Financial agents, water quality and riparian forest buffers

Matthew Joseph Brewer

Iowa State University

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Financial agents, water quality and riparian forest buffers

by

Matthew Joseph Brewer

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

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Program of Study Committee:
Joe P. Colletti (Major Professor)
Matthew Potoski
Richard C. Schultz

Iowa State University
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2002

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This is to certify that the master’s thesis of

Matthew Joseph Brewer

has met the thesis requirements of Iowa State University

Signatures have been redacted for privacy
I wish to dedicate this thesis to my family, whose love and support seems to have no boundaries.
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ABSTRACT

Surface water in the Midwest has high levels of nonpoint source pollution, which can be decreased by riparian forest buffers. In an effort to investigate the attitudes of financial professionals (bankers, land appraisers, realtors, etc.) regarding water quality and riparian buffers, a mail-out survey was conducted in 2001 in the Mark Twain Lake watershed in Northeast Missouri. The survey was preceded by a focus group, and followed by a series of contacts to increase response rate. Results suggest that riparian buffer knowledge is fairly low (mean of 2.66, with 1 being Very Low and 5 being Very High). Most professionals do not discuss buffers with landowner-clients when considering options for improving soil conservation and water quality (68% never discuss buffers). Survey participants are concerned about water quality, and want an increase from 6.17 currently to 7.41 as the acceptable level, on a ten-point scale. On average, they are willing to pay US$6.50 per month for the improvement. Buffers are considered an asset overall by 90%, when considering market and non-market (conservation) benefits and government assistance. When market (financial) benefits exclusively are considered, only 46% think that buffers are a net asset. The Spearman Rank Correlation method indicated a linear association between the professionals’ knowledge level of buffers and the frequency with which they discuss buffers with clients ($r_s=0.49$). Proliferation of buffers in Northeast Missouri seems to be limited by the lack of perceived financial value of buffers and the relatively low level of knowledge of buffers. Considering policy implications, three main conclusions can be drawn from the study. First, the professionals surveyed would like to see government involvement in funding buffers. Second, the professionals’ relatively low knowledge level of buffers
seems to be associated with their disinterest in discussing buffers with clients. Finally, the professionals surveyed seem to perceive the main problem with buffers as financial. Given this, if related legislation (i.e. Conservation Reserve Program) is more flexible in the future in allowing added financial gains for the landowner (i.e. harvesting provisions), it would certainly be more appealing to business-minded financial professionals.
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CHAPTER 1. INTRODUCTION

Introduction

As the population on Earth continues to grow, the available natural resources will become scarcer. In the context of this scenario, the outlook for continued human success depends, in part, on our ability to manage those available resources in a way that is sustainable. On a global scale, and specifically in the Midwest United States, water quality and sound agricultural practices promise to be of importance. In fact, according to an April, 2001 Gallup Poll, "pollution of drinking water tops Americans' list of specific environmental concerns", with about two of every three Americans (64%) indicating that they worry a great deal about the problem (Gallup Poll, 2001, p. 2). Much of the Midwest is dominated by row-crop agriculture, and sustaining this land use depends upon how seamlessly agriculture can co-exist with its surrounding landscape and yield desired agricultural and environmental outputs such as water quality and quantity.

A research project that is addressing one option for improving water quality, through the use of riparian buffers, is located in the Mark Twain Lake watershed in Northeast Missouri. The project is being conducted by researchers at Iowa State University and the University of Missouri. It is investigating both the biological aspects and functions of the riparian zone, as well as the socio-economic interactions involved with buffers, focusing on the role of financial professionals. This paper describes the portion of the larger project that is involved with the social and economic aspects of buffers. The research project focuses on part of the larger issues associated with people, the environment, natural resources and the related social and economic interactions. It is hypothesized that many of the decisions
involving natural resources in this project are based upon factors unrelated to the environment. Similarly, it can be argued that much of the decision-making involving issues related to natural resources nationally and internationally is tied to outside factors, including economic influences, property rights, land use, and political considerations.

Given the current water quality problems, and the positive effects of conservation practices such as riparian buffers in reducing those problems (Lowrance et al., 1984; Schultz et al., 2000; Lyons et al., 2000), one might question the reasons for the relatively minimal use of buffers in an agricultural setting. This project examines some of the possible causes of this hesitance, by investigating the perceptions of financial professionals whom, it is hypothesized, are directly or indirectly involved in landowner decision-making. It is hoped that this research will provide information that will help describe the factors inter-related with optimal use of natural resources, which motivate private decisions affecting those resources. Furthermore, it is hoped that an awareness of the outside influences involving natural resources will be considered by policymakers and will be helpful when making decisions on the national and international level.

Hypothesis

The goal of the Mark Twain Lake study is to answer several questions related to the hypothesis that the decision to use conservation practices in agriculture is substantially influenced by financial agents – people who influence the landowner in various ways. Furthermore, the adoption and integration of conservation practices with agricultural practices is, in large part, dependent on their acceptance and valuation by the landowner. And, that the landowner considers financial incentives, good stewardship practices, or other socio-economic factors.
The Current Situation

Despite the research efforts to date that are focused on conservation in the agricultural setting, the concentration of nonpoint source (NPS) pollutants in many water bodies continues to be higher than most would like. According to Schultz et al. (1995, p. 202), “soil sediment eroded from cropland contributes about 1.4 billion Mg annually to our (nation’s) waterways”. NPS pollutants such as nutrients, which often originate in croplands, also contribute to the deterioration of water bodies (Peterjohn and Correll, 1984). The problem is compounded as the pollutants make their way downstream to areas such as the lower Mississippi River or the Chesapeake Bay. The added nutrients have worsened the problem of eutrophication, creating a hypoxic aquatic environment that is generally less suitable for plant and animal populations (Jacobs and Gilliam, 1985; Woltemade, 2000).

Many factors contribute to high NPS pollutant levels, including runoff and leaching from agricultural areas (i.e. sediment, nutrients, and chemicals), altered hydrology (such as field tile drainage systems) and runoff from urban areas (Schultz et al., 2000). As indicated by Lyons et al. (2000) in a discussion of the comparative benefits of woody vegetation and grasses in the riparian zone, one technique shown to reduce the amount of NPS pollutants entering stream channels is the restoration or installation of riparian buffers. Evidence also suggests that buffers are a cost-effective and economically valuable tool for reducing NPS pollutants on the watershed level (Lowrance et al., 1985; Qiu and Prato, 1998). However, as was the case with a voluntary program designed to reduce NPS pollution in Wisconsin, achieving the participation level necessary to improve water quality is a major obstacle (Wolf, 1995).
 Paramount to increasing the use of “best” soil and water conservation practices, including riparian buffers, there must be acceptance of, enthusiasm for, and valuation of their role/function in the modern agricultural landscape. Voluntary action by citizens, in this case farmers or rural landowners, to improve water quality is more preferred than government-directed measures. Adequate knowledge of the functions of riparian buffers as related to soil conservation and water quality is a key factor in the voluntary decisions and actions by landowners. This is supported by Bergstrom et al. (1990), who assert that information seems to have a strong impact on an individual’s valuation of an environmental commodity. Taken a step further, it can be hypothesized that a more complete understanding by those involved with landowner decision-making regarding ways to optimize both agricultural and environmental benefits can impact the prevalence of riparian buffers in the Midwestern agroecosystem. For this reason, it is important to know the attitudes, opinions and values of those individuals involved in financial decisions with respect to restoring and installing buffers. A key part of the voluntary decision process of attaining agricultural production and environmental goals is whether financial agents, who assist landowners with land use decisions, believe that riparian buffers are an asset or a liability, economically or otherwise.

 Much research has been done in recent years demonstrating the benefits of riparian buffers. However, if buffers are to become more common, there remains a need for more assessments of the social and economic practicality, feasibility, and enthusiasm by landowners and influential parties for improving both water and soil conservation via riparian buffers. The results from this research will fill some of the gaps in knowledge relating to land use decisions and increase the number of miles of primarily low-order (small) streams protected by riparian buffers, as well as other soil and water conservation practices.
Thesis Organization

This paper is organized as follows. Chapter One is a series of foundation sections. It introduces riparian buffers from the perspective of the associated ecological characteristics and functions. In addition, the positive and negative aspects of buffers are explained, considering both financial and non-market impacts. Next, this study is compared to its predecessor, a similar analysis of the Bear Creek watershed in Story County, Iowa. Third, a series of research questions used in the study’s survey instrument are presented, helping to refine the goals of the project (see Appendix A for entire survey).

The next chapter (2) is an article to be submitted to the Journal of Soil and Water Conservation. The article includes a discussion of the methodology used in the Mark Twain Lake study, as well as a presentation of the results of the survey responses. Chapter Three is an article to be submitted to the Society and Natural Resources Journal. Following the article are additional results (Chapter Four), omitted from the proposed journal articles due to space limitations. Finally (Chapter Five), conclusions and some thoughts on the usefulness of the project and possible future projects are offered.

Literature Review

Riparian Forest Buffers. Riparian areas have been described in many ways. They are usually thought to consist of the floodplain of a stream or river and the adjacent hillslope transitioning to an upland area (Lowrance et al., 1985; Schultz et al., 2000). Also included are associated wetlands and other landscape features characteristic to perennial or intermittent water channels (Palone and Todd, 1997). According to Schultz et al. (2000, p. 190), a riparian area has the following characteristics: “(i) is adjacent to a body of water; (ii) has no clearly defined boundaries; (iii) is a transition between aquatic and upland
environments, and (iv) is (curvi) linear in nature.” So, a riparian area can vary in its exact characteristics, but it is located on the landscape between the channel and the upland.

A riparian forest typically consists of a mixture of trees, shrubs and grasses. While riparian forests exist naturally, in the Midwest many millions of acres have been removed in favor of some other land use, and must be reconstructed (Schultz et al., 1997). A reconstructed riparian buffer consists of 60- to 180-ft. (18 to 55 m) wide buffers planted to trees, shrubs and perennial warm-season prairie grasses and forbs (Schultz et al., 1997). Also, a buffer can include “…streambanks stabilized by willow and shrub plantings, and small, constructed wetlands to capture tile flow from agricultural fields.” (Schultz et al., 1997, p. 3). Typically, a waterway is buffered by trees, shrubs and grasses, in that order. On the other side of the warm-season grasses is the upland terrain, often a crop field in the Midwest. The combination of warm-season grasses and woody vegetation is a mixture that offers a lot of advantages, such as sediment trapping, transformation of nutrients (via such processes as plant use, denitrification and microbial activity) and pesticides (through being detained and decaying), and aesthetics/wildlife benefits (Daniels and Gilliam, 1996; Lee et al., 1999). In cases where bank erosion is a serious problem, bioengineering (i.e. Willow (Salix sp.) plantings, bank armoring, etc.) can also offer the added benefit of bank stabilization (Schultz et al., 2000).

The effects of riparian buffers on local hydrology, vegetation, wildlife, and other components of the ecosystem have been explained reasonably well. The riparian forest buffer model described in Schultz et al. (1997) and Lee et al. (1999) provides many benefits, both locally (in the vicinity of the buffer) and at the watershed level (collectively). One benefit is improving water quality by having the ability to act as a filter. Sediment, nutrients
(primarily nitrogen (N) and phosphorus (P)) and chemicals originating in agricultural fields are deposited as the buffer slows the flow of runoff following a precipitation event (Cooper et al., 1987). The NPS pollutants are able to drop out of suspension and/or infiltrate into the soil surface as the water is slowed, and are either used or stored in the buffer’s soil and vegetation. As much as 85-95% of sediment, 68-92% of N, and 70-81% of P may be removed when using a 17 m wide buffer (Peterjohn and Correll, 1984; Palone and Todd, 1997; Lee et al., 2000). Uusi-Kamppa et al. (2000) found that P retention by buffers covers a wide range (27-97%). The importance of this, according to Lowrance et al. (1984), is that the ability of the riparian ecosystem to take up and remove nutrients is essential to maintaining good water quality in an agricultural watershed.

In addition to reducing pollutants, the slowing of overland flow provided by the buffer facilitates infiltration. This increases groundwater supplies and baseflow to the stream in times of little precipitation, and decreases the amount of water available to contribute to flooding following storm events. As one might expect, benefits can be increased with a widening of the buffer, since infiltration and NPS trapping efficiency increase as well (Lee et al., 2000).

In addition to plantings of trees, shrubs and grasses, constructed and/or restored wetlands also serve a useful purpose in the Midwest. The policies of the federal government in the mid-19th century pursued an agenda of draining wetlands (Heimlich et al., 1997). Despite significant changes towards conservation since that time, much land (greater than 35% in many areas) in the Midwest continues to be drained (Burkart et al., 1994). One consequence of the widespread draining of these agricultural lands has been increased nutrient loads in surface waters. Surface runoff (carrying a high level of nutrients) is
commonly drained artificially, primarily through the use of field tiles and drainage ditches (Woltemade, 2000). This water often drains directly into streams and other surface waters, depositing the suspended nutrients. By routing this water through restored or constructed wetlands, where some of the nutrients (those adsorbed to sediment) may be stored as they settle to the bottom, used by plants, or removed by denitrification, nutrient levels can be reduced before entering streams and rivers (Woltemade, 2000). In addition, these wetlands can play a large role in lessening the effect of flooding following major precipitation events by providing added storage and dissipating some of the energy of surface water and runoff (De Laney, 1995). Where wetlands, preferably buffered by vegetation as well, can be integrated into the riparian area, many benefits can be added.

Other benefits of riparian forest buffers (and wetlands) include improved wildlife habitat for both terrestrial and aquatic species. The return or continuation of natural processes such as stream meandering and the presence of large woody debris are additional benefits. Also, a variety of wood, fiber and biomass products may be harvested from the buffer area to sustain proper functioning conditions for increasing nutrient uptake, as well as creating an added economic reward for the landowner. Financial benefits also can come from government programs (such as the Conservation Reserve Program (CRP)) (USDA Farm Service Agency, 1999) and from increased recreational opportunities. Carbon sequestration is also increased with the presence of riparian forest buffers (Schultz et al., 2000). In addition to the main benefits, primarily related to water quality and soil conservation, there are many ancillary benefits of buffer zones, including aesthetic value and improved hunting and fishing.
Negative aspects of installing riparian forest buffers can also be expected. For instance, cropland is taken out of production when a buffer is installed, possibly reducing net income (however, flooding often damages or destroys stream-side crops two or three years out of five). Also, there are costs associated with installing and maintaining a buffer. However, these costs for the landowner can often be offset (at least partially) through enrollment in government programs, non-governmental cost-sharing programs from conservation organizations such as Pheasants Forever, income from future harvesting, and the sale of hunting rights.

One obstacle to widespread use of riparian forest buffers is the perception by the landowner that he/she incurs the costs, whereas the benefits flow downstream and accrue to someone else. Another hurdle is having the knowledge necessary for a landowner to be interested in pursuing the establishment and maintenance of buffers on his/her land. A certain level of expertise concerning the biology, economics, government assistance and such, is needed for a landowner to evaluate the value of buffers. Without this knowledge, buffers can appear intimidating and too risky. These impediments will have to be addressed if buffers are to become a common conservation practice, part of the suite of best management practices.

There are many cost-sharing programs sponsored by different levels of the government (as well as by some non-governmental organizations) that are important to the decision to adopt riparian forest buffers. A major federal program is the Conservation Reserve Program (CRP). Administered by the U.S. Department of Agriculture, the CRP focuses on protecting highly erodible and environmentally sensitive lands. Landowners are paid incentives for removing these lands from crop production or grazing by establishing
long-term cover (Forster, 2000). The program provides a cost-share for landowners of up to 90% of the cost of establishing the approved conservation measure, up to 120% of the local rental rate annually, a signing bonus of $10/ac for each year of the contract, and other qualified incentives (USDA Farm Service Agency, 1999; Iowa State University, 2002). This can effectively eliminate the landowner's installation costs. In addition, the Conservation Reserve Enhancement Program (CREP), a recent development of the CRP, is also based on incentives and, though on a more limited scale, focuses on priority areas such as installing riparian forest buffers and wetlands (USDA Farm Service Agency, 2000; Nakao and Sohngen, 2000).

Other important programs include the Environmental Quality Incentive Program (EQIP), which provides a variety of assistance to landowners who face serious threats to the natural resources on their land, encouraging the use of sound conservation practices (Forster, 2000). Also, the Wetland Reserve Program (WRP) encourages long-term (minimum 10-year contract) restoration of certain wetland areas (Forster, 2000). The importance of government incentives should not be overlooked. In their survey, Johnson et al. (1997) found that the majority of responding landowners were willing to adjust their land-use practices in exchange for compensation on their federal taxes. Similarly, Kline et al. (2000) found that nonindustrial private forest (NIPF) owners expressed a willingness to forego timber harvesting in exchange for a range of incentive payments. Royer and Moulton (1987) also concluded that tax incentives and cost-sharing can influence decision-making by NIPF landowners, in this case in the decision to reforest their land following a harvest. And, in evaluating the Conservation Reserve Program, Plantinga et al. (2001) quantified the level of incentive necessary to encourage landowners in different regions of the country to enroll in
the program. Like the previous examples, this study also found that incentives are effective, but vary in the amount required to be paid due to differing opportunity costs for landowners. In each example, however, government incentives would influence landowner decision-making.

In addition, Dosskey (1998) argues that for riparian buffers to be used on a broad scale, thereby benefiting both private landowners and the public interest, compromises should be made. In other words, the specifications for the composition of buffers, as outlined above, should not be so rigid as to dissuade landowners from adopting the practice. He notes that the landowner may have to adopt a buffer strategy that does not satisfy all of his/her business goals, in order to receive government assistance. Government agencies would follow similar protocol, giving up some degree of the potential benefits in order to increase participation rates. In this way, private individuals may be more willing to adopt riparian forest buffers, optimizing “attainment of both public and private goals” (Dosskey, 1998, p. 431). It is certainly worth noting that compromise may be the best method of achieving an increase in the presence of riparian forest buffers.

**Bear Creek and Mark Twain Lake Watersheds.** During the last decade, the Bear Creek watershed in Story County, Iowa has been a study site for gauging the effects of restored or reestablished riparian vegetation on the surrounding ecosystem (Colletti et al., 1993; Schultz et al., 1995; Schultz et al., 1997; and Schultz et al., 2000). Not only is Bear Creek a research site for studying the ecological functioning of riparian forest buffers, including the benefits listed above, but several surveys have been done to measure the social and economic facets of converting land currently in crop or pasture to a buffer (Colletti et al.,
The 2001 Mark Twain Lake study was structured in a similar fashion as the 1993 Bear Creek study, which will allow for some comparisons of the results.

The Bear Creek study found that there was a good knowledge base concerning the origin of NPS pollution. However, those respondents residing in the local town (Roland, IA) felt the main source of the pollution was from agricultural activities, while the participating farmers viewed the municipality as a major contributor. Overall, water quality was deemed to be about a 6 on a 10-point rating scale, with a 10 being the best water quality ("water quality ladder" amended from Mitchell and Carson (1989)). Respondents felt that water quality should be improved to an 8.0. In terms of a willingness to pay for the desired, improved water quality, the study found that the mean for all respondents was US$4.08 per month. Regarding riparian forest buffers, participants felt that they should play a large role along with other conservation measures in improving water quality (Colletti et al., 1993). There are many parallels between the Bear Creek and the Mark Twain Lake studies, in the approach and the structure of the surveys, and the hope is that future research can continue to compare the two watersheds, both over time and geographically.

Another study, conducted in Georgia in 1991, also examined similar aspects of water quality by using a mail-out questionnaire (Jordan and Elnagheeb, 1993). The survey of Georgia residents indicated that 27% of those respondents using public water sources felt that the quality of their drinking water was "poor", and an additional 23% were "uncertain" about the water quality. In addition, the median (rather than the mean, as in the Bear Creek study) willingness to pay for improved drinking water was US$5.49 for those with public sources, and US$7.38 for those using private wells, per month (Jordan and Elnagheeb, 1993). As
with Bear Creek, there were concerns regarding the quality of drinking water, and an increased willingness to pay for improvements.

**Research Questions**

This paper reports the results of a survey that was conducted in the Mark Twain Lake watershed, located in Northeast Missouri. The project was a study of the social and economic aspects of riparian forest buffers from the perspective of financial decision-makers. The goals include: 1) measuring the opinions of financial professionals in the Mark Twain Lake watershed area with respect to the worth placed on buffers, and 2) providing additional awareness (via information in a mail-out survey) of buffers in the Mark Twain Lake watershed.

As mentioned above, the stated hypothesis for the study is that financial agents substantially influence the decisions by landowners to use conservation practices in agriculture. In an attempt to investigate the hypothesis, several questions became the focus of the study. First, the question of the degree to which financial agents value clean water is pursued. This is measured via questions related to a person’s *willingness to pay* for clean water. Second, the question of what the current level of water quality is, and whether this is acceptable is asked of respondents. To complement this question, for those who do not think water quality is currently excellent, the origin of the pollution was probed. It is hoped that these questions will provide insight into the degree to which financial agents identify with and take responsibility for water quality.

A third research question relates to the knowledge level of respondents concerning riparian forest buffers. In addition, the level of use and frequency with which riparian forest buffers are discussed between financial agents and their clients is probed. Most importantly,
however, are a series of questions related to the value placed on buffers, from the perspective of buffers as both a conservation measure and a financial investment. Several questions attempt to assess the asset or liability characteristics of riparian forest buffers. This is considered from the point of view of both the effect of buffers on land value, as well as when payments from a program such as the Conservation Reserve Program are considered. In addition, the ideal level of government involvement in improving water quality and cost-sharing of buffers is investigated.

Finally, conservation and social values are assessed through questions concerning the respondent’s involvement in community organizations that have as a goal improving the surrounding environment, specifically local water bodies. The two areas investigated are whether the participant currently volunteers with a group in activities designed to clean the water, and whether the person would be willing to take part in these activities in the future. It is with these research questions that a mail-out survey was designed.
CHAPTER 2. FINANCIAL AGENTS, WATER QUALITY AND RIPARIAN FOREST BUFFERS

A paper to be submitted to the Journal of Soil and Water Conservation

Matthew J. Brewer,\(^1,2\) Joe P. Colletti,\(^3\) and Richard C. Schultz\(^4\)

Abstract

The results of a 2001 mail-out survey of financial professionals (i.e. bankers, land appraisers, realtors, farm managers, and land assessors) in Northeast Missouri in the Mark Twain Lake watershed suggest that the knowledge level concerning riparian forest buffers is fairly low (mean of 2.66, with 1 being Very Low and 5 being Very High). Most professionals do not discuss buffers with landowner-clients in considering the various options available for improving soil conservation and water quality (68\% Never discuss buffers). Participants are concerned about water quality in the watershed (want an increase from 6.17 currently to 7.41 as the acceptable level, on a ten-point scale), and are willing to pay for the improvement (mean of US$6.50 per person per month). Also, buffers are considered a net asset by 90\% of respondents when considering market and non-market (conservation) benefits and government assistance. However, when market (financial) benefits exclusively are considered, only 46\% think that the buffer is a net asset. Using the Spearman Rank Correlation method, a linear association was identified between the financial professionals’ knowledge level of buffers and the frequency with which they discuss buffers with clients.

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\(^1\) Graduate student, Department of Forestry, Iowa State University, 253 Bessey Hall, Ames, IA 50011-1021
\(^2\) Co-researcher and primary author
\(^3\) Associate Professor, Department of Forestry, Iowa State University
\(^4\) Professor, Department of Forestry, Iowa State University
(r_s=0.49). The lack of perceived financial value associated with riparian forest buffers by professionals and the relatively low level of knowledge suggest a limiting influence on the proliferation of riparian forest buffers in Northeast Missouri.

**Keywords:** Agroforestry, land stewardship, conservation values, riparian forest buffers, financial agents, adoption, willingness to pay, decision-makers, water quality

**Introduction**

As the population on Earth continues to grow, the available natural resources will become scarcer. In the context of this scenario, the outlook for continued human success depends, in part, on our ability to manage those available resources in a way that is sustainable. On a global scale, and more specifically in the Midwest United States, sustaining water quality and agricultural production promise to be important issues. In fact, according to an April 2001 Gallup Poll, “pollution of drinking water tops Americans’ list of specific environmental concerns”, with about two of every three Americans (64%) indicating that they worry a great deal about the problem (Gallup Poll, 2001). In the Midwest, the dominant land use is row-crop agriculture. Given this, the compatibility of agriculture, the environment, and communities will be essential.

This research project explored the interactions among financial professionals, landowner clients, and riparian forest buffers as conservation practices to sustain water quality and land use, including agricultural production. Many of the decisions involving natural resources, made by agricultural landowners, are based mostly upon factors related to financial gains and less so on the environment (Pampel and van Es, 1977). Similarly, much of the decision-making involving issues related to natural resources nationally and internationally is tied to factors unrelated to ecology, including economics, property rights,
land use, and political considerations. This research will hopefully provide information that will help describe the factors influencing decisions involving the sustainable use of natural resources. Furthermore, an awareness of the environmental benefits and costs involving natural resources will hopefully be considered and helpful when making decisions on a larger scale, such as on the national and international level.

Despite application of best management practices on soil and water conservation in the agricultural landscape, agricultural production and rural land use continue to cause concentrations of nonpoint source (NPS) pollutants to be higher than most would like in many water bodies. According to Schultz et al. (1995), “soil sediment eroded from cropland contributes about 1.4 billion Mg annually to our (nation’s) waterways”. The problem is compounded as the pollutants make their way downstream to areas such as the lower Mississippi River or the Chesapeake Bay. The added nutrients originating from agriculture are linked to the hypoxia problem, and have helped to create aquatic environments that are generally less suitable for plant and animal populations (Woltemade, 2000). Many factors contribute to high NPS pollutant levels, including runoff and leaching from agricultural fields (i.e. sediment, nutrients, and chemicals), altered hydrology (such as field tile drainage systems and dredge ditches) and runoff from urban areas (Schultz et al., 2000). As Lyons et al. (2000) said in discussing the comparative benefits of woody vegetation and grasses in the riparian zone, one technique shown to reduce the amount of NPS pollutants entering stream channels is the restoration or installation of riparian forest buffers.

Paramount to increasing the use of sound soil and water conservation practices is the acceptance of and enthusiasm for their roles/functions and valuation in the modern agricultural landscape (Christensen and Norris, 1983). Voluntary action by farmers or rural
landowners is preferred to government-directed measures to improve water quality. Bergstrom et al. (1990) assert that information seems to have a strong impact on an individual’s valuation of an environmental commodity. Taken a step further, it can be hypothesized that more complete education of those influencing private landowner decisions (such as financial professionals) involving the function, adoption, and valuation of riparian forest buffers, which may or may not also involve financial lending, can impact the use of riparian forest buffers. As a possible, important source of information for landowners, it is important to know the attitudes, opinions and values of financial professionals involved in decisions with respect to restoring and installing buffers. A key part of the voluntary decision process is if financial agents, such as bankers, realtors, land assessors, land appraisers, farm managers, land surveyors, etc., who assist landowners with land use decisions, believe that riparian forest buffers are a net asset or a liability, and act on that belief through professional contacts with landowners. And, based on a review of the literature, a survey of the perceptions of financial professionals regarding water quality and riparian forest buffers seems to be unique.

Riparian Forest Buffers

Riparian areas affect the local hydrology, vegetation, wildlife, and other components of the ecosystem. They are the floodplain of a stream or river and the adjacent hillslope transitioning to an upland area (Lowrance et al., 1985; Schultz et al., 2000). Also included are associated wetlands and other landscape features characteristic of perennial or intermittent water channels (Palone and Todd, 1997). A riparian area can vary in its exact characteristics, but it is located on the landscape between the stream channel and the upland. A riparian forest can consist of a mixture of trees, shrubs and grasses.
While riparian forests, prairies and wetlands exist naturally, in the Midwest many millions of acres have been removed in favor of some other land use, and must be reconstructed (Schultz et al., 1997). Reconstructed buffers also can include “...small, constructed wetlands to capture tile flow from agricultural fields.” (Schultz et al., 1997). Riparian forest buffers, described in Schultz et al. (1997) and Lee et al. (1999), provide important functions related to reducing non-point source pollutants. Likewise, natural or reconstructed wetlands provide similar functions and benefits (De Laney, 1995; Woltemade, 2000). When riparian forest buffers are teaming with wetlands and streambank stabilization techniques, this system provides soil and water conservation benefits both near the buffer system and at the watershed level. Riparian forest buffers in the Midwest can: trap sediment from farm fields (~90%), reduce nutrient inputs to the aquatic system (e.g. nitrate-nitrogen and phosphorus, ~80 to 90%), increase infiltration rates by 5 times over row-cropped or heavily grazed land, increase soil organic carbon (up to 66%), reduce streambank erosion (~80%), and support five times as many bird species as row-cropped or heavily grazed lands (Schultz et al., 1997; Lee et al., 1999; Schultz et al., 2000; Lee et al., 2000).

Also, a variety of fiber and biomass products may be harvested from the buffer area, creating an economic reward for the landowner. Financial benefits also can come from government programs (such as the continuous enrollment Conservation Reserve Program (CRP)) (USDA Farm Service Agency, 1999) and increased recreational opportunities.

Negative aspects of installing riparian forest buffers are also expected. For instance, cropland may be taken out of production when a buffer is installed, possibly reducing income. Also, there are costs associated with installing and maintaining a buffer. These costs can often be offset through enrollment in government programs, especially the
continuous CRP, non-government cost-sharing programs, and income from future harvesting and hunting. One barrier to widespread use of riparian forest buffers is the perception by the landowner that they incur the costs, whereas the benefits flow downstream. Another hurdle is the knowledge necessary for a landowner to establish and maintain riparian forest buffers on his/her land. A certain level of knowledge about the biology, economics, and available government assistance is needed for a landowner to evaluate the value of buffers. Without this knowledge, buffers can seem intimidating and bear too much risk. This notion is supported by Esseks and Kraft (1986), who found that lack of knowledge was a significant obstacle to participation in the CRP.

Dosskey (1998) argues that for riparian forest buffers to be used on a broad scale, private landowners and the public must compromise. The landowner may have to adopt a buffer that does not satisfy all personal goals in order to receive government assistance, and government agencies should follow a similar protocol. The result may be optimizing “attainment of both public and private goals” (Dosskey, 1998).

**Mark Twain Lake Watershed.** This paper focuses on the Mark Twain Lake watershed (located in N.E. Missouri) and a study of the social and economic aspects of riparian forest buffers, from the perspective of financial decision-makers. The goals include measuring a set of attitudes, actions, and values of financial professionals in the Mark Twain Lake watershed area with respect to riparian forest buffers. In addition, it is hoped that the results will be useful in future research investigating the most effective way to encourage use of buffers.

The project generally follows the Fishbein-Ajzen belief-attitudes-behavior model (summarized in Mitchell and Carson, 1989). Actual behavior by a rural landowner to apply
riparian forest buffers depends upon the beliefs of the landowner regarding the consequences of the behavior, and beliefs related to what other people think should be done. In turn, the landowner's attitudes are influenced by beliefs towards riparian forest buffers. The attitudes influence behavior intentions to perform an action (i.e. installing a buffer), which may lead to the action itself, with certain behavioral experiences and context. Given the steps, factors, and implied feedback in the model, it is important to understand the financial professionals that influence landowner beliefs and provide opportunities for client experiences related to riparian forest buffers. Midwestern farmers seem to rely on other farmers and people involved with agriculture, including financial professionals, for information, so perceptions and misconceptions are likely to influence farmers. Landowner beliefs and attitudes related to buffers are based on many things, including financial professionals, leading to a need for a better understanding of the professionals' opinions.

**Bear Creek and Mark Twain Lake Watersheds.** During the last decade, the Bear Creek watershed in Story County, Iowa has been a research and demonstration site for studying the effects of restored riparian forest buffers on the surrounding ecosystems and people (Colletti et al., 1993; Schultz et al., 1995; Schultz et al., 1997; Schultz et al., 2000). A survey was conducted in the Bear Creek watershed to measure the social and economic effects of converting land currently in crop or pasture to a riparian buffer (Colletti et al., 1993). The 2001 Mark Twain Lake study was structured in a similar fashion as the 1993 Bear Creek study, which will allow for some comparisons of the results.

**Methods**

Following the theory that financial agents influence landowner decision-making concerning riparian forest buffers, the Mark Twain Lake survey investigates more thoroughly
the attitudes, values, behaviors, and awareness of the financial agents regarding water quality and buffers. In addition to financial professionals, factors that may influence the landowner's decision to use buffers include landowner (personality) and farm characteristics, knowledge and perception of buffers, economic/financial considerations, non-monetary factors, policy (e.g. government programs), characteristics of the land, and interactions with other farmers (Beedell and Rehman, 2000; Koontz, 2001). The financial professionals may be important “advice structures” (Clark, 1989), affecting the decision to use riparian forest buffers by farmers and rural landowners. The survey was designed to learn more about financial professionals and links with farmers and rural landowners related to riparian forest buffers.

The approach used in assessing the attitudes, opinions, and values (associated with riparian forest buffers) of financial agents in the Mark Twain Lake area included a focus group followed by a mail-out survey. The survey was designed to measure the financial agents’ opinions, perspectives, and level of knowledge of water quality and riparian forest buffers. The project was part of a larger investigation of the riparian zone by researchers from Iowa State University and the University of Missouri.

The Mark Twain Lake is located approximately 200 kilometers (125 miles) northwest of St. Louis, Missouri. The associated watershed covers approximately 600,000 hectares (1.5 million acres) (University of Missouri, 1999), and includes the following major streams: the Elk Fork Salt River, Middle Fork Salt River, North Fork Salt River, South Fork Salt River, and the Otter, Crooked, and Long Branch Creeks. The climate is considered temperate continental, and the dominant topography is level to gently sloping (USDA Natural
Resources Conservation Service, 1995). The primary land use is agricultural, with both row crops and livestock grazing, and there is a mix of rural and urban residents.

The research project consisted of several stages, including: (i) developing the potential participants, (ii) developing the survey instrument, (iii) convening a focus group, (iv) refining the survey instrument, (v) mailing an introductory letter to all of the possible participants, (vi) mailing the survey, (vii) a series of follow-up contacts via mail to those not yet responding (including a reminder postcard and a second copy of the survey), and (viii) contacting possible participants who had not yet returned the survey via telephone. By using a series of follow-up contacts, as demonstrated by Potoski (2001), as well as following the Dillman approach (2000), the response rate was increased to 54%.

Financial professionals are defined as bankers and other lenders, land appraisers, land assessors, realtors and farm managers. Also, to be included in the study the financial professional must work or live in or close to the Mark Twain Lake watershed (see Figure 1). The study boundary was the larger of the watershed boundary plus 16 km (10 miles) or a distance of 64 km (40 miles) from Mark Twain Lake. Several financial professionals from Columbia, MO, known to do business in the watershed, were randomly included.

The list of financial professionals was developed using a combination of resources, including county plat books, multiple online business listings (yellow pages), business advertisements, and personal communication with university and governmental agricultural personnel in northeast Missouri.
In March, 2001, a focus group was convened in Stoutsville, MO. The purpose was to get formative input from financial professionals regarding soil and water conservation concerns in general, and ways to improve the draft survey instrument.

The survey instrument has four sections: (i) water quality, (ii) riparian forest buffers, (iii) community volunteerism, and (iv) demographics. In section one, surface water quality in the Mark Twain Lake watershed was examined from the perspective of what the respondent thinks it is currently and the respondents' acceptable level of water quality. This was rated using a ten-point water quality ladder with "0" being identified as *Unfit for Any*
Use, and "10" being the Best Water Quality (Mitchell and Carson, 1989). Respondents were asked to rank various possible pollution sources on a scale of one to five (one being identified as Not a Source of Pollution, and incrementally working towards a Major Source of Pollution, noted as a five). Participants were asked to indicate their value of improving water quality. Willingness to pay is a hypothetical tool used to gauge the importance, in dollars, of an entity (Mitchell and Carson, 1989). A closed-ended and open-ended approach was used.

**Statistical Analysis.** The statistical analyses of the data were performed utilizing the SPSS computer program (SPSS, 1999). The analyses covered univariate statistics, a comparison of the means between different occupations, and simple correlations between various response variables. One-way ANOVA was used for comparing the means between occupations, and the Spearman Rank Correlation method was used in testing response variables for correlations.

**Results and Discussion**

In June, 2001, surveys were sent to the original 219 possible participants. Several were eliminated because they were duplicates, no longer in business, and not involved with farmers/rural landowners, leaving 183 financial professionals as possible participants. Following Dillman (2000), multiple follow-up contacts were made. The response rate was about 54% (99 surveys returned). The compliance rate, consisting of the response rate but with the exclusion of companies that cannot be located (3), was about 55%. In these cases, the survey was not returned as "undeliverable", but no follow up contact was possible (i.e.

---

5 Because of the relatively small sample size (n=99), the standard error of the means was adjusted for the Finite Population Correction (Philip Dixon, Iowa State University Statistics Department, 2002, personal communication; Hayek and Buzas, 1997).
phone number out of service), indicating the company may have been operational at the time of the initial mailing, but had since gone out of business.

**Focus Group.** The focus group presented these ideas related to conservation activities and water quality. They desired limited government interference, but indicated that funding from the federal government would be acceptable. Conservation actions that might increase taxes were not welcomed. In short, the focus group expressed the view that soil and water conservation actions were important and desired in the watershed, someone else should pay for them, and interference from government should be minimized.

The group indicated that land use and demographics in the watershed are changing. New residents coming from the St. Louis area are moving into the Mark Twain Lake area. These “newcomers” are purchasing or building expensive homes on small “estates” in the rural areas. The newcomers seem to want and are willing to pay for land with streams and forests. They desire and value aesthetic and recreational assets, and have demonstrated that buffers are valuable.

There was concern about the negative effects on agriculture from the higher land prices being offered by newcomers. Also, there was a very strong desire to have more commercial/industrial development in the Mark Twain Lake watershed. Of all the comments and suggestions made during the focus group, the most intriguing was the notion that potential urban buyers/builders seem to want and value riparian forest buffers.

**Perceived Water Quality.** Respondents felt that the quality of the surface water in the area should be improved, and should provide a wider range of purposes (Table 1). Improving the water quality in the Mark Twain Lake area from 6.2 to 7.4 increased by one-half the number of respondents who thought water was clean enough to drink, and increased
the number thinking it was good enough for recreation by 17%. Improving water quality would have little effect on improving the wildlife/fishing, livestock use, and crop irrigation categories.

Table 1. Percentage of financial professionals indicating the suitable uses of surface water currently and at their acceptable level of water quality. The difference between the two percentages is shown in the column on the right. On a 10-point Water Quality Ladder, mean Current Water Quality was rated a 6.2, and mean Acceptable Water Quality a 7.4.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Current Water Quality</th>
<th>Acceptable Water Quality</th>
<th>Difference Between Current and Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Drinking</td>
<td>28%</td>
<td>41%</td>
<td>13%</td>
</tr>
<tr>
<td>Swimming/Recreation</td>
<td>76%</td>
<td>93%</td>
<td>17%</td>
</tr>
<tr>
<td>Wildlife and Fishing</td>
<td>96%</td>
<td>100%</td>
<td>4%</td>
</tr>
<tr>
<td>Livestock use</td>
<td>98%</td>
<td>100%</td>
<td>2%</td>
</tr>
<tr>
<td>Crop Irrigation</td>
<td>99%</td>
<td>99%</td>
<td>-</td>
</tr>
</tbody>
</table>

A 1991 study in Georgia also found that residents were concerned about their drinking water, with 27% indicating it was of "poor" quality (Jordan and Elnagheeb, 1993). The 1993 Bear Creek study found that farmers, absentee landowners and non-farmers in the watershed cited both farm-based and urban sources of nonpoint source pollution. However, urban respondents thought that the main source of the NPS pollution was from agricultural activities, whereas the farmers viewed the municipality as the major source. Using a water quality ladder, the surface water quality was deemed to be about a 6 on a 10-point rating scale, with a 10 being the best water quality. Most respondents wanted an increase to about 8.0. There were no group differences (Colletti et al., 1993).

The possible water pollution source marked as the greatest concern was soil sediment runoff from farmland, with a mean ranking of 3.5 (Figure 2). One interesting point to note is
the mix of urban and rural sources identified by respondents as important, which was also the case in the 1993 Bear Creek study.

![Graph showing ranking of water pollution sources](image)

Figure 2. Ranking of water pollution sources (Likert scale of 1-5, with 1 not a source and 5 a major source) by financial professionals in the Mark Twain Lake watershed in NE Missouri.

Additional sources of water pollution (typically associated with agriculture) in the Mark Twain Lake watershed were assessed. A five-point Likert scale was used with one indicating *Not Important at All*, and five indicating *Very Important*. Participants stated the importance of reducing each pollutant in improving water quality (Table 2). Again, participants identified both the urban and agricultural landscapes as sources of pollution of surface waters.
Table 2. Importance of reducing certain pollutants in improving water quality, as ranked by financial professionals in the Mark Twain Lake area.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing fecal bacteria</td>
<td>4.1</td>
</tr>
<tr>
<td>Reducing sediment</td>
<td>3.9</td>
</tr>
<tr>
<td>Reducing pesticides</td>
<td>3.9</td>
</tr>
<tr>
<td>Reducing Nitrogen</td>
<td>3.5</td>
</tr>
<tr>
<td>Reducing Phosphorus</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Given that financial professionals desire an improvement in surface water quality (6.2 to a 7.4), they were asked about their “Willingness to Pay” for improved water quality. About 69% of respondents indicated that improved water quality was worth US$5.00 per month. The mean maximum willingness to pay was US$6.50 per month. The range was from US$0.00 to US$50.00 per month. There were no significant differences between bankers and the other occupations (p=0.82). The median response for the maximum willingness to pay was US$5.00 per month. In the 1991 Georgia survey, the median willingness to pay for improved drinking water was in the same range as the Mark Twain Lake study - US$5.49 (for those with public sources) and US$7.38 (for those using private wells) per month (Jordan and Elnagheeb, 1993). The Bear Creek respondents indicated a mean willingness to pay for the desired improved surface water quality of US$4.08 per month. Again, there were no differences among farmers, absentee landowners and non-farmers. Also, the respondents felt that riparian forest buffers can play a large role, along with other conservation measures, in improving water quality in the Bear Creek watershed (Colletti et al., 1993).
Soil Conservation & Stream Zone Practices. A self-rating by participants placed their knowledge level of riparian forest buffers in the low-to-moderate range, averaging 2.7 on a five-point scale (with one indicating a Very Low knowledge level, and five corresponding with Very High). Figure 3 shows the respondent’s knowledge level is skewed towards the left, indicating a relatively low knowledge level.

![Figure 3](image.png)

Figure 3. Self-rating by financial professionals in the Mark Twain Lake watershed of their knowledge level of riparian forest buffers (n=96).

The respondents were asked to indicate whether or not certain possible effects of riparian forest buffers are benefits for a landowner-client (Table 3). Note that financial benefits are ranked on the bottom, though still regarded as a benefit by well over one-half of the financial professionals.
Table 3. Perceived benefits of riparian forest buffers by financial professionals in the Mark Twain Lake watershed.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Percent Agreeing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in soil erosion</td>
<td>97%</td>
</tr>
<tr>
<td>Improved wildlife habitat</td>
<td>92%</td>
</tr>
<tr>
<td>Improved aesthetics</td>
<td>86%</td>
</tr>
<tr>
<td>Income from CRP</td>
<td>81%</td>
</tr>
<tr>
<td>Production of forest products</td>
<td>76%</td>
</tr>
<tr>
<td>Increase in land value</td>
<td>62%</td>
</tr>
</tbody>
</table>

Participants were asked whether or not certain possible effects of buffers are liabilities (Table 4). Respondents cited the top liability as the added cost of maintenance for farmers (61%). It is clear that the participants think a mix of benefits and liabilities exist for riparian forest buffers.

Table 4. Perceived liabilities of riparian forest buffers by financial professionals in the Mark Twain Lake area.

<table>
<thead>
<tr>
<th>Liability</th>
<th>Percent Agreeing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of maintenance</td>
<td>61%</td>
</tr>
<tr>
<td>Interference with field tile flow</td>
<td>44%</td>
</tr>
<tr>
<td>Land taken out of production</td>
<td>38%</td>
</tr>
<tr>
<td>Hassle of working with government in CRP</td>
<td>38%</td>
</tr>
<tr>
<td>Attracts nuisance wildlife</td>
<td>36%</td>
</tr>
<tr>
<td>Increased flooding</td>
<td>33%</td>
</tr>
</tbody>
</table>

Respondents were asked in a progression of questions to indicate if buffers are a net asset or net liability when 1) considering all monetary and non-monetary benefits, 2) only considering financial benefits and government cost sharing, and 3) only considering financial benefits. About 90% of participants indicated that riparian forest buffers overall, considering both monetary and non-monetary benefits, are a net asset. About 70% stated that riparian
forest buffers are a net asset when considered from a financial perspective, including government payments such as from the Continuous Conservation Reserve Program. Only 46% felt that riparian forest buffers are a net asset when strictly financial benefits are considered. There is a strong belief that buffers have net value when considering monetary and non-monetary benefits, but that belief drops significantly when evaluated solely on financial benefits (Figure 4).

![Figure 4. Perception of riparian forest buffers as a net asset or liability by financial professionals in the Mark Twain Lake area.](image)

Despite the fact that riparian forest buffers are viewed positively overall, 68% of the professionals indicated that they “never” discuss buffers with clients (Figure 5). When buffers were discussed with landowner-clients, most communication related to comparing costs and benefits (Table 5). If the financial professionals, who are involved in land use decisions, indeed have a significant influence on landowner decision-making, is it realistic to
expect buffers to become common features of the agricultural landscape if agricultural practices, financing structure, and education efforts (i.e. the status quo) do not change?

Figure 5. Frequency with which financial professionals in the Mark Twain Lake area discuss riparian forest buffers with their clients (n=95).

Table 5. The nature of the discussion between financial agents and clients, and the number of financial agents indicating each (n=21).

<table>
<thead>
<tr>
<th>Nature of Discussion</th>
<th>Number of Financial Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Impact (cost prohibitive to have riparian forest buffers)</td>
<td>3</td>
</tr>
<tr>
<td>Cost vs. Benefits (may include government payments such as CRP), Need for Education</td>
<td>11</td>
</tr>
<tr>
<td>Benefits of soil maintenance and reduced soil loss</td>
<td>2</td>
</tr>
<tr>
<td>Social benefits, Bio-diversity, Watershed protection &amp; wildlife preservation</td>
<td>2</td>
</tr>
<tr>
<td>Negative aspects (loss of crop ground, roots pulling moisture from crops, time required for buffer to grow)</td>
<td>2</td>
</tr>
<tr>
<td>Requirements of enlistment into CRP – not worth the hassle</td>
<td>1</td>
</tr>
</tbody>
</table>
Participants were asked to assign the ideal level of responsibility for funding riparian forest buffers (i.e. establishment and maintenance). Ideally, funding for riparian forest buffers should come from the federal government (41%), followed by the state government (34%), and then the landowner (22%). Others included (3%) non-governmental organizations (NGO’s). The financial professionals view riparian forest buffers as assets and they think that three-quarters of the funding for buffer establishment should come from the public. This is similar to the 1993 Bear Creek study, in which respondents indicated that farmers should be responsible for about 25% of the funding.

**Social Action Plans.** An analysis was also made of the willingness of participants to be involved with the community and contribute to conservation of the natural resources in the area. Only one respondent out of 95 currently volunteers with a group whose activities are based around watershed cleanup. However, more professionals indicated a willingness to participate in these sorts of activities in the future (Table 6). A higher percentage of respondents were willing to participate than in the Bear Creek study.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Financial Professionals Willing to Participate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement with youth groups</td>
<td>48%</td>
</tr>
<tr>
<td>Stocking fish/creating fish habitats</td>
<td>47%</td>
</tr>
<tr>
<td>Planting trees, shrubs and grasses</td>
<td>37%</td>
</tr>
<tr>
<td>Cleaning up debris and trash</td>
<td>36%</td>
</tr>
<tr>
<td>Pesticide container recycling program</td>
<td>34%</td>
</tr>
<tr>
<td>Donating money</td>
<td>28%</td>
</tr>
<tr>
<td>Monitoring water quality</td>
<td>25%</td>
</tr>
<tr>
<td>Team leader</td>
<td>7%</td>
</tr>
</tbody>
</table>
Demographics. The financial professionals are on average 51 years old, and 86% are male. Bankers and other lenders comprised the largest group (47% of the universe, 45% of respondents), followed by realtors (10%), land assessors and appraisers (9%), and a mix of about 20 other occupations. The median level of education is a bachelor’s degree (45%). Respondents live and work an average of one to five miles away from any of the lakes, creeks or streams in the Mark Twain Lake watershed, though roughly 4 out of every 10 live or work more than five miles away. Also, the financial professionals have been residents of the Mark Twain Lake watershed for an average of 29 years.

Exploring Relations. To investigate possible links between occupation and responses to various questions, One-way Analysis of Variance (ANOVA) tests were run. In no cases were there found to be significant differences (p=0.05) in the responses between the financial professional groups. This indicates that if riparian forest buffer use is to be expanded, for example, that all financial professionals may respond the same to policy, advice, and education.

Linear relationships were explored to aid in development of a future model to predict influence of financial professionals on landowner decision-making related to riparian forest buffers. Possible correlations were tested by using the Spearman Rank Correlation Coefficient, which measures “the degree of linear association between two variables” (Tamhane and Dunlop, 2000). The Spearman Rank Correlation Coefficient is interpreted using two numbers. First, the p-value indicates that there is some relationship if it is less than 0.05. Second, the correlation value (-1 to 1) describes the strength and nature of the relationship between the two variables. If there is a negative relationship, the value approaches -1, while a positive relationship yields a value nearing 1.
One important correlation was between the self-rating of the respondent's knowledge level of riparian forest buffers and the frequency with which the professionals discussed riparian forest buffers with clients (p-value less than 0.001 and a positive Spearman Correlation value of 0.49). This is important because it points out that there is a connection between knowledge about buffers and more discussion (opportunities for advice) with clients about buffers (Figure 6).

![Figure 6](image_url)

Figure 6. The correlation between respondent knowledge level and the frequency of discussion of buffers. In both cases, 1 is low, 5 is high. \( p < 0.001, r_s=0.49 \). (n=97).

Other possible correlations were also tested, but no significant relationships exist.

**Conclusions**

Most respondents are long-term residents of the area, and presumably are in touch with the needs and concerns of the community. Slightly more than one-half of the respondents work within five miles of a water body included in the Mark Twain Lake watershed. Additionally, the majority of respondents wants improved water quality and
values that improvement. They think that there are numerous causes of water quality problems, specifically NPS pollutants. Also, there is a low rate of discussion of riparian forest buffers (one way to improve water quality) with clients. In addition to not discussing buffers very often with clients, most respondents felt that the government should be responsible for providing the majority of funding for increasing the use of riparian forest buffers as a conservation measure. This may be because of the perception that the benefits of conservation flow downstream, benefiting the general public through cleaner water, while the costs are paid by the landowner.

The financial professional groups seem to be similar to each other in terms of their beliefs and attitudes regarding riparian forest buffers, and communication with clients. The most important tie between the response variables was the relationship between knowledge level of riparian forest buffers and the frequency with which buffers are discussed with clients. This is important because it has been hypothesized that education will be a key component of encouraging the widespread implementation of riparian forest buffers, which seems to be supported by this correlation.

Generally, financial professionals do not communicate with clients about riparian forest buffers. Buffers lose much of their appeal when viewed financially, creating an interesting contradiction: the financial professionals personally think buffers are beneficial; but professionally think that buffers do not provide sufficient financial benefits. Perhaps they also are thinking that advising a client to put in a buffer means involvement of government subsidies and lower demand for money and services from them.
There is a need for more financial outputs from riparian forest buffers. The financial professionals see the positive aspects of buffers, and want what is best for the community (willingness to volunteer), but respond to monetary values.

Whether one is critical or complementary of the way in which modern agriculture is conducted in the Midwest United States, most can agree on at least one point. There is still plenty of room for improvement in soil and water conservation practices that would benefit people, both in the agricultural landscape and downstream. However, despite the fact that science has shown the benefits of riparian forest buffers (and work continues), there is not a widespread acceptance of them.

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Literature Cited


SPSS. 1999. SPSS Base 10.0 Applications Guide. SPSS, Inc., Chicago, IL.


CHAPTER 3. FINANCIAL AGENTS, WATER QUALITY AND RIPARIAN FOREST BUFFERS: WHERE DO WE GO FROM HERE?

A paper to be submitted to Society and Natural Resources

Matthew J. Brewer,6,7 Joe P. Colletti,8 and Matthew Potoski9

Abstract

The results of a 2001 mail-out survey of financial professionals (i.e. bankers, land appraisers, realtors, farm managers, land assessors, etc.) in Northeast Missouri suggest the financial worth assigned to riparian forest buffers is low, but improves with government assistance. Knowledge concerning buffers is fairly low (mean of 2.66, with 1 being Very Low and 5 being Very High). And, most professionals do not discuss buffers with landowner-clients (68% Never discuss buffers). A linear association was identified between the financial professionals' knowledge level of buffers and the frequency with which they discuss buffers with clients (r_s=0.49). Results indicate that low levels of buffer use may be connected with the perception of buffers as a weak financial investment. Possible changes to the Conservation Reserve Program may be one option for increasing the use of highly functional riparian forest buffers.

Keywords: Agroforestry, land stewardship, conservation values, riparian forest buffers, financial agents, decision-makers, Conservation Reserve Program

6 Graduate student, Department of Forestry, Iowa State University, 253 Bessey Hall, Ames, IA 50011-1021
7 Co-researcher and primary author
8 Associate Professor, Department of Forestry, Iowa State University
9 Assistant Professor, Department of Political Science, Iowa State University
Introduction

The Midwest United States is well known for its highly productive agricultural land. The region is somewhat less known, however, for its troubles related to soil conservation and water quality. Decades of farming, including practices such as draining the land and frequent tilling, have resulted in a system of land use and hydrology that is much different from the conditions prior to European settlement. And, while these alterations have produced an abundance of crops, they have also taken their toll on the quality of the surface water in the Midwest. The compromises in water quality are largely due to nonpoint source (NPS) pollutants, which include runoff and leaching from agricultural fields (i.e. sediment, nutrients, and chemicals) and urban areas (Schultz et al., 2000).

The consequences of NPS pollutants on surface waters are delivered downstream as well. For instance, the added nutrients in the lower Mississippi River and the Gulf of Mexico have worsened the problem of eutrophication, creating a hypoxic aquatic environment that is generally less suitable for plant and animal populations (Jacobs and Gilliam, 1985; Woltemade, 2000). One commonly recognized technique that has been shown to reduce the amount of NPS pollutants entering stream channels, particularly in the upper part of the watershed, is the restoration or installation of riparian forest buffers (Lyons et al., 2000). The riparian buffer can consist of trees, shrubs and grasses, and is located in the riparian zone—the area of the floodplain of a stream or river and the adjacent hillslope transitioning to an upland area (Lowrance et al., 1985; Schultz et al., 2000). While riparian forests, prairies and wetlands exist naturally, in the Midwest many millions of acres have been removed in favor of some other land use, and must be reconstructed (Schultz et al., 1997).
Many monetary and non-monetary benefits can be derived from buffers, including:

(i) increased infiltration, (ii) improved groundwater supply, (iii) increased baseflow, (iv) improved stream water quality (including reduction of NPS pollutants), (v) reduced flooding potential, (vi) improved wildlife habitat, (vii) income from the harvest of forest products, and (viii) income from the Conservation Reserve Program (CRP). Riparian buffers can also produce some negative consequences, including: (i) cropland taken out of production, and (ii) installation and maintenance costs. There is compelling evidence that shows net positive consequences of natural and constructed riparian forest buffers in the Midwest agricultural region (Lee et al., 2000). So, given that buffers are highly functional in reducing NPS pollutants in surface water, why not buffer all of the streams? The solution is not that simple, despite a desire to improve water quality. According to an April, 2001 Gallup Poll, "pollution of drinking water tops Americans’ list of specific environmental concerns”, with about two of every three Americans (64%) indicating that they worry a great deal about the problem (Gallup Poll, 2001, p. 2).

However, this is a conflict between a private good and a common resource. The private good belongs to individual landowners in the form of farms, of which there are thousands in the Midwest. These privately held lands have an effect on a common resource – water. There is consistent debate over the degree to which government should act, to protect public resources, where the citizenry cannot. In the case of water quality, the government has acted in the form of several incentive-driven conservation programs, primarily the aforementioned Conservation Reserve Program (CRP) (USDA Farm Service Agency, 1999).

Administered by the U.S. Department of Agriculture, the CRP focuses on protecting highly erodible and environmentally sensitive lands. Landowners are paid incentives for
removing these lands from crop production or grazing by establishing long-term cover (Forster, 2000). The CRP program provides a cost-share for landowners of up to 90% of the cost of establishing the approved conservation measure, up to 120% of the local rental rate annually, a signing bonus of $10/ac for each year of the contract (contract length of 10 or 15 years), and other qualified incentives (USDA Farm Service Agency, 1999; Iowa State University, 2002). This can effectively minimize the landowner's installation costs. At least on paper, the CRP looks like a "win-win" option for the landowner. Cropland that is frequently flooded is replaced with a riparian buffer, for which the landowner is compensated.

Riparian forest buffers enrolled in the Continuous CRP are competitive when compared to traditional row cropping. Buffers in Central Iowa cost $360-$500 per acre to establish, with annual maintenance costs of about $50 per acre for the first 3-4 years (Schultz et al., 1994; National Association of Conservation Districts, 2000).

Consider this simple example of row cropped land adjacent to a stream. Under the current Continuous CRP payment scheme for a 15-year contract, assuming average rental rates for land in Monroe County, Missouri of $67.30 per acre (Janet Huffman, Monroe County Farm Service Agency, 2002, personal communication), and a discount (real) rate of 8%, an acre of land planted to a riparian forest buffer could provide about $53 per year in net cash flow (see Table 7).

The 2001 corn value per acre is currently less than the cost of production in the region (Iowa State University, 2001). Because the crop value ($0) is less than the Annual Equivalent Value (net cash flow before taxes) of the riparian buffer ($53 ac/yr), the riparian forest buffer is the more profitable option. Based on only financial criteria, for corn
production to be financially viable the annual net return would have to be at least $53 per acre. However, non-monetary factors, such as the preference for conventional farming practices and the desire not to be locked into the perceived hassle of a government contract, also contribute to the landowner's decision. In addition, other non-conservation provisions of the current farm bill provide monetary inducements to continue corn production.

Table 7. Discounted cash flow analysis for a riparian forest buffer established in Monroe County, Missouri under the Continuous CRP program.

<table>
<thead>
<tr>
<th>Item</th>
<th>Year</th>
<th>Amount ($/ac.)</th>
<th>Present Value @ 8.0% Real Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffer establishment cost (minus 90% CRP cost share)</td>
<td>0</td>
<td>- $50 ($500 - $450)</td>
<td>- $50</td>
</tr>
<tr>
<td>Maintenance cost (minus $10/yr. CRP)</td>
<td>1-15</td>
<td>- $40 ($50 - $10)</td>
<td>- $343</td>
</tr>
<tr>
<td>Rental Payment (120% of $67.30)</td>
<td>1-15</td>
<td>$80.76 + $692</td>
<td>+ $692</td>
</tr>
<tr>
<td>Signing Bonus ($10/ac/yr)</td>
<td>0</td>
<td>$150</td>
<td>+ 150</td>
</tr>
</tbody>
</table>

Net Present Value (NPV) = $449
Annual Equivalent Value (AEV) = $53 ac/yr

While enrollment in the Continuous Conservation Reserve Program is financially appealing, some restrictions affect the use of the land. With the exception of certain emergency situations, the land cannot be disturbed (forest products cannot be removed). This restriction rules out any opportunity for the landowner to graze livestock, harvest timber
or biomass, etc. And, because the land is in the program for as long as a 15-year contract (Mayer et al., 2002), this “hands-off” commitment poses a significant risk for the landowner.

Despite the environmental benefits and CRP program, restored riparian forest buffers are not common in the Midwest. Yet the public wants clean water. In addition to the financial benefits for a landowner, public water quality could be improved in an agricultural watershed. So how can the (linear) quantity of riparian forest buffers be increased in such a watershed?

**Mark Twain Lake Watershed**

A study was started in 2000 in the Mark Twain Lake watershed, located in Northeast Missouri. Current water quality, efficacy of natural riparian buffers, and opportunities for constructed riparian forest buffers are being investigated. A 2001 mail-out survey of financial professionals related to riparian forest buffers and client interactions was completed. This socio-economic analysis was done under the presumption that the financial professionals play an important role in affecting buffer use by influencing the beliefs, attitudes, and experiences of their landowner-clients.

A review of the literature has indicated that investigating the role of financial professionals and conservation practices is a unique approach in addressing buffers. In fact, while other facets of landowner/farmer attitudes have been studied, previous work focusing on this group’s opinions concerning riparian buffers is also somewhat limited. However, a study by Colletti et al. (1993) did identify the positions of farmers and others regarding riparian buffers in the Bear Creek watershed, located in Story County, Iowa. This study has provided a guide for the current Mark Twain Lake project, and will serve as a useful basis for comparison. While it is thought that financial professionals are an important part of the
decision-making process by landowners, assessments of this influence seem to be absent from the literature. The Mark Twain Lake project investigated the perceptions of these financial professionals.

**Methods**

The mail-out survey focused on the opinions of financial professionals in Northeast Missouri, and was preceded by a focus group. The project generally follows the concepts developed in the Fishbein-Ajzen model (summarized in Mitchell and Carson, 1989), which explains the factors included in making decisions. Adapted to the study, the first component is the beliefs of the landowners, which can be influenced by many things, including various sources of information, observations, the expected consequences of their actions, and the expectations of others. Next are the landowner’s attitudes (a function of one’s beliefs) towards riparian forest buffers. This leads to their intention to perform an action (i.e. installing a buffer), which may lead to the action itself. Because of the steps and factors that impact decision-making, as shown through this process, it is important to understand the parties that influence the process, particularly the landowner’s beliefs and attitudes. Midwestern farmers seem to rely on other farmers and people involved with agriculture, including financial professionals, for information, so perceptions and misconceptions are likely to be transferred to farmers. There is a need for a better understanding of the opinions of financial professionals, as one of the many factors influencing landowner beliefs and attitudes.

The research project consisted of several stages, including: (i) developing the body of potential participants, (ii) developing the survey instrument, (iii) convening a focus group, (iv) refining the survey instrument, (v) mailing an introductory letter to all of the possible
participants, (vi) mailing the survey, (vii) a series of follow-up contacts via mail to those not yet responding (including a reminder postcard and a second copy of the survey), and (viii) contacting possible participants who had not yet returned the survey via telephone. By attempting a series of follow-up contacts, as demonstrated by Potoski (2001), as well as generally following the Dillman approach (2000), response rate was increased to 54%. The statistical analyses of the data were performed utilizing the SPSS computer program (SPSS, 1999).

Study Results

In June, 2001, surveys were sent to the original 219 possible participants. Several were eliminated because they were duplicates, no longer in business, and not involved with farmers/rural landowners, leaving 183 financial professionals as possible participants. Following Dillman (2000), multiple follow-up contacts were made. The response rate was about 54% (99 surveys returned). The compliance rate, consisting of the response rate but with the exclusion of companies that cannot be located (3), was about 55%. In these cases, the survey was not returned as “undeliverable”, but no follow up contact was possible (i.e. phone number out of service), indicating the company may have been operational at the time of the initial mailing, but had since gone out of business.

The financial professionals are on average 51 years old, and 86% are male. Bankers and other lenders comprised the largest group (47% of the universe, 45% of respondents), followed by realtors (10%), land assessors and appraisers (9%), and a mix of about 20 other occupations. The median level of education is a bachelor’s degree (45%). Respondents live and work an average of one to five miles away from any of the lakes, creeks or streams in the Mark Twain Lake watershed, though roughly 4 out of every 10 live or work more than five
miles away. Also, the financial professionals have been residents of the Mark Twain Lake watershed for an average of 29 years.

A self-rating by participants placed their knowledge level of riparian forest buffers in the low-to-moderate range, averaging 2.7 on a five-point scale (with one indicating a Very Low knowledge level, and five corresponding with Very High). Figure 7 shows the respondent's knowledge level is skewed towards the left, indicating a relatively low knowledge level.

![Figure 7](image.png)

Figure 7. Self-rating by financial professionals in the Mark Twain Lake watershed of their knowledge level of riparian forest buffers (n=96).

The respondents were asked to indicate whether or not certain possible effects of riparian forest buffers are benefits for a landowner-client (Table 8). Note that financial benefits are ranked on the bottom, though still regarded as a benefit by well over one-half of the financial professionals.
Table 8. Perceived benefits of riparian forest buffers by financial professionals in the Mark Twain Lake area.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Percent of Respondents Agreeing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in soil erosion</td>
<td>97%</td>
</tr>
<tr>
<td>Improved wildlife habitat</td>
<td>92%</td>
</tr>
<tr>
<td>Improved aesthetics</td>
<td>86%</td>
</tr>
<tr>
<td>Income from CRP</td>
<td>81%</td>
</tr>
<tr>
<td>Production of forest products</td>
<td>76%</td>
</tr>
<tr>
<td>Increase in land value</td>
<td>62%</td>
</tr>
</tbody>
</table>

Participants were asked whether or not certain possible effects of buffers are liabilities (Table 9). Respondents cited the top liability as the added cost of maintenance for farmers (61%). It is clear that the participants think a mix of benefits and liabilities exist for riparian forest buffers.

Table 9. Perceived liabilities of riparian forest buffers by financial professionals in the Mark Twain Lake area.

<table>
<thead>
<tr>
<th>Liability</th>
<th>Percent of Respondents Agreeing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of maintenance</td>
<td>61%</td>
</tr>
<tr>
<td>Interference with field tile flow</td>
<td>44%</td>
</tr>
<tr>
<td>Land taken out of production</td>
<td>38%</td>
</tr>
<tr>
<td>Hassle of working with government in CRP</td>
<td>38%</td>
</tr>
<tr>
<td>Attracts nuisance wildlife</td>
<td>36%</td>
</tr>
<tr>
<td>Increased flooding</td>
<td>33%</td>
</tr>
</tbody>
</table>

Respondents were asked in a progression of questions to indicate if buffers are a net asset or net liability when 1) considering all monetary and non-monetary benefits, 2) only considering financial benefits and government cost sharing, and 3) only considering financial benefits. About 90% of participants indicated that riparian forest buffers overall, considering both monetary and non-monetary benefits, are a net asset. About 70% stated that riparian
forest buffers are a net asset when considered from a financial perspective, including government payments such as from the Continuous Conservation Reserve Program. Only 46% felt that riparian forest buffers are a net asset when strictly financial benefits are considered. There is a strong belief that buffers have net value when considering monetary and non-monetary benefits, but that belief drops significantly when evaluated solely on financial benefits (Figure 8).

Despite the fact that riparian forest buffers are viewed positively overall, 68% of the professionals indicated that they “never” discuss buffers with clients (Figure 9). When buffers were discussed with landowner-clients, most communication related to comparing costs and benefits (Table 10). If the financial professionals, who are involved in land use decisions, indeed have a significant influence on landowner decision-making, is it realistic to expect buffers to become common features of the agricultural landscape if agricultural practices, financing structure, and education efforts (i.e. the status quo) do not change?
Figure 9. Frequency with which financial professionals in the Mark Twain Lake area discuss riparian forest buffers with their clients (n=95).

Table 10. The nature of the discussion between financial agents and clients, and the number of financial agents indicating each (n=21).

<table>
<thead>
<tr>
<th>Nature of Discussion</th>
<th>Number of Financial Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Impact (cost prohibitive to have riparian forest buffers)</td>
<td>3</td>
</tr>
<tr>
<td>Cost vs. Benefits (may include government payments such as CRP), Need for Education</td>
<td>11</td>
</tr>
<tr>
<td>Benefits of soil maintenance and reduced soil loss</td>
<td>2</td>
</tr>
<tr>
<td>Social benefits, Bio-diversity, Watershed protection &amp; wildlife preservation</td>
<td>2</td>
</tr>
<tr>
<td>Negative aspects (loss of crop ground, roots pulling moisture from crops, time required for buffer to grow)</td>
<td>2</td>
</tr>
<tr>
<td>Requirements of enlistment into CRP – not worth the hassle</td>
<td>1</td>
</tr>
</tbody>
</table>

Participants were asked to assign the ideal level of responsibility for funding riparian forest buffers (i.e. establishment and maintenance). Ideally, funding for riparian forest buffers should come from the federal government (41%), followed by the state government.
(34%), and then the landowner (22%). Others included (3%) non-governmental organizations (NGO's). The financial professionals view riparian forest buffers as assets and they think that three-quarters of the funding for buffer establishment should come from the public. This is similar to the 1993 Bear Creek study, in which respondents indicated that farmers should be responsible for about 25% of the funding.

**Exploring Linear Relations.** In addition to the central tendencies, it was also important to investigate any possible connections between two response variables. Linear relationships were explored to aid in development of a future model to predict influence of financial professionals on landowner decision-making related to riparian forest buffers. Possible correlations were tested by using the Spearman Rank Correlation Coefficient, which measures “the degree of linear association between two variables” (Tamhane and Dunlop, 2000). The Spearman Rank Correlation Coefficient is interpreted using two numbers. First, the p-value indicates that there is some relationship if it is less than 0.05. Second, the correlation value (-1 to 1) describes the strength and nature of the relationship between the two variables. If there is a negative relationship, the value approaches -1, while a positive relationship yields a value nearing 1.

One important correlation was between the self-rating of the respondent’s knowledge level of riparian forest buffers and the frequency with which the professionals discussed riparian forest buffers with clients (p-value less than 0.001 and a positive Spearman Correlation value of 0.49). This is important because it points out that there is a connection between knowledge about buffers and more discussion (opportunities for advice) with clients about buffers (Figure 10).
Discussion

Based on the analyses of the data, some observations can be made. Most respondents are long-term residents of the area, and presumably are in touch with the needs and concerns of the community. Slightly more than half of the respondents work within five miles of a water body included in the Mark Twain Lake watershed. Also, there is a low rate of discussion of riparian forest buffers (one way to improve water quality) with clients. In addition to not discussing buffers very often with clients, most respondents felt that the government should be responsible for providing the majority of funding for increasing the use of riparian forest buffers as a conservation measure. This may be because of the perception that the benefits of conservation measures largely flow downstream, benefiting the general public through cleaner water, and that the costs should be absorbed accordingly by the public (government).
In terms of relationships, the tests for correlations within the data did not yield many connections, on the whole. This is somewhat surprising, but is interesting and useful information. The most important tie between the response variables was the relationship between knowledge level of riparian forest buffers and the frequency with which buffers are discussed with clients. This is important because it is thought that education will be a key component of encouraging the widespread implementation of riparian forest buffers, which seems to be supported by this correlation.

**Policy Implications.** Thinking of policy implications, there are three main conclusions that can be drawn from the study. First, the financial professionals surveyed would like to see government involvement in funding buffers. Second, the financial professionals' knowledge level of buffers seems to be associated with their disinterest in discussing buffers with clients. And finally, the professionals surveyed seem to perceive the main problem with buffers as financial. Given this, if legislation dealing with buffers, such as the Continuous Conservation Reserve Program, is more flexible in the future in terms of allowing added financial gains for the landowner (i.e. harvesting provisions), it would certainly be more appealing to business-minded financial professionals. It is this third point that will be the focus of this discussion.

The array of benefits of riparian buffers includes such things as income from the Conservation Reserve Program (CRP), future harvesting, and the sale of hunting rights. Costs can include cropland out of production and installation and maintenance costs. As shown in the comparison scenario, cost sharing provided by the CRP alone is arguably enough to offset the installation and maintenance costs for the landowner. However, there is the perception by the financial professionals in the Mark Twain Lake area that riparian
buffers, when considered financially, lose much of their appeal. Many of the decisions involving natural resources that are made by agricultural landowners are based mostly upon factors related to financial gains and less so on the environment (Pampel and van Es, 1977). Like their landowner-clients, financial professionals are interested primarily in the financial viability of an investment. So, if riparian buffers are to be viewed as a sound investment, they must provide a net financial return annually or fairly regularly that is enough to seem more appealing than the traditional annual crops (and short-term returns) that the professionals routinely handle.

Based on the results of the benefit and liability questions, as well as those asking the financial professionals to indicate whether riparian buffers are an asset or a liability financially, their opinions seem somewhat conflicted. Buffers are perceived generally as a benefit, but when their financial worth is considered, are seen increasingly as a liability. This indicates that while the financial professionals may personally realize an intrinsic value in buffers, with many non-monetary benefits, professionally they are not appealing and any social value is therefore not communicated to clients. After all, these professionals have business needs that determine their financial well-being. And, they are important because they are thought to be influential to the landowner, both in a business sense and as a potential source of information. Thus far, the importance of annual market benefits has overridden any interest in pursuing buffers as an investment.

The citizens of the United States and their elected officials ultimately decide the level of priority that is assigned to water quality and conservation practices in agricultural regions. One question to be asked is: should the government regulate agriculture, the way other sectors of the economy have been regulated, to control pollution? The approach by the
federal and local governments to regulating nonpoint source pollution may well include mandating the use of best management practices (BMPs) and riparian buffers. One possible scenario in which this could occur would be a form of regulation patterned after the Clean Air Act of 1970, which in part attempts to regulate stationary sources of air pollution by requiring “best technology” standards for new sources (Plater et al., 1998). It is not hard to imagine a regulatory system that would require best management practices, including riparian buffers, in attempting to meet state or regional water quality standards. Putting this into practice becomes much more complicated, but the concept is already established. This option of stiffer regulations is not out of the question; however, there are other approaches as well.

If the American public prefers a less regulatory and more voluntary approach, there are changes that could be made to existing laws. The following is one possible scenario for addressing the need for riparian buffers to be more financially profitable, to compete with annual crops; a need identified by this study. The allocation of lending assets could be shifted from land adjacent to a stream (which may flood frequently and where a buffer could be installed), and those assets instead could be used to produce higher yields on the remaining (slightly smaller) cropland. As a result, the value of both the crop yield and the land could increase. This benefits the bankers, realtors (higher commissions), and farm managers (higher crop yields). This is an option under current laws.

However, the problem of increasing the financial profitability of riparian buffers is not solved. One way to increase “buffer income” would be to periodically harvest forest products. Buffers can be thought of as having three zones, based on a U.S. Department of Agriculture model (Schultz et al., 2000). The first zone is adjacent to the stream, about five
meters wide, and should consist of undisturbed, mature trees, with the primary goal of providing stability. Zone 2, also consisting of trees, is adjacent to zone 1 and is at least 18 meters wide. Timber could carefully be harvested from zone 2. The third zone away from the stream, at least six meters wide, consists of warm-season grasses. The grasses can be harvested for use in many types of biomass products and as an energy source. In the Midwest, this model has been adjusted to allow for farmer concerns about flooding by removing some of the emphasis on trees, and instead focusing on warm-season grasses (Schultz et al., 2000). Despite differences in the model, the point remains the same — timber/fiber and biomass from warm-season grasses can be harvested to increase the financial profitability of buffers.

In surveying cropland owners, Esseks and Kraft (1986) found that the freedom to use CRP land for grazing and haying (different uses than discussed here) would increase the likelihood of farmers to want to enroll in the program. However, the problem with financial professionals and farmers using this approach is that disturbing the land is not allowed under the Conservation Reserve Program (except under extreme emergencies – drought, for example) (Mayer et al., 2002). So, if a landowner is taking advantage of the CRP, other income potential is limited.

There are valid reasons for structuring the CRP in this fashion, beginning with the underlying goal of conservation. And improved conservation standards may well offset limited participation, in the taxpayer’s view. If the public decides that a change, such as permitting harvesting, is worth the potential improvements in water quality, one option for accomplishing this is to loosen the regulations in this area of the CRP. Alternatively, if permitting harvesting altogether is not desired, another option would be to reduce the cost-
share and rental payments from the CRP in exchange for allowing the landowner to conduct some harvesting. This study has pointed out that riparian buffers are not perceived to be financially beneficial (despite the comparison scenario) by the professionals in Northeast Missouri, which may be the reason that the professionals surveyed do not discuss buffers with their clients. Of course, other factors may be causes as well, such as lack of knowledge of buffers; but in addition to improved education, the financial appeal of the CRP could also be addressed by loosening restrictions, if this is a priority of the American people.

Conclusion

The Mark Twain Lake watershed survey has provided information about the way in which local financial professionals view riparian forest buffers. Unique in its approach, the study shows that these professionals, thought to be influential in landowner decision-making, do not value buffers as financial investments. While they do recognize an array of benefits, this does not translate into a perception of buffers as an appealing business proposition. In addition, the financial professionals have a generally low level of knowledge of buffers, and think the government should be responsible for the majority of the funding for restoring buffers. There seems to be an association between the relatively low knowledge level of buffers and the low frequency with which the financial professionals discuss buffers with their landowner-clients.

The Conservation Reserve Program (CRP) is the major government incentive program for increasing the use of conservation measures, such as buffers. Thus far, there has been little regulation, focused on water quality, which has addressed nonpoint source (NPS) pollution (much of which originates in agricultural areas, such as the Midwest). One policy option, if there is public support, is some form of regulation in this area. As Potoski (2001)
found, public support for environmental standards exceeded economic pressures on state
governments in determining clean air policy. However, if the will to support regulation does
not exist, then another option for increasing the use of buffers would be a loosening of the
harvesting restrictions in the current CRP. This would allow more financial gains to be
derived from riparian buffers. Since the financial professionals seem to see a need for
buffers to be more valuable financially (if they are to be considered as an option), changing
the CRP may be one way of addressing this need. Not only would this approach be much
more comfortable for farmers than forced regulations, but buffers could clearly be a
financially rewarding proposition. The question, of course, is whether the American public
supports shifting the emphasis of the CRP from more traditional conservation goals towards
tree and biomass farming, in hopes of improving water quality through increased
participation. In other words, how well should private landowners be compensated for
improving a public resource (water) through good land stewardship practices?

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Literature Cited


SPSS. 1999. SPSS Base 10.0 Applications Guide. SPSS, Inc., Chicago, IL.


CHAPTER 4. ADDITIONAL RESULTS

While the majority of the data is presented in one or both of the proposed journal articles in Chapters Two and Three, not everything could be included due to space constraints. The Central Tendencies of variables have been covered entirely, but the discussion was not able to include all of the Correlations that were tested. In addition to the space problem, some correlations were not included because the correlations did not exist or were weak and/or erratic (i.e. a question containing multiple parts with only one or two correlations). The results that follow summarize the tests done for possible correlations, and include material that was also covered in one or both of the journal article submissions, to facilitate understanding. In addition, write-in comments are included in Appendix B.

Correlations

In addition to examining the central tendencies, investigating any connections between answers was deemed to be an important part of the analysis. These possible connections, properly termed correlations, can be thought of as the measure of the degree (i.e. strength or closeness) of a linear relationship between two variables (Snedecor and Cochran, 1989; Ramsey and Schafer, 1997; Tamhane and Dunlop, 2000). While correlations do not necessarily imply a “cause and effect” relationship, they do allow the inference of an association between two variables. Of particular interest was the effect that a certain variable might have on the way a question was answered, when looking at the means. In other words, does a characteristic of the respondent or an answer on a certain question affect the responses to another question? The first type of connection that was investigated involved whether responses were predictable based upon the participant’s occupation. This, however, is a
comparison of the means rather than a strict correlation. The second category investigated
did involve correlations and had to do with connections between an answer on one question
and an answer on a second question.

**Occupation and Response Variables.** By focusing on the participant’s occupation,
the goal is to isolate certain professions to see if their responses to particular questions
differed from the other professions. For most of the questions in the survey, this involved
separating the bankers from all of the other financial professionals (realtors, land assessors,
land appraisers, farm managers, land surveyors, managers, lawyers, elected officials,
agronomists, government employees, insurance salespeople, accountants, etc.), whom were
grouped into a second category. There are two reasons for isolating the bankers: (i) bankers
are the largest single group, both in terms of their percentage of the universe (43%) and of
those responding (45%), and (ii) by virtue of holding the financial purse strings, bankers are
arguably the most important professionals where influence in landowner decision-making
and financing are concerned. Because of these two factors, bankers were determined to be an
important segment of the population, and one that should be investigated to see if they
behave differently from other financial professionals.

In addition, real estate professionals are examined as a separate group in a couple of
instances. In these cases, tests were conducted with three groups: bankers, realtors, and all
others. The reason that real estate professionals were examined as a group was based largely
on comments made by the focus group, in addition to comprising a substantial portion of all
of the respondents (10%). Prior to sending the survey to possible participants, a focus group
was convened with the main purposes of improving the clarity (to reduce participant
confusion and inaccurate responses) and effectiveness (of the survey questions in obtaining
the desired information) of the survey instrument. In addition to honing the survey document, interesting information was also obtained during the discussion. A representative of the real estate profession indicated that there was an increased level of value assigned to riparian forest buffers. Comments suggested that this was based upon the increased marketability of property containing a stream with a riparian forest. The increased sales of land with riparian areas seemed to be due to an influx of buyers from metropolitan areas (specifically St. Louis, MO), who were seeking a residence and acreage with the amenities of a forested stream.

In investigating any possible links between occupation and the response variables, one-way Analysis of Variance (ANOVA) tests are run. No significant differences in the responses of the different occupational groups are found. In all cases, the significance values (p-value) are greater than 0.05, too high to indicate differences between groups. It is interesting that bankers and realtors do not seem to behave differently from the other professions surveyed. This indicates that if riparian forest buffer use is to be expanded, for example, that bankers and lenders will require the same attention as the other financial agents in terms of technical education and understanding of incentives.

**Between Response Variables.** In addition to examining potential connections associated with profession, the analyses also investigated correlations between the responses to certain questions. The goal was to try to identify any links between responses to questions that might be insightful in drawing conclusions and in looking at the "big picture", in terms of how riparian forest buffers fit into the agricultural landscape of the Midwest. In addition, it was hoped that identified correlations might be used as a predictive tool in providing better
education of professionals as to the benefits and costs of riparian forest buffers. Only a few of the statistical tests yielded a connection between the responses.

All of the possible correlations were tested by using the Spearman Rank Correlation Coefficient, which measures “the degree of linear association between two variables” (Tamhane and Dunlop, 2000, p. 586). The Spearman Rank Correlation Coefficient is interpreted using two numbers. First, the p-value indicates that there is some relationship if it is less than 0.05. Second, the correlation value (-1 to 1), expressed as \( r_s \), describes the strength and nature of the relationship between the two variables. If there is a negative relationship, the value approaches -1.0, whereas a positive relationship yields a value nearing 1.0. As mentioned, values range from -1 to 1, with the strength of the relationship being greatest as the number approaches -1 or 1 (weakest at zero) (McClave and Benson, 1988).

One of the most important tests run was to see if there was a connection between the self-rating of the respondent’s knowledge level of riparian forest buffers and the frequency with which the respondent discusses riparian forest buffers with clients. As can be seen in Figure 11, there was an association between the two responses, with a p-value less than 0.001 and a Spearman Correlation value of 0.49 (a positive correlation, indicating an association between higher knowledge level and higher frequency of discussion). This is important because it points out that there is a connection between knowledge (education) and the potential transfer of knowledge from the financial agent to clients seeking or engaged in land use decisions.
Figure 11. The correlation between respondent knowledge level of riparian forest buffers and the frequency of discussion of buffers with clients. In both cases, 1 is low, 5 is high. The trend line shows the positive relationship ($r_s = 0.49$) ($n=97$).

It should be noted that for the rest of the comparisons that resulted in a correlation, the majority of the variables in each category (question) did not result in a significant correlation – those that are discussed are in the minority, but worthy of mention. This is important because there are cases where a correlation does not seem logical, and this should not be interpreted as a generalization applying to the majority, since no correlation was present for the majority of questions in each category. In addition, the computer coding used in the statistical analysis may produce a negative Spearman Correlation value where it would traditionally be positive (and vice versa). This is due to the numbering system used for each answer (the number-coded answers were inverted on some questions, resulting in affirmative (or negative) answers that are both high and low from one question to the next). However,
the interpretations are based upon the trend of the data, reflecting correct information regardless of the coding system used.

Another identified connection is between a question dealing with the extent to which certain sources of water pollution contribute to water quality problems and a question probing the overall perception of riparian forest buffers as either an asset or a liability. The results showed a correlation between the problem of municipal sewage from cities or towns and the asset/liability perception question (p-value of 0.03, Spearman Correlation value of 0.25). So perhaps those respondents who indicate that municipal sewage is less of a problem view buffers as an asset more often. In addition, there is a connection between the water pollution resulting from runoff from agricultural chemicals that are applied to farmland and the asset/liability perception question (p-value of 0.01, Spearman Correlation value of -0.31). In this case, buffers are seen as more of an asset as the pollution problem becomes more important. Also compared with the sources of water pollution was a question concerning the vicinity of the respondent’s place of business to any of the water bodies comprising the Mark Twain Lake watershed. Specifically, the contribution of agricultural support activities, such as those taking place at grain elevators and fertilizer depots, to water pollution seemed to be associated with the nearness of the respondent’s workplace to a stream, creek, or lake of the Mark Twain Lake watershed (p-value of 0.01, Spearman Correlation value of 0.26). In this case, as the distance from one of the components of the Mark Twain Lake watershed increased, so did the concern for pollution from agricultural support activities.

Two questions compared are who should be financially responsible for the establishment and maintenance of riparian forest buffers and a question probing the
community activities, geared toward improving water quality, in which the respondent would be willing to participate. The only case in which there is a connection is the willingness of the participant to donate money and the effect of this on the share of financing to be provided by the landowner (p-value of 0.02, Spearman Correlation value of -0.25). As the ideal landowner's share of the financing increased, the willingness to donate also increased.

Additionally, in examining the questions concerning the possible sources of water pollution in the Mark Twain Lake watershed and whether or not certain results of riparian forest buffers are considered to be a benefit, there are some connections. The first is between runoff from agricultural chemicals that are applied to farmland (as a water pollution source) and the function of riparian forest buffers to improve aesthetics (p-value of 0.01, Spearman Correlation value of -0.28). As the problem of agricultural chemical runoff becomes more important, aesthetic value is seen as more of a benefit. The problem of runoff from agricultural chemicals also is connected to the benefit of improved wildlife habitat (p-value of 0.03, Spearman Correlation value of -0.23). Similarly, as runoff becomes more of a major problem, wildlife habitat is viewed as more of a benefit. In addition, runoff from agricultural chemicals is tied to the benefit of the production of forest products (p-value of 0.02, Spearman Correlation value of -0.26). Once again, as agricultural chemical runoff is viewed as a larger problem, being able to have the rewards from forest products becomes more beneficial. It is interesting to note that the three benefits that showed a correlation to the possible sources of water pollution were all associated with runoff from agricultural chemicals applied to farmland (only one out of eleven possible water pollution sources).

The final group of correlations to be discussed concerned the question of the extent to which certain sources contribute to water pollution problems. In this case, however, the
question is compared with one asking respondents to indicate whether certain outcomes of riparian forest buffers are considered to be negative (bad). The problem of municipal sewage from cities and towns was associated with the negative effect of riparian forest buffers attracting nuisance wildlife (p-value of 0.01, Spearman Correlation value of −0.27). As municipal sewage is viewed as more of a problem, nuisance wildlife is seen as more of a liability. In addition, the problem of sediment runoff from farmland and the negative effect of attracting nuisance wildlife are connected (p-value of 0.03, Spearman Correlation value of −0.24). Again, as sediment runoff is viewed as a major problem, nuisance wildlife is also seen as a larger liability. Also, the problem of stream bank erosion was tied to the perceived negative effect of increased flooding caused by riparian forest buffers (p-value of 0.04, Spearman Correlation value of −0.22). As erosion is seen as more of a problem, increased flooding is perceived as more of a liability.

Also tested, but not resulting in any connection (p>0.05), are the following pairs of questions, as shown in Table 11.

Table 11. Groups of variables in which no correlation was found, indicated by a p-value greater than 0.05. Variable one is checked against variable two for a possible correlation.

<table>
<thead>
<tr>
<th>Variable 1</th>
<th>Variable 2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of discussion</td>
<td>Asset or liability (overall)</td>
<td>0.697</td>
</tr>
<tr>
<td>Frequency of discussion</td>
<td>Asset or liability (w/ CRP)</td>
<td>0.597</td>
</tr>
<tr>
<td>Frequency of discussion</td>
<td>Asset or liability (w/o CRP)</td>
<td>0.788</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Asset or liability (overall)</td>
<td>0.741</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Asset or liability (w/ CRP)</td>
<td>0.776</td>
</tr>
<tr>
<td>Knowledge level</td>
<td>Asset or liability (w/o CRP)</td>
<td>0.474</td>
</tr>
<tr>
<td>Asset or liability (overall)</td>
<td>Financial responsibility (landowner)</td>
<td>0.294</td>
</tr>
<tr>
<td>Asset or liability (overall)</td>
<td>Financial responsibility (state)</td>
<td>0.958</td>
</tr>
<tr>
<td>Asset or liability (overall)</td>
<td>Financial responsibility (federal)</td>
<td>0.755</td>
</tr>
<tr>
<td>Asset or liability (w/ CRP)</td>
<td>Financial responsibility (landowner)</td>
<td>0.391</td>
</tr>
</tbody>
</table>
As can be seen from the previous discussion, there do not seem to be many connections, either between occupations or response variables. This is important information, and raises the question of why there are so few correlations. One theory is that the cause may be the lack of knowledge of riparian forest buffers by the participants, as a whole. As mentioned earlier, Bergstrom et al. (1990) found that information is an important component of consumers' valuation of environmental commodities. If one is not informed in
a certain area, it is not unlikely that his/her opinions in that area might be inconsistent. In other words, if each question is viewed as a separate entity, due to not having the level of knowledge of the subject necessary to view the “big picture”, one’s answers might tend to be disjointed and based upon the perception of only the question being answered. In addition, a lack of knowledge of buffers, for instance, may indicate a lack of interest in this area (or lack of usefulness of buffers to the participant). This lack of interest would certainly not make a respondent more likely to want to invest a lot of thought in the “big picture”. It seems a likely conclusion that participant knowledge of riparian forest buffers, as well as the ability to view buffers in the larger scenario, plays some role in the lack of correlations found.

Statistical Summary

Based on the analyses of the survey data, some additional observations can be made. Most respondents are long-term residents of the area, and presumably are in touch with the needs and concerns of the community. Slightly more than half of the respondents work within five miles of a water body included in the Mark Twain Lake watershed. Additionally, the majority of respondents wants improved water quality and is willing to pay for water quality improvement. They think that there are numerous causes of water quality problems, specifically NPS pollutants, in the watershed. Also, there is a low rate of discussion of riparian forest buffers with clients. Most respondents think that the government should be responsible for providing the majority of funding for increasing the use of riparian forest buffers as a conservation measure. This may be because of the perception that the benefits of conservation measures largely flow downstream, benefiting the general public through cleaner water, and that the costs should be absorbed accordingly by the public (government).
In terms of relationships, the tests for correlations within the data did not yield many connections, on the whole. This is somewhat surprising, but some interesting and useful information is obtained. With regard to the testing by occupation, bankers (and in limited instances, realtors) are similar to other professionals in terms of their responses. The most important tie between the response variables is probably the relationship between knowledge level of riparian forest buffers and the frequency with which riparian forest buffers are discussed with clients. This is important because it is hypothesized that education will be a key component of encouraging the widespread implementation of riparian forest buffers (a notion supported by Bergstrom et al. (1990) in examining the effects of information on willingness to pay for wetlands protection), which seems to be supported by this correlation. In addition, runoff from agricultural chemicals applied to farmland seemed to be an important pollution problem affecting water pollution and water quality in the Mark Twain Lake watershed.

The hypothesis originally set forth is that “the decision to use conservation practices in agriculture is substantially influenced by financial agents – people who influence the landowner in various ways. Furthermore, the adoption and integration of conservation practices with agricultural practices is, in large part, dependent on their acceptance and valuation by the landowner. And, that the landowner considers financial incentives, good stewardship practices, or other socio-economic factors.” Based on the analyses of the data, we fail to accept the hypothesis. While the landowner was not the central focus of the survey, the interaction between the landowner and the financial agents was a major area. Due to the financial agents’ overwhelming lack of discussion of buffers with their landowner clients, the hypothesis cannot be accepted. However, it is not rejected either, since the
reasons (i.e. implied negativity, lack of knowledge of buffers, etc.) for the lack of discussion with clients is unknown.
CHAPTER 5. CONCLUSIONS

With the near exclusion of nonpoint source pollution from the Clean Water Act of 1972, roughly half of the pollution entering the nation’s waterways does so largely unchecked (Plater et al., 1998). Riparian forest buffers are a proven means, along with other conservation practices, for reducing water pollution originating in the agricultural landscape. They are especially important in situations where NPS pollutants are a problem and water treatment facilities may not be a viable option (such as in a rural setting) (Basnyat et al., 2000). Many benefits accompany riparian forest buffers, including improved water quality and lower cost for the consumer for clean drinking water. Despite the fact that buffers make sense ecologically, and in many cases financially (for the landowner), they are not in widespread use in the Midwest agroecosystem. There are several possible reasons for this, which have been supported by this study.

There seems to be a general concern and willingness to pay for achieving an acceptable level of water quality. However, the knowledge level regarding the role and functions provided by riparian forest buffers in improving water quality is lacking with financial professionals (i.e. bankers, realtors, land assessors, land appraisers, etc.). It is hypothesized that because these financial professionals influence the decision-making of farmers and other landowners, and help them to internalize the value of the conservation measure, a significant link in the conveyance of this knowledge to landowners is missing. This, of course, limits the consideration and appeal of riparian forest buffers as a conservation option. In addition, it says nothing of the discouragement of buffers by financial agents that no doubt accompanies the general perception that buffers lose much of
their viability when viewed financially. Unfortunately, this perception is at least questionable, given the array of governmental and non-governmental cost-sharing opportunities mentioned earlier.

This study results in the conclusion that if buffers are to become more widespread in the agricultural landscape, there are at least two areas that need improvement. First, improved education of financial professionals, and presumably landowners, is needed in order to convey the nature and magnitude of benefits (and liabilities) of buffers. Second, since the respondents indicated that the government should be responsible for the major portion of the funding of buffers, the financial incentives associated with buffers need to be demonstrated (education) and/or improved (i.e. government assistance). It seems that these two components play a large role in determining the attractiveness of riparian forest buffers, as demonstrated by the infrequency with which financial agents currently discuss buffers with their clients.

Of course, it remains to be seen whether riparian forest buffers will be used more commonly as a part of the overall conservation plan in agricultural areas. It is a fair assumption that ensuring an acceptable level of water quality will become more of a challenge in the coming years. Additionally, the approach by the federal and local governments to regulating nonpoint source pollution may well include mandating the use of best management practices (BMPs) and riparian forest buffers. One possible scenario in which this could occur would be a form of regulation patterned after the Clean Air Act of 1970, which in part attempts to regulate stationary sources of air pollution by requiring “best technology” standards for new sources (Plater et al., 1998). It is not hard to imagine a regulatory system that would require best management practices, including riparian forest
buffers, in attempting to meet state or regional water quality standards. Putting this into practice becomes much more complicated, but the concept is already established.

However, a more comfortable option to government mandates would be increasing the voluntary use of buffers by landowners, as a measure of good stewardship. Improving the knowledge level of landowners and others who influence the decision-making process is a good first step, and one that would benefit both the landowner and the public. And, while the landowner is the person directly involved with the riparian forest buffer, more education would be beneficial for society as a whole. Each of us is an interested party, whether based upon economics (reducing the cost of water treatment), improving aesthetics, concern for wildlife and the ecosystem, or other related aspects of water quality.

In addition to the specific information learned about water quality and riparian forest buffers, this project can be viewed as a microcosm of the issues, unrelated to ecology, that are interwoven in natural resource decision-making. These can be based upon many factors, including political and economic influences, as well as social opinions. When viewed on the larger scale, natural resource decision-making on the national and international level is impacted by interests that are similar to those seen in this study.

It is expected that future work will include other assessments concerning site-specific valuation of existing and established riparian forest buffers in the Mark Twain Lake watershed in Missouri and the Bear Creek watershed in Central Iowa. The hope is that a comparison can be made between the two watershed areas that will further explain the attitudes and values of citizens and landowners with respect to buffers and provide predictive capability with respect to voluntary establishment of riparian forest buffers in the Midwestern agroecosystem.
APPENDIX A. SURVEY INSTRUMENT

Mark Twain Watershed Survey
Spring 2001

The Mark Twain Watershed, as delineated in the map on the right, is an area in northeast Missouri that includes Mark Twain Lake and several streams flowing into it, including the Elk Fork Salt River, Middle Fork Salt River, North Fork Salt River, South Fork Salt River, and Otter, Crooked, and Long Branch Creeks.

For each question that follows, please record an answer that best represents your opinion about water quality and conservation actions in the Mark Twain Watershed.

(Map provided by www.mapquest.com)

SECTION 1: WATER QUALITY OF STREAMS.

1. We are interested in your opinion of the water quality of the streams in the Mark Twain Watershed. Please rate the current quality of the surface water (the water that you see flowing) in the streams and creeks of the Mark Twain Watershed by circling one number from 0 to 10 on the scale below.

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfit for Any Use (Human, Wildlife, Livestock, Crops)</td>
<td>Best Quality Water (Untreated drinking water for humans)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. In your opinion, is the current water quality level that you circled (in Question 1) suitable for the following purposes?

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Human drinking purposes (e.g. Municipal/industrial uses)?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. Swimming/Recreational activities?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. Wildlife and fishing?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>d. Livestock uses?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>e. Crop uses (e.g. irrigation)?</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

If you circled a 10 (Best Quality Water) in Question 1, go to Section 2, page 4. Otherwise, please continue.

3. What water quality level would be acceptable to you for the surface water of streams in the Mark Twain Watershed? Please circle your response.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Unfit for Any Use (Human, Wildlife, Livestock, Crops)</td>
</tr>
<tr>
<td>1</td>
<td>Best Quality Water (Untreated drinking water for humans)</td>
</tr>
</tbody>
</table>

4. In your opinion, would this acceptable water quality (circled in Question 3) be suitable for the following purposes?

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Human drinking purposes? (i.e. Municipal/industrial uses)?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. Swimming/Recreational activities?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. Wildlife and fishing?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>d. Livestock uses?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>e. Crop uses? (e.g. irrigation)</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
5. The table below lists several possible sources of water pollution. Please indicate the extent to which you think each source contributes to water pollution in the Mark Twain Watershed.

<table>
<thead>
<tr>
<th>Source</th>
<th>Not a source of pollution in Mark Twain Watershed</th>
<th>Major source of pollution in Mark Twain Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Municipal Sewage from cities or towns</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>b. Run-off from agricultural chemicals applied to farmland</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>c. Run-off of soil sediments from farmland</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>d. Run-off from urban areas (Parking lots, building sites, etc.)</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>e. Trash dumps</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>f. Leaking underground storage tanks (gasoline tanks, etc.)</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>g. Animal confinement / Feedlot operations</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>h. Livestock grazing along streams</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>i. Stream bank erosion</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>j. Agricultural support activities (Grain elevators, Fertilizer depots etc.)</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>k. Small communities &amp; residences with minimal sewer systems</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
<tr>
<td>l. Other (Specify: ________________)</td>
<td>1 2 3</td>
<td>4 5</td>
</tr>
</tbody>
</table>
Based on recent USA polls, the number one environmental priority of the people of the U.S. is clean water. Now we want you to think about the acceptable water quality level that you selected in Question 3. Please consider the various pollutants, both farm and non-farm, that might need to be reduced in the Mark Twain Watershed area in order to achieve that acceptable level of water quality.

How important do you think it is to reduce each of the following pollutants in the Mark Twain Watershed area in order to improve the water quality?

<table>
<thead>
<tr>
<th></th>
<th>Not Important at All</th>
<th>Very Important</th>
<th>Don't Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>How important is it to reduce Sediment (e.g., eroded soil)?</td>
<td>1 2 3 4 5</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>How important is it to reduce the Nitrogen (fertilizer) level?</td>
<td>1 2 3 4 5</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>How important is it to reduce the Phosphorus (fertilizer) level?</td>
<td>1 2 3 4 5</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>How important is it to reduce the Pesticide (e.g., Atrazine) level?</td>
<td>1 2 3 4 5</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>How important is it to reduce the Fecal Bacteria level?</td>
<td>1 2 3 4 5</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

7a. In this question, we would like to get an estimate of the value that you place on these improvements in water quality. We will be asking you to tell us how much you value the attainment of your acceptable water quality level expressed in Question #3. This value is generally called “willingness to pay”.

By responding, you are not making any kind of financial commitment. You will not receive a bill for payment from any governmental body nor will your taxes increase because of your response.

We simply want to know how valuable clean water in the Mark Twain Watershed is to you.

Current estimates for improving and maintaining water quality in the Mark Twain Watershed indicate that its value is approximately $5.00 per person per month. Is it this valuable to you?

1 = Yes
2 = No

b. What is the maximum amount of value to you each month?

$________ per month
SECTION 2. SOIL CONSERVATION & STREAM ZONE PRACTICES

There are many soil and water conservation practices that farmers and rural landowners use to reduce erosion, protect the quality of their land, and protect the waterways flowing through their fields. Grass waterways, terraces, planting on the contour and conservation tillage are examples of effective means to achieve goals associated with maintaining land and protecting the environment.

We are particularly interested in the increasing use of grass filter strips and riparian forest buffers, which are established along the banks of streams & waterways in agricultural lands to help protect water quality.

Filter strips are grass-only plantings along the banks of rivers, streams, and lakes.

Riparian (floodplain) forest buffers are plantings of trees, shrubs, and grasses.

Both filter strips and riparian forest buffers are expected to slow down run-off water and intercept soil within the strip. They are also capable of reducing the amount of nitrogen, other nutrients, and pesticides that may travel from a crop field or pasture into a water body.

![Riparian Forest Buffer](image)

The questions that follow in this section relate specifically to riparian forest buffers. Again, we are interested in getting your perceptions relating to a specific practice thought to help to improve surface water quality — a riparian forest buffer.
8. How would you rate your current level of knowledge about riparian forest buffers?
   1 = Very Low
   2 = Low
   3 = Moderate
   4 = High
   5 = Very High

9. Some people consider riparian forest buffers to be an asset, providing benefits to the land & people. Based on your knowledge or opinion, please indicate whether you think that each item listed below is a benefit of using riparian forest buffers.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Benefit</th>
<th>Not a Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Improves land value</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. Provides cash flow from payments from Conservation Reserve Program (CRP)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. Improves aesthetics</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>d. Improves wildlife habitat</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>e. Reduces soil erosion</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>f. Produces other products such as timber, fiber, forage, nuts, etc.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>g. Other (Specify: _________________________)</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
10. Other people consider riparian forest buffers to be a liability. For each item listed below, please indicate whether you feel it is one of the liabilities, or negative aspects, of using riparian forest buffers.

<table>
<thead>
<tr>
<th>Liability</th>
<th>Not a Liability</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Enrollment of riparian forest buffer in the CRP requires long-term government contract &amp; is a hassle</td>
<td>1</td>
</tr>
<tr>
<td>b. Takes land out of production</td>
<td>1</td>
</tr>
<tr>
<td>c. Increases flooding</td>
<td>1</td>
</tr>
<tr>
<td>d. Plugs up field tile flow</td>
<td>1</td>
</tr>
<tr>
<td>e. Attracts nuisance wildlife, such as beaver</td>
<td>1</td>
</tr>
<tr>
<td>f. Adds maintenance cost for farmers</td>
<td>1</td>
</tr>
<tr>
<td>g. Other liabilities (Specify:________________________)</td>
<td>1</td>
</tr>
</tbody>
</table>

11a. Considering both beneficial and negative characteristics, would you say that overall a riparian forest buffer is a net asset or a net liability?

1 = a net asset
2 = a net liability

11b. Next please consider riparian forest buffers from a purely financial perspective (do not consider the assets and liabilities associated with ecology, social impact, health, etc.). From a strictly financial perspective and INCLUDING benefits from the Conservation Reserve Program, would you consider a riparian forest buffer to be an asset or a liability?

1 = an asset (financially)
2 = a liability (financially)
11c. Again, from a **strictly financial perspective**, and **EXCLUDING** benefits from the Conservation Reserve Program, would you consider a riparian forest buffer to be an asset or a liability?

- 1 = an asset (financially)
- 2 = a liability (financially)

12. The establishment and maintenance of riparian forest buffers in the Mark Twain Watershed could be financed by several groups. Please record the percentage of the cost **that you think** should be paid by each of the following groups. The total percentage should add to 100%.

<table>
<thead>
<tr>
<th>Contributors</th>
<th>Share of Cost (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Landowner's share</td>
<td></td>
</tr>
<tr>
<td>b. State government share</td>
<td></td>
</tr>
<tr>
<td>c. Federal government share</td>
<td></td>
</tr>
<tr>
<td>d. Other (Specify: ______________________________)</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong> %</td>
</tr>
</tbody>
</table>

13a. During the last two years, how frequently have you discussed riparian forest buffers with clients? Please circle the appropriate number.

- 1 = Never  →  **Go to Section 3, next page.**
- 2 = Rarely
- 3 = Sometimes
- 4 = Frequently
- 5 = Very frequently

13b. If you have discussed riparian forest buffers with clients, what has been the nature of the discussion(s)?
SECTION 3. SOCIAL ACTION PLANS

"Missouri Stream Teams" have been established in some areas of the state as a way to coordinate volunteer efforts to improve or maintain water quality in local streams and rivers. This is currently being considered in the Mark Twain Watershed area.

14. Are you currently working as a volunteer with a Missouri Stream Team (in other watershed areas) or other volunteer group working with water cleanup (i.e. 4-H, Scouts, etc.)?

1 = Yes 2 = No

15. For each activity listed below, please indicate whether you might be willing to participate (or already are participating) in this activity as part of a Missouri Stream Team or other volunteer organization in the Mark Twain Watershed area.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Planting stream-side trees, shrubs and grasses</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. Cleaning up debris (plastics, bottles, and empty cans, etc.)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. Stocking fish/Creating fish habitats</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>d. Donating money</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>e. Monitoring water quality</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>f. Pesticide container recycling program</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>g. Participating as a team leader and organizing activities</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>h. Involvement with youth groups</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>i. Other activities (Specify:_______________)</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

SECTION 4. ABOUT YOU

16. What is your current age? ________ Years
17. What is your gender?
   1 = Male  
   2 = Female

18. Which category listed below best describes your primary occupation?
   1 = Banking
   2 = Real Estate
   3 = Land Assessment
   4 = Land Appraisal
   5 = Farm Management
   6 = Other (Specify: ____________________________)

19. What is the highest level of education you have completed?
   1 = Less than 12th grade
   2 = High School graduate, includes GED
   3 = Some college, vocational, or technical training
   4 = Bachelor's degree
   5 = Master's degree (MS, MA, MBA)
   6 = Professional degree (PhD, MD, etc.)

20. How close do you live to any of the lakes or creeks or streams in the Mark Twain Watershed?
   1 = Less than 1/2 mile
   2 = 1/2 to 1 mile
   3 = 1 to 2 miles
   4 = 2 to 5 miles
   5 = Over 5 miles away

21. How long have you lived in the Mark Twain Watershed at this location? ______ Years.

22. How close is your place of business to any of the lakes or creeks or streams in the Mark Twain Watershed?
   1 = Less than 1/2 mile
   2 = 1/2 to 1 mile
   3 = 1 to 2 miles
   4 = 2 to 5 miles
   5 = Over 5 miles away
Do you have any questions or comments about this survey, agriculture, land stewardship or anything related to the Mark Twain Watershed?

________________________________________________________________________

________________________________________________________________________

Thank you for your time. The researchers at Iowa State University and the University of Missouri appreciate your input and cooperation.

*Please fold and return your completed questionnaire by mailing in the enclosed, postage-paid envelope. Thanks!*
APPENDIX B. WRITE-IN COMMENTS

The following are comments that were written onto the survey by respondents, in addition to the structured questions. The question will be stated followed by comments. Please refer to Appendix A to reference individual questions.

Question 5: The table below lists several possible sources of water pollution. Please indicate the extent to which you think each source contributes to water pollution in the Mark Twain Watershed. (Additional sources of water pollution).

- Roadway ditches (cans, bottles, etc.)
- Golf courses, MO DOT spraying road ditches so they don't have to mow, boats in the lake (recreation).
- Fish & Wildlife

Question 9: Some people consider riparian forest buffers to be an asset, providing benefits to the land & people. Based on your knowledge or opinion, please indicate whether you think that each item listed below is a benefit of using riparian forest buffers. (Additional benefits).

- Improves water quality
- Increases diversity
- Increases soil productivity

Question 10: Other people consider riparian forest buffers to be a liability. For each item listed below, please indicate whether you feel it is one of the liabilities, or negative aspects, of using riparian forest buffers. (Additional liabilities).

- Maintenance
- Crop loss from increase in wildlife activity and feeding
Question 12: The establishment and maintenance of riparian forest buffers in the Mark Twain Watershed could be financed by several groups. Please record the percentage of the cost that you think should be paid by each of the following groups. The total percentage should add to 100%. (Additional groups).

- Environmental/conservation groups
- Conservation Department
- Wildlife Conservation
- Local Government

Question 13b: If you have discussed riparian forest buffers with clients, what has been the nature of the discussion(s)?

- Financial impact (i.e. it is cost prohibitive to have riparian forest buffers)
- Cost v. Benefits (may include government payments such as CRP), Education
- The benefits of soil maintenance and reduced loss
- Diversity
- Watershed and wildlife preservation
- Negative aspects (loss of crop ground, roots pulling moisture from crops, time required for buffer to grow, will losses overcome benefits?)
- Requirements of enlistment into CRP – not worth the hassle

Question 15: For each activity listed below, please indicate whether you might be willing to participate (or already are participating) in this activity as part of a Missouri Stream Team or other volunteer organization in the Mark Twain Watershed area. (Additional activities).

- Education about programs through local government

Additional Comments

- Largest source of pollution is erosion from cropland, runoff from livestock operations, and untreated raw sewage from residential properties.
- What happened to grass strips for protection?
- If landowners are forced to create clean water for the majority of the population, they should be highly compensated.
Landowners should not have to pay for stream buffers. However, if buffers are established for landowners for free, there should be a system established where the public, who have helped in the process, should have access to the area for recreational use, such as fishing, hunting, hiking, camping, etc.

Am very concerned about water quality in the area. Unauthorized dumping of trash into local streams is a major problem in the area. Water quality appears to be very poor due to dumping and lack of filter strips. Any involvement of EPA and Corps of Engineers is a problem for the landowner or general public.

Boats on the lake contribute to water pollution. Golf courses and the do-it-yourself people in town who spray and fertilize yards also contribute to water pollution. MO DOT sprays ditches so they don't have to mow, has anyone noticed the erosion in the ditches that have been sprayed? I don't feel the landowner should have to pay for watershed improvements unless it is something that really benefits him.

I buy bottled water to drink. I will not drink water at work.

Soil erosion and water quality should be of concern to everyone. More education on the topic would be helpful.
LITERATURE CITED


SPSS. 1999. SPSS Base 10.0 Applications Guide. SPSS, Inc., Chicago, IL.


