

Agroforestry – What Is It? Can You Benefit From It?

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AGROFORESTRY – THE FOUR ‘I’S’

You may be hearing things about agroforestry and have been wondering what it is all about. Basically agroforestry is a combination of forestry and agricultural practices applied in an intensive land management system that optimizes the benefits from the biological interactions created when trees and/or shrubs are intentionally integrated with crops and/or livestock. The combination helps create more integrated, diverse, and sustainable woodlots, farms, ranches, and rural communities. Agroforestry trees are “working trees” that will pay their own way. All they need is a little space, water, nutrients, and some maintenance.

PAST AND PRESENT

Agroforestry is not a new concept, nor is it new technology. It has been practiced around the world for hundreds of years and is most commonly associated with tropical and sub-tropical regions. Agroforestry has only been practiced in the United States since the early 1900’s where permanent tree-covered systems were used to maximize production on arable lands. However, political and agricultural groups opposed the idea of changing the methods of food production, and it wasn’t until the Dust Bowl in the 1930’s that caused the opposing groups to reconsider. There were investigative activities up through the 1950’s until the post WW II economic and industrial technology boom brought a stop to the need for tree crop projects. In the late 1960’s and early 1970’s, an interest in trees and their potential role in food production and soil conservation was renewed. This was because of (1) environmental and ecological concerns; (2) decreasing availability and increasing costs of fossil fuels; (3) soil erosion rates and their direct effect on food production capacities; and (4) an increase in world population and the demand for increased output. Since then, researchers and producers developed an interest in agroforestry as an alternative land use suitable for temperate regions of the United States.

When used appropriately, agroforestry practices can provide many benefits to producers, communities, and society. In particular agroforestry provides:

- Increased income
- Protection of natural resources
- Protection of crops and livestock
- Diversification to reduce economic risk
- Greenways and recreational settings
- Visual screening

AGROFORESTRY PRACTICES

There are five main agroforestry practices: *alley cropping*, *windbreaks*, *riparian forest buffers*, *silvopasture*, and *forest farming*. They are very flexible and can be adapted for use in most situations. There is also a category for a wide array of *special applications*. First we'll focus on the five main practices to illustrate how each offers different benefits and can be used in different situations. Although these practices are of direct beneficial use to farmers, ranchers, and forest landowners, there are many indirect social, economic, and environmental benefits for rural communities as well.

Alley Cropping is created by growing crops or grass between rows of widely-spaced trees. High-value tree species such as black walnut, oak, and ash are commonly used as the rows, and in some cases, nut- and fruit-bearing trees are also used. Annual or perennial crops can be grown between the trees to provide income until the tree canopies close or the trees are ready for harvesting. Crops such as corn, small grains, hay, and clover have been grown in alley cropping systems. Vegetables and fruits, such as peppers and melons work well, as do flowers, herbs, and medicinal plants.

It is very important to choose the right trees for an alley cropping system. The chosen species need to be compatible with the site, satisfy landowner objectives, and have a viable product market. The spacing and orientation is also important. Rows need to be planted on the contour to maximize erosion control benefits, and wide enough to accommodate machinery as it moves between rows.



Melons are being grown between rows of black walnut.

Benefits of alley cropping include:

- Diversity of farm products, increased income, improved cash flow
- Reduction of surface water runoff and erosion
- Improved utilization of nutrients
- Improved crop production through macroclimate modification
- Improved wildlife habitat
- Enhanced aesthetics

Windbreaks use trees to control wind to protect crops, homes, farmsteads, and increase crop production. Windbreaks have also been applied to protect roads from crosswinds and blowing snow, provide buffers in the urban/rural interface, and protect and/or buffer communities. As a buffer zone, they reduce noise and dust, and decrease energy consumption for heating and cooling. They also provide timber, wildlife travel lanes, and serve as a living fence.

The function of a windbreak will often dictate how it's designed and placed. Usually the tree rows are located at right angles to the prevailing wind direction. Field, livestock and farmstead wind-

breaks usually consist of two to five rows of trees and shrubs depending on the intended objective and landscape characteristics. Densities of 40 to 60 percent provide the greatest downwind protection compared to a completely solid barrier. The downwind area protected by the windbreak will extend a distance of 10 to 20 times the height of the trees. As the wind blows against the windbreak, air pressure builds up on the windward side, and large quantities of air move up and over the top or around the ends of the windbreak. The reduction in wind velocity leads to a change in the microclimate within the protected zone. Temperature and humidity levels usually increase, thus decreasing evaporation and plant water loss. Crop yields are increased by as much as 20 percent for an entire field. Livestock windbreaks are designed to provide protection during late fall, winter, and early spring. By reducing wind speed, animals are less stressed, feed more, and are healthier.



Windbreaks protect crops on the Great Plains.

The most cost effective use of windbreaks is to control blowing and drifting snow by installing living snow fences. Reduction of snow plowing costs, fewer road closures, and fewer accidents exceed the cost of establishing living snow fences by an average of 17 to 1. Traditionally the most extensive use of ranch and farmstead windbreaks in the United States has been in the Western, North Central, and Great Plains regions. However, windbreak use for privacy screens, dust control, noise reduction, and unwelcome sights, sounds, and odors has become important to communities, developments, and individual

homesteads. Protection of homes and buildings is also a sure way to reduce energy costs associated with heating and cooling.

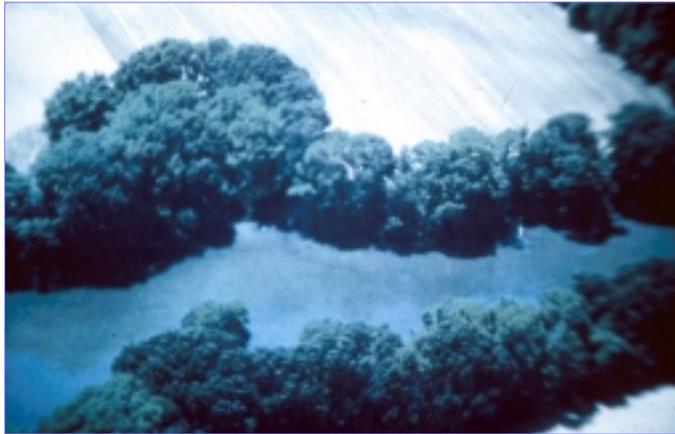
Benefits of windbreaks include:

- Increased crop yield by reducing runoff, erosion, drying winds, and increased moisture
- Wildlife habitat
- Income from timber, nuts, and/or other specialty products
- Reduction of noise, improve aesthetics, provide energy savings
- Protection of livestock, homes, buildings, equipment, and roads

Riparian forest buffers are composed of trees, shrubs, or grass planted or managed along streams, lakes, wetlands, ponds, and drainage ditches. They serve as protective barriers against the negative impacts of activities originating from adjacent land-use practices, such as agriculture, urban or industrial uses. Riparian forest buffers have been shown to reduce nitrogen runoff, protect floodplains, reduce streambank erosion, enhance aquatic environments, and protect wildlife habitat. They also trap sediment that contains animal wastes, pesticides, pathogens, and other pollutants. In some cases they provide harvestable products and function as windbreaks.

Trees and shrubs in the buffer can be harvested for specialty products. For example, nut- and fruit-bearing trees, timber trees, or berry- and floral-producing shrubs can be planted and produce a commodity crop to provide landowner income while functioning as a pollution control system. In this way, buffer systems can be adjusted to meet landowner objectives and perform the desired function by adjusting plant material composition, width, and maintenance activities. The design of the buffer is usually determined by variables such as land characteristics, objectives and desired function (conservation, production, or both), current land use, and capacity for maintenance (low intensity versus high intensity).

Riparian forest buffers are usually established concurrently with other practices as part of a conservation management system. Excluding grazing or livestock access is vital to ensure the survival and functioning of the buffer.



This riparian buffer filters sediment and excess nutrients from the adjacent agricultural field.

Benefits of riparian forest buffers include:

- Increased infiltration
- Reduced bank erosion, runoff, sediments, chemicals, and nutrients
- Wildlife habitat and travel corridors
- Production of timber and specialty products
- Enhancement of aquatic environment
- Decreased flood flows and protection of floodplains

A *silvopasture system* is an intentional combination of trees with forage and livestock production. The trees are managed for high-value sawlogs or nuts, and provide shade and shelter for livestock. Some nut and fruit orchards and Christmas tree plantings may also be grazed to provide added income. Many coniferous woodlands in the South and West, and a few selected hardwood plantations can be transformed into tree/forage systems. By selectively removing or harvesting the correct number of trees, enough light will reach the ground to allow forage growth under the tree canopy. Residual trees will grow faster and have an increased value. Proper livestock grazing or haying of the forages allow for annual returns while trees mature. Alternatively, trees can be planted within existing pastures. Whichever method is used to establish the system, protecting trees from livestock damage is vital, and timing of grazing and length of time the animals are kept in the trees is carefully planned.

It is important to point out that grazing can be detrimental to many hardwood forests and woodlots. **We are not advocating that livestock be turned loose in forests.** The silvopasture systems use must be carefully designed and monitored to produce successful results.

Benefits of silvopasture systems include:

- Erosion reduction
- Improved nutrient utilization/distribution and soil organic matter
- Additional income
- Diversification of farm operation
- Possible improvement of timber production in some intensively managed situations



Southern pine silvopasture system in northern Louisiana.

In a *forest farming* operation, high-value specialty crops are cultivated under the protection of a forest canopy. These are

usually high-value specialty product items derived from green plants, fungi, invertebrates, and other organisms that inhabit forested areas. These products fall into four general categories:

- food (example, mushrooms and nuts)
- botanicals (example, herbs and medicinals)
- decoratives (example, floral greenery and dyes)
- handicrafts (example, baskets and wood products)



Shiitake mushrooms being cultivated on oak logs.

High-value crops like ginseng, shiitake mushrooms, or decorative ferns are sold for medicinal, culinary or ornamental uses. Trees may be retained indefinitely to provide appropriate microenvironment for a series of specialty crops, or mature trees can be harvested for their timber value. Forest farming is a practice that can add much needed diversity to a forest landowner, or a farming or ranching operation. The key factors are that the production system must be intentionally created and intensively managed. Examples include: maple syrup production, medicinal

plants (ginseng, golden seal, black cohosh), craft materials (grasses, burls, pine cones, seed pods, evergreen cuttings), mushrooms, native fruits (persimmon, paw paw), and nuts (black walnut, pecan, hazelnut). Removal of some trees may be necessary to create the appropriate shade conditions.

Benefits of forest farming practices include:

- Increased income and diversity
- Cost effective method of TSI
- Support of local economies
- Watershed protection
- Wildlife habitat

Special applications are tree and shrub plantings that may be used to help solve special landowners concerns, such as disposal of animal wastes and filtering irrigation water, while at the same time producing short or long-rotation woody crops. Other examples include reduced damage to crop fields in floodplains by installing waterbreaks to trap debris and sediment from floods, and designing wildlife habitats that maximize the populations of various game and non-game species for landowner enjoyment or income from fee hunters or wildlife watchers. Special multi-row “timberbelts” can be managed both to protect crops, livestock, or homesteads and to produce hardwood timber for short-rotation wood crops for fuel or fiber.



Short rotation woody crops provide additional income opportunities in places where markets exist for wood pulp or fiber. In this example, wide “timberbelts” of fast-growing hybrid poplars are planted. They serve the purpose of a field windbreak during their 5- to 12-year rotation.

CONSIDERATIONS

It is important to remember that an agroforestry practice is intentional and intensive. It is done for a reason, and it requires a plan and work to establish and manage it. It is neither for every landowner nor every woodlot or field on a farm, but nearly every landowner could benefit from some type of agroforestry practice.

Agroforestry benefits come from the biological interactions caused by the planned integration of woody vegetation with crops and livestock. A properly designed and installed agroforestry practice will provide environmental and economic benefits. Many times the economic benefits of an agroforestry practice come from increased crop yields, specialty products, livestock growth, reduced energy costs, and increased forage production. The introduction of woody vegetation increases production and reduces costs.

Agroforestry practices can also produce income from the sale of products. This income can diversify income and help keep woodlands and farms profitable, especially the small family farm. Trees, shrubs, and herbaceous material can be produced in various agroforestry practices. The sale of products from these plants depends on the local markets. Landowners must evaluate the market to be sure they can produce the quantity and quality of product needed by the market.

Agroforestry practices concurrently produce economic and environmental benefits. It is the combination of these benefits that makes agroforestry so powerful and so challenging. It cannot be fully understood by a single scientific discipline. Because it is the integration of different plants that makes an agroforestry practice, it is the integration of different disciplines in the design and installation of agroforestry practices that maximizes economic and environmental benefits. Foresters, agronomists, wildlife biologists, soil scientists, and marketing specialists working together produce the best agroforestry practices.

FUTURE

Opportunities for the application of agroforestry technologies are unlimited. Currently, millions of acres of marginal and environmentally sensitive lands could be put to sustainable use using agroforestry technologies. Even productive lands could provide additional income to landowners using various agroforestry practices.

Agroforestry systems need to be blended and balanced with other technologies to attain sustainability goals. Integrated into forestland, ranch, or farm operations, these technologies can create and enhance desirable functions and outcomes essential for sustainability, income diversity, wildlife habitat, resource protection, and productivity enhancement.

ADDITIONAL INFORMATION

Publications, brochures, and fact sheets are available at the National Agroforestry Center in Lincoln, NE. The web site address is: <http://www.unl.edu/nac>

Cooperative Extension can provide assistance on planning or budgeting.

Any other questions contact:

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