NON-OPERATOR AND FARM OPERATOR LANDOWNER INTEREST IN AGROFORESTRY IN MISSOURI

A Thesis presented to the Faculty of the Graduate School
University of Missouri-Columbia

In Partial Fulfillment of the Requirements for the Degree

Master of Science

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by

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AUGUST 2006

The undersigned, appointed by the Dean of the Graduate School, have examined the thesis entitled

NON-OPERATOR AND FARM OPERATOR LANDOWNER
INTEREST IN AGROFORESTRY IN MISSOURI

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A candidate for the degree of Master of Science

And hereby certify that in their opinion it is worthy of acceptance.

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ACKNOWLEDGEMENTS

I would like to thank Dr. Corinne Valdivia for her assistance and guidance throughout my master's program. Her continual support accompanied by her challenging questions has enhanced this research. I would like to thank my committee members, Dr. Laura McCann and Dr. Michael Gold, for their support in completing the project.

I would like to thank my professors and fellow graduate students who have provided input and discussion throughout my graduate career. My appreciation goes out to Frayne Olson for keeping me sane in the computer lab.

Finally, I would like to thank my husband, Chris Dorr, for his patience and support. Thank you all!

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ABSTRACT

Farmers are increasingly conflicted between maintaining the integrity of the land and trying to succeed in a competitive market place. Agroforestry may offer opportunities, but awareness of the various practices is very limited, and little is known of what motivates their interest. Five practices are modeled using Logit regressions pooling two data sets of non-operator landowners and farm operators from two regions in Missouri. Attitudinal, structural, and physical characteristics are modeled. Lifestyle attitude increases the likelihood of interest in all practices, excluding windbreaks. A conservative attitude lowers the likelihood of interest in all except windbreaks. Accumulator attitude was not significant. Own knowledge of the practice increases the likelihood of interest overall. Physical characteristics increased likelihood in alley cropping, windbreaks, silvopasture and forest farming. Age decreased it in alley cropping, windbreaks, and forest farming. Education was positive only in silvopasture. Advice was positive in all except riparian buffers and silvopasture.

Chapter I

Introduction

General Research Problem

There is a need in the United States to conserve and protect our farmland. The population of the U.S. continues to increase by three million each year, and "forestry and agriculture will both face the problem of meeting an increasing demand for goods, as well as for an expanding array of services, such as clean water, recreation, and wildlife habitat. More importantly, society will have to meet its needs with a fixed or shrinking land base" (USDA 2000, pg 1).

New technologies in agriculture can often lead to an increase in production. This tends to combat the rise in population and shrinking land base, but these technologies and innovations in the agriculture industry do not necessarily lead to sustainability and better conservation practices of our land. Farmers are increasingly conflicted with the burden of maintaining the integrity of the land while trying to succeed in an increasingly competitive agricultural market place (USDA 2000).

Agroforestry is a farming system that integrates crops and/or livestock with trees and shrubs. The "resulting biological interactions provide multiple benefits, including diversified income sources, increased biological production, better water quality, and improved habitat for both humans and wildlife" (ATTRA, 2006). The main goal of agroforestry practices is to optimize production and conservation benefits simultaneously (University of Missouri,

2006). To be considered agroforestry, the agricultural practices must be intentional, intensive, integrated, and interactive.

Many landowners do not understand the benefits of integrating agroforestry practices into their current agricultural production systems and is often confused with conservation practices that take land out of production. However, agroforestry is considered productive conservation (Gold et. al., 2004); merging trees and shrubs into a productive agricultural landscape simultaneously. Research has shown that landowners can generate income and provide conservation benefits to the land from a wide variety of agroforestry practices.

In this research, two types of landowners were observed, those who farm their land and those who do not farm their land. Landowners who are farm operators will be labeled as "farm operators" and landowners that do not farm their land will be labeled "non-operators" for the duration of this document to minimize confusion.

Specific Research Problem

Over the last 15 years, there has been huge population growth taking place in smaller cities and towns in Missouri. This has required the conversion of 435,400 acres – 680 square miles of fields, farmland, forests and other green space to urban development (Brookings Institution, 2002). Some feel that Missouri's pattern of growth is eroding the rural heritage of the state. The rise in development has increased the price of land and pushed out some farmers who cannot survive due to the increased development (Strong and Jacobson, 2005). Farmers are faced with conserving the land while increasing production, therefore diversifying production and income will be critical in their survival.

Some of the negative ecological effects of this distribution of population encroaching on farmland in Missouri could be counteracted by including trees, prairies, and other natural habitats into the development plans. If done in these areas and other areas conducive to agroforestry practices, agroforestry can help protect rural vitality, the environment, and aid in resource conservation of the land.

Very little information regarding current awareness and interest in agroforestry practices of landowners and farm operators in Missouri is available. Research and extension specialists lack information on agroforestry practices (Workman et. al., 2003; Teel and Lassoie, 1991) and are unaware of how landowners and farmers perceive agroforestry systems to fit their current land management objectives. This research hopes to address that issue and provide literature that will help Extension specialists understand how landowners and farmers perceive agroforestry practices.

Agroforestry Practices

There are five recognized practices in the temperate zone that are considered agroforestry: alley cropping, windbreaks, riparian buffers, silvopasture, and forest farming (University of Missouri, 2006; AFTA, 2006, Beetz, 2002). Alley cropping is defined as growing crops between wide spacings of trees planted in rows. Windbreaks are single or multiple rows of trees planted to reduce wind effects on crops or livestock. Riparian buffers are trees, grasses, and/or shrubs planted in areas along streams or rivers to decrease soil erosion and improve water quality. Riparian buffers are sometimes also called filter strips. Silvopasture is defined as trees, forages, and livestock that are intentionally combined and managed as a single integrated practice. Forest farming is when high-value specialty crops are grown under the canopy of a forested area. Each of these agroforestry practices may be

attractive to different people depending on their attitudinal, structural, and physical characteristics.

Benefits of Agroforestry

Each of the individual practices mentioned above has many potential applications for agroforestry, conservation, and economic gain. Buck (1995) found that temperate agroforestry has been driven by the proven or perceived ability to meet the following needs: 1) help diversify production, 2) help mitigate environmental damage, 3) rehabilitate the land, 4) convert land from annual to timber crops, 5) enhance food production, 6) help sustain marginal or fragile land, 7) enhance the wildlife habitat, and 8) be aesthetically pleasing. Many conservation resource professionals believe the conservation benefits are sufficient for implementing agroforestry practices, while landowners often require the economic benefits to make it a feasible practice, and the conservation benefits are an added bonus (Scherr, 1995).

Environmental Benefits

Each of the agroforestry practices has many environmental benefits. They include carbon storage, pest management, reduction of soil erosion, increase in soil conservation, protection of streams, lakes, and wildlife habitat, water conservation, enhancement of animal performance, increased aesthetics, energy conservation, and improved forest health (Association for Temperate Agroforestry, 2006; University of Missouri Center for Agroforestry Training Manual, 2006).

Economic Benefits

Economic benefits are recognized by direct or indirect monetary compensation gained by the landowner. Direct benefits would include generating additional income by

diversifying products, receiving cost-share or money from other government programs, increasing the farmer's income by switching to a different product market, having healthier livestock consuming less food, enhancing the growth of forages for livestock which decreases the amount of purchased forages, and providing protection for livestock from wind and cold which will increase their production (University of Missouri Center for Agroforestry Training Manual 2006; Association for Temperate Agroforestry 2006).

Many of the environmental benefits will also indirectly affect the economics of the landowners operation. For example, indirect benefits can be seen by the reduction of household risk due to the diversification of income, the reduction of soil erosion allows the landowner to continue farming that land because it has not washed or blown away, and the improved availability of forage and enhanced nutritional quality provides back door economic benefits for the landowner in terms of enhanced animal performance (University of Missouri Center for Agroforestry Training Manual, 2006).

Although direct and indirect benefits have been identified, they have historically been difficult to monetarily estimate due to lack of agroforestry practices in the US. This problem is beginning to be resolved with more agroforestry practices being implemented on research farms and/or private lands providing the economic data needed to run cost/benefit analysis and economic budgeting for agroforestry practices. You can now find articles and books that will help landowners understand the economics of agroforestry practices.

Limits to Agroforestry

There are several limits to the adoption of agroforestry practices documented in the literature. Many of the limitations are associated with the increased amount of risk and uncertainty linked with agroforestry practices as compared to traditional farming systems.

For example, agroforestry practices may take several years to fully realize benefits (Gold et. al., 2004) whereas commodity farming and annual crops often take the few months between planting and harvest. Annual revenues coupled with knowledge of traditional agriculture provide less uncertainty in commodity agriculture. Agroforestry is more complex than commodity agriculture as it requires an unestablished set of inputs which are often new to the farmer. The farmer must feel comfortable with this set of inputs before adopting. Casey (2004) suggests that investments in education and human capital may lead to a higher probability of adoption of agroforestry practices.

While the market for traditional crops is already established, market risk and uncertainty in agroforestry is another limitation to interest and adoption to agroforestry. Although this is a valid concern, market risk and uncertainty can be offset by good market research as strategic marketing is essential for success with an agroforestry enterprise (Gold, Godsey, Josiah, 2004).

Another limitation is the natural resource professional's lack of knowledge on the benefits and limitations agroforestry practices. This lack of knowledge as well as understanding the barriers to adoption may be hindering adoption potential. Teel and Lassoie (1991) found in a project with dairy farmers in New York, there was considerable interest in practices involving woodlands/trees, but there was a lack of information and technical assistance for practices involving agroforestry. Williams et al. (1997) suggest that farmers will readily implement agroforestry practices that have clear economic benefits, provided that adequate support is available to help the farmers work through the kinks of the new practice. All of these underscore that it is critical for researchers and natural resource professionals to understand agroforestry practices and the factors that affect interest in agroforestry. This

research hopes to provide useful information to the researchers and natural resource professionals in Missouri that who work with landowners.

Research Objectives

The primary objective of the proposed research is to investigate the relationship between landowners who are not farm operators and those who are farm operators, analyzing how their attitudes and structural characteristics affect their interest in different agroforestry practices. The primary objective will be achieved through completion of the following specific objectives:

1. To review the literature on non-operators and farm operator landowner attitudes, adoption of agricultural, conservation, and agroforestry practices.
2. To measure the relationships between non-operator landowner and operator landowner attitudes, structural characteristics and interest in agroforestry practices.
3. To hypothesize the attitudinal and structural factors that influence non-operator landowner and operator landowner interest in agroforestry practices.
4. To empirically investigate the relationship between the hypothesized factors and interest in the agroforestry practices.

Overview of the Thesis

The following chapters will provide an in depth analysis of characteristics of landowners in Missouri. Chapter II provides a review of literature regarding agroforestry incentives, interest in adoption, and other methodologies used in similar research. Chapter

III includes a description of the data source, conceptual model and hypotheses. It then describes the variables in the model, the empirical model and analysis technique. Chapter IV provides a description of the farm operators and non-operator landowners in Northeast and Southeast Missouri. Chapter V empirically tests the models and presents the results and discussion of the five agroforestry practices in the model. Chapter VI concludes with the limitations of these findings and provides recommendations for future research.

Chapter II

Literature Review: Incentives and Interest

Marginal resources in developing countries have long demanded the use of agroforestry as sustainable agriculture. However, the United States is just beginning to experience land shortages due to land degradation, soil erosion, water pollution, and population increases (Matthews et al., 1993). Agroforestry practices will be needed in the United States to most efficiently utilize and conserve the land that is still available. This may be a difficult sale to farmers as agroforestry is generally labor intensive, the returns are often not immediate, and it is most likely a new activity to the farmer therefore the farmer may not be knowledgeable about the practice. Agroforestry tends to be more knowledge intensive than traditional agriculture, hence the benefits of practicing agroforestry must be greater than the returns to traditional farming to compensate for increased uncertainty (Casey, 2004).

This chapter presents the current literature on the incentives and interest in agroforestry. Incentives are provided by government or private agencies. The incentives can be rental payments, cost-share, or tax incentives. Much research has been done on the factors affecting interest in adopting agroforestry practices. Interest is discussed below in terms of innovativeness, landowner's and natural resource professional's perceptions and opinions of agroforestry, and actual interest in agroforestry or agroforestry related practices. Bourdieu's "habitus" and "field" are then discussed, followed by findings related to his research. Next, current research regarding the attitudinal characteristics defined by Shucksmith (1993) are discussed. In conclusion, a summary is included regarding the research discussed.

Incentives

Economic theory would suggest that farmers adopt agroforestry practices where there are clear economic incentives that benefit the landowner, as long as risks associated with the practices are perceived as manageable, but it is important to understand farmers' current and historical patterns of farming when designing incentives. Economic gain is the primary motivating factor in the adoption of agroforestry in the US (AFTA, 2006; Scherr, 1995) but the decision to adopt an agroforestry practice depends on the decision maker's perception of how that practice compares with alternative land use options. The adoption of an agroforestry system requires more than good economic conditions, it requires a certain amount of confidence from the farmer; that they can understand and implement the new technology, and that the profitability of the agroforestry system is believable (Casey, 2004). Policy makers should take the uncertainty of outcomes and irreversibility of sunk costs into consideration when designing and examining costs and benefits for policy programs (Isik and Yang, 2004). The new practices must offer at least as much income potential without increasing risk, compared to current farming practices, and better scenarios for solving conservation problems than the current farming practice (AFTA, 2006).

Over the last few years, many studies have been done to identify the incentives for adopting temperate agroforestry practices. Although many of these are not in North America, these studies provide a good background for understanding incentives that may be important in Missouri. Incentives for agroforestry can be implemented to provide economic or ecological benefits to the landowner and entice them to adopt practices that may have been risky or foreign to them prior to the incentives. Incentives are most often provided by government or private sponsored agencies to promote agroforestry and land conservation.

Incentives provide monetary benefits to offset the cost of setting up and maintaining agroforestry practices.

Exploratory research has been done to provide a roadmap for policies involving agroforestry in the US. Buck (1995) points out that it was not until the mid 80's that policies affecting agroforestry in a positive way were implemented. The visibility of the Association for Temperate Agroforestry (AFTA) has increased, and policies including cost share and rental payments by the former USDA Soil Conservation Service (SCS), the Natural Resources Conservation Service (NRCS), the Soil and Water Conservation District (SWCD), and many others have been put into practice. These include land retirement programs and private forest improvement programs among others.

Research has shown that firms and individuals rarely practice sustainable agroforestry activities. Although there are some incentives, this could be due to the lack of additional support by local and federal governments with incentives or tax breaks. This may be changing as the 2002 Farm Bill has been documented by the NRCS (2002) as the "single most significant commitment of resources toward conservation on private lands in the Nation's history." Private landowners were supposed to benefit from many types of financial assistance ranging from cost-share, rental incentive payments, and technical assistance. The 2002 Farm Bill loosened eligibility requirements to encompass more landowners for participation which allows greater access to the incentives by landowners. Although many programs have been funded by the government, there are also programs where funding continues to be an issue.

The programs with the most agroforestry applications include the Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP), the Farmland

Protection Program (FPP), the Grasslands Reserve Program (GRP), the Wetlands Reserve Program (WRP), the Wildlife Habitat Incentives Program (WHIP) and the Conservation Reserve Enhancement Program (CREP) (USDA, 2003).

There are several different types of funding that can incorporate agroforestry into its program. Federal funding incentives are given through the Farm Service Agency (FSA), the NRCS, the USDA Forest Service (FS), the Sustainable Agriculture Research and Education Program (SARE), and the United States Fish and Wildlife Service (USFWS). Missouri State Funding Incentives include the Missouri Department of Agriculture (MDA), the Missouri Department of Conservation (MDC), and the Missouri Department of Natural Resources (DNR). Private sources for agroforestry funding include the National Fish and Wildlife Foundation (NFWF), the National Wild Turkey Federation (NWTF), Quail Unlimited (QU), Ducks Unlimited (DU), and Pheasants Forever (PF) (Godsey 2002, USDA 2003).

It was shown by Cooper and Keim (1996) that landowners can be encouraged to adopt certain conservation techniques through the use of incentive programs. Although the conservation techniques were not specifically agroforestry, this information is still important as agroforestry relates to conservation practices. The techniques tested were integrated pest management, legume crediting, manure testing, split applications of nitrogen, and soil moisture testing. They found that a small group of farmers would adopt the practices with no incentive payments, 10% of the farmers would adopt the practice if offered the current incentive payment, and that to get 50% adoption would require incentive payments that are much higher than currently offered. This was thought to be representative of many programs offered today.

Redhage (1993) did a study on landowners in Missouri who indicated that they would plant trees on their CRP acres. The landowners were asked how many acres they would enroll in an agroforestry program, if they could crop between the trees and the government cost-shared 75% of the cost of planting the trees. He found that gross income from farming and age had a positive effect on adoption of agroforestry, while a high monetary value of the farm operation and a higher level of debt had a negative relationship on the adoption of agroforestry. He then asked the same question and added an incentive. He asked the landowners how many acres they would enroll in an agroforestry program, if they could crop between the trees and the government cost-shared 75% of the cost of planting the trees if a $25 additional payment was added to this program. In this model he found that education had a positive relationship on adoption of agroforestry while value of the farm operation continued to have a negative relationship with adoption of agroforestry. Gross income from farming, age, and percent owned debt-free were no longer significant.

Incentive programs, as currently defined, may not necessarily be beneficial for the future of agroforestry, especially practices that could provide short term economic gains. As currently formulated, landowners cannot harvest for commercial use from areas such as riparian buffers, or CRP trees. These programs and others tie the hands of landowners when trying to begin new agroforestry practices. The landowners are not able to implement a viable agroforestry practice due to the constraints of the incentive program. For agroforestry to survive, it is important to note that agroforestry may need to be more market driven than incentive driven. The development of an agroforestry market place could lessen the risk associated with agroforestry and provide landowners with resources to find bottom line market information and make educated decisions.

Along with the cost share and rental payment programs mentioned above, the federal government provides tax incentives for agroforestry practices. Although tax incentives are helpful, the landowners must know the requirements of the tax code to benefit from the incentives. Knowledge and understanding the tax incentives is key, but is difficult for many landowners as these are always changing. Since 2002, the tax incentives for agroforestry have changed from three areas including reforestation, business investment in farming or forestry, and conservation (Godsey, 2001) to include four areas; reforestation, business investment in farming or forestry, conservation, and long term capital gains (Godsey, 2005). Keeping up on the changing tax codes is nearly impossible for farmers and often require a tax preparer's knowledge.

As shown above in recent studies, there is expanding interest in agroforestry in universities, agencies, and conservation organizations, but there is a slow rate of adoption among landowners (USDA, 1997). Government intervention in developing institutions to support agroforestry systems is critical to the success of agroforestry. Institutions within NRCS, SWCD, and MDC which are geared to help coordinate the activities of the stakeholders must be developed to help facilitate transactions at a minimum cost (Alavalapati et al., 2004).

Finding the Niche – Interest in Adoption

Factors in the adoption of agroforestry practices are distinctive due to their unique features. Understanding these factors is critical to the success of development programs (Adesina and Chianu, 2002). Once these adoption characteristics are identified, development

programs can be better targeted in areas and to individuals with higher adoption potential leading to more efficient use of agroforestry practices.

In a study on adopters and their relationship to innovativeness, Korsching et al. (1983) found that overall, studies show that education, income, business operation size, business orientation, contact with those who advocate change, and participation in organizations relate directly to innovativeness. On the other hand, results for age have been inconsistent with adoption of innovative technologies.

Workman et al. (2003) conducted a survey of landowners and extension professionals in the Southeast United States to better understand their perceptions and opinions on agroforestry. Although the professionals thought agroforestry had moderate to high potential in their area, it showed that professionals thought the lack of demonstrations and lack of familiarity with the practices were major obstacles to the adoption of agroforestry practices. Lack of markets and lack of market information ranked next highest in importance. Workman et al. (2003) also found that landowners had different perceptions on the obstacles to the adoption of agroforestry systems. They ranked lack of equipment, competition between trees, crops, and animals, and lack of land area as the most important. Aligning with the extension professions, the landowners also saw the lack of demonstrations as important.

While studying the adoption of new farming systems, Pannell (1999) found that there are four conditions which are necessary for an individual farmer to adopt a new innovative farming practice: awareness, perception that the new practice is feasible, perception that the new practice is worth trialing, and perception that the farmer's objectives will be met with the new practice. Barriers to adoption were found to be: finding and/or developing a practice that is more profitable than the current practices, assessing whether the practice is more

profitable than the current practices, and overcoming deep uncertainty with farmers about the practice.

In a study by Adesina and Chianu (2002) looking at the adoption of alley farming in Nigeria, they found that certain farmer characteristics influenced the adoption of agroforestry. They included gender, contact with extension agents, years of experience with agroforestry and tenancy status in the village. Economic factors that influenced the adoption of the agroforestry system were the extent of village land pressure, extent of erosion intensity, village fuel wood pressure, importance of livestock as an economic activity, and the distance from urban centers.

In a study on Missouri landowners that are non-operators, Arbuckle (2005) found those that participate in farming activities have a negative relationship with interest in agroforestry. As anticipated, he also found that if the landowner owned the land for environmental or recreational reasons, their interest in agroforestry was very positive while if they had a larger percentage of land in crops, the landowners were considerably less likely to be interested in agroforestry practices. Knowledge of agroforestry and amount of education were significantly and positively related to interest in agroforestry. Age was not significant. Results indicated that differences in farming systems affected interest in agroforestry. Those that have closer ties to farming and strong financial motivations are less interested in agroforestry, while those that place a high importance on environmental and recreational aspects of their land are more interested in agroforestry as a potential land use application.

Other research has been done that suggest several characteristics for the adoption of agroforestry. Matthews et al. (1993) found that the use of agroforestry systems is largely dependent on farmers' attitudes and their willingness to participate in non-traditional

agriculture. Vosti et al. (1997) found that adoption of agroforestry requires a thorough understanding of physical and financial returns along with 1) scale of production, 2) timing/size of investment, 3) maintenance costs, 4) costs of abandonment, 5) competing supply sources, and 6) sources of risk (such as markets, land tenure and the weather.) Pattanayak et al. (2003) found mostly the same results with five categories that affect agroforestry adoption. These are preferences, resource endowments, market incentives, biophysical factors, and risk and uncertainty.

Shucksmith (1993) identified the farmer's disposition to act which helped explain the fundamental difference in behavior, values, and attitudes that are often not revealed in structural terms. The concept of disposition to act is based on Bourdieu's concept of "habitus." Habitus is the process of socialization where the thoughts and experiences of the individual are internalized through continuing experiences and social interactions. Using Bourdieu's definition, DiMaggio (1979) has said that habitus is a system of dispositions that functions as a matrix which integrates past experiences and is continually modified by the individual's encounter's with their surroundings. The farmer's habitus is constantly changing due to new thoughts and experiences, therefore the disposition to act may also change. Farmers have many options available to them, but they may deem them unthinkable due to their habitus. However by having new experiences and interactions with agroforestry, their habitus may change.

There were three types of farm households identified in Shucksmith's survey. They included accumulators, conservatives, and disengagers, but there was not a category for residual households that did not fit into one of those categories. Shucksmith (1993) suggested that the residual, those that do not regard themselves as farmers, be categorized as

hobby or lifestyle farmers. Accumulators are those farmers who are business minded and looking for a profit. They are willing to take risks and make changes to their farm to gain the greatest profit. Conservatives are those farmers who are most traditional in their farming practices. They may expand their farm, but only in conventional ways. They are not interested in diversification or alternative land uses. Disengagers are those farmers who are decreasing their commitment to farming. Lifestyle farmers are those who gain a substantial portion of their income from activities other than farming, but are often interested in land conservation or farming.

Bourdieu created another concept referred to as the "field" to explain actions of individuals in relation to their social relations (external) rather than their social structures. The field of farming would help explain how farmers act and react with different social relations. The field and habitus has been applied by Raedeke et al. (2003) to better understand Missouri farmers' knowledge and perceptions about new agricultural practices, particularly agroforestry. Raedeke et al. used Bourdieu's field and habitus to distinguish between the field and habitus of forestry and farming. They found that economic relations, family relations, and rental relations are fundamental elements in the field of farming (Raedeke et al., 2003). Economic relations are relationships with bankers and lenders, those actors involved in buying and selling the farmers' products. Family relations is the background that many individuals use to define a "good farmer" while rental relations pressure the farmer to conform to the views of the landowner to continue harmonious rental relations. When asked where they would prefer to seek advice from if they were to plant or manage trees, they found that farmers are more inclined to go to those they know and feel comfortable with, such as extension, rather than a district forester. Three major distinctions

were found between farming and forestry. Farming is characterized by working the land, while forestry is characterized by working with trees. Farming is perceived as active, while forestry and the management of trees is passive, and farming includes growing crops, and farmers do not think of trees as crops (Raedeke et al., 2003). Using Bourdieu's field and habitus, they suggest three possibilities for agroforestry to succeed, 1) incorporate agroforestry into the field and habitus of farming, 2) utilize agroforestry as a tool to transform agriculture and farming, and 3) develop agroforestry into a field of its own.

In a study of Missouri farm operators on interest in riparian buffers and forest farming, Flower (2004) found that those with the conservative attitude are more likely to be interested in riparian buffers, while those with the accumulator attitude are more likely to be interested in forest farming. Those with the lifestyle attitude were found to be more likely to be interested in both riparian buffers and forest farming. He also found that knowledge of the practice was a factor in indicating interest in both riparian buffers and forest farming. The physical variable needed for riparian buffers (soil erosion caused by rain or snow melt) was also a factor in predicting interest in riparian buffers.

While studying factors affecting farm operators' interest in riparian buffers and forest farming in Missouri, Valdivia and Poulos (2005) found that age, those who had the physical variable needed for the practice, had knowledge of the practice, were interested in the scenic beauty of planting trees, and those who believed that trees were important for future generations were more likely to be interested in agroforestry practices. Knowledge of the practice was found to be highly significant in both the Flower (2004) and Valdivia and Poulos' (2005) studies.

Knowledge is an important part of the literature and this research, but it must be noted that many researchers disagree on causality when discussing knowledge and interest. The innovation–decision process, designed by Rogers (2003) consists of dealing with the uncertainty associated with the newness of an innovation. Gaining knowledge is a process and the first stage of the innovation-decision process. Many argue that individuals will not expose themselves to new innovations (gaining knowledge) unless they first feel the need for that innovation; called selective perception. For example, if an individual does not seek information about an innovation, but has obtained information by accident, knowledge comes before interest. On the other hand, if a person has interest in a specific innovation, they are more prone to actively seek information about that innovation.

In summary, the current literature shows that attitudes and opinions as well as simple financial and demographic information play a large role in the interest and adoption of agroforestry. The returns must be greater than what the landowner is already doing and financial incentives are important for adoption. Level of education and knowledge of the new technological invention have been shown to be important in many studies. The higher the level of education and knowledge of the practice, the more likely they are to be interested in adopting new practices. The increased level of knowledge helps decrease some of the risk and uncertainty associated with agroforestry practices. The lack of demonstrations and lack of knowledge of natural resource professionals also play a large role in interest and adoption. Landowners feel more comfortable if they are certain they can get help from Extension or other natural resource professionals. This also helps decrease risk and uncertainty associated with agroforestry practices. Those who own their land for more non-traditional reasons, for example, recreation, are often more interested in agroforestry. Age has been shown to be

significant in previous studies. Age is thought to be detrimental to the adoption of agroforestry as the older people get, the less likely they are to be interested implementing new practices. Income has shown to be inconsistent in previous studies. Some studies show that income has a positive effect on interest while other studies show a negative effect on interest. The reasons listed above may not be enough to facilitate adoption, there must also be governmental policies implemented accompanied by institutional change to enhance the adoption of agroforestry as a way of providing safety nets for risk taking.

Expected Contribution

The results of this study will add to the existing literature on agroforestry adoption and technology transfer. This research hopes to help the University of Missouri Center for Agroforestry target landowners that are interested in adopting agroforestry practices. It could also help establish a position for the attitudinal variables in marketing agroforestry to specific categories of people.

Chapter III

Methods and Procedures

This chapter explains data collection and analysis methods and procedures. The data source, procedures for variable selection, formulation of the empirical model, and the analysis technique are presented.

Data Sources

The data analyzed in this research was collected using a farm operator and a non-operator landowner survey in the Fox Wyaconda Watershed (FWW) in Northeast Missouri (which consists of Lewis, Clark, and Scotland Counties) and Scott County in Southeast Missouri. These sites were selected due to their diverse landscapes and agricultural characteristics. The FWW is west of the Mississippi river and on the state line dividing Missouri and Illinois and Missouri and Iowa and includes 430,453 acres. Scott County is also west of the Mississippi river and covers 273,062 acres. Two different surveys instruments were used, although many of the questions were the same. The data sets were combined to study the differences between the farm operators and non-operators landowners with respect to interest in agroforestry. The farm operator survey was administered using face to face interviews, while the non-operator landowner survey was collected by a mail survey. There were 199 farm operators who responded to the survey in the FWW area while 165 responded in Scott County. The response rates were 61 percent and 53 percent respectively (Valdivia et al., 2002). One hundred and eleven (111) non-operator landowners

responded in the FWW area and 128 landowners responded in Scott County providing a response rate of 38 percent and 56 percent respectively (Valdivia et al., 2003). This study uses the data to investigate the economic and social characteristics of the two sites for interest in agroforestry in Missouri.

Conceptual Model: Interest in Adoption of Agroforestry Practices

The conceptual model proposes that interest in adopting an agroforestry practice, the dependent variable, is a function of different attitudinal, structural, and physical characteristics.

Interest in Adopting Agroforestry = f(Attitudinal Variables;

Structural Variable; Physical Variables)

This represents a qualitative choice from the landowner about the possibility of adopting one of the five agroforestry practices mentioned in this paper. The interest in adopting any of these practices depends on the attitudinal characteristics as well as the structural and physical variables associated with that particular practice.

Attitudes of non-operator landowners and farm operator landowners were measured by classifying the landowner into one of three categories: conservatives, accumulators, and lifestyle. The disengager category includes those who are currently farming but are decreasing their commitment to agriculture and have an increasingly residual role in agriculture (Shucksmith, 1993). Many households in the disengager category may be moving towards the lifestyle category, with a very small role in agriculture or conservation with their land, therefore the disengager was not utilized in this research.

The landowners identified in each category will have an independent effect on the adoption of the five agroforestry practices. Conservatives are landowners who are comfortable with the field of farming, but do not want to engage in any practices outside their field of farming. Accumulators are landowners who are interested in expansion in agriculture and also interested in profitable expansion in non-traditional ways. Lastly, lifestyle landowners are those who are interested in a farming lifestyle, but have a large portion of their income come from off-farm activities. The lifestyle category is more interested in land conservation and environmental issues.

Hypotheses

Attitudes of non-operators as well as operators are very important in understanding interest in agroforestry practices. There are many agroforestry practices, often pursuing various objectives. Therefore the factors affecting adoption of each will vary. The primary hypothesis of this research is that attitudinal and structural characteristics have an effect on interest in agroforestry, and depending on the practice these two groups – attitudinal and structural - will have different independent variables. In generic terms the relationships can be stated as follows:

a. Alley Cropping: Landowners interested in alley cropping will have the following characteristics: *accumulator* attitude, *lifestyle* attitude, and varying structural and physical characteristics.

b. Windbreaks: Landowners interested in windbreaks will have the following characteristics: *conservative* attitude, *accumulator* attitude, and varying structural and physical characteristics.

c. Riparian Buffers: Landowners interested in riparian buffers will have the following characteristics: *conservative* attitude, *accumulator* attitude, *lifestyle* attitude, and varying structural and physical characteristics.

d. Silvopasture: Landowners interested in silvopasture will have the following characteristics: *accumulator* attitude, *lifestyle* attitude, and varying structural and physical characteristics.

e. Forest Farming: Landowners interested in forest farming will have the following characteristics: *accumulator* attitude, *lifestyle* attitude, and varying structural and physical characteristics.

Logistic Regression

The estimation of the model uses Logistic regression. SPSS software version 13.0 was used to analyze the data. This regression was used due to the dichotomous nature of the independent variable. Logistic regression predicts the probability of a certain event occurring given known values of X. Although there are similarities between linear regression and logistic regression, the former assumes that the relationship between the variables is linear, but when the dependent variable is dichotomous, the assumption of linearity is violated (Field, 2005). With logistic regression, the form of the relationship can be linear while leaving the relationship itself non-linear which overcomes the violation of the assumption of linearity. Therefore logistic regression is the appropriate data analysis technique.

Below are the regression equations.

$$\text{P(event Y)} = \frac{1}{1 + e^{-(b_0 + b_1 X_1 + b_2 X_2 + \cdots + b_n X_n + \varepsilon_i)}}$$

Where P(event Y) = the probability of Y occurring

e = the base of natural logarithms
b_0 = the constant
$X_1 \ldots X_2$ = predictor variables
$b_1 \ldots b_n$ = coefficients attached to the predictor

The equation is expressed in terms of the probability of Y occurring. This is a probability value between 0 and 1. A value close to 0 means that it is very unlikely that Y has/will occur and a value close to 1 means that it is very likely that Y has/will occur. To interpret logistic regression, the value of the change in odds resulting from unit change in the predicator must be used. The odds of an event occurring is defined as the probability of an event occurring divided by the probability of that event not occurring (Field, 2005; Pindyck and Rubinfeld, 1981).

$$\text{odds} = \frac{P(\text{event})}{P(\text{no event})}$$

$$P(\text{event Y}) = \frac{1}{1 + e^{-(b_0 + b_1 X_1 + b_2 X_2 + \cdots + b_n X_n + \varepsilon_i)}}$$

$$P(\text{no event Y}) = 1 - P(\text{event Y})$$

Using the equations above, we can find the odds before and after a unit change in the predicator variable. To find the change in odds per change in unit of the predictor, we must divide the odds after a unit change in the predictor by the odds before the change.

$$\Delta\text{odds} = \frac{\text{odds after a unit change in the predictor}}{\text{original odds}}$$

If the value of the change in odds is greater than one, it indicates that as the predictor increases by one unit, the odds of the outcome occurring increase by the change in odds. If the change in odds is less than one, as the predictor increases by one unit, the odds of the outcome occurring decrease by one minus the change in odds.

Understanding the Variables

The dependent variables chosen to represent interest in agroforestry were how interested the landowners were in implementing the agroforestry practices on their land. The respondents answered the question of interest based on a likert scale of four categories with a one representing uninterested to a four representing very interested. The variables were recoded to allow those who were slightly interested (2) to very interested (4) to be shown as having interest in agroforestry depicted by a one. Those who showed no interest in agroforestry were recoded as a zero.

Independent variables were selected by grouping variables that were thought to depict the conservatives, accumulators, and lifestyle categories. A correlation matrix was constructed for each category. Structural and physical variables were also selected from the survey to represent other variables that affect interest in agroforestry.

Attitudinal Variables

In the survey, questions were asked that would help identify the attitudes of each respondent. The questions used in the analysis can be found in Appendix A. The frequencies of the responses to these questions were evaluated to identify differences in opinions and attitudes and the respondents were placed into the conservative, accumulator,

and lifestyle groups based on their opinions and preferences. A correlation matrix was constructed to find a suitable variable to identify the appropriate group.

Ideally, there would have been a quantitative and a qualitative variable for each attitudinal category, but the data set did not provide this luxury due to the combining of the farm operator data base and the non-operator data base. Many of the questions in the instruments were not the same, reducing the choices available to construct the variables for the model. An appropriate variable, whether quantitative or qualitative, was chosen for each attitudinal category.

Conservative

The conservative category includes those landowners that are interested in expansion, but only in traditional ways. They are often very comfortable with the field of farming, but are uncomfortable with anything outside of that field. They are less willing to take risks and invest in a practice outside of traditional agriculture.

There were five variables considered for the conservative category. The first variable was the percent of total value of assets in farm assets. A high percentage of farm assets represents someone who has a lot invested in the field of farming and has less diversification of their income. They are often not willing to take the risks to invest in practices outside the field of farming.

The second variable identified was the loss of trees not being a problem on their farm. This shows that they do not see the benefits of planting trees, but see the trees as a hindrance to their traditional farming practices (Raedeke et al., 2003).

The third variable identified was how much other farmers affect their decision making. If they are in traditional agriculture they are often leery of going outside of their

comfort zone to try something new. The opinions of other farmers matter to them and they often do not want to be seen as someone who is outside the box.

The fourth variable identified was if they had harvested trees from their land. This variable was found to be slightly ambiguous as it could be looked at as they have harvested the trees to clear the land for more traditional farming practices or that they were interested and knowledgeable about forestry as an economic alternative to farming, therefore this variable was not a good indicator of the conservative category.

The fifth variable identified was if they had received advice from another farmer they invited onto their land. If the landowner speaks with other farmers about farming practices, they are more likely to care about what the other farmer thinks, therefore may be less willing to try alternative practices.

A correlation matrix was constructed with the five variables listed above (Appendix B). Percent of total value of assets in farm-assets was correlated with all the variables except how much the opinions of other farmers influence your decision making. Loss of trees on your farm was also correlated with received advice from another farmer you invited onto your land. If they had received advice from another farmer was significantly correlated with total value of non-farm assets and significantly correlated with loss of trees as a problem on your farm. The variable of how much the opinion's of other farmers influences your decision making is not correlated with any variable mentioned. The continuous variable of percent of total value of assets in farm-assets was chosen to represent the conservative category. This variable value could be from 0 percent to 100 percent. The higher the value in farm assets, the more the farmer is vested in traditional agriculture, therefore the least interested in new ventures outside the traditional field of farming.

Accumulator

The accumulator category includes those landowners that are expansionist and profit oriented within the field of agriculture, but also interested in new technologies. Six variables were explored for the accumulator category. The first variable identified was leased land to hunters in the last five years. If a landowner had leased out his land for hunting, he may see this as an increased economic opportunity outside the field of farming.

The second, third and fourth variable are related in content. If they have harvested trees for sale, are aware of timber markets in your area, and/or have a high confidence level of getting a fair price for wood, this reflects the respondents and comfort with activities outside the field of farming and interest in new profit oriented technologies.

The fifth variable is if they have attended field days or demonstrations or received advice from a professional they invited onto their land. If they answered yes to this question, they are taking steps to educate themselves on new ideas which may be outside the field of farming.

The sixth variable considered is how much influence other farmers have on their decision making. This last variable is also used in the conservative category, but because the accumulators are interested in opportunities outside their normal field of agriculture and more willing to take risks, the opinions of other farmers will not affect their decision making as much as a conservative farmer who is only interested in the field of agriculture.

A correlation matrix was constructed for the accumulator category (Appendix B). How much the opinions of other farmers influence decision making is not significantly correlated with any other possible variable for accumulators. Leased land to hunters is significantly correlated with confidence of getting a fair price for wood products. Harvested

trees for sale is not significantly correlated with any of the other variables. Being aware of timber markets in your area is significantly correlated with confidence level of getting a fair price for wood products. If they are aware of timber markets in their area, they are very confident that they can get a fair price for wood products. How many times in the last two years have they attended field days or demonstrations is significantly correlated with the confidence level of getting a fair price for wood products. If they have attended a high number of field days or demonstrations, then they are more confident they would get a fair price for wood products. How many times in the last two years have they received advice from a professional they invited onto their land is significantly correlated with confidence level of getting a fair price for wood products. If they had a high number of visits with professionals, they are more confident in their ability to receive a fair price for wood products. The variable aware of timber markets was chosen to depict the attitudes of accumulators; this was a yes = 1, no = 0 variable. If the respondent answered yes to awareness of timber markets in their area, this demonstrates a comfort level with the field of forestry outside the traditional field of agriculture.

Lifestyle

Lifestyle farmers are defined as residential farmers by the USDA Economic Research Service. This includes those farmers that have a main occupation other than farming. Some of these farmers see farming as a hobby that provides a farm lifestyle while others may hope to eventually farm full-time (Economic Research Service, 2002). Shucksmith (1993) defines lifestyle farmers as those who have a part time involvement with agriculture and are often more interested in conservation and environmental issues.

There were three variables identified for this category. The first variable identified was the percent of the total value of assets in non-farm assets. As stated above, the lifestyle farmer obtains the majority of his income from off-farm income.

The second and third variables identified were seeing the loss of wildlife habitat on your farm as a problem and seeing loss of trees on your farm as a problem. Lifestyle farmers are more concerned with conservation and environmental issues therefore losing wildlife or trees on their land would be more of a problem.

A correlation matrix was constructed with these variables (Appendix B) and it was found that all three variables were correlated with each other. Loss of trees as a problem was identified as the variable that represented lifestyle farmers in this research as based on the notion of field and habitus by Bourdieu. The respondents based their answers on a Likert scale from 1 to 4, with one being not a problem and 4 being a very serious problem. This notion leans toward the idea that lifestyle farmers will be more interested in conservation and environmental issues.

Structural Variables

In the survey, several questions were asked that address internal and external structural variables of the farmers and a physical variable of their land. The variables were placed in a correlation matrix to analyze their correlation with other variables, including the attitudinal variables selected to avoid problems with multicollinearity in the model.

Structural variables for all of the agroforestry practices included location of respondent, type of respondent, age, education, know anyone using the agroforestry practice, own knowledge of the practice, how much the requirements of banking or lending institution

affect decision making, percent of total assets owned debt free, and how much the opinions of other farmers influence your decision making.

After the correlation matrix was assembled, percent of total assets owned debt free was eliminated due to correlation with type of respondent, age, as well as the conservative variable of percent in farm assets. Know anybody using the agroforestry practice was eliminated due to its high correlation with own knowledge of the practice. Opinions of other farmers was eliminated due to lack of explanatory power in the model.

It is important that the reader understand the responses available for each variable. The location of respondent could be answered as Fox Wyaconda Watershed = 0, or Scott County = 1. Age was a continuous variable starting at 18. Own knowledge of the agroforestry practice was used as a proxy for education or awareness about the practices and was based on a Likert scale from one to five, with one being very low and five being very high.

Regressions for each model were run including type of respondent. This changed the sign of the coefficient and significance of variables in each model. For alley cropping, the sign of the coefficient of the dummy variable for forestry professionals was changed and the significance of the conservative category was eliminated. For windbreaks, the sign of the coefficient for the conservative attitude and location were changed and location was no longer significant in the model. For riparian buffers, the sign of the coefficient and the significance for the conservative attitude was changed, and the significance of the accumulator attitude, age, and soil erosion caused by rain as a problem was also changed. For silvopasture, the coefficient and the significance of the conservative attitude was changed. The significance of age and acres in unmanaged timber were also changed. For

forest farming, the sign of the conservative attitude was not affected, but the significance of the conservative attitude was affected. These results can be seen in Appendix C. Due to the effects of type of respondent in the model, it was eliminated due to significant correlation with age of respondent. Age is used to represent two topics in this research. As stated in previous research, the older people get, the less likely they are to adopt new technological innovations or new farming practices, and also used as a proxy for type of respondent as the mean age of the non-operators was 61, almost ten years higher than the operators mean age at 52.5.

Physical Variables

A correlation matrix was then done for each agroforestry practice including a physical condition variable. The physical condition variable varies for each practice. The variables are discussed below.

a. Alley Cropping: Acres in cropland and acres in hay/pasture land nonwooded were identified as the physical variables for alley cropping. This is a continuous variable based on the amount of acres listed by the respondent. The practice of alley cropping involves rows of crops intermingled with rows of trees. If the landowner has cropland or hayland, they have the physical variable conducive to alley cropping. The physical variables were not significantly correlated with any of the other variables.

b. Windbreaks: The perception of soil erosion caused by wind was used as the physical variable for windbreaks. This is a categorical variable based on a Likert scale from 1 to 4, with one being not a problem to four being a very serious problem. If the landowner has soil erosion caused by wind on their land, they have a physical variable that would favor utilizing windbreaks. This variable was not correlated with any of the other variables.

c. Riparian Buffers: Several physical variables were considered for riparian buffers. The perception of soil erosion caused by rain or snow melt, stream bank erosion, or surface water quality problems on their farm were considered. These variables are based on a Likert scale from 1 to 4, with one being not a problem to four being a very serious problem. All of the problems mentioned above related to erosion were significantly correlated with the attitudinal variable for lifestyle farmers. Soil erosion caused by rain or snow melt was chosen as it was the least correlated variable. If the landowner has soil erosion caused by rain or snow melt, they have a physical variable that riparian buffers could help mitigate.

d. Silvopasture: Acres in unmanaged timber stands was chosen for the physical variable. This is a continuous variable based on the number of acres the respondent had in unmanaged timber. If the landowner has unmanaged timber on his land, he has a physical variable conducive to silvopasture. The landowner could choose to manage the forest for silvopasture. It was not highly correlated with any of the other variables.

e. Forest Farming: Acres in managed timber stands was used for forest farming. This is a continuous variable based on the number of acres the respondent had in managed timber. If the landowner is already in the practice of managing their timber, they would have the physical variable that is needed for forest farming. It was not highly correlated with any of the other variables.

Empirical Models

The dependent variable is the interest in adoption of agroforestry practices. It will be measured by using variables that represent interest in agroforestry. According to the current literature on the adoption of agroforestry practices, interest in adoption may be influenced by

several factors. The independent variables encompass attitudinal, structural, and physical characteristics.

Alley Cropping

Interest in Alley Cropping = $f\{a_1\, a_2\, a_3\, s_1\, s_2\, s_3\, s_4\, p_1\, p_2\, d_1\, d_2\, d_3\}$

It is hypothesized that the interest in alley cropping is a function of the conservative attitude, accumulator attitude, lifestyle attitude, four structural variables, two physical variables and three dummy variables.

$$\log (IAC/(1\text{-}IAC)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age + \beta_7 edu + \beta_8 crop + \beta_9 hay + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

Where:

IAC	=interest in alley cropping
cons	=conservative attitude (% in farm assets)
accum	=accumulator attitude (aware of timber markets)
life	=lifestyle attitude (loss of trees as a problem)
loc	=location
ownknow	=own knowledge of alley cropping
age	=age of respondent
edu	=education of respondent
crop	=acres of cropland
hay	=acres of hayland/nonwooded
farm	=would prefer to seek advice from landowner/farmers who are knowledgeable about planting and managing trees on planting and managing trees
nrcs	=would prefer to seek advice from NRCS or SWCD on planting or managing trees
frstry	=would prefer to seek advice from a forestry related group on planting and managing trees

The dummy variables are compared to a base category of would prefer to seek advice from University Extension.

The hypothesis for the IAC logit model is the following:

H_o: The attitudinal, structural, and physical variables will have no effect on the probability that non-operators or operators will be interested in alley cropping.

H_a: The attitudinal, structural, and physical variables will increase or decrease the probability that non-operators or operators will be interested in alley cropping.

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	crop	hay	farm	nrcs	frstry
-	+	+	+	+	-	+	+	+	+	+	+

The accumulator and lifestyle attitudes are expected have a positive relationship with interest in alley cropping. Accumulators are interested in new enterprises that are profitable and are willing to take risks outside the field of farming. Lifestyle farmers are more interested in having trees on their land due to conservation purposes.

Knowledge of alley cropping, amount of education, amount of cropland, and amount of hayland is expected to have a positive relationship with interest in alley cropping. Age is expected to have a negative relationship with interest.

It is expected that those respondents that were interested in seeking advice from farmers/landowners, natural resource professions, as well as forestry professionals who are knowledgeable about planting and managing trees would have more interest in alley cropping than those who would seek advice from University Extension.

Windbreaks

Interest in Windbreaks = $f\{a_1\, a_2\, a_3\, s_1\, s_2\, s_3\, s_4\, p_1\, d_1\, d_2\, d_3\}$

It is hypothesized that the interest in windbreaks is a function of the conservative attitude, accumulator attitude, lifestyle attitude, four structural variables, one physical variable, and three dummy variables.

$$\log (IWB/(1\text{-}IWB)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age + \beta_7 edu + \beta_8 winderosion + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

Where:

IWB	=interest in windbreaks
cons	=conservative attitude (% in farm assets)
accum	=accumulator attitude (aware of timber markets)
life	=lifestyle attitude (loss of trees as a problem)
loc	=location
ownknow	=own knowledge of windbreaks
age	=age of respondent
edu	=education of respondent
winderosion	=erosion by wind a problem
farm	=would prefer to seek advice from landowner/farmers who are knowledgeable about planting and managing trees on planting and managing trees
nrcs	=would prefer to seek advice from NRCS or SWCD on planting or managing trees
frstry	=would prefer to seek advice from a forestry related group on planting and managing trees

The dummy variables are compared to a base category of would prefer to seek advice from University Extension.

The hypothesis for the IWB logit model is the following:

H_o: The attitudinal, structural, and physical variables will have no effect on the probability that non-operators or operators will be interested in windbreaks.

H_a: The attitudinal, structural, and physical variables will increase or decrease the probability that non-operators or operators will be interested in windbreaks.

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	winderosion	farm	nrcs	frstry
+	+	-	+	+	-	+	+	+	+	+

The conservative and accumulator attitudes are expected have a positive relationship with interest in windbreaks. Conservatives and accumulators are interested in more traditional ways to increase the efficiency of their farm. Lifestyle farmers will not be interested in windbreaks because they are often combined with more traditional farming practices.

Knowledge of windbreaks, amount of education, and erosion by wind as a problem is expected have a positive relationship with interest in windbreaks. Age is expected have a negative relationship with interest.

It is expected that those respondents that were interested in seeking advice from landowners, natural resource professionals, and forestry professionals who are knowledgeable about planting and managing trees would have more interest in windbreaks than those who would seek advice from University Extension.

Riparian Buffers

Interest in Riparian Buffers = $f\{a_1\, a_2\, a_3\, s_1\, s_2\, s_3\, s_4\, p_1\, d_1\, d_2\, d_3\}$

It is hypothesized that the interest in riparian buffers is a function of the conservative attitude, accumulator attitude, and lifestyle attitude, four structural variables, one physical variable, and three dummy variables.

$$\log (IRB/(1\text{-}IRB)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age + \beta_7 edu + \beta_8 rainerosion + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

Where:

IRB	=interest in riparian buffers
cons	=conservative attitude (% in farm assets)
accum	=accumulator attitude (aware of timber markets)
life	=lifestyle attitude (loss of trees as a problem)
loc	=location
ownknow	=own knowledge of riparian buffers
age	=age of respondent
edu	=education of respondent
rainerosion	=erosion by rain or snowmelt a problem
farm	=would prefer to seek advice from landowner/farmers who are knowledgeable about planting and managing trees on planting and managing trees
nrcs	=would prefer to seek advice from NRCS or SWCD on planting or managing trees
frstry	=would prefer to seek advice from a forestry related group on planting and managing trees

The hypothesis for the IRB logit model is the following:

H_o: The attitudinal, structural, and physical variables will have no effect on the probability that non-operators or operators will be interested in riparian buffers.

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

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	rainerosion	farm	nrcs	frstry
+	+	+	+	+	-	+	+	+	+	+

The conservative, accumulator, and lifestyle attitudes are expected have a positive relationship with interest in riparian buffers. Conservatives and accumulators are interested in more traditional ways to increase the efficiency of their farm. The lifestyle farmers are concerned with environmental and conservation issues due to lack of riparian buffers.

Knowledge of riparian buffers, amount of education, and erosion by rain or snow melt as a problem is expected have a positive relationship with interest in riparian buffers. Age is expected have a negative relationship with interest.

It is expected that those respondents that were interested in seeking advice from landowners, natural resource professionals, and forestry professionals who are knowledgeable about planting and managing trees would have more interest in riparian buffers than those who would seek advice from University Extension.

Silvopasture

Interest in Silvopasture = $f\{a_1\, a_2\, a_3\, s_1\, s_2\, s_3\, s_4\, p_1\, d_1\, d_2\, d_3\}$

It is hypothesized that the interest in silvopasture is a function of the conservative attitude, accumulator attitude, and lifestyle attitude, four structural variables, one physical variable, and three dummy variables.

$$\log (ISP/(1\text{-}ISP)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age +$$

$$\beta_7 edu + \beta_8 unmgdtbr + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

Where:

ISP	=interest in silvopasture
cons	=conservative attitude (% in farm assets)
accum	=accumulator attitude (aware of timber markets)
life	=lifestyle attitude (loss of trees as a problem)
loc	=location
ownknow	=own knowledge of silvopasture
age	=age of respondent
edu	=education of respondent
unmgdtbr	=acres in unmanaged timber
farm	=would prefer to seek advice from landowner/farmers who are knowledgeable about planting and managing trees on planting and managing trees
nrcs	=would prefer to seek advice from NRCS or SWCD on planting or managing trees
frstry	=would prefer to seek advice from a forestry related group on planting and managing trees

The hypothesis for the ISP logit model is the following:

H_o: The attitudinal, structural, and physical variables will have no effect on the probability that non-operators or operators will be interested in silvopasture.

H_a: The attitudinal, structural, and physical variables will increase or decrease the probability that non-operators or operators will be interested in silvopasture.

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	unmgdtbr	farm	nrcs	frstry
-	+	+	+	+	-	+	+	+	+	+

The accumulator and lifestyle attitudes are expected have a positive relationship with interest in silvopasture. Accumulators and lifestyle farmers are interested in practices outside the traditional field of farming.

Knowledge of silvopasture, amount of education, and acres in managed timber is expected have a positive relationship with interest in silvopasture. Age is expected have a negative relationship with interest.

It is expected that those respondents that were interested in seeking advice from landowners, natural resource professionals, and forestry professionals who are knowledgeable about planting and managing trees would have more interest in silvopasture than those who would seek advice from University Extension.

Forest Farming

Interest in Forest Farming = $f\{a_1\, a_2\, a_3\, s_1\, s_2\, s_3\, s_4\, p_1\, d_1\, d_2\, d_3\}$

It is hypothesized that the interest in forest farming is a function of the conservative attitude, accumulator attitude, and lifestyle attitude, four structural variables, one physical variable, and three dummy variables.

$$\log (IFF/(1\text{-}IFF)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age + \beta_7 edu + \beta_8 mgdtbr + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

Where:

IFF	=interest in forest farming
cons	=conservative attitude (% in farm assets)
accum	=accumulator attitude (aware of timber markets)
life	=lifestyle attitude (loss of trees as a problem)
loc	=location
ownknow	=own knowledge of forest farming
age	=age of respondent
edu	=education of respondent
mgdtbr	=acres in managed timber
farm	=would prefer to seek advice from landowner/farmers who are knowledgeable about planting and managing trees on planting and managing trees
nrcs	=would prefer to seek advice from NRCS or SWCD on planting or managing trees
frstry	=would prefer to seek advice from a forestry related group on planting and managing trees

The hypothesis for the IFF logit model is the following:

H_o: The attitudinal, structural, and physical variables will have no effect on the probability that non-operators or operators will be interested in silvopasture.

H_a: The attitudinal, structural, and physical variables will increase or decrease the probability that non-operators or operators will be interested in silvopasture.

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	mgdtbr	farm	nrcs	frstry
-	+	+	+	+	-	+	+	+	+	+

The accumulator and lifestyle attitudes are expected have a positive relationship with interest in forest farming. Accumulators are willing to look outside the field of farming for financial opportunities while lifestyle farmers are interested and can often afford to undertake a new enterprise.

Knowledge of forest farming, amount of education, and acres in managed timber is expected have a positive relationship with interest in silvopasture. Age is expected have a negative relationship with interest.

It is expected that those respondents that were interested in seeking advice from landowners, natural resource professionals, and forestry professionals who are knowledgeable about planting and managing trees would have more interest in forest farming than those who would seek advice from University Extension.

Chapter IV

Profile of Landowners in Missouri

This chapter presents a basic profile of the non-operator landowners and farm operators in the data set collected from a survey in 1999. The survey included face to face interviews for the farm operators and mail-in surveys for the non-operators. Social, economic, production, and demographic information was collected.

Non-Operator Landowners

Demographic Characteristics

(Table 4.1) The largest group of non-operator landowners falls in the age group between 46 and 65 with a mean of approximately 61 years of age. The majority of the non-operator landowners surveyed were male at 67.8 percent. Most (94.4 percent) of the non-operator landowners have completed at least 12 years of education and 39.3 percent are college graduates. Almost 73 percent (72.9) of the respondents have someone in the family presently farming the land while 27.1 percent do not have someone in the family farming the land.

Table 4.1. Household Characteristics of Non-Operator Landowners in Missouri, 1998-1999.

Category	# of Respondents	% of Respondents	Mean (Standard Deviation)
Age (years)			**61.03(13.6)**
20-45	**28**	**12.1**	
46-65	**112**	**48.5**	
>65	**91**	**39.4**	
Gender			
Male	**162**	**67.8**	
Female	**77**	**32.2**	
Education Completed (years)			**12.96(3.48)**
Less than 12	**13**	**5.6**	
High school graduate	**129**	**55.1**	
College graduate	**92**	**39.3**	
Someone in family presently farming land			
No	**172**	**72.9**	
Yes	**64**	**27.1**	

Source: Landowner Survey, 1999

Land Tenure and Rental Characteristics

(Table 4.2) Almost three quarters (73.6 percent) of the non-operator landowners have had family ownership of their land for at least 31 years with just over one quarter (29.8 percent) having ownership for over 61 years. The respondents owned an average of 391 acres, but there is a wide dispersion in groups of ownership. Twelve point six percent owned 49 acres or less, while 35.4 percent owned 50-179 acres, 31.6 percent owned 180-499 acres, and 20.3 percent owned more than 500 acres. One hundred forty-four (60.3 percent) of the non-operator landowners are renting out their land with 19 and 39 percent using cash and share leases respectively. Although the non-operator landowners do not generate a huge income from renting their land, almost half of them receive 1-25 percent of their annual income from renting out their land.

Table 4.2 Land Tenure and Rental Characteristics of Non-Operator Landowners in Missouri, 1998-1999.

Category	# of Respondents	% of Respondents	Mean (Standard Deviation)
Years the oldest portion of land has been in the family			58(37)
0-9	21	9.2	
10-30	39	17.1	
31-60	81	35.5	
61-100	68	29.8	
>100	19	8.3	
Acres of land owned (1999)			391(528)
0	1	.4	
1-49	29	12.2	
50-179	84	35.4	
180-499	75	31.6	
500-999	27	11.4	
>1000	21	8.9	
Landowners renting out their land	144	60.3	
Rented out in 1998			273(368)
0	1	.6	
1-49	23	14.9	
50-179	64	41.6	
180-499	42	27.3	
500-999	15	9.7	
>1000	9	5.8	
Type of lease			
Cash	45	18.8	
Share	88	36.8	
Percent of annual income from rented land			16.6(26)
0	57	32.6	
1-25	85	48.6	
26-50	16	9.1	
51-75	7	4.0	
76-100	10	5.7	

Source: Landowner Survey, 1999

Debt Levels and Assets

(Table 4.3) The majority of the non-operator landowners own a large portion of their assets debt free as the average respondent owns 78.1 percent of total assets debt free. Almost twenty-eight (27.9) percent of the respondents have more than $1,000,000 in market value of their farm, home, business, and other investments. While this is the highest percentage, almost 39 percent have a market value of $300,000 and below. Most of the non-operator landowners own very little farm machinery with 57.3 percent owning zero and 26.8 percent having 1-5 percent of their total value of assets in farm machinery. The mean percent of total in farm land is 50.5 percent. Eight point eight percent (8.8) have zero percent of their total assets in farm land while 12.9 percent have 76-100 percent of their total assets in farm land. While the numbers of percent of total assets in non-farm assets are relatively the same for 0-75 percent (13-19 percent), 34.1 percent of the non-operator landowners have 76-100 percent of their assets in and from non-farm assets.

Table 4.3 Debt Levels and Assets of Non-Operator Landowners in Missouri, 1998-1999.

Category	# of Respondents	% of Respondents	Mean (Standard Deviation)
Percent of total assets owned debt free			**78.1%(20.0%)**
Less than 20%	**8**	**3.7**	
20-30%	**4**	**1.8**	
31 - 40%	**1**	**.5**	
41 - 50%	**4**	**1.8**	
51 - 60%	**7**	**3.2**	
61 - 70%	**14**	**6.4**	
71 - 80%	**23**	**10.6**	
81 - 90%	**25**	**11.5**	
91 - 100%	**132**	**60.6**	

Table 4.3 Continued. Debt Levels and Assets of Non-Operator Landowners in Missouri, 1998-1999.

Market value of farm, home, business, and other investments			**$515,000($389,000)**
Under $100,000	**24**	**12.6**	
$100,001 - $200,000	**26**	**13.7**	
$200,001 - $300,000	**20**	**10.5**	
$300,001 - $400,000	**14**	**7.4**	
$400,001 - $500,000	**13**	**6.8**	
$500,001 - $600,000	**6**	**3.2**	
$600,001 - $700,000	**10**	**5.3**	
$700,001 - $800,000	**5**	**2.6**	
$800,001 - $900,000	**8**	**4.2**	
$900,001 - $1,000,000	**11**	**5.8**	
More than $1,000,000	**53**	**27.9**	
Percent of total assets in farm machinery			**13.6(98)**
0	**106**	**57.3**	
1-5	**50**	**26.8**	
6-10	**12**	**6.5**	
11-20	**5**	**2.7**	
21-30	**9**	**4.8**	
>30	**1**	**.5**	
Percent of total assets in farm land			**50.5(118)**
0	**16**	**8.8**	
1-10	**34**	**19**	
11-25	**42**	**23.3**	
26-50	**44**	**24.5**	
51-75	**19**	**10.5**	
76-100	**23**	**12.9**	
Percent of total assets in non-farm assets			**64(102)**
0	**23**	**13.5**	
1-25	**27**	**15.9**	
26-50	**28**	**16.3**	
51-75	**33**	**19.5**	
76-100	**58**	**34.1**	

Source: Landowner Survey, 1999

Land Characteristics and Use

(Table 4.4) About 37 percent of the respondents viewed their land as river bottom or flood plain areas, while 34.5 percent thought they have sandy soils on their land. Just under two thirds of the respondents (62%) had hills on their land. A little under half (40.4%) had

land that was used for hayland or pasture, while 86.6 percent of the respondents had land that was used as cropland. Although very few respondents managed their timber stands, over half of the respondents had land in unmanaged timber and one quarter (25%) had harvested trees for sale. There were very few respondents who said they have implemented an agroforestry practice on their land. The more traditional agroforestry practices like windbreaks and riparian buffers had 18 and 12.4 percent implementation respectively.

Table 4.4. Land Characteristics and Use for Non-Operator Landowners in Missouri, 1998-1999.

Category	# of Respondents	% of Respondents	Mean (Standard Deviation)
% Land in following categories			
River Bottom or Flood Plain	82	37.4	
Sandy Soils	77	34.5	
Hills	135	62	
Land in following categories (acres)			
Hayland and pasture (non-wooded)			30.6(69)
0	131	58.7	
1-49	51	22.9	
50-179	28	12.6	
180-499	11	4.9	
Cropland			212(335)
0	31	13.4	
1-49	46	19.9	
50-179	77	33.3	
180-499	49	21.2	
500-999	17	7.4	
>1000	10	4.3	
Managed Timber Stands			18.2(88)
0	196	87.1	
1-49	12	5.3	
50-179	10	4.4	
180-499	4	1.8	
500-999	2	.9	

Table 4.4 Continued. Land Characteristics and Use for Non-Operator Landowners in Missouri, 1998-1999.

Unmanaged Timber Stands			**33.3(70.7)**
0	**110**	**48.9**	
1-49	**68**	**30.2**	
50-179	**34**	**15.1**	
180-499	**11**	**4.9**	
500-999	**1**	**.4**	
Harvested Trees for Sale			
Yes	**61**	**25.8**	
Implemented Practice on Farm			
Alley cropping	**6**	**2.6**	
Windbreaks	**42**	**18**	
Riparian Buffers	**29**	**12.4**	
Silvopasture	**14**	**6.0**	
Forest Farming	**5**	**2.1**	

Source: Landowner Survey, 1999

Farm Operator Landowners

Demographic Characteristics

(Table 4.5) The largest group of farm operators falls in the group between 46 and 65 years of age. The mean age of the farm operators is 52.5, almost 10 years younger than the non-operator landowners (61). A large portion (93.3%) of the farm operators were male, and 86.5 percent of them were married. Almost half reported having children still living in the home. Over half (55.8%) of the farm operators had at least a high school education while 34.3 reported having graduated from college. The majority (69.6%) of the farm operators have been farming for at least 21 years since their eighteenth birthday.

Table 4.5. Household Characteristics of Farm Operator Landowners in Missouri, 1998-1999.

Category	# of Respondents	% of Respondents	Mean (Standard Deviation)
Age (years)			**52.5(13)**
20-45	**121**	**33.2**	
46-65	**181**	**49.7**	
>65	**62**	**17**	
Gender			
Male	**335**	**93.3**	
Female	**24**	**6.7**	
Marital Status			
Married	**315**	**86.5**	
Never Married	**17**	**4.7**	
Divorced or Separated	**16**	**4.4**	
Widow/Widower	**16**	**4.4**	
Children			
No Children in home	**193**	**53**	
Children in home	**171**	**47**	
Education Completed (years)			**12.7(2.3)**
Less than 12	**36**	**9.9**	
High school graduate	**203**	**55.8**	
College graduate	**125**	**34.3**	
Years Farming Since 18th Birthday			**29.3(14.2)**
0-10	**40**	**11.4**	
11-20	**67**	**19**	
21 and more	**245**	**69.6**	

Source: Farm Operator Survey, 1999

Land Tenure and Rental Characteristics

(Table 4.6) Over half (61.5%) of the farm operators have owned the oldest portion of their land for at least 31 years. Most of the farm operators did have land ownership with 335 average acres. About sixteen (16.1) percent owned 49 acres or less, 30.6% owned 50-179 acres and 27.2 percent owned 180-499 acres and 19.7% owned more than 500 acres. Over half (51.2 %) of the farm operators rent land to farm. Twenty-eight point eight percent (28.8

%) use a cash lease and 39.3 percent use a share lease agreement with their landlord. Just under half (43.9%) of the farm operators have an off-farm job, while almost two thirds (63%) of their spouses have an off-farm job.

Table 4.6 Land Tenure and Rental Characteristics of Farm Operator Landowners in Missouri, 1998-1999.

Category	# of Respondents	% of Respondents	Mean (Standard Deviation)
Years the oldest portion of land has been in the family			47.5(36)
0-9	33	9.4	
10-30	102	29.1	
31-60	132	37.6	
61-100	84	23.9	
Acres of land owned (1999)			335(501)
0	23	6.4	
1-49	58	16.1	
50-179	110	30.6	
180-499	98	27.2	
500-999	43	11.9	
>1000	28	7.8	
Farm Operators renting land	185	51.2	
Rented in 1998 (acres)			405(775)
1-49	15	8.1	
50-179	33	17.8	
180-499	45	24.3	
500-999	38	20.5	
>1000	54	29.2	
Type of Lease			
Cash	105	28.8	
Share	143	39.3	
Off Farm Employment			Hours/week Mean(SD)
Farm Operator	159	43.9	43.3(15.3)
Spouse	199	63	24.1(21.2)

Source: Farm Operator Survey, 1999

Involvement in Agriculture, Debt Levels and Assets

(Table 4.7) Of the respondents to the farm operator survey, half of them described themselves as part time farmers, and half of them described themselves as full time farmers. Over half (50.8%) estimated working on the farm over 30 hours per week. Twenty one point seven percent (21.7%) receive from $10,001 to $100,000 gross income from farming. One quarter (25%) receive over $100,000 gross income from farming. In general farm operators own less debt free than non-operator landowners. Only 26.9 farm operators own at least 91% of their total assets debt free compared to 60.6 percent of the non-operator landowners. Farm operators have approximately the same percentage of market value of farm, home, business, and other investments at $300,000 or less as the non-operators landowners with 37.5 percent. Almost twenty-seven (26.9) percent of the farm operators have a market value of $1,000,000 compared to 27.9 percent for the non-operator landowners. Almost forty percent (39.6%) of the farm operators have 1-25 percent in machinery for crops and 32.1 percent have 1-25 percent of total assets in machinery for livestock. Almost half (46.4%) of the farm operators do not have any livestock. The farm operator group had the largest percentage assets in farm land in the 51-75 percent category. While 25 percent had zero percent of their assets in non-farm assets, the remainder had at least some of their assets in non-farm assets.

Table 4.7 Involvement in Agriculture, Debt Levels, and Assets of Farm Operator Landowners in Missouri, 1998-1999.

Category	# of Respondents	% of Respondents	Mean (Standard Deviation)
Involvement in Agriculture			
Part Time Farmer	183	50.3	
Full Time Farmer	181	49.7	
Time worked on farm (hours per week)			
0-10	77	21.8	
11-30	97	27.4	
>30	180	50.8	
Gross income from farming			
0	30	8.2	
1-10,000	61	16.8	
10,001-100,000	79	21.7	
100,001-250,000	40	12.6	
>250,000	45	12.4	
Percent of total assets owned debt free			
Less than 20%	22	6.0	
20-30%	13	3.6	
31 - 40%	19	5.2	
41 - 50%	26	7.1	
51 - 60%	33	9.1	
61 - 70%	33	9.1	
71 - 80%	36	9.9	
81 - 90%	39	10.7	
91 - 100%	98	26.9	
Market value of farm, home, business, and other investments			450,000(346,000)
Under $100,000	31	10.0	
$100,001 - $200,000	51	16.5	
$200,001 - $300,000	34	11.0	
$300,001 - $400,000	35	11.3	
$400,001 - $500,000	23	7.4	
$500,001 - $600,000	25	8.1	
$600,001 - $700,000	17	5.5	
$700,001 - $800,000	19	6.1	
$800,001 - $900,000	8	2.6	
$900,001 - $1,000,000	10	3.2	
More than $1,000,000	56	18.1	

Table 4.7 Continued. Involvement in Agriculture, Debt Levels, and Assets of Farm Operator Landowners in Missouri, 1998-1999.

Percent of total assets in farm machinery for crops			
0	97	26.6	
1-25	144	39.6	
26-50	48	13.2	
51-75	9	2.5	
76-100	8	2.2	
Percent of total assets in farm machinery for livestock			
0	188	51.6	
1-25	117	32.1	
26-50	3	.8	
51-75	0	0	
76-100	0	0	
Percent of total assets in livestock			
0	169	46.4	
0-25	125	34.3	
26-50	10	2.7	
51-75	2	0.5	
76-100	1	0.3	
Percent of total assets in farm land			
0	26	7.1	
1-25	44	12.1	
26-50	92	25.3	
51-75	101	27.7	
76-100	39	10.7	
Percent of total assets in non-farm assets			
0	91	25.0	
1-25	134	36.8	
26-50	42	11.5	
51-75	17	4.7	
76-100	17	4.7	

Source: Farm Operator Survey, 1999

Land Characteristics and Use

(Table 4.8) About 56.7 percent of the respondents viewed their land as river bottom or flood plain areas, while 27.3 percent thought they had sandy soils on their land. Just over two thirds of the respondents (66.9%) had hills on their land. Over two thirds of the farm operators (66.9%) had land that was used for hayland or pasture compared to 40.4% of non-operator landowners. Seventy-three point two percent (73.2%) of farm operators had land that was used as cropland, while 86.6 percent of the non-operator landowners had land that was used as cropland. Although very few respondents (7.2%) managed their timber stands, over one third (35.6%) of the respondents had land in unmanaged timber and (32.8%) had harvested trees for sale. Although 24.9 percent of the farm operators had implemented windbreaks on their land, there were very few respondents who said they have implemented other agroforestry practices on their land. The other practices were each under 4% implementation.

Table 4.8. Land Characteristics and Use for Farm Operator Landowners in Missouri, 1998-1999.

Category	# of Respondents	% of Respondents	Mean (Standard Deviation)
% Land in following categories			
River Bottom or Flood Plain	206	56.7	26.4(33.2)
Sandy Soils	99	27.3	17.6(34.2)
Hills	243	66.9	46.6(41.6)
Land in following categories (acres)			
Hayland and pasture (non-wooded)			78.3(135)
0	120	33.1	
1-10	26	7.2	
11-50	92	25.3	
51-100	48	13.2	
>100	77	21.2	

Table 4.8 Continued. Land Characteristics and Use for Farm Operator Landowners in Missouri, 1998-1999.

Cropland			632(1052.4)
0	97	26.8	
1-49	24	6.6	
50-179	55	15.1	
180-499	56	15.4	
500-999	58	16	
>1000	72	19.2	
Managed Timber Stands			4.2(29.3)
0	337	92.8	
1-26	12	3.3	
26-50	6	1.7	
>50	8	2.2	
Unmanaged Timber Stands			16.9(42)
0	234	64.5	
1-26	63	17.4	
26-50	32	8.8	
>50	34	9.4	
Harvested Trees for Sale			
Yes	119	32.8	
Implemented Practice on Farm			
Alley Cropping	2	.5	
Windbreaks	90	24.9	
Riparian Buffers	13	3.6	
Silvopasture	8	2.2	
Forest Farming	1	.3	

Source: Farm Operator Survey, 1999

Sources of Information for Non-Operators and Operators

About 42 (41.8) percent of those who would choose University Extension as their first choice for where they would like to seek advice about planting or managing trees were farm operators while only 33.8 percent were non-operators (Table 4.9). Almost 19 (18.8) percent of the farm operators would choose to seek information from other landowners or farmers who have experience with trees while 19.3 percent of the non-operators would

choose other farmers or landowners as a source of information. The farm operators would choose to seek information from a district forester 13.3 percent of the time while a non-operator would choose to seek information from a district forester 15.5 percent of the time. Farm operators would choose to seek information regarding planting trees from the local Soil and Water Conservation District (SWCD) 10.8 percent of the time while 16.9 percent of the non-operators would choose the local Soil and Water Conservation District to obtain information.

Table 4.9 shows that University Extension is the source where farm operators and non-operators would go to find information about planting and managing trees, while they are also comfortable with other landowners or farmers who have experience with trees. After extension and other landowners, the farm operators are comfortable seeking advice from a district forester while the non-operators are comfortable with the local SWCD. The figures below are useful in understanding how landowners want to receive information and who and where they would like to seek advice.

Table 4.9 Sources of Information for Non-Operator and Farm Operator Landowners in Missouri, 1998-1999.

First choice of group you would seek advice from about planting or managing trees	**Type of respondent**		**Total**	**Percentage of Total**	
	Farm operator	Non-operator		Farm Operator	Non-Operator
University Extension	151	70	221	41.8	33.8
Landowners/farmers who have tree experience	68	40	108	18.8	19.3
Local Soil and Water Conservation District	39	35	74	10.8	16.9
Natural Resources Conservation Service	32	18	50	8.9	8.7
District forester	48	32	80	13.3	15.5
Consulting forester	16	7	23	4.4	3.4
Commercial logger	1	0	1	.003	0.0
Timber buyers	6	5	11	1.6	2.4
Total	361	207	568		

Source: Non-Operator and Farm Operator Survey, 1999

Summary

The mean age of the farm operators (52.5) is almost ten years younger than the non-operators (61). Both categories are very similar in percentage of high school graduates 55%, while the non-operators have about 5 percent more college graduates. This could mean a higher percentage of the non-operators would be lifestyle farmers, those who may have an off-farm job and use the land for conservation or recreational purposes.

The non-operator landowners have 12 percent more landowners who have had family ownership of their land for at least 31 years and almost 6 percent more landowners who have had family ownership for at least 61 years. This may be due to the age difference in the farm operators vs. the non-operators. The percent of acres that each landowner owned was similar between the farm operators and non-operators. Although 60.3 percent of the non-operators are renting out their land, the majority of them are not leasing out all of their acres. With such a large percentage renting out their land for farming, this may indicate that a large percentage of the non-operators may be in the lifestyle category. Close to forty-four percent (43.9) of the farm operators have off farm employment and 50.3 percent classified themselves as part-time farmers. This indicates about half of the farm operators would be classified as lifestyle farmers although they may have traditional farming values which lean more towards the conservative attitudinal category. The variables chosen for the lifestyle and conservative attitude will capture this effect and place the landowners in the most appropriate category.

A much larger percentage (61.8) of the farm-operators compared to non-operators (29.4) percent have (0-25 percent) of their total assets in non-farm assets. Of this 61.8 percent, almost 61 (60.8) percent classify themselves as full-time farmers while nearly 31

(30.6) percent classify themselves as part-time farmers. The remaining eight percent is comprised of those who classify themselves as "landowners" or "retired." The non-operators have 34.1 percent of their total assets (over 76 percent) in non-farm assets while the farm operators have only 4.7 percent of their total assets (over 76 percent) in non-farm assets. Of this 4.7 percent of farm operators, zero classify themselves as full-time farmers while 65 percent classify themselves as part-time farmers. Thirty-five percent classify themselves as other, including "landowners," "suburbanite," "hobby farmer," and "farm laborer." Unfortunately there was not a comparable question in the non-operator survey, so it is not possible to know how the landowners who are not operating classify themselves. These statistics can mean two things, 1) the non-operators are older and have more income from retirement sources, or 2) the non-operators are less vested in farming, therefore have less of their assets invested in farming.

Chapter V

Empirical Results and Discussion

This chapter provides empirical results from the statistical models. Logistic regression was used in this research to test the hypothesis using SPSS 13.0 statistical software. Logistic regression is used to predict the likelihood (the odds ratio) of the outcome based on the predictor variables (independent variables.) Two hypotheses were evaluated for interest in each of the agroforestry practices. Descriptive statistics of the variables are provided below.

Alley Cropping

Descriptive statistics for alley cropping are shown in Table 5.1. This table shows the number of respondents and the percent of respondents for each variable in the alley cropping model.

The model for alley cropping is shown below.

$$\log (IAC/(1\text{-}IAC)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age + \beta_7 edu + \beta_8 crop + \beta_9 hay + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	crop	hay	farm	nrcs	frstry
-	+	+	+	+	-	+	+	+	+	+	+

The results for the interest in alley cropping are shown in table 5.3. The model analysis showed that with only the constant in the model, the model could correctly predict

76.6% of the time with 100% accuracy for those uninterested in alley cropping and 0% of the time for those that were interested in alley cropping. With the independent variables included in the model, it could correctly predict 79.5% of the time with 95.7% accuracy for those that were uninterested and 26.4% of the time for those that were interested (Table 5.4). The model is very good at predicting those that are not interested in alley cropping, but has much less success at predicting those that will be interested in the practice. The interest in alley cropping for landowners is only 10.6 percent which makes it difficult for the model to capture the characteristics of those who are interested in alley cropping, rather than those landowners who are not interested.

Table 5.1. Descriptive Statistics of Alley Cropping in Logistic Regression Model.

Category	# of Respondents	% of Respondents
Alley Cropping		
Location		
FWW	310	51.4
Scott	293	48.6
Age	590	97.8
Education	598	99.2
Aware of timber markets		
Yes	314	53
No	279	47
Loss of trees a problem**	570	94.5
Percent of total assets in farm assets	534	88.6
Interest in Alley Cropping*		
Uninterested	512	89.4
Interested	61	10.6
Own knowledge of Alley Cropping***	596	98.8
Acres in cropland	593	98.3
Acres in hayland	584	96.8

*Categorical variables based on a 0 or 1 response.
**Variable based on a scale of 1-4 from not a problem to very serious problem.
***Variable based on a scale of 1-5 from very low to very high.

Four hundred fifty-three observations were included and the chi-square value was highly significant at 69.14. The Nagelkerke R square was .213 (Table 5.2). The logit results provide statistical evidence for rejecting the null hypothesis as the model with the

independent variables included estimates that respondents with lifestyle characteristics have a significantly higher probability of being interested in alley cropping while those with conservative characteristics are significantly less likely to be interested in alley cropping.

Table 5.2. Empirical Model Summary for Alley Cropping.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
68.14	453	.213

Table 5.3. Parameter Estimates for Interest in Alley Cropping Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-0.11	.004	.007***	.989
Accumulators	-.094	.250	.706	.910
Lifestyle	.534	.142	.000***	1.706
Location	.248	.262	.344	1.281
Age	-.020	.010	.035**	.980
Education	.035	.050	.485	1.036
Own knowledge Alley Cropping	.608	.134	.000***	1.836
Acres cropland	.000	.000	.036**	1.000
Acres hayland	.000	.001	.767	1.000
Advice from farmers	.582	.338	.085*	1.790
Advice from Conservation Professionals	.745	.317	.019**	2.106
Advice from Forestry Professionals	.025	.356	.943	1.026

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table 5.4. Empirical Model Predictive Power for the Dependent Variable Interest in Alley Cropping.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	338	13	96.3	
	Interested	80	28	25.9	79.7

The results also support previous research as knowledge of alley cropping, age, seeking advice from conservation professionals, and acres in cropland had a significant

relationship with interest in alley cropping. Although one of the physical characteristics (acres in cropland) was significant in the model, acres in hayland/pasture and location were not significant in the model. Seeking advice from farmers, seeking advice from forestry professionals, and education did not support previous research as they were not significant in the model.

Windbreaks

Descriptive statistics for windbreaks are shown in Table 5.5. This table shows the number of respondents and the percent of respondents for each variable in the windbreak model.

Table 5.5. Descriptive Statistics of Windbreaks in Logistic Regression Model.

Category	# of Respondents	% of Respondents
Windbreaks		
Location		
FWW	310	51.4
Scott	293	48.6
Age	590	97.8
Education	598	99.2
Aware of timber markets		
Yes	314	53
No	279	47
Loss of trees a problem**	570	94.5
Percent of total assets in farm assets	534	88.6
Interest in Windbreaks*		
Uninterested	389	68.0
Interested	183	32.0
Own knowledge of Windbreaks***	592	98.2
Erosion by wind a problem**	574	95.2

*Categorical variables based on a 0 or 1 response.
**Variable based on a scale of 1-4 from not a problem to very serious problem.
***Variable based on a scale of 1-5 from very low to very high.

The model for windbreaks is shown below.

$$\log (IWB/(1-IWB)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age + \beta_7 edu + \beta_8 winderosion + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	winderosion	farm	nrcs	frstry
+	+	-	+	+	-	+	+	+	+	+

The results for the interest in windbreaks are shown in table 5.7. The model analysis showed that with only the constant in the model, the model could correctly predict 56.7% of the time with 100% accuracy for those interested in windbreaks and 0% of the time for those that were uninterested in windbreaks. With the independent variables included in the model, it could correctly predict 70% of the time with 57.3% accuracy for those that were uninterested and 79.7% of the time for those that were interested (Table 5.8).

Four hundred sixty observations were included and the chi-square value was highly significant at 72.248. The Nagelkerke R square was .195 (Table 5.6). The logit results provide statistical evidence for rejecting the null hypothesis as the model with the independent variables included estimates that respondents with specific structural characteristics and one of the physical characteristics are significant.

While it was expected that conservatives, accumulators, and lifestyle farmers would have a positive relationship with interest in windbreaks, none of the attitudinal categories were significant.

The model estimates that those who would seek advice from a conservation professional, have knowledge of windbreaks, and have the physical characteristic of erosion by wind have a significantly positive relationship with interest. As shown in the literature, age has a significantly negative relationship with interest in windbreaks. Location, seeking advice from farmers, and seeking advice from forestry professionals were not significant in the model. Education did not support previous literature as it is not significant in the model and is negatively related to interest in windbreaks.

Table 5.6. Empirical Model Summary for Windbreaks.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
72.248	460	.195

Table 5.7. Parameter Estimates for Interest in Windbreaks Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-.004	.003	.261	.996
Accumulators	.218	.215	.310	1.244
Lifestyle	.054	.136	.691	1.055
Location	.029	.210	.891	1.029
Age	-.015	.008	.067*	.985
Education	-.052	.041	.209	.949
Own knowledge Windbreaks	.506	.105	.000***	1.659
Erosion by wind a problem	.576	.126	.000***	1.778
Advice from farmers	.172	.287	.550	1.187
Advice from Conservation Professionals	.688	.282	.015**	1.991
Advice from Forestry Professionals	.292	.283	.303	1.339

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table 5.8. Empirical Model Predictive Power for the Dependent Variable Interest in Windbreaks.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	114	85	57.3	
	Interested	53	208	79.7	70

Riparian Buffers

Descriptive statistics for riparian buffers are shown in Table 5.9. This table shows the number of respondents and the percent of respondents for each variable in the riparian buffer model.

Table 5.9. Descriptive Statistics of Riparian Buffers in Logistic Regression Model.

Category	# of Respondents	% of Respondents
Riparian Buffers		
Location		
FWW	310	51.4
Scott	293	48.6
Age	590	97.8
Education	598	99.2
Aware of timber markets		
Yes	314	53
No	279	47
Loss of trees a problem**	570	94.5
Percent of total assets in farm assets	534	88.6
Interest in Riparian Buffers*		
Uninterested	458	80.1
Interested	114	19.9
Own knowledge of Riparian Buffers***	594	98.5
Soil erosion caused by rain a problem**	580	96.2
Stream bank erosion a problem**	574	95.2

*Categorical variables based on a 0 or 1 response.
**Variable based on a scale of 1-4 from not a problem to very serious problem.
***Variable based on a scale of 1-5 from very low to very high.

The model for riparian buffers is shown below.

$$\log (IRB/(1\text{-}IRB)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age + \beta_7 edu + \beta_8 rainerosion + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	rainerosion	farm	nrcs	frstry
+	+	+	+	+	-	+	+	+	+	+

The results for the interest in riparian buffers are shown in Table 5.11. The model analysis showed that with only the constant in the model, the model could correctly predict

62.4% 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, it could correctly predict 67% of the time with 85% accuracy for those that were uninterested and 37% accuracy for those that were interested (Table 5.12). The riparian buffer model also has difficulty in terms of predictive power. The model is very good at predicting those that are not interested in riparian buffers, but has much less success at predicting those that will be interested in the practice. Although there is more interest in riparian buffers at 19.9 percent, it is still difficult for the model to capture the characteristics of those who are interested in riparian buffers, rather than those landowners who are not interested.

Four hundred sixty observations were included and the chi-square value was highly significant at 65.646. The Nagelkerke R square was .181(Table 5.10). The logit results provide statistical evidence for rejecting the null hypothesis as the model with the independent variables included estimates that respondents with lifestyle characteristics have a significantly higher probability of being interested in riparian buffers while those with conservative characteristics are significantly less likely to be interested in riparian buffers.

The results support previous research as those who see themselves with a higher level of knowledge of riparian buffers has a significantly positive relationship with interest in riparian buffers. The results do not support previous research in that accumulators, education, and soil erosion caused by rain are not significant in the model.

Table 5.10. Empirical Model Summary for Riparian Buffers.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
65.64	460	.181

Table 5.11. Parameter Estimates for Interest in Riparian Buffers Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-.010	.003	.004***	.990
Accumulators	-.112	.218	.606	.894
Lifestyle	.221	.131	.092*	1.248
Location	-.243	.235	.300	.784
Age	-0.12	.008	.129	.988
Education	.070	.044	.113	1.072
Own knowledge Riparian Buffers	.620	.113	.000***	1.858
Soil erosion caused by rain a problem	.068	.117	.558	1.071
Advice from farmers	-.287	.300	.338	.751
Advice from Conservation Professionals	.245	.277	.376	1.278
Advice from Forestry Professionals	-.047	.291	.872	.954

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table 5.12. Empirical Model Predictive Power for the Dependent Variable Interest in Riparian Buffers.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	244	43	85	
	Interested	109	64	37	67

Silvopasture

Descriptive statistics for silvopasture are shown in Table 5.13. This table shows the number of respondents and the percent of respondents for each variable in the silvopasture model.

Table 5.13. Descriptive Statistics of Silvopasture in Logistic Regression Model.

Category	# of Respondents	% of Respondents
Silvopasture		
Location		
FWW	310	51.4
Scott	293	48.6
Age	590	97.8
Education	598	99.2
Aware of timber markets		
Yes	314	53
No	279	47
Loss of trees a problem	570	94.5
Percent of total assets in farm assets	534	88.6
Interest in Silvopasture*		
Uninterested	489	85.3
Interested	84	14.7
Own knowledge of Silvopasture***	594	98.5
Acres in unmanaged timber***	587	97.3

*Categorical variables based on a 0 or 1 response.
**Variable based on a scale of 1-4 from not a problem to very serious problem.
***Variable based on a scale of 1-5 from very low to very high.

The model for silvopasture is shown below.

$$\log (ISP/(1\text{-}ISP)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age + \beta_7 edu + \beta_8 unmgdtbr + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	unmgdtbr	farm	nrcs	frstry
-	+	+	+	+	-	+	+	+	+	+

The results for the interest in silvopasture are shown in Table 5.15. The model analysis showed that with only the constant in the model, the model could correctly predict 69.3% of the time with 100% accuracy for those uninterested in silvopasture and 0% of the

time for those that were interested in silvopasture. With the independent variables included in the model, it could correctly predict 72.6% of the time with 93.4% accuracy for those that were uninterested and 25.5% of the time for those that were interested (Table 5.16). The silvopasture model has the same difficulty as the models for alley cropping and riparian buffers in terms of predictive powers. The model is very good at predicting those that are not interested in silvopasture, but has much less success at predicting those that will be interested in the practice. Interest in silvopasture is 14.7 percent which makes it difficult for the model to capture the characteristics of those who are interested in silvopasture, rather than those landowners who are not interested.

Four hundred sixty observations were included and the chi-square value was highly significant at 59.644. The Nagelkerke R square was .172 (Table 5.14). The logit results provide statistical evidence for rejecting the null hypothesis as the model with the independent variables included estimates that respondents with lifestyle characteristics have a significantly higher probability of being interested in alley cropping while those with conservative characteristics are significantly less likely to be interested in alley cropping. The accumulator attitude was not significant.

The results support previous research as knowledge of silvopasture, education, and acres in unmanaged timber had a significant relationship with interest in alley cropping. Seeking advice from farmers, seeking advice from conservation professionals, and seeking advice from forestry professionals, and age were not significant in the model.

Table 5.14. Empirical Model Summary for Silvopasture.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
59.644	460	.172

Table 5.15. Parameter Estimates for Interest in Silvopasture Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-.012	.003	.000***	.988
Accumulators	.212	.222	.341	1.236
Lifestyle	.322	.131	.014**	1.380
Location	-.240	.227	.292	.787
Age	-.007	.009	.395	.993
Education	.091	.045	.046**	1.095
Own knowledge Silvopasture	.563	.126	.000***	1.757
Acres in unmanaged timber	.004	.002	.036**	1.004
Advice from farmers	.150	.307	.625	1.162
Advice from Conservation Professionals	.343	.284	.228	1.409
Advice from Forestry Professionals	-.153	.309	.621	.858

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table 5.16. Empirical Model Predictive Power for the Dependent Variable Interest in Silvopasture.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	298	21	93.4	
	Interested	105	36	25.5	72.6

Forest Farming

Descriptive statistics for forest farming are shown in Table 5.17. This table shows the number of respondents and the percent of respondents for each variable in the forest farming model.

Table 5.17. Descriptive Statistics of Forest Farming in Logistic Regression Model.

Category	# of Respondents	% of Respondents
Forest Farming		
Location		
FWW	310	51.4
Scott	293	48.6
Age	590	97.8
Education	598	99.2
Aware of timber markets		
Yes	314	53
No	279	47
Loss of trees a problem**	570	94.5
Percent of total assets in farm assets	534	88.6
Interest in Forest Farming*		
Uninterested	467	81.6
Interested	105	18.4
Own knowledge of Forest Farming	593	98.3
Acres in managed timber***	587	97.3

*Categorical variables based on a 0 or 1 response.
**Variable based on a scale of 1-4 from not a problem to very serious problem.
***Variable based on a scale of 1-5 from very low to very high.

The model for forest farming is shown below.

$$\log (IFF/(1-IFF)) = \alpha + \beta_1 cons + \beta_2 accum + \beta_3 life + \beta_4 loc + \beta_5 ownknow + \beta_6 age + \beta_7 edu + \beta_8 mgdtbr + \partial_1 farm + \partial_2 nrcs + \partial_3 frstry$$

The following relationship is expected:

cons	accum	life	loc	ownknow	age	edu	mgdtbr	farm	nrcs	frstry
-	+	+	+	+	-	+	+	+	+	+

The results for the interest in forest farming are shown in Table 5.18. The model analysis showed that with only the constant in the model, the model could correctly predict 63.3% of the time with 100% accuracy for those uninterested in forest farming and 0% of the

time for those that were interested in forest farming. With the independent variables included in the model, it could correctly predict 71.0% of the time with 87.9% accuracy for those that were uninterested and 41.7% of the time for those that were interested (Table 5.20). The forest farming model has the same difficulty as the model for alley cropping, riparian buffers, and silvopasture in terms of predictive powers. The model is very good at predicting those that are not interested in forest farming, but has much less success at predicting those that will be interested in the practice. There is slightly more interest in forest farming than alley cropping and silvopasture at 18.4 percent, it is still difficult for the model to capture the characteristics of those who are interested in riparian buffers, rather than those landowners who are not interested.

Four hundred fifty-eight observations were included and the chi-square value was highly significant at 84.617. The Nagelkerke R square was .231 (Table 5.18). The logit results provide statistical evidence for rejecting the null hypothesis as the model with the independent variables included estimates that respondents with lifestyle characteristics have a significantly higher probability of being interested in alley cropping while those with conservative characteristics are significantly less likely to be interested in alley cropping. The accumulator attitude was not significant.

The results support previous research as knowledge of forest farming, age, and seeking advice from forestry professionals had a significant relationship with interest in alley cropping. Acres in managed timber was also significant in the model. Seeking advice from farmers, seeking advice from conservation professionals, and education were not significant in the model.

Table 5.18. Empirical Model Summary for Forest Farming.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
84.617	458	.231

Table 5.19. Parameter Estimates for Interest in Forest Farming Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-.012	.003	.001***	.988
Accumulators	.236	.218	.279	1.267
Lifestyle	.315	.132	.017**	1.370
Location	-.126	.221	.569	.882
Age	-.017	.008	.041**	.983
Education	.024	.045	.591	1.025
Own knowledge Forest Farming	.691	.131	.000***	1.995
Acres in managed timber	.010	.004	.018**	1.010
Advice from farmers	.346	.302	.252	1.413
Advice from Conservation Professionals	.416	.288	.149	1.516
Advice from Forestry Professionals	.647	.294	.028**	1.910

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table 5.20. Empirical Model Predictive Power for the Dependent Variable Interest in Forest Farming.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	255	35	87.9	
	Interested	98	70	41.7	71.0

Discussion

Agroforestry is defined in chapter one as a farming system that integrates crops and/or livestock with trees and shrubs. The five agroforestry practices were presented to the respondents by showing them pictures of the practices embedded in the survey. This was

done in both the face-to-face and mail surveys. They were then asked to answer several questions regarding knowledge of the practices and interest. Based on their knowledge and the pictures presented, they provided an opinion on interest. This research supports previous research in that knowledge of the practice is one of the strongest variables explaining interest.

This research focuses on identifying the characteristics that drive interest and adoption of agroforestry practices with hopes that it will provide information about the groups of farmers and niches where these practices are feasible and attractive to the farmer. According to Gold et. al., (2004), understanding niche markets is an essential ingredient in the success of profitable agroforestry enterprises.

This research analyzed the relationship of key attitudinal factors as well as several structural and physical characteristics. Survey data collected by face to face interviews and a mail in survey were used to better understand farm operator and non-operator landowner characteristics, respectively, in NE and SE Missouri. Due to the dichotomous nature of the independent variable, the interest in the specific agroforestry practice, logistic regression was used to analyze the data in five different models.

The attitudinal categories identified in the study include the disengager, conservative, accumulator, and lifestyle attitudes. The results of the logit regressions showed that the variables chosen are useful predictors regarding interest in the various agroforestry practices. All the models were significant, as well as specific variables in them. The models were able to predict closely who would not be interested in the practices. The performance with those interested varied. The results generally supported the previous research with both the

structural and physical characteristics. Education was not significant, often not the case in previous research.

Analysis of Alley Cropping

All three attitudinal variables were included in the model for alley cropping. The variables chosen to represent these attitudes were the following: for conservatives, the percent of total income from farm income; for accumulators, the fact that they were aware of timber markets in their area; and lifestyle, captured by those who consider the loss of trees as a problem on their farm.

Both the conservative and lifestyle attitudes were significant in the model. Those with the conservative attitude were less likely to be interested in alley cropping, but only slightly as the change in odds is very close to one (.989). This means that those with the conservative attitude are one percent less likely to be interested in alley cropping. This result was expected as conservatives generally do not see the value of trees and do not want trees incorporated in their farming landscape.

The lifestyle attitude had a positive effect on interest. This was also expected as the lifestyle attitude wants more trees in the landscape and is interested in various types of alternative practices. To interpret the change in odds, it must be understood that in logistic regression, the change in odds represents the change in the outcome resulting from a unit change in the predictor variable. Therefore as the respondents moved from one category to the next, for example, from the loss of trees being a small problem to the loss of trees being a somewhat serious problem, they were 1.7 times more likely to be interested in alley cropping, than those in the previous category. If they moved from the loss of trees being a

somewhat serious problem to a very serious problem, they were again 1.7 times more likely to be interested in alley cropping than those who responded as loss of trees being a somewhat serious problem. Coefficients in all the models are interpreted in the same manner. The accumulator attitude was not significant.

Own knowledge of alley cropping, seeking advice from conservation professionals, and acres of cropland were all found, as expected, to be positive and significant in the model. These results support previous research that states that knowledge of the practice, comfort with conservation professionals, and having the physical characteristic needed for the practice have a positive relationship with the interest and adoption of conservation and agroforestry practices.

If someone has knowledge of alley cropping, they are 1.8 times as likely to be interested in alley cropping. It must be noted that there is a disagreement on the causality of knowledge and interest (Rogers, 2003). In this case, the model shows that if someone has knowledge they are likely to be more interested in alley cropping; but it may be that they have more knowledge because they were interested in the practice to begin with, and took it upon themselves to find more information. This study, on the other hand, uses knowledge as a proxy for non-formal education.

Landowners who are comfortable with conservation professionals to seek information about planting and managing trees, are just over twice as likely, than those who do not, to be interested in alley cropping. Although amount of cropland is significant, the change in the odds is one, which means that the physical variable of having cropland will have no effect on the respondent's interest in alley cropping. Seeking information from farmers/other landowners who are knowledgeable about planting and managing trees was also positive and

significant as expected. If the respondents want to seek information from other farmers/landowners, they are 1.7 times as likely to be interested in agroforestry. Age, as expected was negative and significant stating that as the respondents increased in age, the odds of their interest in alley cropping would decrease, but according to rate of change odds, only very slightly. This also means that the non-operator landowners would be less interested in alley cropping as a new venture.

Acres in hayland/pasture, location, seeking information from a forestry professional, and education were not significant in the model. Acres in hayland/pasture was chosen to depict a physical characteristic needed for alley cropping. Location was chosen to depict the differences in landscapes and cultures in NE and SE Missouri. Where they seek information was chosen as a variable to identify who and where they are comfortable obtaining information. Education did not support previous research as it was not significant in the model.

Analysis of Windbreaks

All three attitudinal variables were included in the regression for windbreaks. The variables chosen to represent these attitudes were the following: for conservatives, the percent of total income from farm income; for accumulators, the fact that they were aware of timber markets in their area; and lifestyle, captured by those who consider the loss of trees as a problem on their farm.

None of the attitudinal categories were significant in the model. Although this was not expected, this could be due to the nature of windbreaks; even though they are viewed as more conventional than other agroforestry practices and have been promoted more in

Missouri, the conservatives are still not willing to go outside their traditional field of farming to adopt an alternative practice. The accumulators may not see direct economic benefit from planting windbreaks, and the lifestyle attitude may see windbreaks as more of a farming practice rather than a conservation or aesthetic activity.

Own knowledge of windbreaks, soil erosion by wind, and seeking advice from conservation professionals were all positive and significant, as hypothesized. If the respondents have knowledge of windbreaks, they are 1.7 times more likely to be interested in windbreaks. If the respondent had the physical condition of soil erosion by wind, they were 1.8 times as likely to be interested in windbreaks. If the respondent chose to seek information from conservation professionals, they are almost twice as likely to be interested in windbreaks. Age was negative and significant in the model which was as expected. As the respondents get older, they are less willing to try new things.

Location, seeking information from farmers/landowners who are knowledgeable about planting and managing trees, seeking information from forestry professionals about planting and managing trees, and education were not significant in the model.

According to these results, windbreaks were perceived as useful for erosion and a function of knowledge, not necessarily a function of landowner's attitudes. An important significant variable to note is advice from conservation professionals. This is reassuring for agroforestry technology transfer through the NRCS and SWCD.

Analysis of Riparian Buffers

All three attitudinal variables were included in the model for riparian buffers. The variables chosen to represent these attitudes were the following: for conservatives, the

percent of total income from farm income; for accumulators, the fact that they were aware of timber markets in their area; and lifestyle, captured by those who consider the loss of trees as a problem on their farm.

Both conservatives and lifestyle attitudes were significant in the model. Those with the conservative attitude were less likely to be interested in riparian buffers, but only slightly as the change in odds is very close to one (.990). This means that those with the conservative attitude are one percent less likely to be interested in riparian buffers. The result was expected as conservatives are not willing to go outside their field of farming. The lifestyle attitude had a positive relationship and is almost 1.3 times more likely to be interested in riparian buffers. This was also expected as the lifestyle attitude is more concerned with conservation and activities that increase natural habitat. The accumulator attitude was not significant in the model.

The only variable in this model that was significant other than the two attitudinal variables discussed above was own knowledge of riparian buffers. If the respondent had knowledge of riparian buffers, they are almost twice as likely to be interested in riparian buffers.

Location, seeking advice from farmer/landowners, seeking advice from conservation professionals, seeking advice from forestry professionals, age, education, and soil erosion caused by rain were all included in the model, but were not significant in predicting interest. Soil erosion caused by rain was used to depict a physical characteristic representing a need for riparian buffers.

Although this generally supports research on riparian buffers by Flower (2004) and Valdivia and Poulos (2005), there are a few differences. Flower (2004) found that farm

operators with the conservative (if they had cleared trees from land in the last five years) and lifestyle (interest in someone coming to your land to evaluate it for planting trees) attitudes would be interested in riparian buffers. He also found that farm operators that had the physical variable of soil erosion caused by rain or snow melt and those who said they had knowledge of the practice to be a positive factor in interest. In Valdivia and Poulos' (2005) study of farm operators, they found that age, those with the physical variable of stream bank erosion, those who were interested in the scenic beauty of planting trees, and those who believed trees were important for future generations were more likely to be interested in riparian buffers. Even though there are slight differences in our results, knowledge of the practice is highly significant and the strongest factor in predicting interest in all three.

The models provided by Flower (2004) and Valdivia and Poulos (2005) were capable of providing slightly higher predictive power. This may be due to the diminished number of variables that were available due to combining the farm operator data set with the non-operator data set.

Interest in riparian buffers was analyzed by running another regression with a change in the physical characteristic depicting the need for riparian buffers. Instead of using soil erosion caused by wind as a problem on your farm, stream bank erosion as a problem on your farm was used. This changed the results slightly as shown in the Appendix D.

Analysis of Silvopasture

All three attitudinal variables were included in the model for silvopasture. The variables chosen to represent these attitudes were the following: for conservatives, the percent of total income from farm income; for accumulators, the fact that they were aware of

timber markets in their area; and lifestyle, captured by those who consider the loss of trees as a problem on their farm.

Both conservatives and lifestyle attitudes were significant in the model. Those with the conservative attitude were less likely to be interested in silvopasture, but only slightly as the change in odds is very close to one (.988). This means that those with the conservative attitude are one percent less likely to be interested in silvopasture. Although very small, this result was expected as conservatives are those who are not willing to go outside the field of farming, and planting and managing trees for your livestock to graze does not fall into the traditional field of farming. The lifestyle attitude had a positive relationship and is 1.4 times more likely to be interested in silvopasture. This was also expected as the lifestyle attitude is interested in various types of conservation and alternative farming practices. The accumulator attitude was not significant. This may be due to the labor intensive nature of silvopasture. It could also be due to the state of the cattle market in 1998. Interestingly enough, that was the year that Oprah Winfrey had a show about mad cow disease, causing the cattle market to decline. The accumulators may not have had interest in investing in a new venture where the market for that business was not good.

Own knowledge of silvopasture, education, and acres in unmanaged timber were all positive and significant, as expected. If the respondent had knowledge of silvopasture, they are 1.8 times likely to be interested in agroforestry. Acres in unmanaged timber was used as the physical variable to show that the respondent had land available for silvopasture. Although education and acres in unmanaged timber were positive and significant, their change in odds is very close 1. Those who have an increase of one unit in education are

almost 1 percent more likely to be interested in silvopasture and those who have acres in unmanaged timber are less than 1 percent more likely to be interested in silvopasture.

Location, where they choose to seek information from, and age were not significant in the model.

Interest in silvopasture was analyzed by running another regression with a change in the physical characteristic of land available for silvopasture. Instead of using acres in unmanaged timber, acres in managed timber was used. The only noticeable change this caused in the results (Appendix D) was that managed timber was not significant. The other variables remained very similar in significance and coefficients. This is interesting as those who already manage their timber may not be willing to put cattle into the mix. They see their timber as something they are managing for profit and do not want that profit to be compromised by livestock.

Interest in silvopasture was analyzed by running several regressions changing the physical characteristic depicting the need for silvopasture. Acres in hayland/pasture was included in the model to portray an association with cattle. The regression was run several times including acres in hayland/pasture with and without the other physical variable, along with omitting other variables to see if the predictive power could be increased. None of the models returned results with increased predictive power or greater significance over the variables in the original model.

Analysis of Forest Farming

All three attitudinal variables were included in the model for forest farming. The variables chosen to represent these attitudes were the following: for conservatives, the

percent of total income from farm income; for accumulators, the fact that they were aware of timber markets in their area; and lifestyle, captured by those who consider the loss of trees as a problem on their farm.

Both conservatives and lifestyle attitudes were significant in the model. Those with the conservative attitude were less likely to be interested in forest farming, but only slightly as the change in odds is very close to one (.988). This means that those with the conservative attitude are one percent less likely to be interested in forest farming. This result was expected as conservatives are not willing to go outside the field of farming and try alternative farming practices. The lifestyle attitude had a positive relationship and is 1.4 times more likely to be interested in forest farming. This was also expected as the lifestyle attitude may often have an off farm income and more interested in alternative farm practices. The accumulator attitude was not significant.

Own knowledge of forest farming, acres in managed timber, and seeking information from forestry professionals were all positive and significant in the model. If the respondents have knowledge of forest farming, they are almost twice as likely to be interested in forest farming. Acres in managed timber was included in the model to depict those who have land that would support forest farming. Although it was positive and significant, the change in the odds is close to one (1.010) which means that those who have acres in managed timber are less than one percent more likely to be interested in forest farming. If the respondents choose to seek information about planting and managing trees from a forestry professional, they are almost twice as likely to be interested in forest farming.

Age is negative and significant in the model. This supports previous research that as landowners get older, they are less willing to try alternative farming practices.

Although this generally supports research on forest farming by Flower (2004) and Valdivia and Poulos (2005), there are a few differences. Flower (2004) found that farm operator's with the accumulator (if they had harvested trees from their land) and lifestyle (interest in someone coming to your land to evaluate it for planting trees) attitudes would be interested in forest farming. He also found that those who said they had knowledge of the practice to be a positive factor in interest. In Valdivia and Poulos' (2005) study of farm operators, they found that age, those with the physical variable of already having trees on their land, those who were interested in the scenic beauty of planting trees, and those who believed trees were important for future generations were more likely to be interested in forest farming. Knowledge was found to be a very important factor in interest in forest farming. Even though there are slight differences in our results, knowledge of the practice is highly significant and the strongest factor in predicting interest in all three.

Again, the models provided by Flower (2004) and Valdivia and Poulos (2005) were capable of providing slightly higher predictive power. This is thought to be due to the diminished number of variables that were available due to combining the farm operator data set with the non-operator data set.

Interest in forest farming was analyzed by running another regression with a change in the physical characteristic of land available for forest farming. Instead of using acres in managed timber, acres in unmanaged timber was used. The only noticeable change this caused in the results (Appendix D) was that unmanaged timber was not significant. The other variables remained similar in significance and coefficients. Those respondents who have timber, but do not manage it already are less likely to be interested in forest farming as

an alternative farming practice, but those that already manage their timber may see forest farming as a way to obtain an income while waiting on the trees to reach maturity.

Chapter VI

Conclusion and Recommendations

Conclusion

This research demonstrates that there are landowners in Missouri who are willing to look at alternative opportunities that may provide income, but also promote conservation, provide improved quality of life, and add aesthetic beauty to the landscape.

Knowledge of the agroforestry practice was highly significant and important in all five models. This supports previous research as knowledge has been shown to increase interest in agroforestry. Since knowledge has been shown to be so important, it is necessary to provide a picture of where and how the landowners in this study want to attain their knowledge of agroforestry practices. Almost 42 percent of farm operators and 34 percent of non-operators would go to University Extension to seek advice about planting and managing trees. Nineteen percent of both farm operators and non-operators would go to landowners or other farmers who have experience with trees. The local SWCD has a slightly lower rate for farm operators (10.8%) while non-operators would choose to go to the local SWCD almost 17 percent of the time. The district forester is next in terms of where landowners would like to seek advice about planting and managing trees with 13.3 and 15.5 percent for farm operators and non-operators respectively. The NRCS was low with 8.9 and 8.7 percent for farm operators and non-operators respectively.

The location of the respondent is also a factor in where the landowners would like to seek information regarding advice about planting or managing trees. About 37 percent of

those in FWW would go to extension while 40.5 percent of Scott County would go to extension. Only 15.7 percent of landowners in FWW would go to landowners or other farmers who have experience with trees while 22.5 percent of those in Scott County would go to other landowners. The local SWCD was more popular in FWW as 16.4 percent of respondents would like to seek information from them compared to 9.4 percent of those in Scott County. The district forester is next in terms of where landowners would like to seek advice about planting and managing trees with 16.1 percent for FWW and 11.9 percent for Scott County. Those who would seek advice from NRCS was almost the same for FWW and Scott County at 8.6 and 9 percent respectively.

The attitudinal categories were useful in predicting those who would be interested in agroforestry in all models except for windbreaks where none of the attitudinal categories were significant. The conservative attitude and the lifestyle attitude were very adequately captured by the variables chosen for each. However, the variable for the accumulator category (if the landowner was aware of timber markets in their area) may not have depicted the accumulator attitude very well. This again is appropriately contributed to the combining of the data sets. It was difficult to find a variable that adequately captured the accumulator category as shown in this research.

The structural, attitudinal, and physical characteristics all play an important part in the adoption of and interest in agroforestry. Knowledge of the structural, attitudinal, and physical characteristics related to interest can help Extension and the MU Center for Agroforestry target the appropriate categories for the most efficient promotion of these practices.

Limitations and Recommendations

When combining the non-operator data set with the operator data set, the set of questions that were the same in content was greatly diminished from the complete separate data sets. This caused some problems with identification of variables for the attitudinal categories. There were fewer variables to choose from to identify the questions (variables) that represented the categories appropriately. The variables for the accumulators and lifestyle farmers were opinion questions, while the variable for the conservative attitude was a quantitative question. It was hoped that there would be a qualitative and quantitative variable for each attitude, but the combined data set did not allow this. This was due to correlation among the variables as well as lack of explanatory variables for the model due to the combined data set.

There are several variables for each attitudinal category that could be included to make the data set more complete. They are; for conservatives, if they believed they had invested too much effort in clearing trees, if they saw trees as an obstacle for farming equipment, if the thought a good farmer was someone who produced the best crops and livestock, if they viewed trees as competition for crops, and those variables that represent characteristics of traditional farming. For accumulators, if the respondent thought the importance of economic benefits of planting trees was important, if they thought that a good farmer tends to expand his operation, if they thought that it took too long to make a profit planting trees, and those types of variables that would show that they are interested in new ventures that are profitable. For lifestyle farmers, if erosion control and water quality is important to them, if scenic beauty is important to them, if they believe that wildlife habitat is important, if they believe a main reason for planting trees would be for future generations, if

they are interested in someone coming to their land to evaluate the feasibility of an agroforestry practice, and any other variables that depict characteristics of concern with the environment and conservation issues, along with those variables that show the landowners have income from sources other than farming.

There were many variables that could not be used due to multicollinearity within the data set. Some of these variables could have provided explanations and increased predictive power, but were not used because of correlation with other variables. In future surveys, it is important that the attitudinal categories have enough variables that properly represent each category with the non-operators and operators combined.

As shown in this study, for the future of agroforestry in Missouri, it is important that the MU Center for Agroforestry provides Extension with the appropriate training to educate the landowners of Missouri about agroforestry. It is also important to provide conservation and forestry professionals with appropriate training (Workman et al., 2003; Teel and Lassoie, 1991).

Since the most significant result of this study was the fact that landowners own knowledge of the particular agroforestry practice influences the amount of interest in the practice, it would be beneficial to invest future resources in educating landowners. As stated above, once the natural resource professionals are knowledgeable about agroforestry, demonstrations and on site training for landowners to increase their knowledge of the practices could be beneficial in increasing interest and adoption.

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Appendix A: Survey Questions Analyzed as Attitudinal Variables

Conservatives:

1) Please identify what percent of the total value of your assets are in each of the following categories:

Livestock
Machinery for livestock
Machinery for row crop
Farm Buildings
Farm Real Estate
Non-farm Assets

2) Indicate if you believe that loss of trees is a very serious problem, a somewhat serious problem, a small problem, or not a problem at all on the land you farm?

3) How much do the opinions of other farmers influence the decisions you make about farming?

4) Have you harvested trees for sale from your land?

5) During the past two years, how many times have you received advice from another farmer you invited onto your land?

Accumulators:

1) In the last five years, have you leased any of your land to hunters?

2) Have you harvested trees for sale from you land?

3) Are you aware of timber markets in your area?

4) If yes, how confident are you that you could get a fair price if you were to sell wood products?

5) During the past two years, how many times have you attended field days and demonstrations or received advice from a professional you invited onto you land?

6) How much do the opinions of other farmers influence the decisions you make about farming?

Lifestyle:

1) Please identify what percent of the total value of your assets are in each of the following categories:

Livestock
Machinery for livestock
Machinery for row crop
Farm Buildings
Farm Real Estate
Non-farm Assets

2) Indicate if you believe that loss of wildlife habitat is a very serious problem, a somewhat serious problem, a small problem, or not a problem at all on the land you farm?

3) Indicate if you believe that loss of trees is a very serious problem, a somewhat serious problem, a small problem, or not a problem at all on the land you farm?

Appendix B: Correlation Matrices for Attitudinal Variables

Conservatives

	Percent of total value of assets in farm assets	Loss of trees as a problem on your farm	Opinions of other farmers influence decision making	Harvested trees for sale	Received advice from another farmer you invited onto your land
Percent of total value of assets in farm assets	1	.168**	-.066	.154**	.127**
Loss of trees as a problem on land	.168**	1	-.013	-.021	.205**
Opinions of other farmers influence decision making	-.066	-.013	1	.000	-.004
Harvested trees for sale	.154**	-.021	.000	1	.010
Received advice from another farmer you invited onto your land	.127**	.205**	-.004	.010	1

Accumulators

	Leased land to hunters	Harvested trees for sale	Aware of timber markets	Confidence level of getting a fair price for wood products	Attended field days or demonstrations or received advice from professional they invited onto their land	Opinions of other farmers influence decision making
Leased land to hunters	1	-.006	-.056	.087*	-.018	-.002
Harvested trees for sale	-.006	1	.000	.039	-.007	.000
Aware of timber markets	-.056	.000	1	-.647**	.016	.027
Confidence level of getting a fair price for wood products	.087*	.039	-.647**	1	.203**	.016
Attended field days or demonstrations or received advice from professional they invited onto their land	-.018	-.007	.016	.203**	1	-.006
Opinions of other farmers influence decision making	-.002	.000	.027	.016	-.006	1

Lifestyle

	Percent of total value of assets in non farm assets	Loss of wildlife habitat on your farm	Loss of trees on your farm
Percent of total value of assets in non farm assets	1	-.158**	-.168**
Loss of wildlife habitat on your farm	-.158**	1	.543**
Loss of trees on your farm	-.168	.543**	1

Appendix C. Alternate Logistic Regression Models using Type of Respondent

Alley Cropping

Table C.1. Empirical Model Summary for Alley Cropping.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
89.958	453	.272

Table C.2. Parameter Estimates for Interest in Alley Cropping Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-.001	.005	.822	.999
Accumulators	-.090	.256	.726	.914
Lifestyle	.707	.154	.000***	2.028
Location	.176	.271	.518	1.192
Age	-.030	.010	.003***	.971
Education	.031	.050	.539	1.031
Own knowledge Alley Cropping	.566	.139	.000***	1.762
Acres cropland	.000	.000	.103	1.000
Acres hayland	.001	.001	.527	1.001
Advice from farmers	.582	.346	.093	1.789
Advice from Conservation Professionals	.668	.329	.042**	1.951
Advice from Forestry Professionals	-.115	.368	.755	.891
Type of respondent	1.485	.335	.000***	4.416

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table C.3. Empirical Model Predictive Power for the Dependent Variable Interest in Alley Cropping.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	331	15	95.7	
	Interested	75	31	29.2	80.1

Windbreaks

Table C.4. Empirical Model Summary for Windbreaks.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
78.097	460	.210

Table C.5. Parameter Estimates for Interest in Windbreaks Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	.002	.004	.686	1.002
Accumulators	.207	.216	.338	1.230
Lifestyle	.088	.137	.522	1.092
Location	-.024	.213	.909	.976
Age	-.019	.008	.024**	.982
Education	-.056	.042	.179	.945
Own knowledge Windbreaks	.530	.106	.000***	1.699
Erosion by wind a problem	.626	.129	.000***	1.870
Advice from farmers	.161	.290	.578	1.175
Advice from Conservation Professionals	.680	.285	.017**	1.974
Advice from Forestry Professionals	.253	.286	.376	1.288
Type of respondent	.712	.279	.011**	2.038

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table C.6. Empirical Model Predictive Power for the Dependent Variable Interest in Windbreaks.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	111	88	55.8	
	Interested	51	209	80.4	69.7

Riparian Buffers

Table C.7. Empirical Model Summary for Riparian Buffers.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
94.928	460	.254

Table C.8. Parameter Estimates for Interest in Riparian Buffers Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	.002	.004	.625	1.002
Accumulators	-.169	.226	.454	.845
Lifestyle	.347	.136	.011**	1.414
Location	-.219	.245	.372	.803
Age	-.022	.009	.014**	.979
Education	.072	.045	.107	1.074
Own knowledge Riparian Buffers	.581	.117	.000***	1.788
Soil erosion caused by rain a problem	.223	.126	.076*	1.250
Advice from farmers	-.264	.311	.396	.768
Advice from Conservation Professionals	.195	.288	.498	1.216
Advice from Forestry Professionals	-.068	.302	.822	.934
Type of respondent	1.591	.306	.000***	4.907

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table C.9. Empirical Model Predictive Power for the Dependent Variable Interest in Riparian Buffers.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	245	41	85.7	
	Interested	92	81	46.8	71.0

Silvopasture

Table C.10. Empirical Model Summary for Silvopasture.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
91.817	460	.256

Table C.11. Parameter Estimates for Interest in Silvopasture Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	.000	.004	.903	1.000
Accumulators	.242	.233	.299	1.273
Lifestyle	.491	.139	.000***	1.634
Location	-.388	.240	.105	.678
Age	-.017	.009	.071*	.984
Education	.090	.045	.047**	1.094
Own knowledge Silvopasture	.603	.131	.000***	1.827
Acres in unmanaged timber	.002	.002	.277	1.002
Advice from farmers	.102	.321	.750	1.108
Advice from Conservation Professionals	.251	.298	.400	1.286
Advice from Forestry Professionals	-.274	.323	.395	.760
Type of respondent	1.657	.306	.000***	5.242

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table C.12. Empirical Model Predictive Power for the Dependent Variable Interest in Silvopasture.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	288	31	90.3	
	Interested	91	49	35.0	73.4

Forest Farming

Table C.13. Empirical Model Summary for Forest Farming.

Chi-Square (p-value)	# of Observations	Nagelkerke R square
99.454	458	.267

Table C.14. Parameter Estimates for Interest in Forest Farming Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-.004	.004	.352	.996
Accumulators	.229	.222	.304	.1257
Lifestyle	.414	.136	.002***	1.512
Location	-.167	.225	.458	.846
Age	-.024	.009	.006***	.976
Education	.025	.045	.585	1.025
Own knowledge Forest Farming	.723	.134	.000***	2.060
Acres in managed timber	.009	.004	.038	1.009
Advice from farmers	.365	.307	.235	1.440
Advice from Conservation Professionals	.367	.295	.213	1.443
Advice from Forestry Professionals	.606	.299	.043	1.833
Type of respondent	1.087	.286	.000***	2.967

*significant at α =.10, **significant at α =.05, ***significant at α =.01

Table C.15. Empirical Model Predictive Power for the Dependent Variable Interest in Forest Farming.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	255	34	88.2	
	Interested	90	78	46.4	72.9

Appendix D. Alternate Logistic Regression Models using Various Physical Variables

Riparian Buffers

All three attitudinal variables were included in the second model for riparian buffers. The variables chosen to represent these attitudes were conservatives; percent of total income from farm income, accumulators; were they aware of timber markets in their area, and lifestyle; did they see the loss of trees as a problem on their farm. With this changed variable, only conservative attitudes were significant in the model. Those with the conservative attitude were less likely to be interested in riparian buffers, but only slightly as the change in odds is very close to one (.987). This means that those with the conservative attitude are one percent less likely to be interested in riparian buffers. Although small, this result was expected as conservatives are not willing to go outside their field of farming. The accumulator attitude was not significant in the model.

Although the lifestyle attitude was changed and not significant, the physical variable of stream bank erosion as a problem on your farm was highly significant. If the respondent saw stream bank erosion as a problem, they were 1.7 times as likely to be interested in riparian buffers.

Table D.1. Empirical Model Summary for Riparian Buffers

Chi-Square (p-value)	# of Observations	Nagelkerke R square
84.119	460	.228

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

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-.013	.004	.000***	.987
Accumulators	-.157	.220	.476	.855
Lifestyle	.088	.136	.518	1.092
Location	-.050	.227	.826	.951
Age	-.011	.008	.183	.989
Education	.067	.046	.142	1.069
Own knowledge Riparian Buffers	.604	.116	.000***	1.830
Stream bank erosion a problem	.526	.123	.000***	1.692
Advice from farmers	-.275	.305	.366	.759
Advice from Conservation Professionals	.237	.283	.402	1.268
Advice from Forestry Professionals	.011	.297	.969	1.011

*significant at α =.10
**significant at α =.05
***significant at α =.01

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

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	242	44	84.6	
	Interested	99	75	43.1	68.9

Silvopasture

Interest in silvopasture was analyzed by running another regression with a change in the physical characteristic of land available for silvopasture. Instead of using acres in unmanaged timber, acres in managed timber was used. All three attitudinal variables were included in the second model for silvopasture. The variables chosen to represent these attitudes were conservatives; percent of total income from farm income, accumulators; were they aware of timber markets in their area, and lifestyle; did they see the loss of trees as a problem on their farm. Similar to the original model, both conservatives and lifestyle attitudes were significant in the model. This only noticeable change this caused in the results was that managed timber was not significant. The other variables remained very similar in significance and coefficients. This is interesting as those who already manage their timber may not be willing to put cattle into the mix. They see their timber as something they are managing for profit and do not want that profit to be compromised by livestock.

Table D.4. Empirical Model Summary for Silvopasture

Chi-Square (p-value)	# of Observations	Nagelkerke R square
55.19	460	.159

Table D.5. Parameter Estimates for Interest in Silvopasture Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-.012	.003	.000***	.988
Accumulators	.258	.221	.242	1.295
Lifestyle	.316	.131	.016**	1.371
Location	-.304	.225	.176	.738
Age	-.006	.008	.451	.994
Education	.095	.045	.035**	1.100
Own knowledge Silvopasture	.550	.125	.000***	1.734
Acres in managed timber	.000	.002	.864	1.000
Advice from farmers	.145	.305	.634	1.156
Advice from Conservation Professionals	.339	.283	.231	1.403
Advice from Forestry Professionals	-.111	.307	.717	.895

*significant at α =.10
**significant at α =.05
***significant at α =.01

Table D.6. Empirical Model Predictive Power for the Dependent Variable Interest in Silvopasture.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	300	19	94	
	Interested	107	34	24.1	72.6

Forest Farming

Interest in forest farming was analyzed by running another regression with a change in the physical characteristic of land available for forest farming. Instead of using acres in managed timber, acres in unmanaged timber was used. All three attitudinal variables were included in the model for forest farming. The variables chosen to represent these attitudes were conservatives; percent of total income from farm income, accumulators; were they aware of timber markets in their area, and lifestyle; did they see the loss of trees as a problem on their farm. Both conservatives and lifestyle attitudes were significant in the model. The only noticeable change this caused in the results was that unmanaged timber was not significant. The other variables remained similar in significance and coefficients. Those respondents who have timber, but do not manage it already are less likely to be interested in forest farming as an alternative farming practice, but those that already manage their timber may see forest farming as a way to obtain an income while waiting on the trees to reach maturity.

Table D.7. Empirical Model Summary for Forest Farming

Chi-Square (p-value)	# of Observations	Nagelkerke R square
73.539	458	.203

Table D.8. Parameter Estimates for Interest in Forest Farming Logistic Regression Model.

Variables	Regression Coefficient	Standard Error	P-Value (Sig.)	Change in Odds
Conservatives	-.012	.003	.000***	.988
Accumulators	.262	.215	.225	1.299
Lifestyle	.357	.130	.006***	1.429
Location	-.052	.221	.813	.949
Age	-.017	.008	.038**	.983
Education	.015	.044	.738	1.015
Own knowledge Forest Farming	.691	.128	.000***	1.996
Acres in unmanaged timber	.002	.002	.199	1.002
Advice from farmers	.356	.298	.232	1.428
Advice from Conservation Professionals	.404	.285	.157	1.498
Advice from Forestry Professionals	.613	.289	.034**	1.846

*significant at α =.10
**significant at α =.05
***significant at α =.01

Table D.9. Empirical Model Predictive Power for the Dependent Variable Interest in Forest Farming.

		Predicted			
		Uninterested	Interested	% Correct	% Overall Correct
Observed	Uninterested	255	35	87.9	
	Interested	100	68	40.5	70.5