.ca/rparticle/AbstractTemplateServlet?journal=cjb&volume=82&year=&issue=&msno=b04-123&calyLang=fra

Can. J. Bot. 82(8): 1243–1263 (2004) | doi: 10.1139/b04-123 | © 2004 NRC Canada

Mycorrhizal fungi as drivers of ecosystem processes in heathland and boreal forest biomes

David J. Read, Jonathan R. Leake, and Jesus Perez-Moreno

Abstract: The importance of mycorrhizas in heathland and boreal forest biomes, which together cover much of the landmass of the Northern Hemisphere and store most of the global stocks of carbon, is reviewed. The taxonomic affinities of the organisms forming these symbiotic partnerships are assessed, and the distinctive structural features of the ericoid mycorrhizas of heathland dwarf shrubs and the ectomycorrhizas of boreal forest trees are described. It is stressed that neither in terms of the geographical distribution of the plants nor in terms of the occurrence of their characteristic mycorrhizas in the soil profile should these biomes be considered to be mutually exclusive. What unites them is their apparent affinity for acidic organic soils of inherently low accessibility of the major nutrients nitrogen (N) and phosphorus (P). These properties relate directly to the nature of the nutrient-poor recalcitrant litter produced by their host plants and through positive-feedback mechanisms that are reinforced by selective removal of labile nutrients by the mycorrhizas. We suggest that coevolution of these plant litter traits with mycorrhizal associations that are adapted to them has been one of the defining features of these ecosystems. Ericoid and ectomycorrhizal fungi have biochemical and physiological attributes that make them highly efficient at scavenging for organic sources of N and P in surface soil horizons. In so doing, they restrict supplies of these elements to the decomposer communities. Case studies involving exploitation of N and P in defined organic substrates are described. In both biomes the dominant plants depend upon the abilities of their fungal partners to recover nutrients, so the symbioses control nutrient cycles, productivity, species composition, and functioning of these ecosystems. It is in this context that the fungal symbionts are here considered to be drivers of nutritional processes in their respective biomes. Through their influences upon the quality of carbon residues mycorrhizal fungi must also affect the sink-source balance for this key element in soil. There is an urgent need for the evaluation of the relative contributions of symbiotic and saprotrophic components of the microflora to the processes of carbon storage and cycling in these biomes, particularly in the context of global climate change and impacts of anthropogenic pollutant N deposition.

Key words: carbon sequestration, peatlands, C/N ratios, carbon and nutrient cycles.

http://www.cfr.washington.edu/Research.demo/publications/pubs_ecm.htm

Demonstration of Ecosystem Management Options Study

A Large-Scale Experiment in Structural Retention Harvests in Pacific Northwestern Forests

Studies of Ectomycorrhizal Fungi

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http://www.fsl.orst.edu/lter/data.cfm?topnav=8

Welcome to the Forest Science Data Bank (FSDB). Many of our data sets are accessible online including all core data sets of the Andrews LTER. Please review the Data Access Policy. New data sets, as well as older legacy data sets, are continually being added to this webpage. All data are provided with accompanying documentation compliant with existing LTER metadata content standards, and metadata can be generated in EML (Ecological Metadata Language) or as a PDF. Our data sets consist of long-term research study data, spatial data, and analytical tools including software and models.

http://www.psms.org/mababstr.html

Abstracts of MAB Mushroom Study

1) The MAB Mushroom Study: Background and Concerns, by L. Liegel, D. Pilz and T. Love.

2) Biological Productivity of Chanterelle Mushrooms in and near the Olympic Peninsula Biosphere Reserve, by D. Pilz, R. Molina and L. Liegel.

3) Relative Value of Chanterelles and Timber as Commercial Forest Products, by D. Pilz, F.D. Brodie, S. Alexander and R. Molina.

4) Valuing the Temperate Rainforest: Wild Mushrooming on the Olympic Peninsula Biosphere Reserve, by T. Love, E. Jones and L. Liegel.

5) Integrating Biological, Socioeconomic, and Managerial Methods and Results in the MAB Mushroom Study, by L. Liegel, D. Pilz, T. Love and E. Jones.

6) The MAB Mushroom Study as a Teaching Case Example of Interdisciplinary and Sustainable Forestry Research, by R. McLain, E. Jones and L. Liegel

ABSTRACTS

1) The MAB Mushroom Study: Background and Concerns, by L. Liegel, D. Pilz and

T. Love. Pacific Northwest planners and economic developers have worked hard the past decade creating new jobs to offset steadily declining incomes from timber harvesting and processing industries. Among these new jobs are increasing harvests of nontimber or special forest products such as floral greenery, medicinal plants, and edible mushrooms. But some land managers, biologists, and conservation groups believe that increased harvest of nontimber forest products is not sustainable and threatens long-term resource productivity. The US Man and the Biosphere (MAB) Program funded a USD 51,000 competitive research project from 1993 to 1996 to determine the impacts of nontimber harvests on human and natural systems in the Pacific Northwest of' North America. Integrated and interdisciplinary approaches were used to accomplish three study objectives: i) determine spatial and temporal productivity of chanterelle (Cantharellus sp.) mushrooms on thc Olympic Peninsula for two harvest seasons; ii) build socioeconomic profiles of commercial, recreational, and subsistence harvesters; and iii) link biological and socioeconomic information in order to conserve, maintain, or enhance chanterelle resource stocks on public and private lands. Reasons for starting the research study are outlined and include the major resource concerns identified by regional scientists, land managers, and conservation groups in the 1990s. How to address these concerns provided the framework in which to conduct the biological, socioeconomic, and managerial modules of the MAB Mushroom Study. The five accompanying articles in this Ambio Special Report explain fieldwork, analyses, and synthesis activities completed in each module.

2) Biological Productivity of Chanterelle Mushrooms in and near the Olympic Peninsula Biosphere Reserve, by D. Pilz, R. Molina and L. Liegel.

Burgeoning commercial harvests of wild edible fungi (Cantharellus formosus and C. subalbidus) from the forests of the Pacific Northwest in the United States and Canada have prompted land managers and scientists to begin monitoring the nature and impacts of this activity. This pilot study explores the unique sampling challenges that wild mushroom monitoring entails, especially the large sample area (0.4 ha or greater) and repeated visits, 3 to 6, needed to obtain reasonable estimate of unit-area productivity, given the spatial and temporal clustering of mushroom fruiting. During two years of sampling in various forest types on several land ownerships around the Olympic Peninsula of Washington State (USA), a 3- to 20-fold, and occasionally greater, difference in productivity was noted between the most productive site and all the other sites. For forests in which harvesting was prohibited, a regression equation was developed that estimated the weight of nonharvested mushrooms from average cap diameters. Moi sture contents of harvested mushrooms typically ranged from 80% to 95%, depending on weather conditions, but specimens as dry as 57% were found. Difficulties encountered with sampling chanterelles by commercial grade and correlating fruiting with site conditions are discussed. The paper concludes by considering the application of these results to future forest mushroom monitoring.

3) Relative Value of Chanterelles and Timber as Commercial Forest Products, by D. Pilz, F.D. Brodie, S. Alexander and R. Molina.

Comparing the economic value of edible mushrooms and timber requires many assumptions. We use chanterelle (Cantharelllus sp.) mushrooms collected from productive Douglas-fir (Pseudo-tsuga menziesii (Mirb.) Franco) forests on the Olympic Peninsula as an example. Discounted present net worth in perpetuity is estimated for both mushrooms and timber using two timber harvest regimes and three levels of chanterelle productivity. Given these assumptions, timber is 1-2 orders of magnitude more valuable than mushrooms, yet while timber grows, harvesting mushrooms can provide annual income to harvesters once fruiting is established.

4) Valuing the Temperate Rainforest: Wild Mushrooming on the Olympic Peninsula Biosphere Reserve, by T. Love, E. Jones and L. Liegel.

Commercial, recreational, and subsistence harvesting of chanterelle mushrooms (Cantharellus formosus (cibarius) and C. subalbidus) on the Olympic Peninsula Biosphere Reserve was investigated during three fall harvest seasons (1994-1996). This article describes i) sociocultural characteristics of harvesters (ethnicity, class, power, gender, age, and kinship); ii) the organization of harvesting (unit of production, strategies, practices, harvest methods, division of labor, and rights to resources); and iii) economic values derived from commercial harvesting. Participant observation and interviews with 79 commercial harvesters and participant observation and a mail survey of 53 recreational harvesters were the chief methods used. Ethnicity and social class were the most prominent social dimensions of purportedly antagonistic relations between commercial and recreational harvesters, who otherwise had surprisingly broad overlap in values, norms and collective understandings. Among commercial harvesters, Latinos were replacing Southeast Asians and Euro-Americans. Gross incomes were low, averaging about USD 30 picking day for about 4 weeks of picking during the 3-5 month harvest season.

5) Integrating Biological, Socioeconomic, and Managerial Methods and Results in the MAB Mushroom Study, by L. Liegel, D. Pilz, T. Love and E. Jones.

Some three dozen biologists, resource managers, social scientists, and volunteers worked together between 1993 and 1996 to study the biological, socioeconomic, and managerial concerns of harvesting chanterelle (Cantharellus sp.) mushrooms on the Olympic Peninsula of Washington State in the Pacific Northwest. Highly variable productivity across different landscapes combined with low prices for mushrooms make harvesters wary of more regulations, higher permit fees, and contracts that restrict harvesting to those who pay the highest bid price for the right to pick certain areas. Public and private resource managers face decreasing budgets, necessitating permits and other fees to cover the actual costs of administering harvests; public land managers must also comply with existing laws that require charging those who use forests for commercial or recreational purposes. Vandalism to machinery and property, potential liability claims, and illegal waste dumping are forcing public and industrial forest landowners to gate their properties; this action limits access to forest lands by the general public and mushroom pickers who seek traditional and new harvest sites. Although harvesters and research volunteers come from diverse social and economic backgrounds, most are willing to help managers and scientists conduct long-term field studies. Key elements of successful cooperation are early front-end planning and information sharing by all parties, from initial project conception and establishment through data collection, analysis, synthesis, and reporting.

6) The MAB Mushroom Study as a Teaching Case Example of Interdisciplinary and Sustainable Forestry Research, by R. McLain, E. Jones and L. Liegel.

The MAB Mushroom Study was designed to promote sustainable natural and human communities and to involve multiple stakeholders having widely varying styles and knowledge of forest management. It used an interdisciplinary and collaborative research approach that united biologists, social scientists, land managers, and nonprofit volunteers from academic, federal and state government, and commercial sectors. Because of the cooperative and interdisciplinary nature of the project, study developers were awarded another competitive grant to summarize their work as one of four academic teaching case examples for Oregon State University's Sustainable Forestry Partnership. This second grant produced three products. First, a Narrative, which includes the theoretical basis and definitions of sustainability, how the MAB Mushroom Study operated within a sustainability framework, how stakeholders were chosen and worked in the study, and five key elements of sustainability research. Second, a Teaching Notes packet, which explains how students, resource managers, scientists, and others can use the case study to develop their own interdisciplinary and sustainabilty studies. Third, a set of 64 slides with captions illustrates examples of nontimber product resources in the Pacific Northwest. The case study example can be taught either as a formal university course or a 1-day continuing education workshop.

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Title: Effects of Management Options on the Yield and High Molecular Weight Polysaccharide Content of Shiitake (Lentinus Edodes) Mushrooms

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Interpretive Summary: Shiitake mushroom production in the United States has increased greatly over the last twenty years. Additional expansion of the shiitake mushroom market should be possible if the product can be marketed as a functional food, i.e. a food that has health-promoting effects beyond its nutritional value. High molecular weight polysaccharides (HMWP) including lentinan in shiitake may promote human health. This study was conducted to determine if management protocols influence the HMWP of shiitake mushrooms. Results indicate that log-grown shiitake contained more were HMWP than did substrate-grown shiitake. Among log-grown shiitake, both spawn sources and tree species influenced HMWP content. These results are of interest to shiitake mushrooms growers interested in promoting their product as being healthy and consumers of healthy food products.

Technical Abstract: Shiitake (Lentinula edodes (Berk.) Pegler) mushroom production in the United States has increased greatly over the last twenty years. Additional expansion of the shiitake mushroom market should be possible if the product can be marketed as a functional food, i.e. a food that has health-promoting effects beyond its nutritional value. High molecular weight polysaccharides (HMWP) including lentinan in shiitake may promote human health. This study was conducted to determine if management protocols influence the HMWP of shiitake mushrooms. Results indicate that measuring the total carbohydrate content of water extractable, ethanol insoluble polysaccharides was a simple way to estimate HMWP. Results also indicate that log-grown shiitake contained more were HMWP than did substrate-grown shiitake. Among log-grown shiitake, both spawn sources and tree species influenced HMWP content. The results suggest that there is considerable variation among shiitake mushrooms in HMWP content and that the protocols used to produce mushrooms influence their HMWP content.

http://www.ars.usda.gov/research/publications/Publications.htm?seq_no_115=162976

Research Project: Molecular and Morphological Systematics of Plant Pathogenic Fungi

Location: Systematic Botany and Mycology

Title: The Crepidotaceae (Basidiomycota, Agaricales): Phylogeny and Taxonomy of the Genera and Revision of the Family Based on Molecular Evidence

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Submitted to: American Journal Of Botany
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Citation: Aime, M.C., Vilgalys, R. And Miller, O.K. 2005. The Crepidotaceae (Basidiomycota, Agaricales): Phylogeny And Taxonomy Of The Genera And Revision Of The Family Based On Molecular Evidence. American Journal Of Botany 92(1):74-82.

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Interpretive Summary: Until recently mushroom fungi were classified based on easy-to-see characteristics such as presence or absence of a stalk and color of spores. With the use of genes to determine relationships among living organisms, it is necessary to re-evaluate how mushroom fungi are classified. In this research mushrooms that are directly attached to wood without a stalk and have brown spores were studied to determine if these characters bring together related species. Using sequences of an important gene region, it was determined that these mushroom fungi can be divided into three distinct groups. These groups are only distantly related to each other. The close relatives of each group were determined along with the characteristics these groups have in common. This research will be used by scientists to more accurately describe the diversity of mushroom fungi.

Technical Abstract: Advances in phylogenetic systematics have clarified the position of most major homobasidiomycete lineages. In contrast, the status of the Crepidotaceae, a historically controversial family of dark-spored agarics, remains unaddressed. In this paper, current morphology-based classifications of the agaric genera of the Crepidotaceae were evaluated by parsimony and constraint analyses of sequence data from the nuclear large subunit rDNA. Taxa analyzed include the type species for each agaric genus allied in the family by Singer: Crepidotus, Simocybe, Pleurotellus, Tubaria, and Melanomphalia. Contrary to traditional classifications, results suggest that the crepidotoid fungi have three separate origins within the euagarics. The Crepidotaceae sensu stricto (s.s.) includes Crepidotus and Simocybe and represents a separate lineage of dark-spored euagarics. Pleurotellus is congeneric with Crepidotus. Results indicate the exclusion of both Tubaria and Melanomphalia from the Crepidotaceae s.s. Tubaria is allied with the strophariaceous taxa Phaeomarasmius and Flammulaster, while Melanomphalia has arisen from within a lineage of light-spored omphalinoid euagarics representing an independent acquisition of basidiospore pigmentation. Other pleisiomorphic, and newly uncovered synapomorphic characters are discussed in detail along with the taxonomic status of each genus, and a revised family description is provided.

http://www.ars.usda.gov/research/publications/Publications.htm?seq_no_115=165126

Title: Dietary Supplementation with Whole Shittake Mushrooms Throughout Development Increases Phase II Enzyme Expression in Male But Not Female Rat Liver

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Citation: Ronis, M.J., Curtis, C., Fang, N., Badger, T.M. 2004. Dietary Supplementation With Whole Shittake Mushrooms Throughout Development Increases Phase II Enzyme Expression In Male But Not Female Rat Liver. In: Federation Of American Societies For Experimental Biology Conference, April 17-21, 2004, Washington, D.C. P. 133.

Interpretive Summary: We have been working with Shiitake mushroom growers in Arkansas to determine the health effects of their mushrooms. Shiitake mushroom consumption or mushroom components have been shown to prevent cancer in animals. We formulated a diet made with different levels of Shiitake mushrooms that were grown on trees in Arkansas. The rats ate these diets and grew at the same levels as rats fed control diets without mushrooms. Male rats fed mushrooms had increases in liver enzymes [glutathione-S-transferases (GST alpha and GST mu)], but female rats did not. However, both sexes had increases in another important liver enzyme [quinone oxidoreductase (QR)] that are important in cancer prevention. These data suggest that Shiitake mushrooms contain orally active chemicals which can increase liver enzymes important in breakdown and inactivation of carcinogens, especially in males.

Technical Abstract: Shitake mushroom consumption has been shown to prevent cancer in several animal models. However, the major anti-carcinogenic, immune stiumulatory mycochemical isolated from shitake mushrooms, lentinen, is a complex polysaccharide unable to be absorbed from the gut. It is therefore possible that other bioavailable anti-carcinogenic mycochemicals may be present in shitake. Rats were fed AIN-93G diets with casein protein supplemented with whole dried Shitake mushrooms at 0, 1, 4 and 10% of total calories; feeding was from gestational d 4 until sacrifice at post-natal d 50. The diets were well tolerated and rats grew at identical rates. Activity and expression of phase II enzymes glutathione-S-transferases GST alpha GST mu and quinone oxidoreductase (QR) were assessed in liver from 5 male and 10 female pups in each diet group. In the male pups shitake supplementation produced a dose-responsive increase in GST activity towards both CDNB and DCNB substrates ($p < 0.05$), an up to 5-fold

increase in GST alpha apoprotein expression in Western blots ($p < 0.05$) and a dose-responsive increase in GST mu apoprotein ($p < 0.05$). In contrast, no effect on GSTactivity or expression were observed in females fed mushrooms. QR activity appeared to be slightly increased ($p < 0.05$) by mushroom diets in both sexes. These data suggest that shitake contains orally active mycochemicals which can induce hepatic enzymes important in carcinogen detoxication especially in males.

http://www.ars.usda.gov/research/publications/Publications.htm?seq_no_115=176633

Research Project: Critical Control Points in Corn Resistance/susceptibility to Aspergillus Flavus and Aflatoxin

Location: Mycotoxin Research

Title: Antiinsectan Decaturin and Oxalicine Analogs from Penicillium Thiersii

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Interpretive Summary: There is an urgent need for new sources of antiinsectan agents that can be used in combating insect pests of crops and species of wild mushrooms which are typically free of insects offer a potential source of novel insecticides useful to agriculture. The fungus Penicillium thiersii produced several antiinsectan agents with potent activity against larvae of the fall armyworm (Spodoptera frugiperda), an important insect pest of corn and other crops. Chemical studies revealed three antiinsectan metabolites new to science while others represent known compounds. Insect resistance to pesticides has become increasingly problematic in recent years and new classes of environmentally friendly agricultural pesticides are also needed. These results will benefit agriculture by offering novel lead compounds with antiinsectan activity, information that can be used to guide the synthesis of such pesticides.

Technical Abstract: Three new oxalicine and decaturin analogs have been isolated from organic extracts of Penicillium thiersii, along with the known compounds oxalicines A and B. These compounds are members of a group of unique natural products containing terpenoid and pyridine moieties. The structures of the new compounds were elucidated by analysis of NMR and MS data. Most of these metabolites exhibit potent antiinsectan activity against the fall armyworm (Spodoptera frugiperda).

http://agricola.nal.usda.gov/cgi-bin/Pwebrecon.cgi?v2=2&ti=1,2&SEQ=20060105212521&Search_Arg=MUSHROOMS&CNT=25&Search_Code=GKEY&PID=22866&SID=1

Title: Chemical and analytical screening of some edible mushrooms.
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Abstract: Fractionation of extracts of the edible mushroom, Volvariella volvacea, led to the isolation of two heterocyclic carboxylic acids, namely pyridine-3-carboxylic acid [nicotinic acid, (5)] and pyrazole-3(5)-carboxylic acid (6) and the four steroidal metabolites ergosterol (1), 5-dihydroergosterol (2), ergosterol peroxide (3), cerevisterol (4). Significantly, compound (6) was identified for the first

time, to our knowledge, in the mushroom kingdom and is of taxonomic significance. Compounds (2-4) were isolated for the first time from the Volvariella genus. In view of the structural similarity of compound (6) to pyrazole-3-carboxylic acids, which act as agonists for nicotinic acid receptors, the levels of compounds (5) and (6) were estimated for the first time using HPTLC in V. volvacea and two other edible mushrooms, namely Agaricus bisporus and Calocybe indica. Significant levels of compound (5) were found in C. indica, and compound (6) was found in abundance in A. bisporus. Correlations are suggested between the occurrence of these compounds in mushrooms and consumption as well as beneficial health effects of this food.
Bibliography Note: Includes references

http://agricola.nal.usda.gov/cgi-bin/Pwebrecon.cgi?Search_Arg=MUSHROOMS&DB=local&CNT=25&Search_Code=GKEY&STARTDB=AGRIDB&x=6&y=14

Article Citation Database
Search Request: Keyword Anywhere = MUSHROOMS
Search Results: Displaying 1 through 25 of 2927 entries.

http://agricola.nal.usda.gov/cgi-bin/Pwebrecon.cgi?SC=Subject&PID=22866&SA=mushrooms&BROWSE=1&HC=1161&SID=6

Database Name: Article Citation Database
Search Request: Subject Browse = mushrooms?
Search Results: Displaying 1 through 25 of 1161 entries.

http://agricola.nal.usda.gov/cgi-bin/Pwebrecon.cgi?SC=Subject&SEQ=20060105213226&PID=22866&SA=mycorrhizal+fungi

Database Name: Article Citation Database
Search Request: Subject Browse = mycorrhizal fungi?
Search Results: Displaying 1 through 25 of 25 entries.

http://agricola.nal.usda.gov/cgi-bin/Pwebrecon.cgi?v2=10&ti=1,10&SEQ=20060105213415&SC=Subject&PID=22866&SA=ectomycorrhizae&HC=1520&SID=10

Title: Detection of plot-level changes in ectomycorrhizal communities across years in an old-growth mixed-conifer forest.
Author: Izzo, A.
Other Author(s): Agbowo, J.
Bruns, T.D.
Source Info: New phytologist. 2005 May, v. 166, no. 2

p. 619-630.
ISSN 0028-646X

http://www.fsl.orst.edu/mycology/youngstndthin/Yss.html

CHANTERELLE MUSHROOM PRODUCTIVITY
RESPONSES TO YOUNG STAND THINNING
Young Stand Thinning and Diversity Study

Cascade Center for Ecosystem Management
Willamette National Forest

The fungus functions as an extended fine root system, absorbing water and minerals that are translocated to the tree and, in return, the trees provide the fungus with food (carbohydrates photosynthesized by the tree). The Pacific golden chanterelle and white chanterelle are the fruiting bodies of these Cantharellus species.

Many of the young forests where chanterelles occur are dense and scheduled for commercial thinning in the coming decades. Young stand thinning will likely affect chanterelle productivity (number and weight of mushrooms per acre) by altering a number of factors:

1. Food supplies for the fungus (density and health of host trees)

2. Environmental conditions near the forest floor that affect fruiting (temperature, humidity, and light levels)

3. Soil conditions (compaction, summer and early autumn moisture levels, distribution of rotted wood and organic matter in the soil profile, litter layer thickness, slash burning, and microbial population shifts)

The Young Stand Thinning and Diversity Study on the Blue River, McKenzie and Oakridge Ranger Districts of the Willamette National Forest is an well-replicated, long-term, integrated ecosystem study that is ideal for understanding how chanterelles respond to thinning.

The Study

The study design is replicated on four sites and we are monitoring chanterelle productivity in three stand treatments at each site:

1. Control ~615 original trees per hectare (250 trees per acre)
2. Light thin ~270 residual trees per hectare (110 trees per acre)
3. Heavy thin ~125 residual trees per hectare (50 trees per acre) with underplanting

The study's primary goal is to examine the response (over time) of chanterelle productivity to the thinning treatments. We hypothesize that productivity will decline immediately after thinning (more so, the more heavily thinned) and then eventually rebound to higher than pre-thinning levels as the residual trees begin to grow more vigorously and fully occupy their habitat.

Little prior work had been done on developing efficient and practical methods for sampling edible mushrooms under a variety of field conditions, hence examining sampling methodology also was a research goal.

Additional goals include spatial analysis of how mapped chanterelle patches respond to removal of nearby host trees, DNA analyses of mapped fruiting bodies to determine the number and distribution of genetically unique mycelial colonies, and then combining those analyses to investigate how chanterelle populations respond to the thinning disturbances.

Productivity and Thinning Treatment Results

Productivity data have been collected for one year prior to logging (1994) and three of four years afterwards (1996,1997, and 1999). Chanterelles were found on every site (although not every year) and productivity varied widely among both sites and years. The range was 0 - 1042 chanterelles per hectare (0 - 422 per acre) and 0 - 34 kilograms per hectare (0 - 30 pounds per acre). Because productivity varied greatly among replicate sites prior to thinning, the Analysis of Variance (Repeated measures ANOVA) for thinning treatments was based on the annual increase or decrease in fruiting compared to pre-logging (1994) productivity levels for each replicate. As predicted, chanterelle productivity significantly

($p<0.05$) declined (but was not eliminated) immediately after thinning and the level of decline was greater in the heavily thinned stands than in those lightly thinned. The first two charts below show declines in numbers of chanterelles per hectare and fresh kilograms per hectare. The 3rd chart examines potential recovery (not yet significant) of productivity over time. Removal of ectomycorrhizal host trees, drier forest floors, and layers of slash that make chanterelles difficult to find likely all contributed to the decline.

Genetic Analysis Results

Genetic analysis of chanterelles fruiting in the circular plots indicates significant genetic diversity within seemingly uniform patches of fruiting bodies. Illustrated below are two patches, a relatively uniform patch (mostly one individual of one species) and a diverse patch (five individuals and two species). An unnamed chanterelle species was discovered in these analyses and is in the process of being described and named.

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http://www.fs.fed.us/pnw/pubs/gtrwo63.htm

Special Forest Products: Biodiversity Meets the Marketplace
General Technical Report GTR-WO-63
Nan C. Vance and Jane Thomas, eds.
This publication is large. We have had to break it into downloadable segments.

Introduction and Chapter 1 (465k) The challenge of increasing human demands on natural systems by Nan C. Vance Consumer trends, market opportunities, and new approaches to sustainable development of special forest products by Catherine M. Mater

Chapter 2 (449k) Medicinal plant development in the United States by Steven Foster
Chapter 3 (552k) Special forest product markets in the Pacific Northwest with global implications by Keith A. Blatner
Chapter 4 (220k) Management opportunities and constraints: State and Federal land management perspectives by James R. Freed and John R. Davis
Chapter 5 (229k) Grounds for argument: local understandings, science, and global processes in special forest products harvesting by Thomas Love and Eric Jones
Chapter 6 (209k) Special forest products in a forest community strategy and co-management schemes addressing multicultural conflicts by Lynn Jungwirth and Beverly A. Brown
Chapter 7 (615k) American Indian cultural models for sustaining biodiversity by Dennis Martinez
Chapter 8 (911k) Business and biodiversity rainforest marketing and beyond by Jason W. Clay
Chapter 9 (196k) Wildlife and plant trade and the rode of CITES: challenges for the 21st century by Chris Robbins
Related Literature (29k) References

http://www.blm.gov/nhp/efoia/or/fy2002/im/IM-OR-2002-080Att1.htm

Survey and Manage Management Recommendation Amendments For Fuel Hazard Reduction Treatments Around At-Risk Communities

July 2002

Group 1 – Certain Fungi, Lichens, Bryophytes, Vascular Plants

Fungi: Cantharellus subalbidis, Clavaridelphus occidentalis, Clavariadelphus sachalinensis, Gomphus bonarii, Gomphus clavatus, Gomphus kauffmanii, Helvella crassitunicata, Mycena overholtsii, Otidea leporina, Ramaria rubripermanens, Sowerbyella rhenana, Spathularia flavida, Tremiscus helvelloides

Lichens: Bryoria tortuosa, Dendriscocaulon intricatulum, Peltigera pacifica, Ramalina thrausta, Usnea longissima

Bryophytes: Ptilidium californicum, Schistostega pennata, Tetraphis geniculata

Vascular Plants: Cypripedium fasciculatum, Eucephalus vialis, Botrychium montanum

ATTACHMENT 1-3 Introduction

The enclosed amendments were developed to apply to the National Fire Plan's highest priority fuels treatment areas – those around at-risk communities and three municipal watersheds located in short fire return interval areas. The application of these amendments is limited to specific geographic areas and fuels conditions because by quantifying and understanding the scope and intensity of potential effects to Survey and Manage (S&M) species, taxa specialists were able to develop Management Recommendations (MRs) that appropriately balance risks to individual site occupancies and the need to meet overall species persistence objectives.

ATTACHMENT 1-4
The use of these amendments is optional. Sites should be managed according to either these MR amendments or the existing MRs.

Species Addressed – Approximately 40 species will eventually be addressed regarding fuels treatments and communities-at-risk, with 24 of those included here:

Fungi: Cantharellus subalbidis, Clavaridelphus occidentalis, Clavariadelphus sachalinensis, Gomphus bonarii, Gomphus clavatus, Gomphus kauffmanii, Helvella crassitunicata, Mycena overholtsii, Otidea leporina, Ramaria rubripermanens, Sowerbyella rhenana, Spathularia flavida, Tremiscus helvelloides

ATTACHMENT 1-7 Species-Specific MR Amendments

FUNGI

The following briefly describes habitat information for 4 sets of fungus species. Following this description is the Management Recommendation amendment applicable to all of the fungus species mentioned below.

Species specific habitat information

Clavariadelphus occidentalis, Clavariadelphus sachalinensis - Fungi

Clavariadelphus species are presumed to be ectomycorrhizal with conifer hosts. C. occidentalis has been documented from 17 sites since 1996, often in association with PSME at elevation 1180-4400 ft. C. sachilinensis has been documented from only 5 sites since 1996, often in association with PSME at elevation 2100-3200 ft. A review of the current ISMS database suggests that this group of ectomycorrhyizal fungi is not well distributed geographically, at least insofar as is apparent from surveys completed to date. Because this group of fungi is closely associated with tree roots, the potential for local extirpation through removal of, or damage to, host trees is high. As range-wide distribution is unknown, we have no assurance that these species would persist across the landscape were they to be extirpated locally.

Threats to C. occidentalis and C. sachalinensis include activities that disturb the soil and litter layer. Several recent studies have examined the impact of both wildland and prescribed fire on ectomycorrhizal fungi communities (Penttila, R. and H. Kotiranta, 1996; Baar, J. et al. 1999; Visser, S. 1995; McIver, J.D. and L. Starr, 2000). Impacts to ectomycorrhizal fungi from fire are highly varied depending on fuel volumes, local burning conditions and fire intensity among other factors. However, most evidence indicates that higher fire intensity is associated with greater long-term damage to ectomycorrhizal fungi. High intensity fires may kill forest stands and greatly affect ground cover and deeper soil conditions. Lower intensity fires may be much less disruptive to soil integrity underneath burned surfaces, where most ectomycorrhizal fungi reside (Jonsson, L. et al. 1999). Low intensity prescribed fire may be beneficial, contributing to species persistence in those ecosystems with historically short fire return intervals (e.g. eastern Cascades).

ATTACHMENT 1-7 TO 1-8
Known fungi sites are defined by the presence of reproductive structures (mushrooms, truffles, conks, etc); beneath these structures lies a complex system of microscopic cells associated with living plant parts, wood, or soil. The extent of an individual fungus individual cannot be determined by the size of the reproductive structure alone because ectomycorrhizal fungi form symbiotic associations with the fine root systems of plants, and grow out into the soil matrix. Estimates of diameter sizes for ectomycorrhizal fungal individuals range up to 20 meters (Dahlberg and Stenlid 1995, Bonello et al. 1998). Individuals may remain undetected when reproductive structures are not formed, for example, when climatic conditions preclude mushroom formation. In addition, fungi are often patchily distributed. Even if we have knowledge of a known site, we have no method to determine how much of the surrounding habitat is occupied.

National Fire Plan fuels treatments should provide for a low risk to the persistence of the above species by avoiding mechanical treatments resulting in compaction of soil, or damage to or removal of host trees. We recommend establishment and maintenance throughout Fire Plan activities of diverse intermingled habitat patches, with avoidance of high intensity thinning and/or burning, the objective of which is to create a landscape-wide patchy burn pattern. We accept some short-term risks for and impacts to species in order to better manage for long-term benefits contributing to species persistence and habitat retention.

Gomphus bonarii, Gomphus clavatus, Gomphus kaufmanii, Cantharellus subalbidus, Ramaria rubripermanens – Fungi

ATTACHMENT 1-8 TO 1-9
Because this group of fungi is closely associated with tree roots, the potential for local extirpation through removal of, or damage to host trees is high. Range-wide distribution is probably currently sufficient to maintain persistence within Northwest Forest Plan area. Threats to these species include activities that disturb the soil and litter layer. Several recent studies have examined the impact of both wildland and prescribed fire on ectomycorrhizal fungi communities (Penttila, R. and H.

Kotiranta, 1996; Baar, J. et al. 1999; Visser, S. 1995; McIver, J.D. and L. Starr, 2000). Impacts to ectomycorrhizal fungi from fire are highly varied depending on fuel volumes, local burning conditions and fire intensity among other factors. However, most evidence indicates that higher fire intensity is associated with greater long-term damage to ectomycorrhizal fungi. High intensity fires may kill forest stands and greatly affect ground cover and deeper soil conditions. Lower intensity fires may be less disruptive to soil integrity underneath burned surfaces where most ectomycorrhizal fungi reside (Jonsson, L. et al. 1999). Low intensity prescribed fire may be beneficial in some cases, contributing to species persistence in those ecosystems with historically short fire return intervals (e.g. eastern Cascades).

Helvella crassitunicata, Sowerbyella rhenana, Spathularia flavida, Tremiscus helvelloides - Fungi

A review of the current ISMS database suggests that this group of fungi, presumed to be ectomycorrhizal, might not be well distributed. Helvella crassitunicata, an elfin saddle, has been documented from only 3 sites since 1996, from mixed conifer forests, at elevation 4300 ft. Sowerbyella rhenana, a small cup fungus, has been documented from 36 sites since 1996, often in old-growth PSME forests, at elevations from 900-3100 ft. Spathularia flavida, an earth tongue, has been documented from 13 sites since 1996, in forests where PSME, Abies, and other conifers are components, at elevations from 2700-5200 ft. Tremiscus helvelloides, a jelly fungus, has been documented from 20 sites since 1996, in many conifer habitats, at elevations from 800-4000 ft. To some degree, all of these species occur in forest litter or humus. The potential for local extirpation through removal of, or damage to host trees, substrate, or litter is high. Range-wide distribution may not be sufficient to maintain persistence within the Northwest Forest Plan area.

ATTACHMENT 1-10 TO 1-11

Management within Habitat Areas (13 fungi species addressed above)

These Management Recommendation amendments are intended to manage for continued site occupancy in fuels treatment areas; they supplement existing Management Recommendations (Castellano and O'Dell 1997), and are intended to provide implementation flexibility for the National Fire Plan. Threats to the above species include activities that disturb the soil and litter layer. National Fire Plan fuels treatments should provide for a low risk to the persistence of the above species by avoiding mechanical damage that results in removal of downed wood or large woody debris.

Acceptable treatments (regardless of risk) within the critical first 300 feet surrounding developments and structures associated with a community:

* All necessary fuels treatments may occur; no specific known site management is needed.

Acceptable (low risk) treatments in the remaining 1 to 11⁄2-mile fuel treatment zone include:

· Broadcast Burning: Light broadcast burning (low severity, low intensity) is acceptable within the managed site if average flame lengths are kept at or below 4 feet, if 60% canopy closure is maintained, and if duff layer and any large downed wood at the managed site are retained, or left as intact as possible.

· Hand lines: If a managed site occurs near a proposed hand line, construct the line between the site and the burn area whenever possible.

· Piling and Pile Burning: Piles should be located far enough from managed sites so that radiant heat does not disturb the site or burn the surrounding duff or large decayed woody debris.

· Thinning: Maintain shading and microsite conditions at the managed site by retaining at least 60% canopy cover. Exclude mechanized equipment from managed sites to minimize trampling and soil compaction, damage to host trees and large decayed woody debris.

· Pruning: Maintain shading and microsite conditions at the managed site by retaining at least 60% canopy cover. Exclude mechanized equipment from managed sites to minimize trampling, soil compaction, and damage to host trees.

Unacceptable (medium or high risk) treatments within the remaining 1-1.5 mile fuel treatment zone include:

· Foam: Avoid foam application within 100 feet of managed sites. [Evidence for estimating the average size of saprophytic fungi sites is lacking, but Armillaria spp, for example, can be several acres in size. In addition, estimates of diameter sizes for ectomycorrhizal fungal individuals are from 1 meter to over 20 meters (Dahlberg and Stenlid 1995, Bonello et al. 1998)].

· Chipping, raking: Chipping and raking should not occur at managed fungi sites.

· Crushing, chopping, grinding or mowing: Understory fuels should not be disturbed in habitat around managed sites. Crushing, chopping, or mowing should not occur at managed sites.

When fuels treatment objectives cannot be accomplished within the above parameters, fire managers and/or botanists are encouraged to contact the Regional Mycologist. The Regional Mycologist may be able to offer more specific recommendations if information on proposed activities and timing are presented for their review.

Research, Inventory, and Monitoring Needs

Management for fungi should be dynamic enough to accommodate and incorporate new information. Knowledge about new sites (resulting from new ISMS and PNW data), and the monitoring of management treatments (fire and mechanical) will be essential for effective management of these species. Fungi presence, abundance and distribution may be influenced by parameters independent of treatments associated with fuels reduction. Monitoring, as described in the front of this attachment, should therefore emphasize the degree to which important habitat components were retained in treatment areas, such as coarse woody debris remaining, amount of intact or lightly burned duff material by area or proportion of unit area, amount of canopy cover, and degree of soil compaction.

http://www.sfp.forprod.vt.edu/special_fp.htm

Interest in non-timber forest products (NTFPs) is increasing rapidly. At present there are numerous efforts to increase awareness of these products, their management and market potential. However, there is a shortage of information available and there are few means effective in disseminating the information necessary for the sustainable management and marketing of these resources and products.

The Virginia Tech Department of Wood Science and Forest Products, the USDA Forest Service Southern Research Station and the Top of the Ozarks RC&D in Missouri are collaborating to develop and operate the first web site devoted to gathering information on products and markets. We are compiling information in simple formats and provide a national clearing house for NTFPs - accessible to harvesters and growers, marketers, processors, and end-users.

Help us make this a useful tool for forest managers, processors or marketers of NTFPs:

* Identify important products and management issues from your area;
* Develop information that can be posted on the web site;
* Report on markets both in your local area and region; or
* Locate information sources that can be shared through the web site.

If you would like to contribute any NTFP information to this site, please fill out and submit the on-line form .

Market information, regular updates with new information, and listings on short courses, conferences and relevant publications will also be features of the web site. Eventually, the web site will include direct links with markets, both national and overseas.

http://www.naturalresources.umd.edu/Pages/Shiitake.htm

This is a draft publication of Virginia Tech and Maryland Cooperative Extension

Shiitake Mushrooms Production and Marketing (SPF-2)

Natural Resource Income Opportunities Series
Special Forest Product Enterprises: An Edible Product Example

INTRODUCTION

For generations, many forest landowners have supplemented their income by gathering or cultivating special forest products (SFP) or non-timber forest products (NTFP) from forest lands. These products offer numerous new opportunities for increased income generation for forest landowners. However, without adequate planning these enterprises may have risks and may foster economic growth without assurances that forest resources are managed in a sustainable fashion.

Before exploring new business opportunities, there is an urgent need to examine the markets for these products and to integrate these products into forest stewardship plans. Native Americans traditionally used plants and plant products for food and medicine, and shared this knowledge with early settlers. These traditional forest products had become an integral part of rural economies. But for the most part, this knowledge has been ignored or forgotten.

Shiitake Mushroom Production & Marketing
An Edible Product Example

For example, the consumption of shiitake mushrooms significantly lower blood cholesterol levels and is reported to lower high blood pressure in laboratory animals. Shiitake contains all eight essential amino acids in better proportions than soy beans, meat, milk, or eggs as well as a good blend of vitamins and minerals including vitamins A, B, B12, C, D and Niacin. In addition, shiitake mushrooms are a popular source of protein in Japan, and are a major diet staple in China, and other parts of the Pacific Rim.