

Rural Livelihoods and Agroforestry Practices in the Missouri Flood Plains

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ABSTRACT

Agroforestry practices, new to many small farms in the United States, may offer many economic and environmental benefits. Small farmers in Northeast and Southeast Missouri were interviewed to understand the relationship between their knowledge and interest in agroforestry practices and their livelihood strategies. Different income diversification strategies were found. The Southeast, with richer cropland, has a more diversified crop portfolio. In the Northeast, crop livestock production systems and part-time farming prevail, reflecting a rural lifestyle option where some household members engage in off-farm activities. Given differences in production systems and income from agriculture, the study finds that those interviewed have some knowledge and interest in agroforestry practices. Windbreaks and riparian buffers ranked highest in knowledge and interest in the Southeast, where household strategies focus on commercial crops and there is concern for the environment. Windbreaks and forest farming were first in the Northeast, where farm households are concerned about the environment, future generations, and new economic opportunities. This finding coincides with perceptions of the importance of trees to the environment, future generations, and economic benefits.

INTRODUCTION

Small farms in the U.S. account for 75 percent of the total productive assets in agriculture-- mostly land (USDA, 1998). Because of their numbers and land ownership, family farms could play a significant role mitigating the negative environmental impacts of agriculture, like non-point source pollution, soil erosion and depletion of soil quality. These are also the farms suffering from low prices for commodities in recent years. The U.S. Farm Bill of 1996, often referred to as the Freedom to Farm, paved the way for more flexibility in crop choices and possibilities for production diversification. Though this diversification may take place by using traditional crops to obtain government support, it can also happen outside of the traditional crop-livestock production activities and agriculture (Gardner 2000). One strategy that may address both the environmental and economic production issues on family farms is agroforestry – a familiar land-use strategy in many areas of the tropics, where intensive management systems integrate trees, crops and livestock to maximize production on minimal acreage, mitigating the impacts of slash-and-burn agriculture. The practices are slowly gaining recognition in the United States (Gold et al., 2000). This paper focuses on small farms in Missouri's Northeast and Southeast regions, using a rural livelihoods framework to examine the potential for incorporating agroforestry practices in rural farmers' strategies.

RURAL LIVELIHOODS AND AGROFORESTRY

In order to understand the potential role of agroforestry practices in the livelihoods (Ellis, 1998; Chambers and Conway, 1992) of small farmers in Northeast and Southeast Missouri, investigators

used a household portfolio approach (Schucksmith, 1993; Bebbington, 1998; Valdivia et al, 1996; Valdivia, 2001). The approach considers that households look to maximize their net returns and have other objectives shaped by the life cycle stage of the family, and by more specific objectives related to life in rural areas, like importance of the environment, quality of resources, wildlife, and lifestyle. In order to do this, rural households develop a portfolio of activities based on their access and control of resources and assets. Labor is allocated to agricultural and off-farm income-generating activities by members of the household, resulting in the diversification of the economic portfolio. Diversification may be a strategy to reduce risk (Skees et al, 1998; Knutson et al.,1998), or a mechanism to maximize use of available resources (Ellis, 1998; Valdivia, 2001) and sustainable land management as observed in Africa and Latin America, or a matter of preference and lifestyle, which may be the case in the US and Europe (Schucksmith, 1993; Raedeke et al., forthcoming), or income growth (Gold et al.,2000; Wiersum, 1990; Garrett et al., 1994).

Agroforestry Practices

There are five temperate zone agroforestry practices: alley cropping, silvopasture, windbreaks, forested riparian buffers and forest farming (Gold et al., 2000). In alley cropping, trees are planted in single or multiple rows with agricultural or horticultural crops cultivated in the alleyways between rows. Silvopasture combines trees, forage and livestock into one integrated practice. Windbreaks are trees or shrubs planted as barriers that reduce wind speed and protect crops and livestock, or provide wildlife with a habitat. Riparian buffers are strips of permanent vegetation—trees, shrubs and grasses—planted between agricultural land and water resources to reduce run-off and non-point source pollution, stabilizing streambanks and protecting water quality. Forest farming consists of high-value, shade-tolerant crops cultivated under a forest overstory, modified to provide appropriate microconditions. Many of these practices have multiple benefits, in terms of long-run income, stream, environmental, and/or scenic beauty.

SITE AND METHODS

Study Location

Criteria for selecting study sites were that they represent different ecosystems and have varied agricultural, social, cultural and economic conditions. The two sites selected were: First, the Fox-Wyaconda Watershed (FWW) made up of 430,453 acres and portions of 3 northeastern Missouri counties—Scotland, Lewis, and Clark. The terrain consists of rolling hills dissected by the Wyaconda and Fox Rivers. The Mississippi River forms the eastern boundary of the watershed. Historically the combination of forest and prairie facilitated a process where forestry and agriculture existed side-by-side; mills were established for processing grains and to process timber for building purposes (Knox County Historical Society, 1981). Non-point source pollution is a significant problem in the watershed.

The second site is Scott County – 273,062 acres, about two-thirds the size of the FWW site. Two distinct regions are found in Scott County: the Mississippi River Delta, 82 percent of the county, and an upland area, Benton Hills, the other 18 percent (Festervand, 1981). The forested swamps in the Missouri River Delta barred widespread settlement of the area until the early twentieth century (Raedeke et al., forthcoming). A system of drainage ditches and levees is used to maintain

this converted farmland (Stepenhoff, 1995). Today most of the Mississippi River floodplain has some of the most valuable cropland in Missouri (Plain and White, 1999).

The Sample and Data Collection

Surveys were used to collect data; a qualitative set of interviews with 53 key informants--32 in FWW and 21 in Scott County—helped develop a formal, close-ended questionnaire. Sources included the University of Missouri Outreach and Extension (U O/E), the Natural Resources Conservation Service (NRCS), Soil and Water Conservation Districts (SWCD), farm and sawmill operators, wood processors, farm supply store employees, and members of two intentional communities (communes) in FWW. The sampling frames consisted of lists provided by the Natural Resources Conservation Agency in FWW. The Farm Services Administration Office provided names in Scott County. The household questionnaire was applied through personal interviews in early 1999. Response rate in FWW was 61 percent (196 respondents) and 53 percent in Scott County (162 respondents). A subsample of small farms was chosen – households with “less than \$250,000 gross receipts annually on which day-to-day labor and management are provided by the farmer and/or the family that owns the production, or owns or leases the production assets.”(USDA, 1998) The number of small-farm observations in the sample for Fox-Wyaconda Watershed (FWW) was 123 and for Scott County (SC) 93 – 216 total.

RESULTS

Livelihood Strategies: Household Portfolios

A household economic portfolio reflects the chosen strategy of a family in the context of a market economy. For this study we consider economic activities on and off-farm and the assets and resources that shape them. Agroforestry practices yield environmental, economic, and scenic beauty benefits. To understand why these are important we look at how interest in these relates to the portfolio composition, the resources and assets (productive, natural capital and human capital). Average land owned, a natural capital, (Table 1) in FWW is 288 acres compared to 125 acres for Scott County (SC), whose farmers rent more. FWW farmers have slightly more acreage in managed forestland, though there is a large difference in the amount of unmanaged forestland. Farm operators in both sites harvest their timber, but are more likely to do so in FWW ($p \geq .05$).

Education, experience and knowledge, and demographics of the family make up human capital. Farm operators in the FWW tend to own their land longer, a mean of 52 years, to 44 years in SC. When asked, farmers from both sites were unsure whether the farms would continue after they retired. While operators at both sites spend a similar number of hours working on their farms, SC farmers hire 61% more labor than operators in FWW, because they have more acreage in row crops than FWW operators. There is more pastureland in FWW, and cropland in SC.

Investments in productive assets differ, especially in machinery for crops and investments in livestock and its machinery. SC farmers have 5.4% of their assets in livestock, while they have almost 20% in row crop machinery. FWW farmers have 10% of their assets in row crops machinery and 11% in livestock assets. The asset composition is consistent with the types of land owned, accessed and used.

Table 1: Farm and operator characteristics in The Fox-Wyaconda Watershed and Scott County in 1998.

* Total is the sum of all land from the sample. ** Diversity Index (Valdivia et al 1996) measures the number and spread of income from crops. Significant differences exist in crop diversification. $DI = 1 / \sum (pi^2)$ where pi^2 is the income share of crop i 's share in total crop income, squared.

Household Assets and Resources *Total at the site	FWW Mean (Std. Error)	Scott County Mean (Std. Error)
Age (Yrs.)	54.3 (1.2)	51.7 (1.3)
Education (in years)	12.8 (.2)	12.5 (.3)
Acres rented in 1998	445.4 (56.6)	467.8 (60)
Acres owned in 1998	288 (51.8)	124.9 (12)
Years the land has been in family	51.7 (3.4)	44.1 (3.6)
Average hours/wk working on farm	31.7 (2.1)	32.2 (.3)
Total hours of labor hired in 1998	660.3 (177.8)	1,063.3 (221.9)
Managed timber (Acres) / Total*	611* / 5.0 (3.3)	548* / 5.9 (3.8)
Unmanaged timber (Acres) / Total*	2,249* / 18.3 (4.4)	947* / 10.18 (3.0)
Land in crops (Acres) / Total*	27,791* / 255.9 (28.1)	38,429* / 413.2 (53.4)
Land in pasture/hay (Acres) / Total*	13,313* / 108.2 (13.4)	2,840* / 30.5 (4.6)
Row Crop Machinery (% of total assets)	10.9	19.7
Livestock (% of total assets)	7.5	3.2
Livestock Machinery (% of total assets)	3.4	2.2
Diversity Index of Crops **	1.12	2.33

On-farm activity diversification varies in terms of whether crops or livestock are raised, or have a mixed system. The household portfolio includes off-farm activities. Table 2 presents the distribution of households by production system and by involvement in full or part time farming. Mixed crop-livestock systems dominate in FWW, while crop-only systems lead in SC. Typical crops grown are wheat, corn, and soybeans in FWW. SC is similar, some farmers growing crops not included in diversity index calculations (Table 1). Those producing row crops full time are traditional producers in SC. These farmers diversify the number of row crops that they plant on any given year. Table 1 shows the significant differences between the two sites in terms of crop portfolio diversification. Part time farming is characteristic of about half the sample pointing to off-farm diversification. Those in livestock production are all part time farmers. "Others" include people living in rural areas not involved in commodity production. Livestock and forests dominate in FWW while row crop production is a highly profitable enterprise in Southeast Missouri.

Both part time and full time farmers obtain income from non-farm activities (Table 2). Their perceptions of involvement in farming coincide with the percent of income generated from farming, but not necessarily with the amount of household labor invested. In both part time and full time households, the farm operator's spouse works off-farm a weekly average of 24 to 28 hours, both in FWW and SC. There are differences in household time commitment, where the farm operator in FWW spends more hours of unpaid family labor on the farm than those that are full time. This is not the case in SC. Significant differences occur in the percentages of income derived from agriculture among full time, part time and others. This phenomenon shows that farmers' perceptions about their involvement in agriculture coincide with the proportion of income derived.

The economic importance of activities varies. Crop investments in Southeast Missouri are higher. In the Northeast the weight of non-agricultural activities, as well as those involving trees is higher. The portfolio of those in the FWW is diversified when these activities are included.

Table 2: Percent distribution of respondents by involvement in farming and by production system in Fox-Wyaconda Watershed and Scott County, Missouri in 1998.

¹ includes farm operators, retired farmers and hobby farmers that are not farming full-time or part-time

² do not produce crops or livestock

³ ANOVA to determine differences full time, part time and other.; per site. F= 73.216 (FWW); F=77.463 (Scott C.). At FWW there were significant differences between groups by involvement, and in Scott there were significant differences between full time and part time but not between part time and other.

Involvement/ Production System	FWW				Scott County			
	Full-time %	Part time %	Other ¹ %	Percent of Total %	Full time %	Part time %	Other %	Percent of Total %
Crop-livestock	57	37	6	40	55	41	4	31
Crop	44	41	15	28	64	34	2	44
Livestock	26	58	13	19	0	81	29	17
Other ²	6	56	38	13	0	43	57	8
Farming as % of Gross Income³	78	28	13		83	21	17	

The sample shows that part time farming is important and reflects a growing household strategy to remain in agriculture. For some this rural/urban integration has benefited farm households (Gardner, 2000), also defined as a rural lifestyle. We now look at the relationship between the portfolios and rural-urban linkages, and attitudes towards trees and agroforestry in this context.

Knowledge and Interest About Practices

While in general knowledge about the five agroforestry practices was low, farm operators at both sites rated their knowledge of windbreaks from medium to high. Table 3 presents the number of farm operators by project site responding “Yes,” for any level of interest or knowledge. While there was no significant difference in awareness of windbreaks between sites, there was a significant difference, in knowledge about forest farming and riparian buffers. Farmers in FWW knew more about buffers and alley cropping than did operators in SC (p< .05).

Overall there was some interest expressed in agroforestry, particularly with forest farming in the FWW (they have more forested land). About a third of the farmers in FWW expressed interest in forest farming and riparian buffers. The greater percent is in FWW as it has more mixed crop-livestock production and trees (Raedeke et al, forthcoming). Knowledge and interest of windbreaks ranked the highest, as farmers were also more familiar with the practice. In all practices, FWW farmers expressed a greater interest and knowledge; the only exception was interest in windbreaks. FWW has a combination of land resources that reflects the integration of trees with livestock and crops. It also has less crop diversification, lower income, and more off-farm activities, which may trigger the need to look to other income opportunities.

Table 3. Knowledge and Interest in Implementing Agroforestry Practices by Site in 1998 (numbers on top and percent in parenthesis) Know indicates the number (and percent) of farmers that knew about the practice, and interest indicates percent of farmers interested in any way on the practice.

	Silvopasture		Alley cropping		Forest Farming		Riparian Buffers		Windbreaks	
	Know	Interest	Know	Interest	Know	Interest	Know	Interest	Know	Interest
FWW	0	13 (12)	26 (21)	23 (19)	27 (22)	41 (34)	48 (39)	39 (33)	90 (74)	65 (55)
Scott Co.	0	4 (5)	9 (10)	13 (15)	14 (15)	22 (27)	23 (25)	18 (22)	60 (65)	47 (58)
Total	0	17 (8)	35 (16)	36 (18)	41 (19)	63 (31)	71 (33)	57 (28)	150 (70)	112 (56)

The Importance of Trees

A majority of farm operators at both sites ranked erosion control, intergenerational, wind protection, protection of water quality, scenic beauty and wildlife benefits above economic ones. When farm operators in FWW were asked whether they considered trees to be important for flood protection, they were more likely to respond “yes” than farm operators in SC. This may be due to the larger number of second and third order streams which cause annual spring flooding in FWW. Most flooding in SC and Southeast Missouri is caused by the Mississippi River and while rare, events tend to be large. However, levees protect much of the farmland and few flood events affect farms inside the levee.

Out of the eight potential benefits of trees, economic ranked seventh in FWW, and was tied for sixth in SC, indicating that non commercial motives play a role in decisions, differing from traditional commercial farming objective. This interest in the next generation and the environment points to the need to include in the objective function of the household these goals. It is also true that economic motives exist as reflected in the interest in forest farming in FWW, because of the need to look for more income generating activities.

Table 4 Benefits of Planting Trees in Fox Wyaconda Watershed and Scott County (expressed in percent answering affirmative, any importance, and very important).

Importance of Planting Trees for	Fox Wyaconda (N=123)		Scott County (N= 93)	
	Has Importance	Very Important	Has Importance	Very Important
Future Generations	94	45.5	88	49.5
Economic Benefits	84	33.3	81	41.9
Scenic Beauty	88	25	83	22.6
Wildlife	89	30	90	32.3
Wind Protection	89	32	86	36.6
Water Quality	88	32.5	86	38.7
Erosion	90	38	87	39.8
Flood Protection	83	26.8	61	24.7

Economics Matters: Tree Planting Decisions

Table 5: Factors Affecting Planting Trees Decisions in Fox Wyaconda Watershed and Scott County, 1998-1999 (Total number of respondents and in parentheses percentage that believe it is a problem.)

	Too long to make a profit	Inadequate market prices	Lack of technical info	Time required to manage trees	Establishment costs too high
FWW	87 (71)	78 (64)	76(62)	96(79)	89(73)
Scott	75 (82)	56 (61)	51 (56)	62(77)	80(87)
Total	162 (76)	134 (63)	127 (59)	158(74)	169(79)

The high percent of “too long to make a profit” at both sites indicates that economic returns are a concern. The capacity to engage in markets is also a concern, as is the labor investment required to manage trees properly. Establishment cost is the greatest concern. Because there are government programs that could support establishment of some of these practices, and because cost appears to be a concern, farmers were asked about their participation in other programs. Cost sharing was considered at both sites to be an attractive way to introduce trees in their systems.

CONCLUSIONS

The purpose of this paper was to assess farmers’ attitudes regarding potential for agroforestry in Fox-Wyaconda Watershed and Scott County in Missouri, to improve their quality of life and diversify income sources after the Farm Bill of 1996. Small farms are very diverse, both in type of production activities that farmers engage in, and in time dedicated to farming as opposed to off-farm activities. Small farm households derive an important source of their income from non-farming activities, and their farm cropping enterprises exhibit different degrees of diversification. High levels of income from crop farming in the Southeast compete with the potential for agroforestry as a commercial activity, though interest is still high when it comes to future generations and the environment. Trees potentially used as windbreaks and riparian buffers rank higher in priority than other agroforestry practices. Forest farming, specifically an income-generating activity that could diversify the income portfolio is of interest to Northeast households where traditional farming does not yield high returns. Many of the reasons for interest are primarily non-economic, such as the pursuit of a rural lifestyle. Many of the concerns with adopting are costs. Under these conditions, government programs oriented to improve the environment could find these farmers willing partners.

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