Forest Cultivated Mushrooms
_An emerging industry for the Northeast, Southeast, and Midwest US_

The demand for log-grown gourmet mushrooms has grown tremendously in the past several years, in part led by research in the Northeastern US by Cornell, University of Vermont, and Chatham University, which resulted in the Temperate Forest Mushroom Growers Network, a group that provides growers with resources for the successful cultivation and marketing of log and forest grown mushrooms including shiitake, oyster, lions mane, and stropharia. Shiitake mushrooms have proven to be the most reliable and profitable of the four species. ([www.cornellmushrooms.org](http://www.cornellmushrooms.org))

The network has been on the forefront of developing the industry since the beginning, engaging university researchers, extension educators, and new and active farmers in the process. Members have been collaborating successfully for almost ten years on research and extension projects. Included in the current stakeholder pool are researchers and extension educators from the horticulture, agriculture, and natural resources sectors (8), along with both established and new farmers (60+), spawn producers (4), grower organizations (2), state regulators (5), and farmer support organizations (2).

The rapid growth in the industry follows almost a decade of research by Professor Emeritus Ken Mudge of Cornell on cultivation practices (see: [http://blogs.cornell.edu/mushrooms/research/](http://blogs.cornell.edu/mushrooms/research/)), most notably for shiitake and lions mane. In 2012, the three institutions initiated an on-farm research trial where each of 25 farmers inoculated 100 shiitake logs and kept data on costs, revenue, labor, and other factors. They found that about half of the new shiitake growers were able to begin making a profit in year two, and projected that a small 500-log operation could gross $9,000 over a five-year period. More about the economics in a recent _Small Farms Quarterly_ article: [http://smallfarms.cornell.edu/2015/01/12/mushrooms/](http://smallfarms.cornell.edu/2015/01/12/mushrooms/)

A 2014 marketing survey by Chatham University found there are currently 57 growers in the Northeast US, of which 51 are currently marketing log-grown shiitake off of 17,968 inoculated bolts, which represents a total gross revenue of $287,488, or an average of $5,637 for each farmer. The 57 growers alone are projecting an increase of inoculated bolts to 59,575 by 2018, which would result in revenue of $655,352. This does not include the prospect of new growers or growers outside the northeastern US, of which there are many. Since 2013, Cornell alone has educated over 1,000 farmers and landowners in the process of cultivation. Courses continue to fill rapidly and are sold out soon after announced. The three-year goal of the Cornell Small Farm Program is to engage with 250 new growers, with each generating at least $5,000 in revenue, or a cumulative gross income of $1,250,000. Work is continuing on this project in 2015. ([http://mysare.sare.org/mySARE/ProjectReport.aspx?do=viewProj&pn=ONE14-214](http://mysare.sare.org/mySARE/ProjectReport.aspx?do=viewProj&pn=ONE14-214))

As response from landowners and farmers continues to be strong, many issues have emerged that are the natural consequence of a new and developing industry. While Cornell staff and the Small Farms Program has been engaged primarily in the process of successful cultivation, there is a clear need to develop the policy, marketing, and economic aspects necessary to make forest mushrooms cultivation a flourishing industry. Several issues emerging warrant further development and attention, including:
1. **Concern about inadvertent consumption of poisonous mushrooms.** While it is theoretically possible to have an undesirable mushroom fruit from an inoculated log, there no known cases of poisoning by an undesirable mushroom species growing from a farmer-inoculated log. None the less, misinformation abounds not only among the public by also insurance carriers who have reacted by denying, dropping, or increasing the cost of coverage, citing concerns of increased or unacceptable risk to consumer safety. The reality is that risk is minimized (nearly eliminated) by the practice by the farmer of deliberately actively inoculates a substrate (wood, stumps, chips, etc) with a known mushroom species from a reliable spawn producer.

2. **Solar drying of mushrooms.** One of the benefits of forest grown mushrooms are their excellent quality and how easy it is to dry them outdoors in the sun. Home consumers have long used the simple drying method of placing fresh mushrooms on screens in the sun for 4 – 8 hours. Recent research from Penn State and Paul Stamets has also discovered some compelling arguments that exposure of fresh mushrooms to enhances both Vitamin D2 and D3 content up to 300 fold. This is a boost to the nutritional value of the mushrooms, and also potentially improves their marketability for farmers. Currently, most states in the northeast require a certified kitchen and/or food-processing license in order to legally sell dried products, including mushrooms. In addition enhancing Vitamin D, there is generally little know about possible differences between fresh and dried mushrooms.

3. **Transport of Logs.** Forest products other than timber and firewood are on the rise, as farmers and landowners seek alternative income opportunities from wooded lands. As these new products and markets emerge, it is become critical to consider how to support economic growth and development while protecting our future forests from threats of invasive and exotic species that may threaten forest health and productivity. Currently, mushroom logs are considered “firewood,” and are restricted from transport. For growers, it is unclear what mushroom logs are classified as, and what rules ad regulations they may be subject to.

4. **Health and medicinal compounds.** Mushrooms are purported to have numerous health and medicinal benefits. While there is a significant amount of scientific inquiry into some of these aspects, much of the literature is from Asia, and not often available in English. Many of the studies focus on lab techniques or isolated compounds, instead of examining the whole organism. There is a need to organize, and synthesize currently available research, as well as identify areas for future study.

5. **Spawn quality issues.** In mushroom cultivation, “spawn” is analogous to seeds with plants; it is the material growers purchase and introduce to logs, woodchips, and other materials to grow mushrooms. Alongside the rapid growth of interest in cultivation has been a huge upswing in the number of commercial spawn suppliers. Unlike the seed industry, spawn producers are not regulated and reports of defunct or low quality spawn have become more and more common. There is a need to develop clear standards of quality for the industry, so that growers can come to rely on spawn producers the way vegetable farmers can rely on seed producers.

6. **Identify additional cultivation research.** While the growing industry has shifted its demands to policy, marketing, and regulatory concerns, there is still much more to learn about cultivation strategies in outdoor forest and field settings. More understanding of the selection of substrates, environmental conditions, and cultivation methods would greatly expand the potential profitability and productivity of growers.

7. **State and Regional Grower networks.** In some states, such as Wisconsin and North Carolina, there exist established grower networks for forest mushroom growers. These groups have initiated several
projects that could be useful to an even larger audience. Resources can be more efficiently leveraged by coordinating research and development work at the national level.

While the current efforts on Cornell’s part have been largely focused on the Northeast US, (due mostly to funding restrictions), there are a range of benefits to bringing this conversation to the national level. Forest mushroom cultivation is appropriate in all of the temperate regions of the US, most notably states the Northeast, Southeast, and Midwestern US. To this end, a recent change to our grower network was enacted, changing the “Northeast Forest Mushroom Growers Network” to the “Temperate Forest Mushroom Growers Network.” Cornell has further initiated a survey of active growers in these regions to try and get a sense of what active farmers are in each of these regions. (http://blogs.cornell.edu/mushrooms/join/)

Each of the above issues requires more time and research to develop a basic understanding of the challenges this industry faces. Those involved with developing this crop are at a point where a clear strategic plan is needed to help things move forward. Currently, there is not an extension position at any university funded to facilitate the conversations and development of this crop. In fact, most funded work is related to cultivation research, not crop development. Cornell Small Farms, and Gabriel in particular, are becoming overwhelmed with inquiries and requests from insurance, regulation, and other sectors to address emerging issues. Growers, state networks, spawn producers, and distributors act in isolation. There are also several emerging grower audiences – most notably immigrant or “new american” farmers in urban centers.

The industry of forest mushroom cultivation is at a critical junction; it is young enough to be volatile is prone to failure without the continued support of universities, extension, and grower collaboration to develop a roadmap for the future. In the 2014 Chatham survey mentioned previously, 89% of respondents were favorable of more collaborative work by a coordinated network. Ideally, growers in an emerging industry should be able to focus on establishing cropping systems and scaling up production. Support from a network means that regulatory and market issues can be collectively resolved.

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