



# **Land Owner Characteristics and Perceptions in Northeast and Southeast Missouri**

## **The Economic and Social Value of Flood Plain Agroforestry to Rural Development Projects**

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Land Owner Characteristics and Perceptions in Northeast and Southeast Missouri

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# **The Economic and Social Value of Flood Plain Agroforestry to Rural Development Project:**

## **Land Owner Characteristics and Perceptions in Northeast and Southeast Missouri**

### **Introduction**

Agroforestry is 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. Agroforestry as a practice is slowly gaining recognition in the United States, where it is defined as “intensive land management that optimizes the benefits (physical, biological, economic and social) from biophysical interactions created when trees and/or shrubs are deliberately combined with crops and/or livestock” (Gold et al., 2000).

The research project on social and economic benefits of agroforestry practices aims to identify how and when these practices can become an activity of the portfolio of choices that individuals and their families in rural areas pursue in their livelihood strategies. In order to achieve this, a previous study identified the profiles of farm operators, typologies of production systems and livelihood strategies both in large and small farms, in relation to interest and knowledge of several agroforestry practices. This study aims at understanding the characteristics of land owners that are not engaged in farming, and who may be interested in agroforestry practices.

The research takes place in Missouri’s Northeast (Fox Wyaconda Watershed FWW) and Southeast (Scott County SC) along the Mississippi river. The original intent was to understand the potential for these practices in flood prone areas, to protect the environment while providing alternative economic opportunities. The underlying premise is that agroforestry practices can provide economic, social and environmental benefits when matched with the objectives of decision makers in rural areas.

### **Purpose**

Environmental and economic forces have been affecting rural areas for many years. Rural areas are changing to include owners that have not farmed in the past. These stewards of the land may have different uses and expectations, especially as many are retired people, or are at a different stage in the life cycle than farm operators are. In order to determine if agroforestry interventions are of interest for rural development and the environment, it is necessary to understand who the landowners are.

This report summarizes the results of a survey that took place in 1999. A formal mail-in survey was sent to landowners to obtain information on the social, economic and land tenure characteristics in the Fox-Wyaconda watershed (FWW) and Scott County (SC). Their knowledge and attitudes toward agroforestry practices were elicited to determine the relationship between interest in a practice, and the characteristics of the household.

The respondents had to be land owners who do not farm their land, who may be renting it to others, and who either live on the land or at least 30 miles away.

### **Agroforestry Practices**

The study considers five temperate agroforestry practices: alley cropping, silvopasture, windbreaks, forested riparian buffers and forest farming (Gold et al., 2000). Trees are planted in single or multiple rows at wide spacing with agricultural or horticultural crops cultivated in the alleyways between the rows in the case of the first three practices. Crops grown provide an annual income that may increase when the nut trees come into production if markets exist. Hardwood species can provide income when harvested. Silvopasture combines trees, forage and livestock in an integrated practice by adding trees to pastures or by thinning a forest stand and adding forage crops. Windbreaks consist of trees or large shrubs planted as barriers, in order to reduce wind speed and to protect crops from wind erosion, protect livestock from winds, and/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, stabilize streambanks, and protect water quality. Forest farming includes high-value shade tolerant specialty crops cultivated under a forest overstory modified to provide appropriate microconditions. Many of these practices provide multiple benefits in terms of long run income stream, or environmental and scenic beauty benefits.

### **Setting**

Two study sites near the Mississippi river were chosen. The first is the Fox Wyaconda Watershed (FWW), which is on the west side of the Mississippi on the northeast of Missouri. It spans three counties, Lewis, Clark and Scotland, and an area of 430,453 acres. The second study site is also located west of the Mississippi river in southeast Missouri in Scott County (SC), an area of 273,062 acres. These two sites represent different ecosystems with varied agricultural, social, and economic characteristics. The FWW region consists of a combination of forest and prairie, facilitating the co-existence of forestry and agriculture, and farms contained some woodland (Knox County Historical Society, 1981). Scott County is about two-thirds the size of the FWW site, where the Mississippi River Delta comprises 82 percent of the county, and the upland area covers the rest of the county (Festervand, 1981).

### **Methods**

The survey instrument for non-farming landowners was constructed in a similar manner used for the farm operator survey (Valdivia et al 2000). The Total Design Method (TDM) (Dillman, 1978) was used in both questionnaire construction and dissemination. The survey was mailed to owners of land in the Fox Wyaconda watershed in northeast

Missouri, and to landowners in Scott County, in southeast Missouri. These sites were chosen to compare the findings on landowners with those of farm operators, studied in these regions.

The sampling frame for the Fox-Wyaconda Watershed was based on landowner names provided by the Natural Resources Conservation Service (NRCS) offices in the three counties (Lewis, Clark and Scotland) included in the project. Non-farming landowners living within the study area had already been sampled through the 522-name sample used in the farm operator survey. Those names that interviewers found not to be farm operators became part of the landowner sample frame; these addresses were included within 30 miles. 146 names were provided by the surveyors of non operators in the watershed. These were in the sample as well as an equal number of individuals who lived outside the watershed. The survey was mailed to 292 landowners. We received 111 surveys, which is a 38% response rate.

In Scott County a list of farm operators and landowners exists. The sample of non-farming landowners in Scott County was taken from the list of names identified as such by the Farm Services Agency (FSA). The list of 696 names contained the names of those individuals who lived within a 30-mile radius of the study area and those who did not. A sample was drawn from the landowners list. The sample was stratified by distance from the county. 150 were drawn from those living within 30 miles of Scott County. There were 77 non operators outside the county who were included; 227 surveys were mailed, and 128 were completed.

### **A review of adoption of agroforestry and conservation practices**

Agroforestry practices entail several unique characteristics that need to be considered in understanding interest or adoption. A first is that agroforestry entails activities and institutions that differ from traditional commercial commodity products. A second is the time dimension, returns to investments in trees take many years, often spanning more than the life of the landowner. A third is that it may be a management intensive practice. A fourth, markets may not be identified or known. Finally, investments may be large in the short term, while returns begin many years into the future, lowering the net present value of the investment. In this section studies that address adoption issues, decision making processes, and models to analyze interest and adoption are reviewed. Conservation practices are also reviewed as an approximation to some AF practices with similar characteristics.

#### **Adoption**

Raintree (1983) argues that there are special problems associated with the adoption of forestry related practices. The long time frame associated with the tree production reduces the relative economic advantage, trialability, and observability of tree based innovations. He suggests that for greater adoption of agroforestry practices, there is a need for focused research and development on improvement of existing systems. There is

also need for a problem solving or diagnostic approach to system design that includes general economic conditions of the system.

The land exchanges between forestry and agriculture are affected by specific federal conservation and farm support policies, which are examined by Alig, et al. (1998). They construct a dynamic, nonlinear programming model of the forestry and agricultural sectors which depicts the allocation of land over time to competing activities in agriculture and forestry. The solution from this model reflects the price and quantity equilibria established in each period where producers and consumers have perfect knowledge of market conditions in all periods.

The farm level impacts of the 1996 farm bill are investigated by Knutson, et al. (1996) by means of focus group perceptions. They present data on what farmers have done in terms of shifting cropping patterns to manage risk. They find that producers in the focus groups identify government program participation in the top half of risk management tools.

Shucksmith (1993) argues that the actions of farm households may be understood not only in terms of their structural situation but also as an expression of the values and motivations which underlie behavior. He introduces a model in which a farm household's disposition to act interacts with the internal resources of the farm and household, and with the external context (markets, policies, social and cultural values), in influencing behavior.

Scherr's (1995) study on agroforestry adoption in Kenya finds that the increases in tree domestication and management intensity are responses to a declining supply of uncultivated tree resources and increased subsistence and commercial demand for tree products. Her study revealed that the variability in individual farmer's tree growing strategies reflects differences in resources and livelihood strategies. The farmers reduce the risk in agroforestry practices through incremental adoption and adaptation, and cost and risk reducing modifications in technology design. The study results indicate that different constraints and strategies of access to land, labor, cash and off-farm tree resources led to different agroforestry choices. The profitability of the practice is necessary, but not sufficient incentive. Environmental rehabilitation was also an important objective for most farmers in adoption decisions. Additionally, many farmers also see tree planting activities as a way of increasing the value of assets to be inherited by their children (Scherr, 1995). The strategies followed by the farmers in reducing the risks of integrating agroforestry into their farming systems are initial testing of new technologies, building on familiar practices, species diversity, and technology adaptation to better meet management constraints and increase early economic returns (Scherr, 1995).

In her study conducted in Kenya David (1997) finds that domestic development cycle of households and wealth are likely to affect the adoption of agroforestry systems. The study also reveals that farmers in western Kenya are more likely to give first priority to investing in businesses and livestock enterprises that yield short term returns than in long-gestation agroforestry technologies. The study collects data from a sample of farmers involved in an on-farm agroforestry project and not from a wider population, because sensitive financial information would be difficult to collect. It is an important lesson about the choice of methodology for documenting the financial costs and returns to agroforestry.

## Models

Lynch and Brown (2000) use a two stage model to examine land owner's decision to use riparian buffers. In the first stage the farmer chooses whether to continue farming or sell the land for development. In the event of continuing with farming, the farmer has to decide whether or not to plant a buffer and then the second the stage, i.e., the choice of buffer will come into the scene. Lynch and Brown conduct simulations to determine the impact of different parameters on the decision to plant a forest buffer, a grass buffer, or no buffer. Their results show that the up-front costs for adoption are important in landowner decision making and, increasing cost-share rates may be more effective than increasing rental rates.

Konyar and Osburn (1990) use a discrete choice approach to predict participation in CRP. They use regional data for the entire U.S. and find that farmer's age, farm size, land value, erosion rate, tenure system, percentage of income from farming, and expected net returns all influenced the probability of participation. Hagan (1996) finds that gross income from farming, percentage of net income from farming, age, education and farming experience are important differences between participants and non-participants in the Maryland buffer incentive program.

## Conservation and Agroforestry

Johnson, et al. (1997) in their study of factors influencing landowners' post-contract use of CRP lands find that the presence of livestock enterprise in the contract holder's operation increases the probability of these acres remaining in the established cover. On the contrary, the contract holders who value the commodity base have an increased probability of returning their acres to crop production. Out of the variables used in their model, conservation compliance, livestock enterprise, water and fencing are negatively affecting the land use whereas, reason for Conservation Reserve Program (CRP) enrollment, soil type, financial value of commodity base, education, cotton base and sorghum base have a positive impact. From these only the reason for CRP enrollment, soil type and conservation compliance are insignificant.

Matthews, et al. (1993) study the landowner perceptions and the adoption of agroforestry practices in southern Ontario, Canada. They find that gender does not affect the willingness to adopt and older respondents are less likely to consider using an agroforestry technology. They also find that willingness to participate in the use of agroforestry technology is associated more closely with familiarity of the practice than level of formal education.

Skaggs, et al. (1994) developed a multinomial logit model to analyze the relationship between socioeconomic and attitudinal variables and land use choice options using data from a survey of New Mexico CRP contract holders. They found that the probability of returning the CRP lands to crop production increased if the land was irrigated before enrollment in the CRP, increased with the age of the contract holder, and increased as the size of the contract increased. Janssen and Ghebremicael (1994) applied logistic regression analysis to analyze the post-CRP land use decision. The results of cropland decision model indicate that education, location, number of crop base acres, and anticipated levels of federal price/income support have a positive effect on the decision to

return CRP land to crop production, while the level of conservation cost sharing has a negative effect.

Soule, et al. (2000) use a logit adoption model to analyze the influence of land tenure and rental agreements –share vs cash- in the adoption of conservation practices. They explore two dimensions, one being tenure impact on the timing and magnitude of the costs and returns generated by the conservation practice. The second being the influence of different lease arrangements on the renter’s conservation decisions.

### **A description of who are the landowners in Scott County and the Fox Wyaconda Watershed**

**Profiles of land owners:** The hypothesis that land use patterns in the Fox Wyaconda Watershed and Scott County are determined by land resource quality and access, economic factors, rural-urban factors, and life cycle stage, and perceptions of environmental problems is addressed by developing a profile comparing values for both sites, and by distance. Those who live within 30 miles of their farms are classified as owners who live on the farm; those who live outside a 30 mile range are defined as living away from the farm. Table 1 summarizes the socioeconomic and life cycle characteristics by region and by distance to the land.

**Table 1. Socio Economic and Life Cycle Characteristics (means) by Region and by Distance from the Land in Scott County (SC) and Fox Wyaconda Watershed (FWW) in 1999.** (Number of respondents in parenthesis)

	SC	FWW	t-Test	< 30 Miles	> 30 Miles	t-Test
Age (years)	62.5 (122)	59.3 (109)	<b>1.824</b> <b>(0.070)</b>	62.8 (92)	60.0 (86)	1.403 (0.163)
Years of education	13.13 (123)	12.77 (111)	0.789 (0.436)	12.0 (92)	14.12 (89)	<b>-4.487</b> <b>(0.000)</b>
Acres of land owned	386.7 (127)	331.6 (110)	0.831 (0.407)	318.3 (94)	445.7 (91)	-1.501 (0.136)
Distance living away from own land (Miles)	206 (122)	208 (63)	-0.025 (0.980)	-	-	-
Years the land has been owned by the family	57.9 (122)	58.02 (106)	-0.005 (0.996)	58.7 (92)	59.54 (89)	-0.158 (0.875)

**Household characteristics:** Age, years of education, and acres of land owned are not significantly different by region. In average landowners are 60 years old, and have 13 years of formal education. While SC has in average 50 acres more, there are no significant differences between both groups. Those living away from the farm do so an average of 200 miles, and no differences exist in the number of years land has been owned by the family, around 58 years. When comparing by distance, the only significant variable is years of education, those living away have 2 more years. About 29% of the respondents in Scott County and 26% in Fox Wyaconda have someone in their family



presently farming their land (Table 2). In both areas, about 38% co-own the land with someone in their family or outside the family. More people in Scott County (79%) believe it is likely that somebody in their family will take care of their land in future, compared to only 65% in Fox Wyaconda, which is consistent with the greater agricultural land values and productivity in Scott County.

The average amount of land owned in Scott County is 386 acres, which is lower than 332 acres in Fox Wyaconda. The owners who live away from land own considerably more land (at least more than 120 acres on average) than those who live on the land or nearby. An interesting result is that by distance only 24% of landowners or their spouses of those living away have been involved in farming. *This is relevant as Raedeke et al (2003) point out that agriculture differs from agroforestry, and those that are engaged in agriculture may have a greater barrier to adopting a new activity.*

**Table 2. Social characteristics (frequency) of land owners by regions and by distance from owned land in Scott County and Fox Wyaconda Watershed in 1999**  
(Number of respondents in parenthesis)

	SC	FWW	Chi Square	< 30 Miles	> 30 Miles	Chi Square
Whether the respondent or the spouse ever farmed	47 (36.7%) (128)	51 (47.2%) (108)	2.661 (0.103)	52 (54.7%) (95)	22 (24.4%) (90)	<b>17.671</b> <b>(0.000)</b>
Someone in the family presently farming the land	36 (28.6%) (128)	28 (25.5%) (110)	0.289 (0.591)	30 (31.9%) (94)	19 (21.1%) (90)	2.747 (0.0947)
Any co-owning of the land	48 (37.8%) (127)	40 (37.7%) (106)	0.000 (0.993)	33 (35.1%) (94)	37 (41.1%) (90)	0.703 (0.402)
Someone in the family will own the land in future *	96 (78.7%) (122)	72 (65.5%) (110)	<b>5.071</b> <b>(0.024)</b>	70 (75.3%) (93)	62 (69.7%) (89)	0.717 (0.397)

\* Source: Q. No. 10 (Very unlikely, Unlikely, Unsure: Unlikely; Likely, Very likely: Likely)

**Land Use Patterns:** The land use patterns vary by region but not by distance to the land (Table 3), which is consistent with previous results that highlight the differences in agroecological characteristics of these two sites (Valdivia et al 2000). Proportionately more land is under hay land and pastures, and unmanaged timber stands in the Fox Wyaconda watershed than in Scott County. This county also has a greater average amount of land under the crops (Table 3). The land classified as river bottom is also greater in Scott County than in Fox Wyaconda, whereas it is opposite in the case of land under hills / uplands. The amount of land under sandy soils is greater in Scott County.

**Table 3. Categories of land acres owned by the respondents by region and by distance in Scott County and FoxWyaconda watershed in 1999.** (Number of respondents in parenthesis)

	SC	FWW	t-test	< 30 Miles	> 30 Miles	t-test
River bottom or flood plain acres	115.6 (114)	64.4 (105)	1.385 (0.168)	79.2 (90)	125.7 (80)	-0.984 (0.326)
Acres of land of sandy soils	118.9 (118)	14.7 (105)	<b>5.136</b> <b>(0.000)</b>	89.4 (92)	75.8 (82)	0.504 (0.615)
Acres of land hills / uplands	67.2 (113)	193.0 (105)	<b>-4.353</b> <b>(0.000)</b>	110.0 (89)	109.9 (80)	0.007 (0.994)
Acres of land Other	49.3 (115)	25.2 (104)	1.058 (0.292)	21.4 (91)	71.8 (80)	-1.609 (0.111)
Acres of land Crops	253.2 (122)	164.8 (108)	<b>2.074</b> <b>(0.039)</b>	224.9 (93)	239.2 (86)	-0.265 (0.791)
Acres of land hay and pasture	18.0 (115)	44.3 (106)	<b>-2.82</b> <b>(0.005)</b>	18.01 (86)	29.3 (84)	-1.256 (0.211)
Acres of managed timber stand	23.4 (117)	12.6 (107)	0.948 (0.344)	15.7 (88)	21.9 (85)	-0.423 (0.679)
Acres of timber Unmanaged stand	16.4 (117)	51.8 (107)	<b>-3.75</b> <b>(0.000)</b>	31.6 (88)	33.1 (85)	-0.136 (0.892)

The only significant differences between sites and by distance on erosion sources are presented in table 4. The amount of land affected by wind soil erosion caused is greater in Scott County. Land experiencing rain soil erosion, stream bank erosion and unwanted woody growth is greater in Fox Wyaconda Watershed than in Scott County (Table 4). By distance, only rain erosion is perceived to be higher by those living away from the land.

**Table 4: Problems affecting the land owned by the respondents in Fox Wyaconda Watershed and Scott County in 1999** (Number of respondents in parenthesis)

	SC	FWW	Chi Square	< 30 Miles	> 30 Miles	Chi Square
Wind soil erosion	15(13%) (115)	6(6.3%) (95)	2.616 (0.106)	10(11.6%) (86)	6(81%) (7.4)	0.858 (0.354)
Rain soil erosion	16(14%) (114)	53(52%) (102)	<b>35.617</b> <b>(0.00)</b>	17(19.5%) (87)	31(37.8%) (82)	<b>6.925</b> <b>(0.009)</b>
Agricultural run-off	9(8%) (113)	11(11.6%) (95)	0.776 (0.378)	6(7.1%) (85)	9(11.1%) (81)	0.829 (0.363)
Stream bank erosion	7(6.1%) (114)	24(25%) (96)	<b>14.732</b> <b>(0.00)</b>	8(9.4) (85)	13(16.0%) (81)	1.654 (0.198)
Surface water quality	7(6.1%) (114)	5(5.4%) (92)	0.046 (0.830)	3(3.6%) (84)	5(6.3%) (80)	0.634* (0.426)
Loss of wild life habitat	15(13.3%) (113)	16(17%) (94)	0.566 (0.452)	12(14.3%) (84)	12(14.6%) (82)	0.004 (0.949)
Flooding	21(18.6%) (113)	19(20%) (95)	0.067 (0.796)	16(19.3%) (83)	14(17.1%) (82)	0.135 (0.714)
Loss of trees	7(6.3%) (111)	9(9.5%) (95)	0.717 (0.397)	5(6.1%) (82)	7(8.5%) (82)	0.360 (0.549)
Unwanted woody growth	9(8.0%) (113)	41(40.6%) (101)	<b>31.712</b> <b>(0.000)</b>	14(16.5%) (85)	17(20.2%) (84)	0.400 (0.527)

Def: Not a problem, Small Problem: No Problem; Somewhat serious problem, Very serious problem: Problem)

### **Economic returns from agricultural operations**

Land rental returns to owners and to other enterprises is a basis to compare with the economic potential of the agroforestry practices. Table 5 shows the average number of acres rented out to others and the average rent received per acre. Scott County has significant greater income and rental returns. However the average number of rental agreements is greater in Fox Wyaconda (not significant). Even the length of rental agreements is greater in Fox Wyaconda. Table 5 also shows the percentage of total non farm assets, which is greater for those living away. The mean gross household income in Scott County is almost double of Fox Wyaconda. There is also significant difference between the two regions in the percentage of gross income from the rented land in the last three years; Scott County has the largest. It should be noted that prices for row crops were very low in the year of study. Table 6 shows the lease agreements. The percentage of cash leases is greater in Fox Wyaconda, whereas the percentage of share leases is greater in Scott County. Cash leases are less used than the share leases in both the regions.

**Table 5. Means of Assets in Machinery, Land and Non farm, Income and Land Rental Characteristics of Landowners in Scott County and FoxWyaconda Watershed in Missouri 1999.**

	SC	FWW	t-test	< 30 Miles	> 30 Miles	t-test
Percent in farm machinery	12.5 (98)	14.8 (87)	-0.154 (0.878)	4.97 (69)	12.8 (76)	-0.668 (0.506)
Percent in farm land	47.6 (97)	53.8 (84)	-0.343 (0.732)	44.04 (67)	40.03 (75)	0.295 (0.769)
Percent in non-farm assets	66.3 (95)	60.9 (76)	0.339 (0.735)	41.14 (63)	78.8 (73)	<b>-3.016</b> <b>(0.003)</b>
Average gross household income	23,611 (92)	12,662 (87)	<b>2.034</b> <b>(0.044)</b>	16,132 (66)	23,572 (74)	-1.106 (0.271)
Percentage gross income from rent	22.01 (94)	10.59 (85)	<b>3.048</b> <b>(0.003)</b>	21.8 (68)	16.3 (73)	1.141 (0.256)
Acres rented out	294 (96)	237 (58)	1.001 (0.319)	229 (64)	316 (65)	-1.310 (0.193)
Number of rental agreements	1.39 (93)	15.10 (59)	-1.015 (0.315)	1.22 (60)	13.7 (66)	-1.033 (0.305)
Acres given to who rented most	301 (56)	198 (37)	1.704 (0.092)	232 (31)	301 (46)	-0.905 (0.368)
How long you have rented (years)	14.7 (56)	10.6 (40)	1.450 (0.151)	10.3 (32)	15.5 (47)	-1.668 (0.100)
Percentage of acres under cash lease	72 (25)	88.26 (19)	1.704 (0.096)	76.21 (14)	78.70 (23)	-0.197 (0.846)
Average rent received/acre (\$)	60.95 (24)	57.61 (13)	0.299 (0.766)	59.5 (13)	66.3 (18)	-0.507 (0.616)

**Table 6. Rental Agreements: Cash vs Share in Fox Wyaconda Watershed and Scott County in 1999.** (number of respondents in parenthesis)

	SC	FWW	Chi
Number of cash leases	25 (28.7%) (87)	20 (33.3%) (60)	0.353 (0.552)
Number of share leases	56 (75.7%) (74)	32 (60.4%) (53)	3.397 (0.065)

**Differences between owners living ‘close’ and ‘far away’ from their lands :** A smaller percent of the owners or spouses of those who are living away from the land ever farmed on the land they own. They appear to depend more on non-farm sources of income, as also indicated by the greater percentage of total non farm assets they hold. There is also significant difference among these two groups in terms of percentage of acres leased under share lease, Scott County having more as land is very productive for row crops.

There is also a greater of number of share rental agreements. No significant differences exist in cash lease.

### **Agroforestry and attitudes**

Agroforestry is a farming practice that incorporates woody perennials in a farming operation with either the production of crops (alley cropping, silvopasture, forest farming) and /or livestock with the purpose to maximize ecological, economic, and agronomic benefits by integrating these activities in ways that are mutually beneficial (Raedeke et al). Other common practices in temperate zones include windbreaks and riparian buffers. Alley cropping consists of inter-planting row crops between rows of trees. Silvopastoral practices include trees with pastures. Riparian buffers consist of planting woody and herbaceous plants along streams. Windbreaks consist of planting rows of trees along crop fields, pastures, and buildings. Forest Farming is the cultivation of crops under the shade of managed forests. All of these practices are intended to provide unique environmental, agronomic, economic, and social benefits. All these practices require intensive management (Raedeke et al). These practices are shown in the form of pictures in the questionnaire mailed to land owners, and questions about practicing, knowledge and interest in five agroforestry practices were asked.

**Agroforestry and interest in following them:** Tables 6 through 10 show the results of comparing by site and by distance the knowledge, awareness and interest in each of the five agroforestry practices. The responses have been reclassified by knowledge where very low and low have been grouped as no knowledge, while moderate, high, very high indicate knowledge. Similarly in interest we have reclassified responses in two groups, no interest includes uninterested and slightly interested. Interested includes moderately interested and very interested.

There are very few people who have implemented silvopasture (Table 6) on their land. Only 10% in Fox Wyaconda and 2% in Scott County have implemented them. But comparatively more owners are interested in implementing the silvopasture in Fox Wyaconda (32%) rather than in Scott County (significant differences exist). It also tallies with the finding that average number of acres under unmanaged timber stands is greater in Fox Wyaconda. The knowledge about silvopastoral practice is also low and there is no significant difference between the two areas. There is no significant difference between the owners who are living away and those who are living near the land in terms of interest and of knowledge.

**Table 6. Silvopasture and interest in adopting in Scott County and Fox Wyaconda Watershed and by distance in Missouri 1999.** (total number of respondents in parenthesis)

<b>Silvopasture</b>	<b>SC</b>	<b>FWW</b>	<b>Chi Square</b>	<b>&lt; 30 Miles</b>	<b>&gt; 30 Miles</b>	<b>Chi Square</b>
Done any Silvopasture	3(2.4%) (125)	11(10.2%) (108)	<b>6.218</b> <b>(0.013)</b>	6(6.3%) (95)	2(2.3%) (86)	1.701* (0.192)
Know anybody who implemented	12(9.6%) (125)	15(13.8%) (109)	0.988 (0.320)	7(7.4%) (95)	12(13.6%) (88)	1.929 (0.165)
Own knowledge about Silvopasture*	19(15.3%) (124)	18(16.5%) (109)	0.062 (0.804)	11(11.6%) (95)	15(17.0%) (88)	1.120 (0.290)
Interest in implementing Silvopasture**	15(12.3%) (122)	35(32.1%) (109)	<b>13.327</b> <b>(0.000)</b>	14(14.9%) (94)	21(23.9%) (88)	2.354 (0.125)

\*Very low, Low: No knowledge; Moderate, High, Very high: Yes

\*\* Uninterested, Slightly interested: No; Moderately interested, Very interested: Yes

There are relatively more people who have implemented riparian buffers (Table 7) than the silvopasture. There are significantly more owners who expressed interest in implementing riparian buffers in Fox Wyaconda than in Scott County. The knowledge level about this practice is not significantly different between the owners in the two regions. But there is significant difference between the owners who are living far away and those are living near the land in terms of interest and knowledge about the riparian buffers. Those living far away are more replied they were knowledgeable and interested.

**Table 7. Riparian buffers knowledge and interest in adopting in Scott County and Fox Wyaconda Watershed and by distance in Missouri 1999.** (total number of respondents in parenthesis)

<b>Riparian Buffer</b>	<b>SC</b>	<b>FWW</b>	<b>Chi Square</b>	<b>&lt; 30 Miles</b>	<b>&gt; 30 Miles</b>	<b>Chi Square</b>
Done any riparian buffers	12(9.5%) (126)	17(15.9%) (107)	2.151 (0.143)	7(7.4%) (94)	13(14.4%) (90)	2.324 (0.127)
Know anybody who implemented	15(12%) (125)	17(15.7%) (108)	0.684 (0.408)	7(7.4%) (94)	17(18.7%) (91)	<b>5.169</b> <b>(0.023)</b>
Own knowledge of riparian buffers	36(28.6%) (126)	36(33.6%) (107)	0.698 (0.404)	21(22.1%) (95)	31(34.1%) (91)	3.301 (0.069)
Interest in implementing	28(22.8%) (123)	37(34.6%) (107)	<b>3.940</b> <b>(0.047)</b>	14(14.9%) (94)	34(38.2%) (89)	<b>12.836</b> <b>(0.00)</b>

\*Very low, Low: No knowledge; Moderate, High, Very high: Yes

\*\* Uninterested, Slightly interested: No; Moderately interested, Very interested: Yes

The landowners in Scott County know more people than Fox Wyaconda who have implemented alley cropping (Table 8), but differences are not significant. This aspect tallies with the finding that the number of acres in managed timber stand is greater in Scott County. The landowners who live away from their land have significantly more interest in alley cropping, interesting result as this group has more years of education and has less experience with agriculture (traditional farming). Between 21 and 23 percent of the landowners in Scott County and FWW have knowledge of this practice. 18 percent of the landowners away from the land are interested in implementing this practice.

**Table 8. Alley cropping knowledge and interest in adopting in Scott County and Fox Wyaconda Watershed and by distance in Missouri 1999.** (total number of respondents in parenthesis)

<b>Alley Cropping</b>	SC	FWW	Chi Square	< 30 Miles	> 30 Miles	Chi Square
Done any alley cropping	3(2.4%) (127)	3(2.8%) (108)	0.041* (0.840)	1(1.1%) (95)	4(4.4%) (90)	2.022* (0.155)
Know anybody who implemented	10(7.9%) (126)	5(4.6%) (108)	1.060 (0.303)	5(5.3%) (94)	9(9.9%) (91)	1.381 (0.24)
Own knowledge of alley cropping	23(18.1%) (127)	21(13.4%) (108)	0.068 (0.794)	16(16.8%) (95)	16(17.6%) (91)	0.018 (0.834)
Interest in implementing	15(12.1%) (124)	20(18.7%) (107)	1.943 (0.163)	7(7.4%) (91)	18(20%) (90)	<b>6.171</b> <b>(0.013)</b>

\*Very low, Low: No knowledge; Moderate, High, Very high: Yes

\*\* Uninterested, Slightly interested: No; Moderately interested, Very interested: Yes

Windbreaks have a longer history in the landscape. Table 9 shows the results of this practice. There are more landowners implementing windbreaks in Fox Wyaconda, but differences are not significant. Landowners know more number of people implementing windbreaks in Scott County. Landowners in Scott County are more affected by the soil erosion due to wind. These landowners would be expected to have more interest in this practice, but the results are otherwise. The landowners in Fox Wyaconda have more interest, which could be related to the economic opportunities of the land. Profit loss would be greater in Scott County (and rental of land) if wind breaks would take up land.

**Table 9. Windbreak knowledge and interest in adopting in Scott County and Fox Wyaconda Watershed, and by distance in Missouri 1999.** (total number of respondents in parenthesis)

Windbreaks	SC	FWW	Chi Square	< 30 Miles	> 30 Miles	Chi Square
Done any windbreaks	22(17.6%) (125)	20(18.5%) (108)	0.033 (0.856)	20(21.5%) (93)	10(11.2%) (89)	3.484 (0.062)
Know anybody who does	46(37.1%) (124)	34(31.5%) (108)	0.806 (0.37)	36(38.7%) (93)	28(31.1%) (90)	1.611 (0.281)
Own knowledge of windbreaks	68(55.3%) (123)	54(50%) (108)	0.644 (0.422)	48(51.6%) (93)	46(51.1%) (90)	0.005 (0.946)
Interest in implementing	26(21.3%) (122)	34(31.5%) (108)	3.073 (0.080)	19(20.7%) (92)	26(28.9%) (90)	1.658 (0.198)

\*Very low, Low: No knowledge; Moderate, High, Very high: Yes

\*\* Uninterested, Slightly interested: No; Moderately interested, Very interested: Yes

Forest farming (Table 10) is the cultivation of crops under the shade of managed forests. It helps in preventing the flooding as well as soil erosion due to rain to some extent. Fox Wyaconda is having soil erosion problems due to rain, which may explain the interest of landowners in forest farming. It could be also the need to explore new economic opportunities for the land, and is consistent with forests. But their knowledge about this practice is lower than their counterparts in Scott County, though differences are not significant.

**Table 10. Forest farming knowledge and interest in adopting in Scott County and Fox Wyaconda Watershed and by distance in Missouri 1999.** (total number of respondents in parenthesis)

Forest Farming	SC	FWW	Chi Square	< 30 Miles	> 30 Miles	Chi Square
Done any forest farming	4(3.2%) 125	1(0.9%) (109)	1.451* (0.228)	3(3.2%) (94)	1(1.1%) (89)	0.914* (0.34)
Know anybody who has	7(5.6%) (124)	8(7.3%) (109)	0.276 (0.599)	6(6.4%) (94)	3(3.3%) (90)	0.919* (0.338)
Own knowledge	18(14.6%) (123)	14(12.8%) (109)	0.156 (0.693)	13(13.8%) (94)	10(11.1%) (90)	0.311 (0.577)
Interest in implementing	19(15.7%) (121)	27(24.8%) (109)	2.947 (0.086)	17(18.3%) (93)	19(21.3%) (89)	0.270 (0.603)

\*Very low, Low: No knowledge; Moderate, High, Very high: Yes

\*\* Uninterested, Slightly interested: No; Moderately interested, Very interested: Yes



## About land ownership and planting decision agreements between owners and renters of the land

**Motives for owning the land:** People own the land for various reasons (see table 11). In Fox Wyaconda around 65% of the people own the land in order to keep the land in the family itself as they feel it is a good investment as well as to enjoy the hunting, fishing, etc on their land. Around 80% of the land owners here would like to enjoy the wild life and beauty of the land, and so that becomes the major reason for owning the land. Actual significant differences exist by site on reasons, FWW reasons are related to enjoying wildlife and beauty of the land and not as much keeping the land in the family, when compared to Scott County.

In Scott County around 60% of the people believe that land provides a good financial shelter. The land owners in Scott County also want to keep the land in the family (82%) and they want to keep in touch with the land (67%). But only about 53% feel that land is a good source of income, which is even less in Fox Wyaconda (43%).

**Table11. Reasons that influence the decision to own land by region and distance in Northeast and Southeast Missouri, 1999.** (Number of respondents in parenthesis)

	SC	FWW	Chi Square	< 30 Miles	> 30 Miles	Chi Square
To keep the land in the family	101(82.1%) (123)	75(68.2%) (110)	<b>6.099</b> <b>(0.004)</b>	69(75.8%) (91)	70(77.8%) (90)	0.097 (0.756)
Provides good financial shelter	72(60.5%) (119)	54(50.9%) (106)	2.080 (0.149)	53(58.2%) (91)	49(57.6%) (85)	0.006 (0.936)
To enjoy its natural beauty	79(66.9%) (118)	91(85%) (107)	<b>9.951</b> <b>(0.002)</b>	69(78.4%) (88)	59(67.8%) (87)	2.499 (0.114)
As a good investment	85(72%) (118)	69(64.5%) (107)	1.480 (0.224)	62(69.7%) (89)	61(70.1%) (87)	0.004 (0.948)
To keep in touch with the land	81(66.9%) (121)	70(64.8%) (108)	0.115 (0.735)	64(71.1%) (90)	50(56.2%) (89)	<b>4.314</b> <b>(0.038)</b>
As a good source of income	63(52.9%) (119)	46(42.6%) (108)	2.429 (0.12)	44(47.8%) (92)	46(53.5%) (86)	0.570 (0.450)
To enjoy hunting, fishing, etc	39(33.1%) (118)	68(63.6%) (107)	<b>20.931</b> <b>0.00</b>	43(48.3%) (89)	35(40.2%) (87)	1.165 (0.280)
To keep some personal connection with farming	65(53.7%) (121)	60(56.1%) (107)	0.127 (0.721)	52(57.8%) (90)	43(48.9%) (88)	1.421 (0.223)
To enjoy wildlife on the land	71(59.2%) (120)	87(80.6%) (108)	<b>12.223</b> <b>(0.000)</b>	63(70.8%) (89)	55(61.8%) (89)	1.609 (0.205)

Def: No influence, Little influence: No influence; Moderate influence, High influence, Very large influence: Influence

The main motives for the landowners who are living away from their land are to keep the land in the family and, as it is a good investment. For the landowners who are living close

to their land the motive is to enjoy the natural beauty and wildlife, and also land being a good investment. The only significant different by distance is to keep in touch with the land, where 71 percent of those living near the land think is important, as compared to 56 percent of those living away.

**Rental agreements, division between the landowner and the renter:** Decisions on conversion of land and planting of trees are presented by distance in Table 12 and by region in table 13. The landowner takes up the major responsibility regarding decisions about planting trees either for conservation purposes or economic gains and also decisions regarding conversion of marginal land to tree production. The renters, even if living closer to the land than the owners, do not take the major responsibility in these decisions.

**Table 12. Responsibility divisions in planting trees between the renter and the owner (frequency) by distance in Northeast and Southeast Missouri 1999 (renter%-owner %)**

	100-0		80-20		60-40		40-60		20-80		100	
	< 30 Miles	> 30 Miles	< 30 Miles	> 30 Miles	< 30 Miles	> 30 Miles	< 30 Miles	> 30 Miles	< 30 Miles	> 30 Miles	< 30 Miles	> 30 Miles
1.	7	3	2	4	4	5	5	6	4	13	24	23
2.	8	4	2	3	2	4	3	7	5	11	26	25
3.	9	5	1	4	3	3	5	6	3	9	26	26

1. Planting trees for conservation purposes
2. Converting marginal land to tree production
3. Planting trees for economic gains

**Table 13. Responsibility divisions in planting trees between the renter and the owner (frequency) by site in Northeast and Southeast Missouri 1999.**

	100-0		80-20		60-40		40-60		20-80		100	
	SC	WCC	SC	WCC	SC	WCC	SC	WCC	SC	WCC	SC	WCC
1.	9	2	6	3	8	2	8	5	12	10	28	27
2.	11	2	5	3	7	0	6	7	11	10	31	27
3.	13	2	5	3	7	0	7	6	8	8	31	30

1. Planting trees for conservation purposes
2. Converting marginal land to tree production
3. Planting trees for economic gains

**Sources of information:** There are different factors that influence the land owners in making the decisions about the way the land is being farmed or managed. About 53% of the land owners in SC and 42% in FWW are influenced by the opinions of other farmers, whereas only 17% in both the areas are influenced by the requirements of the banking or lending institutions. The major factor affecting the landowners' decision making is the need to be viewed as a good land owner by the renters who may rent land from the

landowner in the future. The activities landowners took part in to gain knowledge or information are presented in table 14. On average landowners in FWW participate more in field demonstrations, solicit and receive advice from other farmers or professionals such as SWCD technicians. Landowners seek different sources of information about planting or managing trees. Table 15 shows the first choice of landowners in both the areas is university extension. The second choice is also similar in both the areas, which is to approach the office of the local soil and water conservation district (SWDC). The third choice differs; the landowners in SC depend upon the fellow landowners/farm operators who have experience with trees, whereas the landowners in FWW depend on the natural resource conservation service (NRCS).

**Table 14: Different sources of information utilized by landowners in Southeast and Northeast Missouri in 1999** (number of respondents in parenthesis).

	Scott County	FWW
Number of field demonstrations attended	0.56 (120)	0.46 (111)
Number of times received advise from other farmers	0.75 (119)	0.94 (108)
Number of times received advise from professionals	0.84 (118)	0.99 (105)

**Table 15: Preference for sources of information for land management by landowners in Southeast and Northeast Missouri in 1999** (in percentage).

	1st Choice		2nd choice		3rd choice	
	SC	FWW	SC	FWW	SC	FWW
University Extension	38.4	28.4	17.3	18.9	15.4	18.5
Landowner with tree experience	22.3	15.8	13.6	11.6	22.1	14.1
SWDC	13.4	21.1	27.3	25.3	15.4	9.8
NRCS	7.1	10.5	19.1	16.8	18.3	20.7
District forester	11.6	20	10	13.7	11.5	19.6
Consulting forester	3.6	3.2	7.3	10.5	5.8	8.7
Commercial logger and buyers	3.6	1.1	5.4	3.2	11.5	8.7

### **Implications : Landowners Agroforestry Practices and What to Consider**

A review of studies showed that economic opportunity and current returns to land are important in considering keeping land in conservation, or shifting land from crops to forestry (Alig et al.). Conservation programs are also viewed as a risk management strategy (Knutson et al.). The long time frame in returns from agroforestry is another factor to consider (Raintree). On the other hand disposition to act based on values and motivations that underlie behavior are also important factors (Schucksmith). The

different type of constraints and resources also condition people's choices. Stage in the lifecycle, such as the age of the landowner is also a significant factor (Scherr). In terms of incentives to adopt, up front cost share contributes to adoption (Lynch and Brown). Studies focusing on CRP found age, farm size, land value, erosion rate, tenure system, percentage from farming, and expected net returns are factors that influence participation (Konyar and Osburn; Hagan). Livestock has been found to be a factor in keeping land in CRP (Johnson et al), along with reasons for enrollment and soil type. The competition for use of land and its economic returns are also important in understanding the interest of landowners in agroforestry. Older landowners in Canada are less likely to consider adopting agroforestry. Familiarity with the practice is more likely than education to be associated with willingness to participate in the technology (Matthews et al).

As we look at the characteristics of landowners in Scott County and Fox Wyaconda Watershed we need to take into account differences in type of land, economic uses of the land, motivations for owning land, and how these vary as landowners live away from the land. The nature of agroforestry practices differ, some are more labor intensive and provide short term returns like silvopasture, alley cropping and forest farming. Others contribute to the quality of the soils, productivity and energy savings like windbreaks and riparian buffers, so the motives for adoption will vary.

Household characteristics of landowners not farming land only differ by location in terms of average number of years of education; those living away have two more years of education. By location no differences exist. Owners' age is between 60 and 62. The average land size owned in average is 387 acres in SC and 332 in FWW, though not significantly different. Those living away in average do so approximately 200 miles from the land, which has been in the family close to 60 years. Only 37 % of respondents in SC have farmed the land, while 47% have in FWW. Significant differences do exist between those living away, as only 24 % have farmed as opposed to 55% for those living near the land. This has implications in terms of interest in agroforestry, as those not involved with traditional crop farming may be more likely to be interested in agroforestry (Raedeke et al.). More than 65 percent of landowners, regardless of where they live, believe the land will be in their family in the future. Those in SC do believe they will be more likely to own the land in the future, 79%.

There are differences in land use and land types by sites: especially the acres of sandy soils are greater in SC, as are the number of acres in crops. The number of acres in the hills is greater in FWW, as are the acres of land in hay and pasture, and the number of acres of unmanaged timber stand. Land use and land type matter in conservation and agroforestry. Rain erosion, stream bank erosion, and unwanted woody growth are greater problems in FWW. These differences highlight these problems as characteristics that may influence interest in agroforestry practices. It is interesting to note that only rainfall erosion is perceived to be a problem by those living away from the land.

Economic returns to renting are greater, double in SC. Average gross income is also greater in this region, \$23,600 in comparison to \$12,600. Some differences exist (only at 10%) in the number of acres given to who rented the most (301 acres in SC as opposed to

198 in FWW), the percent of acres under cash lease (FWW). These are also two potential variables in explaining interest in different agroforestry practices. When compared by distance landowners were different only in the percent of non farm assets, 41% near the land and 79 % for those living away from the land.

According to the review experience is a factor in interest in a practice. A small percentage of people have done AF practices. There were no differences between sites nor by distance. In percent they had more experience with windbreaks first, and with riparian buffers second. Familiarity with the practice, either because they know a neighbor, or own knowledge only differs in the case of riparian buffers, curiously landowners living away from the land are more interested (34 as opposed to 22, and 19 over 4 percent in own knowledge or that know someone).

Interest by region differs in silvopasture (32% in FWW vs 12 % in SC), riparian buffers (35% in FWW vs 23 % in SC; 38% for those living away vs 15% for those living near), and alley cropping for those living away (20% vs. 7%). There are differences in interest at the 10% level for windbreaks and forest farming by region, where both windbreaks and forest farming are of more interest in the FWW.

Finally values may play a role in implementing agroforestry practices. Landowners in SC and FWW have many reasons that are not statistically significantly different: land as a good financial shelter (>54%), a good investment (>60%), keeping in touch with the land, good source of income, and keep a connection to farming (50%). The reasons where there is a significant difference are: keep the land in the family (SC>FWW), enjoy natural beauty (FWW>SC), enjoy hunting and fishing (FWW>SC), and enjoy wildlife (FWW>SC). By distance, keep in touch with the land, is of greater importance for those living near, 71%. While by region and by distance economic motives are very similar, the greater differences are in enjoyment of the land and environment, which may indicate these as a factor in considering agroforestry in their land.

Understanding concerns, incentives, and interests is important in order to generate information that can inform those interested in incorporating agroforestry practices. University extension, landowners indicate, is their first preference in sources of information, and the source of advice. Further analysis in determining what influences adoption of each practice will contribute to design information for both landowners and extension outreach professionals.

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