# AGRICULTURAL CERTAINTY IN OKLAHOMA: A SURVEY OF AGRICULTURAL PRODUCERS AND POTENTIAL PHOSPHORUS LOAD REDUCTIONS WITHIN THE ILLINOIS RIVER WATERSHED

By

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Abstract: Agricultural certainty is a growing concept in the United States. An agricultural certainty program is a voluntary program, where agricultural producers receive a whole farm conservation plan, implement the recommended conservation practices, and then can choose to sign an agreement with state and/or federal partners agreeing to maintain the implemented conservation practices for a specified amount of time. In exchange, the producer receives "certainty" that they will not be required to implement any additional practices for the length of the agreement if additional state and/or federal regulations are enacted (Natural Resources Conservation Service, 2011). The purpose of this study was to research the willingness of agricultural producers in the State of Oklahoma to participate in a certainty program. To determine willingness, a survey was developed and distributed to agricultural producers in Oklahoma. Although the survey had a low number of responses, it was determined that there is an interest within the agricultural community for a program. Additionally, this study explored the potential phosphorus (P) load reductions associated with best management practice (BMP) implementation on agricultural fields to simulate the P reductions that an individual producer could potentially have within the Illinois River watershed. Based on an existing study of the Illinois River watershed using the Soil and Water Assessment Tool (SWAT), average P load reductions between 7 and 28% were predicted from no overgrazing and litter export on pasture (Storm & Mittelstet, 2014). This study also used the Texas Best Management Practice Evaluation Tool (TBET) to predict Phosphorus (P) reductions from pasture fields for various management practices, which include no overgrazing, riparian buffers and cattle exclusion. Phosphorus reductions of up to 92% could be achieved on overgrazed pasture land, and 83% on well-managed pasture land through the implementation of riparian buffers, proper grazing, and cattle exclusion in the Illinois River watershed. Based on survey responses and potential phosphorus load reductions, the State of Oklahoma, and watersheds like the Illinois River watershed could benefit from the creation of an agricultural certainty program.

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# CHAPTER I

## INTRODUCTION

Since the Clean Water Act (CWA) was created in 1972, the United States (US) has made improvements in water quality. Those improvements were made mainly through point source pollution control (Bucks, 2002). Despite the Clean Water Act's success with controlling point source pollution, the U.S. still struggles to meet the CWA's goal to "restore and maintain the chemical, physical, and biological integrity of the nation's waters" (Clean Water Act 1972). There are currently 41,586 water bodies that are considered impaired in the United States, 657 of which are in the State of Oklahoma (USEPA, 2014).

The leading source of water quality issues in the United States is nonpoint source pollution (NPS), and the leading source of NPS to rivers and lakes is agricultural runoff (USEPA 2005). With the exception of Animal Feeding Operations (AFO) and Confined Animal Feeding Operations (CAFOs), agricultural runoff is not regulated by state or federal agencies. Agricultural management practices, such as the use of nitrogen and phosphorus fertilizers, application of manure, animal feeding operations, livestock management and crop rotations, all influence how an individual agricultural operator

impacts water quality (USEPA, n.d.). Many of these water quality impacts can be reduced through conservation and best management practices (BMPs) (USEPA, n.d.), which will be discussed in a later chapter. Government agencies provide opportunities to help agricultural producers implement BMPs and voluntarily reduce their environmental impacts (USEPA, 2005).

To encourage agricultural producers to voluntarily reduce NPS from their operations, the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) and state conservation agencies, like the Oklahoma Conservation Commission (OCC), develop and implement conservation programs that provide cost share and/or other incentives in return for participation. In order to continue to encourage voluntary reduction of NPS, new conservation programs with new and innovative incentives must be developed. A relatively new type of program, referred to as an agricultural certainty program, might provide incentives other than money that will encourage producers to participate.

Agricultural certainty is a growing concept in the United States. An agricultural certainty program is a voluntary program, in which agricultural producers receive a whole farm conservation plan, implement the recommended conservation practices, and then can elect to sign an agreement with state and/or federal partners agreeing to maintain the implemented conservation practices for a specified period of time. In exchange, the producer receives assurance that they will not be required to implement any additional practices for the length of the agreement if additional state and/or federal regulations are enacted (NRCS, 2011).

The State of Oklahoma has been considering establishing a certainty program. In 2012, a working group on certainty was organized that consisted of a representative from each of the following agencies: Oklahoma Conservation Commission (OCC), USDA Natural Resources Conservation Service, and the Oklahoma Department of Agriculture, Food and Forestry (ODAFF). It is important to investigate if agricultural producers in Oklahoma are interested in participating in a certainty program before deciding whether or not one should be created in the State.

## Objectives

This project had two main objectives. The first objective was to determine whether Oklahoma's agricultural producers are willing to participate in a voluntary agricultural certainty program and to determine the framework characteristics of a program that would encourage participation. To address these objectives, the following questions were asked:

- Are producers interested in a certainty program?
- Would producers prefer a five-year or a ten-year contract?
- Do producers want protection from state regulations or both state and federal regulations?
- Would producers be more likely or less likely to participate if the Environmental Protection Agency was involved?
- Would producers participate in a certainty program if they did not receive cost-share funds?

- Is there a relationship between the desire for state and federal protection and tendency to participate if EPA is involved?
- Do producers who would participate already have a conservation plan?
- Do producers who would participate already participate in Farm Bill programs?
- Of those who would participate, what type of agricultural operations do they have?
- Are variables such as age, education, gender, political beliefs, or income related to participation?

The first objective is in accordance with Oklahoma State Statute Title 2. Section 2-18.3, which states:

> "The Oklahoma Department of Agriculture, Food, and Forestry, in cooperation with the Oklahoma Conservation Commission and the Oklahoma State University Cooperative Extension Service shall determine if there is a willingness among agriculture producers in Oklahoma to institute a voluntary program designed to reduce the liability of landowners through the establishment of best management practices designed to address water quality issues throughout Oklahoma. The program shall be voluntary in nature and encompass all state and federal regulatory requirements."

The second research objective was to predict the potential phosphorus load reductions that could result from the implementation of a certainty program in the Oklahoma portion of the Illinois River watershed. Phosphorus load reductions were

estimated for 100% poultry litter export, no over grazing allowed, and implementation of riparian buffers and cattle exclusion.

# CHAPTER II

# REVIEW OF LITERATURE

## Nonpoint Source Pollution from Agriculture

Agricultural runoff can contain nitrogen, phosphorus and sediment that can come from excessive application of fertilizer, manure application, improper livestock management or soil erosion (USEPA, n.d.). As excess nitrogen (N) and phosphorus (P) enter waterways, they can impair water quality, causing eutrophic conditions. Excess N and P provide nutrients to algae, resulting in population growth. When algae populations grow, they provide more food to decomposing microorganisms, which then leads to decreased dissolved oxygen levels in the water. This, in turn, results in negative changes in the biotic community. Eutrophication can not only cause harm to the aquatic community, but it can also decrease the aesthetic value of a water body, and potentially cause harm to human health through production of toxins (USEPA, 2015).

### Phosphorus as an Agricultural Source of NPS

Phosphorus will be the main pollutant discussed in this study because it is considered an important limiting nutrient in freshwater lakes, streams, rivers and estuaries, especially in the summer and fall (Correll, 1998). As a limiting nutrient, P

levels dictate the extent to which a population of algae species can grow (Correll, 1998). EPA studies have shown that nitrogen flux levels have decreased since 1980, but phosphorus flux levels have increased by 9.5% (USEPA, 2007). This increase in P flux can be explained by the corresponding increases in P inputs. For example, according to the USDA, over the past 50 years, agriculture has become a source instead of a sink for phosphorus because the inputs of phosphorus in feed and fertilizer far outweigh the amount of phosphorus that comes from agriculture as an output. To put this in perspective, Sharpley et al. (2006) estimates that over 600 metric tons of phosphorus have been applied to agricultural land within the Mississippi Atchafalaya River Basin over the past fifty years, and only 250 metric tons of phosphorus have been removed as produce.

**Best Management Practices to Abate Agricultural NPS**

Agricultural producers can implement multiple BMPs to reduce their negative environmental impacts. These practices include crop residue management, cover crops, crop rotations, buffer practices (i.e. filter strips, field borders, riparian forest or herbaceous planting), nutrient management, integrated pest management, prescribed grazing, fencing and water development, control of invasive brush species, cattle exclusion from riparian zones, waste storage structures, and erosion control practices (S. Glasgow, personal communication September 17, 2013). This project focused on riparian buffer practices, cattle exclusion, grazing management (i.e. no overgrazing), and nutrient management (litter export).

**Riparian buffer practices.** A riparian buffer area is an area that is adjacent to a water body that contains trees, shrubs, forbs and grasses (NRCS, 2011). The NRCS lists six different purposes for riparian buffers: provide shade to lower water temperatures, creates/ improves riparian habitat, reduces runoff that contains nutrients, pesticides and sediment, reduces pesticide drift, restores plant communities and increases carbon storage (NRCS, 2011). NRCS standards require that a riparian buffer must have a width of 100 feet or 30 percent of the geomorphic flood plain, whichever is less. Hoffman et al. (2009) compiled multiple studies on riparian areas' effect on P retention. Their results showed a total phosphorus retention rate between 32-93 percent. Furthermore, Mankin et al. (2007) demonstrated 92.1% P reductions by using simulated runoff on riparian buffer system that included grass and shrubs.

**Cattle exclusion.** Cattle exclusion, or access control, is the temporary or permanent exclusion of livestock from an area. Cattle exclusion is practiced for a variety of reasons and on all land types (NRCS 2011). Cattle exclusion can be practiced as the only BMP or can be used in concert with other conservation practices (NRCS, 2008). For example, when implementing a riparian buffer, producers often implement cattle exclusion to keep livestock out of the riparian area and adjacent stream. Cattle exclusion is achieved by constructing fences around the targeted area (NRCS, 2011). Miller et al. (2009) found that over a four-year period, the combination of streambank fencing and cattle exclusion improved the riparian area in their study from being "healthy, but with problems" to being "healthy." They also found that streambank fencing prevented the increase of various water quality parameters downstream from the project site (Miller, Chanasyk, Curtis, Entz, & Willms, 2010). Additionally, Line et al. (2000) demonstrated

a 76% reduction in total Phosphorus after implementing cattle exclusion on a 335 meter long riparian corridor in North Carolina.

**Grazing management.** It is important to properly graze pasture for multiple reasons. Proper grazing improves or maintains the condition of pasture, increases forage production and reproduction of plants. Proper grazing also decreases erosion, increases water conservation and improves water quality (USDA NRCS, 2000). This study considers the phosphorus load reductions that would potentially result from changing overgrazed pasture land (0.50 animal units per acre) in a watershed to well-managed pasture land (0.25 animal units per acre) (Storm & Mittelstet, 2014). Landowners can achieve well-managed pasture by using multiple land management practices. These practices include prescribed grazing, grazing management plans and proper livestock distribution (USDA NRCS, 2000).

**Nutrient management.** The NRCS defines nutrient management as "managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments" (USDA NRCS, 2012). Nutrient management is important to conserve nutrients, protect air quality, and maintain and improve soil conditions. Additionally, nutrient management helps to decrease nonpoint source pollution of surface waters, and also assists in the proper application of animal manure for nutrients (USDA NRCS, 2012). The study area (Illinois River watershed) has suffered from water quality issues due to poultry litter application throughout the watershed. Poultry litter is the largest P contributor in the watershed (Storm & Mittelstet, 2014).

## Illinois River Watershed

The Illinois River watershed (IRW) is approximately 1,069,530 acres and stretches across seven counties: four in Oklahoma and three in Arkansas. Approximately 53% of the watershed is in Oklahoma and is located in parts of Adair, Cherokee, Delaware and Sequoya Counties (Storm & Mittelstet, 2014). For the purpose of this research, only the Oklahoma side of the watershed was examined. The 1970 Oklahoma Scenic River Act designated the Illinois River as a State Scenic River. This means that it is one of Oklahoma's most valuable water resources for aesthetic and recreational value, as well as a drinking water source. Due to point and nonpoint source pollution, the Illinois River has been significantly threatened by excess nutrients (OWRB, 2011). In 2002, the State of Oklahoma adopted a total phosphorus criteria of 0.037 mg/l in an attempt to save the Illinois Rivers status as a scenic river (OWRB, 2011). Additionally, the IRW has been the center of litigation, including a 2006 lawsuit filed by the Oklahoma State Attorney General against seven poultry integrator companies located within the watershed (Storm & Mittelstet, 2014). The IRW was chosen for this project because of its nutrient issues. A certainty program would most likely be implemented in a watershed with nutrient issues like the IRW.


Figure 1: Map of the Illinois River watershed (Storm and Mittelstet 2014)

**Storm & Mittelstet (2014)**

The report, *Hydrologic Modeling of the Oklahoma/Arkansas Illinois River Basin Using SWAT 2012*, identified the amount of phosphorus that various land covers contribute within the IRW. The study also proposed BMPs that could reduce the phosphorus loads to meet the 0.037 mg/L P standard. This research study used load

reductions from Storm and Mittelstet (2014) for base, 100% litter export and no overgrazing management practices.

Storm and Mittelstet (2014) used the Soil and Water Assessment Tool (SWAT) to estimate stream flow and phosphorus loads. The SWAT input included a 10-meter digital elevation model for topography, Soil Survey Geographic Database soil data, and a new representative land cover image that divided the landscape into eight categories: forest, urban, bare soil, crops, rangeland, hay, overgrazed pasture and well-managed pasture. The new 10-meter land cover image was developed by using Landsat images from 2010 and 2011. The researchers delineated the watershed into 147 subbasins and split those subbasins into 4930 HRUs. They used daily precipitation and minimum/ maximum temperatures for weather data, and the National Hydrography Dataset pond data (Storm & Mittelstet, 2014). For land management and soil nutrient input, total inputs for human inputs, cattle, commercial fertilizer and poultry were utilized. They also used soil test phosphorus data from Adair, Delaware, Cherokee, and Sequoya counties in Oklahoma and Benton and Washington County in Arkansas. Water quality data primarily came from 17 U.S. Geological Survey (USGS) Water Quality Division Sites. Since nutrient loads cannot be easily measured, Load Estimator (LOADEST) was used to estimate pollutant loads for the model calibration and validation (Storm & Mittelstet, 2014).

Hydrologic calibration was conducted for the period from January 1990 to December 2010 at four different gauges. The researchers used the Nash-Sutcliffe Efficiency (NSE) and the Root Mean Square Error (RMSE) Standard Deviation Ratio (RSR) to gauge the performance of the model. This method judges the model as very good, good, satisfactory, and unsatisfactory based on the normalized statistic, NSE and

the RSR, which is a ratio of the MRSE and standard deviation (Storm & Mittelstet, 2014). The model performed very good at all four gauges. Hydrologic validation, which tests the calibrated model against observed data that was not used in calibration, was done for daily flow from January 1980 to December 1989. The model performed very good at all four gauges, according to the NSE and RMSE RSR method, with only one "good" exception (Storm & Mittelstet, 2014).

The study used an in-stream phosphorus model with three phosphorus pools: soluble phosphorus, particulate phosphorus, and streambed phosphorus. The phosphorus SWAT model was calibrated for the time period from January 2001 to December 2010. The calibration was conducted by using daily observed concentrations and monthly loads (Storm & Mittelstet, 2014). Their simulated P concentrations were compared to USGS measured total P concentrations, and they had very good geometric means at two gauges and one gauge with more scattered results. The validation used water quality data from 1995 to 2000, and had very good results for all three sites for total and dissolved P (Storm & Mittelstet, 2014).

After calibrating the model for flow and phosphorus, they updated litter application, point source, and weather information to best fit current conditions. According to ODAF, 89% of litter is exported from the Oklahoma side of the IRW which means that 7,700 tons were applied in Cherokee, Adair, and Delaware County (Storm & Mittelstet, 2014). The study showed that from 2004 to 2013 the average P loads into Lake Tenkiller were 188,100 kg. Results showed that a combination of no overgrazing and no litter application could result in a 24.2% load reduction in the Flint Creek

subwatershed, 18.9% reduction in the Barren Fork subwatershed, and 13.2% reduction in the Illinois River subwatershed (Storm & Mittelstet, 2014).

### Texas Best Management Practice Evaluation Tool

The Texas Best Management Practice Evaluation Tool (TBET) is a field level nutrient and sediment load prediction tool. This tool was used to estimate phosphorus reductions that would result from the implementation of riparian buffers within the Illinois River watershed. According to White et al. (2012), TBET was created for two reasons: "1) Assist land managers and agency planners in decision making related to on-farm conservation practice alternatives and effectiveness, and 2) Facilitate evaluation and reporting of agricultural nonpoint source load reductions from practice implementation under Texas conditions." TBET can be used on agricultural fields in Texas, Oklahoma and surrounding states (White et al., 2012).

TBET, which is described as a simplified interface for SWAT was chosen due to its user-friendly program. TBET requires six inputs for each run: cropping system, management practices, soil type, field area, distance to stream, and soil test phosphorus (STP) (White et al., 2012).

## Agricultural Conservation Programs

### Programs Available in Oklahoma

Agricultural producers in Oklahoma can enroll into conservation programs that the Oklahoma Conservation Commission offers or Farm Bill programs offered through the USDA NRCS.

**Federal Farm Bill Programs.** There are many different programs that agricultural producers can enroll in voluntarily to help reduce their operation's environmental impact through the Federal Farm Bill. Those programs include the Conservation Reserve Program (CRP), Conservation Stewardship Program (CSP), Environmental Quality Incentives Program (EQIP), Agricultural Water Enhancement Program (AWEP), Agricultural Conservation Easement Program (ACEP), Healthy Forest Reserve Program (HFRP), and Wildlife Habitat Incentive Program (WHIP).

The Conservation Reserve Program (CRP) was created in 1985. The purpose of CRP is to convert land that is susceptible to erosion to grasslands to conserve the soil and create better soil for future use. According to Randall et al. (1997), 36.5 million acres of land were enrolled into CRP by 1993. Land that is enrolled into CRP significantly decreases the amount of nitrogen that reaches water bodies (Randall et al., 1997). During a six-year study, land under CRP had an average N-uptake of 68 kg/ha and N-removal for the CRP land equaled zero. The CRP system also had a significantly lower drainage rate than other cropping systems such as continuous corn and corn-soybean rotations, approximately 50-80% lower (Randall et al., 1997).

The Conservation Stewardship Program (CSP) aims to benefit agricultural producers and the environment. Through this program, producers implement practices that will improve natural resources on their land. When a producer enrolls into CSP, they enter into a five-year contract. During the five year contract, producers are paid to implement and maintain conservation practices. Producers are eligible for additional payments, if they choose to implement resource-conserving crop rotations (USDA, 2014).

Environmental Quality Incentives Program (EQIP) is the largest conservation financial assistance program and it was enacted in 1996. Under EQIP, producers implement practices that may be structural, vegetation or land management related. (Stubbs 2010). EQIP is a cost-share program where agricultural producers are paid up to 75% of the cost of BMP implementation. Additionally, producers are paid up to 100% of the income that they have forgone while implementing the conservation practices (Stubbs 2010). To receive cost-share funding, producers must sign a contract that lasts from one to ten years, depending on the implemented practices (Stubbs, 2010).

The Environmental Quality Incentives Program also includes two subprograms, the Agricultural Water Enhancement Program (AWEP) and the Conservation Innovation Grants (CIG). The AWEP was created to promote ground and surface water conservation as well as to improve water quality on agricultural lands (Stubbs 2010). The CIG goal is to increase innovative approaches to conservation, environmental technological advancement, agricultural production and forest management through federal funding. (Stubbs, 2010).

The Agricultural Act of 2014 created the Agricultural Conservation Easement Program (ACEP), but it repealed the Grassland Reserve Program, the Farm and Ranch Lands Protection Program, and the Wetlands Reserve Program. The purpose of ACEP is to provide technical and financial assistance to Indian tribes, state and local governments, and non-governmental organizations to protect agricultural lands, and to limit the non-agricultural use of those lands (USDA, 2014). Another easement program, the Healthy Forests Reserve Program (HFRP), establishes easements with 30 year contracts and 10 year cost-share agreements. The purpose of HFRP is to promote endangered and

threatened species recovery, improve plant and wildlife diversity, and to enhance carbon sequestration (USDA, 2014).

**State programs.** The State of Oklahoma currently offers the Conservation Reserve Enhancement Program (CREP), the Wetlands Program, and the Carbon Program. The CREP is a program offered by OCC in cooperation with USDA and it provides funding for landowners to establish riparian buffers. Fifty percent of the funding is provided by USDA. CREP has enrolled 900 acres within the Illinois River/ Lake Tenkiller Watershed and has a goal of 9,000 acres (OCC, 2013).

The Carbon Program encourages landowners to adopt voluntary conservation practices that reduce or sequester carbon emissions. These practices also protect water quality, prevent soil erosion, and improve air quality (OCC, 2015). In 1996, the State of Oklahoma created the *Oklahoma's Comprehensive Wetland Conservation Plan* with the goal to "conserve, enhance, and restore the quantity and biological diversity of Oklahoma's wetlands in the state" (OCC, 1996). There are many benefits from having healthy wetlands, such as natural flood control, wildlife habitat, water purification, and ground water recharge (OCC, 1996).

## Existing Agricultural Certainty Programs

Currently, there are five states that have certainty programs: Louisiana, Michigan, Minnesota, New York, and Texas. The existing programs vary in the steps that an agricultural producer must take, the incentives provided, the partners involved, and the specified length of the certainty contract. The following subsections will provide an overview of those programs.

**Texas Water Quality Management Plan Program.** The Texas Water Quality Management Plan (WQMP) Program was developed in the early 1990s by the passage of Texas Senate Bill 503 and is the oldest certainty program in the United States. Since the WQMP Program's creation, the Texas State Soil and Water Conservation Board (TSSWCB) has provided Water Quality Management Plans for over 15,000 agricultural or silvicultural operations (TSSWCB, 2013).

A Water Quality Management Plan (WQMP) is a farm-specific conservation plan that is designed to reduce water pollution to a level that is consistent with Texas water quality standards. To achieve these standards, the plan includes proper land management measures, production practices, land treatment practices, and technologies. The practices outlined in the WQMP must meet the criteria found in the NRCS field office technical guide (TSSWCB, 2013). The Texas Water Quality Management Plan Program is a five-step process (Figure 2). Initially, the agricultural producer requests a WQMP from their local Soil and Water Conservation District. Then, the WQMP is developed by the SCWD, NRCS, and TSSWCB. Afterwards, the Water Quality Management Plan is certified by the TSSWCB. The agricultural producer then implements the WQMP on their land and the WQMP is subject to status review by the TSSWCB (TSSWCB, 2010).

When an agricultural producer receives and implements a WQMP, they must sign a maintenance agreement. The agreement states that they will maintain the conservation practices that they have implemented. The producer agrees to maintain those practices for the lifespan of the conservation practices (TSSWCB, 2010). The TSSWCB provides a list of approved practices and their expected lifespans, which range from five to twenty years. While the producer is properly maintaining the WQMP, they are assumed to be

meeting water quality standards, and are afforded certain rights much like a discharge permit. The number of participants in the WQMP program attests to its success. John Foster, Programs Officer at the TSSWCB, attributes the success of the program to three main factors: availability of cost-share funding, protection from complaints to Texas Commission on Environmental Quality, and the requirement for all poultry facilities to obtain a WQMP (J.Foster Personal Communication November 3, 2015).

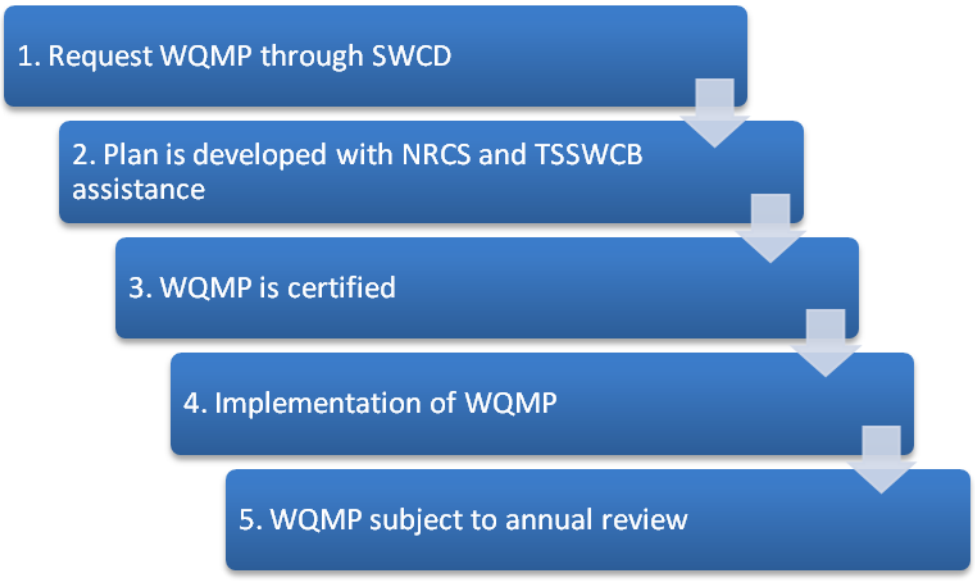


Figure 2: Steps to receive a TSSWCB WQMP

**Michigan Agricultural Environmental Assurance Program.** The Michigan Agricultural Environmental Assurance Program (MAEAP) has been in operation since 1998 when it was created by a coalition of environmental, agricultural and conservation groups. Even though it has been in operation since the late 1990s, MAEAP was codified into law in 2011 by Senate Bill 122 and House Bill 4212 (MAEAP, 2014).

For an agricultural operation to become verified, a producer must complete MAEAP's three-phase process (Figure 3). During the first phase, agricultural producers

attend MAEAP education courses in which they learn about the program and new regulations that might affect their agricultural operations. The second phase includes an on-farm risk assessment that aims to assess farm-specific environmental risks, based on one of three systems. The three systems are: livestock, farmstead, and the cropping system. Each system addresses environmental concerns specific to that operation. The system approach allows the State of Michigan to cater to the needs of their diversified agricultural industry. The last phase in the MAEAP process is a third-party verification. In this phase, a representative from the Michigan Department of Agriculture and Rural Development (MDARD) verifies that the first two phases have been completed, and that producer has implemented the required conservation practices to the specifications of Michigan's Generally Accepted Agricultural Management Practices (GAAMP). Once the farm has been verified, the certainty contract lasts a period of three years (MAEAP 2014). Since its inception, 1,967 operations have been verified, and MAEAP has a goal to complete 5,000 verifications by 2015 (MAEAP, 2014).

The MAEAP offers many incentives to agricultural producers who participate. The incentives include cost share, tax credits, low cost lending, reduced liability insurance premiums from participating companies, and a MAEAP farm sign that producers can display at their farm after they have completed the verification process (MAEAP 2014). The Michigan program saw impressive nutrient load reductions resulting from 424 farm verifications in 2013. The results for 2013 were a sediment load reduction of 347,620 tons, a Phosphorus load reduction of 592,197 and a Nitrogen load reduction of 1,353,505 pounds (MAEAP, 2014).


Figure 3: Steps in the MAEAP process

**Louisiana Master Farmer Program.** In the early 2000s, the State of Louisiana recognized that there was growing public concern over agriculture's impact on the environment. The Louisiana Master Farmer Program (LMFP) is described by the Louisiana State University (LSU) AgCenter as an attempt to show that agricultural producers can and will voluntarily decrease their impact on the environment (LSU AgCenter 2013). The program began in 2001 and has involved over 2,700 agricultural producers. The LMFP provides cost share incentives, as well as the opportunity for rice farmers to receive an extra $0.15-0.50 per barrel of rice through Kellogg (LSU AgCenter, 2013).

The LMFP is a three-phase program (Figure 4) that involves classroom instruction, a model farm field day, and the development and implementation of a farm specific conservation plan. During the first phase, producers learn about the program, the Clean Water Act, Total Maximum Daily Loads (TMDL), farm bill programs, Spill Prevention, Control and Countermeasure (SPCC) Plans, Waters of the US (WOTUS), and conservation practices along with other topics. The second phase, attending a model

farm field day, provides an opportunity for the producer to see demonstrations of best management practices. The next step of the process is for a producer to request a Resource Management System (RMS) level plan through their local NRCS office (LSU AgCenter, 2013). Over 2,500 individuals are currently in one of the three phases, and 210 have completed all three, and are within their five-year certification period (E. Girouard personal communication October 22, 2015).

In addition to the LMFP, Louisiana offers the Master Cattleman's Program (LMCP). The LMCP was created in 2004 to meet the needs of agriculture in the state. To participate in the LMCP, producers must complete phase one of the LMFP, along with additional course work in commodity specific study areas (LSU AgCenter, 2013). The LMCP makes it evident that certainty programs can evolve to meet the ever changing needs of agriculture.

The LMFP has statutory backing through Louisiana State Act 145, which provided the commissioner of agriculture with the ability to create a certification program (E. Girouard personal communication, October 22, 2015). Once a producer has completed all three phases, they are "presumed to be in compliance with the State of Louisiana's water conservation requirements" and are certified for a period of five-years with 6 hours of continuing education credits required for each year. The MCP does not have the "presumed compliance certification" unless the producer has completed all the three phases of the LMFP (E. Girouard personal communication, October 22, 2015).

While the MFP is a state certainty program, the EPA supports the program, and encourages participation. For example, EPA Region 6 Administrator Ron Curry wrote a

statement in the Louisiana Department of Agriculture and Forestry's Market Bulletin in 2013 encouraging agricultural producers in Louisiana to participate in the LMFP (Curry, 2013).

Ernest Girourd, Louisiana Master Farmer Program Coordinator, considers the LMFP to be very successful. The success of the program can be attributed partly to the effective partnerships between program partners, and the fact that producers encourage each other to participate in the program (E. Girouard personal communication, October 22, 2015).

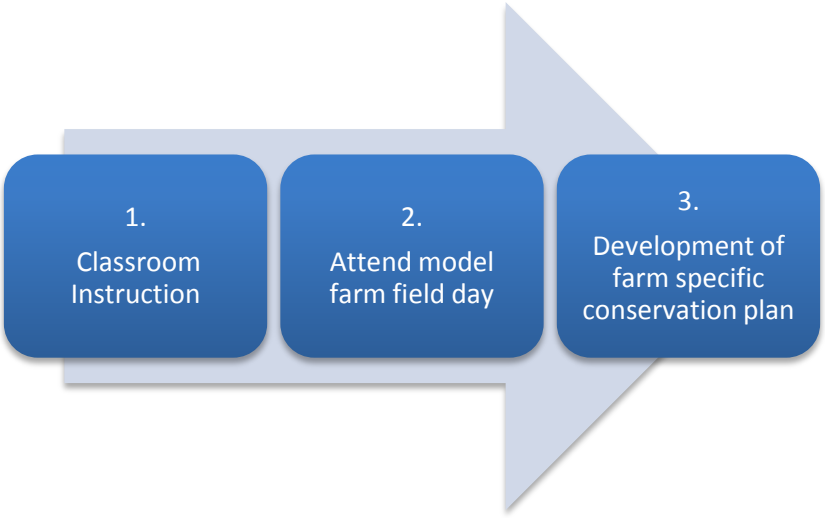


Figure 4: Steps in the LMFP

**New York Agricultural Environmental Management Program.** The New York Agricultural Environmental Management Program (NYAEMP) is operated by the New York Soil and Water Conservation Committee (NYSWCC), in cooperation with local soil and water conservation districts. The program aims to help producers comply with regulations while also helping the environment (NYSWCC, 2014). However, the NYAEMP does not claim to be a certainty program (NACD, 2012). New York's

program has a five-tier framework (Figure 5): In tier one, an inventory questionnaire is completed that establishes basic information about the agricultural producers and their operation, as well as potential concerns and interests. Tier two is the assessment worksheet step in which the producer and an AEM staff member completes an assessment to document stewardship and benchmark conditions, and takes inventory of environmental concerns. In tier three, the NRCS uses a nine step planning process to create a farm plan. Tier four is the implementation step in which the producer installs the required conservation practices to the standards of the NRCS, and also initiates management changes. The final tier is the evaluation step, where the farm is evaluated, the planning unit is evaluated, and the county program is evaluated (NYSWCC, 2014).


Figure 5: Steps in the NYAEMP

**Minnesota Agricultural Water Quality Certification Program.** The Minnesota Agricultural Water Quality Certification Program (MAWQCP) is the most recently created, and is administered by the Minnesota Department of Agriculture

(MDA). This program is unique because it involves an agreement between the State of Minnesota and the EPA. It was created in 2012 when the Minnesota Governor Mark Dayton, U.S. Secretary of Agriculture Tom Vilsack, and USEPA administrator Lisa Jackson signed a memorandum of understanding. Considering that the agreement involves the USEPA, it is the only certainty program that provides formal protection from future federal regulations (MDA, 2013).

The MAWQCP is a five-step process (Figure 6). In the first step of the process, the farm operation is assessed using an assessment tool that was developed specifically for the State of Minnesota. The assessment tool provides a numeric score of one through ten, and a certain threshold must be met for a farm operation to receive certification. The second step of the process provides an opportunity for the agricultural producer to obtain technical assistance from local conservation professionals, and financial assistance to create a conservation plan and to implement the required conservation practices. The State of Minnesota gives financial and technical priority to producers who are seeking certification. During the third step of the process, producers receive certification. Certification is granted by meeting certification criteria, which are determined by an MDA accredited certifier who uses an assessment tool and on-farm visits. Once a producer achieves certification, they are protected from additional state and federal regulations for a period of ten years. Certifications are subject to verification in the fourth step of the process, and then recertification in the fifth step (Minnesota Department of Agriculture, 2013). While the program does not have a formal classroom education component like the MFP, producers become very educated during the assessment and technical assistance phases. During the assessment phase local Soil and Water

Conservation District staff looks at each parcel of land with the landowner and while going through the conservation planning process the landowner learns about BMPs and how their operations may be negatively affecting water quality (B. Redlin personal communication, October 22, 2015).

During the first 3 years, MAWQCP was in a pilot phase. The program was transitioned out of the pilot phase in July 2015 and is currently being implemented statewide (B. Redlin personal communication, October 22, 2015). The program is considered to be successful thus far with 62 farms certified and 264 in progress. The success of the program can be attributed to the operating efficiency of the program, and the fact that it is implemented at the local level by the Soil and Water Conservation Districts (B. Redlin personal communication, October 22, 2015).

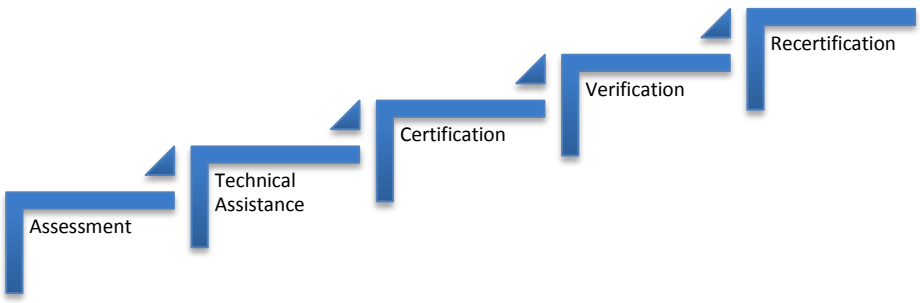


Figure 6: Steps in the MAWQCP

## Chapter Summary

Chapter II provided an overview of the literature that is relevant to this research. This included a review of agriculture's impact on water quality, best management practices to reduce those impacts, and existing conservation programs that are available to Oklahoma's agricultural producers to implement those BMPs. To continue to encourage BMP implementation, and to reach new producers in Oklahoma, it would be beneficial to consider creating a certainty program, like those discussed in Texas, Louisiana, Michigan, Minnesota, and New York. Through the review of existing programs, it is evident that there are differences in programs from state to state. The following chapter will demonstrate the methods that were used in this research to determine if Oklahoma's agricultural producers are interested in a certainty program.

# CHAPTER III

# METHODOLOGY

## Survey of Agricultural Producers

### Sample Population

The survey was intended for agricultural producers in the State of Oklahoma who could potentially participate in an agricultural certainty program, if it was created. Originally, the survey was distributed to five selected watersheds across Oklahoma: Illinois River, Honey Creek, Fort Cobb, Turkey Creek and Lake Wister Watersheds. Approximately 600 producers received mailed surveys. The agricultural producers within the watersheds that received the survey were producers who have worked with the Oklahoma Conservation Commission, or their local Soil and Water Conservation District. The intent was to obtain survey responses from cooperators within watersheds that were thought to contain producers with varying opinions and agricultural operations. Eventually, the survey population was widened to any agricultural producer in the State of Oklahoma who might potentially participate in a certainty program.

## Survey Distribution

The first round of distributed surveys went to producers in the five listed watersheds via mail in hard copy form (Appendix B). After the first mailing, an online version of the survey was created. A follow-up letter (Appendix F) was sent to the original recipients that included a reminder to complete the survey and the website address to the online survey. The website address was then provided to Soil and Water Conservation District Directors across the state with the option to forward it to any other agricultural producers who may be interested.

The Oklahoma Farm Report, a farm radio station in the State of Oklahoma, ran an article about the certainty survey in the daily email newsletter "Oklahoma's Farm News Update" (Appendix G). At that time, the daily email was distributed to approximately 3,000 email addresses. Additionally, the web link to the survey was distributed via a social media site for the OCC as well as their website. Our last measure was to have conservation staff that work with producers in the IRW distribute approximately 50 surveys to producers by hand.

## Survey Data

The survey had four main sections. The first section asked questions that were specific to a certainty program to determine if they would participate in a certainty program and what they would like the framework to look like. Section two included questions about the participants' current agricultural operation. This section was intended to find out who would want to participate in a certainty program, i.e. producers with crops, grasslands or animal feeding operations, or farmers who have or have not

previously participated in conservation programs. Section three contained demographic questions, and section four was a comments section. The survey was created through a collaborative effort between the researcher and the certainty working group. It can be found in Appendix B.

**Statistical Analysis of Survey**

STATA data analysis and statistical software was used for the statistical analysis. Descriptive statistics were run on all survey questions. Descriptive statistics were used to answer the following research questions:

- Are producers interested in a certainty program?
- Would producers prefer a five-year or a ten-year contract?
- Do producers want protection from state regulations or both state and federal regulations?
- Would producers be more likely or less likely to participate if the Environmental Protection Agency was involved?
- Would producers participate in a certainty program if they did not receive cost share funds?

Cross tabulations, Pearson Chi-Squared test and Fisher's Exact Test were used to answer the following research questions:

- Is there a relationship between wanting state and federal protection and being more or less likely to participate if EPA is involved?
- Do producers who would participate already have a conservation plan and are they related?

- Do producers who would participate already participate in Farm Bill programs and are the two variables related?
- Of those who would participate, what type of agricultural operations do they have and is there a relationship between the variables?
- Is age, education, gender, political beliefs, or income related to participation?

The Pearson Chi-Squared test statistic is used both as a goodness of fit test, and contingency table. The contingency table method determines if there is a relationship between two or more variables (Howell n.d.); this is the method that was used in this analysis. The equation for the Pearson chi-squared test statistic is:

$$\chi^2 = \sum\sum \frac{(O_{ij}-E_{ij})^2}{E_{ij}}$$

By using this statistical analysis, the above research questions can be answered. When using the chi-square test, a small p-value ($\leq 0.05$) indicates strong evidence against the null hypothesis; a large p-value ($>0.05$) indicates weak evidence against the null hypothesis; p-values that are close to the cut off (0.05) are considered marginal (Freund, Wilson & Mohr, 2010). The null hypothesis is that there is no relationship between variables. The chi-square test assumes that each cell will have a value of 5 or more, if this was not met, the Fisher's exact test was also conducted. Fisher's exact test is widely used when the chi-square test is desired, but sample size is small, or if one of the categories is a rare event (Freund et al., 2010). The Fisher's exact test is a very complex formula and requires statistical software to conduct.

## Phosphorus Load Reduction from Potential Program Implementation

### Phosphorus Load Reductions

First, by using existing load reductions from "Hydrologic Modeling of the Oklahoma/Arkansas Illinois River Basin Using SWAT 2012" by Storm and Mittelstet (2014), P load reductions were calculated for no overgrazing, 100% litter export, and no overgrazing and 100% litter export on pasture land within the Illinois, Barren Fork, and Flint Creek subwatersheds. Then, the Texas Best Management Practice Evaluation Tool (TBET) was used to calculate field level P reduction for no overgrazing, riparian buffers, and cattle exclusion.

### Study Area: Illinois River Watershed

The Illinois River watershed is approximately 1,069,530 acres and stretches across seven counties: four in Oklahoma and three in Arkansas Approximately 53% of the watershed is located in Oklahoma, and includes parts of Adair, Cherokee, Delaware and Sequoya counties (Storm & Mittelstet, 2014). For the purpose of this research only the Oklahoma side of the watershed was considered. The Illinois River watershed was chosen for this project because of its present problems with nonpoint source pollution, and the 0.037 mg/l P criterion; a certainty program would most likely be implemented in a watershed with nutrient issues like the IRW.

### Storm and Mittelstet (2014) P Load Reductions

Storm and Mittelstet (2014) used SWAT to identify the sources of phosphorus within the Illinois River watershed on the Oklahoma portion, and identified best

management practices to help reduce Phosphorus loads to meet the 0.037 mg/L P standard. To find average P reductions on pasture land for no overgrazing, 100% litter export, and no overgrazing and 100% litter export, total P loads for each subwatershed were combined for each management scenario. Then reductions were determined based on the base scenario. After that, the reductions were divided by the total number of acres in pasture land (approximately 102,253 acres) to produce a lb/acre P reduction.

Storm and Mittelstet (2014) states that pasture land within the study area has a base average P yield of 0.37 lb/acre. This value was used to determine the average P yield under the three different management scenarios. The resulting values were then used to find average percent reductions in P yields.

**TBET Inputs**

TBET requires six inputs for each run. The inputs include cropping system, management practices, soil type, field size, distance to stream, and soil test phosphorus (White et al., 2012). The inputs for each of the six categories are below.

**Cropping System**. A mixed pasture management cropping system was used. Originally TBET did not have a mixed warm and cool season grass option. A mixed pasture option was added and went through testing to ensure that the cooler months matched the same trends as fescue (Figure 7), and warmer months with bermuda (Figure 8) (A. Mittelstet, personal communication). TBET also requires the following information for pasture: forage type, grazing system, pasture management, stocking density and fertilizer use. Warm/cool mix was chosen for forage type. A continuous grazing system was utilized. No phosphate fertilizer was applied.

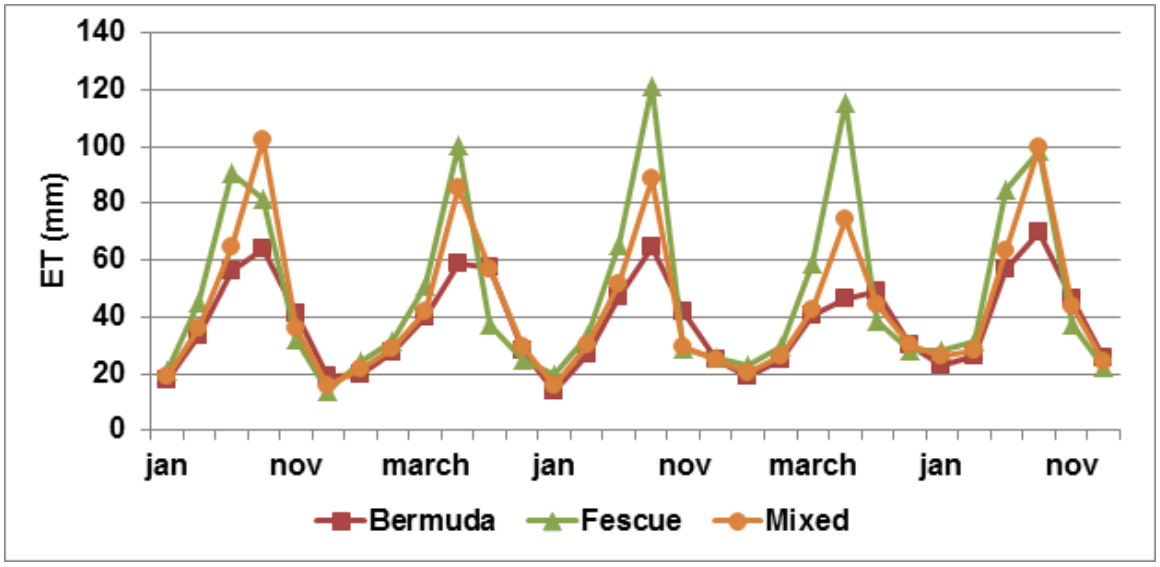


Figure 7: TBET mixed pasture management system validation for cooler months

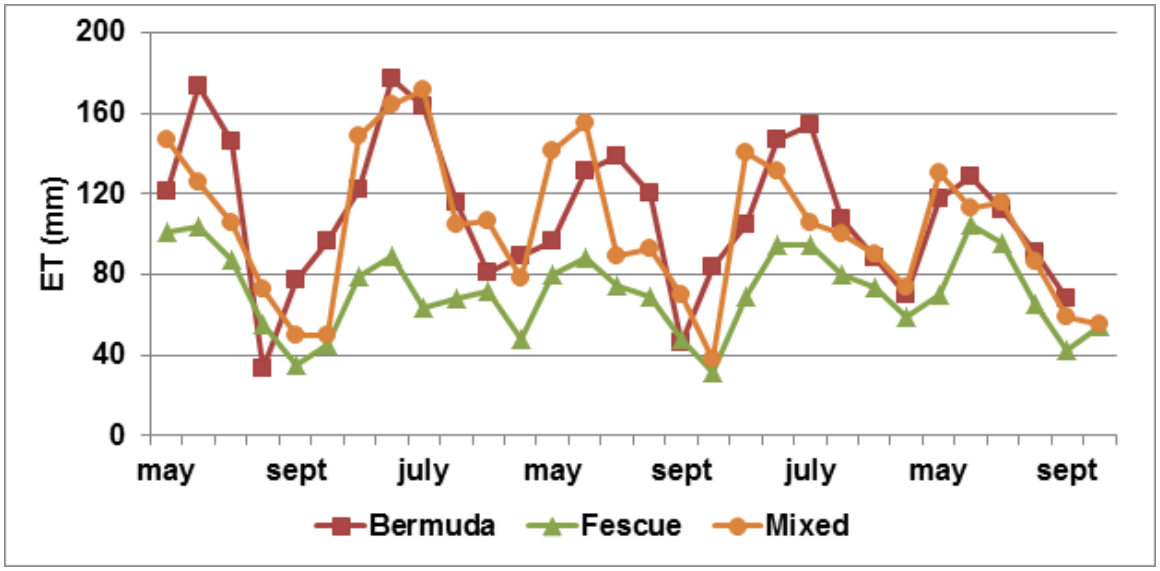


Figure 8: Mixed pasture management system warm month validation

Phosphorus yields were predicted for both overgrazed and properly managed pasture. To estimate P yields for scenarios in which overgrazing is being allowed within the watershed, the pasture management TBET option moderate overgrazing allowed was used, and a stocking density of 0.5 AU/acre. For scenarios in which no overgrazing is

allowed, the pasture management option optimally grazed, and a medium stocking density of 0.25 AU/acre was used.

**Management Practices.** In addition to overgrazing allowed and no overgrazing allowed, TBET was used to estimate the phosphorus yields and reductions resulting from riparian buffers, and cattle exclusion. The riparian buffer conservation practice requires an input of the length of riparian buffer, and a width. The 40-acre field was assumed to be square, which would make one side of the square field 1320 feet. Also, the NRCS standard of a 100-foot wide riparian buffer was used.

**Soil Type.** The soil type within the Illinois River watershed was determined by using ArcGIS. The most representative soil type, Clarksville Gravely Silt Loam; 0 to 3 percent slope was used as the input (A. Mittelstet personal communication April 30, 2014).

**Field Size.** The actual field sizes within the Illinois River watershed are included in confidential documents. Therefore, an average field area was used that is based on the professional judgment of conservation professionals working within the IRW. The average field size was 40 acres (T. Kirk, personal communication, April 21, 2014).

**Distance to Stream.** The average field distance to stream was 561 feet. This was found by using a 1:24,000 stream layer for the Illinois River watershed, and by converting the raster layer of pasture into polygons. The nearest neighbor proximity tool was utilized to calculate the distance from each polygon to the nearest stream segment (A. Mittelstet, personal communication, April 30, 2014). Although the average distance to stream in the watershed is 561 feet, a producer would not typically implement a

riparian buffer or cattle exclusion that far from the stream. Riparian buffers and cattle exclusion from streams are implemented in the riparian area, which is the area adjacent to the stream. So to estimate P yields for riparian buffers and cattle exclusion, a distance to stream of 0 feet was used.

**Soil Test Phosphorus.** Soil Test Phosphorus (STP) varies throughout the watershed. Adair County has 112,458 acres of pasture in the watershed, and an average STP of 134 lb/ac in pasture; Cherokee County has 63,278 acres of pasture and an average STP of 75 lb/acre in pasture; Delaware County has 19,411 acres of pasture and an average STP of 104 lb/acre in pasture; Sequoya County has 2,031 acres of pasture and an average STP of 43 lb/acre in pasture (Storm & Mittelstet 2014). A weighted average, based on the percent of total pasture, of the four counties' STP values was used (table 1). This value calculated to be 111 lbs/acre.

Table 1

*Weighted Average of Soil Test Phosphorus (STP) Based on Percent of County in Pasture.*

| County | Avg[1] Pasture STP | Pasture (ac)[2] | % Total Pasture |
|---|---|---|---|
| Adair | 134 | 112,000 | 57 |
| Cherokee | 75 | 63,300 | 32 |
| Delaware | 104 | 19,400 | 10 |
| Sequoyah | 43 | 2,030 | 1 |

[1] Avg is the abbreviation for average

[2] ac = acre

Table 2
*TBET Inputs Used for Field Level Phosphorus Reductions in the IRW.*

| TBET Inputs | |
|---|---|
| Cropping System | mixed pasture |
| Management Practice | Riparian Buffer |
| Soil Type | Clarksville Gravely Silt Loam; 0 to 3% slope |
| Field Size | 40 acres |
| Distance to Stream | 171 meters, and 0 meters |
| STP | 111 lbs/ac |

**Individual TBET Runs**

In total, ten different management scenarios were calculated using TBET. The ten scenarios can be seen in Table 3.

Table 3
*Individual TBET Runs to Predict Phosporus Reductions on Fields in the IRW.*

| Management Scenario | Distance to Stream (ft)[1] | Stocking Density (au/ac)[2] |
|---|---|---|
| Overgrazing allowed | 516 | 0.50 |
| No Overgrazing | 516 | 0.25 |
| Overgrazing allowed | 0 | 0.50 |
| Overgrazing allowed and Cattle Exclusion | 0 | 0.50 |
| Overgrazing allowed and Riparian Buffer | 0 | 0.50 |
| Overgrazing allowed, Cattle Exclusion, and Riparian Buffer | 0 | 0.50 |
| No Overgrazing | 0 | 0.25 |
| No Overgrazing and Cattle Exclusion | 0 | 0.25 |
| No Overgrazing and Riparian Buffer | 0 | 0.25 |
| No Overgrazing, Cattle Exclusion and Riparian Buffer | 0 | 0.25 |

[1] feet

[2] animal units per acre

**Differences in Methods to Obtain Phosphorus Reductions**

The load reductions found in Storm and Mittelstet (2014) resulted from using SWAT, which is a basin-scale model (Gassman, Reyes, Green & Arnold, 2007). This means that load reductions are for the entire watershed, and the pound per acre values calculated in this study should be viewed as average values for pasture land if the described BMPs were implemented watershed-wide. However, TBET is a field level P reduction tool (White et al., 2012). To expand, the research methods utilizing TBET provided P reduction for a specific field. Reductions from the TBET runs can be considered the potential P reductions for an individual field resulting from the BMPs entered.

# CHAPTER IV

# RESULTS AND DISCUSSION

## Survey Results

### Survey Response Rate

Overall, survey response was very low. Of the approximately 600 surveys mailed to producers within the five designated watersheds, there were zero responses. The 0% response rate prompted the creation of the online survey, and follow-up letter. The online survey received 46 responses. However, these responses could have come from the producers within those watersheds, individuals who read the Oklahoma Farm News article, individuals who followed the link on social media, or those Soil and Water Conservation District directors who received the email from the OCC. The conservation professionals within the IRW collected 21 survey responses. In total, there were 67 responses. Of those 67, 2 were blank, and 7 were determined not to be complete enough to be included in the survey analysis. The survey analysis was based on 58 surveys. It is important to note that not all respondents answered all of the questions, therefore the results often do not reflect a total of 58.

### Questions about certainty

Of the total response to the survey, approximately 86% said that they would be interested in participating in a certainty program. The remaining 14% said that they are

not interested in participating in a certainty program. Ninety percent of the agricultural producers who responded said that they would participate in a certainty program if the certainty contract lasted five years. However, only 56% of respondents reported that they would participate if the certainty contract lasted for ten years. When asked about whether or not producers would participate if they were guaranteed protection from state regulations or both state and federal regulations, almost 49% of the survey participants said that they would participate if they were guaranteed protection from future state regulations only, whereas 51% said that they would not. On the other hand, 90% of the survey participants said that they would participate if they were guaranteed protection from both state and federal future regulations; only 10% said that they would not participate if they were guaranteed protection from both state and federal future regulations (Table 4). Protection from future federal regulations would involve the EPA, therefore it was important to ask if producers would be more likely or less likely to participate in a certainty program if the EPA is involved in the agreement. The results indicate that 41% of survey respondents would be more likely to participate if the EPA is involved in the certainty agreement and the remaining 59% said that they would be less likely to participate if the EPA is involved in the agreement. The survey showed that 71% would not participate in a certainty program if they did not receive cost share funding to implement conservation practices. The remaining 29% said that they would participate if they did not receive cost share funding. These finding are summarized in Table 4.

Table 4

*Survey Results for Questions Pertaining to Certainty.*

| Question | Answer | Frequency | Percent |
|---|---|---|---|
| Would Participate | Yes | 49 | 86 |
| | No | 8 | 14 |
| Five Year Certainty | Yes | 45 | 90 |
| | No | 5 | 10 |
| Ten Year Certainty | Yes | 28 | 56 |
| | No | 22 | 44 |
| State Certainty | Yes | 24 | 49 |
| | No | 25 | 51 |
| State & Federal Certainty | Yes | 44 | 90 |
| | No | 5 | 10 |
| EPA Involved | More Likely | 20 | 41 |
| | Less Likely | 29 | 59 |
| No Cost Share Funds | Yes | 14 | 29 |
| | No | 35 | 71 |

**Cross Tabulations**. Of the respondents who said that they would participate if they had protection from future state and federal regulations, 55% said that they would be less likely to participate if the EPA is involved in the certainty agreement. Results indicate that 45% would be more likely to participate if EPA is involved. Of all the cross-tabulations, this is the only scenario that holds statistical significance. A Chi-Squared test statistic of 3.8401 along with a P value of 0.05 is considered marginal. This indicates that there is possibly a relationship between EPA's involvement and whether or not agricultural producers would participate in a certainty program (Table 5). Because there were values less than 5 in the contingency table, the Fisher's exact test was also conducted and resulted in a P value of 0.07, meaning the null hypothesis is not rejected. In other words, based on the Fisher's exact test, which is more appropriate with smaller

values, there was no relationship between EPA's involvement and whether or not a producer would participate in a program.

Table 5
*Cross-Tabulation of Willingness to Participate in a Certainty Program by Participation if EPA is Involved .*

| | | State & Federal Certainty | |
|---|---|---|---|
| | | No | Yes |
| Participate if EPA is Involved | Less Likely | 5 | 24 |
| | | 100% | 55% |
| | More Likely | 0 | 20 |
| | | 0.00% | 45% |

*Note:* Pearson Chi-Square(1) = 3.84 Pr= 0.050

Of the survey participants who are interested in participating in a certainty program, 74% produced crops, 74% had grasslands, and 45% had animal feeding operations (Table 8). Additionally, 68% already had a conservation plan that was written by either NRCS or OCC (Table 6), and 45% participated in one or more federal Farm Bill Programs (Table 7). The Chi-Square test resulted in a p-value greater than 0.05 for all of the agricultural operation cross tabulations. In all cases, we failed to reject the null hypothesis, meaning that whether or not a producer had a conservation plan, participated in farm bill programs, or the type of operation they had is not related to whether or not they would participate. Because of low values in the contingency tables, the Fisher's exact test was conducted on each of these scenarios. Each test resulted in p-values greater than 0.05, meaning we failed to reject the null hypothesis with the Fisher's exact test as well.

Table 6

*Cross-Tabulation of Participation in a Certainty Program and Already Having a Conservation Plan.*

| | | Participate | |
|---|---|---|---|
| | | Yes | No |
| Conservation Plan | Yes | 28 | 5 |
| | | 68% | 71% |
| | No | 13 | 2 |
| | | 32% | 29% |

*Note:* Pearson Chi-Square(1) = 0.027
Pr= 0.869

Table 7

*Cross-Tabulation of Participation in a Certainty Program and Participating in Farm Bill Programs.*

| | | Participate | |
|---|---|---|---|
| | | Yes | No |
| Farm Bill | Yes | 20 | 4 |
| | | 45% | 67% |
| | No | 24 | 2 |
| | | 55% | 33% |

Pearson Chi-Square (1) = 0.952
Pr= 0.329

Table 8

*Cross-Tabulations of willingness to participate with having crops, grasslands, or animal feeding operations.*

| | | Participate | | | | Chi-Square[2] | |
|---|---|---|---|---|---|---|---|
| | | Yes | | No | | | |
| | | Freq.[1] | % | Freq. | % | (1)[3] | Pr [4] |
| | Yes | 31 | 89 | 4 | 11 | | |
| Crop | No | 11 | 73 | 4 | 27 | 1.81 | 0.178 |
| | Yes | 31 | 79 | 8 | 21 | | |
| Grassland | No | 11 | 100 | 0 | 0 | 2.69 | 0.101 |
| | Yes | 19 | 83 | 4 | 17 | | |
| AFO | No | 23 | 85 | 4 | 15 | 0.061 | 0.804 |

[1] Frequency

[2] Chi-Square Test Value

[3] 1 degree of freedom

[4] Probability value resulting from the Chi-Squared test

**Demographics**

Cumulative demographic statistics are presented in Table 9. The table includes demographics broken down into those who are interested in participating in a certainty program, and those who are not. N-values may not match in all cases because some participants did not answer all demographic questions. Some interesting findings include the following: more men completed the survey, but a larger percentage of women were interested in a certainty program. Forty-seven percent of the survey participants had a bachelor's degree, and 83.33% of those individuals were interested in a program. The largest represented age group was age 55-64, at 27%. The next largest groups were 35-44 and 65-74, both with 18%. The majority (56%) of survey respondents received 0-25% of their income from their agricultural operations, but a large percent (22%) received 76-

100% of their income from agricultural operations. Chi-Square test statistics did not show statistical relationship between any of these variables and participation.

**Limitations**

The most significant limitation of this study was the low response rate. The data and results presented are not necessarily representative of Oklahoma's agricultural community as a whole and hold little statistical significance. There are many possible reasons that survey recipients did not respond. For example, they may have needed more information before giving their input, or maybe the subject of regulation deterred responses, or maybe the survey was too long. Nonetheless, the reason for low response rate is impossible to know for sure.

Table 9

*Survey Results for Demographics Separated by Willingness to Participate in a Certainty Program with Associated Chi-Square Test Results.*

| | | Participate | | | | Chi-Square[2] (df)[3] | Pr[4] |
|---|---|---|---|---|---|---|---|
| | | Yes | | No | | | |
| | | Freq.[1] | % | Freq. | % | | |
| Gender | Male | 25 | 83 | 5 | 17 | 1.23 (1) | 0.260 |
| | Female | 17 | 94 | 1 | 6 | | |
| Ethnicity | White | 29 | 85 | 5 | 15 | 0.561 (3) | 0.905 |
| | Native American | 10 | 83 | 2 | 17 | | |
| | Black | 1 | 100 | 0 | 0 | | |
| | Asian | 2 | 100 | 0 | 0 | | |
| Education | High School | 4 | 100 | 0 | 0 | 3.49 (5) | 0.625 |
| | Some College | 8 | 80 | 2 | 20 | | |
| | Vocational | 2 | 67 | 1 | 33 | | |
| | Associates | 4 | 100 | 0 | 0 | | |
| | Bachelors | 20 | 83 | 4 | 17 | | |
| | Graduate | 5 | 100 | 0 | 0 | | |
| Age | 18-24 | 1 | 100 | 0 | 0 | 6.87 (6) | 0.333 |
| | 25-34 | 5 | 83 | 1 | 17 | | |
| | 35-44 | 7 | 78 | 2 | 22 | | |
| | 45-54 | 6 | 100 | 0 | 0 | | |
| | 55-64 | 13 | 93 | 1 | 7 | | |
| | 65-74 | 5 | 66 | 3 | 38 | | |
| | 75+ | 6 | 100 | 0 | 0 | | |
| Income | 0-25% | 23 | 82 | 5 | 18 | 5.29 (3) | 0.775 |
| | 26-50% | 6 | 86 | 1 | 14 | | |
| | 51-75% | 4 | 100 | 0 | 0 | | |
| | 76-100% | 9 | 90 | 1 | 10 | | |
| Political | Very Conservative | 8 | 100 | 0 | 0 | 5.30 (3) | 0.152 |
| | Somewhat Conservative | 11 | 85 | 2 | 15 | | |
| | Moderate | 13 | 87 | 2 | 13 | | |
| | Somewhat Liberal | 2 | 50 | 2 | 50 | | |
| | Very Liberal | 0 | 0 | 0 | 0 | | |

[1] Frequency

[2] Chi-Square Test Value

[3] degrees of freedom

[4] Probability value resulting from the Chi-Squared test

## Phosphorus Load Reductions

### Load Reductions Derived from Storm and Mittelstet (2014)

"Hydrologic Modeling of the Oklahoma/Arkansas Illinois River Basin Using SWAT 2012" estimated Phosphorus loads for three subwatersheds within the Illinois River watershed. Those subwatersheds included the Illinois, Flint Creek, and Barren Fork. Phosphorus loads from Storm and Mittelstet (2014), and resulting average lbs/acre P reductions on pasture land are summarized in Table 10.

Table 10

*Phosphorus (P) Loads and Reductions on Pasture Land within the IRW derived from Storm and Mittelstet (2014).*

| Scenario | Total P load (lbs) | Phosphorus Reduction (lbs) | Avg[1] lbs/ac Pasture | Reduction |
|---|---|---|---|---|
| Base | 59,600 | | 0.37 | |
| No Overgrazing | 52,200 | 7,430 | 0.30 | 20% |
| No Litter Application | 57,000 | 2,620 | 0.34 | 7% |
| No litter and No Overgrazing | 49,100 | 10,500 | 0.27 | 28% |

[1] Average

### TBET Results

The Texas Best Management Practice Evaluation Tool (TBET) estimated P yield and total P reduction for implementation of conservation practices on both overgrazed and well-managed pasture fields. First, at the average distance to stream, there would be a 47% P reduction resulting from changing pasture from overgrazed to well-managed (Table 11).

Table 11

*Phosphorus (P) Yield and Reduction at Average Distance to Stream within the IRW.*

| Management Scenario | P Yield (lbs/ac/yr) | Reduction |
|---|---|---|
| Overgrazing Allowed | 1.90 | NA |
| No Overgrazing | 1.00 | 47% |

Next, multiple management scenarios were completed on overgrazed pasture land. For an overgrazed field that is bordering a stream, the P yield with no additional BMPs is 5.7 lbs/acre (Table 12). By eliminating overgrazing, there would be a 51% decrease in P yield. Additionally, the highest P reduction would result in eliminating overgrazing, implementing a riparian buffer, and excluding cattle from the riparian area. By implementing all three management measures, there would be a 92% reduction in P yield. Results for all management scenarios on overgrazed pasture and percent reductions in yield are reported in Table 12. In addition to lbs/acre results, TBET predicted total P reductions for the field (40 acres). These management measures resulted in total P reductions ranging from 51.6 lbs/year /field to 209 lbs/year/field (Figure 9).

Last, P yields and reductions were predicted for well-managed pasture land that is bordering the stream. In this scenario, the base P yield was 2.82 lbs/acre/year. Implementing cattle exclusion alone resulted in a 66% decrease in P yield. However, implementing only a riparian buffer resulted in a 23% reduction in yield. Combining the two practices resulted in the highest reduction: 83% (Table 13). Total P reductions per field ranged from 25 lbs/year/field to 94 lb/year/field (Figure 10).

Table 12

*Phosphorus (P) Yield and Percent Reduction from Management Practices on Overgrazed Pasture Bordering Stream within the IRW*

| Management Scenario | P (lbs/ac/yr) | % Reduction |
|---|---|---|
| Overgrazing Allowed | 5.70 | NA |
| Overgrazing Allowed and Cattle Exclusion | 1.85 | 68 |
| Overgrazing Allowed and Riparian buffer | 4.41 | 23 |
| Overgrazing Allowed, Cattle Exclusion, and Riparian buffer | 0.86 | 85 |
| No Overgrazing | 2.82 | 51 |
| No Overgrazing and Cattle Exclusion | 0.96 | 83 |
| No Overgrazing and Riparian Buffer | 2.18 | 62 |
| No Overgrazing, Cattle Exclusion and Riparian Buffer | 0.47 | 92 |

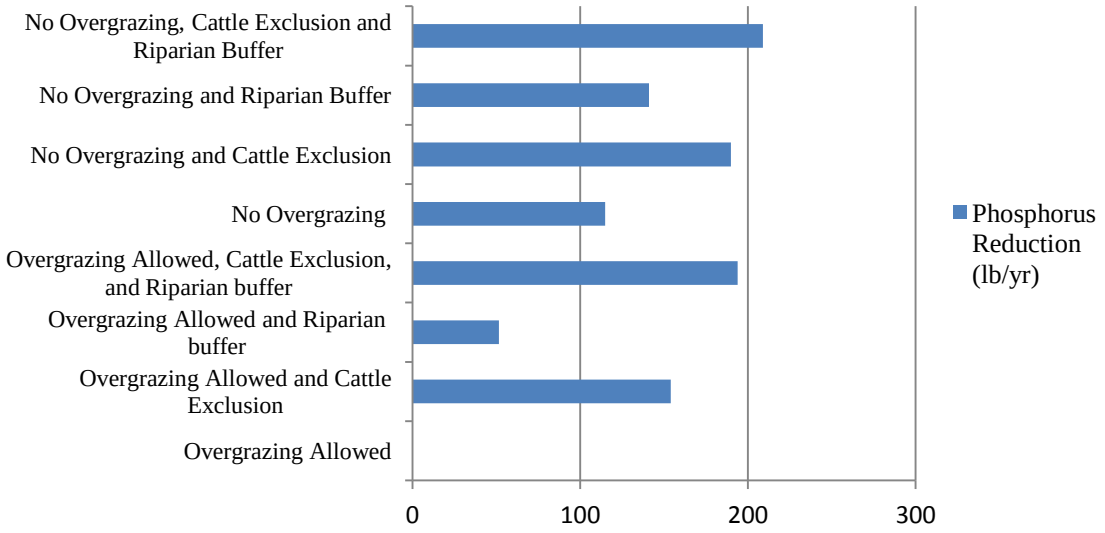


Figure 9: Total Phosphorus Reduction from BMP implementation on 40 Acre Field of Overgrazed Pasture

Table 13
*Phosphorus Yield and Percent Reduction from Implementation of BMPs on Well Managed Pasture Land Bordering Stream within the IRW .*

| Management Scenario | Phosphorus (lbs/ac/yr) | % Reduction |
|---|---|---|
| No Overgrazing | 2.82 | NA |
| No Overgrazing and Cattle Exclusion | 0.96 | 66 |
| No Overgrazing and Riparian Buffer | 2.18 | 23 |
| No Overgrazing, Cattle Exclusion and Riparian Buffer | 0.47 | 83 |

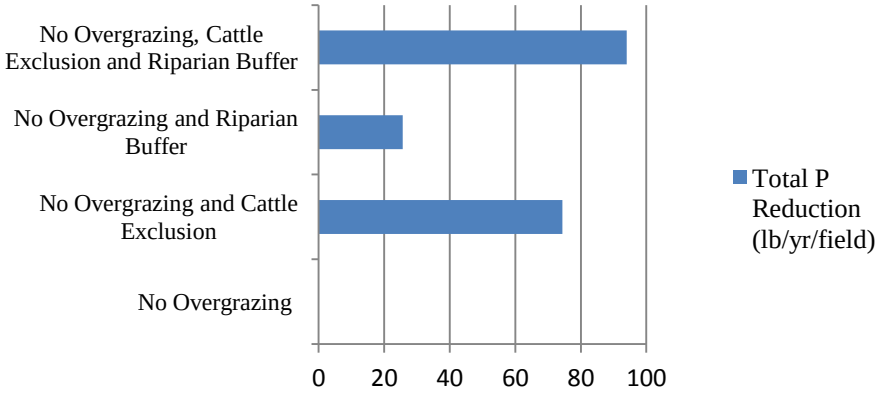


Figure 10: Total Phosphorus Reduction from BMP implementation on 40 Acre Field of Overgrazed Pasture well-managed pasture

**Possible Producer Impact on P Reduction**

If a producer were to enroll in a program, they would have a whole farm conservation plan. The plan would include grazing management and nutrient management, along with other conservation practices like the riparian buffer and cattle exclusion if their land is bordering a stream. On average, if a field is not bordering a stream and only grazing management and nutrient management are implemented, P yield

could be reduced by 28% on average according to Storm and Mittelstet (2014). The same scenario could result in 47% P yield reduction based on TBET results. However, potential reductions increase substantially when the field is bordering the stream. On well-managed pasture bordering a stream, a field could see up to 83% load reductions, whereas overgrazed pasture could result in up to 92% P reductions from BMP implementation. Based on these results, the impact that the producer has on P reductions within the IRW is dependent on the current management practices in place, and the location within the watershed.

**Data differences and limitations**

Inherently, there are differences between the data generated from TBET and Storm and Mittelstet (2014). These differences can be easily explained through the models used and the data entered. TBET generated loads for two scenarios with no BMP implementation, one in which overgrazing is allowed, and the other in which no over grazing is allowed. TBET results for no BMP implementation are different than that seen in Storm and Mittelstet (2014) results for no BMP implementation. This difference is present because TBET calculations are on a field level, whereas the reductions from Storm and Mittelstet (2014) are for the whole study area.

# CHAPTER V

## CONCLUSSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Despite the limitations of this study, conclusions can be drawn specifically about the agricultural producers who completed the survey. Of the producers who completed the survey, it can be concluded that there is definitely an interest in a certainty program. Also, more of the survey participants would participate if the certainty contract lasted five years instead of ten. Respondents also demonstrated the desire to receive cost-share assistance. Additionally, more of the producers would participate if they were guaranteed protection from additional state and federal regulations. However, more producers said that they would be less likely to participate if the EPA is involved in the agreement. This suggests that there is a misunderstanding of the role that EPA would play in the certainty agreement, which is a problem considering that EPA's involvement could potentially provide producers with the protection from future federal regulations that they want. Producer interest combined with a potential phosphorus load reduction of up to 92% warrants further exploration into developing a program.

Therefore, based on these survey results combined with a review of existing certainty programs, a recommended program framework was developed. First, it is

recommended that Oklahoma explore a state certainty program that resembles that of Texas' WQMP Program and Louisiana's MFP, but also would share similarities with the MAWQCP. A program should be locally driven through the Soil and Water Conservation Districts, like the WQMP program, and the MAWQCP. While education is important, a formal classroom style education component is not necessary. As seen with the MAWQCP, there are multiple opportunities for education through the conservation planning process which would keep the landowner engaged because it pertains directly to their operation. Based on the survey results, the certainty contract should be five years in length, and should provide cost-share assistance to participants if at all possible. As it pertains to EPA's involvement, the Louisiana MFP seems to have an effective approach, and a similar approach is recommended in Oklahoma if possible. In other words, an effective federal state partnership is important and beneficial to a certainty program, but it does not seem necessary to include EPA in the certainty agreements. However, to obtain the federal certainty that producers want, the State may explore entering into a Memorandum of Understanding regarding certainty for federal regulations.

Before moving forward with the creation of a program in Oklahoma, further input from producers should be sought out. From the lessons learned through this survey process, an additional survey is not recommended. Alternatively, the State may want to explore small town hall meetings, or potentially meeting directly with Soil and Water Conservation District Directors to obtain input and comments regarding the creation of a program. Rolling this idea out at the Regional Oklahoma Area Conservation District Meetings would be a great place to begin the process.

## Recommendations for Future Studies

Although some certainty programs have been in existence for over a decade, agricultural certainty is a relatively new concept and little research exists pertaining to it. This study obtained opinions regarding if producers would participate in a program and factors contributing to that, but studies should be conducted on existing programs and what factors have impacted participation. This knowledge would aid in the development of certainty programs in other states. The research would be relevant and beneficial, considering there are multiple states that are currently developing programs. Those states include Arkansas, Maryland, Vermont, and Virginia. Additionally, there may be other states like Oklahoma who are just beginning to explore the possibility of a certainty program.

## Concluding Remarks

The State of Oklahoma has a great opportunity to create a new and innovative conservation program with an incentive that has not been offered in the State before. A certainty program could potentially reach agricultural producers who have not previously participated in a conservation program, which could increase the land in conservation in Oklahoma. As seen through the individuals surveyed in this study, there is an interest in a program, and if a program was implemented in the Illinois River watershed program participants could potentially decrease their Phosphorus load by up to 92 percent.

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# APPENDICES

# APPENDIX A

## COPY OF INSTITUTIONAL REVIEW BOARD APPROVAL PAGES

## Oklahoma State University Institutional Review Board

| | |
|---|---|
| Date: | Thursday, October 03, 2013 |
| IRB Application No | GU1316 |
| Proposal Title: | Agricultural Certainty in Oklahoma: A Survey of Agriculture Producers |
| Reviewed and Processed as: | Exempt |

**Status Recommended by Reviewer(s): Approved Protocol Expires: 10/2/2016**

Principal Investigator(s)

| | |
|---|---|
| Lisa Marshall | Scott Stoodley |
| 204 N Husband St | 117 Life Sciences East |
| Stillwater, OK 74078 | Stillwater, OK 74078 |

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI, advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,

Shelia M. Kennison

Shelia Kennison, Chair
Institutional Review Board

## Oklahoma State University Institutional Review Board

| | |
|---|---|
| Date: | Wednesday, December 11, 2013 Protocol Expires: 10/2/2016 |
| IRB Application No: | GU1316 |
| Proposal Title: | Agricultural Certainty in Oklahoma: A Survey of Agricultural Producers |
| Reviewed and Processed as: | Exempt<br>**Modification** |

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s):

Liza Marshall
204 N Husband St
Stillwater, OK 74078

Scott Stoodley
117 Life Sciences East
Stillwater, OK 74078

The requested modification to this IRB protocol has been approved. Please note that the original expiration date of the protocol has not changed. The IRB office MUST be notified in writing when a project is complete. All approved projects are subject to monitoring by the IRB.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:

Modification to add 1) a drawing for six Atwoods gift cards, 2) an online option for the survey, and 3) waiver documentation of consent for the online portion. No increased risk to participants.

Signature:

Shelia Kennison, Chair, Institutional Review Board

Wednesday, December 11, 2013
Date

# APPENDIX B

# SURVEY

**Please answer the following questions by writing your response in the spaces provided, or by checking the appropriate box. Once you have completed the survey, please return it to: Environmental Science Graduate Program, 117 Life Science East, Stillwater, Oklahoma 74078.**

**SECTION I: Questions pertaining to the potential certainty program**

NOTE: The term ***certainty program*** refers to a potential voluntary agricultural program in which producers: 1. obtain a conservation plan 2. implement the conservation plan, and 3. maintain the conservation practices for the length of the contract. In exchange, agricultural producers gain assurance from state and/or federal regulatory agencies that they will not be required to implement additional practices if additional regulations are enacted.

1. Would you be interested in participating in a certainty program? ☐ Yes ☐ No

   If YES, why?

   If NO, why?

   **If you answered NO, you may skip to Number 8.**

2. Would you participate in a certainty program if the certainty contract lasted for 5 years? (Meaning that you would be protected from addition regulation for 5 years) ☐ Yes ☐ No

3. Would you participate in a certainty program if the certainty contract lasted for 10 years? (Meaning that you would be protected from additional regulation for 10 years) ☐ Yes ☐ No

4. Would you participate in a certainty program if you were guaranteed protection from state regulation only? ☐ Yes ☐ No

5. Would you participate in a certainty program if you were guaranteed protection from both state and federal regulation? ☐ Yes ☐ No

6. Would you participate in a certainty program if you did not receive any form of cost share funding to implement the required conservation practices? ☐ Yes ☐ No

7. Would you be more likely or less likely to participate in a certainty program if the United States Environmental Protection Agency (EPA) was part of the agreement?

☐ More Likely ☐ Less Likely

7a. Please give a brief explanation of your answer:

**SECTION II: Questions about your current agricultural operation**

This section will help us to understand the characteristics of the producers who are willing to participate in a certainty program. This understanding will assist in the creation of a program that most benefits Oklahoma's producers.

8. What type of operation(s) do you currently have? (check all that apply)

☐ Crop (Please indicate what type):

☐ Wheat ☐ Other Hay
☐ Canola ☐ Cotton
☐ Corn, grain ☐ Soybeans
☐ Sorghum, grain ☐ Peanuts
☐ Alfalfa ☐ Other: _____

☐ Grasslands (Please indicate what type):

☐ Native range (examples: native grasses, forbes, or legumes)
☐ Introduced warm season grasses ( examples: Bermuda, Old World Bluestem, Weeping Love Grass)
☐ Introduced cool season grasses (examples: Fescue, Tall Wheat Grass)

☐ Animal feeding operation (Please indicate what type):

☐ Cattle ☐ Dairy
☐ Swine ☐ Goats
☐ Poultry ☐ Other: _____

Are any of these Confined Animal Feeding Operations? ☐ Yes ☐ No

If you answered "Yes", please specify which animal feeding operation is confined:

_____

9. Fill in the following table with the number of acres that you have in production, and the county that those acres are located in. Also, check whether you own or lease that land, and indicate the type of operation (use the options from number 8). If you have multiple plots of land, separate those by using multiple lines.

The following is an example of a producer who has 2 pieces of land:

| | Number of acres | County | Own | Lease | Type of operation |
|---|---|---|---|---|---|
| Example | ***160*** | ***Payne*** | ***X*** | | ***Wheat*** |
| Example | ***320*** | ***Payne*** | | ***X*** | ***Native Range*** |

*Please fill in the table below with your information:*

| | Number of acres | County | Own | Lease | Type of operation |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |

10. Do you have a conservation plan written by the Natural Resource Conservation Service or the Oklahoma Conservation Commission? ☐ Yes ☐ No

10a. If YES, have you implemented the recommended conservation practices? ☐ Yes ☐ No

10b. If YES, what conservation practices have you implemented? (Check all that apply)

☐ Crop Residue Management (i.e. no-till, strip till, mulch till)
☐ Cover Crops
☐ Crop Rotations
☐ Buffer Practices (i.e. filter strips, field borders, riparian forest or herbaceous planting)
☐ Nutrient Management (i.e. precision application, soil testing)
☐ Integrated Pest Management
☐ Prescribed Grazing (i.e. Grazing Management System)
☐ Fencing and Water Development – used to facilitate implementation of a grazing management system
☐ Control of Invasive Brush Species (i.e. Eastern Red Cedar)
☐ Fencing of Riparian areas to exclude livestock
☐ Waste Storage Structures (i.e. lagoons, storage ponds, dry stacks, litter storage)
☐ Erosion Control Practices (i.e terraces, waterways, grade stabilization structures)

11. Do you currently participate in any of the following Farm Bill programs? (Check all that apply)

- ☐ Conservation Reserve Program (CRP)
- ☐ Conservation Stewardship Program (CSP)
- ☐ Environmental Quality Incentives Program (EQIP)
- ☐ Agricultural Water Enhancement Program (AWEP)
- ☐ Grassland Reserve Program (GRP)
- ☐ Healthy Forest Reserve Program (HFRP)
- ☐ Wildlife Habitat Incentive Program (WHIP)

**SECTION III: Demographics**

12. What is your gender? ☐ Male ☐ Female

13. How would you classify yourself?

- ☐ Asian/ Pacific Islander
- ☐ Black/ African American
- ☐ Caucasian/ White
- ☐ Hispanic
- ☐ Latino
- ☐ Native American
- ☐ Other: _____
- ☐ I don't know / I Prefer not to answer

14. What is the highest level of education that you have completed?

- ☐ High School/ GED
- ☐ Some college
- ☐ Vocational or technical school
- ☐ Associate's degree
- ☐ Bachelor's degree
- ☐ Graduate or professional degree
- ☐ Other:_____

15. What was your age on your last birthday?

- ☐ 18-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65-74
- ☐ 75 and over

16. How much of your income is derived from your agricultural operations?

- ☐ 0-25%
- ☐ 26-50%
- ☐ 51-75%
- ☐ 76-100%

17. How would you describe your political beliefs?

- ☐ Very liberal
- ☐ Somewhat liberal
- ☐ Moderate/ Middle of the road
- ☐ Somewhat conservative
- ☐ Very conservative
- ☐ I prefer not to answer

**SECTION IV: Please use the following space to provide us with any additional remarks or comments that you may have pertaining to an agricultural certainty program.**

**Also, provide a mailing address if you wish to be entered into a drawing to win one of six $50.00 gift cards to Atwoods.**

# APPENDIX C

# PARTICIPANT INFORMATION SHEET

**PARTICIPANT INFORMATION**
**OKLAHOMA STATE UNIVERSITY**

**Title:** Agricultural Certainty in Oklahoma: A Survey of Agricultural Producers

**Investigators:** Liza Marshall, B.S., Graduate Research Assistant, Oklahoma State University Environmental Science Graduate Program; Dr. Scott Stoodley, PhD., Advisor and Director of Environmental Science Graduate Program, Oklahoma State University.

**Purpose:** The purpose of the research study is to determine whether or not Oklahoma's agricultural producers are willing to participate in a voluntary agricultural certainty program. The study will also determine the characteristics of the producers that are willing to participate in order to help develop a program.

**What to Expect:** Participation in this research will involve completion of a survey. You may skip any questions that you do not wish to answer. You will be expected to complete the survey only once. It should take you about 10-15 minutes to complete.

**Risks:** There are no risks associated with this project which are expected to be greater than those ordinarily encountered in daily life

**Benefits:** By participating in this study you can help the state develop a program that would best benefit agricultural producers and the natural resources of the state.

**Compensation:** There will be no compensation for participation in this study.

**Your Rights:** Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time, without penalty.

**Confidentiality:** All information about you will be kept confidential and will not be released. All survey data will be entered into a computer program, where your survey will be assigned a unique identification code. The survey data will be kept on a password protected hard drive. The paper copies of the surveys will be kept in a locked file cabinet in a locked office. Only researchers responsible for research oversight will have access to the records. Results will be reported to state and federal agencies as group data, and will not have any personal identifying information attached.

**Contacts:** If you have any questions or concerns about your participation in this study, or would like to request information about the study results, please contact Liza Marshall, at 405-269-6500 or liza.marshall@okstate.edu, or Dr. Scott Stoodley, PhD., at 405-744-9229. If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

**If you choose to participate:** Returning your completed survey in the envelope provided indicates your willingness to participate in this research study.

# APPENDIX D

# INITIAL LETTER


Greetings,

At the request of the Oklahoma Conservation Commission, the Natural Resource Conservation Service, and the Oklahoma Department of Agriculture, Food and Forestry, Oklahoma State University is conducting research to determine if Oklahoma's agricultural producers are interested in participating in a voluntary agricultural certainty program. We would like you to take 10 minutes out of your day to help us determine whether or not this type of program should be created.

First, you may be wondering what exactly a "certainty program" is. This type of program has been implemented by other states, and each has varying characteristics, but the principles are the same. The process is that an agricultural producer ***voluntarily*** enrolls into a program where they receive a conservation plan written by the U.S.D.A. Natural Resource Conservation Service or a similar entity. After the producer implements the recommended conservation practices, they can elect to sign an agreement with state and federal partners in which he or she agrees to maintain the implemented conservation practices for a specified amount of time. In exchange, the producer receives assurance, or "certainty" that they will not have to implement any additional practices for the length of the contract if additional state and/or federal regulations are implemented. In other words, such a program protects agricultural producers from future regulations.

This research is being conducted in the form of a survey in accordance with Oklahoma Statute, Title 2. Section 2-18.3. In the following pages you will find a participant information sheet, and the survey. Please read the participant information sheet before completing the survey. If you have questions about the potential certainty program, please contact Shanon Phillips, Oklahoma Conservation Commission Water Quality Division Director, at (405) 522-4728. For questions about the survey, please contact Liza Marshall, Oklahoma State University Graduate Research Assistant, at (405)-269-6500. We thank you in advance for your participation.

Sincerely,

Shanon Phillips
Water Quality Division Director
Oklahoma Conservation Commission
(405) 522-4728

Liza Marshall
Graduate Research Assistant
Environmental Science Graduate Program
Oklahoma State University
(405) 269-6500

# APPENDIX E

# MODIFIED PARTICIPANT INFORMATION SHEET

**PARTICIPANT INFORMATION**
**OKLAHOMA STATE UNIVERSITY**

**Title:** Agricultural Certainty in Oklahoma: A Survey of Agricultural Producers

**Investigators:** Liza Marshall, B.S., Graduate Research Assistant, Oklahoma State University Environmental Science Graduate Program; Dr. Scott Stoodley, PhD., Advisor and Director of Environmental Science Graduate Program, Oklahoma State University.

**Purpose:** The purpose of the research study is to determine whether or not Oklahoma's agricultural producers are willing to participate in a voluntary agricultural certainty program. The study will also determine the characteristics of the producers that are willing to participate in order to help develop a program.

**What to Expect:** Participation in this research will involve completion of a survey. You may skip any questions that you do not wish to answer. You will be expected to complete the survey only once. It should take you about 10-15 minutes to complete.

**Risks:** There are no risks associated with this project which are expected to be greater than those ordinarily encountered in daily life

**Benefits:** By participating in this study you can help the state develop a program that would best benefit agricultural producers and the natural resources of the state.

**Compensation:** By participating, you have the choice to be entered into a drawing for one of six fifty dollar gift cards to Atwoods.

**Your Rights:** Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time, without penalty.

**Confidentiality:** All information about you will be kept confidential and will not be released. All survey data will be entered into a computer program, where your survey will be assigned a unique identification code. The survey data will be kept on a password protected hard drive. The paper copies of the surveys will be kept in a locked file cabinet in a locked office. Only researchers responsible for research oversight will have access to the records. Results will be reported to state and federal agencies as group data, and will not have any personal identifying information attached.

**Contacts:** If you have any questions or concerns about your participation in this study, or would like to request information about the study results, please contact Liza Marshall, at 405-269-6500 or liza.marshall@okstate.edu, or Dr. Scott Stoodley, PhD., at 405-744-9229. If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

**If you choose to participate:** Returning your completed survey in the envelope provided or submitting the online version, indicates your willingness to participate in this research study.

# APPENDIX F

# FOLLOW UP LETTER

OKLAHOMA CONSERVATION COMMISSION

117 Life Science East
Oklahoma State University
Stillwater, Oklahoma 74078

December 2, 2013

Greetings,

You are receiving this letter because we have recently sent you a survey pertaining to a potential agricultural certainty program in Oklahoma. This is just a friendly reminder to please take 5-10 minutes of your time to complete the survey and return it in the provided prepaid return envelope. We would also like to offer you the chance to win **one of six $50.00 gift cards to Atwoods!** All you have to do is write your address in the comments section of your completed survey, return it in the provided envelope, and you will be entered in a drawing for your chance to win. If you are the winner, we will simply send the gift card to the address that you provided on the survey.

If you have any questions please do not hesitate to contact Liza Marshall at (405) 269-6500 or liza.marshall@okstate.edu. We hope that you will assist us in our research, and thank you in advance for your participation.

Sincerely,

Liza Marshall

Liza Marshall
Graduate Research Assistant
Environmental Science Graduate Program
Oklahoma State University
(405) 269-6500

# APPENDIX G

# OKLAHOMA FARM REPORT ARTICLE


Support Our Sponsors!

A AND M FEEDS

Oklahoma Cattlemen's Association OCA

CROPLAN by WINFIELD

OKLAHOMA CITY Farm Show

# Oklahoma's Latest Farm and Ranch News

Presented by

OKLAHOMA FARM BUREAU

**Your Update from Ron Hays of RON**
**Thursday, March 6, 2014**

Howdy Neighbors!

Here is your daily Oklahoma farm and ranch news update.

-- Phosphorous Levels Declining in Illinois River

-- Drought, Crop Conditions Worsen Across Oklahoma

-- AFBF Supports Recommendations on Biotechnology and 21st Century Ag- Plus Go Back in Time with Us to Hear from Keith Kisling on AC21

-- Google Earth Simplifies Creation of Custom Maps

-- **55 Groups Ask Congress to Help Stop USDA from Relaxing FMD Protections**

-- Researchers Seek Producers' Opinions on Conservation 'Certainty' Plans- You Can Be a Winner IF You Offer Your Input!

-- This N That- Superior Set for their Regular Feeder Cattle and Calf Sale- and a Jeff Edwards First Hollow Stem Update

## Featured Story:

**Phosphorous Levels Declining in Illinois River**

## Researchers Seek Producers' Opinions on Conservation 'Certainty' Plans

Researchers at Oklahoma State University, in cooperation with the Oklahoma Conservation Commission, Natural Resource Conservation Service, and Department of Agriculture, Food, and Forestry, are conducting a survey to determine if agricultural producers in Oklahoma are interested in participating in a potential agricultural "certainty program". In a certainty program agricultural producers would voluntarily enroll into a program where they receive a conservation plan written by the U.S.D.A. Natural Resource Conservation Service or a similar entity. After the producer implements the recommended conservation practices, they can elect to sign an agreement with state and federal partners in which he or she agrees to maintain the implemented conservation practices for a specified amount of time. In exchange, the producer receives assurance, or "certainty" that they will not have to implement any additional practices for the length of the contract if additional state and/or federal regulations are implemented. In other words, such a program would protect agricultural producers from potential future regulations.

If you are an agricultural producer in Oklahoma, researchers are seeking your input. Click here to read more and to find a link to the survey.

# APPENDIX H

# TBET OUTPUT PAGES

## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

TSSWCB

**Farm Information**

Producer: OG to No OG
Plan #: 111-11-555
Field: Default
Imp. Status: Pre-Program
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**Topographical Information**

Field Area: 40 ac.
Dist. to Stream: 561 ft.
Has Stream: No

Bare Soil: 0 ac.

**Soils**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**Soil Test Information**

Phosphorus: 55.59 ppm

**Management Options**

Crop System ~ TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Moderate Overgrazing
Stocking Density: Heavy (0.5 AU/acre)
Fertilizer: None

**Active Conservation Practices**

No Additional Conservation Practices

**Monthly Predictions**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.2 | 1.6 | 0.000 | 0.13 | 5.98 |
| Feb | 0 | 0 | 3.0 | 1.4 | 1.7 | 0.000 | 0.16 | 5.14 |
| Mar | 0 | 0 | 4.6 | 1.8 | 2.2 | 0.000 | 0.21 | 4.30 |
| Apr | 0 | 0 | 4.6 | 1.5 | 1.8 | 0.000 | 0.18 | 2.75 |
| May | 0 | 0 | 6.3 | 1.5 | 1.8 | 0.000 | 0.18 | 2.23 |
| Jun | 0 | 0 | 5.0 | 1.2 | 1.3 | 0.000 | 0.15 | 1.80 |
| Jul | 0 | 0 | 3.3 | 0.4 | 0.4 | 0.000 | 0.05 | 0.50 |
| Aug | 0 | 0 | 3.7 | 0.3 | 0.3 | 0.000 | 0.05 | 0.50 |
| Sep | 0 | 0 | 4.4 | 0.5 | 0.5 | 0.000 | 0.07 | 0.26 |
| Oct | 0 | 0 | 4.6 | 0.9 | 1.0 | 0.000 | 0.14 | 1.26 |
| Nov | 0 | 0 | 5.0 | 2.0 | 2.3 | 0.000 | 0.31 | 4.79 |
| Dec | 0 | 0 | 3.7 | 1.8 | 2.2 | 0.000 | 0.28 | 6.83 |
| Ann. | 0 | 0 | 50.7 | 14.3 | 17.3 | 0.000 | 1.90 | 36.34 |

## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

TSSWCB

**Farm Information**

Producer: OG to No OG
Plan #: 111-11-555
Field: Default
Imp. Status: Year 1
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**Topographical Information**

Field Area: 40 ac.
Dist. to Stream: 561 ft.
Has Stream: No

Bare Soil: 0 ac.

**Soils**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**Soil Test Information**

Phosphorus: 55.59 ppm

**Management Options**

Crop System ~ TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Optimally Managed
Stocking Density: Medium (0.25 AU/acre)
Fertilizer: None

**Active Conservation Practices**

No Additional Conservation Practices

**Monthly Predictions**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.1 | 1.8 | 0.000 | 0.07 | 4.76 |
| Feb | 0 | 0 | 3.0 | 1.3 | 1.8 | 0.000 | 0.10 | 3.83 |
| Mar | 0 | 0 | 4.6 | 1.6 | 2.2 | 0.000 | 0.13 | 3.03 |
| Apr | 0 | 0 | 4.6 | 1.4 | 1.9 | 0.000 | 0.11 | 1.95 |
| May | 0 | 0 | 6.3 | 1.3 | 1.6 | 0.000 | 0.10 | 1.44 |
| Jun | 0 | 0 | 5.0 | 1.0 | 1.2 | 0.000 | 0.08 | 0.77 |
| Jul | 0 | 0 | 3.3 | 0.3 | 0.4 | 0.000 | 0.03 | 0.25 |
| Aug | 0 | 0 | 3.7 | 0.2 | 0.3 | 0.000 | 0.02 | 0.30 |
| Sep | 0 | 0 | 4.4 | 0.3 | 0.5 | 0.000 | 0.03 | 0.30 |
| Oct | 0 | 0 | 4.6 | 0.6 | 0.9 | 0.000 | 0.06 | 1.01 |
| Nov | 0 | 0 | 5.0 | 1.6 | 2.0 | 0.000 | 0.14 | 2.51 |
| Dec | 0 | 0 | 3.7 | 1.6 | 2.2 | 0.000 | 0.14 | 4.55 |
| Ann. | 0 | 0 | 50.7 | 12.4 | 16.8 | 0.000 | 1.00 | 24.70 |

**Conservation Practice Evaluation Report**

**Texas BMP Evaluation Tool (TBET) - Version 1.05**

**Plan#: 111-11-555** **Producer : OG to No OG** **Funding Source :**

**Location: Adair,Oklahoma**

**Total Phosphorus Yield (lb/acre/yr)**

| Default | Pasture~Gen | Pre | Yr1 | Yr2 | Yr3 | Yr4 | Post |
|---|---|---|---|---|---|---|---|
| - | - | 1.90 | 1.00 | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |

**Total Phosphorus Reduction (lb/yr)**

| Default | Pasture~Gen | Pre | Yr1 | Yr2 | Yr3 | Yr4 | Post |
|---|---|---|---|---|---|---|---|
| - | - | - | 36.00 | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| | Farm Totals | | 36.00 | 0.00 | 0.00 | 0.00 | 0.00 |

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## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

**----------Farm Information----------**
Producer: Catttle Ex and Rip Buff
Plan #: 111-11-333
Field: Default
Imp. Status: Pre-Program
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**--------Topographical Information---------**
Field Area: 40 ac.
Dist. to Stream: 0 ft.
Has Stream: Yes

Bare Soil: 0 ac.

**----------Soils----------**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**--------Soil Test Information--------**
Phosphorus: 55.59 ppm

**----------Management Options----------**
Crop System - TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Moderate Overgrazing
Stocking Density: Heavy (0.5 AU/acre)
Fertilizer: None

**------Active Conservation Practices------**
No Additional Conservation Practices

**---------- Monthly Predictions ----------**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment Yield (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.2 | 1.6 | 0.000 | 0.29 | 7.03 |
| Feb | 0 | 0 | 3.0 | 1.4 | 1.7 | 0.000 | 0.30 | 5.72 |
| Mar | 0 | 0 | 4.6 | 1.8 | 2.1 | 0.000 | 0.43 | 5.85 |
| Apr | 0 | 0 | 4.6 | 1.5 | 1.8 | 0.000 | 0.53 | 5.54 |
| May | 0 | 0 | 6.3 | 1.5 | 1.8 | 0.000 | 0.56 | 5.16 |
| Jun | 0 | 0 | 5.0 | 1.2 | 1.3 | 0.000 | 0.52 | 4.50 |
| Jul | 0 | 0 | 3.3 | 0.4 | 0.4 | 0.000 | 0.44 | 3.32 |
| Aug | 0 | 0 | 3.7 | 0.3 | 0.3 | 0.000 | 0.43 | 3.34 |
| Sep | 0 | 0 | 4.4 | 0.5 | 0.5 | 0.000 | 0.44 | 3.02 |
| Oct | 0 | 0 | 4.6 | 0.9 | 1.1 | 0.000 | 0.52 | 4.12 |
| Nov | 0 | 0 | 5.0 | 2.0 | 2.3 | 0.000 | 0.67 | 7.46 |
| Dec | 0 | 0 | 3.7 | 1.8 | 2.2 | 0.000 | 0.55 | 8.74 |
| Ann. | 0 | 0 | 50.7 | 14.4 | 17.3 | 0.000 | 5.70 | 63.81 |

## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

TSSWCB

**Farm Information**

Producer: Catttle Ex and Rip Buff
Plan #: 111-11-333
Field: Default
Imp. Status: Year 1
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**Topographical Information**

Field Area: 40 ac.
Dist. to Stream: 0 ft.
Has Stream: Yes

Bare Soil: 0 ac.

**Soils**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**Soil Test Information**

Phosphorus: 55.59 ppm

**Management Options**

Crop System - TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Moderate Overgrazing
Stocking Density: Heavy (0.5 AU/acre)
Fertilizer: None

**Active Conservation Practices**

Restricted Riparian Access

**Monthly Predictions**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.2 | 1.6 | 0.000 | 0.13 | 5.84 |
| Feb | 0 | 0 | 3.0 | 1.4 | 1.7 | 0.000 | 0.15 | 4.59 |
| Mar | 0 | 0 | 4.6 | 1.8 | 2.1 | 0.000 | 0.20 | 4.15 |
| Apr | 0 | 0 | 4.6 | 1.5 | 1.8 | 0.000 | 0.17 | 2.85 |
| May | 0 | 0 | 6.3 | 1.5 | 1.8 | 0.000 | 0.18 | 2.31 |
| Jun | 0 | 0 | 5.0 | 1.2 | 1.3 | 0.000 | 0.15 | 1.74 |
| Jul | 0 | 0 | 3.3 | 0.4 | 0.4 | 0.000 | 0.05 | 0.46 |
| Aug | 0 | 0 | 3.7 | 0.3 | 0.3 | 0.000 | 0.05 | 0.49 |
| Sep | 0 | 0 | 4.4 | 0.5 | 0.5 | 0.000 | 0.07 | 0.26 |
| Oct | 0 | 0 | 4.6 | 0.9 | 1.1 | 0.000 | 0.14 | 1.27 |
| Nov | 0 | 0 | 5.0 | 2.0 | 2.3 | 0.000 | 0.30 | 4.70 |
| Dec | 0 | 0 | 3.7 | 1.8 | 2.2 | 0.000 | 0.27 | 6.68 |
| Ann. | 0 | 0 | 50.7 | 14.4 | 17.3 | 0.000 | 1.85 | 35.33 |

## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

TSSWCB

**Farm Information**

Producer: Catttle Ex and Rip Buff
Plan #: 111-11-333
Field: Default
Imp. Status: Year 2
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**Topographical Information**

Field Area: 40 ac.
Dist. to Stream: 0 ft.
Has Stream: Yes

Bare Soil: 0 ac.

**Soils**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**Soil Test Information**

Phosphorus: 55.59 ppm

**Management Options**

Crop System - TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Moderate Overgrazing
Stocking Density: Heavy (0.5 AU/acre)
Fertilizer: None

**Active Conservation Practices**

Riparian Buffer
Restricted Riparian Access

**Monthly Predictions**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.2 | 1.6 | 0.000 | 0.06 | 3.42 |
| Feb | 0 | 0 | 3.0 | 1.4 | 1.7 | 0.000 | 0.07 | 2.67 |
| Mar | 0 | 0 | 4.6 | 1.7 | 2.1 | 0.000 | 0.09 | 2.53 |
| Apr | 0 | 0 | 4.6 | 1.5 | 1.9 | 0.000 | 0.08 | 1.91 |
| May | 0 | 0 | 6.3 | 1.5 | 1.8 | 0.000 | 0.08 | 1.53 |
| Jun | 0 | 0 | 5.0 | 1.2 | 1.3 | 0.000 | 0.07 | 0.96 |
| Jul | 0 | 0 | 3.3 | 0.4 | 0.4 | 0.000 | 0.02 | 0.26 |
| Aug | 0 | 0 | 3.7 | 0.3 | 0.3 | 0.000 | 0.02 | 0.21 |
| Sep | 0 | 0 | 4.4 | 0.4 | 0.5 | 0.000 | 0.03 | 0.14 |
| Oct | 0 | 0 | 4.6 | 0.9 | 1.0 | 0.000 | 0.06 | 0.78 |
| Nov | 0 | 0 | 5.0 | 1.9 | 2.3 | 0.000 | 0.14 | 2.74 |
| Dec | 0 | 0 | 3.7 | 1.8 | 2.2 | 0.000 | 0.13 | 3.92 |
| Ann. | 0 | 0 | 50.7 | 14.1 | 17.0 | 0.000 | 0.86 | 21.07 |

**Conservation Practice Evaluation Report**

**Texas BMP Evaluation Tool (TBET) - Version 1.05**

**Plan#: 111-11-333** **Producer : Catttle Ex and Rip Buff** **Funding Source :**

**Location: Adair,Oklahoma**

**Total Phosphorus Yield (lb/acre/yr)**

| | | Pre | Yr1 | Yr2 | Yr3 | Yr4 | Post |
|---|---|---|---|---|---|---|---|
| Default | Pasture~Gen | 5.70 | 1.85 | 0.86 | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |

**Total Phosphorus Reduction (lb/yr)**

| | | Pre | Yr1 | Yr2 | Yr3 | Yr4 | Post |
|---|---|---|---|---|---|---|---|
| Default | Pasture~Gen | - | 154.00 | 39.60 | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| | Farm Totals | | 154.00 | 39.60 | 0.00 | 0.00 | 0.00 |

**Created 11/7/2015 3:10:26 PM**

## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

**----------Farm Information----------**
Producer: Cat Ex Rip Buff No OG
Plan #: 111-11-444
Field: Default
Imp. Status: Pre-Program
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**--------Topographical Information---------**
Field Area: 40 ac.
Dist. to Stream: 0 ft.
Has Stream: Yes

Bare Soil: 0 ac.

**----------Soils----------**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**--------Soil Test Information--------**
Phosphorus: 55.59 ppm

**----------Management Options----------**
Crop System - TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Moderate Overgrazing
Stocking Density: Heavy (0.5 AU/acre)
Fertilizer: None

**------Active Conservation Practices------**
No Additional Conservation Practices

**---------- Monthly Predictions ----------**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.2 | 1.6 | 0.000 | 0.29 | 7.03 |
| Feb | 0 | 0 | 3.0 | 1.4 | 1.7 | 0.000 | 0.30 | 5.72 |
| Mar | 0 | 0 | 4.6 | 1.8 | 2.1 | 0.000 | 0.43 | 5.85 |
| Apr | 0 | 0 | 4.6 | 1.5 | 1.8 | 0.000 | 0.53 | 5.54 |
| May | 0 | 0 | 6.3 | 1.5 | 1.8 | 0.000 | 0.56 | 5.16 |
| Jun | 0 | 0 | 5.0 | 1.2 | 1.3 | 0.000 | 0.52 | 4.50 |
| Jul | 0 | 0 | 3.3 | 0.4 | 0.4 | 0.000 | 0.44 | 3.32 |
| Aug | 0 | 0 | 3.7 | 0.3 | 0.3 | 0.000 | 0.43 | 3.34 |
| Sep | 0 | 0 | 4.4 | 0.5 | 0.5 | 0.000 | 0.44 | 3.02 |
| Oct | 0 | 0 | 4.6 | 0.9 | 1.1 | 0.000 | 0.52 | 4.12 |
| Nov | 0 | 0 | 5.0 | 2.0 | 2.3 | 0.000 | 0.67 | 7.46 |
| Dec | 0 | 0 | 3.7 | 1.8 | 2.2 | 0.000 | 0.55 | 8.74 |
| Ann. | 0 | 0 | 50.7 | 14.4 | 17.3 | 0.000 | 5.70 | 63.81 |

TSSWCB

## Conservation Practice Evaluation Report

### Texas BMP Evaluation Tool (TBET) - Version 1.05

**Farm Information**

Producer: Cat Ex Rip Buff No OG
Plan #: 111-11-444
Field: Default
Imp. Status: Year 1
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**Topographical Information**

Field Area: 40 ac.
Dist. to Stream: 0 ft.
Has Stream: Yes

Bare Soil: 0 ac.

**Soils**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**Soil Test Information**

Phosphorus: 55.59 ppm

**Management Options**

Crop System ~ TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Optimally Managed
Stocking Density: Medium (0.25 AU/acre)
Fertilizer: None

**Active Conservation Practices**

No Additional Conservation Practices

**Monthly Predictions**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.1 | 1.8 | 0.000 | 0.15 | 5.31 |
| Feb | 0 | 0 | 3.0 | 1.3 | 1.8 | 0.000 | 0.17 | 4.05 |
| Mar | 0 | 0 | 4.6 | 1.6 | 2.1 | 0.000 | 0.20 | 3.52 |
| Apr | 0 | 0 | 4.6 | 1.4 | 1.9 | 0.000 | 0.25 | 3.11 |
| May | 0 | 0 | 6.3 | 1.3 | 1.6 | 0.000 | 0.29 | 2.86 |
| Jun | 0 | 0 | 5.0 | 1.0 | 1.2 | 0.000 | 0.26 | 2.10 |
| Jul | 0 | 0 | 3.3 | 0.3 | 0.3 | 0.000 | 0.22 | 1.66 |
| Aug | 0 | 0 | 3.7 | 0.2 | 0.3 | 0.000 | 0.21 | 1.73 |
| Sep | 0 | 0 | 4.4 | 0.3 | 0.5 | 0.000 | 0.22 | 1.71 |
| Oct | 0 | 0 | 4.6 | 0.7 | 1.0 | 0.000 | 0.25 | 2.49 |
| Nov | 0 | 0 | 5.0 | 1.6 | 2.0 | 0.000 | 0.32 | 3.89 |
| Dec | 0 | 0 | 3.7 | 1.6 | 2.2 | 0.000 | 0.27 | 5.49 |
| Ann. | 0 | 0 | 50.7 | 12.6 | 16.7 | 0.000 | 2.82 | 37.93 |

## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

TSSWCB

**Farm Information**

Producer: Cat Ex Rip Buff No OG
Plan #: 111-11-444
Field: Default
Imp. Status: Year 2
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**Topographical Information**

Field Area: 40 ac.
Dist. to Stream: 0 ft.
Has Stream: Yes

Bare Soil: 0 ac.

**Soils**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**Soil Test Information**

Phosphorus: 55.59 ppm

**Management Options**

Crop System - TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Optimally Managed
Stocking Density: Medium (0.25 AU/acre)
Fertilizer: None

**Active Conservation Practices**

Restricted Riparian Access

**Monthly Predictions**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.1 | 1.8 | 0.000 | 0.07 | 4.71 |
| Feb | 0 | 0 | 3.0 | 1.3 | 1.8 | 0.000 | 0.09 | 3.49 |
| Mar | 0 | 0 | 4.6 | 1.6 | 2.1 | 0.000 | 0.12 | 2.91 |
| Apr | 0 | 0 | 4.6 | 1.4 | 1.9 | 0.000 | 0.10 | 2.01 |
| May | 0 | 0 | 6.3 | 1.3 | 1.6 | 0.000 | 0.10 | 1.43 |
| Jun | 0 | 0 | 5.0 | 1.0 | 1.2 | 0.000 | 0.08 | 0.72 |
| Jul | 0 | 0 | 3.3 | 0.3 | 0.3 | 0.000 | 0.02 | 0.23 |
| Aug | 0 | 0 | 3.7 | 0.2 | 0.3 | 0.000 | 0.02 | 0.31 |
| Sep | 0 | 0 | 4.4 | 0.3 | 0.5 | 0.000 | 0.03 | 0.33 |
| Oct | 0 | 0 | 4.6 | 0.7 | 1.0 | 0.000 | 0.06 | 1.07 |
| Nov | 0 | 0 | 5.0 | 1.6 | 2.0 | 0.000 | 0.13 | 2.51 |
| Dec | 0 | 0 | 3.7 | 1.6 | 2.2 | 0.000 | 0.14 | 4.50 |
| Ann. | 0 | 0 | 50.7 | 12.6 | 16.7 | 0.000 | 0.96 | 24.21 |

## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

TSSWCB

**Farm Information**

Producer: Cat Ex Rip Buff No OG
Plan #: 111-11-444
Field: Default
Imp. Status: Year 3
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**Topographical Information**

Field Area: 40 ac.
Dist. to Stream: 0 ft.
Has Stream: Yes

Bare Soil: 0 ac.

**Soils**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**Soil Test Information**

Phosphorus: 55.59 ppm

**Management Options**

Crop System - TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Optimally Managed
Stocking Density: Medium (0.25 AU/acre)
Fertilizer: None

**Active Conservation Practices**

Riparian Buffer
Restricted Riparian Access

**Monthly Predictions**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.1 | 1.7 | 0.000 | 0.04 | 3.15 |
| Feb | 0 | 0 | 3.0 | 1.3 | 1.7 | 0.000 | 0.04 | 2.31 |
| Mar | 0 | 0 | 4.6 | 1.6 | 2.1 | 0.000 | 0.06 | 1.98 |
| Apr | 0 | 0 | 4.6 | 1.4 | 1.9 | 0.000 | 0.05 | 1.54 |
| May | 0 | 0 | 6.3 | 1.3 | 1.7 | 0.000 | 0.05 | 1.01 |
| Jun | 0 | 0 | 5.0 | 1.0 | 1.2 | 0.000 | 0.04 | 0.44 |
| Jul | 0 | 0 | 3.3 | 0.3 | 0.3 | 0.000 | 0.01 | 0.14 |
| Aug | 0 | 0 | 3.7 | 0.2 | 0.3 | 0.000 | 0.01 | 0.19 |
| Sep | 0 | 0 | 4.4 | 0.3 | 0.4 | 0.000 | 0.01 | 0.26 |
| Oct | 0 | 0 | 4.6 | 0.6 | 0.9 | 0.000 | 0.03 | 0.84 |
| Nov | 0 | 0 | 5.0 | 1.6 | 2.0 | 0.000 | 0.06 | 1.69 |
| Dec | 0 | 0 | 3.7 | 1.6 | 2.2 | 0.000 | 0.07 | 2.98 |
| Ann. | 0 | 0 | 50.7 | 12.4 | 16.5 | 0.000 | 0.47 | 16.55 |

**Conservation Practice Evaluation Report**

**Texas BMP Evaluation Tool (TBET) - Version 1.05**

**Plan#: 111-11-444** **Producer : Cat Ex Rip Buff No OG** **Funding Source :**

**Location: Adair,Oklahoma**

**Total Phosphorus Yield (lb/acre/yr)**

| | | Pre | Yr1 | Yr2 | Yr3 | Yr4 | Post |
|---|---|---|---|---|---|---|---|
| Default | Pasture~Gen | 5.70 | 2.82 | 0.96 | 0.47 | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |

**Total Phosphorus Reduction (lb/yr)**

| | | Pre | Yr1 | Yr2 | Yr3 | Yr4 | Post |
|---|---|---|---|---|---|---|---|
| Default | Pasture~Gen | - | 115.20 | 74.40 | 19.60 | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - |
| | Farm Totals | | 115.20 | 74.40 | 19.60 | 0.00 | 0.00 |

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## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

TSSWCB

**Farm Information**

Producer: OG and Rip Buff
Plan #: 111-11-888
Field: Default
Imp. Status: Year 2
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**Topographical Information**

Field Area: 40 ac.
Dist. to Stream: 0 ft.
Has Stream: Yes

Bare Soil: 0 ac.

**Soils**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**Soil Test Information**

Phosphorus: 55.59 ppm

**Management Options**

Crop System - TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Optimally Managed
Stocking Density: Medium (0.25 AU/acre)
Fertilizer: None

**Active Conservation Practices**

Riparian Buffer

**Monthly Predictions**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.1 | 1.7 | 0.000 | 0.11 | 3.70 |
| Feb | 0 | 0 | 3.0 | 1.3 | 1.7 | 0.000 | 0.11 | 2.83 |
| Mar | 0 | 0 | 4.6 | 1.6 | 2.1 | 0.000 | 0.14 | 2.55 |
| Apr | 0 | 0 | 4.6 | 1.4 | 1.9 | 0.000 | 0.19 | 2.55 |
| May | 0 | 0 | 6.3 | 1.3 | 1.7 | 0.000 | 0.23 | 2.33 |
| Jun | 0 | 0 | 5.0 | 1.0 | 1.2 | 0.000 | 0.21 | 1.72 |
| Jul | 0 | 0 | 3.3 | 0.3 | 0.3 | 0.000 | 0.19 | 1.46 |
| Aug | 0 | 0 | 3.7 | 0.2 | 0.3 | 0.000 | 0.19 | 1.51 |
| Sep | 0 | 0 | 4.4 | 0.3 | 0.4 | 0.000 | 0.19 | 1.54 |
| Oct | 0 | 0 | 4.6 | 0.6 | 0.9 | 0.000 | 0.21 | 2.16 |
| Nov | 0 | 0 | 5.0 | 1.6 | 2.0 | 0.000 | 0.24 | 2.97 |
| Dec | 0 | 0 | 3.7 | 1.6 | 2.2 | 0.000 | 0.19 | 3.90 |
| Ann. | 0 | 0 | 50.7 | 12.4 | 16.5 | 0.000 | 2.18 | 29.22 |

## Conservation Practice Evaluation Report

## Texas BMP Evaluation Tool (TBET) - Version 1.05

TSSWCB

**Farm Information**

Producer: OG and Rip Buff
Plan #: 111-11-888
Field: Default
Imp. Status: Year 1
Climate: Adair,Oklahoma
Ecoregion: Ozark Highlands

**Topographical Information**

Field Area: 40 ac.
Dist. to Stream: 0 ft.
Has Stream: Yes

Bare Soil: 0 ac.

**Soils**

| Coverage (%) | Soil Type | Slope (%) | SL (ft) |
|---|---|---|---|
| 100.0 | Clarksville | 2.0 | 276 |

**Soil Test Information**

Phosphorus: 55.59 ppm

**Management Options**

Crop System - TSSWCB Region:
Forage Type: Warm/Cool Mix
Grazing System: Continuous
Pasture Management: Moderate Overgrazing
Stocking Density: Heavy (0.5 AU/acre)
Fertilizer: None

**Active Conservation Practices**

Riparian Buffer

**Monthly Predictions**

| Month | Fertilizer N (lb/acre) | Fertilizer P (lb/acre) | Precip (in) | Runoff (in) | Water Yield (in) | Sediment (t/acre) | Total Phosphorus (lb/acre) | Total Nitrogen (lb/acre) |
|---|---|---|---|---|---|---|---|---|
| Jan | 0 | 0 | 2.6 | 1.2 | 1.6 | 0.000 | 0.21 | 4.53 |
| Feb | 0 | 0 | 3.0 | 1.4 | 1.7 | 0.000 | 0.21 | 3.71 |
| Mar | 0 | 0 | 4.6 | 1.7 | 2.1 | 0.000 | 0.30 | 4.10 |
| Apr | 0 | 0 | 4.6 | 1.5 | 1.9 | 0.000 | 0.42 | 4.40 |
| May | 0 | 0 | 6.3 | 1.5 | 1.8 | 0.000 | 0.44 | 4.17 |
| Jun | 0 | 0 | 5.0 | 1.2 | 1.3 | 0.000 | 0.41 | 3.51 |
| Jul | 0 | 0 | 3.3 | 0.4 | 0.4 | 0.000 | 0.38 | 2.90 |
| Aug | 0 | 0 | 3.7 | 0.3 | 0.3 | 0.000 | 0.38 | 2.85 |
| Sep | 0 | 0 | 4.4 | 0.4 | 0.5 | 0.000 | 0.38 | 2.69 |
| Oct | 0 | 0 | 4.6 | 0.9 | 1.0 | 0.000 | 0.42 | 3.42 |
| Nov | 0 | 0 | 5.0 | 1.9 | 2.3 | 0.000 | 0.48 | 5.29 |
| Dec | 0 | 0 | 3.7 | 1.8 | 2.2 | 0.000 | 0.38 | 5.82 |
| Ann. | 0 | 0 | 50.7 | 14.1 | 17.0 | 0.000 | 4.41 | 47.38 |

VITA

Liza Danielle Parker

Candidate for the Degree of

Master of Science

Thesis: AGRICULTURAL CERTAINTY IN OKLAHOMA: A SURVEY OF AGRICULTURAL PRODUCERS AND POTENTIAL PHOSPHORUS LOAD REDUCTIONS WITHIN THE ILLINOIS RIVER WATERSHED

Major Field: Environmental Science

Biographical:

Education:

Completed the requirements for the Master of Science in Environmental Science at Oklahoma State University, Stillwater, Oklahoma in December, 2015.

Completed the requirements for the Bachelor of Science in Agriculture at Cameron University, Lawton, Oklahoma in 2012.

Experience:

Nonpoint Source Pollution Project Manager, Texas State Soil and Water Conservation Board, June 2014-Present

Graduate Research Assistant, Oklahoma State University, August 2013-May 2014

Environmental Programs Intern, Environmental Programs, City of Stillwater, September 2012- May 2014

Professional Memberships:

Phi Kappa Phi

Society of Environmental Scientists (SES), Member, Oklahoma State University, August 2012-May 2014