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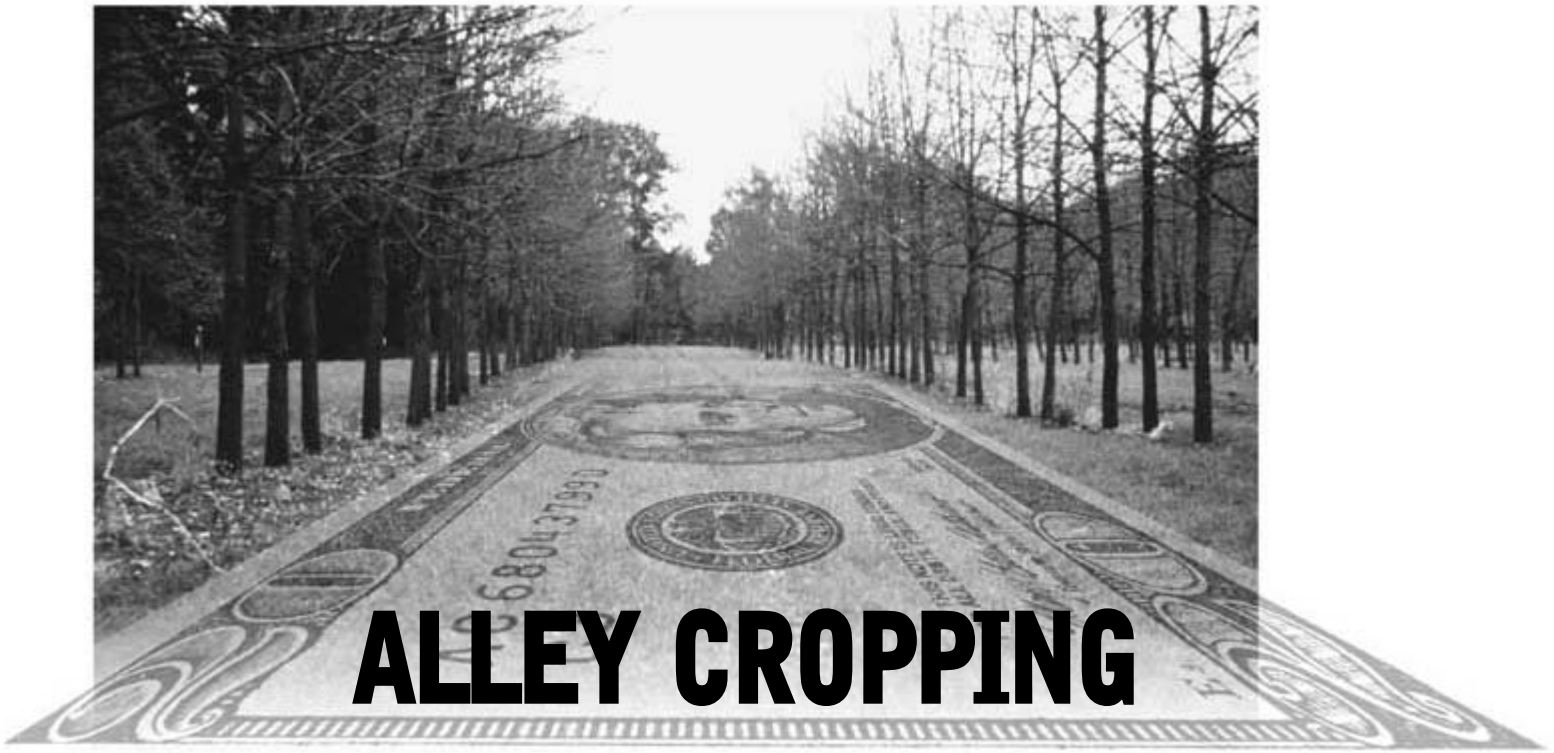


ALLEY CROPPING

20/20 VISION FOR FARMING'S FUTURE

This issue of *Inside Agroforestry* highlights the potential of alley cropping practices to diversify and improve farm economics. As you read this issue, think of innovative landowners who you can talk to who might benefit from alley cropping's versatility.

Considerations for Designing an Alley Cropping Practice

Alley cropping is broadly defined as the planting of single or multiple rows of trees into a field of crops or forage. The tree rows create protected alleys for the agricultural or horticultural crops.

Role on the farm

There are numerous roles that alley cropping can play on a farm or acreage:

● *Diversify farm products* – Alley cropping provides the opportunity to grow wood or other tree products such as nuts or fruit, while producing annual income through companion crops.

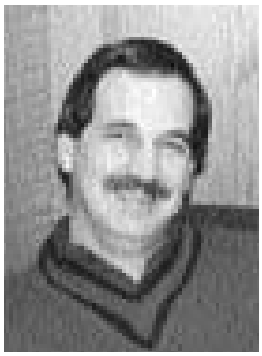
● *Supplement income* – Timber and non-timber products may contribute to income generation. In addition to the potential for producing nuts, berries, and fruits, well-managed timber can provide a long-term timber investment.

● *Reduce soil erosion from wind and water* – Soils with a high erodibility index (greater than eight) are susceptible to damage and are difficult to protect when managed as cropland. Alley cropping protects fragile soils through a network of tree and grass roots and supplemental ground cover resulting from fallen leaves and the companion crop. Rows of trees, shrubs, and/or grasses planted on the contour of a slope will also serve to reduce soil movement down the slope. Wind speeds can also be reduced with beneficial effects similar to that of field windbreaks.

● *Improves Soil* – Alley cropping can reduce crop evapotranspiration by 15 to 30 percent and increase water content in the tillage layer by five to 15 percent. Deep tree roots trans-

see **DESIGN** on page 9

Inside



NAC Director's Corner

A commentary on the status of agroforestry by Center Director, Dr. Greg Ruark

Alley Cropping: An Underutilized Option

On the farm making a living from year to year is fraught with uncertainty. Success depends on weather conditions and favorable markets at harvest. Alley cropping systems provide a way to lower risk by diversifying production. In alley cropping an agricultural crop is grown in the "alley" formed between tree rows. This provides for the generation of annual income from agricultural crops, while the tree crop is managed as a long-term economic investment. An attractive feature of installing alley cropping is that it allows a landowner to gradually transition a field into an alley cropping system, while continuing to crop most of the field area each year.

Traditionally, fine quality hardwoods such as walnut, pecan, and oaks have been preferred species, as they can be managed to produce high-value lumber or veneer logs. More recently, fast-growing hybrid poplars (mainly cottonwoods) are being grown for pulpwood or even sawtimber where wood markets exist. When nut-bearing trees are used, they can provide an intermediate product for sale in as little as seven to ten years. In addition to improving annual cash flow, these systems can also protect annual crops from wind, reduce soil erosion, and provide wildlife habitat. Most row, grain, and forage crops, as well as specialty crops, such as catnip or St. John's Wort, have been shown to grow well in alley cropping systems. The type of agricultural crop grown will vary over time as the trees mature and produce more shade.

Two years ago the National Association of Resource Conservation and Development (RC&D) Councils conducted a national survey of agroforestry. Although 22 states were reported to be using alley cropping systems, it was found to be the least pervasive of the agroforestry practices. It was most commonly encountered east of the Mississippi River, although several states in the Great Plains and the Northwest were also using the practice. The main motivation reported for adopting alley cropping was to improve farm economics. Other reasons included controlling field erosion, improving water quality, and providing wildlife habitat. Typically, hardwood tree species are being used in single and multiple row arrangements, but some locations do employ softwoods. The survey concluded that the greatest impediments to further adoption of the practice were the lack of knowledge by natural resource professionals and landowners and the need for more localized demonstrations that illustrate the practice and document economic returns.

New in 2002! Selected NAC Publications have been translated into Spanish

Agroforestería por Dentro, Verano 1998
Inside Agroforestry, Summer 1998

Árboles Trabajando en Beneficio de la Agricultura
Working Trees for Agriculture

Árboles Trabajando en Beneficio de la Ganadería
Working Trees for Livestock

Árboles Trabajando en Beneficio de la Ganadería - Agroforestería: Silvicultura en el Sureste de los EE. UU.
Working Trees for Livestock - Agroforestry: Silvopasture in the Southeast

Notas de Agroforestería *Agroforestry Notes*

#8 Silvopastoreo: Una práctica agroforestal
Silvopasture: An Agroforestry Practice

#9 Biología Silvopastoril
The Biology of Silvopastoralism

#18 De un Bosque de Pino hacia un Sistema Silvopastoril
From a Pine Forest to a Silvopasture System

#22 De sistemas Pastoriles a Silvopastoriles
From a Pasture to a Silvopasture System

When properly applied, alley cropping can help meet specific needs of a landowner while at the same time preserve the integrity, stability, and beauty of the family farm.

Agroforestry and Alley Cropping:

Opportunities for the 21st Century and Beyond

Gene Garrett, Director, University of Missouri, Center for Agroforestry

Agroforestry has an important role to play in revitalizing rural America. Both the need and opportunities for agroforestry are overwhelming.

Historically, much of North America was covered with forests. However, with the increasing demand for building materials and agriculture in the late 1800s and early 1900s, our forested acres declined. Forest area in the US has remained relatively consistent since the 1930s but recently we have begun to again see a reduction in forest acreage as development pressures have increased. Many in our society, for reasons of resource, economic, environmental, and social considerations, would like to see a stronger transition from conventional cropping systems to combinations of croplands and forests or permanent forests on much of our marginal and less productive agricultural lands. A conversion of this magnitude, however, requires an economic justification. The returns on conventional forestry practices typically are not enough in many regions of the US and Canada to serve as an inducement to farmers and other landowners to make this conversion.

Never before in the history of North American agriculture has the opportunity for agroforestry adoption been greater. As part of an ecologically-based land management system, agroforestry can contribute substantially to generating the ecosystem diversity and processes that are so important to long-term sustainability and profitability. In contrast to the industrial agriculture/forest management models that have dominated development through the 1990s and are now being challenged due to high environmental costs and the degradation of rural economies, agroforestry offers a more holistic land-use management model for the 21st century and beyond. However, it is a model that requires a shift in our thinking and perspective, and demands skills in managing rather than reducing complexity. It challenges us to transcend disciplinary boundaries and explore the potential synergisms created from synthesizing, integrating and diversifying landscapes. When properly applied, the agroforestry model can meet the specific needs of the landowner and society while preserving the integrity, stability, and beauty of the family farm. At a time when rural America is looking for alternatives to "help pay the bills" and a shortfall is predicted for wood production in the US this match appears to be natural.

Alley cropping, an intensive land-management program that optimizes the benefits from the biophysical interactions created when trees and/or shrubs are deliberately combined with crops, provides a means of integrating land-use management systems

see **OPPORTUNITIES** on page 10

Close-up of black walnut trees (left). Black walnut trees being "trained" to grow straight for an eventual high-value lumber crop next to Douglas fir Christmas trees (right).

Oregon Family Farm Mixes Christmas Trees and Black Walnut

Miles Merwin, President, Association for Temperate Agroforestry (AFTA)

Are Joe and Stan Low of Beavercreek, Oregon mainly Christmas trees growers or black walnut growers? The answer is both, but the question stirs an amicable, on-going debate between father and son. Forestry, agriculture, and agroforestry all coexist profitably on their 900 acre Highland Farm in the northern Willamette Valley.

A native of West Virginia, Joe learned the value of black walnut timber during the Depression years. After moving to Oregon in 1943, he began a 30-year career in the sawmilling business, primarily cutting native Douglas fir in the local area. But, his interest in black walnut remained, prompting him to plant some of Oregon's first stands of walnut for timber 35 years ago. Over the past 20 years, Joe and his son Stan have established over 200 acres of black walnut/Christmas tree alley cropping - or vice versa.

"I planted almost every tree on the place," Joe said, referring to the 50,000 black walnuts now growing on Highland Farm. "Timber has always been my business and I'm serious about walnut timber."

In Joe's experience, eastern black walnut grows well in the Willamette Valley. The only disease he has encountered is walnut anthracnose, but he says it is less of a problem in Oregon than in the warm humid climates of the Midwest. Weed control is the main cultural practice, Joe said, along with training during the early years of establishment to correct stem form deficiencies.

At Highland Farm, black walnuts are planted on a 15 X 15 foot spacing (about 200 trees per acre) with either Douglas fir or noble fir as the short-rotation intercrop. About 25 years after planting, Joe plans to thin the walnut to a final crop spacing of 30 X 30 foot. (about 50/ac). His aim is to produce a straight, four foot diameter log in about 75 years that will yield high-value timber or veneer.

Fast-growing and commercially-valuable Douglas fir is co-dominant with walnut and serves as a "crowd tree" to force the walnut to produce tall, straight stems. In stands where Joe has simultaneously planted walnut and Douglas fir at the same initial spacing (200 trees per acre), he will be able to choose at the time of first thinning whether to leave the walnut or the Doug fir to grow as the final timber crop.

In some stands, Joe has interplanted the relatively-slower growing but more valuable noble fir, planted on 5 X 5 foot. spacing, with walnut on 15 X 15 foot. centers. Noble fir is ready for harvest as Christmas trees in eight to10 years, compared to about seven years for Douglas fir Christmas trees.

The alley cropping enterprise at Highland Farms is a good example of the extra management and economic tradeoffs inherent in agroforestry versus monoculture.

In all of his plantings at Highland Farm, Joe has planted nuts rather than seedlings. Experience has shown him the importance of direct seeding to develop a strong taproot that will produce hardy trees better able to cope with Oregon's dry summers. Joe has scouted all the best walnut trees in the local area and each year collects nuts from selected trees for planting. He either plants the nuts in the fall or stratifies them during the winter for spring planting.

The alley cropping enterprise at Highland Farms is a good example of the extra management and economic tradeoffs inherent in agroforestry versus monoculture. According to Stan, who manages the Christmas tree operation, there is an economic cost to alley cropping. Labor costs to shear Christmas trees intercropped with black walnut are higher because extra care and time must be taken to avoid damage to the walnut. Weed control during the early years of establishment is also more problematic when firs and walnuts are mixed.

As the walnut trees mature, they compete for light with the Christmas trees. Stan has observed that shade will degrade the needle length and color of the firs compared to open-grown trees, and therefore decreases their quality and potential price as Christmas trees.

He suggests that increasing the initial spacing of the walnuts would help overcome these problems. If the walnuts were planted at 15 X 20 or 25 feet, in every fourth or fifth row instead of every third row, the firs would have more available light and develop into higher quality Christmas trees. Shearing costs would also be reduced, he said, by allowing more space for the firs.

Whatever they decide for initial spacing and management, it is obvious that the Lows have a very large resource of valuable hardwood timber slowly maturing to harvest age. Joe anticipates that this resource will create markets for his timber both locally and overseas, especially in Europe. There will also be a substantial nut crop that could be processed on-site or shipped to processors in California.

Joe is also thinking about other potential intercrops that could be produced among his black walnuts after the Christmas trees are harvested. After canopy closure occurs, he said that ginseng could be cultivated under the trees in a forest farming regime.

Reprinted from The Temperate Agroforester, *(AFTA), April 1998 (Vol. 6, No 2).*

Stop Soil Erosion with Alley Cropping

Soil erosion from water on sloping land continues to be a significant concern for many agricultural producers in the United States. Many different soil conservation practices are applied to reduce this soil erosion including conservation tillage, terraces, contour strip cropping, contour buffer strips, vegetative barriers, and others. These practices are usually applied in different combinations with crops to form a conservation cropping system. One variation to these traditional approaches is alley cropping, where an agricultural crop is grown simultaneously with a long-term tree crop to provide annual income while the tree crop matures.

The spatial arrangement of the trees in an alley cropping system depends on the landowner's objectives. For example, if the landowner wants to reduce erosion and continue to grow agricultural crops for a long period, the alley cropping system can be configured similarly to contour strip cropping. In this case the trees and/or shrubs ae planted on the contour with a vegetative barrier or into a wider strip of grass as with a contour buffer strip. The tree/grass combinations in a contour buffer strip can vary in width along the length of the strip to accommodate the natural lay of the land thus eliminating small odd areas that would be difficult to crop. The tree/grass strip should not be less than 30 feet in width. The width of the agricultural crop strip is constant for the entire strip length and is determined by farm machinery widths and the maximum slope distance allowable to control erosion and water borne contaminants. With these width guidelines, the agricultural crop will not experience production losses from tree competition throughout the entire length of the tree rotation.

Two demonstrations have been established in Iowa using this approach. The tree/grass strips contained three to four rows of trees with the outside rows being conifers

see **EROSION** on page 11

Soil erosion, as seen below, can be reduced with alley cropping. Trees in an alley cropping system take up excess water and create a stable zone of permanent vegetation, while at the same time provide economic and conservation benefits.
Photo courtesy USDA NRCS

HOW TO BUILD ECONOMIC DIVERSITY with ALLEY CROPPING

Adapted From: Economic Budgeting for Agroforestry Practices. *By Larry D. Godsey, University of Missouri, Center for Agroforestry. March 2000.*

Rows of trees create a productive environment for irises, while at the same time produce a tree crop of nuts or wood chips as pictured above.

Alley cropping can be economically attractive for some landowners in that it provides a strategy for economic diversification where long-term income from trees is combined with continued annual income from cropping or livestock. However, before venturing into alley cropping its economic aspects should be evaluated to provide a basis for estimating financial needs and feasibility, highlights trade-offs between multiple benefits, and monitors economic efficiency.

Unique Characteristics of Alley Cropping:

- Long planning horizon
- Irregular occurrences of costs and revenues
- Fixed tree component with variable crop or livestock component

The main technique used in economic analysis is budgeting. Economic budgeting is a very flexible process. Alley cropping, however, poses some unique budgeting problems because it involves multiple enterprises with varying production cycles.

Unlike most agricultural commodities, alley cropping has a "planning horizon" of greater than one season due to the tree component. A "planning horizon" is simply the time period in which all costs and revenues for a given practice are realized. For soybeans, a planning horizon may be six months to a year. For alley cropping, a simple planning horizon may be as long as sixty years when the trees are taken into consideration. Furthermore, because of the long planning horizon of alley cropping, many of the revenues and costs do not occur at regular or predictable intervals throughout the entire planning horizon.

Additionally, because alley cropping typically incorporates a fixed tree component with a crop or livestock component, the crop or livestock component may change over time. For example, an alley cropping practice may start out as soybeans grown between rows of eastern 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 more uniform surface is required to harvest the nuts.

These characteristics of alley cropping practices require a specific type of budgeting method that will be flexible enough to allow for variable crop and/or livestock components, as well as being comprehensive enough to show annual cash flows for the entire planning horizon.

Budgeting

Budgeting is a two-step process:

- Develop **enterprise budgets**
- Combine the enterprise budgets into a **cash flow plan.**

An enterprise budget is simply a com-

A black walnut/forage alley cropping system can produce hay, nuts, firewood from thinnings, and eventually high-value walnut lumber or veneer.

plete, detailed listing of all the costs and revenues expected for each single enterprise, such as corn, livestock, or trees. A cash flow plan combines the details from the different enterprise budgets in an alley cropping 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 alley cropping system over time.

Developing the Enterprise Budgets

The development of an enterprise budget is a three-step process:

- List all possible sources of revenue for an enterprise.
- List all possible sources of variable costs.
- List all possible fixed costs.

For the tree component of an alley cropping system it is important to list not only the sources, but also list the timing of revenues. For example, an alley cropping practice with eastern black walnut trees may receive CRP payments for the first 15 years of the planning horizon but not after that period. Income from nut production may start at year ten or twelve and continue until the tree is harvested for wood in year fifty-five or sixty.

Variable costs are those costs attributed to the productive use of resources. Variable costs can be grouped into cash and non-cash costs. Variable cash costs include payments for establishment, maintenance, harvesting, and marketing. Variable non-cash costs do not require a cash outlay, but reflect opportunity costs. Opportunity cost is simply the value of the next best alternative that is not chosen. For example, labor supplied by family members may not require a cash outlay, but should still be considered in the economic analysis since the opportunity to do something else is expended.

The third and final step to preparing an enterprise budget is to list all fixed costs. Fixed costs are typically those costs that are attributed to resource ownership. Fixed costs occur regardless of any productive activity being attempted. Fixed cash costs usually include property taxes, insurance, interest on intermediate or long-term debt, and lease agreements. Fixed non-cash costs are important when developing an investment analysis, because these costs have significant influence on taxes. However, these costs are difficult to determine. Depreciation and land costs are the two main areas of fixed non-cash costs.

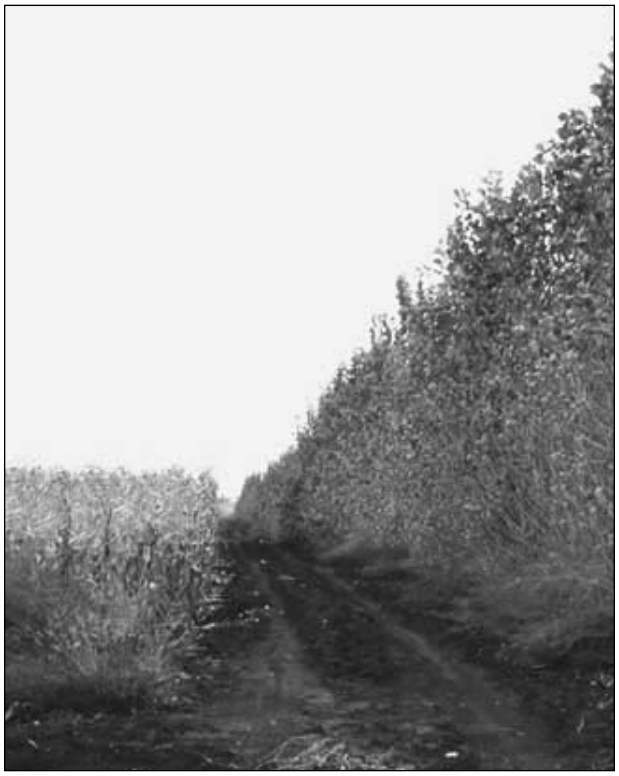
From Enterprise Budgets to Cash Flow Plans

Once enterprise budgets are developed, a cash flow plan for the alley cropping practice can be developed. A well-established alley cropping practice may combine a tree enterprise with a hay and livestock enterprise. As mentioned earlier, often times the tree enterprise is constant while the crop or livestock enterprises vary over time. Cash flow planning has two major benefits for agroforestry economic analysis: 1) a cash flow plan allows for multiple enterprises to be considered; and 2) a cash flow plan incorporates a time dimension.

Using a cash flow plan in conjunction with enterprise budgets can simplify the process of economic analysis by allowing the enterprise budgets to reflect the detailed information, and the cash flow plans reflect a broader economic picture. In this way the producer can compare resource management alternatives to determine the one that best meets management goals.

Reassessment

Economic analysis is not meant to be, nor is it designed to be, a one-time activity. It is designed to be a roadmap for a dynamic and living system. Reassessment takes the information gathered in the economic analysis and combines it with other information to change the original goals or fine-tune the design so that it is more successful at meeting those goals. Reassessment is the continuous loop that helps redefine goals, adjust designs, and modify indicators. Economic analysis is just one part of the reassessment loop. ●



TIMBERBELTS
Holding Up the Farm

Scott J. Josiah
Extension Forester, University of Nebraska-Lincoln

Timberbelts are multiple row windbreaks that are planted with commercially valuable, fast growing trees to produce wood products. Timberbelts are a good example of "productive conservation," that is, a conservation practice that creates a new source of income, while improving the crop environment and protecting and conserving resources.

A network of four-year-old experimental hybrid poplar (cottonwoods) timberbelts of varying widths (two to 14 rows) in west-central Minnesota are demonstrating the power of this concept to quickly provide wind protection over large areas, as well as to produce large amounts of salable wood fiber. Trees growing on the better soils, without supplemental irrigation, average 29 feet tall and four inches in diameter at breast height (4.5 feet above the ground). These timberbelts are providing substantial wind protection 15 times the height of the trees or nearly 450 feet into the adjacent fields. It would take more traditional windbreak species (green ash, eastern red cedar, and pine) up to 20 years to provide similar levels of protection. These timberbelts are expected to reach 60 feet in height in six years, which will double the area protected from wind. In dry years, crop yields in these adjacent protected areas can be expected to be 10 to 20 percent greater than in unprotected fields, resulting in greater whole farm profitability. In addition, the trees are slated for harvesting in six to eight more years, and are expected to produce 35 cords (128 cubic feet) of wood per acre, worth $1,400 per acre at today's stumpage prices (approximately $40 per cord).

Timberbelts can improve net farm income, sequester carbon, enhance wildlife habitat, and improve water quality. They serve as windbreaks to reduce soil erosion, increase crop yields, and improve public safety through enhanced snow management. Other benefits include diversifying farming systems and agricultural landscapes, improving soil quality, reducing the input and transport of agricultural chemicals and fertilizers, and improving local air quality. Because they both protect adjacent crops from the wind *and* produce wood products, timberbelts are an agroforestry practice that becomes a new profit center for the farm.

Above: Timberbelts can create a new source of wood-based income, while enhancing the crop environment, and protecting and conserving natural resources.

Design
continued from page 1

port soil nutrients to leaves. Leaves contribute organic matter to soil and release nutrients as they decompose.

● *Create and provide wildlife habitat* – Linear plantings of trees and/or shrubs in an agricultural landscape increases the wildlife habitat diversity, both through increased amount of edge and/or as a result of the increased diversity (vertical and horizontal) of vegetative types. Increased vertical complexity has been correlated with higher bird numbers. These areas can also serve as protective corridors for wildlife movement and provide a food source.

● *Reduce non-point source pollutants delivery off-site* – Fertilizers, in excess of that taken up by the crop, can be utilized by the tree, shrub, and/or grass plantings whose root density is typically greater than traditional annual agronomic crops. This same benefit can apply to pesticides and herbicides, which infiltrate soil profiles and then move horizontally through the soil until reaching zones in which plant roots act as filters.

Designing an alley cropping practice

● Determine the landowners objectives and site conditions

● Consider the physical interactions between the woody component and the crop

Each alley cropping practice can be uniquely designed to reflect landowner needs and site potential. However, there are physical interactions between the rows of woody species and the companion crop that should be understood and reflected in the alley cropping practice design.

Physical growth traits of individual trees and how these influence the crop, are based on three factors:

● *Light competition* – A tree species should be selected that best accommodates the light needs of a selected crop. Some tree species have small leaves and feathery foliage casting a light shade and lend themselves well to alley cropping. Additionally, tree spacing and row orientation, an understanding of crown and foliage characteristics and timely thinning are all considerations for managing light intensity.

● *Root competition* – Competition for water and nutrients between the tree and the intercropped species not only affects the yields of the companion crop but also the growth of the trees. Tree species have different root zones and site requirements.

● *Allelopathy* – Traditionally, literature has used the term allelopathy (Greek: *allelon,* on another; *pathos,* suffering) to denote the negative biochemical influence exerted by one plant on the growth of nearby plants. The current trend is to accept a broader definition that includes both the positive and negative influence that a plant has on the growth of nearby plants. This includes interactions induced by the release of organic and other chemicals, such as nitrogen, acids, and/or growth inhibitors.

Companion crops are planted in the alleys between the tree rows. The choice of companion crops will vary depending on the types of trees selected. There are three major groups of crops that can be grown in an alley cropping practice. Initially, the growing environment in the alley will be favorable to row crops requiring full sun, but as the trees grow they produce more shade leading the producer to either thin and prune the trees or switch to a more shade tolerant crop.

Typical companion crops include:

● *Row crops* – Typical row crops, such as corn, soybeans, or wheat, can be used for several years. Depending upon the selected tree species and the row spacing, shade can become a problem within three or four years (fast-growing species such as poplar) or in a decade or more with slower growing species (oak, walnut, etc.).

● *Forages* – In an alley cropping practice, forage crops such as fescue, orchard grass, or alfalfa, are grown for hay production between rows of planted trees, but are not grazed. This distinguishes the alley cropping practice from a silvopasture practice.

● *Specialty* – More often associated with the forest farming practice, specialty crops also have potential for integration into alley cropping systems. Plants that can be marketed for their medicinal, ornamental, or food values (including ginseng, St. John's Wort, goldenseal, wildflowers for seed, pumpkin, small fruit trees, etc.) also provide unique opportunities in alley cropping. Species that are light demanding can be established in the alleyways while those requiring some shade can be planted within the tree rows as shade develops.

Each alley cropping practice can be uniquely designed to reflect landowner needs and site potential.

Arrangement of tree rows and number of rows

As mentioned earlier, landowner objectives will determine the products to be harvested from the alley cropping practice. These objectives also determine the arrangement of trees and crops and the set of management practices needed to obtain those products. Alley cropping practices are highly diverse and range from simple to complex. Plantings can consist of a single or multiple tree species. Similarly, single or multiple tree rows may be used. While past practices have emphasized the establishment of monocultures, today's emphasis on optimizing biodiversity and creating more sustainable systems requires different designs that incorporate mixed species plantings. There are several key factors to consider when planning and establishing the practice on a given site:

● *Single or mixed species, Single tree row or multiple rows, Tree arrangement within the row* – Each of these considerations can affect the following: biodiversity, wildlife habitat, economics, plant competition, plant-

see **DESIGN (2)** on page 11

Opportunities
continued from page 3

for optimal production and conservation benefits. Through the application of agroforestry's alley cropping principles, large acreages of agricultural lands could gradually be removed from pure agricultural crops and placed into various combinations of trees and crops without financial loss to the landowner and with much gain for society.

However, if alley cropping is to be broadly adopted and its principles applied in North America, both need and opportunity must be clearly demonstrated. Landowners, in general, and farmers in particular must be convinced that if they practice alley cropping, the accrued benefits, including profits earned, will justify their actions.

Alley cropping presents an opportunity for the family farm. It capitalizes on the interactions created when trees and crops are grown together and bridges the gap between production agriculture and natural resource management while providing environmental protection. Among the benefits resulting from the interactions created are increased crop production, alternative crops and diversified rural economies, improved water quality, filtering and biodegrading of excess nutrients and pesticides, reduced flooding, microclimate moderation, diversified habitats for wildlife and people, and the restoration of degraded ecosystems.

The face of rural America has changed from a constellation of small family farms banding together to meet the food needs of a hungry nation to one dominated by large corporate farms producing surpluses that help feed hungry millions abroad. Our largest 600,000 farms account for more than ninety percent of US farm output. The remaining 1.5 million farms produce only six percent of our food needs. Found within that 1.5 million farms are millions of acres of "under-used" land ideally suited for the application of agroforestry.

In transitioning to alley cropping, owners of small family farms could improve their finances and in the process retain a way of life that has been handed down from one generation to the next. Long-term, they could expect strong markets for their wood products and through careful planning could select companion crops for their trees that could be marketed locally, regionally, and nationally. Success of such an endeavor is obviously tied to maintaining a cash flow while waiting for the trees to produce fruit (pecans, walnuts, chestnuts), specialty products (pine straw, floral green products, chemicals) or wood. This is achieved by carefully selecting crops for which known markets exist and diversifying so that several markets can be explored simultaneously. Should a market dry up due to competition, either new markets must be found or new crops established for which markets exist.

Rural America is in need of revitalization. While alley cropping's potential varies by region due to diverse landscapes, values and regional/local markets and economies, the need for adoption and the opportunities afforded the adopter are without question.

Adoption within the US is currently on the upswing thanks to greater landowner awareness. This heightened awareness is attributed to a dramatic increase in the number of professionals actively researching and teaching agroforestry principles, better national and regional organizations of agroforestry enthusiasts, and greater involvement of these enthusiasts and their organizations in securing state and national policies to support agroforestry.

It can provide multiple and long-term benefits to the user and society and can help meet the ecological, socioeconomic and cultural needs of land management, provide raw wood products to off-set the loss from public lands, and help preserve a way of life that is critical to the revitalization of rural America.

Erosion
continued from page 5

and the inside row(s) a hardwood. The conifers were placed in the outside rows to be used as trainer trees to reduce lower branching on the high-value hardwoods, and also to absorb the damage that machinery in the field could cause on the hardwood crop trees. The rows of trees were spaced about nine to 10 feet apart and the trees in the row were six feet apart. Herbicide was applied in a band along the tree rows to reduce weed and grass competition during establishment. Vegetation between the rows was periodically mowed. An initial measurement of sedimentation in the tree/grass strips at one site showed that sediment was effectively trapped in the strip. A third demonstration is being established at Arbor Day Farm near Nebraska City, Nebraska using a similar design but incorporating additional species that can be used for decorative florals, nuts and fruits.

Although this type of system can provide improved soil and water quality, is it economical? Incorporating trees into this type of soil conservation system decreases the overall risk in the farming operation by integrating a variety of crops that can respond to diverse markets. The agricultural crops provide annual cash flow while the tree crops are increasing in value over the long term. Depending on the site characteristics, using fine hardwoods like walnut, oak, ash, and pecan can potentially produce high value lumber or veneer logs. Incorporating improved tree and shrub species that produce nuts, fruit or decorative floral products can result in additional intermediate products and income. To determine the economic feasibility of this approach and the conditions needed to make it a competitive alternative, Dave Countryman and John Murrow of Iowa State University conducted an economic analysis based on one of the Iowa demonstrations. They used a row cropping sequence of corn and soybeans with conventional tillage as a base and then added different conservation practices, including contour strip cropping, contour tree buffer strips, and terraces. A scenario incorporating income from the Conservation Reserve Program (CRP) was also included. The contour tree buffer analysis included four tree species: black walnut, red oak, white oak, and ash. Sensitivity analyses were also carried out on land values, real interest rates, and the projected costs and revenues associated with the different scenarios.

Results from this study indicate that contour tree buffers provide an economically feasible alternative for agricultural lands that have soil erosion, a low land value and low crop yield. On higher value land wih greater productivity the wide tree/grass strips were not economically feasible. However, if the value of other landowner objectives is considered, the economic feasibility will improve. Contour tree buffers rely on the row crop cash flow initially, but unlike some of the other conservation practices, the contour tree buffer provides future revenue. This study focused on the economics of contour tree buffers, but they also provide several non-market values that are difficult to quantify. These non-market values may include reduced soil erosion, improved water quality, added landscape diversity, and enhanced wildlife habitat. Landowners who value these items and want to develop a long-term investment, should consider the contour tree buffer alternative.

Adapted from: Economic Analysis of Contour Tree Buffer Strips Using Present Net Value. *By D.W. Countryman and J.C. Murrow in* Journal of Soil and Water Conservation, *Second Quarter, 2000. Volume 55, Number 2. Pp. 152-160.*

Design (2)
continued from page 9

insect relationships, the environment, tree form, and erosion.

- *Width of alleys* – Tree rows are typically established in a straight line, or along a contour, with an alley between them. Whether single or multiple tree rows are established, the overall success of any alley cropping program often is linked directly to the spacing between the rows of trees. Allowing for adequate space for the annual crop is a must if the system is to be economically productive.
- *Equipment size* – It is important to consider the size of all farm equipment that will be operating in the alleys. The alley should be wide enough to allow clear passage of the widest piece of equipment. Another alternative is to allow clear passage of multiple widths of equipment (Example: 13-foot wide disk and 60-foot alleyway allowing four passes of the disk [52 feet] plus a buffer to ensure that no damage is done to the trees). Be sure to plan for space of the tree crown area. This is particularly important in nut production when early crown development is desirable.
- *Changes through time* – Over time, shade in the alleyways will increase due to the developing crowns. Row crops can be grown until shading reduces the productivity of the site for those crops. At this time, the companion crops must be changed or trees must be thinned to reduce competition.

Alley cropping offers another land stewardship alternative to convert degraded lands, protect sensitive lands, and diversify farm production systems.

Adapted from: "Designing an Alley Cropping Agroforestry Practice" *By Gene Garrett and Dusty Walter in* Agroforestry Training Manual: Applied Land Use Practices UMCA-2-2000.

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Upcoming Events

April 1-3, 2002
13th Central Hardwood Forest Conference, Urbana-Champaign, IL, Contact: Scott C. Miller, Phone: 217-333-2880; Fax: 217-333-9561; scmiller@uiuc.edu

April - June, 2002
Silvopasture Training Workshops for natural resource professionals in AL, FL, SC and potentially GA. Contact: Sid Brantly, Phone: 334-887-4568; Sid.Brantly@al.usda.gov

July 13-17, 2002
Soil and Water Conservation Society 2002 Annual Conference; Theme: "Setting the Pace for Conservation." Indianapolis, IN, Contact: Nikki McClain, 765-747-5531; www.hoosierchapterswcs.org/activities/settingpace

October 5-9, 2002
Society of American Foresters National Convention. Theme: Forests at Work ; Benton Convention Center; Winston-Salem, NC www.safnet.org/calendar/presentations

October 8-10, 2002
Changing Faces of Conservation and Agriculture: The Future of Working Lands, Soil and Water Conservation Society; Moline, IL, Contacts: Chris Murray, chrism@agribiz.org; Lynn Betts, lynn.betts@ia.usda.gov; http://www.iaswcs.org/west_north_central.htm

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The USDA National Agroforestry Center (NAC) is a partnership of the Forest Service, Research & Development (Rocky Mountain Research Station) and State & Private Forestry and the Natural Resources Conservation Service. The Center's purpose is to accelerate the development and application of agroforestry technologies to attain more economically, environmentally, and socially sustainable land-use systems. To accomplish its mission, the Center interacts with a national network of partners and cooperators to conduct research, develop technologies and tools, establish demonstrations, and provide useful information to natural resource professionals.

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