

The Natural Farmer

Nontimber Forest Products - Spring 2002 Special Supplement on AgroForestry

by Deborah Hill

Nontimber forest products (NTFPs), also known as "nonwood," "minor," "secondary," and "special" or "specialty" forest products, involve an existing forest or woodland, and intentionally cropping something other than trees. The practice may or may not involve cultivation—the intention is to manage the forest for nontimber crops. This kind of cropping can be done in any kind of forest and has been traditional in many parts of the world. With careful planning, forest farming can be done in conjunction with other agroforestry practices.

Forest farmed products include mushrooms, botanicals of medicinal or culinary value, fruits and nuts, craft materials, maple and other syrups, and baled pine straw. Other, more traditional wood products such as fenceposts and fuelwood are also possibilities, while the raising of honeybees (apiculture) is yet another option.

Exotic Mushrooms

Wild mushrooms that can be found in temperate woods include morels (*Morchella* spp.), chanterelles (*Cantharellus* spp.), boletes (*Boletaceae*) and honey mushrooms (*Armillaria mellea*) along with several other edible species. Most of these are only seasonally available, and one must be VERY sure that the mushrooms in question are the edible ones—not look-alikes that may be poisonous!

High quality mushrooms may be forest-farmed, on the other hand. These include culinary mushrooms such as shiitake (*Lentinula edodes*), maitake (*Hen-of-the-woods*, *Grifola frondosa*), oyster mushrooms (*Pleurotus* sp.) Lion's Mane (*Hericium erinaceus*), King Stropharia (*Stropharia rugosoannulma*) as well as a primarily medicinal mushroom, reishi (*Ganoderma lucidum*). The majority of these mushrooms grow in wood fiber and can be inoculated into small diameter (7-12 cm (3-5 inch)) logs.



The underside of a shiitake mushroom fruiting body is a lovely thing!

Production of these mushrooms can return enough economic benefit to justify thinning and culling forest stands to upgrade the quality and improve the health of the remaining trees. Because small logs are preferred for mushroom production, large branches can be used as well as small diameter trees.

Shiitake and oyster mushrooms are probably the most familiar of the exotic mushrooms. These, along with Lion's mane, reishi, and maitake can be inoculated into drilled holes in logs harvested during the dormant season (November-February in the central U.S.A.). The objective is to inject the active mycelium or "root" of these fungi into the wood that they will ultimately consume at a time when it contains the maximum amount of sugars. This season begins when the tree is shutting down for the winter—having shed its leaves—and runs through the time it gears up again in the spring, preparing for the new year's growth.

Trees used for this purpose must be alive at the time of cutting. Even though the fungi feed on dead wood, it is important to get the desirable mycelium into the wood before some other bacterium or fungus begins the decay process. Log lengths vary, but most people cut lengths they find easy to handle. All my experimental work has been done with logs one meter (39 inches) long, but other people have worked with logs both longer and shorter. Cutting logs shorter than 70 cm (24 inches) could create problems with the mushroom spawn drying out.

My own experiments, as well as those of people in Ohio, Oklahoma, Minnesota, and Wisconsin, show that shiitake will grow on almost any species of hardwood tree, although oaks, especially the white oaks, are favored. It is possible to grow these mushrooms on conifers, but this has not been very successful.

Once the logs have been inoculated and sealed, they need to be placed in a relatively cool, moist environment for the fungi to grow (run) through the entire log. Ideally this would be a wooded site with some mixture of conifers (so that there is some shade year round), and near a water source. Monitoring the moisture content of the logs is important; supplemental watering may be necessary in hot, dry weather. Production usually begins 6 to 18 months after inoculation and continues seasonally with the right combination of moisture and temperature. The logs usually produce about 10% of their original weight in mushrooms over their productive life. Shiitake logs can be sterilized and reinoculated with oyster mushrooms when the shiitake production declines.

Markets are available and increasing in many parts of the country. If you expect to sell mushrooms, however, it is important to locate your own markets before inoculating any logs. The fungi that do not grow on logs—stropharia and morels—grow on the forest floor. Stropharia can be "seeded" into wood chip beds in the forest and watered like a garden until they begin to produce mushrooms. Even though these mushrooms can grow to remarkable sizes (big enough for a child to sit on!), they are marketed when relatively small—roughly the size of large commercial button mushrooms.

Morels are a little trickier to grow—their life cycle is known, but it is still difficult to produce them at will. Kits are available, and at least two companies are producing morels commercially under controlled indoor conditions. They too require a prepared bed on the forest floor and need to be kept moist until they produce. Under outside conditions they will only produce in season, which is late spring to early summer.

Botanicals and Medicinals

Every culture has had people in it who knew which plants to collect in the forest and how to use their different parts to remedy various ills. Botanicals such as echinacea (purple coneflower) and St. John's

wort are now available in outlets from your local pharmacy to Wal-Mart. Some of the forest-based botanicals include herbs such as goldenseal (*Hydrastis canadensis*), black cohosh (*Cimicifuga racemosa*), bloodroot (*Sanguinaria canadensis*), and blue cohosh (*Caulophyllum thalictroides*), as well as bark from such trees and shrubs as witch hazel (*Hamamelis virginiana*), slippery elm (*Ulmus rubra*) and sassafras (*Sassafras albidum*).

Probably the best known and certainly most valuable botanical is American ginseng (*Panax quinquefolium*) Ginseng grown under forest conditions, so-called woods-grown, woods-cultivated, or wild-simulated, has maintained a stable price of close to \$300 per pound for some time.

Most of the herbaceous and shrubby botanicals are marketable for pennies to dollars per pound, and there are several national herb companies that will buy dried material from producers. Several of these herbs can be encouraged to grow in larger patches than occur naturally, by techniques that disturb the forest soil very little. Both herbaceous medicinals and exotic mushrooms prefer a forest canopy—usually with fairly dense (75-85%) shade, so minimal alteration of the overstory is needed. As with most plant cultivation, the problems are competition for water and nutrients, so some weeding may be necessary.

Most of these herbaceous plants, especially those with marketable leaves, seeds, and fruits, bear annually. Harvesting roots may take longer. Goldenseal, from which both root and leaves are marketable (and seed for that matter), takes two or three years to develop a large enough root mass to market. Ginseng commands a high market price because it takes five to ten years to develop the kind of root that brings top dollar.

Ginseng plants usually begin to produce seed in their third year and the seed can be a product in itself. The planting market demands both seed and 1st- or 2nd-year rootlets, so small roots can also be marketed for transplanting.



The greatest challenge in growing ginseng to fruition is keeping it until it's big enough to sell. In the central U.S.—and the Appalachian and Ozark Mountains in particular—thrift of nearly-grown ginseng is widespread. Ginseng is considered by the federal government to be a threatened plant, and its harvesting is restricted to certain months of the year and to certain ages of root, but there is considerable disregard for those laws, and little enforcement by local officials.

Ginseng roots of marketable size and quality take five to ten years to develop.

Trees and shrubs from which roots (sassafras) and bark (witch hazel, slippery elm) are taken for their medicinal use, require a different kind of management. Witch hazel is best managed by cutting the stems fairly close to the ground, then stripping the bark off. Cutting the stems encourages resprouting while taking the bark off the standing stems would probably kill the whole plant. Slippery elm, which can grow into a large tree, can either be managed—like the witch hazel—by coppice when young, or could bear some vertical strips of bark being removed from a mature tree, as long as most of the bark is left around the trunk to keep its circulation functioning. Some of the roots of sassafras may be removed without killing the whole tree; alternately, only the smaller shoots may be harvested, roots and all.

Fruits and Nuts

Native fruits and nuts are other options for forest farming, and can include such species as persimmon (*Diospyros virginiana*), pawpaw (*Mimosa triloba*), hazelnuts (*Corylus* spp.), pine nuts (*Pinus* spp.), and walnuts (*Juglans* spp.). Unfortunately, one of the greatest nut trees of all time, the American chestnut (*Castanea dentata*), no longer grows big enough to produce nuts. It occupied some 20% of the eastern deciduous forest and was effectively wiped out by an exotic disease in the 1920s.

As with apiculture and maple syrup production, farming of fruiting species requires adjustment of the forest canopy (more water, nutrients, sunlight) to allow for better growth of the crop trees. This usually means removing the surrounding trees whose crowns touch the crowns of the crop trees (you can then use some of the harvested wood for mushroom production, fenceposts, or firewood for boiling maple syrup!).

Crafts Materials

Working crafts materials as part of forest farming ranges from collecting pine cones and gilding them for decorations, or waxing them for fire starters, to selecting odd-shaped branches or burls on trees for carving. There are many plant species at all levels, from herbs to shrubs to vines to canopy trees, that may produce something harvestable for crafts. Grape vines are collected for fashioning into decorative wreaths, while small diameter (less than 25 cm (10 inches)) white oak saplings are the ideal size for making splints for white oak baskets. People have even made (beautiful) baskets from kudzu vines, so opportunities live greatly in the eyes of the beholder. One enterprising company injected dyes into very young pine saplings (less than 5 cm (2 in) in diameter) and then cuts the stems and branches into disks that were made into jewelry—the color already in them.

Crafts from wood are the dominant types produced in Kentucky and probably in most of the mountain regions of the central United States; they are also the most economically valuable. Greens and grasses used in the floral trades may be more valuable in areas like the Pacific Northwest. Although many of the forest resources for crafts may be obtained by collection or "wild crafting," some of the most desirable species can be "farmed" by intentionally altering the habitat to increase their production.

Maple syrup and other tree saps

Maple Syrup, and syrup or "beers" made from other tree saps, have been produced for centuries in North America. Native Americans figured out how to get this sweet material long before Europeans came to this continent. A "sugar bush" is simply a forest where the owner has selected for maple trees, specifically sugar maple (*Acer saccharum*). Maple syrup can be made from the sap of any maple tree species but the sugar content of sugar maple sap is higher than that of the other maples, and it therefore takes fewer gallons of sap to make a gallon of syrup (with sugar maple the ratio is about 40 to 1, so it's a lot more work to get the syrup from the others).

Management of the sugar bush requires spacing the trees far enough apart that they form large crowns (when the trees are all crowded together in a normal forested situation, the crown of any individual tree is not particularly large). Large crowns mean a lot of leaves, and a lot of leaves means high syrup production.

The expense of maple syrup production lies in the fairly substantial capital investment required for the tapping (buckets or plastic tubing), boiling, and bottling equipment and materials. People who do this

every year build a "sugar shack"—a building that houses the boiling pans, with lots of roof ventilation for the steam to escape, and a long, deep fire pit for heating the sap. Scrap wood from other forest management operations can be used to fuel the sugaring process. Labor is intensive during the production process, but the season of work is short, lasting usually four- to six-weeks in the spring—when days are beginning to warm but nights are still cool, and before bud break. The result is a very high value-added product.

Pine straw

Pine straw is the annual needle drop of pine trees. Commercially, it is baled from under long-needled pines in the Deep South, specifically loblolly (*Pinus taeda*) and longleaf pines (*P. palustris*). This material makes excellent mulch, especially for landscaping. There have even been experiments to color the pine needles for interior landscaping so that they can match the decor of the room! Even though harvesting removes organic material from the forest floor, and thereby reduces the amount of nutrient cycling available to the stand of trees, people have found that it is possible to rake and bale the pine straw from the same location every other year or every third year without markedly affecting the nutrient balance. Pines with long needles are preferred because these take longer to break down. The pine straw is baled much like hay, and can return a significant short-term economic benefit while owners are waiting the 20-30 years required for the timber crop to mature. Managing for pine straw production means planting the trees in widely-spaced rows to accommodate the movement of the straw harvesting machinery.

Fenceposts

The most desirable tree species for fenceposts in the eastern United States are black locust (*Robinia pseudoacacia*) and Eastern red cedar (*Juniperus virginiana*). In the west, it is probably redwood (*Sequoia sempervirens*). These species are desirable because of their natural resistance to decay—locust posts may last for decades without chemical treatment, whereas other species, even with treatment, may not last as long. Management consists of favoring the growth of these species over others and providing access to maximum water, light, and nutrients in the system where they are growing. Fenceposts are also an option as an intermediate product in the crop tree rows of an alley cropping system. Black locust, for example, can grow large enough to be harvested for fenceposts in 12-15 years, while black walnut may take three times longer than that to reach a size that would be considered marketable.

Fuelwood

Fuelwood, or firewood, is more of a byproduct of other management for forest farming than perhaps a specific activity, unless the forest is managed to encourage the growth of trees that are known to be excellent fuelwood, such as black locust or some of the less commercially desirable oaks (post oak, *Quercus stellaria*, or blackjack oak, *Q. marilandica*). Exhausted mushroom logs can be used for firewood also, although they may be punky enough that they are better ground up and used for mulch.

Apiculture

If agroforestry is "the intentional integration of agronomic crops with tree crops or livestock with tree crops," then with apiculture in forest farming, the "livestock" are very tiny! It has been estimated that one in every three bites of food we eat is dependent on active pollination of plants. The insect world, specifically bees and wasps, are the major operators in this case.

The European honeybee (*Apis mellifera*) is the best-known of these insects, although it is not a native species. It has a couple of characteristics which make it particularly valuable. One is that honeybees show species fidelity, which means that they will use the same source of nectar to make honey until source is exhausted. This enables them to make "specialty" honeys from crops such as buckwheat, tupelo, and sourwood. Another is that they collect pollen, along with nectar, and use both to raise their young, but also collect it in sufficient volume that it can be harvested without compromising the health of the hive.

Managing honeybees is not difficult, and getting setup with bees and hives is neither particularly expensive nor complicated. Extracting honey from the combs is an expensive proposition (extractors are costly), but it is possible to get good equipment second-hand.

Forests can be managed to favor trees that honeybees particularly like, such as basswood (*Tilia americana*) and black gum (*Nyssa sylvatica*), providing extra light, water, and nutrients for those trees, as well as exposing the crowns to maximize surface area for flower production.



In well managed agroforestry, high value crops are cultivated under the protection of a canopy that has been modified to provide the correct conditions.

Average production for a hive is 23 kg (50 lbs.) of honey per year. It is also possible for a hive to produce 23 kg (50 lbs.) of pollen in a year. Products from the hive include: royal jelly (the super-rich food fed in tiny amounts to all honeybee larvae, but the exclusive diet of the queens) popular in both the health food and cosmetic markets; propolis, another product used in food supplements; and beeswax, used for candle-making and other crafts. Pollination itself is another saleable service, as hives can be transported from place to place to pollinate crops. And some alternative health practitioners use honeybees for their venom, which anecdotally is said to be extremely helpful to people suffering pain from rheumatoid arthritis, or other joint problems.

Summary

Farming the forest provides many options for annual (maple syrup, crafts, some botanicals, mushrooms) and longer-term (fuelwood, fenceposts, ginseng) commodities, along with the possibility of timber crops. Production of these commodities may involve altering the forest canopy (shade for mushrooms and botanicals, crown spread for apiculture and maple syrup) or making changes in the forest floor (sowing medicinals such as ginseng and goldenseal, inoculating for morels or stropharia). Many of these options could also be implemented in the tree rows of alley crop plantations, as well as in the selection of species for windbreaks and riparian buffer strips. One or more of these options can provide annual cash flow and can be managed by various members of a family. Implementing several of them will bring greater biodiversity to the existing forest, thereby enhance its health, while supplementing annual income from the land.

Further Reading

- **American Ginseng - Green Gold.** by Scott W. Persons. 1994. Bright Mountain Books, Asheville NC, 203 p.
- **Forest Farming: Revitalizing and Expanding Crop-Yielding and Forest Based Enterprises.** by Deborah B. Hill and Louise Buck 1998. Chapter 8 In: Agroforestry - An Integrated Science and Practice. W.J. Rietveld, H.E. Garrett, and R.F. Fisher (eds.). American Society of Agronomy Special Publication.
- **Income Opportunities in Special Forest Products.** by M.G. Thomas and R. Schermann. 1993. USDA Agricultural Information Bulletin 666, 206 p.

Web Links

- The National Agroforestry Center's page on forest farming, with a link to species tables: <http://www.libfind.unl.edu/nac/pubs/afnotes/ff-1/>
- NAC's fact sheet on forest farming with mushrooms, including resource information, by Deborah Hill: <http://www.libfind.unl.edu/nac/pubs/afnotes/ff-2/>
- The FAO Forest Products Division's Non-Wood Forest Products web site has extensive information including organizational database and a broad range of publications in electronic form in English, French and Spanish: <http://www.fao.org/forestry/FOP/FOPW/NWFP/nwfp-e.stm>
- The Special Forest Products Web Site focuses on the use and markets for special forest products: http://www.sfp.forprod.vt.edu/special_fp.htm
- Institute for Culture and Ecology's Non Timber Forest Products in the United States has extensive reference information: <http://www.ifcae.org/ntfp/>
- Conservation International's Directory of Information Resources for Non-Timber Forest Products lists many useful publications: <http://www.conservation.org/library/books/ntfp.htm>

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