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FARMING THE FORESTS OF APPALACHIA: OPPORTUNITIES AND CHALLENGES

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Abstract: People have been informally farming their forests for generations, although only in recent years has attention been directed at formalizing this land-use practice through research and development. Forest farming is becoming popular for landowners to diversify income, improve resource management, and increase biological diversity. The social, ecological and economic implications of forest farming may be significant to private landowners. Forest farming focuses on producing herbaceous plants that traditionally have been wild-harvested for food, medicine, and other income generating opportunities. Many opportunities and challenges face landowners interested in forest farming. Many markets for forest farmed products are developing rapidly. Under-utilized species may present specialty opportunities for creative entrepreneurs. Shifting from wild-harvest to cultivation may present significant challenges to rural people who are economically marginalized. These new forest ventures may require additional skills and expertise. There may be additional capital or labor requirements that could put undue burden on interested landowners. Market demand and economies of scale may reduce the attractiveness of alternative forest enterprises. Technical challenges of cultivating native herbaceous plants under forest canopies may be daunting, as well. Opportunities and challenges abound for developing forest farming into a viable land-use practice for landowners in the Appalachian hardwood region.

Key Words: Appalachia, Forest Farming, Medicinal Plants, Non-Timber Forest Products

INTRODUCTION

Forest farming has been promoted as an alternative practice that can lead to better and more sustainable management of resources. The practices have been documented, formalized, but in many situations the science behind forest farming is not well developed. The potential to diversify and stabilize income sources, increase forest health, and promote alternative ‘green’ enterprises through forest farming is relatively untapped.

Early settlers to the Appalachian Mountains who wanted to make sure that they had a ready supply of products would replant seeds and treat their patches of forest herbs as if they were gardens. These informal “forest farmers” understood the need to conserve natural resources and realized the importance of taking actions to sustain those resources. Today, forest farming has become more formal with the incorporation of readily accepted farming practices. People interested in farming their forests have many opportunities and constraints that they must consider.

Sholto and Hart (1985) first promoted forest farming to increase and diversify the productive capacity of forestlands. They wanted to promote the production of a range of food and other essential products with the growing of trees for timber. These pioneers of forest farming integrated forestry, animal husbandry and horticulture to achieve maximum output and optimum conservation. They envisioned that a forest farm would integrate three main components – trees, livestock and forage. To these visionaries each piece was an essential element of a whole ecosystem. Over time, the concept of forest farming has evolved to exclude livestock and forage.

Today, forest farming involves the cultivation or management of understory crops within an established or developing forest (University of Missouri Center for Agroforestry, 2006; Agroforestry Research Trust, 2007; Center for Sub-tropical Agroforestry, 2007; Cornell Cooperative Extension, 2007; NAC, 1997). Forest farming can be done in a natural forest or a plantation, and is a sustainable production system that helps keep a forest healthy by diversifying the landscape. Forest farming requires co-management of resources for timber and non-timber products. Management may include intensive cultivation of understory species that are introduced to a stand of trees, or activities to nurture existing plants to improve their production and marketability.

There are advantages and disadvantages to forest farming (University of Missouri Center for Agroforestry, 2006). Forest health can be improved by increasing biological diversity, removing damaged and infected vegetation. It can give people additional and diversified forest income opportunities by producing for more and different markets. Forest farming can increase the amount of productive land available to the landowner. But, forest farming requires more intensive management which demands greater skills and increased time. The markets for many of the products are not well defined nor readily understood by landowners increasing the need for more research and assistance. Learning about and entering new markets may be daunting to many forest landowners. Integrating forestry and farming requires broader knowledge to understand how to grow and manage trees and understory crops, simultaneously.

Forest farmers can realize economic, ecological and social benefits. Diversifying crops, products, production cycles and land management systems, forest farmers may reduce financial risk, decrease environmental impacts and improve cultural and recreational benefits. Economic benefits include increased income from new crops that have shorter rotations and provide revenues streams while longer-term crops mature. Lands that are marginal for traditional agricultural production can be used to generate revenue. Labor may be diversified as new crops can have different production schedules. Water and other resources may be better conserved in a forest farming system. Overall, forest farming provides economic and conservation incentives that boost stewardship and community development.

LOOKING FOR OPPORTUNITIES

Potential forest farmers need to analyze internal and external factors that could influence their success. New practices may require additional skills and expertise. More capital or labor investments may be needed. Potential profit margins in new ventures, such as edible mushrooms, Christmas trees and bees, may be such that investing in these alternatives is not feasible. Landowners need to examine the markets and fully understand the potentials and pitfalls of each

possible venture. Though there are many challenges of developing forest farming, a diversified land use and management strategy can be economically rewarding to landowners willing to invest time and energy.

Growth and emerging markets

Two NTFP markets – herbal medicines and forest foods -- exhibit great growth potential for forest farming. Farming woodlots with plants that are native, have economic value and are traditionally harvested from natural forests can reduce pressures on natural populations and meet the demands of global markets. Farming the forests can provide consistent quality and quantity of products that are wanted by the herbal products industry, worldwide. Interest in and demand for forest foods, such as berries, ferns, greens, onions, mushrooms and nuts provide opportunities in other markets that may be as lucrative. Specialty and niche markets for other product categories (e.g., floral decorative, landscaping, etc.) may provide opportunities, as well.

Herbal Medicines: There are hundreds of native forest plants that are used for their therapeutic value, and marketed either as herbal medicines or dietary supplements. Farnsworth and Morris reported in 1976, that 25 percent of all prescriptions dispensed in the United States contained active ingredients extracted from plants. The number of plant species in Appalachian forests with medicinal value exceeds 125 (Krochmal and others 1969, World Wildlife Fund 1999), yet less than a dozen are commonly harvested for commerce. This region is the principal source of many of these, including black cohosh (*Actaea racemosa*), American ginseng (*Panax quinquefolius*), and bloodroot (*Sanguinaria canadensis*). The potential for expanding the medicinal plant industry is limited only by the tremendous biodiversity of the forests.

The most forest farmed native medicinal plant in Appalachia is American ginseng. Everyone knows about this species, and lots of people are promoting its production in forest farming. Over 3 decades (1978-2006), approximately 2.7 million pounds of ginseng were harvested from the hardwood forests of Kentucky, West Virginia, Tennessee, Virginia, and Indiana. Much of this was farmed in the forests by wild-simulated methods. Kentucky was the largest producer during that period, with a total harvest of 489,000 pounds of dried root. In 2006, twenty-five percent of total ginseng harvest came from Kentucky forests, and 70 percent of the total came from the combined states of Indiana, Kentucky, North Carolina, Tennessee, and West Virginia. Although, ginseng gets most of the attention, many medicinal plants grow under the same forests.

Of the 22 medicinal plants studied by the American Herbal Products Association in 2004-2005, seventeen were harvested from natural forests (AHPA 2007). Table 1 presents the estimated volumes of medicinal herbs harvested from Appalachian forests. All, except one, are herbaceous understory plants. Only one species, Lady Slipper (*Cypripedium* spp.) is reportedly predominantly cultivated. According to the AHPA survey, 100 percent of Bloodroot (*Trillium erectum*) used in commerce is harvested from natural forests. An average of 190 thousand pounds of slippery elm (*Ulmus rubra*) bark was harvested annually from 1997 through 2005. Star root (*Alertris farinosa*), is a slow-growing forest plant that is harvested for its root. Other native medicinal plants, such as Black cohosh (*Actaea racemosa*) offer more opportunities.

Table 1. Estimated production volumes of Appalachian medicinal herbs, 2004 - 2005

Year	Plant Part	Scientific	Alertris	Trillium	Actaea	Sanguinaria	Caulophyllum	Chamaelirium	Hydrastis	Hydrastis	Cypripedu	Ulmus	Aristolochia	Dioscorea
		Binomial	farinosa	erectum	racemosa	canadensis	thalictroides	luteum	canadensis	canadensis	m.spp.	rubra	serpentaria	villosa
		Common Name	Alertris	Bethroot	Black cohosh	Bloodroot	Blue cohosh	False Unicorn	Goldenseal	Goldenseal	Lady's slipper	Slippery Elm	Virginia snake-root	Wild yam
			root	root & rhizome	root	root	root	root & rhizome	leaf	whole plant	bark	root	tuber	
2005	Cultivated		2	0	6930	0	126	1043	33756	7092	15	1731	0	363
	Wild		51	1038	136370	5328	8039	4945	47714	6939	0	203984	59	33003
2004	Cultivated		50	0	3312	0	207	1034	2100	5178	123	803	0	412
	Wild		571	475	318729	11487	5054	3638	61180	2495	135	78380	353	27616
2003	Cultivated		0	0	410	20	86	1400	11070	2435	286	0	0	42
	Wild		546	1469	318143	39590	7627	4839	31802	6869	5	229866	135	37021
2002	Cultivated		0	0	282	26	80	1400	15779	8926	110	0	0	54
	Wild		1326	1471	169436	26473	4449	5086	41845	16612	0	202309	40	31573
2001	Cultivated		0	0	6521	19	90	700	21337	4941	210	0	0	356
	Wild		2109	1040	177681	41236	8085	4735	105099	47558	113	197634	17	37899
2000	Cultivated		0	0	149	0	0	700	18963	4248	0	0	0	10055
	Wild		1508	1911	117843	48674	5506	3730	70396	18770	95	148387	287	32358
1999	Cultivated				2600				47599	5487		10200		100
	Wild				145367				91435	87524		256839		58544
1998	Cultivated				35430				6445	2228		5000		200
	Wild				725984				258843	65490		181053		61794
1997	Cultivated				0							0		0
	Wild				227002							205418		61799
Total	Cultivated		52	0	55,634	65	589	6,277	157,009	40,535	744	17,734	0	11,582
	Wild		6,111	7,404	2,336,555	172,788	38,760	27,173	708,294	252,257	348	1,702,870	891	381,597
Percent	Cultivated		0.84%	0.00%	2.33%	0.04%	1.50%	18.77%	18.14%	13.84%	68.13%	1.03%	0.00%	2.95%
Total	Wild		99.16%	100.00%	97.67%	99.96%	98.50%	81.23%	81.86%	86.16%	31.87%	98.97%	100.00%	97.05%

Source: American Herbal Products Association, AHPA 2004-05 Tonnage Survey

Since the U.S.D.A. Food and Drug Administration took actions to restrict Hormone Replacement Therapy, market demand for black cohosh, a native medicinal plant used for menopausal symptoms, has been on the increase (Dog and others 2003). When consumers became aware that cohosh was effective for menopausal symptoms, retail sales sky-rocketed. From 1997 through 1998, retail sales of this medicinal plant increased more than 500 percent (Blumenthal 1999). Over 9 years (1997 – 2006), more than 97% of the 2.39 million pounds of black cohosh roots were harvested from the wild. Forest farming this important medicinal plant would reduce the pressures on native populations, and could be lucrative for private forest landowners.

Forest Foods: Most people don't think of the forest as a source of things to eat. But people have been collecting native plants for their personal consumption for generations. Recently, there has been a surge of interest in forest edibles, and markets are emerging and developing rapidly for these products. The potential is only limited by the diversity of plants that are edible. Edible and culinary products that can be farmed in the forests of Appalachia include mushrooms, ferns, fruits, leaves, and roots and tubers. Perhaps the most popular in Southern Appalachia are ramps (*Allium tricoccum*); wild onions that are harvested for a short period in the spring. Surprisingly, Southern Appalachian forests also are a source of maple syrup and berries.

Many edible mushrooms, such as shiitake (*Lentinula edodes*), maitake (*Grifola frondosa*), lion's mane (*Hericiium erinaceus*), and oyster (*Pleurotus* spp.) can be forest farmed for commercial gain. The shiitake mushroom is the most popular for small-scale cultivation. Production of

shiitake in this country started about 2 decades ago, when demand exceeded the ability of importers to fulfill orders, and the technology for landowner production became readily available and simple. As the market develops and more people begin to grow mushrooms, profit margins will decrease. Under-utilized and less well-known mushroom species may provide greater returns on investment, yet they may present additional risks as well. Successful forest farmers of mushrooms will figure out how to compete with established and experienced enterprises by finding niche markets and producing high-quality and low-cost products. Growing mushrooms can be very rewarding, but successful commercial producers are those who market them well.

Appalachian forests are the source of wild onions, locally known as ramps, the market for which is burgeoning. Once a local delicacy, shared at annual festivals, this forest food can now be purchased over the internet and in distant markets, such as New York City and Chicago. They are only available for a short period in the spring, before the tree canopy is completely developed. Ramps grow naturally under a forest canopy of beech, birch, maple, and/or tulip poplar. To forest farm ramps, the leaves are raked back to expose bare soil; seeds are then sown and then covered with leaf litter. It is also possible to transplant bulbs, if a natural patch is available. The plants are relatively slow growing, and it may take 5 years before harvest is feasible. Once they mature and produce seed and reproduce vegetatively, farming the forests with ramps should be fairly low-cost.

Surprisingly, some southern states produce maple syrup, and this may present a forest farming opportunity. According to 2002 Census data, there were 71 maple syrup farms in the south. Kentucky is one of three states in the south that have maple syrup farms, and it had the most sugar bushes. In 2002, 38 maple syrup farms could be found in Kentucky, with a total of 4,142 active taps. These farms produced approximately 416 gallons of syrup, representing about 9 percent of total maple syrup production in the southern region. At the same time, Virginia had 26 sugar bushes, with 28,864 taps. Virginia produced 91 percent of the total (4,824 gallons) maple syrup production in the south. Though this market may be limited, a landowner with a stand of sugar maple may want to consider this option.

Other Non-Timber Opportunities: Many forest products are harvested for use in floral displays or decorative crafts. The diversity of products available is limited only by the crafter's imagination. A variety of plant parts are harvested, including wood, boughs, leaves, vines, flowers, or whole plants. Forest farmers may manage their woodlots for these products and harvest raw materials to sell to crafters, or produce finished products to be sold at craft fairs, retail stores, or online. Decorative wreaths, commonly made from pines (*Pinus* spp.), hollies (*Ilex* spp.), junipers (*Juniperus* spp.), willows (*Salix* spp.), ivy (various species), grapevines (*Vitis* spp.), and smokevine (*Aristolochia macrophylla*), may present opportunities for enterprising forest landowners. Harvesting non-native invasive plants, such as kudzu (*Pueraria lobata*), can be lucrative, as well. Developing forest farming practices for these alternative products may be one of the greatest challenges.

FACED WITH CHALLENGES

Interest in farming the forests for botanicals is driven by a variety of forces. As the natural products industry grows, demand for raw materials will increase. And as interest in organic and

sustainably harvested products increase, the potential for forest farming increases, as well. Recent safety and quality issues with foreign imports have convinced some companies to purchase more domestically produced herbs. Consumers are driving demand for certified organic products, and as concerns about the conservation of wild-harvested herbs increases manufacturers are starting to source herbs that are certified to be harvested using sustainable practices. This has resulted in increased prices paid for quality cultivated material. The number of forest landowners interested in growing alternative crops has been increasing, as a result of this trend. Those interested in adopting forest farming of native plants are faced with new and often daunting challenges.

Production

Growing native plants should be simple, as they occur naturally in Appalachian forests. But, many questions remain unanswered for most native herbaceous plants. Ginseng is the major medicinal herb farmed in the forest, and there is a great deal of literature on the subject. There also is adequate information on growing goldenseal (*Hydrastis canadensis*). But, for other forest herbs forest farming information is lacking. Information may be available, but finding it is challenging. Companies that sell seed often can provide information on propagation. Before venturing into a new crop, it is wise to learn as much as possible about the new plant. Through trial and error, production practices can be developed and refined for the new plant.

Estimating how much production to expect presents a special challenge. Production figures are presented in much of the literature (Persons and Davis 2005; Jacobson and Burkhart 2005; Burkhart and Jacobson 2008; Hankins 2000). In one example, twelve and half pounds of ginseng seed, planted under wild-simulated conditions, yielded 80 pounds of dry roots after nine years (Persons and Davis 2005), representing a 540 percent increase in biomass. Another example indicated that a grower could expect 1150 percent increase in biomass over six years in a woods-cultivated scenario (Persons and Davis 2005). The final yields in both examples were presented in dry weight, which suggests that there was even greater biomass production over that period. Such yields from slow growing forest species may not be unrealistic and need to be further assessed.

Jacobson and Burkhart (2005) project yields for six non-timber forest products under two planting schemes. They estimate that under a woods cultivated scenario, a forest farmer can expect to produce about 40 pounds per acre of black cohosh root in three years. Under a wild-simulated scenario, they estimate black cohosh production to be about 17 pounds per acre. These estimates and others (Persons and Davis 2005) may not be supported by empirical evidence that is needed to accurately assess production figures. They do provide a good place to start assessing the potential for forest farming, but more pragmatic indications are needed to support such claims.

To exacerbate the situation, no metrics have been developed to allow for the inventory of below-ground biomass (i.e., roots) based on above-ground biomass (e.g., leaves, stems, etc.) for these herbaceous native medicinal plants. A forester can take measurements of the trees and estimate the volume of standing timber. But, there is no way to take measurements of a stand of ginseng, black cohosh, or other native medicinal plants and estimate the volume of merchantable roots.

Further, the empirical evidence is lacking to estimate mean annual growth or mortality in a stand of these medicinal plants. Under forest farming these are needed for a landowner to estimate how much can be harvested on a regular basis.

Markets

Finding and entering NTFP markets can be easier said than done. Most forest landowners who have harvested timber can identify places to sell products and potential markets. This may not be as simple for herbal medicines, forest foods, or other alternative forest products. Even though, herbal medicines have been gathered and traded in this country for more than 300 years, the markets for these products remain an enigma to most people. In many cases, transactions are based on long-term relationships, which can impede entry by new players.

Over the last decade there has been a surge of interest in foods from the forests. Most forest foods are not sold in typical grocery stores, although natural food stores may offer these products. Demand for unusual and tasty edible forest products may be small, but it is increasing. Some forest foods, such as ramps, have been highlighted on cooking shows and in gourmet magazines (Turczyn 2002). Many are sold over the Internet and a quick search will bring new opportunities to the entrepreneurial producer.

Economics

The economics of growing native plants under forest farming may not be attractive to private landowners. Most estimates of NTFP values and volumes are not based on consistent or reliable data, making it difficult to estimate the economic value of producing these crops. The production of only a few non-timber forest products are tracked regularly. Estimating production volumes and translating this into economic terms presents a challenge that needs to be addressed.

Most NTFPs are traded as commodities; large volumes sold at low prices. For a small forest landowner, producing for this scenario is challenging. To effectively serve NTFP markets may require larger volumes than possible for a small woodlot to produce. Though small-scale production may be possible, getting sufficient prices to make forest farming feasible may not be possible. Getting a high enough price on these products to cover costs and provide a profit may require developing long-term relationships with buyers and ensuring high quality and quantity. Forest farming cooperatively with other landowners may be warranted to get higher prices by being able to offer larger volumes.

Traditionally, NTFPs have been gathered from natural forests and the pricing structure reflects this. Typically, prices are not sufficient to warrant many inputs. Forest farming can require inputs in the form of land preparation, planting stock, fertilizer and pesticides, as well as machinery. Overcoming this challenge may mean keeping inputs to a minimum and finding ways to increase product value. Production systems that mimic natural processes may be the best approach. Producing high quality, consistent product that is certified organic (though the process of getting certified increases costs) may also be advisable.

CONCLUSIONS

Most contemporary discussions of forest farming include only medicinal plants, yet there may be a broader range of opportunities for landowners to farm their forests. A critical feature that distinguishes forest farming is that it incorporates shade-tolerant, non-timber forest resources with trees that form a closed canopy and may be grown for timber. Co-management of over-story trees with shade-tolerant understory plants is a major objective and challenge of forest farming. It will require new skills and expertise, and can increase income opportunities for the landowner. At the same time, forest farming can increase the diversity of plants while keeping trees standing longer.

Compared to traditional agricultural or forestry commodities, there may be few market structures in place, and relatively sparse information regarding production. Integrating forestry and farming will require broader knowledge to successfully manage the trees, understory and their interactions. Forest farming can take more time and energy, and landowners may lack the expertise to understand and produce quality and quantity needed by 'new' markets. But for the tenacious and patient entrepreneur, forest farming can be rewarding.

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