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Introduction

Agroforestry is a land use option that has been increasingly accepted as environmentally sound and potentially sustainable. It is a production system that attempts to link agriculture with the longer-term protective, productive, and social functions of trees and other woody and herbaceous vegetation. Economically beneficial perennials like fruit trees, fuel wood, and leguminous vegetation are incorporated in a farm to produce food, fuelwood, fodder, and fiber; to perform functions like soil improvement, erosion control, windbreaks, and as nurse crops to other plants on the farm; to provide shade to animals and serve as living fences; and as a source of cash revenue. It is adaptable to suit individual needs of farmers and the climatic conditions of an area.

Agroforestry is a system of producing diverse agronomic and forestry (hence “agro-forestry”) outputs, a feature that may be very practical in trying to diversify the primarily agricultural economy of Iowa. While agroforestry is still an emerging food, fiber, and industrial material production system in the Midwest, it has been proven to be a sustainable system of land use in many parts of the world. For 10,000 years, farmers have relied on their own resources and knowledge and have demonstrated keen understanding of the principles of sustainability by having sustained agricultural systems (some of which are now called agroforestry) in China, Indonesia, Nepal, Philippines, Peru, and other parts of the world [Gonzalvez, 1991]. In the United States, the notion of greater production through mixing forestry and agricultural practices was advocated as early as 1914 [Smith, 1914]. Agroforestry ideas may seem to have been emphasized earlier in the tropics than in temperate regions. Today, these practices can be found around the globe, addressing problems related to energy, environment, resource conservation, and food.

A review of agroforestry systems in the U.S. indicated such practice as grazing and intercropping with managed conifers in northwestern and southern U.S., and multi-cropping agronomic crops with hardwoods in the southeast and parts of the Midwest [Gold and Hanover, 1987]. The latter system usually involves northern hardwoods as black walnut and oaks and agronomic crops such as corn, soybeans, and wheat and fodder for grazing. Although there have been reports of agroforestry surveys for other sections of the U.S. [Lawrence et al., 1992; Henderson and Maurer, 1993; Zinkhan, 1993], no survey of these systems was yet conducted for the midwestern region of the United States before 1990.

Survey of Agroforestry Systems in Eight Midwestern States

In 1990-1991, a survey was conducted by researchers at the Department of Forestry at Iowa State to explore the different kinds of agroforestry activities and forestry-related systems being practiced in the midwestern U.S. It covered eight states: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.

The systems explored were classified into three general groups: traditional agroforestry, nontraditional agroforestry,
and other specialized systems. Traditional agroforestry included agrisilviculture, silvipasture, and agrisilvipasture. The nontraditional agroforestry systems included windbreaks or shelterbelts, intercropping of trees and other shrubs or perennials, and boundary plantings. The specialized systems included those that involve trees and the production of other nonwood products, such as maple syrup, ginseng tea, mushrooms, honey, and other nontimber products. These products, though grown in a forestry setting, are typical of the diversity of products one would get from an agroforestry system. Table 1 lists, describes, and gives examples for these various systems, with examples.

There was a total of 155 respondents to the survey. An indirect method of respondent selection was used because of the unknown population of farm and forest landowners doing agroforestry in the region and the large area coverage. First, identification of the respondents was done through district/area/extension foresters and other resource managers who were requested to provide names and addresses of people known to be doing agroforestry and forestry-related systems. Then a follow-up letter of verification with an invitation for their voluntary participation was extended to those who were identified. All who were contacted related to this survey were given information about agroforestry systems and a list of examples of these systems (Table 1).

Survey Results

Table 2 presents the results of the survey: 46 traditional agroforestry systems, 61 nontraditional systems, and 97 other specialized systems involving trees and nonwood products. The area of these systems ranged from less than an acre to hundreds of acres. These systems included hobbies, secondary sources of income (mostly for specialized systems), research-related or demonstration plots, and commercial operations such as for maple syrup production, tree-crop farms, and hunting area leases involving hundreds of acres. Some respondents indicated many other individuals are involved with certain practices, e.g., Christmas tree farming, windbreak programs and specialized systems. Thus, the numbers from the survey may not represent the total population of those doing these systems in the region but could indicate where systems could be more commonly practiced.

A. Traditional systems

Of the 46 systems reported, the most common was agrisilviculture (28 cases reported), followed by silvipasture (12) and agrisilvipasture (6). Almost 75% of these traditional systems were reported from the states of Minnesota, Iowa, Indiana, and Missouri.

The 28 agrisilvicultural systems were further categorized into three subsystems: alley cropping (16 cases) which included those that have agronomic crops intentionally grown between rows of trees or shrubs; any mixed cropping of trees and agronomic crops (8); and Christmas tree production with agronomic or horticultural crops planted between tree rows (4). Growing Christmas trees with crops in-between the rows, especially when the trees are still young, is an observed practice in the region. Often an alley cropping practice, this was considered a special case because Christmas trees have a much shorter production period compared with the usual timber and nut tree species used in other alley cropping systems. There are hundreds of Christmas tree growers in the region, and the number reached by the survey could just be a small portion of this
group. The crops often planted in the agrisilvicultural systems are corn, soybeans, wheat, and oats, and the trees are usually walnuts, pecans, other hardwood species such as oaks, ash, and poplars and evergreen (mostly pine) species for Christmas trees.

There was a total of 12 silvipastoral systems with two subsystems defined based on the animals involved: cattle (10) and sheep (2). The animals were allowed to graze for certain periods of time in mostly natural stands of oak, oak-hickory-maple, other northern hardwood species, and in black walnut plantations. Little information was available from respondents regarding their grazing practices despite a request for more detail.

Grazing woodlots is common in the Midwest as part of farm operations. From survey comments, there was a mixed response to grazing of forests in the Midwest. Strong sentiments against silvipastoral systems noted the incompatibility of livestock and timber production, while some practitioners reported grazing of cattle under the trees with no problem at all. Literature also yields the same mixed argument about woodland grazing [for example, see Cramer, 1991, Donohoe, 1982, Lewis et al., 1983, and Pearson, 1983 for the Pros, and DenUyl, 1945, Lentz and Wright, 1959, and Zinkhan, 1993 for the Cons]. Based on these comments and reports, silvipastoral systems still need a lot of research as far as the midwestern situation is concerned.

Only six agrisilvipastoral systems were reported. Two subsystems were represented, indicating the presence of animals (4 cases, all cattle) or having pasture/grass only in the area (2 cases). The trees were mostly black walnut and other northern hardwood species. Some of the grass species were timothy, buffalo grass, and hay. Since the survey, a new system has been established in 1992 in Iowa where the farmer had, in a very complex design, several animals (pigs, chickens, turkeys, cattle), row crops (corn, oats, red clover), and several tree species selected for nut production, for timber, and for animal shelter and windbreaks.

B. Nontraditional systems

Table 2 also shows 61 nontraditional systems reported as follows: field windbreaks or shelterbelts (29), intercropping of trees and shrubs (21), and boundary plantings (11). Shelterbelts or windbreaks are rows of trees planted in the field mainly to reduce the adverse effects of wind action. In the Central Great Plains, some of these have been in place several decades earlier mostly in response to the dust bowl crisis in the 1930s [Read, 1964]. However, a decline in interest in windbreaks in recent years and the removal of a considerable amount of those planted earlier have been observed [Byington, 1990]. Intercropping of trees and perennial shrubs included combination of two or more tree/shrub species, for various purposes, such as for nuts, timber, and fruits. Boundary plantings are rows of trees or shrubs planted to set up a barrier between two ownerships, or to delineate difference in land uses.

Nontraditional systems ranged from one or two or more rows of trees and/or shrubs. There have been a number of species used for these systems, including but not limited to: various oak species, pine species (red, scotch, white), ash, walnut, larch, maples, blue spruce, Norwegian spruce, eastern red cedar, Austrian pine, and poplars. Among the shrub species usually planted were osage orange, Russian olive, autumn olive, dogwood, lilac, cranberry, and ninebark. Promotion of
wildlife and its habitat was also cited by some respondents who are doing these systems.

C. Other specialized systems

Not normally considered as agroforestry, the specialized systems involve growing of trees and the production of nontimber outputs such as maple syrup (41 cases) and mushrooms (15, primarily Shiitake), and the promotion of wildlife for educational/recreational pursuits (30). A few other systems involved production of honey, ginseng tea, cones, ropings/wreaths, and other crafts. Trees, shrubs, grasses, and other herbaceous plants also have been grown as stream buffers and for energy production. A number of respondents reported more than a single system or practice, especially for these activities, most of which are either hobbies or are additional sources of income.

These specialized systems are important because they involve trees and the production of some nonwood benefit within a forest environment and thus enables those involved to relate to forestry more easily. Thus, these systems could be possible “transition” systems, as when one wishes to expand ginseng tea and thus start planting them in-between trees on a bigger scale, or when one wishes to increase honey production and starts putting in more boxes for “beehives” and increase pollination in the area. This could be true for most of the nonwood products that are produced within this category.

Summary

The survey showed that three traditional and three nontraditional agroforestry systems are practiced in the region. The most common traditional system was agrisilviculture. The traditional systems often involved corn, soybeans, and hay planted with tree species for nut, timber, or Christmas tree production, and cattle. Nontraditional agroforestry systems included field windbreaks/shelterbelts, tree-shrub intercropping systems, and boundary plantings. These systems involved a variety of northern hardwood species, evergreens, and shrubs. The specialized systems are the most common practices in the region, producing outputs such as mushrooms, nuts, syrup, wildlife, and other nonwood products. Not normally considered as agroforestry, the significance of these specialized systems is that they offer varied ways of connecting forestry with other activities in a largely agricultural landscape, and that they may even be seen as opportunities for easier transition into agroforestry.

Although the results may not represent a complete count of people involved with agroforestry in the region, the numbers reported may indicate where a practice may be prevalent. The survey data provided some basis for further research on more suitable systems, and for identifying other researchable questions on agroforestry for the region. The survey also generated information for a directory to help foster the exchange of information on agroforestry and related systems. The results show that traditional agroforestry is indeed practiced in the Midwest, but that much work still needs to be done to “sell” the idea to many more landowners and resource managers.
Table 1. Agroforestry and related systems*

Agroforestry is generally defined as a land-use system that deliberately combines trees or shrubs with annual plants and/or animals on the same land area. This combination may occur in space (that is, grown at the same time) or in temporal (sequential) fashion. The three basic or traditional types of agroforestry systems are agrisilviculture, silvipasture, and agrisilvipasture. These three and other types of agroforestry systems with some specific cases are described below.

A. Traditional Agroforestry Systems

1. **Agrisilviculture** — combination of agronomic crops ("agri") and trees ("silvi").

1A. Alley cropping — This is the most common example of agrisilvicultural systems, wherein the agronomic crops are grown between rows of trees or shrubs.

1B. Mixed cropping of agronomic crops and trees

1C. Christmas trees and agronomic/horticultural crops, either spatial or temporal mix

2. **Silvipasture** — combination of trees ("silvi") and pasture (animals, pasture, or both).

2A. cattle under trees (black walnuts, pecans, pines, other tree species)

2B. sheep under trees (black walnuts, pecans, pines, other tree species)

3. **Agrisilvipasture** — combination of agronomic crops, trees, and animals/pasture.

3A. Alley cropping with shrubs/trees, crops, grass species, and with animals

3B. Alley cropping with shrubs/trees, crops, grass species, and without animals

3C. Any mix of crops, trees, grass, and animals

3D. Any mix of crops, trees, grass, without animals

B. Nontraditional Agroforestry Systems

4. **Shelterbelts/Windbreaks** — plantings of rows of trees, mainly for purposes of reducing the adverse effects of wind action, such as erosion, loss of soil moisture, and drought stress on crops.

5. Intercropping of trees and shrubs (perennial species) — combination of two or more tree/shrub species. Most common examples are combinations of fruit-bearing shrubs and/or trees.

6. **Boundary plantings** — rows of trees or shrubs that are planted for purposes of setting up a barrier between two ownerships, or to delineate difference in land uses.

C. Other Specialized Systems
7. Wood-nonwood forest product combinations — combination of trees with nonwood outputs such as mushrooms, wildlife, pine cones, and similar nonwood forest items.

4A. trees and mushroom production
4B. trees and wildlife promotion — e.g., leased hunting
4C. trees and pine cone production
4D. trees and (ginseng) tea production
4E. trees in combination with other nonwood forest products (e.g., maple syrup, honey, others)

*Partly based on a glossary developed by the Winrock International Institute for Agricultural Development in 1990.

Table 2. Traditional and nontraditional agroforestry and other specialized systems reported for the eight midwestern states in the United States*.

<table>
<thead>
<tr>
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<th>IL</th>
<th>IN</th>
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<th>MN</th>
<th>MO</th>
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*Although there were 155 respondents, the total number of systems reported was 204 because some respondents reported more than one system, especially for the specialized and nontraditional systems.*
References


