

Agroforestry and forestry-related practices in the Midwestern United States

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Abstract. A survey, conducted in 1990–1991 on agroforestry and forestry-related systems in eight Midwestern states, showed that three traditional and three nontraditional agroforestry systems are practiced in the region. Of 46 traditional systems reported, most common was agrisilviculture (28), then silvipasture (12) and agrisilvipasture (6). These systems often involved corn, soybeans, and hay planted with tree species for nut, timber, or Christmas tree production, and cattle. Non-traditional agroforestry systems were field windbreaks/shelterbelts (29), tree-shrub intercropping systems (21), and boundary plantings (11). These systems involved a variety of northern hardwood species evergreens, and shrubs. There was also a preponderance of specialized systems (97) of growing trees with the production of mushrooms, nuts, syrup, wildlife, and other nonwood products. The survey is exploratory in nature and, 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 results reflect the fact that much work still needs to be done by agroforesters in this region. They also provide some basis for further research on more suitable systems, and for identifying other researchable questions on agroforestry for the region. The methodology also made possible a bigger nucleus for networking of agroforesters and other interested people in the Midwest. Finally, although not normally considered as agroforestry, the significance of the other specialized systems reported in this survey 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.

Introduction

Agriculture is a primary economic activity in the Midwest, a region that contains some of the richest but most erodible soils in the United States. In 1982, Iowa's loss of 9.4 tons per acre was the worst in the United States and was twice the national average [USDA Soil Conservation Service, 1986]. Agriculturally-related activities have caused other serious environmental problems in the region, such as high nitrate concentrations, toxic pesticides in water supplies, and siltation of water bodies. Agroforestry has the potential to reduce the seriousness of these problems.

Agroforestry is a land-use system that intentionally combines trees or shrubs with annual plants and/or animals on the same land area. The combination may be grown at the same time or in a sequential fashion. This definition implies a production system that aims to increase overall produc-

tion by more fully harnessing the potential of the various resources involved [Agroforestry Systems, 1982].

For about 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 what is now called agroforestry) in China, Indonesia, Nepal, Philippines, Peru, and other parts of the world [Gonsalvez, 1991]. In the United States, the notion of greater production through mixing forestry and agricultural practices was advocated as early as 1914 [Smith, 1914]. However, agroforestry ideas 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, as well as problems in areas where increasing populations call for greater production from a fixed land base.

A review of two agroforestry systems for the temperate zone mentioned grazing and intercropping with managed conifers in northwestern and southern US, and multi-cropping agronomic crops with hardwoods in Alabama, Missouri, and Illinois [Gold and Hanover, 1987]. Literature on silvipastoral systems were mostly for the southern forest range [Burton, 1973; Cramer, 1991; Davis et al., 1984; Lewis et al., 1983; Pearson, 1980–84]. An evaluation of silvicultural and economic relationships of a multicropping system with soybeans, wheat, fodder or grazing, and black walnut was also reported for Missouri [Garret and Kurtz, 1983]. Integrated forestry-farming activities with black walnut were cited for Indiana and Missouri, and a simulation study was done in Illinois on multicropping systems involving black walnut and other tree species with several field crops [Campbell et al., 1989]. Although there have been reports of surveys on agroforestry systems for other sections of the US [Henderson and Maurer, 1993; Lawrence et al., 1992; Zinkhan, 1993], no survey of these systems was yet conducted for the midwestern region of the United States before 1990.

Increasing emphasis on temperate zone agroforestry may be indicated by several conferences on this subject held mostly in the US during the last five years. The new series of conferences focusing on North American agroforestry held its initial event at the University of Guelph, Canada in August 1989, the second at the University of Missouri in August 1991, and the third in August 1993 at Iowa State University in Ames. The fourth conference scheduled for 1995 will be held in Idaho. Related international events [Raintree, 1994] are the Agroforestry Education Conference held in 1988 at the University of Florida, the international symposium on Planning for Agroforestry held in 1989 at Washington State University, and the conference on 'Agroforestry: Principles and Practice' held in Edinburgh, Scotland in 1989.

Objectives and methods

A survey was conducted in 1990–1991 with a prime goal of exploring the different kinds of agroforestry activities and forestry-related systems being practiced in the Midwestern United States. It covered the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. By forestry-related systems, we include the production of 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.

The survey was also designed to gather initial information for a directory [Rule et al., 1992] to help foster information exchange regarding agroforestry and forestry-related systems. The unknown population of farm and forest landowners doing agroforestry in the region (hence the exploratory nature of the survey) and a large area coverage called for the use of a two-step methodology to get in touch with the actual respondents and for a brief questionnaire. One weakness of this approach, however, was that once the respondents were identified, it was very expensive to visit every case and verify results on the ground. This problem was solved by two follow-up contacts and verification through the mail. Their consent to be included in the directory also implied their willingness to be contacted by others for information about their systems.

First, to reach those actually involved with agroforestry and forestry-related practices, a preliminary group consisting of 247 district, area, service, and extension foresters and other resource professionals in the eight states was contacted for information on individuals known to be involved with these practices. Information and a list¹ of various agroforestry and forestry-related systems were sent to them. This list included the three traditional agroforestry systems (agrisilviculture, silvipasture, and agrisilvipasture) as structurally classified by Nair [1985], three non-traditional systems such as windbreaks or shelterbelts, intercropping of trees and other shrubs or perennials, and boundary plantings, and other specialized systems involving trees and the production of other nonwood products. Examples of these systems were also given to the group.

The preliminary group suggested 250 names of practitioners and specialists who were then contacted to verify the information initially given by the preliminary group, to obtain further information about their systems, and to get their consent to be included in the directory of agroforestry and related systems. They were also given the same set of information given to the first group. They were asked further about the various components or elements that are found in their systems or practice, such as tree species used, crops, animals, fruits/vegetables, other products, as well as the area and the approximate time the practice was started.

Results and discussions

Of the 250 people contacted, 155 verified and/or gave further information about their systems, 68 did not respond, 20 declined, and 7 could not be located. Information presented in this section reflects data verified by 155 respondents. The systems will be broken into three groups: traditional agroforestry, nontraditional agroforestry, and other specialized systems.

Reported in the survey were a total of 46 traditional agroforestry systems (agrisilviculture, silvipasture, and agrisilvipasture), 61 non-traditional systems (shelterbelts/windbreaks, tree-shrub intercropping, boundary plantings), and 97 other specialized systems involving trees and non-wood products. These results are displayed in Table 1.² The acreage of the various systems reported ranges from less than an acre to hundreds of acres. They spanned from hobbies and secondary source of income (mostly for specialized systems) to research-related or demonstration plots (for some traditional systems). They also included commercial operations, such as maple syrup production, tree-crop farms, and hunting area leases involving hundreds of acres. Comments and observations from some respondents indicated many other individuals are involved with certain practices, such as with windbreak programs and specialized systems. Thus, although the numbers reported in this survey do not represent a complete count of people practicing the system in the region, figures in Table 1 may indicate where a practice is most likely to be prevalent.

Table 1. Traditional and nontraditional agroforestry and other specialized systems reported for the eight midwestern states in the United States.

System/state	IA	IL	IN	MI	MN	MO	OH	WI	Total
1. Agrisilviculture	5	2	7	1	3	7	2	1	28
2. Silvipasture	3	1	1	1	2	1	1	2	12
3. Agrisilvipasture	0	0	1	0	1	3	0	1	6
(Subtotal)									(46)
4. Shelterbelt/ Windbreak	5	4	6	4	4	1	3	2	29
5. Intercropping	0	3	6	3	3	2	0	4	21
6. Boundary planting	0	3	2	1	3	2	0	0	11
(Subtotal)									(61)
7. Other specialized systems	4	11	14	4	19	2	12	31	97
Grand total	17	24	37	14	35	18	18	41	204

Traditional agroforestry systems

Of the 46 systems reported for the region, the most common was agrisilviculture (28), followed by silvipasture (12) and agrisilvipasture (6). Four states (Minnesota, Iowa, Indiana, Missouri) accounted for 74% of all traditional systems reported in the survey. These results are consistent with earlier reports [Campbell et al., 1989; Garret and Kurtz, 1983; Gold and Hanover, 1987] that indicated locations of some agroforestry systems in the region, especially for agrisilvicultural systems.

Agrisilvicultural production systems involve combinations of agronomic crops and trees. Of the 28 agrisilvicultural systems reported, seven each were from Missouri and Indiana, and five were from Iowa. Three subsystems were represented in the survey. First was alley cropping (16 cases reported) which included those that have agronomic crops intentionally grown between rows of trees or shrubs. The second subsystem covered any mixed cropping of trees and agronomic crops (8), as opposed to alley cropping. The third subsystem, Christmas tree production with agronomic/horticultural crops planted between tree rows (4), was included as a special cropping system by itself in recognition of the practice in the region of growing Christmas trees with crops in-between the rows, especially when the trees are still young. Although often an alley cropping practice, this subsystem was considered a special case because of the nature of the production cycle i.e. Christmas trees involve a much shorter production period as compared with the usual timber and nut tree species used in other alley cropping systems. As there are hundreds of Christmas tree growers in the region, the number reached by the survey could actually be a very small sample of this subgroup, and this may be another area for further agroforestry research in the future. 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. One practitioner reported planting vegetables (broccoli, cabbage, peas) between tree rows that provided a longer cool season for these crops.

All states reported one to three silvipastoral systems for a total of 12. Two subsystems could be defined based on the animals involved which are primarily cattle (10) and sheep (2). Grazing by goats was suggested but no example was given. Little information was available from respondents regarding their grazing practices despite a request for more detail. In the cases reported, 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.

Grazing woodlots is quite common in the midwest as part of farm operations, with farmers having a hundred or so head of cattle (D. Countryman, personal communication, 1994). There has been a mixed response to grazing of forests in the Midwest, and this showed up in the survey comments. Strong opinions expressed against silvipastoral systems (not from those who reported

the system though) noted the incompatibility of livestock and timber production, and these were similar to sentiments in earlier years calling for the elimination or reduction of woodland grazing [Abbott, 1954; Den Uyl, 1945; Julander, 1946; Lentz and Wright, 1959]. In Iowa, for example, grazing was identified to be a major cause of much of the poor stocking in the past, with the impact a bit more pronounced on farmer-owned land as opposed to other private and publicly owned lands [Leatherberry et al., 1992]. Although grazing has declined since then, this report should indicate that there is probably more silvipastoral systems in Iowa than the three cases reported. On the other hand, some practitioners reported grazing of cattle under the trees with no problem et all. This, too, finds support from other reports on silvipastoral systems. For instance, research results from Illinois were cited which indicate that timing of pasturing cattle in the woodlands could be the key to good woodlot pasture management [Cramer, 1991], while there were also those who wrote about good pasture management in southern forest range [Donohoe, 1982; Lewis et al., 1983; Pearson, 1983]. A survey of public land-use professionals' perceptions of agroforestry applications in the south also revealed the most commonly mentioned problem to be the effect of grazing on seedling survival and soil productivity [Zinkhan, 1993]. Judging from the comments and these reports, silvipastoral systems still needs a lot of research as far as the mid-western situation is concerned.

Agrisilvipasture, the third traditional system, had the least reported occurrences. It included production systems that combine agronomic crops, trees, and animals and/or pasture/grass. Six of these systems were reported, half of which were from Missouri. The other states reporting this system were Indiana, Minnesota, and Wisconsin. Two subsystems were represented, indicating the presence of animals (4 cases) 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, and the animals were cattle. Since the survey, there has been a new system 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. This area has since become a good demonstration farm for visitors and the general public.

Non-traditional agroforestry systems

Sixty-one nontraditional systems were reported, distributed as follows: field windbreaks or shelterbelts (29), intercropping of trees and shrubs (21), and boundary plantings (11) (Table 1). Shelterbelts or windbreaks are rows of trees planted in the field mainly to reduce the adverse effects of wind action, such as erosion, loss of soil moisture, and drought stress on crops. In the Central Great Plains, some of these have been in place for several decades now as they have been encouraged for erosion control especially in the 1930s during

the dust bowl crisis [Read, 1964]. However, a decline in interest in windbreaks in the US 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.

These 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.

Other specialized systems

The last category, although not normally considered as agroforestry, included several specialized practices that involve growing of trees and the production of maple syrup (41 reported) 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 additional sources of income.

The significance of these specialized systems stems from the fact that they involve trees and the production of some nonwood output or benefit within a forest environment. As such, the practitioners are able to relate forestry with these other production activities. 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. The fact that these specialized systems are widely practiced in the region should be taken as a plus by the agroforesters working for wider adoption of agroforestry systems in the region.

Who is practicing agroforestry in the Midwest?

Various types of people are doing agroforestry in the Midwest. Four Midwestern universities (Illinois, Missouri, Michigan State, and Iowa State)

reported on various agroforestry projects. Their research emphasized various elements and/or purposes of agroforestry and often involved different spacings and combinations of various trees and crops or other vegetation. Survey results also included a small number of local/county projects and cooperation with research institutions and local government agencies. Although funding may or may not be involved, some agencies, such as the Department of Natural Resources and local county conservation boards, helped promote or encourage some of the nontraditional agroforestry systems mostly through cooperative programs. Also notable was the involvement of farmers and other private individuals, such as some of the private farmers, nut growers, and Christmas tree producers, in agroforestry activities. The prevalent practice of other specialized systems in the region could play an important role in persuading people who already dabble with forestry-related practices into doing something more with agroforestry activities. It has been suggested that early adopters of new ideas are innovators, or those active information seekers, who usually have a higher degree of exposure to the mass media and an even wider interpersonal network usually reaching outside of their local systems [Rogers, 1983]. A study has also suggested that the major cause for rejection of agroforestry systems in the south was the perceived high level of uncertainty associated with the workability of agroforestry systems as land uses [Zinkhan, 1993]. Thus, cooperation with research institutions, the provision of possibilities for wider networking with other interested/practicing individuals, and efficient use of the media could advance the cause of agroforestry in the region.

Summary and conclusions

Survey results showed that the three traditional agroforestry systems exist in the Midwestern United States, and that nontraditional systems such as windbreaks/shelterbelts, interplantings of trees and shrubs, and boundary plantings are practiced as well. The prevalence of various specialized systems involving trees and the production of nonwood products or benefits is also important in the sense that these systems could be transitional activities for would-be agroforestry adopters.

This survey was designed to explore the kinds of agroforestry activities being practiced in the Midwestern United States. As an initial attempt, it uncovered considerable information about these systems. It also identified some researchable questions that could help promote the adoption of applicable agroforestry systems in the region, and it provided for a bigger nucleus of practitioners and specialists for networking purposes. Specifically, it also provided some benchmark information necessary for a more detailed investigation of selective systems in terms of their economic and environmental benefits which is being pursued by the authors currently. The existence of some cooperative projects among farmers/private individuals, research insti-

tutions, and some public agencies are also encouraging signs that there would be more demonstration areas for other would-be adopters to see and believe.

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Notes

¹ This list was based on a glossary developed by D. Henderson of the Winrock International Institute for Agricultural Development.

² It must be noted that although there were 155 respondents, the total systems reported was 204 because some respondents reported more than one system, especially for the specialized and the nontraditional systems.

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