

HABITUS AND INTEREST IN AGROFORESTRY PRACTICES IN MISSOURI

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ABSTRACT

This study analyzes the factors driving interest in two agroforestry practices, riparian buffers and forest farming. Because agroforestry is outside main stream commodity production in US agriculture, the purpose is to evaluate a framework to understand attitudes. The framework incorporates Pierre Bourdieu's notions of "habitus" and "field" along with individual economic and demographic characteristics of farm operators' traditionally used in adoption studies. Four attitudes are analyzed: disengagers, conservatives, lifestyle, and accumulators.

A Logit regression measures the effects of respondents' attitudes, and other internal and external factors to assess interest in each practice. The data used is from a household survey of 364 farm-operators from the Fox Wyaconda watershed in northeast Missouri and Scott County in southeast Missouri gathered in 1999. Findings show that a conservative or a lifestyle attitude, are significant, with high probability of being interested in riparian buffers. Those with an accumulator or a lifestyle attitude have a significant and high probability of being interested in forest farming. Other variables also significant in riparian buffer interest are knowledge of agroforestry, and interest in alternative farming practices, and especially having perceptions of erosion problems. In forest farming, a high value of farm and assets has a negative effect, while belonging to informal groups has a positive effect pointing to characteristics that do not belong to traditional farmers.

KEY WORDS: adoption, attitudes, forest farming, habitus, interest, riparian buffers

INTRODUCTION

Interest in agroforestry has been increasing as public awareness of soil erosion and chemical contamination of waterways are on the rise (Gold and Hanover; Buck). Agroforestry is defined as, “intensive land use management that optimizes the benefits (physical, biological, ecological, economic, and social) from biophysical interactions created when trees and/or shrubs are deliberately combined with crops and/or livestock” (Garrett). One problem that agroforestry is faced with is the lack of information for communities and agricultural professionals. Currently, agricultural extension reinforces traditional commodity and livestock practices, or introduces new innovations for crop, livestock, and timber production, but fails to provide support for integrated land management practices such as agroforestry (Teel and Lassoie; Workman et al.). The objective of this study is to investigate the effect of attitudinal and structural characteristics on interest in incorporating riparian buffers and forest farming on their land.

With public perception of environmental degradation on the rise and with continual agricultural restructuring, now is the time that social scientists might influence new agricultural policy innovation. Over the past two decades, research in agroforestry has been designed around the scientific aspects of production and conservation, which has advanced agroforestry techniques. The next step is to understand the adoption behavior of farmers in the temperate zone. Public policy towards agroforestry can be influenced through market modifiers, institutions, and the creation of new laws, but ultimately the success of agroforestry depends on household decision making to maintain

or incorporate, and manage trees within the farm based on personal welfare, social obligations, or legal conformity (Buck; Mercer and Miller).

This study assesses attitudes and structural characteristics of farm operators in two regions of Missouri, the Fox Wyaconda Watershed and Scott County, to evaluate interest in agroforestry. Because agroforestry is outside main stream commodity production in agriculture, the purpose is to evaluate a framework that considers attitudes. Once these characteristics are recognized and farmers who are interested in agroforestry are identifiable, future extension programs can be designed taking into account identified niches.

AGROFORESTRY PRACTICES

Agroforestry has a “proven or perceived ability to meet the following needs: product diversification, environmental impact mitigation, land rehabilitation, land use conversion (from annual to timber crops), increased or decreased food production, sustainable use or retirement of marginal or fragile land, habitat enhancement, and aesthetic appreciation.” (Buck) The benefits of agroforestry are usually measured through economic gains and/or improved environmental conservation.

Environmental benefits include: soil stabilization and soil erosion reduction through either wind speed reduction or reduction of run-off potential, reduction in soil compaction, carbon sequestration, pest management by providing habitat for predators and parasites of pests, water conservation through reduction in evaporation and protection of waterways from agricultural runoff, and increased wildlife habitat which provide food, cover, and travel corridors (Williams et al.).

Economic benefits from agroforestry are realized through direct and indirect monetary incomes. Forested riparian buffers are strips of permanent vegetation—trees, shrubs and grasses—planted between agricultural land and water resources to reduce runoff and non-point source pollution, as well as to stabilize stream banks and protect water quality. They can be intentionally designed to produce harvestable products for economic benefits. Forest farming includes high-value shade tolerant specialty crops cultivated under a forest overstory. Crops may include medicinal plants or a variety of mushrooms. Trees are managed for high value timber (Williams et al.; Gold and Hanover; Garrett and Kurtz). Riparian buffers may provide income on marginal lands through government cost share programs, and/or could potentially include woody floral shrubs, short term income earning flows.

REVIEW OF THE LITERATURE

The needs of traditional commodity, livestock, and forestry producers are well established and addressed, but support for integrated land management practices such as agroforestry are not well established in the US (Workman et al.). Household decision making is at the center of the success of adopting new technologies in agroforestry, and therefore policies need to be informed about their interests (Mercer and Miller; Buck). A worldwide review of agroforestry adoption studies identifies five factors (Pattanayak et al): farmer preferences, resource endowments, market incentives, bio-physical factors and risk and uncertainty. Koontz finds non-economic motives to be important in attitudes towards land use, as well as non-farming opportunities (Lynch and Brown).

A wide variety of variables have been used in adoption studies throughout the developed world. Generally, these variables fall into three categories of attitudinal,

internal, and external variables. The groups of structural variables that classify external and internal resources for individual adoption studies have been given many names. External variables are listed as ecological variables, institutional variables, market incentives, and biophysical factors. This group often contains such variables as relative prices, labor market opportunities, and soil erosion conditions. Internal variables are listed as material resources, social psychological variables, economic factors, personal factors, and resource endowments of the decision maker. This group often contains such variables as age, education, tenure, size of farm, and social participation (Clearfield and Osgood; Shucksmith; Pattanayak).

Attitudinal variables have been used to explain interest, such as Pierre Bourdieu with his ground breaking concepts of field and habitus (DiMaggio). Shucksmith introduced field and habitus concepts in agriculture with the disposition to act variable which was further broken down into three categories of accumulators, conservatives, and disengagers. Interviewers subjectively placed farmers into a single category, based on characteristics defining each category. Shucksmith's disposition to act variable was a development from Pierre Bourdieu's concept of "habitus" which connects an individual's actions to culture, structure, and power (Swartz; DiMaggio). Before Bourdieu, sociological theory could be broken into two opposing groups in regards to individual behavior. First, individuals respond to external factors such as economic factors or social factors. Second, individuals act in response to internal factors such as intentions or calculation (Swartz). Bourdieu's concepts of habitus attempts to find the middle ground between the two groups of theories. According to Swartz, the habitus is a 'structured structure' that develops from early class specific experiences of socialization in family

and peer groups during which external structures are internalized. In other words, attitudes are contextualized.

A “field” explains an individual’s behavior by looking into the relations that form an individual’s actions. While the habitus is the internalized structure taken on by an individual, the field is the structure in which the habitus works. According to DiMaggio, “field refers to both the totality of actors and organizations involved in an arena of social or cultural production and the dynamic relationships among them.” In this case a traditional farmer will belong to the field of farming, and all the institutions, structure and organization that support that field. Raedeke et al. applying Bourdieu’s concepts of field and habitus gain insight into farmer’s attitudes about farming, identifying three alternative paths for social change that include agroforestry. Two paths work within the fields of farming and forestry, while a third is a new field, of agroforestry.

Other studies have focused on attitudes towards conservation, relevant in the case of riparian buffers. Ervin and Ervin used land stewardship to study farmers’ attitudes towards conservation, finding it to correlate positively with the adoption of conservation. Clearfield and Osgood review identified attitudinal variables in empirical studies that take four forms in conservation adoption: stewardship, risk orientation, non economic orientation toward farming, and attitudes towards government involvement. The first three have had a positive effect on adoption of conservation practices, while the attitude towards government involvement produced mixed results. Workman et al. showed different attitudes between extension workers and farmers on the importance of agroforestry and its benefits. Koontz investigated monetary versus non monetary attitudes towards private land use in Ohio, where reliance on a parcel of land for

economic livelihood, income, and educational attainment led to more non monetary attitudes towards land use. Land size holding and age on the other hand, led to monetary motivations towards land use. Farming was not the only use of land in this study.

External variables have also been used in conservation adoption. Erosion potential (Ervin and Ervin; Clearfield and Osgood), government cost share programs, and subsidies (Ervin and Ervin; Clearfield and Osgood; Mary et al.), and involvement with the Soil Conservation Service (Ervin and Ervin) had a positive effect. Clearfield and Osgood also found that contact with institutions had a positive relationship as well.

Many different internal variables, characteristics of the decision maker are significant. Age is a variable with mixed results, positive and negative effects on adoption. The nature or type of practice may be a factor explaining this (Clearfield and Osgood). Education level has been widely regarded as having a positive relationship with adoption of conservation practices (Clearfield and Osgood; Ervin and Ervin; Matthews et al.). Other internal factors associated with a positive relationship include involvement in local organizations, farm size, income, land ownership or tenure, family size, and familiarity with conservation practices (Abd-Ella et al.; Clearfield and Osgood; Korsching et al.).

THE MODEL

The framework incorporates Pierre Bourdieu's notions of "habitus" which connects an individual's actions to culture, structure, and power, and "field", the actors and organizations relations in a given arena (Raedeke et al; Schucksmith), along with individual economic and demographic characteristics of farm operators of previous adoption studies (Ervin and Ervin; Korsching; Matthews; Koontz; Clearfield and

Osgood). The ‘habitus’ is an internalized structure of social rules. The ‘field’ is the structure in which interactions occur, such as the field of agriculture. Four attitudes are tested: disengagers, conservatives, lifestyle, and accumulators.

Disengagers are not likely to be interested in any new practices inside or outside of their traditional field because they are continually reducing their overall commitment to the field of agriculture. Conservatives are interested in commercial opportunities, but only if these are in the field of agriculture. Farmers with a lifestyle attitude will likely be interested in new commercial opportunities, as well as conservation practices that allow them to maintain and protect their rural lifestyle. Accumulators are more likely to be interested in commercial opportunities that take them into new fields outside of traditional agriculture.

Conceptual Model

$$\mathbf{Interest\ in\ Adopting\ Agroforestry = f \{Attitudinal\ Variables; Structural\ Variables\}}$$

The dependent variable represents a qualitative choice, the interest in adopting agroforestry. Two agroforestry practices are studied, riparian buffers and forest farming. The interest in adopting each practice depends on a combination of attitudinal and structural variables. Attitudinal variables correspond to the proposed theory that farmers interest is based on their outlook (Shucksmith; Raedeke et al.; Valdivia et al.).

Farm operators’ attitudes can be classified into accumulators, conservatives, lifestyle, and disengagers. Each of these has an independent effect on the adoption of agroforestry practices. Accumulators will be interested in forest farming as a new commercial option, and have no relationship with interest in riparian buffers (Shucksmith). Conservatives will have a positive relationship with interest in riparian

buffers because it is a new practice that can be incorporated into the existing field of agriculture. This attitude will have no effect on interest in forest farming which would take them outside of their familiar field (Shucksmith; Raedeke et al.). The lifestyle attitude will have a positive relationship with both the interest in forest farming and riparian buffers which will allow farmers to explore new fields and incorporate a new conservation practice into their existing field (Shucksmith; Raedeke et al.; Valdivia et al.). Disengagers will have no effect on interest in any new agroforestry practices because these farmers are completely removing themselves from the field of agriculture (Shucksmith).

Structural variables are subdivided into internal/decision maker, and external variables. These independent variables include resources, socioeconomic factors, and demographic characteristics. External variables considered in the conceptual model include erosion potential, value of crops sold in the market, government cost share and subsidy programs. Internal to the household are farm size, age, income, land tenure, education level, familiarity with conservation practices, institutional contact, involvement in local organizations, and family size.

Erosion potential, government cost share and subsidy programs, farm size, income, land ownership, higher education levels, familiarity with conservation practices, institutional contact, involvement in local organizations, and family size are hypothesized to have positive relationships with interest in agroforestry practices. The value of crops sold in the market place will have a negative effect on the interest in agroforestry practices because as agricultural sales increase, farmers will not be interested in change from a perceived successful approach. Age may have a positive effect or a negative

relationship (Ervin and Ervin; Korsching et al.; Clearfield and Osgood; Matthews et al.; Mary et al.; Isik and Yang).

METHODS

In the conceptual model the interest in adoption of agroforestry practices is a function of attitudinal (a) and structural (s) variables. It is hypothesized that the interest in riparian buffers is a function of the lifestyle attitude, conservative attitude and eight structural variables while interest in forest farming is a function of the lifestyle attitude, accumulator attitude, and nine structural variables.

Riparian Buffers

$$\log(\text{IRB}/(1 - \text{IRB})) = \alpha + \beta_1 \text{cons} + \beta_2 \text{life} + \beta_3 \text{mv} + \beta_4 \text{krb} + \beta_5 \text{mags} + \beta_6 \text{wrp} + \beta_7 \text{oip} \\ + \beta_8 \text{child} + \beta_9 \text{silvo} + \beta_{10} \text{erosion}$$

Where:

IRB	= interest in riparian buffers
cons	= conservative attitude (acres of trees cleared in last 10 years)
life	= lifestyle attitude (interest in someone coming to your land)
mv	= market value of your farm, home, business, and other investments
krb	= knowledge of riparian and or stream bank plantings
mags	= # of magazine subscriptions for forestry or conservation magazines
wrp	= acres in WRP
oip	= acres in other incentive programs
child	= # of children in the home
silvo	= know anyone using silvopasture
erosion	= soil erosion caused by rain and or snow melt as a problem

The Hypothesis for the IRB logit model is the following:

H₀: The attitudinal and structural variables will have no effect on the probability that farm operators will be interested in riparian buffers.

H_a: The attitudinal and structural variables will increase or decrease the probability that farm operators will be interested in riparian buffers.

We expect the relationship to be the following:

cons	life	mv	krb	Mags	wrp	oip	child	silvo	erosion
+	+	+	+	+	+	+	-	+	+

The lifestyle (life) and conservative (cons) attitude variables should have a positive relationship with interest in riparian buffers. Lifestyle farmers are interested in conservation practices that will allow them to maintain their rural quality of life, and conservatives (cons) would be able to utilize this agroforestry practice to protect or improve the quality of resources in their current field of agriculture. The market value (mv) variable should have a positive effect on interest in riparian buffers because as farm size increases, interest in conservation or alternative practices increases.

Knowledge of riparian buffers (krb), knowledge of silvopastoral (silvo), and the number of magazine subscriptions (mags) are expected to have a positive effect on interest in riparian buffers. Knowledge of riparian buffers is a proxy for education level, which is correlated with know anyone using silvopasture. Education level also did not show much variation due to Missouri state law which requires everyone to attend school until the age of 16. As the education level increases adoption of conservation practices is expected to increase. Knowledge of riparian buffers, knowing anyone using silvopasture, and number of magazine subscriptions also represent the familiarity with the practice, which is expected to have a positive effect on interest. Acres in WRP (wrp) and other incentive programs (oip) should have a positive relationship with interest in riparian buffers because participation in these programs shows use of outside institutional contact. Having children (child) in the household is expected to have a negative relationship with interest in riparian buffers because having children increases the magnitude of family financial demands from the farm, and less is available for conservation. Lastly, soil

erosion (erosion) caused by snow melt should also have a positive effect on interest in riparian buffers. This variable represents the perception of erosion potential which is expected to have a positive effect on adoption of conservation practices.

Forest Farming

$$\log(\text{IFF}/(1 - \text{IFF})) = \alpha + \beta_1 \text{accum} + \beta_2 \text{life} + \beta_3 \text{mv} + \beta_4 \text{krb} + \beta_5 \text{mags} + \beta_6 \text{wrp} + \beta_7 \text{oip} + \beta_8 \text{child} + \beta_9 \text{mco} + \beta_{10} \text{ifg} + \beta_{11} \text{edlev}$$

Where:

- IFF = interest in forest farming
- accum = accumulator attitude (harvested trees for sale)
- life = lifestyle attitude (interest in someone coming to your land)
- mv = market value of your farm, home, business, and other investments
- krb = own knowledge of riparian and or stream bank plantings
- mags = # of magazine subscriptions for forestry or conservation magazines
- wrp = acres in WRP
- oip = acres in other incentive programs
- child = # of children in the home
- mco = membership in how many civic organizations
- ifg = belong to any informal farming groups
- edlev = education level

The hypothesis for the IFF logit model is the following:

H₀: The attitudinal and structural variables will have no effect on the probability that farm operators will be interested in forest farming.

H_a: The attitudinal and structural variables will increase the probability that farm operators will be interested in forest farming.

We expect the relationship to be the following:

Accum	life	mv	krb	Mags	wrp	oip	child	mco	ifg	edlev
+	+	+	+	+	+	+	+	+	+	+

The lifestyle (life) and accumulator (accum) attitudes are expected to have a positive correlation with the interest in forest farming because both of these attitudes are interested in new commercial opportunities that will potentially take them outside of their

field. Lifestyle farmers are interested because new commercial opportunities can help them maintain their rural lifestyle while accumulators are interested because of their tendency towards experimentation, expansion, and profit.

The market value (mv) should be positively correlated with interest in forest farming because as farm size increases there is more room for diversification and experimentation. Knowledge of riparian buffers (krb) should be positively correlated with forest farming for the same reason as with riparian buffers, familiarity with the field of agroforestry, as a proxy for education. Also included is a measure of education (edlev), and number of magazine subscriptions (mags). Acres in WRP and other incentive programs should be positively related with interest in forest farming because they represent contact with institutions that promote trees. The number of children (child) in the household is expected to be positive as more income is required for the family and therefore more income generating opportunities like forest farming. Finally, number of memberships in civic organizations (mco), and belonging to any informal farming group (ifg) are expected to have a positive effect on interest.

The Setting, Sampling and Data

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 in northeast Missouri. It spans three counties, Lewis, Clark and Scotland, and an area of 430,453 acres. The second study site also located west of the Mississippi river in southeast Missouri is Scott County (SC), with an area of 273,062 acres and highly valued crop land. 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 (Knox County Historical Society). 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).

The data collected with a household survey of farm operators in 1999. These are two diverse agricultural areas in the Northeast and Southeast portions of the state. The survey development involved key informant interviews followed by face to face interviews with selected 365 farm operators through a random sample with replacement (Valdivia et al.).

Quantitative Technique in the Estimation of Interest

The quantitative data analysis technique used is a logit regression with SPSS software version 12.0. A Logit regression was chosen because of the dichotomous nature of the dependent variable in the equation. This regression converts the possibility of a yes or no response into a probability within a range of a real line. Logit is not estimated using the least squares method as in linear regression but instead uses a maximum likelihood technique which derives the probability of a response based on the independent variables (Pindyck and Rubinfeld).

FINDINGS

This section provides the estimation results of the empirical models. Logistic regression provides results based on the natural log of the dependent variable outcome which is then converted to a probability of outcome based on a one unit increase in the independent variable.

Riparian Buffers

Two hundred and eighty two observations were included in the analysis and the chi-square value was highly significant at a value of 77.028. The pseudo R squared value for the model was 34.1% (Table 1). The Logit results provide statistical evidence for rejecting the null hypothesis. The parameter results for the interest in riparian buffers logit model are presented in Table 2. The model analysis shows that with only the intercept included, the model could predict correctly 70.9% of the time with 100% accuracy for those uninterested in riparian buffers and 0% of the time for those that were interested in riparian buffers. With the independent variables included in the model, the model can predict correctly 76.6% of the time with 90% accuracy for those that were uninterested and 43.9% accuracy for those that were interested (Table 3).

The estimation results (Table 2) indicate that farm operators who are conservative are interested in forest farming ($p < .07$), while lifestyle has a positive and more significant effect ($p < .000$) on interest in riparian buffers. Conservatives was measured “as an operator who removed trees in the last ten years”, because of their involvement with traditional commodity farming. The effect is weak, but they are interested in riparian buffers. The parameter estimates (Table 2) also support previous research indicating that there is a positive relationship between the probability that a farm operator will be interested in riparian buffers and farm size ($p < .07$), with their knowledge level of the practice ($p < .003$), with familiarity with the practice number of magazine subscriptions for forestry or conservation magazines ($p < .036$), and with perception of erosion potential ($p < .009$). On the other hand children in the home, and experience with government

programs involving trees, such as acres in WRP, acres in other incentive programs were not significant.

Table 1. Empirical Model Summary for Riparian Buffers.

Chi-Square (p-value)	# of Observations	Pseudo R-square
77.028 (.000)	282	.341

Table 2. Parameter Estimates for Interest in Riparian Buffers Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value	Rate of Change Probability
Conservatives	.027	.015	.070*	1.027
Lifestyle	.890	.161	.000***	2.435
Market Value of your Farm, Home, Business, and Other Investments	.081	.045	.074*	1.084
Own Knowledge of Riparian Buffers	.482	.160	.003***	1.620
Number of magazine subscriptions	.305	.145	.036**	1.356
Acres in WRP	.012	.018	.498	1.012
Acres in Other Incentive Programs	.001	.001	.581	1.001
Number of Children in the Home	.106	.130	.413	1.112
Know Anyone Using Silvopasture	1.070	.510	.036**	2.916
Soil Erosion Caused by Rain or Snow Melt	.403	.155	.009***	1.497

*significant at $\alpha=.10$

**significant at $\alpha=.05$

***significant at $\alpha=.01$

Table 3. Empirical Model Predictive Power for the Dependent Variable Interest in Riparian Buffers.

		Predicted			% Overall Correct
		Uninterested	Interested	% Correct	
Observed	Uninterested	180	20	90.0	76.6
	Interested	46	36	43.9	

Forest Farming

Two hundred and eighty four observations were included in the analysis and the chi-square value was highly significant at a value of 99.914. The pseudo R squared value for the model was 42.2% (Table 4). The Logit results provide statistical evidence for rejecting the null hypothesis. The estimation results indicate that farm operators with the accumulator and lifestyle attitude have a significantly higher probability of being interested in forest farming.

Table 4. Empirical Model Summary for Forest Farming.

Chi-Square (p-value)	# of Observations	Pseudo R-square
99.914 (.000)	284	.422

The parameter results for the interest in forest farming presented in Table 5. The model analysis shows that the intercept alone, the model predicts correctly 70.4% of the time, 100% accuracy for those uninterested in forest farming and 0% of the time for those interested in forest farming. With the independent variables the model predicts correctly 81.3% of the time with 92% accuracy for those uninterested and 56% accuracy for those interested (Table 6).

Lifestyle farmers (those interested in having someone come to their farm to advice on planting trees) were most likely to be interested in forest farming ($p < .000$), while accumulators, who have experience harvesting trees for sale, are also significantly interested in forest farming ($p < .031$). The parameter estimates also support previous research that indicates there is a significant relationship between the probability that a farm operator will be interested in forest farming and their knowledge level and familiarity with the practice. This is indicated by the positive effect on interest in forest

farming of own knowledge of riparian buffers ($p < .073$), which is a proxy for own knowledge of forest farming.

Table 5. Parameter Estimates for Interest in Forest Farming Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value	Rate of Change Probability
Accumulators	.732	.339	.031**	2.079
Lifestyle	1.279	.177	.000***	3.594
Market Value of your Farm, Home, Business, and Other Investments	-.116	.050	.020**	.891
Own Knowledge of Riparian Buffers	.303	.169	.073*	1.355
Number of Magazine Subscriptions	.160	.156	.303	1.174
Acres in WRP	-.006	.035	.864	.994
Acres in Other Incentive Programs	.001	.001	.245	1.001
Number of Children in the Home	-.073	.148	.620	.929
Membership in How Many Civic Organizations	-.368	.215	.088*	.692
Belong to any Informal Farming Groups	2.272	.985	.021**	9.702
Education Level	.085	.073	.247	1.088

*significant at $\alpha = .10$

**significant at $\alpha = .05$

***significant at $\alpha = .01$

Table 6. Empirical Model Predictive Power for the Dependent Variable Interest in Forest Farming.

		Predicted			% Overall Correct
		Uninterested	Interested	% Correct	
Observed	Uninterested	184	16	92.0	81.3
	Interested	37	47	56.0	

A variable significant in this study, but opposite in effect to previous research, is the market value of your home, farm, business, and other investments ($p < .02$). Rather than measuring wealth, the variable appears to measure how invested farm operators are in farming, and therefore how less willing they are of considering new commercial

opportunity. The number of magazine subscriptions, acres in WRP, acres in other incentive programs, and number of children in the home were not significant in this model. Why membership “in how many civic organizations” ($p < .08$) had a negative effect, belong to any informal farming groups (.021) had a positive effect. Membership and involvement in local organizations has previously been found to have a positive relationship with the adoption of agroforestry, but in this case the more civic organizations a farm operator belonged to, the less likely they were interested in forest farming. Belonging to an informal farming group did highly support the previous research in the strong effect on interest in forest farming.

SUMMARY AND CONCLUSIONS

This study was conducted to better understand the socioeconomic characteristics of farm operators in Missouri and to investigate the effect of attitudinal attributes of those farm operators interested in agroforestry practices, by focusing on two cases riparian buffers and forest farming. The research setting of northeast and southeast Missouri provides a diversity of environmental factors, agricultural practices, success with commodities, and land tenure systems. These differences between the study areas allow for broader application of the results to farm operators throughout the state of Missouri who are involved in commodity crops, crop-livestock production systems, and livestock only, as well as by full and part time involvement in the field of agriculture and farming.

Analysis of Study Results

The attitudinal categories explored as those conducive to interest in agroforestry were conservative, accumulator, and lifestyle attitudes. The expected motives for interest would differ according to the service of the practice, conservation or commercial. The

results of the logit regression confirmed that these attitudinal attributes are very useful in providing explanatory power for which farmers will be interested in various agroforestry practices. The results generally supported the previous research on the structural variables that were included in the regression analysis with a few exceptions.

Analysis of Riparian Buffers

The attitudinal variables included in the regression for riparian buffers were the conservatives and the lifestyle farmer attitudes. The variables chosen to represent these farm operators were how many acres of trees they had cleared from their farms in the last 10 years for the conservatives and whether they were interested in a farm visit for a feasibility study of trees on their farms for lifestyle farmers. The results were as expected and showed that lifestyle farmers were almost two and a half times more likely to be interested in riparian buffers while there was a slightly better than fifty-fifty chance that conservatives would be interested in riparian buffers.

Acres in WRP and acres in other incentive programs were used to represent institutional contact which has been shown to have a positive relationship with adoption of conservation practices. The number of farm operators with acreage enrolled in WRP or other incentive programs was very small. The reduced number of positive responses may have had an impact on the significance of these variables. The number of children in the home has been previously found to have a negative relationship with the adoption of conservation practices. In this study, over half of the farm operators did not have children and of those that did 128 had either one or two children. This low number of children in the home may reduce the pressure for financial output from the farm which reduces the adoption of conservation practices. Of the farm operators with children in the

home, 73 listed themselves as part time farmers which could also reduce the financial pressure on the farm.

Analysis of Forest Farming

The attitudinal variables that were included in the regression for interest in forest farming included the accumulators and the lifestyle farmers. Accumulators were farm operators that had harvested trees for sale from their land, and lifestyle were those that replied that they were interested in a farm visit for a feasibility study of trees on their farms for lifestyle farmers. Lifestyle farmers were three and a half times more likely to be interested in forest farming, while accumulators were slightly better than two times more likely. This result is consistent with the idea that both of these attitudinal categories are interested in new commercial opportunities.

The farm operators' knowledge level of riparian buffers and whether they belonged to any informal farming groups were found to be positively related with interest in forest farming. These variables supported previous research that showed education level, familiarity with the practice, and membership in organizations were positively related with adoption of agroforestry practices. The nature of the organization appears to be very important for the interest in agroforestry because only around 5% of the farm operators in this study belonged to informal farming groups, such as no till clubs. Those farmers are almost ten times as likely to be interested in forest farming.

Variables that did not support previous research were the number of civic organizations they belonged to, number of magazine subscriptions, acres in WRP, acres in other incentive programs, number of children in the home, formal education level, and the market value of your farm, home, business, and other investments. The number of

civic organizations that they belonged was used as a measure of membership in local organizations and institutional contact which is expected to have a positive relationship with the interest in commercial and conservation practices. The nature of the organization appears to be a critical factor for whether the farm operator will have an increased or decreased interest in agroforestry practices in general and forest farming specifically. The civic organizations that farm operators belonged to include a range from volunteer firefighters to the local chamber of commerce. These organizations do not provide information on new agricultural practices and more likely continue to engrain farm operators into the traditional field of agriculture, which might explain the deviation from the expected result. Belonging to informal farming groups was also a measure of membership in local organizations, but these groups provide information on farming practices and the relationship with interest in forest farming was highly positive.

The number of magazine subscriptions was expected to have a positive relationship with interest in forest farming, but the magazine that was most often listed in the farm operators' responses was the Missouri Conservationist. This variable had a significant and positive relationship with interest in riparian buffers, which may be more commonly referenced in this magazine. If that is the case, then it would explain why there is no relationship between magazine subscriptions and interest in forest farming.

The acreage in WRP and other incentive programs was found not to be significant for interest in forest farming. The reason for this is the same as the reason for the lack of significance in the interest in riparian buffers model. The variation on both of these variables was very low which would lead to a lack of explanatory power in the model.

The number of children in the home was expected to have a positive relationship with interest in forest farming as a commercial opportunity. In previous research, this variable was analyzed when investigating new commercial practices that were considered part of the field of agriculture. In this case, forest farming is a new commercial opportunity but it is a practice that farm operators would not feel pressured to use because it is outside of their traditional field. The reasons provided in the analysis of riparian buffers are valid in this case as well. If the number of children in the home is relatively low or the household earns most of its money outside of the home this would reduce the financial pressure on the farm.

The formal education level variable did not have much variation in responses due to the fact that state law requires attendance until the age of 16. This variable has traditionally been used in studies of developing countries where the variation in education levels can be extreme. The homogeneity of this study sample most likely led to the variable not being significant.

The market value of your farm, home, business, and other investments had a negative relationship with the interest in forest farming. The market value was used as a proxy for farm size. This variable is expected to have a positive relationship with interest in new commercial opportunities. The reason for this inconsistency could be that as the farm size increases the result is more specialization. This would tend to reduce farmers interest in new practices intended for diversification of their production.

Conclusion

Farm operators in Missouri, with attitudes such as accumulator or lifestyle in Missouri's northeast and southeast are interested in alternative land management

practices of the field of agroforestry. Although structural variables have been shown to be effective tools for understanding the conditions in which farmers will adopt new agricultural practices, attitudes play an important role in whether there will be interest in new practices. It is important to recognize whether new agricultural practices can be incorporated into the current field of agriculture, or a new field of practice is feasible. Traditional farmers will prefer to remain in the field of agriculture and farming. The information on attitudes and awareness of structural characteristics that trigger interest allow researchers and extension agents identify the niche groups for these new practices, using appropriate attitudinal categories. For agricultural and conservation policies to be effective, information on the motives and interest of farm operators and land owners is critical, as it will help avoid contradictory policies on production and conservation (Dobbs and Pretty).

Limitations and Recommendations

Observable behaviors were selected to represent the conservative, accumulator, and disengager attitudinal categories. Observable indicators are useful as these can be used in identifying farm operators with these attitudes who may be interested in agroforestry practices. On the other hand lifestyle was identified through subjective measures, an opinion on wanting someone to come to advise them, which is not observable in currently gathered statistics. This makes the latter more difficult to use in a practical sense. In the future, surveys should try to combine questions that identify specific observable and subjective indicators for all categories. This will make the practical application of the findings more relevant for extension of agroforestry practices.

One of the requirements of logit regression is to have no correlation between independent variables. In this study, many variables that could provide increased explanatory power were not used because of significant correlation with other variables. Some of these variables included farm visits from agribusiness or government agents, age, and amount of land owned or rented. In the future it may be worthwhile to attempt to use another analysis technique such as cluster analysis which does not provide the explanatory power of logit but does provide another view of groups that would potentially be interested in agroforestry practices.

Logit regression will only analyze observations which are complete for all of the independent variables in the model. In this study, many of the respondents did not provide financial information which limited the number of observations that were included in the analysis. Out of 364 total observations, 284 were included in the analysis of interest in forest farming and 282 were included in the analysis of interest in riparian buffers. It would be beneficial to repeat the survey in the same area which would provide a time series analysis that determines a cause and effect of factors of interest in agroforestry practices such as does a farmer who is slightly interested in agroforestry subscribe to more magazines and become highly interested, or do those farmers that are already highly interested in agroforestry subscribe to more magazines.

In future surveys it will also be important to develop survey questions based specifically on the attitudes, to obtain measures that are observed in all categories, instead of some being observed and others being based on expressed opinions. Willingness to take risks outside of the farmer's current field and willingness to experiment outside of the field should be purposely asked, to identify who are the accumulators.

If goal of agroforestry research and extension programs is to increase adoption of agroforestry in Missouri, then it could also be worthwhile to invest resources in farmer education, which has been shown to be highly correlated with interest and adoption of new practices. Knowledge was a strong factor in explaining interest. This could be done through participatory processes such as farm based experiment stations and demonstrations. From the survey it is clear that many farmers rated their knowledge level of agroforestry practices as very low, excluding windbreaks. A participatory process could improve that knowledge, especially for other practices such as alley cropping and silvopasture, which were the least understood. This would be especially important since it was found that knowledge of the practice heavily influences interest. A participatory program would also allow farm operators to observe the practice and understand its risks, without having to take on the risks (of the unknown) by attempting new practices.

REFERENCES

- Abd-Ella, M. M., E. O. Hoiberg, and R. D. Warren. "Adoption Behavior in Family Farm Systems: An Iowa Study." *Rural Sociology* 46, no. 1(1981): 42-61.
- Buck, L. E. "Agroforestry Policy Issues and Research Directions in the U.S. and Less Developed Countries: Insights and Challenges from Recent Experience." *Agroforestry Systems* 30, no. 1-2(1995): 57-73.
- Clearfield, F., and B. T. Osgood. "Sociological Aspects of the Adoption of Conservation Practices." 1986. Soil Conservation Service.
- DiMaggio, P. "On Pierre Bourdieu." *The American Journal of Sociology* 84, no. 6(1979): 1460-1474.
- Dobbs, T. and J. N. Pretty. "Agri-Environmental Stewardship Schemes and "Multifunctionality"". *Review of Agricultural Economics* 26 no. 2(2004).
- Ervin, C. A., and D. E. Ervin. "Factors Affecting the Use of Soil Conservation Practices: Hypothesis, Evidence, and Policy Implications." *Land Economics* 58, no. 3(1982): 277-292.

- Festervand, D. F. *Soil Survey of Cape Girardeau, Mississippi and Scott Counties, Missouri*. Columbia: United States Department of Agriculture Soil Conservation Service, in Cooperation with the Missouri Agricultural Experiment Station. 1981.
- Garrett, H. E. "A Floodplain Analysis of Agroforestry's Physical, Biological, Ecological, Economic and Social Benefits." Environmental Protection Agency Proposal, pp. 93.
- Garrett, H. E., and W. B. Kurtz. "Silvicultural and Economic Relationships of Integrated Forestry-Farming with Black Walnut." *Agroforestry Systems* 1, no. 3(1983): 245-256.
- Gold, M. A., and J. W. Hanover. "Agroforestry Systems for the Temperate Zone." *Agroforestry Systems* 5, no. 2(1987): 109-121.
- Isik, M., and W. Yang. "An Analysis of the Effects of Uncertainty and Irreversibility on Farmer Participation in the Conservation Reserve Program." *Journal of Agricultural and Resource Economics* 29, no. 2(2004): 242-259.
- Knox County Historical Society. *History of Lewis, Clark, Knox, and Scotland Counties, Missouri*. Wallsworth Publishing Company. Originally printed in 1887. 1981.
- Koontz, T. M. "Money Talks-But to Whom? Financial Versus Nonmonetary Motivations in Land Use Decisions." *Society and Natural Resources* 14(2001): 51-65.
- Korsching, P. F., C. W. Stofferahn, P. J. Nowak, and D. J. Wagener. "Adopter Characteristics and Adoption Patterns of Minimum Tillage: Implications for Soil Conservation Programs." *Journal of Soil and Water Conservation* 38, no. 5(1983): 428-431.
- Lynch, L., and C. Brown. "Landowner Decision Making About Riparian Buffers." *Journal of Agricultural and Applied Economics* 32, no. 3(2000): 585-596.
- Mary, F., C. Dupraz, E. Delannoy, and F. Liagre. "Incorporating Agroforestry Practices in the Management of Walnut Plantations in Dauphine, France: An Analysis of Farmers' Motivations." *Agroforestry Systems* 43(1999): 243-256.
- Matthews, S., S. M. Pease, A. M. Gordon, and P. A. Williams. "Landowner Perceptions and the Adoption of Agroforestry Practices in Southern Ontario, Canada." *Agroforestry Systems* 21(1993): 159-168.
- Mercer, D. E., and R. P. Miller. "Socioeconomic Research in Agroforestry: Progress, Prospects, Priorities." *Agroforestry Systems* 38(1998): 177-193.

- Pattanayak, S. K., D. E. Mercer, E. Sills, and J. Yang. "Taking Stock of Agroforestry Adoption Studies." *Agroforestry Systems* 57(2003): 173-186.
- Pindyck, R. S., and D. L. Rubinfeld. *Econometric Models and Economic Forecasts*. 2nd ed: McGraw Hill, Inc., 1981.
- Raedeke, A. H., J. J. Green, S. Hodge, C. Valdivia. "Farmers, the Practice of Farming and the Future of Agroforestry: An Application of Bourdieu's Concepts of Field and Habitus." *Rural Sociology* 68, no. 1(2003): 64-86.
- Shucksmith, M. "Farm Household Behaviour and the Transition to Post-Productivism." *Journal of Agricultural Economics* 44, no. 3(1993): 466-478.
- SPSS Inc. Logistic Regression. Chicago, SPSS Training Department, 2000, pp. 7.1-7.34.
- Swartz, D. *Culture and Power: The Sociology of Pierre Bourdieu*. Chicago: University of Chicago, 1997.
- Teel, W. S., and J. P. Lassoie. "Woodland Management and Agroforestry Potential among Dairy Farmers in Lewis County, New York." *The Forestry Chronicle* 67, no. 3(1991): 236-242.
- Valdivia, C., S. Hodge, and A. Raedeke. "Small Farmer Livelihood Strategies and Agroforestry Practices in Northeast and Southeast Missouri.", University of Missouri, forthcoming.
- Williams, P. A., A. M. Gordon, H. E. Garrett, and L. Buck. (1997) *Agroforestry in North America and its Role in Farming Systems*, ed. A. M. Gordon, and S. M. Newman, CAB International, pp. 9-84.
- Workman, S. W., M. E. Bannister, and P. K. R. Nair. "Agroforestry Potential in the Southeastern United States: Perceptions of Landowners and Extension Professionals." *Agroforestry Systems* 59(2003): 73-83.

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