

Profitable Farms and Woodlands

A Practical Guide in Agroforestry for
Landowners, Farmers and Ranchers



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INTRODUCTION

This handbook is part of an interdisciplinary, interinstitutional and comprehensive effort to develop a practical guide to assist underserved and limited resource small farmers and woodland owners to adopt best management technologies in agroforestry. Funding for this effort was provided through the USDA National Agroforestry Center (NAC) from the US Forest Service and the Natural Resources Conservation Service (NRCS) under cooperative agreement number 68-7482-7-361 with Tennessee State University, Cooperative Extension Program and the 1890/1862 Agroforestry Team.

This guide was prepared by an agroforestry team of research and extension specialists from the 1862 and 1890 Land Grant Universities in collaboration with USDA - NAC. The handbook depicts step-by-step methods and principles on developing agroforestry practices for farmers and woodland owners for the purpose of enhancing the economic and environmental benefits of their farms and woodlands.

Douglas Wallace, NRCS lead agroforester, and Richard Straight, Forest Service lead agroforester, both from the USDA National Agroforestry Center provided additional helpful review and edits for this guide.

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PURPOSE

Profitable Farms and Woodlands: A Practical Guide in Agroforestry for Landowners, Farmers and Ranchers is a practical handbook on agroforestry, in an easy to read format written for underserved and limited resource farmers and woodland owners living in the Southeastern U.S. The handbook is designed to assist farmers and woodland owners establish, manage and market agroforestry projects that are diverse, integrated, profitable, healthy and sustainable. A team of agroforestry experts collaborated to produce this manual. Rigorous and extensive reviews were made for each chapter to ensure the information applies to the targeted audiences and their needs.

The 1890 Agroforestry Consortium conducted two landowner focus groups in Birmingham, Alabama and Atlanta, Georgia. Although not all the suggestions were used to develop this handbook, the reviews expressed by the underserved and limited resource landowners were the “guiding light” that led to the development of this handbook.

The participants indicated they wanted the following subjects covered:

- What is agroforestry?
- Is agroforestry economically feasible?
- Are there local, state and federal resources available for agroforestry?
- What are some specialty crops that could be established in this area?
- What is the availability of potential grants and contracts?

The handbook is presented in five chapters, one for each agroforestry practice. Chapter topics are:

- Introduction
- The Basics
- Economic Considerations

- Further Assistance and information
- Success Stories

The authors sincerely hope that readers will find this guide to be a useful resource to establish and manage integrated, profitable, healthy and sustainable family farms and woodlands.

This handbook also provides technical guidelines with practical information that may be useful to field technical staffs to train small size farmers and woodland owners to establish, manage and market agroforestry projects that are diverse, integrated, profitable, healthy and sustainable.

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ALLEY CROPPING

W.D. 'Dusty' Walter, Larry D. Godsey, Gwendolyn D.L. Boyd, and Joshua Idassi

Introduction

This chapter is intended to help you design and manage an agroforestry practice called alley cropping (Figure 1). Properly applied on a landscape, an alley cropping practice can enhance and diversify farm income opportunities, improve the environment and create wildlife habitat. Developing an understanding of the interactions between trees and other plants will help you achieve the goals of the alley cropping practice.



Figure 1. Alley Cropping with black walnut and corn

When trees are established in rows separated by wide spacing that allow the growing of other crops in that between-row space, you have created an alley cropping practice. Depending on the space between rows of trees, alley cropping can be designed to use plants that do well in either full sun or partial shade. It is also possible to design alley cropping to begin growing sun-loving crops and then change over to shade tolerant crops as the tree rows begin shading the alleys (Figure 2). Understanding plant interactions and competition will help you design an alley cropping practice that meets your needs. Proper planning helps you achieve success.

When properly designed and used on a farm, an alley cropping practice can benefit overall farm productivity and the number of farm products that are produced, while at the same time helping to improve the environment by reducing soil loss and improving the use of soil nutrients, such as nitrogen and phosphorus. However, for proper design it is essential to have a good understanding of the goals for your land, both short and long term, and to design the alley cropping practice based on a good understanding of the interaction between the trees, shrubs and crops that have been selected.

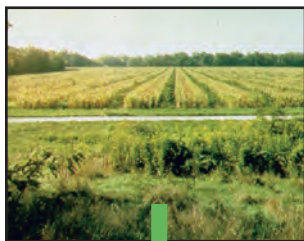
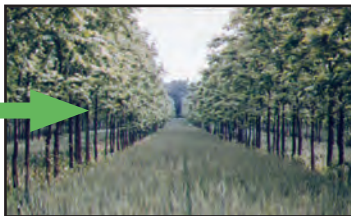


Figure 2. Changing from a sun-loving crop of corn, established with a six-row corn planter between tree rows on 22.5 foot centers, to a wheat crop. By age 9 this planting needs to be thinned if the owner wants to maintain row crops. The alternative is to change to a more shade tolerant crop, or to a tree product such as a nut crop.



Crops that can be produced in full sun include (Figure 3):

- Horticultural plants, such as tomatoes, corn and blackberries
- Forages, grains and oilseeds
- Tree crops, such as plums and nuts
- Seeds, such as wildflowers or select grasses
- Christmas trees
- Shrubs and other landscaping plants
- Trees for lumber and wood fiber products

Crops that can be produced at some level of shade may include:

- Herbal medicinal plants, such as ginseng, goldenseal and black cohosh

- Landscape plants like ferns, mayapples, and Jack in the pulpit
- Mushrooms such as shiitake



Figure 3. Lettuce intercropped with peaches until mid-June followed immediately by a pumpkin intercrop until October. (Ontario, Canada. Source: <http://www.omafra.gov.on.ca/english/crops/hort/news/hortmatt/2005/16hrt05.pdf>)

Advantages and Challenges of Alley Cropping

Advantages of Alley Cropping

Short-term cash flow from annual crops

'Sun' crops compete with weeds

Soil amendments for crops also benefit the trees

Trees reduce losses from runoff

Trees act as windbreaks for companion crops

Long-term income from tree products (wood, fruit, nuts)

Diversity of farm products

Challenges of Alley Cropping

Trees can be an obstacle during cultivating

Trees may compete with companion crops for light, moisture and/or nutrients

Companion crops may compete with trees for moisture and/or nutrients

Integrated management is often hard to do and challenging

The Basics

Design

Alley cropping is a multicropping practice – two or more types of plants growing on the same area of land at the same time – in which the trees, shrubs and/or other plants compete for light,

water and nutrients. An understanding of how different trees and shrubs, forages and grasses, respond to site conditions on your farm will be an invaluable tool in designing a successful alley cropping practice. In addition to appropriate species selection, there are a number of ways you can influence the ability of plants to compete for light, water and/or nutrients.

Different plants have different spacing requirements. When designing your practice, space the trees, shrubs and herbaceous plants appropriately for their mature size, or plan to thin them before competition reduces productivity. If you are starting with existing trees it is likely that some will need to be removed by thinning in order to reach the number of trees (density) that you want. If you are using new plants, this involves planting at the right density.

Between row spacing. The overall success of your alley cropping system often is linked directly to the spacing between the rows of trees. There is a direct link between the distance between tree rows and the years a light-demanding crop can be produced (Figures 2, 3 and 4). When the distance between rows of trees is increased, the years an alleyway may be farmed with minimal competition from the trees is increased. The spacing you select will be based on many factors, including whether the emphasis is on a tree related crop such as nuts or wood production, or on maintaining crop production in the alleys between the tree rows.

If the emphasis is a change to nut production from your system, then the alleyways will need to be wide enough to allow for full development of the tree's crown as well as spacing to accommodate nut harvesting equipment. However, if the emphasis is on wood production from the trees, you may choose to have narrower alleyways in order to have the highest number of tree stems per acre. The alleys will still produce income from an annual companion crop. However, with narrower alleys, it will be necessary to plan for an earlier change to a companion crop which can grow more easily in a shaded environment.

If maintaining an annual income from specific alley-grown crops is a major desire, then alleyways must be designed wide. Since many alley crops are not shade tolerant (e.g., row crops, forages, or small berry crops), alleys must be wide enough to meet their light requirements. In addition, the spacing will be

determined by the length of the cropping system selected. If a shade-intolerant crop is to be grown in the alleyway for more than a few years (5 to 10), then the spacing between rows must be wide (75 feet or more).

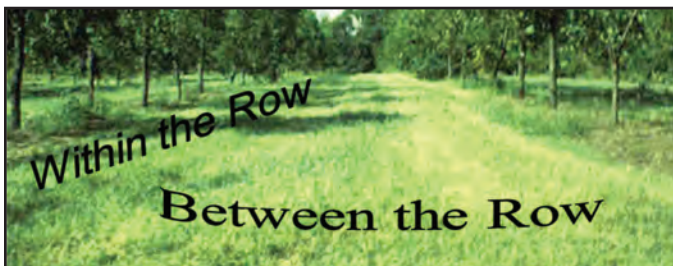


Figure 4. Spacing and row orientation impact the longevity of the alley cropping practice by influencing the competition between trees and crops for light, water and nutrients.

Within Row Spacing. Space between trees/shrubs within a row will have a strong influence on their growth and development. For example, trees that are grown tightly spaced will have a tendency to grow up, towards the light. This type of growth is highly desirable when growing trees for quality wood production. Additionally, as these tightly spaced trees begin to produce shade on one another, each of their branches in the shade will begin to die and eventually fall off. This is called self-pruning, and is again desirable when trying to grow high quality wood in timber production.

On the other hand, trees spaced far apart tend to grow out, as well as up, creating larger tree crowns. Also, the additional light on lower branches encourages a tree to keep and grow those branches. While this is not highly desired in trees grown for timber, it is desirable if a tree is being grown for nut production. Therefore, if a tree, such as pecan, is planted with the intention of harvesting nuts, then a wider initial establishment will help branch development and growth creating a better tree for nut production. And, since light is important to the crown of trees producing a nut crop, the wider spaced trees allow for full sun to reach that tree's crown for extended longer number of years before a thinning within the row is required. For nut production, a beginning spacing of 30 feet between trees may be best. However, it is likely that some trees will need to be removed at some point in the future.

Row Direction. Row direction should be an additional consideration when establishing your alley cropping practice. In general, by establishing tree rows on an east-west orientation, more sunlight can get to the alleyway. If however, erosion or wind control is a concern, then trees may be established on the contour to minimize erosion, or perpendicular to prevailing winds. In these cases, although available light may not be maximized, yields can be maintained by addressing other areas that limit production.

Multiple Tree Rows. Trees and shrubs within the rows can be arranged in several different ways including single rows, double rows or other multiple row configurations (Figure 5). Factors influencing how many rows to establish and the arrangement of the trees within the rows should be based on a number of potential benefits.



Figure 5. Examples of single, double and triple row configurations for alley cropping

Advantages of single and multiple row plantings
Single Row
Less ground is used
Better for nut production
Maintenance is simplified
Fewer trees to plant
Farm production is enhanced
Multiple Row
Enhanced erosion control
Better growth of trees for timber
Improved wildlife value
Greater diversification of farm products

Equipment Needs. The alley between the tree rows should be wide enough to allow clear passage of the widest piece of equipment. This includes planning to allow space for the growth of the tree crowns. This is particularly important in nut production when early crown development is desirable. Plan alleys such that full, or multiple, passes of the equipment can be utilized. For example, if using a 13-foot wide disk, it may be desirable to have an alleyway 60 feet wide. This allows for four passes with the disk (52 feet) and a buffer of eight feet to ensure damage is not done to the tree trunk (Figure 6). The equipment you own will dictate much of the design and spacing chosen for the alley cropping practice.

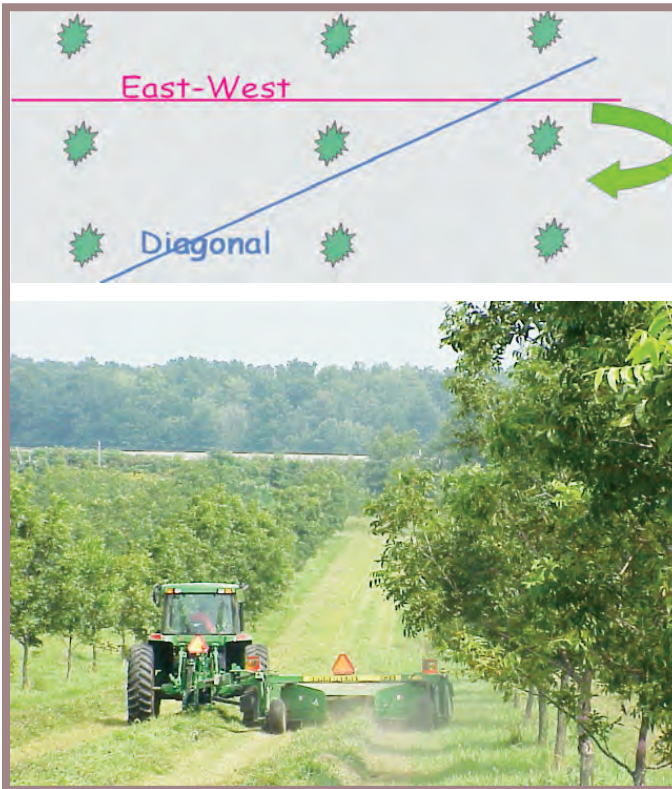


Figure 6. Plan for the type of equipment used in harvest and management. Row orientation, direction of travel, and turn radius of equipment should all factor into the layout of an alley cropping practice

Management

Below-ground Management

Root Systems. Trees, shrubs, grasses, crops and other plants can have root systems that are shallow, deep or both. Plants that have root systems in the same depths of soil are going to be in competition for water and nutrients, and will impact the yield and growth of each other. Ideally the trees selected for an alley cropping practice should have a deep root system in order to minimize competition with crops in the alley. However, if erosion is a concern, then trees with a more shallow root system may provide better soil stability. If root competition looks like it is happening, one method of reducing this competition is to prune roots so that they do not occupy the same area.

Root pruning lowers the competition between trees and crops grown in the alley. Starting early will help train roots to grow deeper. If you have existing trees that need root pruning, then partial pruning in steps is recommended to reduce the shock to a tree. Pruning too many roots from older trees will damage their ability to collect water and nutrients, and will be evident by damage in the tree's crown. Pruning in steps involves pruning part of a tree's root system over a number of years. At the very least, you should begin by only pruning roots on one side of the tree in a given year. However, once the process is started you will want to prune tree roots every year or two in order to keep them from growing into the cropped alley.

Manual root pruning can be done by forcing the blade of a spade into the soil or by digging a trench. Mechanized root pruning is done with a tractor mounted ripper, coulter or chisel plow, ideally with subsurface knives attached to sever deeper roots. How close to the trunk to prune the roots depends on where the plants in the alleys are growing. Pruning tree roots inside a tree's drip line (outer edge of the tree crown) should be done cautiously to minimize damage to the tree.

Fertilization. In most cases extra fertilizer will not be needed. Trees will benefit from crop fertilization. Where concern exists over trees taking nutrients from the crop, then competition can be minimized by root pruning or by adding more nutrients. Nutrients can be added in the form of chemical fertilizer, animal manure or a wide range of other materials. This may also include

the use of living mulches or green manures (see <http://www.attra.org/attra-pub/covercrop.html> for additional information).

Canopy Management

If there is too much shade under an existing stand of trees, the canopy can be pruned to allow more light to reach the understory plants. You may be able to accomplish this by pruning for improved timber production. Start by removing branches low on the stem of a tree, to raise the height at which the canopy begins. This allows more light to reach the ground from side angles. Remember, removing more than 60% of the tree's leaves and branches (live crown) may significantly reduce the growth of the tree. It is a good general rule to always leave at least 50% of the trees height in live crown in order to maintain good tree growth..

Trees with small fine leaves will also allow more light through the canopy. These leaves decompose rapidly and allow nutrients to be recycled into the soil faster, and at the same time this will begin to improve the overall soil health.

Additional considerations may include the use of trees that leaf out late in the spring and/or drop leaves early in the fall. If the crop in the alleys matures in early spring like winter wheat, or heads out in late fall like milo, a tree species should be incorporated that best accommodates the light needs of that specific crop (i.e., a tree species with a late dormancy for winter wheat; or a species that drops its leaves early for milo).

Ground Management

Weed Control. Weeds are plants growing in your agroforestry practice that you don't want there, and that compete for water, nutrients and light with the plants for which you do have a market. Where necessary these trees, shrubs or herbaceous plants should be removed or suppressed to reduce the competition with your crop plants. Weed removal can be done in a number of different ways from herbicides, to cutting, to cultivation. An additional consideration for use in controlling weeds adjacent to trees may include mulch, fabric barriers or living mulches (plants that don't compete with your crops but help reduce unwanted weeds). The control of undesirable plants in your alley cropping practice will better ensure its success.

Irrigation. On some sites irrigation may only be required for the first year or two until root systems are well established. In other cases, as in some dry areas, your tree plantings may need permanent irrigation of some type. If you are unable to irrigate, make sure you chose trees, shrubs and herbaceous plants that will grow in your climatic area and soils without additional water.

Economic Considerations

Economic budgeting is a very flexible process. However, effective use of budgets requires an understanding of the crop practice or system to which it is being applied. Alley cropping poses some unique economic budgeting problems because it involves multiple enterprises with varying cropping cycles, such as trees, row crops, forages and/or livestock.

First, unlike most agricultural crops, alley cropping has a planning horizon of greater than one season due to the tree or shrub component. A planning horizon is simply a time period which covers all costs and revenues for a given practice. For soybeans, a planning horizon may be six months to a year. For alley cropping, a simple planning horizon may be as long as 60-80 years when the timber value of trees are taken into consideration. However, the planning horizon may also include tree incomes much sooner than 60 years. The time it takes to begin realizing a money return from the tree crop depends on the product being harvested. In the previous examples, the harvest of timber may take 60 years, while the harvest of profitable nut crops may only take 10 years that repeat on an annual basis. The planning horizon is for the duration of your alley cropping practice and may include multiple income opportunities.

Second, because of the longer planning horizon of alley cropping practices, many of the incomes and costs do not occur at regular or predictable intervals throughout the entire operation, but are irregular in occurrence.

Finally, because alley cropping practices typically incorporate a fixed tree or shrub component with an alleyway crop, the crop may change over time. For example, an alley cropping practice may start out as soybeans grown between rows of black walnut trees, but by the time the trees are producing nuts, hay may be

the crop grown between the rows of trees because a smoother surface is required to mechanically harvest the nuts and less light is available in the alleyways. These three characteristics of an alley cropping practice require a specific type of budgeting method that will be flexible enough to allow for variable crops, as well as detailed enough to show annual income for the entire planning horizon.

Alley cropping budgeting is therefore a two-step process. The steps are to develop enterprise budgets, and combine the enterprise budgets into a cash flow plan. An enterprise budget is a complete, detailed listing of all the costs and income expected for each single crop, such as corn, livestock or nut and timber trees. A cash flow plan combines the details from the different enterprise crop budgets in the agroforestry practice and adds a time dimension. The enterprise budget provides a framework for reporting and monitoring the profitability of each enterprise, and the cash flow plan provides the information necessary to assess and forecast the economic feasibility of the agroforestry practice over time.

Economic analysis is not meant to be a one time activity. It is a roadmap to help in determining the profitability of your alley cropping system and to assist in understanding when costs might occur over the life of the planting. For more on development of a personal enterprise budget and cash flow plan, please feel free to download the Agroforestry Economic Handbook titled *Economic Budgeting for Agroforestry Practices* at: <http://www.centerforagroforestry.org/pubs/economichandbook.pdf>.

For information on profiting from trees and other agroforestry crops visit www.centerforagroforestry.org/profit/.

Further Assistance and Information

Technical

USDA National Agroforestry Center

<http://www.unl.edu/nac/alleycropping.htm>

University of Missouri Center for Agroforestry DVD

Visit www.centerforagroforestry.org, or the University of Missouri Extension web page at <http://extension.missouri.edu/explore/agguides/agroforestry/af1008.htm> to purchase.

ASA Book Chapter

Garrett, H.E. and R.L. McGraw. 2000. Alley Cropping. IN: North American Agroforestry: An Integrated Science and Practice (H.E. Garrett, W.J. Rietveld and R.F. Fisher, eds.). Agronomy Society of America, Madison, WI. pp. 149-188.

UMCA Research Publications

<http://www.centerforagroforestry.org/research/pubs.asp>

From the United Kingdom

<http://www.agroforestry.co.uk/silvoar.html>

From the Association For Temperate Agroforestry (AFTA)

http://www.aftaweb.org/alley_cropping.php

From the University of Florida

<http://cstaf.ifas.ufl.edu/research2.htm>

From Australia

<http://www.rirdc.gov.au/>

Financial

There are a number of cost-share and incentive programs and grants for landowners interested in the establishment of an alley cropping system. You may contact your local Extension office, NRCS office, or Soil and Water Conservation office for information regarding the following cost-share/incentive plans:

Environmental Quality Incentives Program (EQIP)

USDA-Natural Resources Conservation Service

Wildlife Habitat Incentives Program (WHIP)

USDA-Natural Resources Conservation Service

Conservation Stewardship Program (CSP)

USDA-Natural Resources Conservation Service

Sustainable Agricultural Research and Education Program (SARE)

USDA-National Institute of Food and Agriculture

Success Stories

Dan Shepherd
Shepherd Farms
Clifton Hill, Missouri

Bluegrass hay and pecan alley cropping practice; buffalo ranch and agritourism business



Dan Shepherd raises buffalo for processing into lean, high quality meats and jerky, in addition to his pecan and bluegrass hay alley cropping practice. Shepherd Farms is also a nationwide leader in production, wholesale and retail distribution of eastern gamagrass seed. "Alley cropping is ideal for achieving both our production and conservation benefits," said Shepherd. "We earn an annual income off the ground, while the trees are being established. We also enjoy an abundance of wildlife in the habitat created by alley cropping. While the crops are growing we see deer, turkey and quail utilizing this ground and the trees."

Alvin and Shirley Harris

Harris Farms
Millington, Tennessee

Growing hybrid eastern black walnuts using organic farming principles: An Interview by Dr. Frank Mrema of Tennessee State University Cooperative Extension



Introduction: Just beyond the northern suburbs of Memphis, amid fields of cotton and soybeans, forested creeks and new housing developments, lies the small family farm owned by Alvin and Shirley Harris.

Frank: Mr. Harris, when did you learn about alley cropping?

Alvin: When Dr. David Brauer, the USDA-Agricultural Research Service representative in this project, talked to me about growing eastern black walnut trees in my farm. I wanted them far enough so I could grow something in between while the trees were growing. I knew nothing about growing trees. While the trees were growing I wanted some space where I could grow watermelons, black eye peas and other short rotational

crops. I was instructed to grow the trees using 25' by 25' spacing. My interest was to space them in this format, 25' by 30' so that I have more room in between the rows to grow some other crops, while these trees are growing.

Frank: Was the space in between the rows based on the machinery you were using or the crops?

Alvin: It was based on an arbitrary figure that I picked. I wanted enough space to grow three to four rows, and thirty feet was going to give me pretty good spacing.

Frank: So how many types of crops do you normally plant in your alley cropping?

Alvin: I've grown peas, watermelon, corn, and etc. by rotating them every now and then. That's the only things I have grown in between the trees.

Frank: Are there any other species of crops apart from the ones you mentioned which you grow in the alley cropping in other areas?

Alvin: Oh yeah. I rotate the crops on the whole farm on a three to five year rotation. Everything is rotated, but I haven't grown tomatoes or anything like that in here. I have too much other space, and I don't want to take a chance on losing a crop of tomatoes in here. I know what I can do with them out there. The peas and the corn have done really well in here. The watermelons did really well.

Frank: Which species did you say have done well in the alley cropping system?

Alvin: Field peas... all types of field peas, cream peas, purple hull... all types of field peas did well in here. The corn did well the year we planted corn in the site. Also, the watermelons did really well. So I have no complaints about their performance in the field. Very good results.

Frank: Did somebody come and tell you to practice this or was it your own initiative?

Alvin: It was mine. Nobody told me anything. But I've been rotating crops for years. A lot of what I do I learned overseas traveling around the world seeing how they did things.

Frank: So you traveled overseas. That's where you learned about this practice?

Alvin : Well I saw more of it over in Europe and Asia than I did any place in the U.S.

Frank: Organic farming is a costly practice, and may be very expensive to other farmers. How do you manage and account for the cost you inject on the alley cropping?

Alvin: I don't get the production off the whole field because the space where the trees are, I'm losing that space. But I don't do intensive farming anyway. Everything I do is organic. These trees are grown organically. There are no chemicals out here on the farm anywhere. I have been doing this for 30 something years and it's going to stay that way.

The forage and the blueberries we have up there, are all organic. In the last 30 years I haven't used any chemical fertilizers or petroleum based fertilizers on the farm. So I did organic farming when they told me it couldn't be done, and I'm going to continue doing it. I've made money so I'm not complaining. So everything out here on this farm is organic, everything!

Frank: Is there any other reason you decided to grow organic crops instead of others?

Alvin: Yes. I was in the military. I was trained in chemical warfare, and I know chemicals and their affect on plants and the environment in general. That was the basic reason. And I know if you put it in the soil the plants will absorb it and then we will eat it in the form of foods. I also refused to feed it to my children and to the general public.

Frank: Will you advise other farmers to practice alley cropping system?

Alvin: Alley cropping. .. Yes... As far as the trees, if they are not going to do it for nuts even if they put in trees for timber, while the trees are small they need to grow something between them—make some money somewhere because if I was growing these for timber, what are we talking about? Forty years. Forty years with no income would be real trouble for a person that needs money. But if they space them so they can grow something between them, even for 10 years, you've got 10 years of income from the land. Whereas right now even with the nuts I haven't lost that much on the farm yet. I am making money in this field every year. Not from the trees yet, but from growing produce in between them. I still make money. Really I haven't lost anything, I don't think, in this field, and I think this is the fifth or sixth year.





FOREST FARMING

Deborah B. Hill and Rao Mentreddy

Introduction

Sales of medicinal plants are now worth \$60 billion worldwide, and over \$12 billion in the United States. For example, a grower of goldenseal in Georgia can earn \$6,500 per acre each year. A well-managed hive of bees can gross \$300 per year for all bee products, and remember their value in pollinating crops. In an 800-log shiitake business, a grower can earn about \$6,000 per year (see Success Stories). Returns from timber can take 50 to 80 years. In the past, forests in the South have been managed badly or not at all. Their quality can be improved by “weeding,” which foresters call timber stand improvement (TSI). Economic returns on weeding can take many years. A guaranteed way of making cash flow faster is by farming the forest. Forest farming is managing the forest to produce things called non-timber forest products (NTFP) that can be sold on a yearly or short-term basis. Non-timber forest products are a variety of “crops” that can be produced in a forest. These include, but are not limited to:

bee products	fuelwood	maple syrup	fence posts
medicinal plants	crafts	fruits & nuts	mushrooms

These forest farming options need attention in different seasons. Bee products, fruits and nuts, mushrooms, and medicinal plants are usually managed during warmer months. Maple syrup is collected and processed in mid to late winter. Firewood, fence posts and craft materials can be collected year round. Management of these options may compete with time, money and energy needed by other farm crops. However, developing several of these options will improve the quality of the remaining timber on the forested land and at the same time provide annual or short-term extra income for the farm or forest.

Many of these forest farming options need equipment, skills and knowledge, which can be very different, depending on what

you choose to do. For example, maple syrup production needs expensive equipment to begin, but once you have the equipment, those costs are usually not repeated. However, maple syrup is a high value product with a long shelf life and can be marketed year round. On the other hand, firewood, fence posts and craft materials may only need basic tools, knowledge and time to create a product. They can be collected, created and marketed at any time of year, although firewood would probably sell more rapidly and in greater amounts in the winter months.

The economics of developing non-timber forest products in a forest farming system can be very different. Options like maple syrup will probably need an investment of several hundred dollars to get all the necessary equipment. On the other hand, options like crafts materials and native fruits and nuts may not require any out-of-pocket costs other than containers to sell the products in. Products like maple syrup, some medicinal plants, mushrooms and honey are high-value products and will bring a quick return on investment, while crafts, jams and jellies may make money in volume rather than in per unit value.

A variety of options and references are outlined in this chapter to help you look at forest farming further. Depending on what resources you have in your woodlots, you could choose to do one, several, or all of them. Many have specific times of year when you need to work on them. Maple syrup production is usually a four to six week period in late winter/early spring, and then you are done for the season. Crafts can be worked on all year. Choose things that interest you and that you know you will be able to market locally or on the Internet.

Beekeeping

Introduction

Raising honey bees in hives can produce honey, beeswax, pollen, propolis (beehive glue) and royal jelly. These products can be harvested every year (honey possibly can be harvested more than once a year) and are valuable. From these basic products, several other value-added products can be developed for more income.

The Basics

Buy your bees, equipment and materials and put your hives in a place protected from wind and near either crops or orchards. Get advice from neighbors or your extension office on how many hives to start with and what kinds of bees have been most successful in your area. Check your hives at least once a week for disease or loss of bees. Make sure they have water and if the weather gets dry, make sure they have sugar water. Always leave enough honey in the hive for the bees to feed on over the winter. Other beekeepers can help you with this.



Materials and Equipment



You will need bees, a beekeeping suit, gloves, hat and veil, hive boxes, supers, smoker, and hive tools. Some equipment,

especially metal tools, can be found second-hand which can lower your startup costs. Since there have been problems with pest insects and diseases, it is probably not wise to buy hives second-hand. Check your neighborhood for other beekeepers and talk to them or ask at your county agriculture extension office for information. You may also contact your state beekeeping association and the state apiarist or bee specialist.

Economic Considerations	
Item	Cost
Starter kit (suit, gloves, hat, veil, one hive box with supers and bees)	\$200-\$400
Hive boxes	\$250
Supers	\$50
Smoker	\$35
Hive tools	\$4-\$6
Bees (1 pound)	\$75
Honey extractor (not every beekeeper needs to have one of these)	\$200-\$300

You will probably need to replace supers and bees every year (www.beekeepingstarterkit.com, www.kelleybees.com).

Crafts

Introduction

From sweetgum balls and locust pods painted with gold paint to make Christmas tree ornaments, to sculptures made of wood, crafts options created from wood or other materials (seeds, branches, twigs, roots, burls) found in woodlots are limited only by your imagination. Markets are available through statewide juried crafts guilds, farmer's markets, local craft stores, state park stores, and the Internet. If you are not feeling particularly creative, but have raw materials on your property (grape vines or kudzu for wreaths or baskets), you can also make money by selling the raw materials to the people who do make crafts.



The Basics

It all starts with an idea, whether you want to make baskets, or wreaths, or sculptures, or useful objects like spoons, bowls and walking sticks. Walk through your woods and see what kinds of trees, shrubs and ground covers you have. If you have an idea of something to create, check with your state tourism office or with a statewide crafts guild and see what your options are for marketing your product. You will be surprised at what people will pay good money for!



Materials and Equipment

The kinds of materials and equipment you will need to make crafts depends on what you want to make. Usually you need hand tools, paints and brushes, small saws, and so forth and a space to work that is big enough for your project.

Economic Considerations

If you are creating a product out of “found” things in your woods (cones, seed pods, oddly shaped branches and so on), the start-up costs are mainly your time, which, as you continue to make your product, will also be the major recurring cost.

Fruits and Nuts

Introduction



We are talking about fruits and nuts that occur naturally in our woodlots. This could include persimmons and pawpaws, wild grapes and berries, black and white walnuts, hickory nuts, hazelnuts, and beech nuts. Because native fruit species seem to ripen at the same time, it is hard to get a good price for them as fresh fruit, since there is lots of competition in the marketplace. So, rather than marketing them as fresh fruits, you might want to consider making value-added products such as jams, jellies, wines, fruit leathers or other products. Value-added products have long shelf lives, and can be marketed year-round. The nuts can be marketed fresh. Black walnuts are a gourmet item, and Hammons Products in Missouri collects them (in the hull) from different locations in seven surrounding states, so there is an annual market for them. The other nuts can be gathered in the fall and marketed through farmer’s markets and local grocery stores.

The Basics

It is important to know your woods well. Walk through them and learn to identify the trees and shrubs that are there. If you have native fruit and nut trees, and berries, clear some of the trees that are right next to them so that the fruit and nut trees can spread out with more branches where the fruits and nuts are produced. Removing some of the competition not only gives the trees you want more sunlight, but also gives them more water and nutrients than they had before.

Materials and Equipment

There are no special materials or equipment needed for growing and harvesting native fruits and nuts. You may want to buy collecting baskets or bags to make collection easier in the fall, but you can also use buckets and baskets that you may already own. If you decide to make value-added products, then you would need whatever materials and equipment that are necessary. You may need large pots, canning jars and lids for jams and jellies, and fermenting equipment, bottles and caps for wines.



Economic Considerations

Since there are no special material or equipment needs for harvesting native fruits and nuts, the costs are limited to what you decide to do with the fruits and nuts once they are harvested. Whatever containers (jars, bottles, lids, caps, labels) your value-added products are sold in are examples of materials that will need replacement on an annual basis.



Maple Syrup

Introduction

Maple syrup has been made in North America for hundreds of years. Native American tribes, particularly in the northeastern United States, made it from the sap of maple trees. Products include maple syrup, maple butter, maple sugar, and maple candies. All of these products are marketable year round, and all have long shelf lives. All are also high value products.

The Basics



Check your woodlots and see what kinds of maple trees you have. Maple syrup can be made from any kind of maple tree. Sugar maples are the best because they have a higher sugar content in their sap than the other kinds of maples. You need a lot of trees (10 - 20 at least) that are fairly close together in the woods and have a minimum diameter of 10 inches. This may require removing some small trees, or making openings to let some sunlight in, to favor the trees that you want to keep. This is one option that you should not just try to go out and do on your own. A good reference manual on maple syrup production is the *North American Maple Syrup Producers Manual* (Bulletin 856) from The Ohio State University. Working with that, and talking with someone else who has tapped trees, will be very helpful.

Materials and Equipment

Maple syrup production is probably one of the most expensive non-timber forest products to get into. You need stainless steel equipment (pans, piping, baffles or flanges in the boiling pans) to boil down the sap, and if you are going to do this as a serious business on an annual basis, you probably should have a special “sugar shack” that you would use only to make the syrup. The steam from the boiling sap can be very sticky, so you don’t want to try this in your kitchen. The good news is that the expensive equipment is probably a one-time cost, but it still means the money is going out before the product is bringing it back in. Sometimes you can find second-hand equipment that isn’t quite so expensive, or if you have neighbors that might be interested in making maple syrup, too, you could buy the boiling down equipment together.

Economic Considerations

As was noted before, the boiling equipment is the expensive part. There are, however, replacement costs for collecting buckets or tubing, spiles (the spigots that go into the trees to collect the sap) and containers for selling the syrup. Maple syrup and other maple products have long shelf lives and are marketable all year through many different options of outlets (local grocery stores, craft stores, farmer’s markets, etc.).



Medicinal Plants

Introduction



Forest medicinal plants grow mostly near the ground under shade, and, like most plants, need special soil and environmental conditions. It is important for the grower to understand the special plant-soil relations for the target plant. Many medicinal plants are most valuable for their roots. Many are also perennials, so that once you have started them growing in an area, they will continue to grow year after year. Some can be harvested every year. Some, like ginseng (*Panax quinquefolius*), take many years to grow big enough for a valuable harvest. Before you decide on what crop to grow, walk through your woods and find out what type of trees you have, what your soil type and pH are (see your County Cooperative Extension office and USDA Service Center for help with this), and what kinds of plants are growing under your trees and shrubs. Most of the forest medicinal plants grow in mixed communities. For example, if you have mayapple (*Podophyllum peltatum*), you may also have ginseng, black cohosh (*Actaea racemosa*), goldenseal (*Hydrastis canadensis*) and/or bloodroot (*Sanguinaria racemosa*). One very important thing is to find out what the market is for the plant or plants you want to grow. Most of the well known forest medicinal plants need 60% to 80% shade during their growing season (spring and summer), and deep, moist, well drained forest soils with pH measurements between

6 and 7. They also will grow best if they have special fungi growing on their roots called *mycorrhizae*. Ginseng for example, grows well under dense shade from tree species such as sugar maple, basswood, tulip poplar and black walnut. Ginseng also needs a lot of calcium and does well under maple trees which supply calcium. There are other forest medicinal plant species such as vanilla leaf (*Carphephorus odoratissimus*), roundleaf sundew (*Drosera rotundifolia* L.), true unicorn (*Aletris farinosa*), and trilliums (*Trillium spp.*) which are common in southern forests.

Medicinal plants can be grown for raw products such as the roots, stems, bark or leaves (or combinations of these from the same kind of plant). Some can be marketed fresh, but most are sold dried.

They are bulky materials and need proper storage and packaging. They will involve shipping costs which may reduce the amount of your profit. Adding value or product packaging, such as making tinctures, lotions, steam distilled aromatic oils, and soaps could bring higher prices and greater profits. A success story is a farmer in Georgia who has developed a



wide range of products using organic goldenseal. The farmer is able to increase his profits by offering not only bottled products and soaps, but also seed and roots for planting, which he can sell to other growers in the cooperative he has started. Organic production of medicinal plants results in a purer product and brings the highest prices.

The Basics – ginseng

Scouting your woodland will help you decide what grows best among the forest trees and will help you decide whether you want to grow them as wild-simulated or woods-cultivated. The easier and cheaper wild-simulated method can make money on

a large or small scale. For most of the forest medicinal species, planting is done in the fall. Using a rake or a garden hoe, rake the leaves aside, make furrows 1 inch deep and about 3 inches wide



about 18 inches apart in beds 5 feet wide and about 50 feet long under trees that make about 70% shade. Plant stratified seed (seed that has gone through a cold period – either overwinter or in a refrigerator) 3 inches apart in the furrow, cover the seeds with $\frac{3}{4}$ inch of soil and lightly press down the soil. Rake the leaf litter back over the seedbed. If your soil needs something to correct the pH, gypsum or rock phosphate may be applied over the surface of the bed. The seed will germinate the next spring. In the wild-simulated method for ginseng, no more work is required after planting until the roots are dug six to ten years later. Since many of the medicinal plants need more than one year to mature for market, new beds should be planted every fall, for future harvests.

10 lbs. of ginseng seeds	\$800
Planting labor (160 hrs. at \$6/hr.)	\$960
Harvest labor (270 hrs. at \$6/hr.)	\$1,620
Drying labor (16 hrs. at \$6/hr.)	\$96
Gypsum (16 - 50 lb. bags at \$4/bag)	\$64

One person can reasonably plant one acre or more each year with hand tools, even on steep hillsides. The quality of harvest depends on whether or not you have chosen a site that is good for your target plants. Preparing cultivated beds (woods-cultivated) under the forest canopy requires more labor, so it is more difficult to develop an acre of product using this method. You need small machinery such as a small tractor with a backhoe, and disking and cultivating equipment, in addition to farm tools such as shovels and rakes to cultivate medicinal plants. This has a higher cost because it needs more materials, equipment and/or labor. In this method, prepare a fine seed bed under the shade of the

trees, using farming equipment. Plant seeds or 1 to 2 inch long root pieces the same way as in wild-simulated. However, with woods-cultivation, you may need to apply chemicals to protect the plants from weeds, insects and diseases. In terms of both labor and chemicals, this increases the cost of production. The more intensive management for woods-cultivation may give you higher yields than you would get with the wild-simulated method. Wild-simulated products often can be sold at a higher price than cultivated products, because they are grown without chemicals. According to some sources, a half acre of wild-simulated ginseng can yield about 80 lbs of roots, which is worth about \$15,300 to \$16,500 in net profit if sold at \$260/lb. For the woods-cultivated method, assuming sales at \$200 per pound, growers could average a gross income of \$80,000, and a net profit of about \$65,000. The same yield of cultivated ginseng (grown on raised beds under shade cloth in fields) sells at less than \$100/lb and yields a net profit of about \$25,000. These figures include costs for labor.

Materials and Equipment

The costs of growing wild-simulated medicinal plants are different for each plant type. An example of the cost of growing half an acre of wild-simulated ginseng is as follows:

Root yield	Gross income	Net income
50 lbs.	\$13,000	\$9,232
75 lbs.	\$19,500	\$15,732
100 lbs.	\$26,000	\$22,232

The amount of money you may be able to get for growing half an acre of wild-simulated ginseng depends upon the yield of ginseng roots and future prices. If a low price of \$260 per pound of dried roots is used, net income will be about \$15,000.

Economic Considerations

Startup costs can range from \$250 for wild-simulated to about \$2,500 for a cultivated ginseng crop and depends much on the type of medicinal plant or plants you decide to grow. The costs could be higher if basic equipment such as a small tractor and cultivation tools for preparing the seedbeds have to be bought.

Recurring costs include labor to weed the beds and apply chemicals if needed. For information on growing ginseng in a forest, refer to: Boisvert, H., Nadeau, I. and Poisson, G. 2005. Ginseng Grown in the Woods, version 3.0. (Agdex 262-1) Ministry of Agriculture, Fisheries, and Food, Quebec, Canada. 6 pg.

Mushrooms

Introduction



Lots of different kinds of mushrooms grow in our woodlots, some can be eaten and others are poisonous. Fortunately, most of the ones you can eat look a lot different from the ones that can make you sick. In addition to the kinds of mushrooms that grow naturally in our woodlots, there are some that can be grown commercially. The major mushroom that is grown commercially is a Japanese mushroom called shiitake (*Lentinula edodes*). Most mushrooms grow either on the forest floor or on wood. Shiitake mushrooms are grown on our native hardwood trees. Although they can be grown on pine and other conifer trees, the resins in those trees make the mushrooms taste funny, so they are not recommended.

The Basics

If you are interested in native mushrooms, the first step is to walk through your woods and see what kinds of mushrooms you find. Morels (*Morchella spp.*), often called dry land fish, are very valuable in the marketplace and are highly prized by chefs in restaurants. They appear in the spring, grow on the forest floor and have a cone-shaped cap with lots of pits or “holes” in them – they can be black, cream-colored or yellowish. They often can be found where there has been a fire, or near apple or elm trees (there might be apple trees in the woods where an old homestead once was). Chanterelles (*Cantharellus cibarius*) are bright yellow mushrooms that also grow on the forest floor, often in groups, and their shape is like a vase rather than a rounded cap like many mushrooms. These two mushrooms are most likely found on north or east facing hillsides where the soil is damp and cool. Both are worth a lot in the marketplace, but are very difficult to control in any way. Other native mushrooms that can be grown commercially are:

- **Lion’s mane** (*Hericeum erinaceum*), is a white or cream-colored mushroom that either looks like large cotton balls or like a frozen waterfall of little teeth in summer or fall. These are single mushrooms that can grow quite large and they often are found on hardwood trees that have been injured.



- **Hen-of-the-woods** (also called maitake, *Grifola frondosa*), often grows at the base of trees and looks like turkey feathers, with many overlapping shell-like brown and cream-colored rosettes in the late summer or fall.



- **Wine cap or burgundy cap** (*Stropharia rugoso-annulata*), can be found alone or in groups on the forest floor, but in areas that are more open, even in grassy areas in the spring

and summer. These reddish-capped mushrooms (which give them their common names) can grow to be very large, and are best picked when they are small – the size of button mushrooms in the market.



- **Reishi** (*Ganoderma tsugae*) is not a mushroom that can be eaten, but is used as a medicinal plant. When it forms a mushroom, usually growing on logs or stumps of conifer trees, it hardens quickly. When picked, it can be ground to a powder and put in capsules or made into tinctures. The Chinese call it “elixir of life.” These can be found all year, but usually grow from spring to fall.



Lion’s mane, hen-of-the-woods, and reishi can be grown on logs (hardwoods for the first two, and conifers for reishi). Wine cap can be grown on sawdust or wood chips. These mushrooms are all grown using a very similar method. You need logs of a size that you can lift and move around (usually 3 to 8 inches in diameter and 3 to 4 feet in length). The trees from which you get the logs must be alive and healthy at the time you cut them. Then you inoculate the logs with the spawn of the mushroom you want to grow. Spawn is a mixture of sawdust and spores of the mushrooms, with a little grain added for extra food for the growing mycelium, which is the main part of the organism. Mushrooms are the fruits of the organism. For shiitake,



sometimes the spawn comes in the form of small dowels which have been mixed with the spores so that the mycelium starts to grow. Inoculation is simply drilling holes in the logs, putting the spawn into the holes and sealing the holes with hot wax. Then the logs are left to incubate for several months before it is time for the mushrooms to start growing.

Materials and Equipment

To start a mushroom production business, you will need logs; a high-speed drill with wood bits; spawn; an inoculating tool if you use sawdust spawn; cheese wax and a flameless heat source (a second-hand deep fat fryer works well, or a hot plate); something to use to put the hot wax on the logs (dauber, paintbrush); aluminum tags; hammer and nails. It will protect your back if you have a high table or bench, or an X-shaped sawhorse to work on when you are drilling the logs. You will also need containers for selling the mushrooms, and a refrigerator to store them. Most of the mushrooms you can grow will take several months to incubate in the logs. Mushrooms like moisture, so you need to make sure the logs stay damp during their incubation period, and you will need either something like a stock watering trough or a sprinkler system to keep them damp. Check with your local Cooperative Extension Office to see if there are any inoculation workshops scheduled and go to one of those to get some hands-on experience. There also are materials on the Internet that can walk you through the steps of inoculation (for example, FOR-77 *Growing Shiitake Mushrooms on Logs: Step-by-Step in Pictures* from the Department of Forestry at the University of Kentucky). Materials and tools are also available from several sources around the U.S. If you are collecting native mushrooms, all you need are containers to collect them into (bags, baskets) and the time to go mushroom hunting.

Economic Considerations

If you do not already own a high-speed drill (800-1000 rpm), that will be the most expensive start-up cost (\$100-\$200). Any kind of equipment that you need to buy for your mushroom operation (for example, an inoculation tool, \$30-\$40), will be a startup cost and will not need to be repeated. The cost of wax and spawn will be the next highest cost (approximately \$25

for two pounds of sawdust spawn or 1,000 dowels – enough to inoculate 10-15 logs). If you do not have your own woodlot, then the logs themselves will be a cost (\$1-\$2/log). You may be able to work with an ongoing logging operation and get logs from the tops of trees or from large branches – this may reduce the cost of the logs. Once the logs have been inoculated, they can probably produce mushrooms for a few years (3-5 years, depending on the diameter of the logs). If you want a steady business for several years, you would be inoculating some new logs every year. Start small (maybe 50 or 100 logs) and find out how well the logs produce and whether or not you like working with logs and mushrooms. The mushroom season runs from early spring to late fall, and if you have a building in which you can control heat and humidity, it is possible to produce mushrooms all year long. Because the logs are usually stacked like cordwood several logs high, 50 or 100 logs don't take up much space. They do need to be in an area where they will receive 80% or more shade year round, so if you have a little pine stand, that might be the best place to put the logs.

Marketing these unusual mushrooms is the hard part. You will need to contact both local grocery stores, farmers' markets and restaurant chefs to sell them. It would be good to check out the market possibilities before you inoculate logs, but if you start with a small number of logs, you have about six months to do your homework before the mushrooms start appearing. Throughout the South, shiitake mushrooms have sold from \$8 to \$16 a pound fresh weight, mainly in farmers' markets. Selling to restaurants is like selling wholesale, so you would get less from them, but they can be very reliable customers. There is no set market like those for corn and soybeans for these mushrooms, so you have to make your own markets. If you don't like working with the public and with small businesses like grocery stores, then this is not a good option for you.

Further Assistance and Information

Apiculture

State Beekeeping Associations
Beginning Beekeeping in Kentucky

Crafts

Local or state crafts guilds or other organizations
Wood workers organizations
Local or state floral distributors/wholesalers

Exotic and Native Mushrooms

Field & Forest Products, Inc. (WI)
www.fieldforest.net/

Mushroom Harvest (OH)
mushrooms@eureka.net

Mushroompeople (TN)
www.mushroompeople.com

Northwest Mycological Consultants, Inc. (OR)
www.nwmycol.com

Kentucky Shiitake Production Workbook VHS/DVD/CD: *Growing and Marketing Shiitake Mushrooms on Natural Logs* (KY)

Fruits & Nuts

Cooperative Extension county offices, State Departments of Agriculture, Nut growers' associations, Orchard organizations

Maple Syrup

North American Maple Syrup Producers Manual
Ohio State University

North American Maple Syrup Council
www.northamericanmaple.org

Leader Evaporator Co., Inc.
www.leaderevaporator.com

Dominion & Grimm Inc.
dgusa@together.net

LaPierre USA Inc.
<http://www.elapierre.com/>

Medicinals/Botanicals

W. Scott Persons. *Green Gold* (ginseng)
Scott Persons and Jeanine M. Davis. *Growing & Marketing
Ginseng, Goldenseal & Other Woodland Medicinals*

American Botanical Council
<http://www.herbalgram.org/>

American Herbal Products Association (AHPA)
<http://www.ahpa.org/>

Aveda Corporation
<http://www.aveda.com/>

Botanical Liaisons
<http://www.botanicalliaisons.com/>

Elk Mountain Herbs
<http://www.elkmountainherbs.com/>

Frontier Herbs
<http://www.frontiercoop.com/>

Hardscrabble Associates
1061 Mountainview Rd., Waterbury, Vermont 05676,

USA Pfizer
<http://www.pfizer.com/pfizer/main.jsp>

Steven Foster Group, Inc.
<http://www.stevenfoster.com/>

Success Stories

Jim Day

Nashville, Tennessee



Jim Day built a hoop house to grow mushrooms year-round.

Jim Day wanted to grow shiitake (*Lentinula edodes*) mushrooms. This gourmet mushroom, originally from Japan, has become a mainstream mushroom in the United States over the past 30 years, and gets a good price in the marketplace. Starting in 2000, Jim inoculated a few logs, grew really nice mushrooms and established a marketing relationship with some restaurants in the Nashville, Tennessee area over the next year and a half. After his early success, in 2003, Jim expanded his operation from a spring-to-fall mushroom production to a year-round production. He also established his home place (about 5 wooded acres with his house in a suburban development north of Nashville) as Timbertop Farm (www.timbertopfarm.com). In order to grow the mushrooms year-round, Jim built a hoop house, 10' by 20' with its long axis oriented east-west. It's insulated on the north side and top, but has a non-insulated opening on the south side so that the winter sun can come in and help warm the inside of the building by passive solar heating.

Jim wanted to work with white oak (*Quercus alba*) logs but was having problems with competing fungi on the bark of his logs.

This is not a good thing in a shiitake production operation, since it is really important to keep the tree bark on the logs while the mushrooms are incubating and producing. In 2006, he submitted (and received) a grant proposal to SARE to test different management techniques to see if he could solve this problem. From that research work, Jim learned the importance of paying close attention to the logs at all stages of development, keeping good records and an activity log, and monitoring labor hours and expenses to help determine the fair market value of your product. Jim also advises to start small and grow as you gain confidence, don't be afraid to make mistakes, and diversify.

Jim's logs are mostly four to six inches in diameter and about three feet long. As a result of his research experience, Jim thinks that less is more, so he makes very few holes in his logs. When he first started, working alone, he inoculated logs with a series of two to three diagonal chainsaw kerfs, packed them with sawdust spawn and waxed them just the way you would with dowel or sawdust plug spawn. Today, with the information he got from his research grant, and from many trial and error processes, Jim has expanded his operation and now has 1,000 to 2,000 logs in production, which have been producing about 1,300 pounds of mushrooms in a March to December growing season.



Since one of his best ideas was to diversify, in 2007 he built another, larger hoop house where he now grows gourmet greens, squashes (for the flowers), peppers and some oyster mushrooms, and is beginning to expand to outside production of other crops. He has an online order and delivery service and has turned his little "farm" into an economic success.

Randy and Cindi Beavers

OrganiPharm

Dalton, Georgia

On their 40-acre family farm, Beavers and his wife Cindi own OrganiPharm and grow *Hydrastis canadensis* or goldenseal, a plant valued for its antimicrobial properties. From goldenseal, they manufacture liquid dietary supplements. Goldenseal is on the endangered species list due to overharvesting in the wild. Beavers developed a domesticated form of the plant that small farmers and landowners can grow. They have 23 growers in the Southeast and are a 100-percent, grower-owned company.

In 1993, Randy and Cindi Beavers saw that they would one day be faced with the choice of either selling her grandfather's farm or moving there and trying to make a living. The couple spent three years learning about different crops. In 1996 they decided to build on their long time interest in native medicinal plants and try to grow several plant types organically, especially those considered endangered or threatened such as goldenseal (*Hydrastis canadensis*).

In the beginning, they did have another source of income. Although they could recognize certain medicinal plants where they grew naturally in the forest, Randy and Cindi had no farming experience. Starting out was even harder because there was very little information available on how to grow and market these plants profitably. After some "trial and error" in their first five years, they came to two important conclusions:

1. The small, independent grower is faced with an extremely limited market and therefore faces a very high degree of risk when trying to produce medicinal plants successfully. Producing these plants as a group of growers instead of alone allows the possibility of a wider distribution as well as the sharing of production techniques.
2. Producing science-based, value-added products from native medicinal plants as a group or cooperative offered the greatest economic return for all the growers.

Using these ideas, Randy applied for grants and awards from the US Department of Agriculture's Small Business Innovation Research Program (SBIR). Randy formed OrganiPharm, LLC

(OP) in 2007. OrganiPharm is a botanical product company that specializes in forest-grown medicinal plants. The company grows the raw material and processes it into various skin care products. OP currently has 12 member farms plus 11 additional participating growers located in Georgia, Alabama, Tennessee, and North Carolina. Over the past four years the group has developed about 10 acres of forest-cultivated goldenseal along with other medicinal plants such as ginseng, black cohosh, purple coneflower (*Echinacea*), and both elderberry flowers and fruit.

OrganiPharm increases grower/owner profits by producing a line of certified organic herbal extracts (USDA National Organic Program). The quality and reliability of their products have been recognized by the National Institutes of Health (NIH) through a new SBIR award to develop a series of goldenseal products to be used in NIH-funded clinical studies.

Medicinal plant production is a type of “forest farming” which holds much economic promise for the future. Randy believes that the current trends of a) increased consumer awareness of where the products they buy come from, b) tighter regulations about product purity, and c) environmental concerns, will come together to make medicinal plant production a practical crop choice for an increasing number of family farms. However, growers must be careful when choosing the medicinal plant crop to grow, and should work with other growers of the same crops in order to maximize their marketing ability and share production and marketing information.

The information from the Beavers’ project was used to develop potential on-farm forest sites to match natural sites as closely as possible. They suggest the following preparation and planting procedures:

- Clear six to eight foot wide alleys between the larger trees of scrub and undergrowth using a small backhoe.
- Till four foot wide beds within the alleys.
- Adjust soil pH to natural conditions (pH 6.0 - 6.5) with dolomitic lime.
- Use goldenseal root pieces (rhizomes) as planting stock and divide into small pieces, each with a bud and at least one root.

(Based on their research, the rhizome is expected to double in size every two years, resulting in a harvest size of 18 to 20 grams after four years.)

- Plant the goldenseal rhizomes on a 6 x 6 inch spacing pattern - 400 plants per 100 square feet. Because of tree locations, hills and slopes, and the need to keep enough space to work around the goldenseal beds, about 25% or 10,000 square feet of bed space is usable per acre, providing room for roughly 40,000 plants per acre.

A summary of the production and yield assumptions underlying the 5-year financial projections for the project are presented in the tables below.

Table 1: Production Assumptions and Estimates

Planting stock cost: \$5,000 per acre
Labor: 120 man hours per acre for clearing, tilling, planting, mulching (labor supplied by family)
Plants per acre: 40,000 (harvest weight = 18 grams each)
Alkaloid content: Sleepy Hollow Farms' average = 7.159%
\$10 for each 1% alkaloids/pound farm price for goldenseal (i.e., 3% alkaloid = \$30/lb.)
1/3 of the harvest replanted
Drying recovery factor: .32

Table 2: Yield Assumptions

Estimated Yield and Return per ¼ Acre	
Yield per ¼ acre	400 lbs (10,000 plants per ¼ acre)
Yield allocation	133 lbs replanted, 277 lbs net fresh harvest, 89 lbs net dry harvest
Return per ¼ acre	\$6,372 (89 lbs dry harvest x \$71.59/lb)

Table 3 indicates an annual net income potential of \$5,600 per acre for a small farmer with 1 acre of forestland suitable for goldenseal production and planted according to the following totally sustainable production system:

- The farmer would plant 1/4 acre of goldenseal per year for 4 years.
- In the 5th year the farmer would harvest the goldenseal planted in the 1st year.
- About 1/3 of that harvest would be replanted and harvested in another 4 years.
- No income is received in years 1 through 4. In year 5 (the first harvest year), the farmer recovers 85% of the out-of-pocket expenses incurred in years 1 through 4.
- The price per pound received by OrganiPharm growers is roughly 3 times the bulk market price.
- Costs of production are based on actual information produced through the SBIR awards.
- The system is sustainable, with the planting stock cost of the first four years becoming a capital investment which doesn't have to be repeated.
- This system gives individuals thinking about starting a forest farming project an opportunity to develop a reliable income stream on a part-time basis before going full time.
- It also allows existing farmers to diversify their operations without taking away from acreage used for other crops.

Table 3: Net Profit or Loss from One Complete 8-year Goldenseal Production Cycle

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Planting Stock & Seed	\$1,250	\$1,250	\$1,250	\$1,250	\$0	\$0	\$0	\$0
Tractor & Equipment Cost	\$250	\$250	\$250	\$250	\$125	\$125	\$125	\$125
Soil Amendments	\$100	\$100	\$100	\$100	\$100	\$100	\$100	\$100
Property Taxes	\$50	\$50	\$50	\$50	\$50	\$50	\$50	\$50
Organic Certification					\$500	\$500	\$500	\$500
Out of Pocket Expense	\$1,650	\$1,650	\$1,650	\$1,650	\$775	\$775	\$775	\$775
Income	0	0	0	0	\$6,372	\$6,372	\$6,372	\$6,372
Profit or (Loss)	(\$1,650)	(\$1,650)	(\$1,650)	(\$1,650)	\$5,597	\$5,597	\$5,597	\$5,597



Riparian Buffer Strips



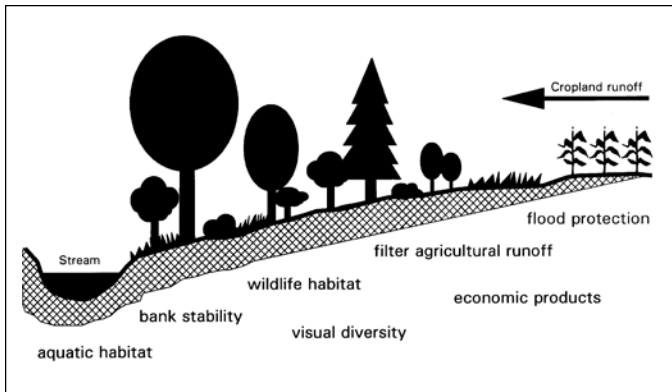
RIPARIAN BUFFER STRIPS

Colmore S. Christian, Rory Fraser and Joshua Idassi

Introduction

Riparian or streamside forests can improve your farm income by saving money or earning income. When planted correctly, they can protect water quality, stop erosion of stream banks, improve food and cover for wildlife, improve habitat for fish and other water creatures, and improve opportunities to make farm income through products harvested from the buffer. Lon Strum in Story County, Iowa, for example, says he has saved \$10,000 since putting in a riparian buffer. Before he did, his tractor would occasionally get stuck on the banks of the creek. Now, he no longer loses his crops from flooding and enjoys the benefits of a healthy stream and improved wildlife habitat. Buffer strips and riparian zones around streams improve and maintain the overall integrity of the waterway and improve aesthetics.





Many designs for a riparian buffer strip include three zones of vegetation, each planted parallel to the stream.

The combination of trees, shrubs, and grasses in a riparian buffer helps protect the stream and creates a better system than just planting a single type of tree. In addition, trees and shrubs provide well developed root systems and nutrient storage close to the stream. Landowner Strum says, “I don’t think we’ve lost hardly any stream bank since (the big floods of) 1993, but before, we were moving fences almost every year.”

One of the biggest benefits of a riparian buffer is making good wildlife habitat. Native grasses and forbs provide different heights, densities, shapes of stems and leaves, different flowering times, and different flowers and fruits to attract several different species of wildlife. Strum says his riparian buffer “is the hunting paradise of Story County right here, especially for pheasant hunting. People have come from Alaska, Michigan, and all over Iowa. The demand is very large.”

The Basics

A typical riparian forest buffer usually has three primary management zones:

Zone I. A 30-foot area closest to the stream that is mostly trees that can withstand periods of flooding. The main effect of Zone 1 is to stabilize the bank and provide woody “trash” for the stream habitat.

Zone II. A narrower (12 to 15 feet) area inland from Zone I with fast growing native shrubs that can withstand some flooding. Their primary water quality purpose is to take up and store nutrients. Woody stems also slow floodwater. This zone can be managed for additional income from nuts, berries or woody floral products.

Zone III. A wider (15 to 25 feet) area between crop fields or grazing lands and the shrub zone of the buffer strip that filters and absorbs nutrients and chemicals from the fields, keeping them from polluting the stream. Native grasses, forbs, sedges, reeds, and wildflowers are good for their multiple benefits and ability to withstand changing conditions, but dense, stiff-stemmed introduced grasses can also be effective.

Design

The first step in creating a buffer is developing a design that will work. You are strongly encouraged to make a sketch of the buffer on an aerial photo of the property and identify major problem areas, such as severe bank erosion, gullies, drainage tiles, and so forth. List the cash crops to be considered and make sure those trees, shrubs, and grasses grow in your plant zone (contact your local NRCS office for help with this).

If the stream banks are badly damaged, you may need to mend them with either plant or rock systems, or a combination of the two. To get professional help with this restoration contact your local Cooperative Extension Office, state forestry agency, USDA Service Center, or Conservation District.

The design should also address special problem areas, and should address three different locations:

In the Stream. What is the present condition of the streambed and the stream banks? You may want to consider the channel bed material, and whether or not the stream is downcutting. Look at points of erosion on the stream bank, such as slipping or bank undercutting. These areas may need to have their bank regraded with equipment, and then properly stabilized to slow or stop future bank erosion. Fish habitats may be a consideration in designing changes to the streambed.

Next to the Stream. Plants growing on land in direct contact with the upper edge of the stream bank can both stop or slow erosion and act as a living filter. This area can also function to filter flood debris and slow flood waters. You should consider the question: What and where is the problem I need to address? This question will help decide the kinds of trees, shrubs and grasses you choose, and how close you plant them to one another. Trees, shrubs and grasses differ in how well they can withstand flooding. Planting trees/shrubs/grasses in this area should also take into account the kinds of soils you have and how likely the area is to flood. Be sure and obtain a detailed soil map of your area. Soils maps can be obtained from your local NRCS office or from the Web Soil Survey at <http://websoilsurvey.nrcs.usda.gov>. Choose the type and kinds of plants that are adapted to your land and soil. Choose trees and shrubs that are deep rooting and good shade producers. Shade lowers water temperatures, reduces growth of algae and improves the oxygen content of the water. Forest farming opportunities within the riparian forest buffer can be explored. For example, crop trees such as walnut and cherrybark oak as well as ornamental shrubs and berries, or vegetation suitable for wildlife habitats, may also be grown here.

Between Buffer and Crops. This area is the first defense against direct runoff from neighboring land uses. Native grasses and forbs are most often used in this area.

Warm season grasses with stiff stems are preferred; however, it is again a good idea to check soil types and flood frequencies and durations to make sure that the grass of choice will do well and stay for the long term. These grasses should provide good soil coverage that will slow the overland flow of water, allowing it to penetrate the soil, and induce suspended sediments to drop out. Warm-season grasses are often used because they have both stiff stems and deep roots. This area may be very good for developing wildlife habitat.

Materials

A list of the different plant types, their planting location and spacing are a very important part of the design sketch. Include in your design some types of plants that can be used as cash crops in the short term as well as the long term. There are certain types of trees and vegetation that are more adapted to grow and thrive

in riparian buffer areas. Care should be taken to select plants and trees that do well with wetter streamside soils and that meet potential wildlife needs on the site. The landowner should consult with their county forester or a cooperative extension agent to determine the best species to plant and to review any design. Local and state nurseries sell a variety of wetland and streamside trees that a landowner can choose from. If beavers are present in the area where the buffer is to be installed, care should be taken to protect planted trees from damage. See Table 1 for potential streamside tree species to use in riparian forest buffer plantings and design. This list is intended to be used only as a basic guide. Each restoration site is different; therefore, planting plans should be developed on a case-by-case basis. Not all of the plants listed in the following tables are appropriate for all riparian buffer sites. Consult with local plant guides and/or plant professionals if in doubt about your buffer plan.

The following website is a good source for additional information on possible species: http://www.bae.ncsu.edu/programs/extension/wqg/sri/stream_rest_guidebook/appendix_f.pdf

Economic Considerations

Costs

Costs will depend on the problem and the possible solution. However, most costs such as streambed changes, planting trees and perennial shrubs occur only once. Grasses may need to be re-planted from time to time. Streambed changes can cost anywhere from \$10 to \$100 per foot; much of the cost is for heavy equipment and materials such as rocks and stones. Streamside efforts could cost from \$500 to \$1,000 per acre; much of that cost is for labor and plant materials.

Products

At the same time, many products produced in a riparian buffer can have cash value in addition to their conservation and environmental benefits. Florist or craft stores use a variety of plants, plant parts, and plant stems. Many local stores are interested in buying locally and sustainably grown materials such as berries and nut crops and even some timber products grown in riparian buffers. Some examples of specialty forest

products from riparian areas include nuts (chestnut, pecan, black walnut), fruits (black cherry, currants, elderberry, pawpaw, persimmon), woody decorative florals (dogwood, willows, witchhazel, bittersweet), and medicinals and botanicals (black cohosh, ginseng, mayapple, sumac, Culver's root).

In addition, one of the most notable benefits of a buffer is the creation of effective wildlife habitats, thus providing opportunities for fee hunting, fee fishing, and nature/farm tourism related to wildlife viewing and outdoor experiences.

Further Assistance and Information

Technical

- NRCS/Conservation District – maps and information on soils; plan development; practice design
- State Cooperative Extension Service –identifying problems/ opportunities and developing plans
- Local university faculty – current information on design and evaluation of buffers
- State Forestry Division or Commission – information on suitable local/native trees and shrubs
- State Fish and Wildlife Service – information on fish and wildlife habitats

Financial

There are many state and federal agencies offering programs that can be used to help plant and maintain riparian forests on private land or reimburse participants for installing these practices. One of these agencies is the USDA Farm Service Agency (FSA) that offers three different programs that support riparian forest buffer management: the Conservation Reserve Program (CRP), the Continuous Conservation Reserve Program (CCRP), and the Conservation Reserve Enhancement Program (CREP). Each of these programs is designed to protect lands that can easily be damaged by wind and water by offering annual rental payments and cost-share to help establish

various conservation practices. These programs also offer other financial incentives to landowners who agree to protect their land and keep it out of marketable production for a number of years. A partial listing of USDA programs that are available to landowners includes:

USDA Farm Service Agency (FSA)

- Conservation Reserve Program (CRP)
- Continuous Conservation Reserve Program (CCRP)
- Conservation Reserve Enhancement Program (CREP)

USDA Natural Resources Conservation Service (NRCS)

- Environmental Quality Incentives Program (EQIP)
- Wildlife Habitat Incentives Program (WHIP)
- Conservation Stewardship Program (CSP)

For more information on these programs go to www.nrcs.usda.gov/programs/ and www.fsa.usda.gov/programs/.

Table 1. Typical riparian forest buffer species for the Southeast

Common name	(Scientific name)
Trees	
ash, green	(<i>Fraxinus pennsylvanica</i>)*
ash, white	(<i>Fraxinus americana</i>) *
baldcypress	(<i>Taxodium distichum</i>)
birch, river	(<i>Betula nigra</i>)
cottonwood	(<i>Populus deltoides</i>)
hackberry	(<i>Celtis occidentalis</i>)
hickory, shellbark	(<i>Carya laciniosa</i>)
maple, boxelder	(<i>Acer negundo</i>)
maple, silver	(<i>Acer saccharinum</i>)
maple, red	(<i>Acer rubrum</i>)
oak, bur	(<i>Quercus macrocarpa</i>)
oak, pin	(<i>Quercus palustris</i>)
oak, Nuttall	(<i>Quercus nuttallii</i>)
oak, willow	(<i>Quercus phellos</i>)
oak, laurel	(<i>Quercus laurifolia</i>)
oak, overcup	(<i>Quercus lyrata</i>)
oak, swamp white	(<i>Quercus bicolor</i>)
oak, cherrybark	(<i>Quercus pagoda</i>)
oak, shumard	(<i>Quercus shumardii</i>)
native pecan	(<i>Carya illinoensis</i>)
persimmon	(<i>Diospyros virginiana</i>)
sugarberry	(<i>Celtis laevigata</i>)
sycamore	(<i>Platanus occidentalis</i>)
walnut, black	(<i>Juglans nigra</i>)
Shrubs	
alder, hazel	(<i>Alnus serrulata</i>)
buttonbush	(<i>Cephalanthus occidentalis</i>)
cane, giant	(<i>Arundinaria gigantea</i>)
dogwood, silky	(<i>Comus amomum</i>)
dogwood, rough leaf	(<i>Comus drummondii</i>)
hawthorn, green	(<i>Crataegus viridis</i>)
holly, deciduous	(<i>Ilex opaca</i>)
privet, swamp	(<i>Forestiera acuminata</i>)
Eastern wahoo	(<i>Euonymus atropurpureus</i>)
willow, black	(<i>Salix nigra</i>)
willow, coastal plain	(<i>Salix caroliniana</i>)

* Use these species with caution due to potential emerald green ash borer concerns.

Success Story

Frances and Will Powers

Oconee County, Georgia

For three generations, the Breedlove family in Oconee County raised their children on the family homestead. Ann (Breedlove) Powers wanted to do the same thing. Rising property taxes, increasing pressure to sell to developers in this highly lucrative market, and the cost of maintaining the farm was making hanging onto the land more and more difficult.

That's when the Powers family heard about something called the Farm and Rangelands Protection Program (FRPP) and made a visit to the United States Department of Agriculture Service Center in Watkinsville.

The first step was to develop a conservation plan for the farm with the help of USDA-Natural Resources Conservation Service (NRCS). NRCS provides the technical expertise on the land that helps determine the best use of all their resources in a way that conserves the natural resources for future generations. To participate in the federal conservation programs, you must have a conservation plan.

Cost-share programs from USDA's Farm Services Agency, NRCS, the Georgia Forestry Commission and others helped provide the funds to implement the farm renovation. Large riparian buffers were established and alternate water sources for livestock were constructed to help keep water clean and safe. Trees were planted to provide habitat for wildlife. Nutrient and pest management assistance is provided on an ongoing basis.

Now the heart of the farm, the home place, has been preserved through the joint efforts of the Athens Land Trust, Oconee County, the Georgia Greenspace Program, NRCS, the Oconee County Partnership for Farmland Protection and, of course the Powers themselves.

The development rights for 60 acres have been purchased using funds from Oconee County's GA Greenspace grant and

NRCS' Farmland Protection Program. These rights are held in perpetuity by the Athens Land Trust through a conservation easement.

The fourth generation, Frances and Will Powers, agreed to carry on the agricultural heritage of their ancestors and have ensured that agricultural benefits will be available to residents of Oconee County for generations to come.

Acknowledgment

The primary source for the information contained in this section was obtained from The Center for Agroforestry at the University of Missouri.



Silvopasture



SILVOPASTURE

O. U. Onokpise and J. Hamilton

Introduction

A silvopasture system integrates trees, forages, livestock and related animals and plant species. This practice can occur under planted pines, fruit and nut orchards, and/or other types of woodland, depending on the objectives and circumstances of the landowner. Silvopasture systems are managed to produce high-value timber products and possibly fruit crops in the long term while obtaining short-term economic benefit from the livestock and forage components. In the southeastern United States, livestock may be large ruminants such as bison and cattle, small ruminants, such as goats and sheep, or even domestic geese sometimes used in fruit tree orchards.

Establishing a silvopasture system requires many economic and management considerations to ensure its success in the long run. Landowners have shown impressive revenue benefits from their silvopasture practices. For example, George Owens in Florida realized more than a 10% increase in annual revenue by combining beef cattle with pine trees on his land. Allen Edwards, highlighted in the USDA National Agroforestry Center publication *Inside Agroforestry*, showed that a traditional tree farm focused on sawlog production may net \$150 per acre per year, while an integrated enterprise (of trees and sheep and/or goats) may yield up to \$500 per acre per year. In woodlands, other than pine plantations, which have problems with invasive woody shrubs, managed browsing by goats and other small ruminants can be effective. This will also reduce fuel loads and lower fire risks from wildfires. These sites can then be developed into permanent silvopasture systems. The end result will be a more sustainable land use. It should be noted that other animals, such as geese, when used as weeders in fruit and nut tree orchards assist in the management of insect pests.

Various options for silvopasture systems exist for landowners, for example:

- Wood and pasture for hay and silage
- Wood and grazing livestock (cattle, bison, sheep, llamas)
- Wood and browsing livestock (goats)
- Fruits and nuts with weeder birds (geese, ducks, turkeys)
- Christmas trees and sheep

Agencies such as the USDA-Natural Resources Conservation Service (NRCS) and the USDA-Forest Service (FS) assist with the establishment and management of silvopasture by providing specialized funding and technical assistance. Procedures and methods for designing and managing silvopasture systems are given in the next section.



Goats grazing on a thinned hardwood stand. *Courtesy O.U. Onokpise and A. McKenzie-Jakes (Florida A&M University)*



Fenced paddocks for rotational grazing goats. *Courtesy Uma Karki (Tuskegee University)*



Goats browsing underbrush in woodland. *Courtesy Uma Karki (Tuskegee University)*



Goats pulling down a vine from a tree in woodland. *Courtesy Uma Karki (Tuskegee University)*



Cattle grazing in a mature pine silvopasture system. Enough light reaches the ground floor to promote forage growth, yet the shade reduces heat stress and allows cattle to retain better weight. *Courtesy Jim Hamilton (NC Cooperative Extension)*



A beautiful silvopasture with slash pine and mixed forage. *Courtesy Jim Hamilton (NC Cooperative Extension)*

Advantages of Silvopasture
Livestock creates short-term cash flow not available with traditional forestry
Shade from trees protects animals and improves their health
Shade improves growth of forages
Makes property more beautiful and adds additional habitat
Improves nutrient cycling
Adds to on-going pasture operations
Nitrogen fixing forage crops also benefit trees and vice-versa
Reduces erosion on grazing land
Disadvantages of Silvopasture
Using equipment may be more difficult
Intensive grazing management is required
Fencing cost will increase as more paddocks are formed
Animals may be exposed to fruits/seeds or toxins from certain shrubs or trees
The three parts of the system require skilled labor for management
In the beginning, finding markets for additional products can be challenging
Livestock can harm trees and shrubs if not protected properly
<i>Source: Center for Agroforestry, University of Missouri, Missouri Training Manual for Applied Agroforestry Practices</i>

The Basics

A planted pine silvopasture system is the most widely practiced and utilized form of silvopasture in the southeastern United States. Silvopastures can be accomplished in one of several ways:

1. Converting an existing pine plantation into a silvopasture
2. Converting an open pasture into a silvopasture
3. Converting a tree orchard such as walnuts or pecan into a silvopasture
4. Converting an existing woodland into a silvopasture

Before embarking on a silvopasture system, check with your local county extension agent, USDA Service Center, and other organizations that may be able to help you get more information about tree species, forages, and livestock options for your property. You should choose appropriate silvopasture methods and objectives for your property based on local markets, the lay of your land, access to water, personal preferences and finances. It is important to identify the materials, equipment costs and potential benefits to be derived from the particular silvopasture operation. In other words, you should do a cost-benefit analysis to determine if silvopasture is the best option for you. This will help you decide. Do you really want to practice silvopasture and what are your objectives? Site selection and determining thinning, land preparation, seeding and fertilization costs are important. If you are converting an existing plantation to silvopasture, you will need to thin the existing stand to single or double tree rows (the latter being preferred). You will have to work with a professional forester who understands your objectives for this sort of thinning. If you don't already have livestock, you should also research breeds of domestic animals to use and where to obtain these breeds. For example, while cattle producers may be relatively common in your area, there may not be many goat producers.

Design

Southern pines — loblolly, longleaf, and slash (see Table 1) — are compatible with forage production and livestock grazing when properly managed. While a number of hardwood species have been successfully incorporated into silvopasture systems with grazing animals, these species typically take a longer time

to establish and reach maturity, thus increasing the rotation period between timber harvests for the landowner.

Trees planted in rows often perform poorly if they do not have at least one side in full sun. Therefore, for maximizing growth, single or double rows are generally preferred over triple or multiple rows of trees. There seems to be no disadvantage to planting in double rows compared to single rows, although single-row plantings seem to exhibit less tree-to-tree competition.

The planting arrangement for the tree component of silvopasture may change depending upon the landowner's objective in achieving timber and forage growth and wildlife habitat. It can also influence production costs and equipment accessibility. However, a healthy tree stocking range for silvopasture establishment is typically between 200 to 400 trees per acre.

Management

Livestock must be intensively managed in silvopasture systems. Timing and duration of grazing, stocking rates, and carrying capacity of the pasture must be carefully monitored to maintain site quality and tree seedling survival, thus minimizing damage to seedlings by trampling and rubbing, and preventing overgrazing and soil compaction. Depending on the density and growth rate of forage, livestock must be rotated between pastures to sustain growth and productivity of forages. A comprehensive grazing management plan — fencing or paddocks, periodic burning, rotational grazing, fertilization, placement of watering and/or supplemental feeding areas—must be implemented to maintain a silvopasture system.

Trees should be established or spaced to optimize growing space and light penetration for high-quality sawlogs and forage. Forest sites may require thinning and some tillage to provide a favorable seedbed for germination and growth of selected forages. Research shows that legumes under the pine canopy perform better than legume forage in open areas. On pasture sites, weed/forage suppression and competition control (through subsoiling, herbicides, tillage, and/or mulch) may be required for 2 to 3 years to establish tree seedlings, but must be carefully selected to avoid damaging desirable plants. (From *Silvopasture: Establishment & Management Principles for Pine Forests in the Southeastern United States*)

Materials

While a silvopasture system does not require out of the ordinary farm equipment or materials, the type of silvopasture system(s) will determine your material and supply needs. Additional or portable fencing may be needed and watering structures or other similar strategies are going to be necessary. You can use existing tractors and plows to convert plantations and pastures into silvopasture. Seeds, if pasture and other crops are to be established, are an additional supply as well as housing for animals. Depending on the livestock used, moveable housing for the silvopasture (e.g. poultry) may be necessary. A farmer or landowner should see his or her county extension agent or state forestry agency for information on suppliers for specific components of silvopasture. For example, tree seedlings can be obtained from your state's Forestry Commission or Division of Forestry.



Light disking between trees for planting forage seeds. *Courtesy O.U. Onokpise.*

Economic Considerations

Integrating trees, forage, and livestock creates a land management system to produce marketable products while maintaining long-term productivity. Economic risk is reduced because the system produces multiple products, most of which have an established market. Production costs are reduced and marketing flexibility is enhanced by distributing management costs between timber

and livestock components. Before a new silvopasture system is established, the landowner should explore thoroughly their economic and environmental considerations along with local land use, zoning, cost-share program, and tax regulations. Forest and agricultural land may have separate zoning and land-use regulations accompanied by different tax assessments. Environmental requirements (e.g., planting trees, streamside protection, and wildlife habitat maintenance) also may vary with land use. (From *Silvopasture: Establishment & Management Principles for Pine Forests in the Southeastern United States*)

There are several initial establishment costs to consider:

1. Site Preparation: Clearing the site - either mechanically or with herbicide (cost of equipment + labor + herbicide)
2. Tilling and plowing rows of trees for planting or between thinned tree rows for pasture establishment
3. Soil sampling and fertilizer amendments (if necessary)
4. Seed and/or seedling cost
5. Labor cost associated with planting and/or introducing livestock into the silvopasture system
6. Fencing (permanent or temporary; electric high tensile or portable polywire; solar or traditional)
7. Establishing firebreaks (if fire will be a management option or concern)

In addition, there are recurring long-term costs that should also be noted:

1. Tax value classification of the system. Does your system qualify for tax breaks?
2. Yearly costs for annual crops/forage establishment (seed, herbicide, labor, equipment, etc.)
3. Fence maintenance
4. Livestock management expenses
5. Watering facilities/structures for livestock
6. Fertilizer amendments (for forage, crops and/or trees including fruit trees)
7. Labor costs for pruning and/or harvesting

Products

Many products can be integrated into a silvopasture system to enhance short term and long-term benefits. Some examples include:

Trees	Timber, fence posts, fire or fuelwood, pulpwood, and sawtimber
Orchards	Fruits, nuts, Christmas trees, straw, grapes, etc.
Animals	Domesticated: meat, eggs, milk, wool and feathers, especially from quail and pheasants Non-domesticated: wildlife habitat, personal hunting and hunting leases
Pastures	Grazing areas, hay, silage and others

Further Assistance and Information

Technical

Silvopasture Online Course

<http://www.silvopasture.org>

USDA National Agroforestry Center

<http://www.unl.edu/nac/silvopasture.htm>

Auburn University

<http://www.ag.auburn.edu/agrn/silvopasture/silvopastureindex.htm>

The Center for Subtropical Agroforestry

<http://sfrc.ifas.ufl.edu/cstaf/>

University of Missouri Center for Agroforestry

<http://www.centerforagroforestry.org/practices/sp.asp>

Association for Temperate Agroforestry (AFTA)

<http://www.aftaweb.org/silvopasture.php>

TreeSearch

<http://www.treesearch.fs.fed.us>

Appalachian Farming Systems Research Center-USDA Agricultural Research Service

[http://www.ars.usda.gov/pandp/people/publications.htm?
personid=1685](http://www.ars.usda.gov/pandp/people/publications.htm?personid=1685)

Dale Bumpers Small Farm Research Center – USDA Agricultural Research Service

[http://www.ars.usda.gov/research/projects/projects.
htm?accn_no=412583](http://www.ars.usda.gov/research/projects/projects.
htm?accn_no=412583)

Financial

There are a number of cost-share and incentive programs and grants for landowners interested in the establishment of a silvopasture system. You may contact your local extension office, NRCS office, or Soil and Water Conservation office for information regarding the following cost-share/incentive plans:

- Environmental Quality Incentives Program (EQIP) – USDA NRCS
- Wildlife Habitat Incentives Program (WHIP) – USDA NRCS
- Conservation Stewardship Program (CSP) – USDA NRCS
- Sustainable Agricultural Research and Education Program (SARE) – USDA NIFA
- Non-Governmental Organizations (NGOs) – Quail Unlimited, Ducks Unlimited, and National Wild Turkey Federation.

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Table 1. Suitable pine species for silvopasture.

Loblolly pine (*Pinus taeda*): Loblolly pine is the most commonly planted commercial yellow pine species in the Southeast and typically has the fastest growth of the pine species. Loblolly is suitable to plant in well drained upland areas or clay soils. Loblolly typically requires more frequent pruning as it has more branches and produces more shade than the other southern pine species.

Slash pine (*Pinus elliotii*): A good self-pruner, grows well in moderate to poorly drained sandy soils. Light canopy cover produces less shade. Slash pine is commonly planted throughout the Coastal Plains of Florida, South Carolina, Georgia, Louisiana, and Alabama. However, with smaller branches, slash pine is susceptible to ice damage which should be considered in more northern latitudes.

Longleaf pine (*Pinus palustris*): Much of the southeastern United States used to be naturally covered in longleaf pine. Due to overharvesting, replanting to loblolly pine, and fire suppression, there are few remaining natural stands. Longleaf has the highest value timber of the southern pines, but traditionally required the longest rotation length due to the “grass-stage” that seedlings may remain in until release from this stage. New herbicides are available to release longleaf from this grass stage within one year. Longleaf can be planted in upland or wetter sites. Containerized seedlings are highly recommended for longleaf pine.

From Silvopasture: Establishment & Management Principles for Pine Forests in the Southeastern United States

Success Story

The Legacy Continues

*By Angela McKenzie-Jakes
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The land grant universities and their Cooperative Extension programs throughout the Southeast provide educational programming, events and activities to small-scale farmers/producers on alternative land use enterprises. These include programs on livestock enterprises such as beef cattle, meat goat, pastured poultry, and small-scale swine production and marketing, as well as timber and non-timber land use alternatives such as forest farming and silvopasture. The three ladies featured in this article are from Florida. With assistance from their land grant university, they converted their traditional family farm into a meat goat enterprise. They implemented a silvopasture system that integrates meat goats into their managed pine woodlands. Here is their story:



Eunice Cornelius, Norma Tillman and Willonese Adams

“My father was born in Jasper, Florida on my grandparent’s farm in 1919,” explains Eunice Cornelius. “At six years old, his father died leaving behind his mother and four children to farm the land. When his brother and sisters grew older, they moved away and my father and my grandmother stayed in Jasper and continued to farm. In the early years, they grew peanuts, tobacco, soybeans and they raised fowl, cattle and hogs. Eventually, my father began buying his own property. In 1948, he built a grocery store and he sold watermelons, corn and peas

that he grew on his farm. He also sold other traditional items in his store. As far as I know, he was the first black man in Jasper, Florida to own a grocery store.”

She continues, “In the early 90s, he became a member of the local Cattleman’s Association in Hamilton County and he donated some space on his land for the association to put a billboard which could be seen northbound on I-75. The billboard read, ‘Home of Alberta and Charlie Cross’ and below on the billboard was written ‘sponsored by the Cattleman’s Association.’ Shortly after my father passed, I started attending classes on goat production and management at Florida A&M University (FAMU) to become a better manager of my goat herd. When my mother became ill, I couldn’t go as often so, I asked two of my dearest friends, sisters Norma Tillman and Willonese Adams, to attend some of the training activities and bring the information back to me.”

“When I retired,” Norma explains, “I was looking for a way to pay the taxes on our land. We weren’t making any money from the land and the taxes were very high. I thought if we did something on the land we could at least get an agriculture exemption.” Her sister Willonese adds, “Our goal was also to keep the land in the family because it’s tied to our heritage. We had a lot of wonderful memories of what our grandfather did on the land. He grew tobacco, peas, corn, tomatoes, okra and beans on his land, and he loved gardening.”

Norma continues, “When I started accompanying Eunice to the workshops, I slowly became interested in raising goats on our farm.” Willonese laughs, “I thought that was the craziest thing I had ever heard. However, I became involved with raising goats because I could see Norma needed help. It’s really a lot of work for one person to manage a goat herd by themselves. Some things I am better at than Norma such as record keeping, but Norma is an excellent herdsman.”

When asked what was the key to their success, they all agreed that attending educational and training activities has helped them tremendously. “We don’t know everything because new things are happening with our goats that didn’t occur the year before,” says Norma. “I was the first child in our family to go

to college,” Willonese continues. “I went to Talladega College and majored in biology.” Norma adds, “I earned a degree in social science at Florida Memorial. Therefore, we know the value of a good education and that knowledge is power. Besides, as teachers we had to keep our certificates updated, so why not keep up with the changes in the goat industry? As certified Master Goat Producers, we really feel more confident in managing our goat herds and more confident in standing by the prices we ask for our animals. If we can get more producers on the same page, we feel we all can get a fairer price for our animals.”

When asked whether they were sharing the information they received with other producers in the community, Willonese responded, “Many of the farmers we know, especially minority farmers, are not aware of the different programs that are available to them. So, we are establishing a black farmer’s association in Hamilton County to keep minority farmers informed about the educational opportunities and services available to them.”

At the feed store in Lake City, Florida the employees often recommend to other goat producers, products that Norma buys for her goats. If someone calls the store about a question concerning goats they are referred to Norma.

Willonese was recently appointed to serve on the Southern Region Risk Management Education Center Advisory Council and also serves on the SARE Advisory Board for Florida which means she will have more insight on other programs available to small and limited resource farmers. Norma is also on the SARE Advisory Board for Florida, the Florida Small Farm Expo Planning Committee with the University of Florida and she continues to present the poisonous plants segment of the Master Goat Producer’s Certification Program at FAMU to other producers.

When asked about their future goals, Eunice stated that her goal is to open a bed and breakfast on her farm where guests will have an opportunity to pet and feed the goats and pick various fruits and vegetables from her garden. “We want to incorporate value-added products in our business to enhance

our profit margin,” Willonese continued. “My son-in-law is also a certified Master Goat Producer and my daughter, granddaughter and niece are helping with our goat business, so the legacy will continue.”

*For more information about the Master Goat Producer’s Certification Program at FAMU, contact Angela McKenzie-Jakes (Program Coordinator) at (850) 875-8557 or [angela.mckenziejakes@famu.edu](mailto:mckenziejakes@famu.edu). And visit their websites at <http://www.famu.edu/goats> and <http://www.famu.edu/herds>. Reprinted with permission of Cierra Publishing Company, *Minority Landowner Magazine*, Victor L. Harris, publisher and editor.*





WINDBREAKS

Sarah Workman

Introduction

When designed and planted correctly on a farm, a windbreak can improve farm income opportunities and the environment, define property lines and create wildlife habitat. By looking at how the windbreak (trees and shrubs) relates to the neighboring fields or buildings, you can think how its layout can meet your production or protection needs.

Wind causes erosion, transports dust, and carries spray drift and other pollutants. Wind also slows plant growth and can damage plants and buildings. Windbreaks can protect soil from erosion, create shelter for livestock and help reduce the loss of irrigation water. A good windbreak can serve as a sound barrier to decrease traffic noise and help reduce odors from animal barns and sheds. They often screen ugly views as well as help reduce the spread of dust.

Production of many fruit and vegetable crops improve with protection from wind and from early or late season frost. For example, these protections can improve flower and fruit quality of peppers, tomatoes, melons, and strawberries or the stem form of cut-flowers. Protecting livestock from too much heat and cold lowers animal stress and increases their weight gain or milk production. Windbreaks can help save energy in the home and on-farm by keeping cold wind away from buildings in winter months.

A windbreak is a continuous, but not solid, barrier of trees and shrubs. The height of the plants controls how far wind protection is effective on the downwind side, and the tree spacing (density or thickness) determines the level of protection. The general rule is a windbreak will reduce wind to a distance 10 times the height (H) of the trees and reduce wind speed 70%

to 80% immediately inside the barrier. Windbreaks also reduce wind speed for 2 to 5 times the height of the windbreak (2H to 5H) on the upwind side.



Though it may take awhile to establish a good windbreak, you will find the benefits outweigh the cost.

The Basics

A major key to a successful windbreak is recognizing what you want it to do on your land. The next step is to understand how a successful windbreak works and what makes a good design. The final step is planting the kinds of trees and shrubs in the windbreak that will make it work for you. Also, a relatively low value fencerow that you already have, with some imagination, common sense, and effort can be converted into a valuable windbreak investment. There is a lot of online information on windbreaks available through the Internet (see the Resources section at end of this document).

Design

Windbreak design depends on the goals and uses you have in mind. In planning, think about your land, what you want to do, and the wind related problems: What do I want from this planting? What needs to be protected: crops/orchards; livestock; roads or fields/soil; buildings; privacy? This careful look at your land and your goals brings up questions such as:

- *Which direction(s) does wind cause the most problem(s)?*
- *When do your livestock or crops need the most wind protection?*

- *Are there concerns about summer air movement in the livestock area or planting zone?*
- *Are you interested in choosing tree and shrub types and a design that will add beauty, or attract songbirds or wildlife to your yard?*

Pay attention to practical things, too, such as not blocking the

Elements that make Windbreaks Work

Height Density
Length Location
Width
Cross-sectional shape

winter sun or scenic views, or being able to see oncoming traffic near driveways. Make sure you have enough room to use your mowing equipment around the whole windbreak and between the rows inside the windbreak. The main thing to remember is that once you plant trees and shrubs,

they will be there for a long time. Choose the site carefully for planting the windbreak, hedgerow or shelterbelt. Space trees so that there are no gaps big enough to funnel wind, but the trees and shrubs are dense enough to break the force of the wind. Ask for assistance when making decisions about the technical parts of installing the practice, like how many rows to plant, how to space the trees, and if the types of trees and shrubs you want to grow will grow well on the planting site. How bushy the trees/shrubs are, how closely they are planted and how they are arranged between rows will affect the success of the windbreak. By combining low shrubs with medium and tall trees, you can create a windbreak that is effective for its entire height. Mixing rows of evergreen trees with trees that drop their leaves helps the windbreak work better all year long. A windbreak needs a density ranging from 60% to 80% to be most successful. All tree rows, single or multiple, work best when placed at right angles to the problem wind direction. A field windbreak has one to three tree rows. A homestead windbreak should have at least three rows with 10 to 15 feet between rows and different spacing within each row. Tree spacing within a row depends on the kinds of plants used. Be sure to protect and weed around planted seedlings for the first 2 to 3 years.

Conservation tree and shrub groups have selected trees and shrubs that are likely to be successful on different kinds of soils

and climates, and they also predict height growth of those plant species at 20 years. These guides are available from your USDA Service Center and found online in the state NRCS Technical Field Office Guides.

Management

Remove weeds from the planting sites. Regular maintenance of weeds and checking regularly for any insect or disease problems will help your windbreak continue to do its work for many years. Because gaps in windbreaks will create big problems it is very important to keep livestock out of the windbreak. Keep new plantings watered at least through the first growing season and replant where seedlings have died or been eaten. Because the usefulness of a windbreak depends on complete rows of trees/shrubs, check for and replace dead seedlings for at least three years. Mulch around trees at planting and continue as needed for at least the first five years.

Economic Considerations

Placing windbreaks around homesteads and farm buildings can help cut heating bills by as much as 30%. Correct placement of windbreaks can shade air conditioning compressors. Windbreaks reduce wind chill effects for less stressful and safer outdoor work and feeding areas. Marketable fruits or nuts can also be harvested from windbreaks and sold locally, either

Advantages of Windbreaks

- Protect structures (homes, buildings, roads)
- Capture water runoff and nutrients
- Improve irrigation efficiency
- Visual screen
- Filter and reduce dust
- Help control odors
- Provide wildlife travel corridors and habitat
- Decrease noise
- Improve attractiveness
- Improve yields
- Protect soil from wind erosion
- Shelter livestock and crops

from UMCA

fresh or as value-added products such as jams or jellies. If the windbreak has multiple rows, you can harvest firewood and save money on indoor heating fuel costs.

Products

Depending on your windbreak design and purpose, you can plan for possible thinning or harvest of marketable products. A windbreak can have both a primary function, such as protection, plus options for value-added products or benefits. A grower in Massachusetts saw that “Hybrid poplars can provide a very economical windbreak at pennies per foot. Adding diversity, value, and longevity to a tree row with walnuts, pawpaws, and persimmons still keeps the total cost under a dollar per foot.” (see 2003 *Spring, NAC Inside Agroforestry*). Lumber for crates and pallets can come from the larger windbreak trees (such as poplar and oak), while redcedar and black locust are resistant to decay and can yield posts and poles. Redcedar may also be chipped for animal bedding and brings top price when packaged for the small animal or pet market.

Examples of products that can come from actively managed windbreaks:

- timber, fence posts, firewood
- Christmas trees
- boughs, cones, wreaths or other craft materials
- nuts, fruits, berries
- landscape plants
- shade-loving plants such as those grown in the forest farming practice
- hunting lease opportunities when managed for wildlife benefits
- bioenergy crops for on-farm or off-farm use

Materials

Shrub and tree seedlings used for windbreaks are available through regional or county offices of a Forestry Commission or State Division of Forestry and can be found at various prices

from many sources. Seedlings are usually available from 10 cents to \$1.50 each, and up to \$2.50 each for some hardwood species. Private nurseries may have similar costs and more available varieties.

Further Assistance and Information

Technical

There are several agencies/groups in your county that can assist with windbreak practices. To learn about what tree or shrub seedlings can work for you, contact your local forester in state forestry agencies, wildlife manager in state, territorial and tribal fish and wildlife offices, The Association of Fish and Wildlife Agencies, NRCS district conservationist, or USDA Service Center. Additional tools and information are available through the USDA National Agroforestry Center, a partnership between the US Forest Service and NRCS.

Financial

There are many agencies offering programs with funds that can be used to start and maintain windbreaks on private land. One agency is the USDA Farm Service Agency (FSA), with programs that offer a soil rental payment, a cost-share for starting various conservation practices and other financial incentives to landowners who set aside their land in windbreaks and shelterbelts. The Natural Resources Conservation Service (NRCS) also offers a number of cost-share programs for windbreaks, such as Environmental Quality Incentives program (EQIP), Wildlife Habitat Incentives Program (WHIP) and the Conservation Stewardship Program (CSP). Cost-share is offered through these NRCS incentive programs for establishing windbreaks and shelterbelts. Sign up for all USDA programs is at your local USDA Service Center.

Information on the Internet

USDA National Agroforestry Center

<http://www.unl.edu/nac/windbreaks.htm>

<http://www.unl.edu/nac/insideagroforestry/2003spring.pdf>

<http://www.unl.edu/nac>

Center for Subtropical Agroforestry

<http://cstaf.ifas.ufl.edu/>

Natural Resources Conservation Service

<http://www.nrcs.usda.gov/technical/efotg/>

Department of Energy

http://www.energysavers.gov/your_home/landscaping/index.cfm/mytopic=11950

University of Missouri

www.centerforagroforestry.org

<http://extension.missouri.edu/explore/agguides/agroforestry/index.htm>

Association for Temperate Agroforestry

<http://www.aftaweb.org/windbreaks.php>

Success Stories

McCorkle Nurseries

Dearing, Georgia

A family business near Augusta since 1942, the nurseries annually produce over 4 million container plants between the facilities at Luckey's Bridge and adjacent Neal Mill Farms. The growing operation



consists of 700 acres of which 400 is currently in production. The majority of water used for irrigation is reclaimed run-off from production areas into 17 ponds. They supply box stores from Georgia to Long Island, NY and work with 2,000 independent landscape contractors.

Trees and shrubs form an important component of the landscape at McCorkle Nurseries. Tree screens, for example, are used along nursery borders and property lines as dust barriers edging dirt roads in the interior of the locale, and to help delineate managed areas. The planting along the paved road helps provide security for the property as well as an aesthetic border.



Tree screens are used along nursery borders and property lines as dust barriers.

Windbreaks are important in the nursery areas to serve as barriers to the flow of cold air and to prevent drafts along ridges and next to open areas where container stock is placed. Above the creek, Japanese cedar effectively disperses wind flows and helps break up the chilling effects. These plantings provide shelter by also helping prevent blow-over. Wind speeds of 20-30 mph are not uncommon during summer storms around the nursery. The McCorkles learned the value of the plantings one year after investing over 1000 man-hours of labor in a pick up detail after a storm.

Windbreaks separate stock block areas from propagation areas. Needlepoint holly and southern magnolia both make fine borders. Trees also serve as filters to prevent weed seed from blowing into irrigation ponds and serve as living fences for protection from accidents around pond sites or capture and recycle basins. Shawnee Brave bald cypress and Torulosa juniper are effectively used by pond areas. One notable example of a safety planting was crepe myrtle back-planted with greenleaf American holly. Crepe myrtle is used as a screen in front of natural vegetation along Fort Creek that lies adjacent to Luckey's Bridge Farm.



Windbreaks separate areas, create borders, serve as filters and serve as living fences.

Trees are used as sound and visual barriers adjacent to farm homes as well as to separate homes from production areas. A line of deodar cedar, now 50 years old, that was originally planted as a landscaping feature is now useful as shade for the main house on the property. Other plantings, such as alligator juniper and leyland cypress, serve as privacy fences and screen parking areas from houses as well as production areas.



Deodar cedars provide shade for this house.

Both Florida and Japanese anise make excellent screen hedges. Planted as a nursery seed source, *Ternstroemia* serves as an aesthetic border. A combination of little gem magnolia with tea olive is handsome as a tall hedge, and borders of various hollies provide evergreen variety and natural beauty. The nursery website, www.mccorklenurseries.com, contains a species database that can be used to assist with design and species selection for windbreaks.





Part of the beauty of the active nursery areas are the trial plantings area managers use to test the visual effect of varieties. Area managers customize their areas with selected border trees and test color and growth characteristics while providing a pleasant environment for workers. Combinations for windbreaks and screens can be tested, with larger trees planted for space coverage and quick establishment. Interval spaces are then often filled in with shrubs. Plantings are drip irrigated and receive some overspray. They serve as dust barriers along the dirt roads and prevent dust from flying onto container stock.

Family of Claire Demick Arnoldsville, Georgia



Looking at windbreak from the corner of the property while facing the pasture with the home in the background.

The Demick Family lives on and farms 11 to 12 acres near Arnoldsville, Georgia. About half of the land is fenced pasture with some natural tree cover towards the lower middle of the

pasture area. The patch of forest makes a natural break between the upper, larger pasture where they have cow calf pairs and the lower pasture that holds a few goats. More than 20 years ago Mrs. Demick decided that though the trees in the pasture gave the animals good shade in the summer, the family house could use a bit of protection, both from the wind and dust off the unpaved road adjacent to their property. The wind coming up the draw from below their house and along the road beside their pasture was noticeably stronger in the winter months. By planting an evergreen windbreak, the family could protect the house from winter winds and also provide a screen along part of the fence beside the forested area where the cattle tend to rest. The windbreak could screen sight of the water and hay station from the family house, reduce the cold winter winds blowing toward their driveway and one side of their home, and help keep the dust from blowing their way.

