COMMUNICATING TOWARDS RESILIENCY: IDENTIFYING THE BARRIERS AND SOCIAL CONSTRAINTS RELATED TO GRAZING BEST MANAGEMENT PRACTICES IN KANSAS AND OKLAHOMA

by

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Abstract

Kansas and Oklahoma were in the top five cattle producing states in the United States. Beef cattle producers across Kansas and Oklahoma had access to best management practices (BMPs) for proper grazing land management, but were still underutilizing these practices. This study sought to understand why producers did not adopt grazing BMPs suggested by Extension professionals and to identify opportunities to improve communication and adoption. Under the postulates of elaboration likelihood model (ELM), if BMPs were communicated to producers in a way that persuaded them to adopt BMPs, the resiliency of the entire beef cattle grazing system, would increase. This study was guided by community-based social marketing (CBSM) and elaboration likelihood model (ELM). Semi-structured qualitative interviews were conducted with 43 producers in north central Oklahoma and south central Kansas during the summer of 2015. Initial participants were recruited using a purposive sampling method through Extension contacts with a snowball sample after initial participants were identified. Interviews were transcribed by a professional transcription service and analyzed using Glaser's constant comparative method. Producers in the study were aware of BMPs like rotational grazing, prescribed burning, and the usage of alternative forages. The major themes discovered in this study include Producers had varying definitions of both rotational grazing and cover crops; Producers used each other, Extension and university materials and personnel as information sources; Practices producers used were determined by visual observations and past experiences. Barriers and social constrains to the adoption of BMPs that were discovered included: water availability and quality, land leases, time and labor, land lords, generational gaps, and a lack of skilled employees. Producers saw the benefits of burning practices and rotational grazing. Another major theme was drought tested the resiliency of producer's operations. This study offers several recommendations for

Extension professionals and research. The way that Extension agents were communicating BMPs should be researched and analyzed. The implementation of CBSM and ELM by Extension professionals could increase the adoption of BMPs in grazing systems. A major implication of this study was the need for Extension to more openly communicate with producers rather than just exchange information.

Keywords: grazing, best management practices, social constraints, community based social marketing, elaboration likelihood model, communication

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Dedication

To my research participants, though anonymous you know who you are, your tenacity and devotion is truly inspiring.

Chapter 1 - Introduction

The public perception of agriculture has changed from a reputation of good land and animal stewardship to that of pollution and abuse (Rahelizatovo & Gillespie, 2004). The public was increasingly concerned about the effect of modern agriculture on the environment (Wachenheim & Rathge, 2000). However, members of the agricultural community continued to view themselves as good stewards (Rahelizatovo & Gillespie, 2004). The recent droughts of 2011 and 2012 left pasture and rangeland across the Southern Great Plains overgrazed and damaged (USDA Economic Research Service, 2013). Agriculturists manage pastures and rangeland in all 50 states (Range & Pasture, n.d.). Range and pasture lands make up over 27% (528 million acres) of the total acreage of the contiguous 48 states (Range & Pasture, n.d.). That is more acreage than both forest and cropland. Improper management of grazing lands has resulted in degraded land quality (Ohlenbusch & Watson, 1994). The degraded land appearance caused by the droughts has not helped improve the public image of agriculturalists. Traditionally, producers focused their attention on care of livestock rather than maintaining grazing lands. In the 1960s, a shift in this attitude occurred. Changing economics, politics, and social issues were some of the driving forces behind this change (Ohlenbusch & Jones, 2002).

Livestock producers have based stocking rates on tradition, neighbors, guesses, or financial pressure (Ohlenbusch & Watson, 1994). Grazed forages are most productive when grazing pressures are matched to the pasture's grazing capacity on a case-by-case basis, and then adjusted for periods of stress, such as drought. Overuse of pasture for many years resulted in reduced profitability and increased soil erosion (Ohlenbusch & Watson, 1994). Best management practices, or BMPs, are practices producers can adopt to effectively manage resources and

reduce environmental impacts (Paudel, Gauthier, Westra, & Hall, 2008). BMPs are backed by research as the most effective, environmentally sustainable, and long-term economically logical way to manage an operation (Feather & Amacher, 1994; Gillespie, Kim, & Paudel, 2007; Paudel et al., 2008). Scientists, policy makers, and Extension professionals conveyed frustration at the level of adoption of BMPs (Pannell et al., 2006). BMPs are intended to contribute to the sustainability of an operation. Sustainability is defined by the three E's: environment, economics, and equity or social justice. When considering sustainability, the environmental impact, economic consequences, and social justice should be considered. Sustainable practices promote the long-term environmental health and economic productivity of land (Cox, 2013), therefore increasing the resiliency of a producer's operation.

Statement of the Problem

Worldwide drought contributes to land degradation, which has affected 1.9 billion hectares of land annually (Desertifcation, n.d.), leading to overgrazing and soil erosion. A drought plagued the Southern Great Plains from 2011 to 2014. Proper management practices for grazing lands can increase forage production and reduce soil erosion (Ohlenbusch & Jones, 2002). Effectively communicating the BMPs for grazing could increase the adoption of BMPs thereby lessening this effect.

According to the 2012 census of agriculture there were 22.1 million acres of grazing lands in Oklahoma (2014). Permanent pastureland in Oklahoma accounted for over 56% (19.45 million acres) of total land use as of 2012 (*2012 census of agriculture,* 2014). Grazing lands in Kansas were equal to 16.2 million acres and permanent pastures accounted for one-third of Kansas land

area (15.5 million acres) (*2012 census of agriculture,* 2014). In 2011 alone there was more than $1.6 billion lost from the agricultural sector in Oklahoma, moreover there was over $6.6 million of loss in the livestock sector (Wessler, 2011).

Producers depend on rain and green pastures to raise livestock. Kansas and Oklahoma were in the top five cattle producing states in the country. In 2014, drought conditions caused beef cow numbers to reach the lowest number since 1951, 2013 marked the eighth year of decreasing beef cow numbers. In the Southern Great Plains there was a loss of 1.6 million head (Hurt, 2014). This drop was a result of both degraded pastures and high feed prices.

A behavior change in BMP adoption is necessary to increase the resiliency of not only individual producer's operations, but the overall resiliency of the cattle industry and the rural areas it influences. Community-based social marketing (CBSM) has proven successful at generating environmental behavior changes (McKenzie-Mohr, 2011). The utilization of CBSM in Canada, resulted in a 32% reduction of outdoor water use. CBSM has several steps: select the behavior to promote, identify the barriers and benefits associated with the behavior selected, develop a strategy with behavior-change tools to address the barrier, pilot the plan, and evaluate the plan once implemented (McKenzie-Mohr, 2011). A few of these steps in relation to BMP adoption have been completed. Behaviors related to responsible grazing management have been identified, as BMPs. Several Extension publications reviewed for this study pointed out barriers the authors assumed existed, i.e. fear, water availability, and drought (Ohlenbusch & Harner, 2003; Ohlenbusch & Hartnett, 2000). These have been explored in research previously but not to the extent necessary (Gillespie et al., 2007). According to CBSM, the first step to identify

barriers is reviewing literature and then observing people who are already engaging in the selected behavior. Next, research should be conducted to understand attitudes about the behavior and finally, surveys are conducted with a random sample of the target audience (McKenzie-Mohr, 2000). Utilizing CBSM to communicate BMPs for grazing management to producers could increase adoption of BMPs.

According to Gillespie et al. (2007), a producer who heard about BMPs but still chose not to implement them in his or her operation was an unexplained phenomenon. The elaboration likelihood model (ELM) could help to understand how producers are processing information, either centrally or peripherally. If information is centrally processed, that information is more likely to be used. One of the best ways to motivate people to centrally process information is to make it personally relevant to them (Petty & Cacioppo, 1984). Personal relevance is not presented in the literature related to grazing BMPs. Therefore, it is important to determine awareness, perception, personal relevance, and processing of BMP information.

Many studies have examined why producers adopt BMPs (Prokopy, Floress, Klotthor-Weinkauf, & Baumgart-Getz, 2008; Rahelizatovo & Gillespie, 2003, 2004). These studies examined the motivations of producers who adopt practices (Greiner, Patterson, & Miller, 2009), factors that affected the adoption of practices in stocker-cattle operations (Johnson et al., 2010), BMP adoption among Louisiana Dairy producers (Paudel et al., 2008), adoption of cow-calf BMPs in Oklahoma (Ward, Vestal, Doye, & Lalman, 2008), and factors that influenced BMP adoption in Louisiana Sugarcane operations (Henning & Cardona, 2000). Few studies identified the

characteristics of non-adopters (Gillespie et al., 2007), and no literature was available on the barriers and social constraints to adoption.

Resiliency of a system is measured by the amount of change that can occur while the system still retains its function (Carpenter, Walker, Anderies, & Abel, 2001). Resiliency can be either positive or negative. If a population of weeds is resilient, that is negative. Sustainability is the positive form of resiliency (Carpenter et al., 2001). The resiliency of grazing systems is important in the face of a changing climate, especially in the Southern Great Plains ("Climate Risks in the Southern Plains", n. d.). Resiliency and sustainability are promoted through the use of BMPs (Johnson Alonge, & Martin, 1995). It remains unknown if producers view BMPs as sustainable or beneficial for their operation.

Purpose of the Study and Research Questions

The purpose of this study was to determine the barriers and socials constraints producers faced in the process of choosing whether or not to adopt BMPs for grazing systems. The following research questions guided the study:

- RQ1: What are Kansas and Oklahoma cattle producers' perceptions and awareness of BMPs in grazing systems?
- RQ2: How do producers seek and process information related to BMPs in grazing systems?
- RQ3: What are the barriers to adoption of BMPs in grazing systems?
- RQ4: What are the social constraints related to the adoption of BMPs in grazing systems?
- RQ5: How do producers perceive resiliency related to the adoption of BMPs in grazing systems?

Assumptions

The prevailing assumption in this study was that not all producers were utilizing BMPs for grazing (Gillespie et al., 2007). It was also assumed that Extension agents would be willing to help with recruiting participants for interviews. Another assumption was that when people participate in semi-structured, in-depth interviews, they were willing to divulge information that would be beneficial for this study, which is an assumption of all qualitative research (Creswell, 2007).

Definition of Key Terms

Barriers- Anything that would discourage someone from adopting a BMP (McKenzie-Mohr, 2011).

Best Management Practices (BMPs)- Voluntary practices agricultural producers can adopt to manage resources and mitigate environmental pollution (Paudel et al., 2008). Though these practices can mean an initial cost, they can be economically beneficial in the long run (Boyer et al., 2004). BMPs are designed to reduce water pollutants and conserve soil, while improving or maintaining productivity of land (Sanders, Wegenhoft, & DelVecchio, 2002).

Cattle Producer- A person involved in the production of cattle on his or her agribusiness operation.

Community-Based Social Marketing (CBSM)- Theoretical approach to attaining the adoption of sustainable behaviors within a community. It utilizes psychology and social marketing to influence members of a community to take action in a behavior change; CBSM is intended to be a grass-roots movement (McKenzie-Mohr, 2011).

Drought- A lack of precipitation over a long period of time, more than one season, that brings about a deficiency of water ("What is drought?," 2014)

Dual-Purpose Wheat- A wheat crop that is planted for the purpose of not only grain harvest, but for cattle grazing as well (Dhuyvetter & Tonsor, 2014).

Ecoregions- Areas of similar ecosystems, taking into account geography, geology, vegetation, climate, soils, land use, etc. (Chapman et al., 2001; Woods et al., 2005).

Elaboration Likelihood Model- A persuasion theory that describes how attitudes are made and transform (Cacioppo & Petty, 1984)

Extension Agent- Individuals who provide access to information from land-grant universities to their assigned communities across the nation ("County Extension Offices," n.d.).

Land-Grant University- A university that is supported by the Morrill Acts of 1862 and 1890 (i.e. Kansas State University and Oklahoma State University). These universities were originally developed to serve people, industry, and government in respective states, through research and Extension (Campbell, 1995).

Pasture- Lands that are used primarily for the production of adapted, domesticated forage plants for livestock (U. S. EPA, 2013).

Rangelands- Lands on which the native vegetation is predominantly grass, grass-like plants, forbs, or shrubs suitable for grazing use (U.S. EPA, 2013).

Resiliency- Propensity of a system (economic or otherwise) to retain its organizational structure and productivity following a perturbation (Briguglio, Cordina, Farrugia, & Vella, 2008; Holling, 1973).

Social Constraints- A barrier that is in place due to social situations (McKenzie-Mohr, 2011)

United States Department of Agriculture (USDA)- A government agency that provides leadership concerning agriculture, food, and natural resources. It was established by Abraham Lincoln in 1862 (USDA, 2016).

Summary

Beef cattle producers across Kansas and Oklahoma have access to BMPs for proper grazing land management, but are still choosing not to utilize the practices (Gillespie et al., 2007). Research has examined the reasons why producers choose to adopt BMPs but has yet to determine why producers do not adopt BMPs. The theoretical framework for this study was ELM and CBSM. If BMPs were communicated to producers in a way that persuaded them to adopt BMPs associated with responsible grazing management, the resiliency of the entire beef cattle grazing system would increase (Carpenter et al., 2001). Producers were fighting a battle against changing land-use, climate, and markets. This study examined the social constraints regarding adopting BMPs, how producers processed information related to BMPs, and the perceived resiliency of BMPs.

Chapter 2 - Literature Review

The goal of this study was to discover the barriers and social constraints associated with the adoption of BMPs in grazing systems through addressing the research questions: 1) What were Kansas and Oklahoma cattle producers' perceptions and awareness of BMPs in grazing systems? 2) How did producers seek and process information related to BMPs in grazing systems? 3) What were the barriers to adoption of BMPs in grazing systems? 4) What were the social constraints related to the adoption of BMPs in grazing systems? 5) How did producers perceive resiliency related to the adoption of BMPs in grazing systems? The literature reviewed in this chapter includes an overview of the livestock and grazing industry, the suggested BMPs for grazing by Kansas State University and Oklahoma State University, research about the adoption of BMPs, and resiliency. A theoretical framework will be introduced consisting of CBSM and ELM.

Industry Background

Drought effected regions of Kansas and Oklahoma from 2011 to 2014. Drought conditions for mid-February in the United States from 2010 to 2014 are shown in Figure 1. In 2010, most of the United States experienced near normal conditions with no presence of drought in Kansas or Oklahoma (Fig. 1a). In 2011, parts of Oklahoma and Kansas were beginning to experience abnormal dryness, moderate drought, and even severe drought (Fig. 1b). In 2012, that trend continued (Fig. 1c) and cattle inventory was down in Kansas by 25% (Voorhis, 2012). However, 2013 proved to be the most severe for Oklahoma and Kansas as well as most of the Great Plains (Fig.1d). The drought continued for Kansas and Oklahoma into 2014 and continued in some areas of Kansas and Oklahoma in 2015 (Fig. 1e) (Folger & Cody, 2014; Rippey, 2015).

Figure 1. Progression of Drought

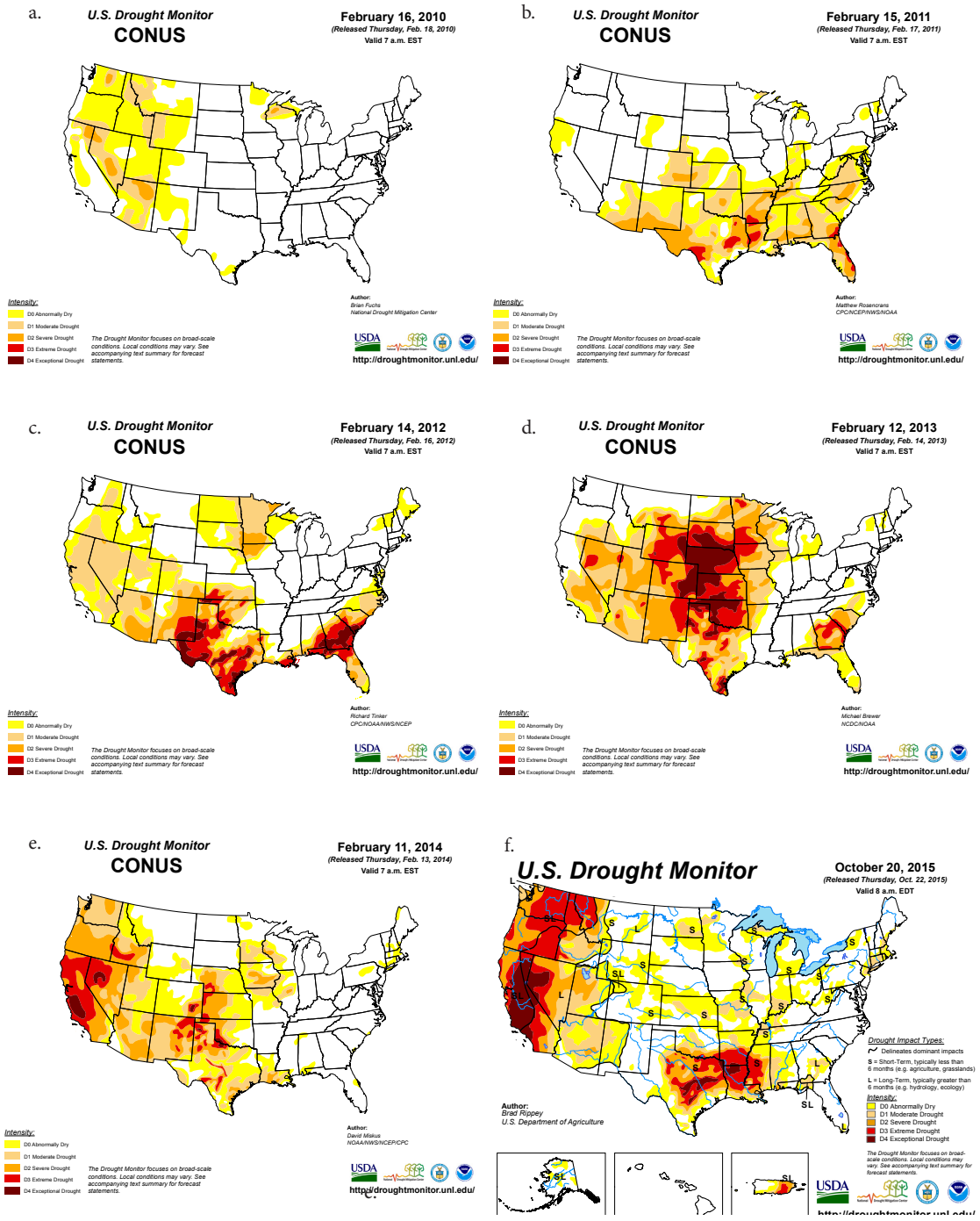

Figure 1. U.S. Drought Monitor archived maps showing the progression of drought from 2010 to 2015

As of 2012, there were 16.2 million acres of grazing and pasturelands in Kansas; beef cattle production is the main industry on these lands (*2012 census of agriculture*, 2014; Boyer et al., 2004). In the 2012 agricultural census, Kansas had 27,568 farms with cattle; totaling 7.46 million head and Oklahoma had 51,043 farms with cattle, totaling 4.24 million head. These cattle numbers were some of the lowest seen since 1951 ("U.S. cattle inventory still declining," n.d.). The low population of cattle was due to the drought conditions. The drought negatively affected the quality and quantity of forage available for cattle production (Hurt, 2014). The areas affected by the 2011-2014 drought encompassed many different forage types, ecoregions, and people.

There were three predominate ecoregions in the study area: Flint Hills, Central Great Plains, and Southwestern Tablelands (Chapman et al., 2001; Woods et al., 2005). For detailed maps describing the ecoregions, see Appendix A. The ecoregion maps showed rangeland and pastureland consisted of warm and cool season grasses and had similar climates. The eastern part of Kansas and Oklahoma had higher amounts of precipitation than the western. As of 2012, in Oklahoma the annual precipitation varied from 56 inches in the southeast to less than 16 in the northwest (Tyrl, Bidwell, Masters, Elmore, & Weir). In Kansas, the annual precipitation varied from 42 inches in the northeast to 16 inches in the southwest (Jia, Ramaswamy, Whitworth, Ohlenbusch, & Thiessen, 2003).

The Flint Hills ecoregion, located in eastern Kansas and part of north central Oklahoma, was identified by rolling hills, limestone, and rocky soils. Summers were known to be generally wet and humid. The Flint Hills received between 38 to 42 inches of precipitation a year. The tallgrass prairie was the dominant land cover in this ecoregion and was used primarily for grazing, since

the shallow soils and rocky ground resulted in very little cropland (Chapman et al., 2001; Woods et al., 2005). Big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*) were the dominate grasses in the Flint Hills (Jia, et al.,, 2003; Tyrl et al., 2012).

The Central Great Plains was the largest ecoregion in both Kansas and Oklahoma and the mixed grass prairie was the native vegetation of this area. As the name implies, a mixture of short and tall grass made up this prairie. The dominant species were big bluestem, indiangrass, blue grama (*Bouteloua curtipendula)*, side-oats grama (*Bouteloua curtipendula*), western wheatgrass (*Pascopyrum smithii*), and switch grass. Western ragweed (*Ambrosia psilostachya),* is also present in the mixed grass prairie (Chapman et al., 2001). The annual precipitation of this ecoregion ranged from 22 to 38 inches (Jia, et al.,, 2003; Tyrl et al., 2012). Much of this ecoregion has been dedicated to crop production, the rangeland found on rougher land had been encroached by eastern redcedar (*Juniperus virginiana*) (Woods et al., 2005).

The western quarter of Kansas and the Panhandle of Oklahoma, home to the shortgrass prairie, were encompassed by the Southwestern Tablelands ecoregion. The dominant grasses of this prairie were blue grama, buffalograss (*Buchloe dactyloides)*, western wheatgrass, and switch grass (Jia, et al., 2003; Tyrl et al., 2012). The Southwestern Tablelands consist of hills, canyons, plains, buttes, mesas, and terraces. This topography limited row crop production, and the land use remained in rangeland and grassland. Eastern red cedar encroachment has been documented in this ecoregion. The precipitation in this ecoregion ranged from 16 to 28 inches annually (Chapman et al., 2001; Woods et al., 2005).

Producer information sources.

Available information for producers on grazing practices became more pervasive and muddled than ever. It was essential that producers found quality information at the right time and the right place. Extension has an important role in this and should strive to communicate with producers (Diekmann & Batte, 2009; Rasmussen, 1989).

A study on the information sources used by cotton producers discovered that producers tend to use multiple information sources, rather than just one, to make choices regarding precision agriculture. Extension was the main source of information used, but it was combined with other sources like private consultants, media, other producers, and farm dealerships (Velandia et al., 2010). According to a survey of Northwest Florida producers other cattle producers, county Extension, and veterinarians were the top information sources used (Vergot III, Israel, & Mayo, 2005). The producers contacted for this study were from an Extension mailing list, however 32% of those producers surveyed did not use Extension on a regular basis. A study done by the USDA's National Animal Health Monitoring System in 1994 showed that veterinarians were the most used source of information concerning animal health. When it came to beef production information, producers used veterinarians, family, Cooperative Extension Service/university, and agricultural magazines (*Information Sources for Beef Cow/Calf Producers*, 1994).

Vergot III et al. suggested that Extension should use more individual consultations, multiple channels for information, and examples with visible results for the most effective communication possible (2005). Velandai et al. called for Extension to tailor information to each client, and for

Extension educators to collaborate with other information sources to provide more comprehensive recommendations for producers (Velandia et al., 2010).

Cooperative Extension Services.

The Cooperative Extension Service (Extension) was originally designed as a partnership between land-grant universities and the U.S. Department of Agriculture. The Smith-Lever Act of 1914 put the system in place (Rasmussen, 1989). Extension was formed around the principle of cooperation, county, state, and federal partners working together. Each state has its own version of Extension, therefore variations exist; however, all share a common mission. Extension was formed to bring the university to the people, making the results of university research available to those who would benefit (Rasmussen, 1989). Local Extension personnel feed the system and tell researchers about the problems that exist to encourage research. This results in a two-way communication system.

The Extension system places agents or educators in each county to serve constituents on a personal level. County agents have the unique advantage of becoming integrated into the community and establishing themselves as a trusted source. Each agent should be a skilled communicator. Communication is of the utmost importance to make county Extension offices function (Rasmussen, 1989).

The Natural Resource Conservation Service (NRCS), was a part of the USDA and the purpose of NRCS was to encourage the voluntary adoption of conservation practices. In 2003, the NRCS published a report about the strategy NRCS intended to use in regard to conservation practices in

animal agriculture (USDA, 2003). One of the main components in that plan was for Extension agents to provide accurate information and educational materials, and NRCS would provide technical and financial assistance to producers (USDA, 2003).

Leasing and renting land

Private parties and governmental agencies lease land ("Agricultural leases: An overview," n.d.). Pasture has been rented typically on a flat rate basis, either by acre or by the number head put on the pasture. Historically, Flint Hills pasture rental rates were based on a per head rate for an entire grazing season. However, in most other areas grass was typically priced on a per acre basis (Dumler & Dhuyvetter, 2011). Lease agreements varied from landowner to landowner and different constraints placed on leases depend on the landowner. Stocking rates and other management decisions could have been determined by the landowner, but could also be left up to the leaseholder.

Oklahoma school land.

As part of the Land Ordinance of 1785, each state that entered the Union in 1803 and later was given land to support public schools (Souder, Fairfax, & Ruth, 1994). Sections 16 and 36 in each township were reserved for public schools. A school could be built on the land or the land could be leased and the money generated would be given to the public schools of the state (Hainer, 1893).

The land known simply as “school land” in Oklahoma was first leased while Oklahoma was still a territory in 1891 (Hainer, 1893). At that time, it was not unusual for states to have designated school land.

The Oklahoma Organic Act of 1890 laid out the original role of the Commissioners of Land Office; therefore, the management of school land and the Commissioners of Land Office predate Oklahoma becoming an official state ("Commissioners of the Land Office," 2015). After the Enabling Act of 1906, President Theodore Roosevelt declared Oklahoma a state on November 16, 1907 (Everett, 2009). At the time of statehood, the Commissioners of Land Office was in charge of 3,177,480 acres of land in Oklahoma (Wilson, 2009).

There were several rules associated with leasing school land. Producers were not allowed to mine the lands, the lands could only be quarried for stone for the foundation of buildings and producers could not remove timber for any purpose. Trees could not be removed to make fences or buildings. The goal was to preserve this land, not to degrade it, but to improve it. Producers who “cultivated the land in a business like manner” (p.18) were granted preference for the land at the time of lease renewal (Hainer, 1893).

In 1928, the predominant school land lease was for a five-year duration. County appraisers determined the cost of the lease, though the cost of leasing school land was significantly cheaper than buying land. The current lessee was also given preference and often school land could stay in families for generations (Vadjunec & Sheehan, 2010). Regardless of the amount of time a family leased the land, Oklahoma did not make adjustments to the cost of leases. Good management practices were not rewarded; however, substandard practices were not reprimanded either (Souder & Fairfax, 1996).

The school land structure remained unchanged from 1890 to 1982, when the Oklahoma Education Association sued the State Land Board and won, arguing that the income potential of the State Land Office was not being realized. The result of the lawsuit was a change to public auctions that resulted in an 80% increase in lease rates (Souder & Fairfax, 1996). Preference was no longer given to the former lessee, and there was no way to ensure a producer would have a piece of land for more than five years. While the increased revenue benefitted schools, those leasing the land experienced big changes. It was less justifiable to make improvements to the land when the lessee might not have the land in five years. Policy changes also enabled the land to be leased for other uses, such as hunting or other recreational uses (Vadjunec & Sheehan, 2010).

Grazing Management Strategies

There are two main grazing management strategies that have been used by producers: conventional season-long grazing and management intensive grazing systems. Season-long grazing has been the easiest management strategy, because cattle stay on a single pasture for the duration of the grazing season (Ohlenbusch & Jones, 2002). Although this usually results in the best weight gain for growing cattle, it has been a challenge to ensure proper grazing distribution.

Management intensive grazing systems have utilized cross fencing to control grazing and pasture rest. This involved more than just moving cattle from place to place, but also required attention to detail. While animal performance may be slightly less than season-long grazing, the per-acre performance of grass can be enhanced, and more beef can be produced overall (Ohlenbusch & Jones, 2002). Water, fencing, forage, and animal performance are all factors that should be

carefully assessed and considered before determining the best strategy for each respective operation (Ohlenbusch & Jones, 2002).

Best Management Practices.

The push for adoption of BMPs can be traced to the Dust Bowl. After this tragedy, producers and ranchers began to understand the importance of caring for the land for the future. On April 27, 1935, the Soil Conservation Service (SCS) was established as a branch of the USDA to provide financial incentives for producers to take unsuitable land out of crop production and help them return it to its natural state. The SCS also encouraged implementation of BMPs such as terraces, contour plowing, and crop rotation. The SCS was later renamed the Natural Resource Conservation Service (NRCS, n.d.). BMPs were determined by years of research to be not only effective, but a practical way to conserve soil, reduce water pollutants, and improve the productivity of agricultural lands (Sanders et al., 2002).

The BMPs for the tallgrass, mixed grass, and shortgrass prairies are similar. All prairie types should have proper stocking, grazing distribution, planned periodic rest, proper season of use, and weed and brush control. Both the tallgrass and mixed grass prairie BMPs include prescribed burning, but this practice is not suggested for use in the shortgrass prairie (Jia et al., 2003; Ohlenbusch & Jones, 2002; Weir et al., n.d.). The type of forage and its growth patterns fluctuate greatly throughout Oklahoma and Kansas. This can be attributed to the varying degree of rainfall. This results in different ranches or operations having considerably different needs and practices (Redfearn, Rice, Bidwell, & Woods, 2005). Weather has an effect unlike any other factor on grazing land management. Rainfall or other precipitation limits not only plant growth,

but also cattle performance (Ohlenbusch & Jones, 2002). The management of forage is the key piece to cattle production and should be the primary focus of beef producers. Climate, soil, amount of weeds, or other unpalatable species affected forage availability. Climate had the greatest effect on the production of forage (Ohlenbusch & Jones, 2002).

Stocking Rate.

The number of animals grazing on a given amount of land was known as the stocking rate. The stocking rate affected a number of things, for example, how well plants recovered from grazing, future production of forage, quality of forage, changes of forage species within the pasture or rangeland, and the performance of the grazing animal (Ohlenbusch & Watson, 1994). If stocking rates were too heavy, supplemental feeding was required. It was determined that it was nearly always more economical to provide grazeable forage than to supplement cattle with another source of nutrition (Redfearn et al., 2005). In order for a proper stocking rate to be established, cattle producers match the stocking rate to each individual pasture's carrying capacity. This ensured forages remained productive for future grazing use. For proper stocking rates to be established, a cattle producer must have knowledge of forage production and grazing pressure. Producers who had been using the same pastures for many years had a sense for how much forage their land could produce and the number of cattle it could sustain (Ohlenbusch & Jones, 2002). The goal of proper stocking was to optimize both animal and forage production overtime, rather than maximizing one or the other. Moderate grazing pressure resulted in the best long-term economic gain (Ohlenbusch & Watson, 1994). It was recommended that no more than 50% of forage should be removed from an area within a growing season so plants could recover and

still be productive in the future (Ohlenbusch & Watson, 1994). This was referred to as the "take half leave half rule" (Redfearn et al., 2005)

The ratio of forage demand to the amount of forage available determined the grazing pressure. The type of livestock grazed determined forage needs as does size, age, and reproductive stage of the animal. Beef cattle mainly grazed on grasses, while lactating and pregnant females required more forage from the last trimester through weaning. Once grazing pressure and forage availability was calculated, stocking rates could then be determined (Ohlenbusch & Watson, 1994). An excellent forage management plan should have the greatest number of grazing days while still considering the body conditions of cattle and the general health of the herd (Redfearn et al., 2005).

Grazing Distribution.

Grazing distribution was referred to as the pattern in which livestock graze a pasture or rangeland. Grazing distribution was best understood when cattle producers identified areas where the livestock concentration was the highest (Ohlenbusch & Harner, 2003). Once those areas were identified, it was essential to understand why those patterns were present. There were four primary factors that lead to a higher concentration of grazing: 1) water location, 2) location of shade, 3) wind direction, and 4) topography. The concentration of livestock was often influenced by at least two of these factors. These factors could be manipulated by providing multiple areas for water and shade. Salt or mineral feeders could also be used to draw livestock to areas of lower concentration. Fencing was used to better distribute grazing patterns within an area of land, or fence off the part of the pasture or rangeland that was overgrazed so the rest of the area

was grazed at the same rate (Ohlenbusch & Harner, 2003). Proper fencing could help change grazing patterns and more effectively harvest forage (Ohlenbusch & Jones, 2002).

Changing the location of winter feed locations was often under utilized by producers but was a simple way to change the distribution of grazing (Ohlenbusch & Jones, 2002). During winter months, if producers fed cattle in the same place every time, that ground became trampled and eroded. Moving locations of winter feeding could have prevented this (Ohlenbusch & Jones, 2002). Prescribed burning could also have affected grazing distribution. Cattle preferred to graze in burned areas; therefore, prescribed burning could have been used in combination with other practices to change grazing distribution (Ohlenbusch & Harner, 2003).

Planned Periodic Rest.

Planned periodic rest, also known as systematic rest, was an important factor in the maintenance and improvement of grazed forages (Boyer et al., 2004). Letting range and pasturelands rest allowed the forage to grow and improve in quality. The seasonality of forage was essential because the time of year forages were grazed effected how much forage could be utilized without the overall productivity of the plant being reduced (Boyer et al., 2004). The use of rest in a systematic way between two or more pastures showed to improve pastures with very small disruption to the management of cattle (Boyer et al., 2004; Ohlenbusch & Jones, 2002).

Weed and Brush Management.

Proper weed and brush management resulted in a more productive range or pastureland. Brush and weeds reduced livestock performance, obstructed grazing, and interfered with livestock

handling. While some trees were desirable for shade or even protection from snow and wind, the removal of brush and weeds resulted in a higher carrying capacity for the land (Towne & Ohlenbusch, 1992). Brush was controlled by prescribed burning, mechanical control, or herbicide use. Mechanical control was expensive and labor intensive; these factors made it only feasible for small areas. Trees could be cut off at ground level, but required two to three consecutive years in order to be completely removed. Moderate stocking rates could stunt woody plant seedlings. Therefore, when livestock were removed from a grazed range or pasture, woody plants began to appear (Towne & Ohlenbusch, 1992). Grazing management, prescribed burning, mechanical control, and herbicide were all options to control rangeland weeds (Ohlenbusch & Towne, 1991). If cattle grazed weeds early in the growing season, when weeds were small enough to be palatable, those weeds were stunted; moderate stocking rates and continuous grazing helped control weed seedlings. As mentioned above, mechanical control was expensive and labor intensive. Mowing weeds removed the top of the plant, but often encouraged rapid growth (Ohlenbusch & Towne, 1991).

Thousands of acres of native grass were sprayed in Oklahoma each year. This expensive practice was not usually profitable. Broadcast application of herbicide over pastures had not been shown to improve livestock gains. These herbicides also had the potential to eradicate plants that were beneficial to livestock and their productivity. Oklahoma State University suggested producers assessed the desirability of plants in pastures with the assistance of the USDA Natural Resources Conservation Service Ecological Site Descriptions (Weir et al., 2009). Spot spraying provided a good alternative to full pasture spraying and targeted specific problem species. Prescribed

burning and patch burning were suggested as a more economic alternative for weed control (Weir et al., 2009).

Prescribed Burning.

Prescribed burning occurred on rangelands more than on pasturelands (Boyer et al., 2004); the practice recycled nutrients in old plant growth, controlled woody species, reduced wildfire risk, and improved grazing distribution (Ohlenbusch & Hartnett, 2000). Prescribed burning controlled weeds and cattle found forage in burned areas more appealing (Boyer et al., 2004). Large amounts of old forage growth presented a hazard for wildfires, especially in dry conditions. Prescribed burning prevented the accumulation of plant growth, therefore reducing wildfire risk (Boyer et al., 2004).

The timing of burning was the most crucial aspect to achieving the goals associated with prescribed burning. If the producer sought to kill undesired plants, those plants needed to be burned when at their weakest. For Buckbrush (*Ceanothus cuneatus*) to be eradicated, it must be burned in the late spring two to three years in a row. Eastern red cedar trees were usually killed by burning if they are less than five feet tall. Prescribed burning was considered to be an economical way to control weeds and brush (Ohlenbusch & Jones, 2002). When burning was meant to benefit desirable grass, it was done when plants were starting to turn green in the spring. The earlier a forage was burned, the lower the forage yield. However, there was no difference in yield between forage that was burned in the late spring or unburned forage (Ohlenbusch & Jones, 2002).

Stocker cattle gained 10-12% more weight on forage that was burned in late spring than on unburned pastures or pastures that was burned early in the spring. Cow-calf pairs did not have the added gain benefits that occurred with stockers. However, burning was still beneficial for use on rangeland used for cow-calf pairs to sustain a productive rangeland (Ohlenbusch & Jones, 2002).

Winter Wheat Grazing.

Winter wheat (*Triticum aestivum*) grazing was another common practice in Kansas and Oklahoma. Producers who chose to use dual-purpose wheat started by planting wheat early; typically, by planting in late August. Producers began grazing cattle on wheat in October or November and removed the cattle before the wheat reached the jointing stage in order to minimize the loss of grain yield (Boyer et al., 2004; Dhuyvetter & Tonsor, 2014). Jointing stage was characterized by the development of nodes and internodes; jointing began when growth of tillers was complete and usually occurred in the spring (K-State Research and Extension, 1997). Grazing should not begin until plants were well rooted and have tillers, approximately six to eight weeks after planting (Campbell, 2013). Winter wheat forage production increased with the addition of nitrogen (30 lbs/acre) and phosphorus (20lbs/acre) when planted, regardless of the level indicated by a soil test (Hossain, Epplin, Horn, & Krenzer, 2004; Krenzer & Redfearn, 2005). Although grazing winter wheat was a practice used in Kansas and Oklahoma, it was not used as forage to the fullest extent to which it could (Campbell, 2013). Grazing winter wheat offered producers another source of income from the forage as well as the grain (Dhuyvetter & Tonsor, 2014).

Introduced Grasses.

In Kansas and Oklahoma there were several different types of introduced grasses used for grazing: bermudagrass (*Cynodon dactylon*), old world bluestems (*Bothriochloa*), tall fescue (*Festuca arundinaceus*), and brome (*Bromus*) (Ohlenbusch & Jones, 2002). Bermudagrass was a drought resistant grass but had to be managed very carefully as forage quality degrades with maturity. Rotational grazing was suggested as a way to enhance grass efficiency. Old world bluestems were not related to the native big or little bluestem grasses. This grass was well adapted to Oklahoma because of its drought and pH tolerance. Old world bluestem was a very aggressive species, and there was no known way to stop its advance once it began to take over where it was not intended (Ohlenbusch & Jones, 2002).

Alternative Forages.

Alternative forages ranged from crop residues, cover crops, and small cereal grain. Crop residues such as corn, milo, wheat, and many other crop residues were grazed for short periods of time. Cattle needed water and supplemental protein in order maintain proper nutrition (Ohlenbusch & Jones, 2002). Cereal crops such as triticale (*triticosecale)*, barley (*Hordeum vulgare)*, cereal rye (*Secale cereal)*, and oats (*Avena sativa)* were all grazeable forages utilized in Oklahoma and Kansas. Cereal rye had the greatest growth potential during winter months; however, volunteer rye was problematic in regions with wheat seed production. Rye offered the shortest time for grazing in the springtime. There was little demand for rye grain, so it was often grazed out rather than harvested (Krenzer & Redfearn, 2005). Triticale was a cross between wheat and rye and its grain was used for animal feed. Barley, though it was ideal for fall forage production, had limited

production during the colder months and was susceptible to winterkill. Oats were more sensitive to winterkill than barley, this made them both less than ideal for winter and spring forage production (Krenzer & Redfearn, 2005).

Different types of summer annual forages were also options for grazing. Sudangrass (*Sorghum sudanense*) were used for grazing, haying, and green chop. However, sudangrass was not as productive as other summer annual options (Towne, Fjell, & Fritz, 1992). Sorghum-sudangrass hybrids were the most common summer annual used in Kansas. These plants were best suited for hay, silage, or green chop, rather than a grazing source. Pearl millet hybrid plants (*Pennisetum glaucum*) were leafy, drought-resistant, and grow back quickly, this made them ideal for grazing or haying. However, pearl millet was easily overgrazed (Towne et al., 1992). Using farmland as a source of forage gave pastures periods of rest, and reduced the need for supplementing cattle with hay (Fisher, Shelton, & Bailey, 2014). Crabgrass (*Digitaria*) was utilized as another alternative forage. Crabgrass was sometimes planted, but there was also volunteer crabgrass that grew in winter wheat that had the potential to be grazed after wheat had been harvested (Lomas & Moyer, n.d.).

Cover Crops.

Cover crops were an emerging source of alternative forages. Cover crops were used to solve compaction problems, reduced and prevented erosion, and improved the health of soil by retaining and adding nutrients to the system as well as increasing organic matter. Cover crops could be either a pure stand or various mixes. Legumes and grasses alike were utilized as cover crops (Warren, n.d.). The flexibility to utilize cover crops for grazing or hay was an additional

benefit (Warren, Meeks, & Edwards, n.d.). Though grazing cover crops in a no-till system removed residue, it was a potential benefit if the subsequent crop to be planted did not perform or emerge well in high residue.

According to the NRCS, cover crops could be grazed, but management was essential. Most cover crops met the nutritional needs of cattle (Fisher et al., 2014). There were many benefits to grazing cover crops, these included increased flexibility and less supplementing with hay or other forages. Pastures got a much-needed rest when cover crops were utilized. This was particularly important during drought when permanent pastures suffered (White, 2014). NRCS cautioned that cover crops could be used for multiple benefits, such as grazing, but the primary goal of cover crops, increasing the health of soil, should not be jeopardized (Fisher et al., 2014). In order to ensure the integrity of cover crops, livestock should not be left in one place too long. Cattle should be moved or given new forage every one to two days (Fisher et al., 2014).

Fertility Management of Grazing Lands.

The fertilization of native pastures showed an increase in forage yields when timed correctly in both tallgrass and shortgrass range. However, the profitability of this practice was nearly non-existent and depended heavily upon the markets of both fertilizer and cattle. Introduced grasses, like bermudagrass, produced massive amounts of forage if cut multiple times or grazed heavily. Bermudagrass reacted favorably to nitrogen, phosphorus, and potassium fertilization. Fertilizer should be applied in accordance to soil tests (Ohlenbusch & Jones, 2002). It was suggested that summer annual forages such as sudangrass, sorghum-sudangrass hybrids, and pearl millet should

be fertilized according to soil test recommendations. Often times, nitrogen was the nutrient that limited forage production (Towne et al., 1992).

Introduced cool-season grasses responded well to fertilizer that was properly timed and distributed (Kilgore, n.d.-b). Soil tests were performed to determine the correct rate of fertilizer to be applied. Nitrogen applications were split into fall and winter applications if fall and spring grazing is to occur. Phosphorus and potassium should be applied in the fall or winter (Kilgore, n.d.-b).

Bermudagrass was a warm-season grass. When bermudagrass was fertilized with nitrogen it could carry more cattle per acre, but did not increase the daily gain of the cattle. Fertilizer applied during the growing season was the most profitable. It was also beneficial to split the application into at least two different applications. Potassium and phosphorus applied according to soil test recommendations with the first application of nitrogen was the most beneficial (Kilgore, n.d.-a).

Adoption of BMPs

Existing research looked at many characteristics of BMP adopters. When Oklahoma stocker cattle producers were studied, it was found that operation size, income dependency on the operation, and working off farm all positively affected the likelihood a producer knew how to set stocking rates (Johnson et al., 2010). Producers who depended entirely upon cattle for their income were 10.2% more likely to be knowledgeable about setting stocking rates. Producers who were employed off farm, either part or full time, were more likely to set proper stocking rates,

13.7% and 15.1% respectively (Johnson et al., 2010). This study also showed producers who utilized wheat as a forage perceived the stocking rates to be critical; these Oklahoma producers would rather stock at lower rates rather than risk inadequate forage (Johnson et al., 2010). Similar results were found for adoption of BMPs in cow-calf production. Dependence upon income from cattle and education were positive indicators for adoption of BMPs, and age was a negative indicator for adopting most BMPs (Ward et al., 2008).

Motivations for adopting conservation practices and BMPs have also been examined. Ryan, Erickson, and De Young (2003) found intrinsic motivations were the strongest motivators towards adopting BMPs. These intrinsic motivators included feeling connected to the land and a desire to maintain fruitful land for future generations. Ryan, Erickson, and De Young's particular study found that economic motivation was the lowest-rated category. This contradicted a long-standing idea that producers are only motivated by cash, profit, or other extrinsic gains (Ryan, Erickson, & De Young, 2003). Land-management decisions were driven mainly by personal goals. Understanding the motivation behind adoption of BMPs is essential to explain the adoption or lack of adoption for each producer (Pannell et al., 2006). Producers utilized a decision-making process to determine whether or not they wanted to adopt a BMP (Pannell et al., 2006). The end decision was based on expectations and perceptions. The decision depended on "the process of learning and experience, the characteristics and circumstances of the landholder within their social environment, and the characteristics of the practice" (Pannell et al., 2006, p. 1408). This process yielded a different kind of knowledge for each producer. Many different factors affected this process: past experiences, scientific knowledge, and cultural factors.

Past research suggested government policies should be developed based upon the motivations of the producers in specific areas (Greiner et al., 2009). Many of these motivations had yet to be fully understood. Understanding these motivations would make tailoring programs easier, therefore making programs or policies more likely to be adopted (Greiner, Patterson, & Miller, 2009). Understanding a producer's management strategy could help Extension agents understand how producers make choices (Russell & Bewley, 2013).

The best financial predictor of adoption is capital (Baumgart-Getz, Prokopy, & Floress, 2012). Many producers were hesitant to "participate in conservation programs because they are uncomfortable with the idea of government control over their land-use decisions" (Smith, Peterson, & Leatherman, 2007, para. 42). The more information a producer had on a particular practice, the more likely they were to adopt it (Prokopy et al., 2008).

In a study surveying Louisiana beef producers, the highest percentage of non-adopters felt the BMPs, i.e. grassed waterways, rotational grazing and nutrient management, were not relevant to their operations (Gillespie et al., 2007). It is likely many of these producers lacked an understanding of BMPs. The second reason for non-adoption was being unfamiliar with BMPs; this showed that information about BMPs still has not reached all producers. These producers also tended to have less contact with Extension services (Gillespie et al., 2007). The number of producers who chose not to adopt BMPs because of cost is relatively low. A substantial number of producers simply did not adopt because they preferred not to (Gillespie et al., 2007). This phenomenon has yet to be explained.

Theoretical Framework

Community-Based Social Marketing.

Community-based social marketing (CBSM) had proven successful at generating socially desirable behavior change. CBSM stemmed from social marketing and pulled from social psychology research that established behavior change campaigns were most effective when targeted at the community level, while focusing on the barriers associated with adopting the desired behavior (Pallack, Cook, & Sullivan, 1980). CBSM did not rely as heavily upon mass-media advertising as social marketing. Behavior change initiatives were more effective when they came from the community level with personal contact rather than the global level with little personal contact (McKenzie-Mohr, 2011). CBSM intended to increase sustainable behaviors, hence why so many of its uses pertained to environmental issues like decreasing waste to landfills, saving energy, and conserving water (McKenzie-Mohr, 2011; Vigen & Mazur-Stommen, 2012).

CBSM had several steps: 1) select the behavior to promote, 2) identify the barriers and benefits associated with the behavior selected, 3) develop a strategy with behavior-change tools to address the barriers identified, 4) pilot the plan, and then 5) evaluate the plan once it has been implemented (McKenzie-Mohr, 2011). Barrier identification began with literature reviews, then observing people who were already engaging in the selected behavior. Barriers may include lack of capital or information. Next, focus groups should be conducted to understand attitudes about the behavior, and finally surveys should be conducted with a random sample of the target audience (McKenzie-Mohr, 2000). Once the initial research has been conducted, the intended

plan should be put into motion, regular evaluations should be completed, and appropriate changes made (McKenzie-Mohr, 2011).

It was essential to select the proper behavior to promote. The behavior must be "an end-state, non-divisible behavior" (McKenzie-Mohr, 2011, p. 43). An end-state, non-divisible behavior is the absolute last step in a behavior. For grazing practices, this could be applying defined stocking rates. However, just defining the stocking rate would not be an end state. The barriers and benefits to the behavior must also be identified, so the benefits can be promoted and the barriers eliminated (McKenzie-Mohr, 2011). A barrier to adoption could be increased cost, but the benefit would be the amount of profit a producer could earn.

The strategy around CBSM focused not only on promoting a behavior but also discouraging a different behavior. When a behavior is promoted, a communicator considered the alternative behavior, which was possibly easier than the behavior encouraged. Therefore, the alternative behavior, the less sustainable of the two, was discouraged just as much as the sustainable behavior was encouraged (McKenzie-Mohr, 2011).

Identifying barriers was an important step in CBSM. Often program planners skipped this step (Pallack et al., 1980). Some of the most common reasons for skipping this essential step was that program planners thought barriers were already known and time and funding constraints prevented adequate barrier research (Pallack et al., 1980). Several Extension documents reviewed for this study pointed out barriers the authors assume existed, i.e. fear, water

availability, and drought (Ohlenbusch & Harner, 2003; Ohlenbusch & Hartnett, 2000). However, these had not been explored in research previously.

Strategic communication was used by an organization to purposefully communicate in order to spread its mission (Hallahan, Holtzhausen, van Ruler, Vercic, & Sriramesh, 2007). Strategic communication was planned communication with a purpose; it was not communicating a random message, but communicating a specific message for a specific purpose (Hallahan et al., 2007). Communication was an essential part of the strategy of CBSM. CBSM strategic communication at its core was persuasion. Persuasion was any communication that tries to shape, reinforce, or change the receiver (Miller, 1980). Persuasion was prevalent throughout society, whether through television ads or personal relationships (Baldwin, Perry, & Moffitt, 2004). Persuasion must begin with getting the attention of the audience. Persuasion was best done not through mass media, but through personal contact. In order for persuasion to be successful, the effects of the adopted practices needed to be displayed to the audience (McKenzie-Mohr, 2011).

Communication should be concrete and personalized to the audience. Without vivid and personal communication, behavior change was much less likely to occur (McKenzie-Mohr, 2011). The more vivid information stood out against all the other information bombarding audiences daily (McKenzie-Mohr, 2011). Personalized communication simply meant knowing the audience and having an understanding of the different sectors of the community within that audience. When audiences were analyzed, communicators considered all people affected by the message. Multiple audiences were also considered when messages were developed (McKenzie-Mohr, 2011), for example, spouses of cattle producers, seed sales people, and crop consultants.

The source of the communication was also important to consider (McKenzie-Mohr, 2011). This is why Extension agents were a great liaison for BMP communication; Extension agents were seen as credible information sources within their communities (Patton & Blaine, 2001). In the case of this study, producers needed to be informed about the impact their practices were having on the environment surrounding them. Once initial contact had been made, CBSM called for seeking commitments, delivering prompts, and establishing social norms (McKenzie-Mohr, 2011). CBSM focused on utilizing connections people already had, and using those to change social norms and promoting sustainable behaviors, such as BMPs (McKenzie-Mohr, 2011).

Establishing commitment was the next step in the CBSM communication strategy, first, a small, public commitment was preferred, followed by a larger commitment toward sustainable behaviors (McKenzie-Mohr, 2011). A small commitment changed the way a person viewed oneself; for example, when a person signed a petition related to an issue, that signature changed their attitudes surrounding the particular issue. Their self-perception changed enough that they saw themselves as a supporter of the issue. When people made a small commitment, it made them more likely to agree to a larger commitment, as they wanted to be seen as consistent. This was a great strategy to gain compliance for sustainable behaviors (McKenzie-Mohr, 2011), such as the adoption of grazing BMPs. Research found simply ending a phone call with "We'll count on seeing you then, OK?" increased the likelihood of participants attending a blood drive from 62 to 81% (McKenzie-Mohr, 2011, p. 47). Commitments were both verbal and written. Written commitments showed to be more successful than verbal commitments (Pardini & Katzev, 1983). While written commitments were more effective, public commitments were the most successful.

A public commitment made the person more accountable; a public commitment could simply be printing names of those committed in a local newspaper (McKenzie-Mohr, 2011).

Prompts were a tool used to remind people of the commitment they have made; prompts were used to help remind people to carry out the selected sustainable behavior. Prompts could be meetings or mailers from Extension agents or a sign posted in the local community. Prompts were most effective when they were specific and noticeable. When a prompt was presented as close in both time and space to the action as possible, the prompts had greater effects. Prompts were also best used to promote positive behaviors rather than discourage negative behaviors (McKenzie-Mohr, 2011).

History and Evolution.

CBSM was first introduced in the article, "Promoting a sustainable future: An introduction to community-based social marketing" in 1996 by Doug McKenzie-Mohr. CBSM was a bridge between environmental psychology and the people who were designing environmental programs (McKenzie-Mohr, 2000). Before 1996, most environmental programs were heavy with information, presuming the more information an audience had, the more likely they were to adopt sustainable behaviors. It took into account the difficulty associated with behavior change, and utilized its five steps to combat that difficulty (McKenzie-Mohr, 2000).

Studies Utilizing CBSM.

CBSM was often used in local settings, rather than at a national or large scale (Vigen & Mazur-Stommen, 2012). CBSM was intended to be seen as a "grass roots" kind of movement, rather

than top-down (McKenzie-Mohr, 2000). CBSM was applied most often to environmental issues. In Nova Scotia, there was a ban of all organic materials in landfills, this resulted in a need for backyard composting. After using CBSM in the province, 80% of the original audience who had expressed interest in composting were actually composting several months after initial contact (McKenzie-Mohr, 2000).

Iowa City, IA, was the site of a program intended to reduce the use of both electricity and natural gas. CBSM was utilized and resulted in a reduction of energy consumption by 10-20% (Pallack et al., 1980). CBSM had yet to be widely applied to agricultural sustainability issues, though one study examined barriers to the adoption of sustainable agriculture in Iowa (Carolan, 2006). This study found the benefits to sustainable agriculture were not easily seen, such as an increase in soil health, but the costs, such as more labor, were highly visible. Conventional agriculture was exactly the opposite; the benefits of conventional agriculture, like higher yields, were highly visible, while costs, like potential ground water pollution, had low visibility. It was also noted that barriers were not only economic or technology based, they were also social (Carolan, 2006). These results pertained to this study in several ways. Like sustainable agriculture, the benefits of BMPs were not always easy to see, especially immediately. This study also suggested the barriers to adoption were not only economic but also social.

Baumgar-Getz, Prokopy, and Floress' (2012) examined the current literature on BMP adoption by producers, the suggested continuation for research from their study aligned well with CBSM. They proposed that first, producers who are most likely to adopt should be the focus of policy makers, and then networks, or communities, should be utilized to increase awareness about the

benefits of adoption. Therefore, encouraging the adoption of practices at a personal, not global level, aligned with the structure of CBSM.

Elaboration Likelihood Model

The elaboration likelihood model (ELM) sought to understand how people process information. ELM was a model of attitudinal change (Cacioppo & Petty, 1984). In the context of this model, elaboration meant "the extent to which people think about the issue-relevant arguments contained in a message" (Petty & Cacioppo, 1984, p. 128). A high level of elaboration likelihood occurred when motivations to process information related to a message were ideal, therefore an ideal environment was created for information processing (Petty & Cacioppo, 1986). The higher the motivations, the more likely the information was processed.

There are seven postulates to the ELM, 1) seeking correctness; 2) variations in elaboration; 3) arguments, cues, and elaboration; 4) objective elaboration; 5) elaboration versus cues; 6) biased elaboration; and 7) consequences of elaboration (Petty & Cacioppo, 1986). Postulate one stated that people want to hold correct attitudes; they wanted to be a "good guy." Postulate two stated that though people wanted to hold correct attitudes, they did not want to think much about it. That was where the word elaboration came into play. Postulate three stated that variables, such as cues, had an effect on how much an attitude changed and in what direction. Postulate four stated that objective processing was influenced by variables affecting motivations and the ability to process the message. Postulate five stated the less motivation to interpret the message the more important peripheral cues were to the argument and vice versa. Postulate six stated that biased processing could either have a negative or positive effect on the processing of the

message. Finally, postulate seven stated attitude changes that come from central processing were far more likely to persist than attitude changes made from peripheral processing (Petty & Cacioppo, 1986).

ELM major tenets indicated people 1) attended the appeal; 2) drew from memories to find relevant information, such as images and experiences; 3) examined the message provided to them with available memories and information they received; 4) drew inferences about the validity of the message based upon the memories of the person; 5) completed an assessment of the message. If someone had a positive experience with past information related to the topic or message that was being communicated, it was far more likely they would process with a high elaboration likelihood, meaning, information was more likely to be acted upon (Cacioppo & Petty, 1984).

A producer who processed BMP literature or messages might have viewed the message like this: they listened, recalled information from their own ranching practices going as far back as their childhood, considered the BMP information while the source was considered as well, established the validity of the source based on previous interactions, and finally decided if a BMP was worth adopting.

When an individual was receiving a message, the information in it was either peripherally or centrally processed. When information was centrally processed, the individual listened more intently and the individual was more likely to act upon the information. One of the best ways to motivate people to centrally process information was to make it personally relevant to them

(Petty & Cacioppo, 1984). Messages could be made more personally relevant if messages were more relevant to the producer, like if examples from their own operations were used. The central route occurred when people were highly motivated and analyzed arguments (Petty & Cacioppo, 1986). The individual focused less on the peripheral argument and the information was less likely to be acted upon. The peripheral route occurred when the individual had low motivation and ability to process. In the case of peripheral processing, the resulting attitude was determined by the cues in the persuasive context, either positive or negative. Peripheral persuasion occurred without examination of the argument itself (Petty & Cacioppo, 1986). Peripheral processing happened in a large group meeting of producers with generic examples and low application, and therefore low personal relevance. Central and peripheral were not only ways of processing, but parts of the message itself. Central components were things like argument quality and logic. Peripheral elements included source credibility and attractiveness of the medium through which the information was presented (Baldwin et al., 2004).

Individuals had to work harder in order to centrally process information; central processing required an individual to scrutinize an argument and all of its elements (Petty & Cacioppo, 1984). Peripheral arguments were almost instantly decided upon, because an audience member basically automatically decided if they found the message to be attractive or not (Petty & Cacioppo, 1984). One way to sway attitudes was fluctuating the quality of the messages in a persuasive argument. However, arguments could be greatly affected by a peripheral cue that prevented or obstructed argument processing (Petty & Cacioppo, 1986). For example, a peripheral cue that obstructed argument processing would be an unattractive presentation of the message, like small, yellow text on a black presentation slide.

Personal relevance was the most important variable when motivation for audiences was established. This meant audiences were more likely to be motivated to centrally process if they could see how it was relevant to their own lives (Sherif & Hovland, 1961). A feeling of personal responsibility had a similar effect to personal relevance (Petty & Cacioppo, 1986). "Attitude changes via the central route appear to be more persistent, resistant, and predictive of behavior than changes induced via the peripheral route" (Petty & Cacioppo, 1986, p. 191).

Communicating about BMPs in a way that made them relevant to producers' lives and operations could have increased the likelihood of BMP information being centrally processed, and therefore, the BMPs being used. Though ELM described the way the components of arguments were processed and the characteristics of arguments that were likely to be beneficial to processing, it did not describe why arguments were processed the way they are (Petty & Cacioppo, 1986).

History and Evolution.

Richard Petty and John Cacioppo developed the ELM in 1981. Research that supported this model was rooted in social psychology. It was used in communications, psychology, and other disciplines. ELM was used in counseling, psychotherapy, and mass-media advertising (Petty & Cacioppo, 1984). ELM had been used to influence the adoption and acceptance of information technology (IT) (Bhattacherjee & Sanford, 2006). In this study, ELM was used to introduce two different routes, central and peripheral, for motivating IT acceptance. It was found that both the central and peripheral routes were feasible ways to influence users to adopt. The results from this

study also confirmed that those who centrally processed information had more stable attitude changes (Bhattacherjee & Sanford, 2006).

Studies utilizing ELM.

Research in agricultural communications had also used ELM to describe the persuasive messages in organization's websites (Abrams & Meyers, 2012). This study examined websites from two opposing non-profit organizations to determine the persuasive strategies used by each. The researchers used ELM to describe the receiver's role in the communication of the message (Abrams & Meyers, 2012). ELM had also been used to examine text from newspapers concerning biotechnology (Miller, Annou, & Wailes, 2003). This study focused on the premise that when buyers refused to, or could not make choices based on a concrete understanding of a new technology, peripheral cues were used. These were not based on actual scientific findings, but were easily remembered and comprehended by the buyer (Miller et al., 2003). ELM was also used in a study exploring consumer views on plants and plant characteristics in Florida (Wilson, Barnes, & Irani, 2013). This study found that if garden centers market plants as locally grown and supported local producers, the product became more relevant to the consumer. Using a credible source of branding was also found to be essential (Wilson et al., 2013).

Summary

My study sought to understand why producers did not adopt grazing BMPs suggested by Extension professionals and to identify opportunities to improve marketing and adoption. Previous research showcased many of the characteristics of adopters, but only a few focused on

non-adopters. My study helped fill this gap by offering an in-depth understanding of the social constraints and barriers to adopting BMPs.

The theories that informed this study, CBSM and ELM, had one common theme; the traditional model of bombarding the audience with information about environmental issues had proven to be ineffective. Alternative routes should be explored, which included grass roots movements, influencing peers and opinion leaders, and removing perceived barriers. These theories offered a conceptual framework to understand producers' communication needs when it came to BMPs, i.e. setting proper stocking rates, prescribed burning, rotational grazing, and utilizing dual-purpose wheat.

Chapter 3 - Methods

Available research suggested an in-depth understanding of motivations and barriers associated with the adoption of BMPs could yield higher adoption rates among producers (Baumgart-Getz et al., 2012; Pannell et al., 2006; Prokopy et al., 2008; Rodriguez, Molnar, Fazio, Sydnor, & Lowe, 2008; Smith et al., 2007). The purpose of this study was to fully understand the barriers and social constraints associated with the adoption of grazing BMPs in order to help producers overcome them. The increased adoption of BMPs could result in a more resilient beef cattle industry within Kansas and Oklahoma. After the literature associated with this topic was reviewed, the following research questions were identified.

- RQ1: What were Kansas and Oklahoma's cattle producers' perceptions and awareness of BMPs in grazing systems?
- RQ2: How did producers seek and process information related to BMPs in grazing systems?
- RQ3: What were the barriers to adoption of BMPs in grazing systems?
- RQ4: What were the social constraints related to the adoption of BMPs in grazing systems?
- RQ5: How did producers perceive resiliency related to the adoption of BMPs in grazing systems?

In order to address these research questions an in-depth understanding of producers' perceptions and awareness was necessary. Qualitative research yields an in-depth understanding and rich information (Flick, 2009). The data collected from qualitative research is detailed, specific, and

rich, resulting in a full understanding of the subject matter (Flick, 2009). The data for this study were collected during in-depth interviews with participants across Kansas and Oklahoma.

Design of the Study

A qualitative approach was ideal for this study so the researcher could gain an in-depth understanding behind producers' motivations, barriers, and social constraints when choosing to adopt best management practices. In-depth, semi-structured interviews were used to collect this rich data. Semi-structured interviews acquire in-depth data by asking direct questions to participants and asking follow-up questions to reach the depth of answers researchers desire. If the same questions were asked in a survey-type format there would not be an opportunity to ask follow-up questions (Flick, 2009; Rubin, 2005).

The documented use of qualitative methods began in 1928 by Wundt (Flick, 2009). Qualitative research is particularly useful when studying social relations and ideal for studying complex subjects (Flick, 2009). The social interactions that result in the barriers and social constraints for producers are complicated and diverse. "Most phenomena cannot be explained in isolation, which is a result of their complexity in reality" (Flick, 2009, p. 15). In other words, nothing in this world has meaning independent from all other things, and understanding that meaning is complicated. Hence, why qualitative understanding of this subject was essential.

Qualitative research is guided by the study itself. The questions of the study guide the methodology rather than trying to tailor the study and research questions to fit the methodology being used (Flick, 2009). Since a review of the literature showed the need for more in-depth knowledge about producer's motivation behind behaviors, it was essential to examine those

behaviors in a way that seeks to understand the meaning behind them. Qualitative research "demonstrates the variety of perspectives" (Flick, 2009, p. 16) of the participants in each study. Understanding the different perspective involved with the issue of adoption of BMPs for grazing will help stakeholders change the current communication strategies to better serve producers everywhere.

Interviewer.

The role of the interviewer was to guide the direction of the interview in a respectable manner while allowing the participant to not only feel comfortable but also share in-depth information. The interviewer kept the conversation rolling and on point. It was also essential the interviewer assured confidentiality. The interviewer was very familiar with the question route utilized to ensure the appropriateness and timeliness of each question (Krueger, 1998b).

The assistant interviewer was a very important and vital part of the study. While the interviewer focused on the direction of the discussion, the assistant interviewer took comprehensive notes and responded to unexpected interruptions or extenuating circumstances (Krueger, 1998b). In this study these included dogs, bees, and talkative wives. The assistant interviewer occasionally asked additional questions, assisted in probing, or reminded the interviewer of questions she may have unintentionally omitted (Krueger, 1998b).

The interviewer and assistant interviewer trained for their respective roles by reviewing the text concerning interviewing by Richard Krueger (1998b). They also reviewed the question route to

familiarize themselves with the question content and sequence. Both the interviewer and assistant interviewer completed Kansas State University's Institutional Review Board training.

Subjectivity is a component of a researcher that affects the way a researcher may look at a subject or influence the attitude of a researcher toward the topic of study. It is argued by qualitative experts that a researcher should be up front and honest about his or her subjectivity so the researcher can understand how their personal views may effect their research, and so that readers can accurately consider the credibility and quality of a study (Peshkin, 1988; Preissle, 2008). In the name of academic honesty and integrity, interviewers have detailed their subjectivities below.

Interviewer Subjectivity Statement.

I was an agricultural education and communications graduate student; this research was completed as a component of my thesis research. Since I grew up in a small, rural town in southwestern Kansas I grew up around producers and agriculture my whole life. I was a Caucasian, middle-class female. My father was a producer and involved in the feedlot industry. I had great respect for producers and the cattle industry as a whole. From an undergraduate minor in agronomy, I had some background knowledge concerning native grasses, introduced grasses, and their respective management.

Assistant Interviewer Subjectivity Statement.

As a previous agricultural communications graduate student, I found much value and importance to the data collection and analysis of this study. In addition to being connected to this research

through my previous master's degree experiences, I served as the program coordinator for the project that funded this research. I was a Caucasian, middle-class female who grew up in rural town in northeast Kansas. I spent my academic and professional career working in the agricultural industry in Kansas, and therefore always worked with agricultural producers.

Questioning Route

Open-ended questions paired with follow-up probes were used to gather responses from participants concerning their grazing operations, practices, attitudes, and beliefs towards BMPs. The interviewer's guide can be viewed in it's entirety in Appendix A. Before participants began interviews they signed a consent form, found in Appendix D. Introductory questions were used to introduce the topic. The interviewer introduced the main theme of the interview and the topics that the interviewers wished to cover. Transition questions were then used to guide the interview into the key questions that drove the study and to shift to more in-depth information (Krueger, 1998a). In this study the interviewer began by asking a simple question, "Tell me about your operation." The transition question was more in-depth, asking specifically about the practices used as well as why the producers chose to implement those. Probes can be beneficial to use at the beginning of an interview to establish the depth of information needed from the participant (Krueger, 1998a).

There were two to six key questions. The number of these questions varied from participant to participant depending on his or her grazing strategies and the type of forages associated with them. For an in-depth look at the questioning route, see Appendix A. These questions were deeper and required more time to answer, unlike previous questions posed. These questions also

required substantial probing to yield the data needed (Krueger, 1998a). The key questions referred to the kind of grasses used in grazing practices as well as questions about stocking rate, drought, and alternative forages. See Appendix A for the complete question route. Main questions were intended to be the research questions, in more relatable language. The questioning route took the broad research questions and made them less abstract (Rubin, 2005). Probes were used throughout the interview to clarify and keep conversation flowing (Rubin, 2005). Probes asked for examples, completion of an idea, or just more information. Probes are difficult to plan prior to interviews as they must match the content and be applicable to the interviewee and the situation (Rubin, 2005).

At the end of each interview, the interviewer recapped the discussion and asked participants if this was an accurate reflection as a source of a member check. This step was used to confirm the interviewer's interpretation of the participants' views (Creswell, 2007). An ending thank you statement was used to acknowledge the time that was spent for the interview (Creswell, 2014). Kansas State University's Institutional Review Board approved the study and questioning route, proposal number 7684, The full application can be viewed in Appendix B.

Screening Process and Subject Selection

In order to assess the research questions, a qualitative study utilizing individual interviews was conducted with participants selected from south central Kansas and north central Oklahoma. A purposive sampling technique was used; it enabled researchers to select participants that best understood the phenomenon being studied and informed the best understanding of the research questions (Creswell, 2007). Extension agents in these geographic areas facilitated this initial

sampling technique. These specific areas were chosen to look closely at grazing systems that involve dual-purpose wheat, tallgrass prairie, and mixed grass prairie.

When Extension agents were asked to recruit participants for the study, the researcher asked for beef cattle producers that utilized grass or grazing in their operations. The researcher originally sought non-adopters for this study. However, it was discovered that Extension agents did not have established relationships with non-adopters and there were varying degrees of adoption within the adopters group. Bearing this in mind, the researcher asked for a more average producer, rather than a progressive producer. At the close of interviews, participants themselves were asked to help direct the researcher to other participants with different views. This enacted a snowball sampling method (Creswell, 2007). Snowball sampling is often used once a researcher breaks into a population. Snowball sampling was executed by asking participants "Who are other producers in the area that you recommend I visit with? Is their view on grazing management similar to or different than yours?"

A total of 43 interviews were conducted for this study. Interviews began on May 6, 2015, and concluded on August 18, 2015. Pseudonyms were assigned to participants based upon their EPA ecoregion (Appendix C). Pseudonyms that begin with A were assigned to participants located in the Flint Hills region (Table 1), B for participants in the Southwestern Tablelands (Table 2), and C for participants from the Central Great Plains (Table 3).

Participants' operations were sorted into sizes of small, medium, and large, based on the designations from the 2012 Census of Agriculture. One to 49 head of cattle was classified as

small, 50 to 499 head of cattle was classified as medium, and 500 or more was classified as large. Farms that range from 1 to 139 acres were classified as small, 140 to 999 acres as medium, and 1,000 or more as large. These classifications were based purely upon information volunteered by each producer. There were no specific questions asked about farm or herd size.

The interviewer and assistant interviewer determined the level of BMP adoption of each producer. Many factors were considered when establishing BMP levels. Those factors included the adoption of rotational grazing, alternative forages, introduced grass, watering systems, and cover crops. The interviewer and assistant interviewer discussed each producer to determine their relative level of adoption.

Tables 1, 2, and 3 show the participants who participated in the study. Table 1 displays the participants from the Flint Hills, Table 2 shows the participants from the Southwestern Tablelands, and Table 3 shows the participants from the Central Great Plains. These tables include the state in which the participants resided, their operation size, and their adoption level.

Table 1

Participants from the Flint Hills Ecoregion

Pseudonym	EPA Ecoregion	State	Size	Level of BMP adoption
Adam	Flint Hills	Kansas	Large	High
Alex	Flint Hills	Kansas	Medium	Low
Allen	Flint Hills	Kansas	Large	Medium
Andy	Flint Hills	Kansas	Large	Low
Art	Flint Hills	Kansas	Medium	High

Table 2

Participants from the Southwestern Tablelands ecoregion

Pseudonym	EPA Ecoregion	State	Size	Level of BMP adoption
Barry	Southwestern Tablelands	Oklahoma	Small	Low
Ben	Southwestern Tablelands	Oklahoma	Large	High
Blake	Southwestern Tablelands	Kansas	Large	Medium
Bo	Southwestern Tablelands	Oklahoma	Small	Medium
Brady	Southwestern Tablelands	Kansas	Medium	Medium
Brett	Southwestern Tablelands	Kansas	Medium	Medium
Brice	Southwestern Tablelands	Kansas	Large	Medium
Bruce	Southwestern Tablelands	Oklahoma	Large	High

Table 3

Participants from the Central Great Plains ecoregion

Pseudonym	EPA Ecoregion	State	Size	Level of BMP adoption
Cade	Central Great Plains	Kansas	Large	High
Cal	Central Great Plains	Oklahoma	Medium	Low
Cale	Central Great Plains	Oklahoma	Medium	Low
Caleb	Central Great Plains	Oklahoma	Large	High
Cam	Central Great Plains	Oklahoma	Medium	High
Carl	Central Great Plains	Oklahoma	Medium	Medium
Carter	Central Great Plains	Oklahoma	Large	High
Casey	Central Great Plains	Kansas	Medium	High
Cecil	Central Great Plains	Oklahoma	Medium	High
Chance	Central Great Plains	Kansas	Small	Low
Chandler	Central Great Plains	Kansas	Small	Low
Chester	Central Great Plains	Oklahoma	Medium	Medium
Chip	Central Great Plains	Kansas	Medium	Medium
Chris	Central Great Plains	Kansas	Medium	Medium
Chuck	Central Great Plains	Kansas	Medium	High
Clarence	Central Great Plains	Oklahoma	Medium	Medium
Clark	Central Great Plains	Oklahoma	Medium	Medium
Clem	Central Great Plains	Kansas	Medium	High
Cliff	Central Great Plains	Oklahoma	Large	Medium
Clint	Central Great Plains	Kansas	Large	High
Clyde	Central Great Plains	Kansas	Medium	Medium
Cody	Central Great Plains	Oklahoma	Large	Medium
Colby	Central Great Plains	Oklahoma	Large	Medium
Cole	Central Great Plains	Oklahoma	Medium	Medium
Collin	Central Great Plains	Oklahoma	Medium	Low
Conner	Central Great Plains	Kansas	Medium	High
Corey	Central Great Plains	Kansas	Medium	Low
Craig	Central Great Plains	Oklahoma	Medium	Low
Curt	Central Great Plains	Oklahoma	Large	Medium

Procedure

The researchers visited producers in their geographic locations to conduct interviews. Interviews were conducted at each participant's location of choice. These locations varied from the tailgate of pickup trucks, county Extension offices, farm kitchens, local restaurants, and oilfields. Questions were asked in order to gain an in-depth understanding of the producer's operations and practices (Rubin, 2005). The questioning route is available in Appendix A. These questions guided the interviewer and participant through the research questions in a way that was more relatable to the participant, was helpful to researchers, and ensured consistency between interviews as recommended by Creswell (2007).

Internal consistency was assured by comparing the interviewer's notes, assistant interviewer's notes, and participants' recorded and transcribed responses. They were also used to establish validity. The notes by the primary interviewer consisted of handwritten notes on hardcopies of the interviewer's guide for each interview. The assistant interviewer took field notes while the interviews were taking place. All data were collected from interviews via audio recorders and from the interviewers' notes, creating an audit trail. This audit trail served as a description for the research that took place from start to finish (Flick, 2009). The data was transcribed by the professional transcription service, TranscriptionStar (Diamond Bar, CA). All identifying information was removed for confidentiality purposes, and each participant was given a pseudonym. The protocol was reviewed by a panel of experts for face and content validity. The experts included professors from agricultural communications, agronomy, and animal science.

Establishing validity is important so that the research will be accurate. By establishing validity the researcher ensures the credibility and trustworthiness of the study (Creswell, 2014).

Data Analysis

The researcher first listened to each interview to confirm the transcribing was done correctly by the professional transcription service, made edits to family names, and created the pseudonyms. The software Nvivo 10 was used to code each interview using the constant comparative method. Codes are labels attached to words or phrases within qualitative data to give description or meaning (Bhattacharya, 2007).While coding interviews the researcher compared it with previous interviews that had been coded. The comparison between interviews was based upon memory and did not require looking back for every comparison (Glaser, 1965). Codes were then sorted into categories of related codes. These categories of codes were sorted by word or concept similarities. For example, each limiting factor was grouped together under a parent code. Those categories were then used to establish themes (Bhattacharya, 2007). If a theme was present within at least 20 interviews, it was considered a major theme. Each ecoregion was sorted, and major themes were then determined per ecoregion. States were also considered within each theme, either major or within ecoregions. Themes were then reviewed and confirmed with the assistant interviewer, who was present at every interview, to increase credibility.

Limitations

The limitations associated with this study are those associated with all qualitative research. This data cannot be generalized to the general population (Creswell, 2014), but may be transferable to other similar cases. Since the audience researchers are concerned with are Kansas and Oklahoma

cattle producers, the purposive and snowball sampling technique is the most appropriate choice for this endeavor (Creswell, 2014). Since Extension agents were used in the initial purposive sampling methods, this may result in some bias towards Extension in the data.

Summary

Participants for this study were recruited using a purposive sampling method made possible by Extension agents, and snowball sampling was used once participants were secured to obtain more participants. An interviewer and assistant interviewer conducted 43 qualitative in-depth interviews during the summer of 2015. A standardized questioning route was established and used for each interview. The questions were used to investigate the research questions of the study. These interviews were conducted with beef cattle producers in south central Kansas and north central Oklahoma. The audio from the interviews was transcribed, imported into NVivo 10, and analyzed using Glaser's constant comparative method to identify themes across the data set and by state and ecoregion.

Chapter 4 - Results

Introduction

The purpose of this study was to determine the barriers and socials constraints producers face in the process of choosing whether or not to adopt BMPs for grazing systems. The following research questions guided this study:

- RQ1: What were Kansas and Oklahoma cattle producers' perceptions and awareness of BMPs in grazing systems?
- RQ2: How did producers seek and process information related to BMPs in grazing systems?
- RQ3: What were the barriers to adoption of BMPs in grazing systems?
- RQ4: What were the social constraints related to the adoption of BMPs in grazing systems?
- RQ5: How did producers perceive resiliency related to the adoption of BMPs in grazing systems?

The results presented in this chapter are from in-depth interviews with beef cattle producers in Oklahoma and Kansas. Interviews ranged from 45 to 90 minutes. The results are presented in order of the five research questions. There are also results presented that arose organically from the data that did not align with research questions. The interviews were analyzed with Glaser's (1965) constant comparative method. The interviews were coded in NVivo 10; the codes were then organized into themes. Any concept that had 20 or more participants in agreement was considered a major theme.

Participants were all assigned pseudonyms. Pseudonyms that begin with A were assigned to participants located in the Flint Hills ecoregion, B for participants in the Southwestern Tablelands ecoregion, and C for participants from the Central Great Plains ecoregion. For a detailed map of the ecoregions see Appendix C. If half of the producers in an ecoregion mentioned a concept, it was considered a theme for that ecoregion. There were a total of eight participants from the Southwestern Tablelands; therefore, if four or more participants mentioned the same topic, it was considered a theme. There were a total of five participants interviewed from the Flint Hills ecoregion. Therefore, if three or more producers mentioned something it was considered a theme. There were a total of 30 participants interviewed from the Central Great Plains ecoregion. Therefore, if 15 or more producers mentioned a topic it was considered a theme.

Results

RQ1: What are Kansas and Oklahoma cattle producers' awareness of BMPs in grazing systems?

To understand the level of BMP awareness in grazing systems, producers were asked questions pertaining to the kind of practices they used, practices they were aware of, and other practices producers used in their area. Interview responses yielded the following themes: rotational grazing was subjective and occurred at varying degrees of intensity; rotational grazing offered benefits; cover crops and alternative forages were being utilized as a substitute for grass pastures; everyone had a different definition of cover crops; and alternative forages made up for small pasture sizes and increased the number of head per operation.

Rotational grazing was subjective and occurred at varying degrees of intensity.

When participants were asked about their grazing practices or the grazing practices of others everyone except nine mentioned rotational grazing, cell grazing, or mob grazing. Participants had different definitions of what they would consider rotational grazing. Many producers felt there were different levels of rotation to consider.

Allen, a large producer with a medium level of BMP adoption from Kansas said:

> You know when I talk about rotational grazing…there are differing styles of rotational grazing. In my operation around here a lot times, I'll do a pretty intensive rotational grazing…On another place, while I do rotate all the time it is not an intensive rotation.

He also commented on other producer's practices, "I would say just virtually every decent size producer I know rotationally grazes; I will say again that they might not do it as intensively as some areas would."

This theme continued to other ecoregions as well. Brice, a large producer with a medium level of adoption from Kansas, considered his rotation to be on a smaller scale than most:

> We did do some rotational grazing but not on a scale that you might be thinking we do it. We have four connected pastures out there that are about 400 acres of wheat. And so we will do some rotational grazing between those four pastures usually on about a one-month rotation.

Carter, an Oklahoma producer with a high level of adoption, also saw himself as a more relaxed producer:

> I'm not much on the intensive rotational grazing. Not that I'm against it but with the – not much labor available and quite a bit of acreage to cover. I don't have time to go build a thousand electric fences all over the place. And I do rotate my cattle some on native grass but not any intensive system. I just feel like I get a more even utilization of the pasture by rotational grazing on the native, but I don't think the cattle do any better.

Producers had information gaps associated with a consistent definition of rotational grazing. Brice, a large producer from Kansas with a medium level of adoptions stated this very clearly. "And I guess there's about as many different variations as a guy has an imagination, but those things are more labor intensive than I'm willing to do."

Rotational grazing offered benefits.

When discussing rotational grazing, Adam, a large producer from Kansas with a high level of adoption mentioned the benefits associated with it "By rotating and using chemicals, I can run a third more cattle than I used to be able to just by leaving them in the same pasture." Producers also saw that rotational grazing promoted better utilization of grass. Caleb, a producer from Oklahoma with a high level of adoption, described it well:

> I'll tell you that from a rotational grazing standpoint, cows will go eat where they think it's the best, shaded areas in the summer where the grass is the most tender. But with the rotational grazing, you're making them eat in certain areas. And, so sometimes, it just takes the fence line.

Clarence, a medium-sized producer with a medium level of adoption from Oklahoma described the process and benefits of rotational grazing:

> We've put a lot of cross fences in, and divided pastures up. We can manage through grass a lot better. We get more good out of some of the grasses that they don't like. We kind of force them to eat it, and we can do it kind of at the time when it is most palatable for the animal to have, anyway. So, by fencing it off and dividing things up made it –it just helps the operation out. It's a good deal.

Dissent.

Some producers did not see the benefits or applicability of rotational grazing. Andy, a large Kansas producer with a high level of adoption explains why rotational grazing did not work for his operation:

> Our system isn't really set up for that. All those things sound really great if it sets up and works for you, but the way we're constantly buying cattle, shuffling and sorting cattle, so we don't have a set of cattle that we're gonna move around everywhere. It just doesn't work for us that great.

Carter, a large Oklahoma producer with a high level of adoption, did not see the benefits to rotational grazing. "I'm not much on the intensive rotational grazing…I don't think the cattle do any better." Clint, a large Kansas producer with a high level of adoption, did not see that the benefits of rotational grazing could outweigh the costs. "We're just kind of set up…our wheat fields are scattered, so the rotation is a little bit lot more work than it be worth probably."

Cover crops and alternative forages were being utilized as a substitute for grass pastures.

Overall, in the study area there were 32 producers utilizing alternative forages as a way to expand their operations and run more cattle. Brice, a producer from Kansas, described his utilization of alternative forages:

> I will often graze wheat fields after harvest. In our particular area, I have a pretty sandy soil and a lot of it, real conducive to volunteer crabgrass. And we would graze several fields after harvest for the volunteer crabgrass and then whatever else I might happen to decide to grow out there at the time, so we do that.

Ben, a large producer from Oklahoma with a high level of adoption, commented on utilizing farmland for grazing, "I try to do the best job possible of keeping something growing on our farmland as much as we possibly can." Producers were also utilizing cover crops as forages. Cody, a large producer from Oklahoma with a medium level of adoption saw benefits for the soil as well as cattle:

> [Cover crops] seem like they kind of help the ground out a little bit too, and the forage has been excellent. Actually it's much better than just a straight haygrazer or something. You still get a lot of tonnage, but the quality is quite a bit better.

Clyde, a medium-sized producer from Kansas with a medium level of adoption described the benefits of cover crops on his operation:

> We probably doubled our cow-calf numbers, and with the same amount of native grass that we've always had… with the cover crops we could get to where, you know, we could have something

> for them to graze year-round. It's kind of I guess the ultimate goal of it.

Cody, a large producer from Oklahoma with a medium level of adoption struggled with finding grass to rent or buy, so he utilized farm ground to make his large operation successful.

> Grass is short around here as far as finding more, and we have the farm ground. So, we try to – it's kind of dual purpose as well. Well, you know, hay it, or graze it through the summer, and then kill it in the fall, and it's planted for wheat also. So, it just works well for me.

Casey and Clyde, two medium-sized Kansas producers with a high and medium level of adoption respectively, used farm ground, cover crops, and alternative forages as a way to support their families. “We have kids coming home. The only way we can do it is pasture stuff, more of our farm ground,” said Casey. “And then since [his son] came home from school two or three years ago, we’ve started doing a lot of the cover crops, and grazing them too,” Clyde stated.

Each producer had their own definition of cover crops.

Throughout the interviews, there was a big question about what constitutes a cover crop. Producers had different definitions of cover crops. Ben, a large producer with a high level of adoption from Oklahoma looked at cover crops in a unique way. “I use whatever I can as a cover crop. I define that loosely…any time I use a cover crop I graze it. Because if I don’t graze it then it does not stay profitable for me as a cover.”

Brett, a medium-sized producer from Kansas with a medium level of adoption did not define cover crops as an actual growing plant:

> My cover crop really is my residue from the previous crop. We plant one crop a year; we do not double-crop. But the straw, the stubble from the canola and the straw from the wheat stays out, so we do not destroy it.

Chance, a small producer from Kansas with a low level of adoption described cover crops in the most traditional sense, "It's a mixture of cowpeas, sudan, millet, field radishes and some kind of hemp…and then go back to wheat this fall. I don't intend to graze it."

Alternative forages made up for small pasture sizes and increased the number of head per operation.

Alternative forages gave producers the opportunity to rest grass. Ben, a large producer with a high level of adoption from Oklahoma described the benefits of alternative forages:

> Although the native range and the improved grasses are the typical homes for our cattle, we will try to pull them off to reserve as much forage for a time when we don't have adequate crop growth.

Clyde, a medium-sized Kansas producer with a medium level of adoption, described the flexibility that cover crops offer his mid-sized Kansas operation.

> This last year, I planted some oats and barley and we had milo stalks there, we threw just small pasture aside, we calved the cows in the small pasture and then flip them back out on the oats and barley then and let them run out there for a few weeks and then we took them off and take them to their summer grass or whatever.

Cam, a mid-size Oklahoma producer with a high level of adoption, talked about how farm ground benefited cattle. “We are starting to graze some cover crops and some different things like that. More and try to integrate some of this farm ground into the cattle I guess.”

Crabgrass was seen as a viable alternative forage for grazing cattle. Clark, a medium-sized producer from Oklahoma with a medium level of adoption, discussed the different practices associated with crabgrass:

> We have a lot of crabgrass here that will come in a wet year, that will come behind our wheat, and so we’ve got two places right now that we’re grazing cows on one and yearlings on another, grazing crabgrass that’s just, you know, they just occur. It’s not anything that we’ve planted, but whatever it’s just kind of a bonus crop I guess. You know, a lot of people will hay it, but where we’ve done that before you take a little too much out and your wheat crop the next year really suffers, you’re grazing and your wheat pasture really suffers if you go ahead and pull that crabgrass hay crop off.

Dissent.

There were 12 producers who offered different opinions on cover crops than the majority. They did not see the benefits of cover crops or found them to be impractical. Art, a medium-sized producer with a high level of adoption from Kansas found it difficult to fit cover crops into his operation. “There is a very short time there that we don’t have anything going. And we thought about getting something in…its hard to get something growing…there’s not an open window there, for cover crops. But we’re still looking.” Carter, a large producer from Oklahoma with a high level of adoption, found cover crops to be less reliable than native grass pastures:

> Because you have to plant them, they have to come up. They have to get enough rain to make it go. So, you know, if you had 400 heifers you're planning on grazing on the summer for annual forage, you might be in trouble. So it's not as dependable.

Brush was controlled by a combination of burning and mechanical means in the Southwestern Tablelands.

The Southwestern Tablelands is an ecoregion that struggles with Eastern redcedar trees and other brush. There are many different ways that brush can be controlled: mechanical, burning, chemical, etc. Brady had recently started using prescribed burning and was envisioning a change in practices. Brady had a medium-sized operation and adopted BMPs at a medium rate:

> This was the first year there was some controlled or some prescribed burns. And, I think we're going to see more of a combination between mechanical control and burns in the future. And I think we're burning more, there's been some folks bring more attention to burning and the details that are required rather than simply going out and lighting a match with your neighbor and dragging gunny sacks around the road. It takes a lot more planning and preparation, and I think we're seeing more of that happen. To do a better job of getting the desired end result.

Blake had a large operation in Kansas and adopted at a medium rate. Blake controlled brush and cedar trees by mechanical means. "We have certainly done a lot in tree removal and trying to get rid of brush and burning. Though over the last five years we have not burned once." Blake would like to burn more often, but there were limiting factors:

> We cannot burn here in this country every year like they do in Eastern Kansas, it just isn't there. If I could burn the way I wanted to and had the help to do it, that's another big thing especially when you're working you know large acreages. You know a lot of this country out in the hills you know it takes weeks to get ready to burn and you've got to have every neighbor you have ready to do it with you, because you just fight you know. I mean you're just constant fighting fire, you can't go around and mow every canyon you know it just doesn't happen. You have to work with neighbors.

Dissent.

One producer did not use fire to control brush in their operations. Ben, a large producer with a high level of adoption said he did not burn due to fear and past losses. "We have lost some land to fire in the past few years."

RQ2: How do producers seek and process information related to BMPs in grazing systems?

In order to understand the way producers process information about BMP adoption, researchers asked questions about how changes were made in grazing systems and the experiences or decisions that led them to their current practices. Producers were also asked about the sources they used to obtain information. Interview responses yielded the following themes: peers served as information sources; Extension and university resources are utilized by producers; and visual observation and experience determine practices and strategies.

Information sources shaped the practices of producers.

Peers served as an information source.

Peers were mentioned as a source of information by 21 producers. Ben, a large producer from Oklahoma with a high level of adoption explained:

> You would be surprised how many times, it's just a conversation with a neighbor and for instance a neighbor who was talking about a cover crop species that he is planting and you know we were just talking it over, throwing out ideas and that idea leads to an Internet search and that leads to some kind of desire to try something…

Adam, a large producer in Kansas with a high level of adoption, found peers to be a reliable source of information. "I use peers of course, I mean as far as what they've – you know, what they're doing on their particular programs." Chester, a medium-sized producer from Oklahoma with a medium level of adoption, who also kept an off-farm job also found his peers to be a helpful source. "But a lot of it's just word of mouth you know, sitting down, visiting with guys about what they're seeing." Cody, a large Oklahoman producer with a medium level of adoption, even reached across state lines for information, "I suppose just networking with friends and from other parts of, not necessarily Oklahoma." Carl, a medium-sized producer from Oklahoma with a medium level of adoption, spoke about the wisdom that he sought from older producers. "I'm a believer in listening to old timers and adages. I think the books teach us a lot, but I think the old timers teach us a lot too."

Extension and university resources were utilized by producers.

When asked about information sources, 30 producers said they used university or Extension resources. Ben, a large producer from Oklahoma with a high level of adoption, saw the value of Extension and the university system. "I like Extension…university research is probably one of

the first places that I go. I rely on our Extension agents quite a bit." Bo, a small Oklahoma producer with a medium level of adoption, also saw the benefit. "Some of it would come through the OSU Extension office."

Blake, a large Kansas producer with a medium level of adoption, used both Kansas State University (K-State) and Oklahoma State University (OSU) publications as information sources.

> You know from anything and everything from planting alfalfa, you know planting dates everything. I read about that stuff all the time…I would say most of my stuff comes from K-State or OSU. OSU actually while I don't consider the information better, their climate and their rainfall and their soil types are much closer to ours, than ours would be to most of what's done in K-State…you know we're four hours away [from Manhattan].

Brett, a medium-sized Kansas producer with a medium level of adoption, valued Extension and university research. "And the Extension program has been a good one: sample, graze, plots, samples, you know. And K-State does an excellent job overall of giving that information out through their Extension programs and through magazines."

Barry, a small producer from Oklahoma with a low level of adoption, expressed an interesting view on Extension and the university system:

> So, I still think that Extension has a purpose, but I think that it's going to go through a metamorphosis, and change some. I mean our land-grant colleges are still important; it's just that their roles I think will change.

Barry saw the value of Extension, but speculated that other producers did not see the value or did not utilize Extension. He thought Extension should implement changes to make information

more accessible to other producers. Many other information sources were mentioned by producers, ranging from meetings to publications (Table 4).

Table 4

Information sources used by producers

Information source	Flint Hills (n=5)	Central Great Plains (n=30)	Southwestern Tablelands (n=8)	Total (n=43)
Association memberships	1	0	0	1
Conventions, meetings, etc.	1	1	5	7
Extension	3	19	8	30
Field days	0	1	0	1
Grazing books	1	2	1	4
Internet	2	7	4	13
Noble Foundation	0	0	2	2
NRCS	1	5	0	6
Peers	2	14	5	21
Social media	0	4	0	4
Trade publications	5	11	3	19
Universities	1	13	4	18
Watersheds	2	0	3	5

Dissent-

Only two producers did not see the value of university research. Allen, a large Kansas producer with a medium level of adoption, did not see the value or applicability of university/Extension research shared by the majority of other producers:

> I mean, K-State is great, our organization is a great place, but there's a lot of Ivory Tower up there. They think they know everything and you come out here. When I went to school, I lived in it, this is what I did. My grandpa was in charge, and I went to

> school, I've learned some of neat stuff. I came back, and then you find out that facts from K-State are one thing, tradition is another and they don't match…And so you got to start to mesh all of them together and that's – and then sometimes, tradition, there's a reason they traditionally did that. Because a lot of times, your research is done at an ideal time, and they don't take into account the three-year slump.

Bo, a small Oklahoma producer with a medium level of adoption, shared this view:

> I have an ag minor…I was going though those ag classes…there was a rationale, how you're supposed to…feed a cow in the winter time with a calf…And I took that home and…talked to my dad and granddad and they were close, but they weren't feeding exactly like what we were talking about in college…Part of those things you do is just because that the way we've always done it. And that's not a good answer, and that's not a good reason.

Trade publications were a popular source for Flint Hills producers.

Producers in the Flint Hills used different trade publications for industry information. Alex, a medium-sized Kansas producer with a low level of adoption, used various publications. "*Farm Journal* and *Midwest Producer* and stuff like that." Allen and his father, a large Kansas producer with a medium level of adoption, used publications, "The *Drover's Journal* has the information online. Dad takes some of the farm magazines and I'll read on some of those so, *Range Magazine* basically."

Andy, a large Kansas producer with a low level of adoption, also utilized several different publications for information, "I don't know what its called. Range or ranch something. Sometimes, you'll see the same articles in different magazines. Anyways*, Farm Talk, High*

Plains Journal, Drovers." Art, a medium-sized Kansas producer with a high level of adoption, also agreed that *Drover's* and *High Plains Journal* were good publications, "*Drovers*, I read that one. It probably does me as much good as anything. Oh there's a few others that I periodically read a little bit. *High Plains Journal*."

Visual observation and experience determined practices and strategies.

It was important to determine how producers process information related to grazing practices. Producers indicated they use visual observations and past experiences to process information. When asked about how they determined stocking rates and other essential management decisions, producers were quick to mention visual observation and past experiences as main determinants. It is clear that producers processed information visually. Producers also valued their own experiences at a higher level than research or other sources of information.

Visual observations influenced strategies used by producers.

When producers were asked how they determined stocking rates, many stated they made choices based on visual observations of their cattle, but more often based on visual observations of grass. Brett, a medium-sized Kansas producer with a medium level of adoption, elaborated:

> Well, I'm a visual person. I pick up cattle by my experience of looking at them. And I basically do the same thing on grass. If something don't look right, if something is too short, I pull them off. I'm no crop scientist; I can't go out there and tell you the species that's out there. But over years of experience, I understand what cows will eat and what they don't eat. If it looks like it's stressed or overgrazed; I just come off of them [pastures] or I just do something different.

Curt, a large Oklahoma producer with a medium level of adoption, talked about visual observation while simultaneously calling out substandard producers for irresponsible choices.

> If you pay attention and look at your cows or your steers or your calves on your cows and looking at the grass you ought to know something about what you have. If you don't, what the hell are you doing in cattle business? You know, I mean seriously if you're not willing to pay attention why do have that much money borrowed?

Stocking rates and other choices were determined by looking at the resources available according to Colby, a large producer from Oklahoma with a medium level of adoption. "Just basically look at what's out there and then move them accordingly. Because even on…your tame grass you don't want to over graze them or they lose productivity." Cecil, a medium-sized Oklahoma producer with a high level of adoption, turned to animal excrement to determine the health of his herd. "I mean I kind of look at the manure too, you know you can kind of tell." Clint, a large Kansas producer with a high level of adoption, even determined his time of rotation based off the appearance of the forage "Well, like when we rotate…I don't really go by the calendars so much. We're just kind of looking at it."

Cam, a medium-sized Oklahoma producer with a high level of adoption, was very concerned about overgrazing; he ensured that his grass resources were not abused by looking at the resource itself.

> It's more of how the pasture is looking; I mean with rainfall or how much is getting eaten down or if they're overgrazing and then we'll move or rotate out or rotate around. So, it's just more of a visual, nothing really scientific I guess, but just how it looks.

Current strategies evolved from years of compounded experience.

Beyond visual observations, previous experiences were used by producers to make choices about the future. Cale, a medium-sized Oklahoma producer with a low level of adoption, valued not only his experience, but also that of his ancestors:

> I guess just history, I guess from [what] my…grandpa did and my dad did, I do it. I mean that's just what we kind of have always done it. And that seems to work fairly well for us so.

Clark, a medium-sized Oklahoma producer with a medium level of adoption, found that knowledge of his land is beneficial to him. "Just based on the past history and experience as much as anything because you learn pretty well what…kind of rates you can stock around here." Trial and error and learning from experience were valuable tools for Curt, a large Oklahoma-based producer with a medium level of adoption. "A lot of years of trial and error and finding out that if you grub that stuff [overgraze] you got two years of nothing because you gotta let it sit." Cade, a large Kansas producer with a high level of adoption, put it simply, "Some are just from good old-fashioned experience."

RQ3: What are the barriers to adoption of BMPs in grazing systems?

To explore the barriers associated with the adoption of BMPs, participants were asked questions related to the challenges they face. These questions were related to drought and other challenges that present themselves in grazing strategies. Interview responses yielded the following themes: water availability and quality deters producers from adopting BMPs; leasing and renting land

presents unique challenges, particularly in Oklahoma; and other limiting factors, like school land, exist for adopting BMPs.

Water availability and quality deterred producers from adopting BMPs.

Art, a medium-sized Kansas producer with a high level of adoption, mentioned algae infected ponds as a limiting factor for utilization of rotational pasture grazing.

> Big pond down here at the bottom of the hill up until last year we had quite a bit of, about three years of blue-green algae in that pond. And so, that was limiting that pasture as far as use on it. We have since got rid of it, got some rain, got it filled back up and so it will hopefully be alright.

Blake, a large Kansas producer with a medium level of adoption, mentioned the lack of a watering system as a major barrier to an ideal rotational grazing system.

> You know in this country, if you – unless you have a watering system you have to work with what the Lord provides for you and it hasn't been much. So a lot of your rotational grazing might not be exactly what you want to do; it's what you can do…It's been tough these last five years…I don't have a watering system.

Caleb, a large Oklahoma producer with a high level of adoption, said water was the biggest limiting factor from continuing his existing rotational grazing strategy in his operation. "Number one, there's no water. The ponds had all dried up." Andy, a large Kansas producer with a low level of adoption, shared the sentiment. "A lot of it is on moisture, and how much regrowth I've got on it from the year before…I was hauling water since January…We had cleaned ponds out."

Blake, a large Kansas producer with a medium level of adoption, was limited by drought "I have a few places that are watered but without good pond water, it's just hard on what your rotation has been in the past." Cal, a medium-sized producer from Oklahoma with a low level of adoption, also struggled with water and worked hard to acquire it for his herd to continue his implementation of rotational grazing.

> I suppose water supply on some of that would be a big factor. You know, having access to get them to water. We have dug several ponds, dug ponds out or had a couple on trial and error basis whether they hold water or not.

Leasing and renting land presented unique challenges, particularly in Oklahoma.

While both Kansas and Oklahoma producers expressed challenges and barriers related to renting or leasing land, there were distinct differences separated by state lines. Oklahoma had unique challenges related to school-land leases. Kansas does not have that system, but producers still struggled with barriers associated with leased land.

Adam, a large producer from Kansas with a high level of adoption, saw a distinct difference between renting grass for cows and stockers. "It's very hard for guys to rent cow grass." Without having access to grass resources, BMPs cannot be adopted. He also said that absentee landowners were an obstacle for Kansas producers "…dealing with the next generation land owner, maybe the investment land owner. You know, they just see it as you're taking something off of that ground."

Clyde, a medium-sized producer from Kansas with a medium level of adoption, talked about the unavailability of grass in his area:

> And in our area, it's hard to – grass is hard to – you know, it's hard to come by. And if you can find it, it's hard to get it rented. It's not as bad now as it was a few years ago, but until just the last couple of years, not only that you have to compete with other people that had cattle, the recreational use on grass is – I mean – and most of the people that want it for recreation have unlimited money.

A lack of land to work with limited the ability to rest pastures from grazing or to implement rotational grazing. If more land had been available to Clyde, he said he would have implemented these practices.

Carter, a large Oklahoma producer with a high level of adoption, discussed the issues with urban landowners and the problems he had.

> I leased a new pasture and the people are really concerned about it being overgrazed. They are from Norman, from OU, but they didn't know. They didn't know any better so they were saying, the lady asked me, she said "What is the best three months for this native grass to grow?" And I said, well, April, May and June are the primary growth months for the grass. Well you're not to graze it during those three months. But, I don't really like being restricted, you know.

These kind of limitations restricted producers from grazing the way they wanted. Producers mentioned other challenges related to burning, installing watering systems, or other BMPs on leased ground.

Oklahoma school land.

Cliff, a large Oklahoma producer with a medium level of adoption, specifically mentioned leased land as a direct barrier to the adoption of rotational grazing, and described the way school land can affect the choices made by producers.

> So [school land leases] kind of dictates how much you can put into it as far as fencing it for rotational grazing or, you know, you hate to go in and spend $40 or $50 an acre when your rent is $20 an acre and you may not have it, you know, down the road. So there's some give and take with that, but that's kind of with anything, you know, as far as renting and most people here do rent. There is a lot of, I won't say absentee landowners, but I would say the vast majority of producers in Oklahoma are renting way more ground now and that may be true in a lot of places, but it kind of dictates what you can afford to do I guess as far as improving those places or managing.

There were four producers that leased school land. Three of those producers shared this view.

Dissent-

Caleb, a large producer with a high level of adoption, leased school land in Oklahoma and made an unusual choice to make updates to that land.

> We have introduced or put in new fences on one place, school land-lease places, on a school land place if you lose the lease or somebody outbid you at the auction every five years, they don't own the fences you do.

Caleb was the only producer that expressed dissent on this topic.

Adoption of rotational grazing was restricted by many barriers.

Producers across all ecoregions expressed issues they had with adopting the practice of rotational grazing. Andy, a large Kansas producer with a low level of adoption, expressed his limitations.

> Oh yeah, like rotational grazing. But, our system isn't really set up for that. All those things sound really great if it sets up and works for you, but the way we're constantly buying cattle, shuffling and sorting cattle, so we don't have a set of cattle that we're gonna move around everywhere. It just doesn't work for us that great.

Brady, a medium-sized producer from Kansas with a medium level of adoption, discussed the limitation of time and the way landlords can affect the practices a producer can implement.

> If I was ranching full time I would probably try to implement more of those things myself. But, with my time limitations and some landlords. I have one landlord that I rent 280 acres from and he doesn't want it involved in any government programs…I have approached him before to get trees cut and his, pasture is probably my most expensive pasture. Because its got the most tree cover on it, so I get less.

Caleb, a large producer from Oklahoma with a high level of adoption, said there were reasons other producers may have for not adopting practices.

> Why? Average producers, you know, the average producer is older, they don't have the time to do it or they don't have resources to do it, they put their cows out there and wean their calves, take them to the sale barn, you know, those kind of things.

There were also physical boundaries producers identified as issues for adoption of rotational grazing. Cole, a medium-sized Oklahoma producer with a medium level of adoption, talked about the benefit and boundaries associated with rotational grazing. “We try to practice rotation on all pastures except for two where water is an issue where we just can’t. Rotation pays for itself.”

Other barriers mentioned.

There were barriers mentioned that could not be considered themes because not enough producers mentioned each one. However, since the goal of this study was to find the barriers to BMP adoption all barriers are mentioned. These are categorized as time and labor constraints.

Time and labor constrained the adoption of BMPs.

Nine producers mentioned time and labor as a constraint to the adoption of BMPs. Carter, a large Oklahoma producer with a high level of adoption, mentioned time as the reason behind a less intensive rotational system. “I don’t have time to go build a thousand electric fences all over the place. And, I do rotate my cattle on my native grass but not any intensive system.” Brett, a medium-sized Kansas producer with a medium level of adoption said, “[Rotational grazing] requires electric fences, and I just don’t have time to check a hot wire,” Brice, a large Kansas producer with a medium level of adoption, echoed this point. “But, I just don’t have the time to spend with my cattle that maybe some other people that are in this farming might.”

Clint, a large Kansas producer with a high level of adoption, discussed that labor and the physical set up of the land, rather than time limited the adoption of BMPs. However, he also

mentioned that perhaps it wouldn't be worth his time either. "We're just kind of set up our wheat fields are scattered so the rotation is a little bit lot more work that it be worth probably."

The following barriers were mentioned by producers in passing:

- Physical layout of land
- Moisture
- Regrowth of grass
- Drought
- Family traditions
- Economics/market prices

RQ4: What are the social constraints related to the adoption of BMPs in grazing systems?

In order to explore the social constraints surrounding the adoption of BMPs, participants were asked questions related to the challenges they face and the information sources they use. Questions were also asked pertaining to their peers and the kind of practices they chose. Interview responses yielded the following themes: disproportionate view of self and maintained a defensive attitude regarding neighbors; producer networks as an information source and constraint; and landlords can make or break practices.

Deluded view of self and peers and maintained a defensive attitude regarding neighbors.

Producers had distinctly positive views of themselves, regardless of reality, while they maintained negative views of other producers, regardless of reality. However, as previously mentioned, they rarely called out substandard producers by name. They would also end up

defending those producers' actions. Ben, a large Oklahoma producer with a high level of adoption, was an excellent example of this.

> You know not everybody is going to switch and I, and one thing I came to realize after talking to a lot of different people is that they have earned the right to farm the way they want to farm…I don't know, drives me crazy. I don't know why people don't do more stuff, but what we know is, we can point the drill at the ground and plant wheat and it grows. That's what people here know.

Art, a medium-sized Kansas producer with a high level of adoption, saw things differently. He had recently seen mismanaged land, but then turned to modest statements, "Well the last 10 or 20 years, I've noticed a lot of, how do I put this? Marginal managers that are letting the trees get out of hand. And that's a problem for me too; it's a constant battle." Cade, a large producer and with a high level of adoption from Kansas saw that other producers are slow to adopt in comparison, and then also led to modest statements. "It seems like everybody is slow to adapt; I think that's our advantage. And not that we adapt as quickly as we should."

Barry, a small Oklahoma producer with a low level of adoption, saw a distinct line between two groups of producers.

> But, I think you have two groups there. I think you have the people that are sincere and trying to do it right and those that are just trying to get what they can get… Well, it goes back to what I said earlier, I leave it better than I found it. And you know, I got too many neighbors that will ruin it just to make a buck.

Cecil, a medium-sized Oklahoma producer with a high level of adoption, recognized the benefits to fertilizing pastures, but his neighbors choose not to fertilize.

> And, you know, you asked about what other neighbors are doing and things. And that's one thing on some of them that they don't fertilize, and I've got one crossroad from one mine is belly deep of grass, and there it's just grubbed up to the ground, and just pale yellow you know.

Chris, a medium-sized Kansas producer with a medium level of adoption, also saw that his neighbors were lacking in good management strategies.

> A lot of them will take a shovel, or a scoop shovel and beat the last one in the gate so they can get it shut. And overgraze it terribly, I mean you could shoot marbles out there. But, we don't do that.

Conner, a medium-sized Kansas producer with a high level of adoption, compared himself with other producers and saw other producers fall short.

> There's only a few guys that graze crabgrass. A few of them do, but not very many. Nobody divides their pasture right around here. I don't know why, but they don't. Maybe because they have more grass and they don't have to utilize what I have.

Curt, a large Oklahoma producer with a medium level of adoption also saw his neighbors fail.

> As a general rule they flatten it; they really over do it…There is a lot of rent ground; any rent ground is just grubbed, some of the stuff that…They graze the hell out of it then they haul hay to them. I don't understand.

Producer networks acted as double-edge sword.

Producer networks were complex, interconnected groups of producers. Producers expressed they used peers, neighbors, etc. for information and ideas. These producer networks presented a double-edged sword. They presented the ability to promote the adoption of BMPs or to restrict

the adoption of BMPs, based upon the limits and knowledge of social circles and a producers' rank within those social circles.

Some producers were involved in associations, such as state livestock associations, local soil conservation boards, or recently reinvigorated county cattleman associations. Those producers who were involved in organizations spoke about the difficulty of educating and engaging other producers, and something they found personally frustrating. Art, a medium-sized Kansas producer with a high level of adoption and a member of his local soil conservation board expressed this frustration:

> There are a lot of programs available. You go to a meeting, and I don't know how many times I've heard, whoever is putting it on say, "You know, I feel like I'm preaching to the choir." The guys that need to be there aren't.

During the snowball sampling portion of the interviews, producers only gave the names of above-average producers, even if they had mentioned earlier in the interview that their neighbors were substandard producers. When prompted about those producers previously mentioned, Clarence, a medium-sized Oklahoma producer with a medium level of adoption, said "Well, I can tell you one, but don't write it down." Furthermore, when producers gave names of producers, good or bad, they often didn't want to be credited with giving out that information.

Cade, a large producer from Kansas with a high level of adoption, highlighted this point in a different light. He stated that his life was complicated enough without scrutinizing all other producers, but then later stated that he noticed people mismanaging grass.

> I've got enough of my own stuff to worry about, so I don't need to worry about my neighbors, but one thing that I noticed is, well we implemented drought management strategies as quickly as possible….What I noticed was, a lot of people just kind of stuck their head in the sand and just went on. And, I mean it hurt, there is grass here that still hasn't recovered…And, it is just because they didn't manage it properly when we went through the drought…And so, especially when we went thought the drought my comment was, "people here just don't know how to manage the drought."

While he noticed other producers were poorly managing their resources, he still didn't want to be viewed as judgmental or condescending toward other producer's practices.

The positive side of producer networks came to light when talking about burning practices. Many producers expressed that when they chose to burn pastures they often recruited neighbors or friends to help them, and they later reciprocated, which made burning a team effort. Chip, a medium-sized producer with a medium level of adoption, talked about these groups: "We all work together, we kind of coordinate ourselves and then you know I help him, he helps me type stuff that way we got an army of guys out there." Conner, a medium-sized Kansas producer with a high level of adoption mentioned the way a neighbor helped him out:

> But, we've got a good neighbor over here on the fire department, and they will come out and teach you and assist you in what it takes to do some of this stuff. So, they're good about it. So, that helps.

There were other mentions of neighboring. Art, a medium-sized Kansas producer with a high level of adoption, mentioned an instance, "And we partner with a neighbor on some machinery."

Ben, large Oklahoma producers with a high level of adoption, worked with his neighbor to artificially inseminate cows, "I had this neighbor he and I worked back and forth on AI-ing cows." However, not all neighbors were helpful. Blake, a large Kansas producer with a medium level of adoption said that the lack of buy-in from neighbors limited his practices. "If I could burn the way I wanted to and had the help to do it…you've got to have every neighbor you have ready to do it with you…you have to work with neighbors."

Landlords could make or break practices.

For financial reasons, landlords pushed producers to abuse the land to make every dollar possible. Brady, a medium-sized Kansas producer with a medium level of adoption, leased all of his land from several different landlords, each of whom presented their own challenges:

> If I was ranching full time, I would probably try to implement more of those things myself. But, with my time limitations and some landlords, its just not doable…[The landlord] actually has not had us rotate yet because he's been trying to grow some fuel. And, as you know, the last few years have been droughty and so he hasn't necessarily wanted us to rotate into every area.

Andy, a large producer from Kansas with a low level of adoption, also noticed that his leased land was lower quality than the land he owned. "I have to spray the lease ground more than I do mine…I had to spray some musk thistle the last couple of years on it too." Art a medium-sized producer from Kansas with a high level of adoption, dealt with absentee landowners in his area. "Absentee landowners are another problem. Somebody has inherited, they moved away, inherited the land, and they live three states away and as long as they get the check, that's all

they care about." This attitude put financial pressures on Art. Allen, a large producer from Kansas with a medium level of adoption, had similar struggles with landowners.

> Stocking rates and rentals become an issue…people that don't live in the state anymore. They want dollars, grandpa was the one that owned the property, and it got handed down to him or somebody died and now they have it.

Other social constraints mentioned.

There were social constraints mentioned that could not be considered themes because not enough producers mentioned them. However, since the goal of this study was to find the social constraints related to BMP adoption all the social constraints mentioned are included: one producer mentioned community involvement, three producers mentioned generational gaps, and four producers mentioned employee issues.

Community involvement-

Brett, a medium-sized Kansas producer with a medium level of adoption, dealt with issues because of his position in the community as well as some historical events "I'm a county commissioner, so we set some pretty strict guidelines on burning in our county because of three large wildfires. And, the western part has formed a good burning organization and they're doing an excellent job." This involvement caused Brett to become an example for producers in his county. This pressure reduced his flexibility.

Generational gaps served as serious constraint for some producers-

Three producers discussed issues that arose from differences in age or generations. Caleb, a large Oklahoma producer with a high level of adoption, noted that age can also deter producers from adopting practices. “Average producers, you know, the average producer is older, they don’t have the time to do it or they don’t have resources to do it.” Collin, a medium-sized Oklahoma producer with a low level of adoption who operated with his father, talked about the differences they had in philosophy. This contention made for an interesting dynamic.

> My goal is a little different than my dad’s goal; my goal would be improve the health of the pasture; his goal is to run as many cattle given the amount of hay he has to feed them. Without just putting words in his mouth, I think that’s basically the way he operates.

Clarence, an older, medium-sized Oklahoma producer with a medium level of adoption, talked about the older generation and what he saw as their lazy sense of management. He found the younger generation to be better managers.

> We are doing a better job of managing the grass, and I think that generation is phasing out, and the younger ones coming in are doing a better job of managing their grass and their cattle all the way around.

Skilled labor and employees was a necessity-

If operations were large enough to have outside help, it was difficult for producers to find employees that were “good help.” Three producers made comments about this issue. Blake, a large Kansas producer with a medium level of adoption, described this issue in detail.

> It’s hard to find good help that can ride a horse at all now, and so we’ve become an operation that’s call them with a pick up and run them a four wheeler, I don’t like that but I guess you know – the

> lack of expertise and it's tougher and tougher to find good farm help you know, because so many kids have just moved off the farm plain and simple, and the ones who haven't well they're helping their fathers and others themselves.

When Clyde, a medium-sized Kansas producer with a medium level of adoption, ran short on help due to the season, he had to stop using certain pastures due to time and labor constraints.

> And we have pulled off of that grass several years just because there's grass there, but there wasn't water. We got to the point where it's 12 miles probably from home. And here well, usually the first part of September, because all of our summer help goes back to school, and you're shorthanded, and you're like, we're going to bring those cattle home and feed them.

Caleb, a large Oklahoma producer with a high level of adoption, also found it essential that employees understand his grazing strategies and the logic behind the decisions that were made.

> And then it's having buy-in from the guys that work for you. So, sharing with them so that everybody understands why we're doing this. We're not just rotating the cattle to go play cowboy or because we felt like it kind of thing… Probably the biggest key, especially on a ranch that has diverse employees and different people coming in and out, such as ours – everybody has to know the outcome and why you're doing this. And then the bottom line, it has to profitable. I'm not out there doing it for my health, especially in 105 to 110 degrees.

RQ5: How do producers perceive resiliency related to the adoption of BMPs in grazing systems?

To understand how producers perceived BMPs and the way they relate to resiliency, producers were asked about their practices, practices of other producers, and about how they dealt with drought. Interview responses yielded these themes: rotational grazing allowed for resiliency; improved watering systems allowed producers to be more resilient; burning practices allow for resiliency; and drought was a common occurrence that tests the resiliency of operations.

Rotational grazing allowed for resiliency.

When asked about their practices, producers talked about the justification for their practices. It was evident that those who utilized rotational grazing clearly saw benefits to it. Bruce, a large Oklahoma producer with a high level of adoption, had recently adopted some rotational grazing practices and planned to expand those practices to the rest of his operation.

> I grazed nine different pastures ranging in size from a section to 40 acres was probably my smallest, and I saw the benefits from that last year that this year I'm going to do it a lot better, and I'm going to manage it a little more and try to take care of it.

Chuck, a medium-sized producer from Kansas with a high level of adoption, found that rotational grazing made him better at making choices during drought; it was easier to gauge the number of grazing days left on a patch of grass.

> And that was [the] big thing about adding paddocks is we kind of had an idea of how many days of grazing we had, prior to putting the paddocks in, it was kind of like, when we ran out of grass it's

> going you know – it was hard to, for me I can't judge that just by going but if you have paddocks and you kind of have an idea, "Okay I know this will last them three days or seven days." You can kind of you know have an idea but without that it's just a shot in the dark so for me.

Clark, a medium-sized Oklahoma producer with a medium level of adoption, found rotational grazing to be beneficial when it came to the utilization of grass in his pastures and overall management "…allowed so much better opportunities for pasture to recover and overgraze to the extent that we used to do everything."

Dissent.

There were only two producers who outwardly expressed a problem with rotational grazing. Carter, a large Oklahoma producer with a high level of adoption, did not see the benefits that a more intensive rotational grazing strategy would give him "I don't think the cattle do any better." Andy, a large Kansas producer with a low level of adoption, stated, "All those things sound really great if it sets up and works for you…it just doesn't work for us that great.

Improved watering systems allowed producers to be more resilient.

Producers recognized the benefits to installing improved watering systems in their operations, which is a BMP that can aid in resiliency. Chuck, a medium-sized Kansas producer with a high level of adoption, had recently installed pipeline and planned on installing tanks in his pastures within days of completing our interview "We put in about 9700 feet of pipeline in the last two years, so pushed it out, put a bunch of tanks and stuff to get hooked up so I got tire tanks brought in, but I don't have them set."

Clyde, a medium-sized Kansas producer with a medium level of adoption, saw his cattle benefit from the addition of improved watering systems in his operation.

> And between that and water, you know, water sources, not watering out of – you know, it used to be – I know 20 years ago, if you would have told somebody you wanted to put a tank and a solar pump in, so the cattle couldn't drink in the creek, I mean that's when – when you went to look at a pasture for rent, if it had springs in it or a pond, or a creek, you always thought that's great because then we don't have to worry about water. You know, now there's a lot of…I think they found too that the cattle actually do better on clean water, and then drinking out of some of the ponds and stuff, they get so stale in the middle of the winter…20 years ago, I don't even think you could probably buy a solar pump, nobody ever seen one before. But that may have been about the time they first kind of started coming in to, you know.

Clem, a medium-sized Kansas producer with a high level of adoption, had also seen improvement in the health of his cattle from improved watering. “One thing that I didn’t mention that the water tanks and everything like that, that has been so beneficial to me. Because my cattle – the health of those cows are so much better with that water than drinking out of a pond.”

Burning practices allowed for resiliency.

While eight producers mentioned drought discouraged prescribed burning practices, 23 producers saw the benefits burning could offer their operation. Chris, a medium-sized Kansas producer with a medium level of adoption, burned pasture for the health of the grass:

> I had leased this place, and it had a lot of undergrowth on it, it had a lot of brush, a lot of thatch, and I thought it would make it a little healthier situation if we could burn it, and that’s why I did it.

Cliff, a large Oklahoma producer with a medium level of adoption, also burned grass "to kind of keep things clean and freshen up pastures." Clint, a large Kansas producer with a high level of adoption, saw a side-by-side comparison of the increased palatability of grass once exposed to fire.

> One year, we tried some within the same pasture, we burnt some on one side of the creek and we didn't get some on the other side of the creek. And the old cows, they just kept on that we burned, grazed into the ground. And the other side, they didn't hardly go over there.

Chip, a medium-sized Kansas producer with a medium level of adoption, did not like burning, but saw the benefits, particularly with controlling cedar trees that he burned regularly.

> And part of that getting those pastures and that little devil [cedar trees] under control is burning so every three years to four years we burn you know, and I really don't like to burn but we do. You just have to; you just have to do it.

Curt, a large Oklahoma producer with a medium level of adoption, also used fire to control brush and saw it as a more profitable and a less time consuming alternative to other forms of eradicating cedars and brush from his pastures.

> Generally, to kill the brush. Everything from paws and cedar trees oh my God. It saves on poisoning; we've got poisoning which kill the cedars and everything. It's pretty expensive, pretty time consuming, so we can burn in two hours and if we get a 20% kill and burn next year, or two years, three years. You know you get 20% well pretty soon you are getting on up there and you haven't dumped $5,000 in poison.

Drought was a common occurrence that tested the resiliency of operations.

Drought has plagued the Southern Great Plains for many years. Andy, a large Kansas producer with a low level of adoption, detailed the issues that drought presented on his operation and the practices that shifted during drought.

> Well it effects your stocking rate. It effects whether or not you're going to burn. It effects whether you've got water or not, I mean they're all, it effects how many you're going to put in there, if you don't have the water there you're not gonna stock it as heavy, or not at all. I've had some pastures that I didn't have any water in at all that I didn't put any cattle in

Carl, a medium-sized producer from Oklahoma with a medium level of adoption, was affected by drought, specifically in decision-making regarding practices.

> Drought makes a lot of difference in your decisions, in what you do and how you manage… Drought makes you change your way of thinking. I'm glad I've lived through it. It was tough. We squeaked through it, we bought a lot of feed. We packed a lot of feed out.

Drought did not discriminate between levels of adoption. Corey a medium-sized producer with a low adoption level from Kansas, was also affected by drought, "In the past ten years, I think it's gotten tougher because of the drought. And, we've had to change because of the drought."

When tested with drought, some operations do not maintain resiliency. Cade, a large producer with a high level of adoption, commented on the way pastures were tested in the area "What I

noticed was, a lot of people just kind of stuck their head in the sand and just went on. And, I mean it hurt, there is grass here that still hasn't recovered."

Flexibility was essential in the Southwestern Tablelands.

Ben, a large and progressive producer from Oklahoma discussed the importance of flexibility in grazing systems and the way that offered him more opportunities for success:

> It's important to me that we also spread out our grazing opportunities, I don't have enough cattle to graze all of my wheat pasture, when the wheat pasture is ready. On a bad year, I have enough land to let all of my cattle graze something in terms of wheat pasture. But by having the different crops, I may be able to, let's say, I'm not able to plant wheat behind grain sorghum which might happen because one field is too wet to plant it early on grain sorghum and it will come off in November. I can graze cows on that, when I wouldn't be able to otherwise. I can graze cattle on a summer forage crop, but I wouldn't be able to if I was determined to plant that to wheat. So it gives me a lot of flexibility and a lot of grazing opportunities.

Brady, a medium-sized Kansas producer with a medium level of adoption, agreed with this point. "You could use the word flexible there. Try to be a little bit flexible and give rest where you can."

Brett, a medium-sized Kansas producer with a medium level of adoption, stressed the utmost importance of this flexibility. "I've always tried to keep an open mind and adapt to change. I mean, a lot of things you don't deal, you're very good handling from time to time, and if you don't adapt, you don't survive." Brice, a large Kansas producer with a medium level of adoption,

also found this to be important, particularly during drought. “And at least some others are being more flexible to change when the drought’s or whatever’s here to be willing to do what we have to do to get through that particular situation.”

Other emergent themes.

During analysis, five themes arose that did not align directly with any research questions. Emergent themes were: introduced grass usage; Angus breed dominance; government programs were used in the Southwestern Tablelands and Central Great Plains; producers of the Southwestern Tablelands showed an interest in research; and pasture fertilization practices varied by ecoregion.

Introduced grass usage.

Twenty-nine participants mentioned introduced grass. While the state line was often a nonfactor in this research, when it came to introduced grasses, there was a clear difference in the practices utilized, from different grass species to management choices. Producers in Oklahoma utilized old world bluestem as a forage, while producers in Kansas regarding it as an invasive species. Bermudagrass was utilized by Kansas and Oklahoma producers and was stocked at extremely high rates.

Kansas.

Andy, a large producer from Kansas with a low level of adoption, talked about how bermudagrass worked into his operation. In Oklahoma, producers boasted about the benefits of bermudagrass. This Kansas producer, Andy, was not impressed with it “The whole bottom was

planted to bermuda, but that bermuda is such a…some of that stuff cattle didn't like. It got so big and rank, you had a hard time getting them to eat it." Cliff, a large producer from Oklahoma with a medium level of adoption, talked about the high rate he chose to stock bermudagrass. "I think bermuda doesn't really benefit from rest. I think bermuda is almost stimulated by a lot of abuse in a way--not abuse, but intensive grazing, I guess." Allen a large producer from Kansas with a medium level of adoption, used similar strategies, but with brome grass, "We're putting a lot of cows on small acreage of brome...we might have 150 cows on 35 or 40 acres."

Oklahoma.

In Oklahoma, old world bluestem was a popular forage. In some cases, such as Cecil, a medium-sized producer with a high level of adoption, it is the only forage he utilized, "We did have some native pasture, and we worked it up, and planted the old world bluestem, you know, 20 years ago too because we were just so impressed with it." Carl, a medium-sized producer with a medium level of adoption, stocked introduced pasture at a higher rate than native grass.

> On introduced pasture it doesn't matter to me if I flood it. But once I see that it is headed downhill, I'll remove them, I'll sell them, I'll do whatever it takes to not jeopardize my stand. On introduced grass you can graze it heavier than native grass, in a shorter time period.

Colby, a large producer with a medium level of adoption, continued this theme. "So on the tame grasses we'll graze them shorter, because they tolerate it and some of them need it I think." Cole a medium-sized producer with a medium level of adoption, called his grazing abuse.

> You know, the Bermuda you can abuse it as long as you give some rain, fertilizer on it… Bermuda grass, you need to keep Bermuda grass shorter. I mean, it gets too tall, they'll walk away from it, you

> know. They like it growing. And so, that's what we try to do is put enough on there that they can clean it up good and then move them to another pasture another place.

Dissent

While most Oklahoma producers said old world bluestem was the most ideal introduced grass, Barry, a small producer with a low level of adoption, disagreed.

> There's a lot of old world bluestem around here, which I think is – about two-thirds useless in my opinion. A lot of people think it's the neatest thing since spring. So, you know, you got your improved grasses there on that, and that's probably about the only one that really does any good right here…But it has a small window I think in my opinion to where it can be, you know, when they get very ripe, very mature that becomes to me like wheat hay. And, I think a lot of people misuse it.

Carter, a large Oklahoma producer with a high level of adoption who was also a seed salesman had a strong view about old world bluestem.

> So, it's got some problems there and it – like I said, it spreads, people make hay out of it and it spreads through other – any place that feed the hay and it comes and gets all over the pastures. And if you're not fertilized, and then it's surely not a very good grass. It's stemming too quick.

Angus breed dominated.

When the basics of producers' operations were discussed, 33 producers mentioned Angus cattle. Not every producer had pure-bred Angus herds; many were crossbred. No one issue related to Angus was discussed in the majority of interviews, but some had Angus cattle or had issues related to the breed. Chuck, a medium-sized Kansas producer with a high level of adoption, had transitioned from black to red Angus for heat tolerance. "There's like 15 or 20 degrees difference in surface temperature with reds versus black." Clyde, a medium-sized Kansas producer with a medium level of adoption, had also transitioned from black to red.

> We've been moving more to the red Angus. We used to be – almost like everybody I guess we were entirely – every cow we had was probably black, and now we're almost moving to where almost everything we have is red.

There were several mentions of the marketing that has promoted the Angus breed. "You've got it give up to the Angus association. They've done well in marketing their program. You take the hide off any animal, and its red inside," said Carl, a medium-sized Oklahoma producer with a medium level of adoption. Chance, a small Kansas producer with a low level of adoption, made the change to red Angus because he was making less money with other breeds.

> The reason I went to the red Angus is because the Limousine is good, I like the looks of them, but they had a tendency to run about 10 cents a pound less than if you had Angus. Now, I did some checking around. Now, my herd is red. I'm not going to go black. I've just never liked the black.

Chip, a medium-sized Kansas producer with a medium level of adoption, had also seen the trend go towards Angus, and had followed the money in that direction.

> As far as trends go I just try and stay where the money is and the black Angus thing, when it kind of got started I kind of fell under

> that because I was a full blood Gelbvieh herd. And I would take…and we would take a hit remember, at the sale barn, and so we would always take a hit with this full blood Gelbvieh standing right next to a black steer. We would take a 15 to 20 cent a pound hit and then you would read the data from the feed logs and the Gelbvieh was producing just as much or better as the Angus and in the feed lot department he was still getting good grades and the same amount of money but the prejudice was out in the field. So we just kind of kicked over to Angus.

Blake, a large Kansas producer with a medium level of adoption, was an example of this "I was predominantly Angus. Now I am crossbreeding to Simmental and trying to have quarter bloods and half bloods. And, we've always crossbreed to some degree, you know I really believe in crossbreeding."

Government programs were used in the Southwestern Tablelands and Central Great Plains.

Producers in the Southwestern Tablelands participated in government programs. They listed NRCS programs like Environmental Quality Incentive Program (EQIP) and Conservation Stewardship Program (CSP). Often producers did not remember the name of programs they used. Blake, a large Kansas producer with a medium level of adoption, used programs for tree removal and other environmental additions.

> The only thing I have done is the prairie chicken program and trees, tree removal, and that was actually tree programs I think the prairie chicken program as well as I can't remember what's the other one's called. I know they all have initials and I forget those

> initials, whatever. So that's the only thing that I can think outside of your regular farming program that we have ever done

Brice, a large Kansas producer with a medium level of adoption had participated in the EQIP program.

> There [was] also a program called the EQIP program…this has been like I said 20 something years ago, the program probably doesn't exist anymore. But, we got involved in that basically for – another thing we did with that program is we built two ponds with that program. So, there was cross fencing, farmland replacing that with grass and building some ponds, I think that's the three main things that we did in that program. And, so yeah, you're right that we did change of practices a little bit to follow the guidelines of that particular program.

Though Brice had not participated in programs in a long time, there were improvements in his operation that were still being used.

Bo, a small Oklahoma producer with a medium level of adoption, used government programs to make overall improvements to his pastures.

> But, we have planted some real sandy ground that wasn't real productive back to grass. We have sprayed plum thickets, we have sprayed trees, there's an EQIP, I don't remember what it was for, but it was a program if I think a minute, I might be able to remember what it stood for, but it was a government program through the FSA office. Some type of environmental something, something, but it is EQIP and they paid you spray plum thickets and spray tress and plant it back to grass. And, there is even something about water, but we had water on the place, we had watering tanks there.

There was a wide use of government programs in the Central Great Plains region. Cade, a large Kansas producer with a high level of adoption, used many programs to progress his operation. "What has helped us do that is EQIP, that's all in the EQIP program, we've also done a lot of tree work, a lot of brush work." Cade utilized as many government programs as he could "Anytime that we can, anytime we know there are cost share dollars there that we can utilize, then we feel like we ought to go ahead and take advantage of those and utilize them." These programs helped him adopt more BMPs.

Caleb, a large Oklahoma producer with a high level of adoption, used government programs to burn several different pastures.

> Yes. I don't do it. I hire the Fire Department to do it. So we have burned places with their consent. We've worked with NRCS on EQIP programs and different areas of – to burn and utilize fire in different places.

Carl, a medium-sized Oklahoma producer with a medium level of adoption, also used EQIP. He utilized these programs to put farm ground back into grass.

> We've done some EQIP. On the west side of town where we've taken 40 acres of what we call broken ground, tilled ground, and we put it back to Midland 99, just this spring. And we're still in the midst of that. They funded their side, and we did our side. But there's not regulations if we can graze it or not, we can graze it if we want. My intentions are not to for the first two or three years to get it established. My intentions are hay acres.

Clem, a medium-sized Kansas producer with a high level of adoption, heavily utilized government programs to progress his operation through water tanks and cross fencing:

> Initially I started off with EQIP programs. And, that was through our county and our NRCS director. And, she got me into starting, we – initially we started off with water well and tanks and then we started the cross fencing.

Clem claimed the stigma related to government programs was completely misguided.

> Guys think that you sign that contract that says so many head per acre, it's just a guideline, it's not a rule. It's not a rule and all you have to do is talk to your land owners and NRCS guys and they will work with you, they do, they really do.

Pasture fertilization practices varied by ecoregion.

When fertilizing pastures was discussed, producers were not soil testing before applying fertilizer. Bo, a small Oklahoma producer with a medium level of adoption, discussed this practice.

> Maybe you should soil sample and then take soil samples to see if the fertilizers that we're putting on are right. Because he asked me that, have you done soil test? And I said well no, we just last year put some nitrogen on and so that could be something that could help, something that I could improve on by doing soil test to find out if the fertilizer I'm putting on.

Bo also discussed the kind of fertilizer he applied and the tradition behind it.

> Nitrogen. Now you're going to ask what the guy over here at the air port asked me, "Nitrogen?" And I said yes we always just put on nitrogen, weed killer and nitrogen. "Why do you put nitrogen

> on it?" I don't know that's just what we've always done. And that's what we're going to do again.

Ben, a large Oklahoma producer with a high level of adoption, used fertilizer to enhance the quality of his forages.

> The next factor of what we do is try to improve that forage quality. So we have a couple of different methods of doing that. One is although rye is a nitrogen scavenger and it doesn't require a lot of nitrogen, it will excel with nitrogen. So we try to keep our nitrogen rates up, of course phosphorus as well but that's right in this area we have a high natural phosphorus in the soil so that's not a big issue.

Unlike producers in the Southwestern Tablelands, Flint Hills producers soil tested their pastures prior to fertilization. When discussing fertilization Adam, a large Kansas producer with a high level of adoption, mentioned, "We are not as diligent about doing [it on our pastures] as our crop land." Allen, a large Kansas producer with a medium level of adoption, did not soil test every year. "We soil test some. And maybe put a third of it every year. In that way, you know, you don't do it all every year. You can get along pretty good that way."

Andy, a large Kansas producer with a low level of adoption, had applied lime based on soil tests in the past.

> Its more fertilizer, I have had to apply lime before, from a soil test, but its more, I guess I've used it more for fertilizer. And you know you don't have to apply lime every year like you do fertilizer. You apply it, and it can last you for years.

Producers of the Southwestern Tablelands showed an interest in research.

Producers in the Southwestern Tablelands took a particular interest in research. Brice, a large Kansas producer with a medium level of adoption, utilized the Internet to do secondary research on grazing practices.

> The other thing is just if you get some kind of an idea in your mind about something you just start getting on the Internet and research on it and see what you can find out about what other people have done.

Bruce, a large Oklahoma producer with a high level of adoption, participated in research trials with OSU. "I enjoy research projects; OSU did a deal with me on wheat pasture gain on mineral intake. I do my own trials all the time, so I enjoy stuff like this." Ben, a large Oklahoma producer with a high level of adoption, even volunteered to do more research with the researchers themselves. "We should sit down and do some research together. It'd be lots of fun."

Summary

Producers in the study were aware of BMPs like rotational grazing, prescribed burning, and the usage of alternative forages. Producers had varying definitions of both rotational grazing and cover crops. Producers used one another as an information source. Producers also used information from Extension and university sources. The practices that producers used were determined by visual observations and past experiences. Barriers to the adoption of BMPs included: water availability and quality; leasing land; time; and labor. Producer networks presented a double-edged sword for those communicating about BMPs. Land lords, generational

gaps, and skilled employees were social constraints associated with the adoption of BMPs. Producers saw the benefits of burning practices and rotational grazing. Drought tested the resiliency of producers' operations. Overall, producers saw the benefits of BMPs, but experienced some barriers or social constraints related to the adoption of BMPs.

Chapter 5 - Conclusions, Recommendations, and Discussion

Introduction

The purpose of this study was to determine the barriers and socials constraints producers face when choosing whether or not to adopt BMPs for grazing systems. To assist the reader, the final chapter of this thesis will restate the problem and include an outline of the methodology used to conduct this study. This chapter will include conclusions, discussions, and the implications this study developed for theory and practice. Lastly, the chapter will conclude with recommendations for future research and Extension professionals.

This study sought to find the barriers and social constraints related to the adoption of BMPs in grazing systems. The problem began when producers based stocking rates on tradition, neighbors, guesses, or financial pressure (Ohlenbusch & Watson, 1994). However, forages are most productive when grazing pressures are matched to the pasture's grazing capacity on a case-by-case basis, and then adjusted for periods of stress, such as drought. The overuse of pasture for many years can result in reduced profitability and increased soil erosion (Ohlenbusch & Watson, 1994) creating problems for producers. BMPs are practices producers can adopt to effectively manage resources and prevent environmental damage (Paudel et al., 2008). As beneficial as these practices are, scientists, policy makers, and Extension professionals have conveyed frustration with the current level of adoption of BMPs by producers (Pannell et al., 2006). The increased adoption of BMPs could increase the resiliency of the beef cattle industry and the rural communities it affects. To find the barriers and social constraints related to the adoption of BMPs, the following research questions were established:

- RQ1: What were Kansas and Oklahoma cattle producers' perceptions and awareness of BMPs in grazing systems?
- RQ2: How did producers seek and process information related to BMPs in grazing systems?
- RQ3: What were the barriers to adoption of BMPs in grazing systems?
- RQ4: What were the social constraints related to the adoption of BMPs in grazing systems?
- RQ5: How did producers perceive resiliency related to the adoption of BMPs in grazing systems?

To explore these research questions, 43 qualitative, in-depth interviews were conducted with producers in south central Kansas and north central Oklahoma in the Flint Hills, Southwestern Tablelands, and Central Great Plains ecoregions (Appendix C). Interviews lasted between 45 and 90 minutes. Extension agents in these geographic areas facilitated a purposive sampling technique. At the end of each interview participants were asked if there were other producers in the area he or she suggested we visit with, resulting in a snowball sampling method. Interviews were conducted from May to August 2015, at the time and location preferred by participants. Interviews were audio recorded and transcribed by a professional transcription service. Transcripts were analyzed using Glaser's constant comparative method (1965) via NVivo 10.

Conclusions

To determine producers' awareness and perception of BMPs, how they sought information related to those practices, the barriers and social constraints related to the adoption of BMPs, and the perceived resiliency the practices offer, producers were asked a series of questions related to the use of BMPs in their operation. Producers' responses to these questions were used to develop themes. This section will summarize those themes by research questions. If 20 participants agreed on a subject, this established a theme for the entire study. Some concepts were only present in certain ecoregions. These themes were established if over half of the producers in that

ecoregion addressed the issue. Conclusions and themes are presented with each research question in the following sections.

RQ1: What are Kansas and Oklahoma cattle producers' perceptions and awareness of BMPs in grazing systems?

Producers were aware of many BMPs: rotational grazing, mob grazing, burning practices, weed management, brush management, improved watering systems, setting proper stocking rates, periodic rest, cross fencing, use of introduced grasses, utilization of alternative forages, forage fertility management, and grazing distribution. Overall, opinions were mixed regarding the perception of these BMPs, and the definition of these practices was not consistent from producer to producer. Practices with the greatest producer-to-producer variability in the definition of scope included rotational grazing and cover crop utilization.

The major themes for this research question included: rotational grazing was subjective and occurred at varying degrees of intensity; rotational grazing offered benefits; cover crops and alternative forages were used as a substitute for pasture; and brush was controlled by a combination of burning and mechanical means in the Southwestern Tablelands. Minor themes included the definition of cover crops varied from producer to producer and the use of alternative forages made up for small pasture size furthermore it increased the number of head per operation. A minority of producers perceived many BMPs, like cover crops, rotational grazing and prescribed burning, to be irrelevant to their operations.

Producers referred to rotational grazing by several different names: rotational grazing, cell grazing, mob grazing, and cross fencing. This discrepancy was a major theme of the study. Participants had different views of what they would consider to be rotational grazing, and thought many different levels should be considered. The intensity of rotational grazing varied. Some participants moved their cattle every three or four days through small paddocks, approximately 40 acres. Others would move their cattle every two or three weeks through larger paddocks, while some producers would move their cattle with the season, and still considered that to be rotational grazing. An additional theme related to rotational grazing was that producers saw rotational grazing as beneficial, especially to forage. Some producers saw an increase in the productivity of cattle as well, but not enough to consider this a theme.

Another theme producers mentioned was the use of alternative forages. Producers used alternative forages to expand herds, utilize poor farm ground, increase flexibility, or enhance resiliency. Cover crops were one of the alternative forages used. During the interviews there were discrepancies regarding the definition of a cover crop. Four producers cited monoculture crops as cover crops or the residue from already harvested crops. If cover crops were planted, they were typically grazed. Economics was usually the reason for grazing cover crops.

RQ2: How do producers seek and process information related to BMPs in grazing systems?

The major themes for this research question were: information sources shaped the practices of producers and visual observation and experiences determined practices and strategies. When producers were asked where they sought information several sources were named.

Overwhelmingly producers said they relied on other producers for information and university or Extension information. Producers sought information from their neighbors, friends, and peers. State lines did not deter producers when it came to seeking information from networks or university/Extension sources. Producers from Kansas were using information from OSU and producers from Oklahoma were using information from K-State. Producers expressed an interest in university research and a few had participated in research. The information producers gleaned from these sources was then applied to their operations, thereby shaping their current practices.

When investigating how producers processed information, the use of visual observation and past experiences were the most mentioned methods. Producers processed information regarding BMPs through visual observations and through the lens of their past experiences. Producers visually assessed the health and vigor of their forage and made decisions based on those observations. Visual observation of cattle was used to assess the relative health of cattle and visual observations of manure was used to determine the quality of forage. Past experiences were also a tool for processing information. When making choices associated with BMPs, producers often referenced past experiences. Producers knew the history of their land and its quality. Three producers based their current practices solely on the practices their fathers or grandfathers used, though this was not a major theme.

RQ3: What are the barriers to adoption of BMPs in grazing systems?

The major themes associated with this research question were: water availability and quality deterred producers from adopting BMPs; leasing and renting land presented unique challenges, particularly in Oklahoma; and the adoption of rotational grazing was restricted by many barriers.

Other barriers existed for adopting practices, but were not mentioned enough to be considered themes.

The theme of water quality was an issue for producers during drought when ponds developed blue-green algae. Additionally, during periods of drought, ponds dried up completely making it difficult for producers to implement rotational grazing. A lack of watering systems also prevented producers from adopting rotational grazing or other BMPs, like rotational grazing.

Leasing land presented a barrier for adoption for the majority of producers. Oklahoma's school land leasing system presented unique issues for producers. The system contributes to a non-conservationist approach by producers. This fell short of being a major theme, but was mentioned by three out of four producers who leased school land. However, it was an overall theme that producers found it difficult to justify improvements on leased land. When there was no guarantee the producer would maintain the lease, the producers were not keen to invest large amounts of money into that land, such as watering systems, fencing, and brush/tree removal. However, there were also instances of landlords insisting producers utilize BMPs and managing pasture responsibly, but this only occurred for two producers. These producers were happy to comply.

RQ4: What are the social constraints related to the adoption of BMPs in grazing systems?

The major themes associated with the research question were: deluded view of self and peers and maintained a defensive attitude regarding neighbors; producer networks acted as a double-edge

sword; and landlords could make or break practices. There were other social constraints mentioned, but not enough producers mentioned them to be considered themes. Those social constraints mentioned dealt with the networks to which producers belong and their respective standing within them.

The theme of deluded view of self and peers while being defensive of neighbors exhibited itself when producers pointed out other producer's substandard practices, while they refused to name them. They also made excuses for their neighbors and came quickly to their defense. Interestingly, producers viewed themselves as good producers, regardless of reality or the use of BMPs.

The theme of producer networks as a double-edged sword was created based on groups mentioned by producers consisting of other producers, neighbors, and trusted industry professionals. These networks are the main source of information for producers. However, producers also said their neighbors and peers were substandard producers. This presented an interesting dynamic. If substandard producers were seeking information from good producers, then all is well. However, if good producers were to seek information from substandard producers then bad practices could spread. Despite that, influencing a few key producers could also change the rest of the producers within the region.

The theme that landlords could make or break practices was identified in the majority of interviews. Absentee landlords were disconnected from with the industry and did not necessarily understand the need for improvements or the financial burdens producers faced. Typically,

producers said landlords were concerned with the money they made off the property, rather than the integrity of the land. In a small number of cases, producers ended up spending more money on maintaining leased land than on the land they owned.

RQ5: How do producers perceive resiliency related to the adoption of BMPs in grazing systems?

The major themes for this research question were: rotational grazing allowed for resiliency; improved watering systems allowed producers to be more resilient; burning practices allowed for resiliency; drought was a common occurrence that tested the resiliency of operations; and flexibility was essential in the Southwestern Tablelands. Producers who were choosing to implement BMPs saw the benefits of them. Rotational grazing, prescribed burning, and improved watering systems were the most mentioned in relation to resiliency.

Producers who utilized rotational grazing saw many benefits; this presented as a major theme. Producers often initially tried rotational grazing on a small scale, one or two pastures, and then once the success was realized, practices were expanded to the other parts of their operation. Rotational grazing also helped producers make more informed choices during drought since they could more accurately visualize and quantify the amount of forage that remained. Producers also found that it increased the utilization of grass, and overall resiliency.

Watering systems allowed producers to be more resilient as well, which was another major theme. A lack of watering systems was also a barrier to adopting BMPs. Producers who used

watering systems found that grazing distribution and the health of cattle was improved. Improved watering systems allowed producers to be more resilient; this was a major theme.

Another theme was producers found when they practiced prescribed burning their operations thrived. Prescribed burning controlled cedar trees and increased the quality of forage. Producers also used it to even out the grazing distribution. Burning was an economical way to eradicate brush and other invasive species. All of these factors combined to make for a more resilient operation. Burning practices allowed for resiliency.

Drought was a common occurrence that tested the resiliency in the majority of operations. In many cases drought caused producers to reassess and adopt better management practices. Producers tended to destock and cull their herds during drought. Drought shifted the way producers thought and changed their management strategies.

Discussion

This section details the application of this study to previous literature. There are many instances of this data supporting past research but contradicting others. This study presented new information for the encouragement of BMP adoption.

RQ1: What are Kansas and Oklahoma cattle producers' perceptions and awareness of BMPs in grazing systems?

This study supported many previous findings from Pannell et al. (2006), Prokopy et al., (2008), and Gillespie et al. (2007). In this study, each producer had his or her own unique view, making

it difficult to reach saturation. This supports what Pannell et al., said in 2006: past experiences, scientific knowledge, and cultural factors shape the views of producers, making each one unique. In addition to this unique view, the motivations of producers varied. Pannell et al. (2006) also said that understanding the motivations behind adoption of BMPs is essential to explain the adoption, or lack thereof, for each producer. There was no standard motivation for producers found in this study. Though many producers expressed a motivation towards economics, when they further explained this reasoning it could come down to time, personal situations, labor, age, or even what their spouses wanted them to do. Since the motivations for each producer were so unique, communicating clearly to these producers about BMPs would require getting to know their operations, needs, barriers, and constraints.

Producers who were more informed about BMPs adopted more practices. It is not clear if the increased information was the cause of the adoption, or if producers were just informed about the practices they chose to use. This supports Prokopy et al., (2008) findings that the more information a producer has regarding a practice, the more likely they are to adopt it. In this study, it was found producers often said, "That just doesn't work for us." This aligns with Gillespie et al.'s (2007) work that concluded non-adopters saw that practices were not applicable or relevant to their operation. Perhaps this would not be the case if messages related to those practices would have been made personally relevant and centrally processed, as suggested by the elaboration likelihood model (ELM) (Petty & Cacioppo, 1986).

This study contradicted some findings by Gillespie et al. (2007). Regardless of their level of adoption, producers were aware of different practices like using cover crops, rotational grazing,

improved watering systems, prescribed burning, nutrient management, weed control, and grazing distribution. This theme contradicts the finding by Gillespie et al., (2007), that one of the reasons producers do not adopt is that they are unaware of the practices.

Rotational grazing and continuous grazing were the grazing strategies most often mentioned in interviews. However, it was found producers did not have a clear understanding of rotational grazing. There was not a consistent definition of rotational grazing found throughout any ecoregion. When the researcher combed through Extension materials from both Kansas and Oklahoma, a consistent definition could not be found. Moreover, an Extension document that solely concerns itself with rotational grazing does not exist. Therefore, it is not shocking that producers could not define or properly use rotational grazing to its greatest benefit.

The lack of consistent understanding and definitions of practices and terms is not limited to rotational grazing. When discussing cover crops, this theme continued. Producers did not have a clear definition. A few producers even thought that crop residues qualified as cover crops. Cover crops are defined as actual growing plants that contribute to the health of the soil (White, 2014). At the time there were few Extension documents concerning the grazing of cover crops. There are very explicit specifications for grazing cover crops. The NRCS suggests that while cover crops are being grazed they should be checked everyday, regardless of moving cattle (Fisher et al., 2014). Producers did not indicate this kind of vigilance when they talked about their own practices.

It was found that producers were grazing cover crops and other alternative forages like crabgrass. Producers who were utilizing these cover crops needed to find different ways to use farm ground in order to supplement native grasses. The reasons were either a shortage of native grass pastures in their operation, in the region in general, or producers wanted to expand their operations to support their families or the return of a second generation. These producers had children moving back to the farm and needed to increase the number of head that their operation could sustain; this was a minor theme. Every producer that planted cover crops, excluding one, used the cover crops as a source of forage. Producers said the economics and profit as the reasoning behind this decision. According to NRCS, grazing cover crops is an acceptable practice if properly monitored. When cover crops are used as a forage profits increase (Fisher et al., 2014; J. D. Miller et al., 2003; Warren, n.d.).

Alternative forages such as crabgrass that grows after wheat, crop residues, and cover crops gave more opportunities for grazing thereby increasing the number of head an operation could sustain; this was a major theme in this study. Producers in the Southwestern Tablelands used alternative forages to increase the flexibility of their operations. They took advantage of grazing opportunities whenever they were available; this was a major finding within the ecoregion. This is likely because this area had less rainfall than the other ecoregions and is impacted by drought more often. Flexibility became far more important during drought than times of normal precipitation.

RQ2: How do producers seek and process information related to BMPs in grazing systems?

This study supported the premises of ELM and CBSM. It was found that producers were more likely to adopt practices they knew more about and they saw as relevant to them and their operation. Producers who had positive results from practices or programs were more likely to adopt additional practices or participate in new programs.

Information sources producers used were varied, however, peers/other producers and university and Extension were the two most commonly used sources. This was a major theme. This aligned with findings by Vergot III et al., and Velandia et al. (2005 & 2010). Producers in this study used many different resources, rather than just one. This supports the findings of Velandia et al. (2010).

A bias towards Extension may be present in this study. Most participants were contacted through Extension agents; researchers drove Kansas State University vehicles, and wore Kansas State University polos. These factors could have resulted in a bias towards university and Extension as a source of information. Often when producers mentioned Extension and university information they gestured towards the shirts researchers were wearing, or said things like “Of course there’s Extension.” The observation of other producers and word of mouth as information sources was a major theme of the study. Since producers are known for chatting over coffee at local shops and driving around looking at other people’s land, this isn’t surprising.

This study showed that producers process information related to BMPs through visual observations and past experiences. ELM states that if someone has a positive experience in the past, it is more likely that information related to that experience will be received positively and acted upon by the message recipient (Cacioppo & Petty, 1984). Since producers in this study used their past experiences to make choices, positive experiences would result in central processing and higher likelihood of adoption. Central processing takes place when the listener attends to the message more intently and the information is more likely to be acted upon (Petty & Cacioppo, 1984). For example, producers who had positive experiences with rotational grazing on a small scale expanded to the rest of their operations.

Negative experiences would have the opposite effect. For example, producers who had planted cover crops that failed were not planning on using that practice again; instances like this occurred for five producers. ELM also states that people want to hold correct attitudes; in this case, producers want to be seen as good producers (Petty & Cacioppo, 1984). Producers saw themselves as responsible and great at their job; this was a major finding of this study. Producers held this belief regardless of reality. This could explain the deluded sense of self, only seeing themselves in a good light, regardless of reality. Even producers who had a low level of adoption still saw themselves as a good producer; this was also a major theme.

RQ3: What are the barriers to adoption of BMPs in grazing systems?

An essential step to CBSM is identifying barriers to the adoption of a specific behavior. This step is often overlooked because developers think they already know the barriers that exist (McKenzie-Mohr, 2011). This step had been overlooked by the Extension system for years, even

though frustration has been expressed by Extension professionals (Pannell et al., 2006). It was often just assumed the reason producers didn't adopt was purely financial (Ohlenbusch & Harner, 2003; Ohlenbusch & Hartnett, 2000). It was also cited that there may be factors of fear, water availability, and drought that prevented adoption (Ohlenbusch & Harner, 2003; Ohlenbusch & Hartnett, 2000). That is not necessarily the case. Though water availability was mentioned as a barrier, producers also said water quality, leasing and renting land, and skilled labor were also barriers to the adoption of BMPs. Money, economics, and finances were mentioned as barriers in this study; however, it was not recognized as a theme. Time and labor were also mentioned as barriers and constraints in this study, though these can also be considered economics factors, they also were not a theme. A study conducted by Ryan, Erickson, and De Young (2003) recognized that economic motivations were the lowest motivator for the adoption of BMPs.

The more vivid and personal communication is, the more persuasive it becomes. In order for communication to be personalized, the audiences must be fully understood (McKenzie-Mohr, 2011). Important information related to government programs or barriers in general might be targeted at the wrong audiences. Since leasing and renting lands was a barrier, landowners or landlords should also be targeted with this information. The analysis of audiences that Extension must cater to should be more in-depth and inclusive to include secondary and tertiary audiences, like seed salesmen, landlords, and spouses of producers.

RQ4: What are the social constraints related to the adoption of BMPs in grazing systems?

Barriers are both physical and practical and include forms of social constraints. The social constraints are just as difficult to overcome as the physical barriers. It was found that the networks producers are a part of had a hand in determining the practices they utilize. Producers see themselves as good producers, regardless of reality. As ELM states people like to see themselves as the "good guy" (Petty & Cacioppo, 1986). Producers then said their neighbors were not very progressive and had substandard practices. Producers seemed to see the best in themselves and the worst in others. However, the concept of being a "good guy" reached even further when producers defended their neighbors shortly after calling them substandard. One minute a producer would call his neighbors ineffective and lazy, then the next he would defend them with an excuse; this was a major theme of the study. This interesting dynamic is unexplained. ELM states people want to see themselves as responsible and consistent (Petty & Cacioppo, 1986). Producers put down the other producers around them to seem better. However, they felt only producers have the right to call other producers substandard. If someone else would make a comment, they would jump to the defense of their peers. This notion of insiders and protecting of peers make the integration of Extension agents into communities ever more prudent.

Producers relied on their peers as a source of information. So, what happens when producers are using bad producers as a source of information? This is where producer networks became a double-edged sword. This was a major social constraint in adopting BMPs. Engaging opinion

leaders or key stakeholders in each region or county could result in changes in practices across the region. CBSM suggests identifying key stakeholders as an important step in establishing a new social norm among a community (McKenzie-Mohr, 2011).

RQ5: How do producers perceive resiliency related to the adoption of BMPs in grazing systems?

There were many BMPs like rotational grazing, improved watering systems, and prescribed burning that producers saw as increasing the resiliency of their operations. This aligns with the findings of Johnson Alonge, and Martin (1995) that stated the implementation of BMPs makes an operation more resilient. Producers found when they utilized BMPs their operations became more stable and vigorous. This confirmed that BMPs are effective. BMPs helped producers manage more effectively and producers saw the benefits from them. Carolan (2006), states that the benefits of sustainable agricultural practices are not easily seen. Therefore, the positive experiences and noticeable benefits should be communicated clearly to other producers considering the adoption of BMPs.

Drought acted as a test for many operations. Drought forced producers to change their practices; this was a major theme of the study. In most instances within this study these changes were positive in terms of BMPs. This study found when producers faced the daunting occurrence of drought, they took pause and changed the way they managed, and began to centrally process information and think critically (Petty & Cacioppo, 1986). Then they adjusted their practices towards more responsible practices. This finding is contrary to the inferences by Ohlenbusch, Harner and Hartnett (2003 & 2000), that drought is a barrier to adopting BMPs. In this study,

once a producer and his operation had survived a harsh drought, he was more likely to make responsible management decisions.

Implications

The implications of this study were both for the development of theory and the practice of Extension. There were contributions to CBSM and ELM. Implications for Extension affect Extension at all levels, state and local.

Theory.

This study contributed significantly to the theoretical field. This study utilized the premise of CBSM in a new context: agricultural BMPs. This context established an improved way to promote the adoption of BMPs in not only grazing, but also other agricultural practices. This opened the door for the increased use of CBSM in other agricultural contexts.

This study also made modifications to CBSM to better integrate it into the field of agricultural communications and the promotion of BMPs. CBSM has five steps, 1) select the behavior, 2) identify the barriers and benefits, 3) develop strategies, 4) pilot the study, 5) implement on a broad scale. The proposed changes to CBSM are featured in Figure 2. This study proposed that the first step should be to establish strong community connections. In order to establish behavior changes in producers, Extension agents should first integrate themselves into the community, the first addition to CBSM. Once they are part of the community, they can better determine the practices that the producers are using. Extension agents should then start to make recommendations based on the knowledge they acquire, the second addition to CBSM.

Figure 2. Modified Version of CBSM for Extension Professionals

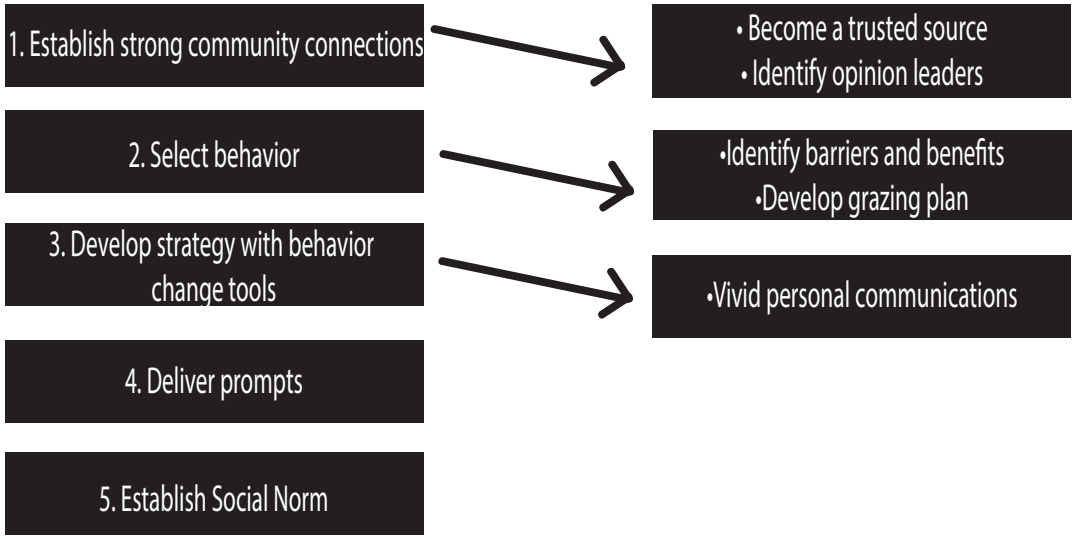

Figure 2. The integration of ELM into CBSM will help Extension professionals better communicate with constituents.

This study also integrated CBSM with ELM, this integration is the third addition to CBSM. ELM is used in the message-designing portion of the program. Since messages should be personalized and concrete according to the theory of CBSM (McKenzie-Mohr, 2011), integrating ELM is a logical addition to the message planning phase. When an individual receives a message, the information in it is either peripherally or centrally processed. When information is centrally processed, the individual listens more intently and the individual becomes more likely to act upon the information. One of the best ways to motivate people to centrally process information is to make it personally relevant to them (Petty & Cacioppo, 1984). The individual focuses less on the peripheral argument and the information is less likely to be acted upon.

Extension.

Extension is a part of nearly every community in the United States. Extension is responsible for propagation of university research and information. There are other sources producers can use to obtain information about BMPs such as, NRCS, watershed organizations, etc. The majority of producers in this study were users of Extension. However, the majority of producers were not high-level adopters of BMPs. It can then be easily inferred that Extension agents may not be addressing grazing BMPs in a proper or effective format. This study found that although Extension is being used in the study area it is not being used to its fullest potential and improvements are possible. Current efforts of Extension involve an exchange of information. This exchange takes place between the university to Extension agents, and Extension agents to the public. Information is then exchanged from the public to Extension agents and then back to the university. This study suggested that the information exchange should be treated as an open communication.

This study found that producer networks are a way that producers acquire information about BMPs. If Extension could influence leaders in these producer networks and implement CBSM, a behavior change regarding grazing BMPs could be achieved. These producer networks are a huge opportunity Extension cannot ignore.

Recommendations

Research.

This qualitative research represented the producers who were interviewed but similar research should be continued in other regions. Understanding the motivations behind the decisions producers make is the best way to understand the choices themselves (Pannell et al., 2006). Understanding these choices can help communicators change those choices (McKenzie-Mohr, 2011). This research could also be expanded to different sectors of agriculture, like row or specialty crop production.

Developing a continuum of BMP adoption would benefit the field. It is clear that while some producers have adopted practices and are seeing positive results from these practices, not all producers have adopted. However, pigeonholing producers into two groups of adopter and non-adopters is neither helpful nor accurate. There appears to be a continuum on which producers can be placed. The accessibility to information, social network, family history, and current practices need to be taken into account when considering where to place producers on the BMP adoption continuum. The development of a model regarding the continuum of adoption could help Extension agents and other partners determine the best strategies or communication methods to use with producers.

Perhaps the most important research that should take place is to examine how BMPs are currently being communicated. In order to change the way BMPs are communicated, it must first be understood how they are currently being communicated and orchestrate a strategy to improve

that communication. It is likely that each agent communicates about BMPs differently and there could be opportunities for streamlining to improve the quality of this communication overall.

Extension.

Since it was found that Extension was the most utilized source of information in this study and Extension agents have a unique opportunity to insert themselves into producer networks, Extension should begin a grass roots movement to encourage the adoption of BMPs. Extension agents should be experts in communication (Rasmussen, 1989). Extension agents should be trained in CBSM. This kind of communication-based training would benefit agriculture and natural resource programs and could be applied to the family and consumer sciences Extension programs as well. The current form of Extension is an exchange of information; the researcher proposes that rather than an exchange of information, communication with producers should be utilized.

Extension should begin their communication efforts by first integrating themselves into the community. Strong community connections will help Extension agents be seen as trusted and knowledgeable. If Extension agents have been in their communities for an extended period of time, the community relationships have likely been established. The reputation of the agents will become a factor during communication.

In order to find and influence key stakeholders in the community, Extension agents should continue to be engaged with their communities and even get involved in producer organizations like county cattleman associations. Once involved in these organizations, agents should reach out

to producers. Once a relationship has been established, personalized recommendations should be made. By integrating him or herself into the community, agents can identify the opinion leaders. Since producers utilize one another as information sources, the top information providers should be the first producers contacted to begin establishing new social norms.

Once relationships have been established it is important to communicate with constituents regarding their current practices and then select the practices that would be best suited to the operation. When selecting these practices it is essential to consider the barriers that may exist for each operation. Once these barriers have been identified, it is important to enable the producers to overcome these barriers. For example, if the practice is prescribed burning, and the barrier is a matter of labor and time, an Extension agent could organize a burning association for the county. That would benefit multiple producers and overcome barriers for many.

Personalized plans are the most effective way to establish a high level of BMP adoption in producer's operations (Diekmann & Batte, 2009; Lawson & Dail, 1966; Vergot III et al., 2005). In order to make proper recommendations Extension agents must fully understand the operation of each producer. Extension agents should also take the opportunity to collaborate with NRCS staff to present technical tools and accurate information to producers. These recommendations and grazing strategies should look to overcome barriers and maximize benefits of each individual producer. This is why an established relationship is so important. While this seems like a lot of labor, once recommendations have been established, the operations will be low maintenance.

An integrated communication strategy is needed to encourage the adoption of BMPs, Figure 3 displays the process needed to develop a personalized grazing plan. Since these plans will be personally relevant, they will likely be processed centrally, according to ELM (Petty & Cacioppo, 1986). While there is a need for vague, widely applicable information, it is likely those documents and practices are processed peripherally; therefore, practices are less likely to be adopted. Tailoring Extension publications to regions or ecoregions could help promote the central processing, resulting in the adoption of BMPs. Extension publications should be updated and tailored. These publications should be easier to find and have a place of prominence on each University's webpage. Extension agents should utilize these updated, personalized documents to start the personalized planning for producers.

Figure 3. Extension Model Integrated with CBSM

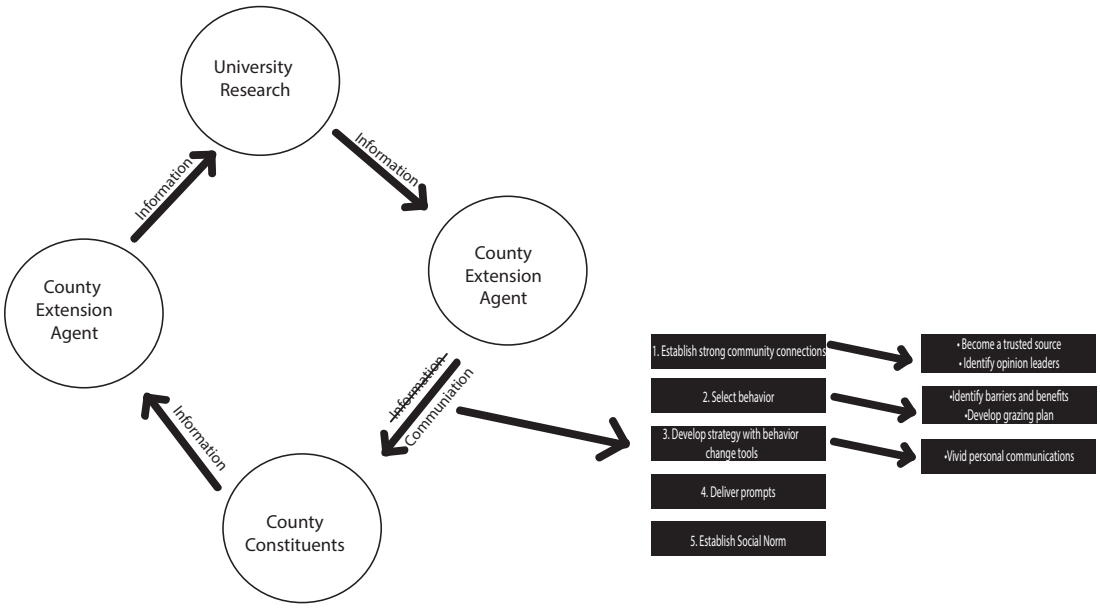

Figure 3. This model details the strategy for communicating BMPs to producers.

In order to establish a behavior change, a commitment should be sought from the producer. CBSM states that commitments should start small and be public. Once a small commitment is

established, producers are more likely to commit to something larger (Cacioppo & Petty, 1984; McKenzie-Mohr, 2011). For example, if a producer will commit to going to a short meeting about starting a burn association, then they would be more likely to establish a bigger commitment of joining an actual burn association. Once commitments are made, prompts are needed to remind the producer of the commitment.

Prompts are pieces of material that communicate reminders to producers to act on the commitments that have been made. Agents could use hard copy mailers, emails, social media notices, or even post signs in yards. Prompts remind producers to act and make their commitments more public. Prompts and the messages in them should be designed based upon the premises of ELM. The messages should be concrete, personalized, and vivid. These factors will increase the likelihood that messages will be processed centrally and therefore, adopted (Petty & Cacioppo, 1986).

Communication training for Extension agents is a necessary step for the implementation of this plan. This training should be as convenient as possible for agents. When new agents begin their training, CBSM should be implemented into the current curriculum. For existing agents, CBSM experts will travel to geographically convenient locations throughout respective states to offer a daylong training regarding CBSM and other communication efforts. This training should be required for all agents, regardless of focus or discipline. This training could also serve as an opportunity to implement other communication efforts like social media and interpersonal communications.

When the researcher began collecting information regarding BMPs, the process was taxing and information was lacking. The information was difficult to find and once found, for the majority, was outdated. The information was often too vague to be widely applicable and recommendations were not concrete. Though vague information is suitable for a broad, state-wide approach, in actual practice and application it does not suffice. Extension and researchers should clearly define the BMPs that are needed for each region, or find ways to reach out to producers and personalize grazing management strategies to increase the resiliency of each operation. State Extension specialists could develop overall information and leave space for region specific information to be integrated and update regularly with prudent information. Extension agents are in every county for a reason, and this reason is to personally tailor communication to the producers in that area. If producers do not understand what is suggested for their regions or operations, they cannot adopt BMPs. CBSM should be used to communicate grazing BMPs. Extension should make good use of the producer networks and use them to its advantage. Extension is not the only organization that communicates and promotes BMPs. NRCS provides cost share programs for producers. Other government programs are also available for producers. These opportunities provide additional support for producers that Extension should help to promote and integrate into communications efforts.

The way BMPs are currently communicated should be examined, rethought, revamped, and streamlined throughout the region. Extension was the most used resource in the study area. Therefore, Extension has an opportunity to increase the adoption of BMPs. Since each agent is unique, it stands to reason that the way they communicate would also be unique. Training Extension agents on communication tools and strategies, like CBSM, would promote the

adoption of BMPs. All the best strategies and BMPs in the world can be available, but if they are not effectively communicated to the correct audiences, they will never be adopted.

Summary

The purpose of this study was to determine the barriers and social constraints associated with the adoption of BMPs in grazing systems. Five research questions guided this study:

- RQ1: What were Kansas and Oklahoma cattle producers' perceptions and awareness of BMPs in grazing systems?
- RQ2: How did producers seek and process information related to BMPs in grazing systems?
- RQ3: What were the barriers to adoption of BMPs in grazing systems?
- RQ4: What were the social constraints related to the adoption of BMPs in grazing systems?
- RQ5: How did producers perceive resiliency related to the adoption of BMPs in grazing systems?

In order to assess these research questions 43 qualitative in-depth interviews were conducted in south central Kansas and north central Oklahoma.

Results from this study indicated that producers in this study were aware of BMPs like rotational grazing, prescribed burning, and the usage of alternative forages. Producers had varying definitions of both rotational grazing and cover crops. Producer used one another as an information source. Extension and university information were also a source for producers. The practices that producers used were determined by visual observations and past experiences. Barriers to the adoption of BMPs included: water availability and quality; leasing land; time; and labor. Producer networks present a double-edged sword for those communicating about BMPs. Landlords, generational gaps, and skilled employees were social constraints associated with the

adoption of BMPs. Producers saw the benefits of burning practices and rotational grazing. Drought tested the resiliency of producer's operations.

This study offers several recommendations for Extension professionals and research. This research should be continued in other regions and with other agricultural BMPs. A continuum of adoption should be developed. The way that BMPs are currently being communicated by Extension agents should be researched and analyzed. The communication of BMPs should be improved by implementing CBSM.

The implementation of CBSM by Extension professionals could increase the adoption of BMPs in grazing systems. Extension agents should start their communication efforts by integrating themselves into their respective communities. Once relationships have been established, Extension agents should identify the opinion leaders in the community to influence the practices of other producers in their network, thereby increasing the resiliency of the entire beef cattle grazing system.

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Appendix A - Interviewer's Guide

Hi, my name is Audrey Holderness, and I received your information from _____, a _____ at _____. I'm working on a study being conducted through Kansas State University's Department of Communications and Agricultural Education regarding best management practices for grazing systems.

Your identity and responses will be kept confidential.

There aren't any expected risks to participate in this study, and there will be no cost to you to participate in this study.

Do you have any questions? Do you agree to participate in this study?

Non-geographic specific questions

1. Tell me a little about your operation?
   - **Probe**
     - cow/calf, stocker, owned or rented ground, grass/forage type, size of operation?
     - predominate grass types (and maybe predominate cattle breed?)
     - is this your primary occupation for income?
     - How many years have you been in the business?

2. Tell me about your grazing practices?
   - **Probe**
     - Tell me more about the history of your grazing practices?
     - What would say are the major changes you have seen in [beef cattle grazing operations] in the past ten years? Twenty years?

3. How did you come to use these specific practices?
   - **Probes**
     - Can you tell me about the process/experiences that lead to the use of these practices?
     - When you make changes to your grazing practices, how is that done?
     - What sources of information did you use to make these changes?
       - People, publications, etc.
     - Have you ever made changes in response to a particular incentive through a state/federal program?

4. What other grazing practices are you aware of?
   - **Probes**

- Where did you hear about these (Focus on information sources)?
- Has your county agent discussed grazing management with you or offered programs about it?

5. What grazing practices do others in your area use?
   - **Probe**
     - Are they different from yours? How?

6. Do you use wheat pasture in your grazing systems?

If yes→

What percentage of your operation is in dual-purpose wheat?
How does dual-purpose wheat currently fit into your grazing strategy?

7. Do you utilize introduced pasture?

If yes→

What percentage of your operation is introduced pasture?
Do you soil test?

- Do you apply fertilizer or lime based on soil test?

Rest from grazing is important for maintaining plant vigor and allowing plants time to recover from defoliation.

- If you do intensive grazing or double-stock grazing, how are you incorporating periodic rest into your current grazing strategies?

Proper stocking rates are an important grazing management tool.

- How do you determine stocking rates?
- What are your stocking rate goals?

8. Do you utilize alternative forages?

If yes→

What percentage of your operation is alternative forage?
Do you currently use cover crops?

- What cover crops are you using?
  - Mixes?
- Why do you choose to use cover crops?
- Do you graze your cover crops?

If no→

- Why are cover crops not used in your grazing systems?

9. Do you utilize native range?

If yes→

What percentage of your operation is native range?
Do you frequently use prescribed burning?

- When burning what is your primary goal?
  - Increased weight gain, more even grazing distribution, control of weeds and brush
- How often?

Rest from grazing is important for maintaining plant vigor and allowing plants time to recover from defoliation.

- If you do intensive grazing or double-stock grazing, how are you incorporating periodic rest into your current grazing strategies?

Proper stocking rates are an important grazing management tool.

- How do you determine stocking rates?
- What are your stocking rate goals?

10. Periodic droughts are frequent in this area.

- Does drought affect your grazing strategy?
- What strategies do you implement when drought occurs?

Conclusion

Is there anything else you'd like to share with me?
Who are other producers in the area that you recommend I visit with?
Is their view on grazing management similar or different than yours?

Interviewer will then summarize the points talked about during the interview.

Is this an accurate summary of our discussion today? Do you have anything to add or something you would like clarified?

Thank you for your time!

Appendix B - IRB Application

FOR OFFICE USE ONLY: IRB Protocol # _____ Application Received: _____

Routed: _____ Training Complete: _____

Committee for Research Involving Human Subjects (IRB)

Application for Approval Form

Last revised on January 2011

ADMINISTRATIVE INFORMATION:

Title of Project: (if applicable, use the exact title listed in the grant/contract application)

An analysis of barriers and social constraints to adopting best management practices in grazing systems

Type of Application:

☐ **New/Renewal** ☐ **Revision (to a pending new application)**

☐ **Modification (to an existing #_____ approved application)**

Principal Investigator: (must be a KSU faculty member)

Name:	**Lauri M. Baker**	**Degree/ Title:**	**PhD**
Department:	**Communications and Agricultural Education**	**Campus Phone:**	**(785) 532-1140**
Campus Address:	**307 Umberger Hall**	**Fax #:**	**785-532-5633**
E-mail	**lmbaker@ksu.edu**		

Contact Name/Email/Phone for Questions/Problems with Form: **Audrey Holderness, audreyeh@ksu.edu, 785-532-1192**

Does this project involve any collaborators not part of the faculty/staff at KSU? (projects with non-KSU collaborators may require additional coordination and approvals)**:**

☒ **No**

☐ **Yes**

Project Classification (Is this project part of one of the following?)**:**

☒ **Thesis**

☐ **Dissertation**

☐ **Faculty Research**

☐ **Other:**

Note: Class Projects should use the short form application for class projects.

Please attach a copy of the Consent Form:

☒ **Copy attached**

☐ **Consent form not used**

Funding Source: ☐ **Internal** ☒ **External (identify**

source and attach a copy of the sponsor's grant application or contract as submitted to the funding agency)

☒ Copy attached ☐ Not applicable

Based upon criteria found in 45 CFR 46 – and the overview of projects that may qualify for exemption explained at http://www.hhs.gov/ohrp/policy/checklists/decisioncharts.html **, I believe that my project using human subjects should be determined by the IRB to be exempt from IRB review:**

☐ No

☒ Yes (If yes, please complete application including Section XII. C. 'Exempt Projects'; remember that only the IRB has the authority to determine that a project is exempt from IRB review)

If you have questions, please call the University Research Compliance Office (URCO) at 532-3224, or comply@ksu.edu

Human Subjects Research Protocol Application Form

The KSU IRB is required by law to ensure that all research involving human subjects is adequately reviewed for specific information and is approved prior to inception of any proposed activity. Consequently, it is important that you answer all questions accurately. If you need help or have questions about how to complete this application, please call the Research Compliance Office at 532-3224, or e-mail us at comply@ksu.edu.

Please provide the requested information in the shaded text boxes. The shaded text boxes are designed to accommodate responses within the body of the application. As you type your answers, the text boxes will expand as needed. After completion, print the form and send the original and one photocopy to the Institutional Review Board, Room 203, Fairchild Hall.

Principal Investigator:	Lauri M. Baker
Project Title:	An analysis of barriers and social constraintsto adopting best management practicesin grazing systems
Date:	

MODIFICATION

Is this a modification of an approved protocol? ☐ Yes ☒ No If yes, please comply with the following:

If you are requesting a modification or a change to an IRB approved protocol, please provide a concise description of all of the changes that you are proposing in the following block. Additionally, please highlight or bold the proposed changes in the body of the protocol where appropriate, so that it is clearly discernable to the IRB reviewers what and where the proposed changes are. This will greatly help the committee and facilitate the review.

NON-TECHNICAL SYNOPSIS (brief narrative description of proposal easily understood by nonscientists):

The purpose of this study is to determine the barriers and social constraints associated with the adoption of best management practices through individual in-depth interviews with producers.

I. **BACKGROUND** (concise narrative review of the literature and basis for the study)**:**

In the past five years, Kansas, along with a large portion of the country, has been affected by severe drought resulting in decreased cattle inventory. Lack of pasture, both quality and quantity, continues to pressure ranchers to take cattle off grass at lower weights. This, paired with a high grain prices, has reduced the price of feeder cattle. Placing cattle on grain feed sooner causes production

declines, which often leads to higher prices. Effectively communicating the BMPs for grazing related to drought could lessen this effect. A behavior change in BMP adoption is necessary to increase the resiliency of not only individual producer's operations, but the overall resiliency of the cattle industry and the rural areas it influences. Currently, no literature is available on the barriers and social constraints to adoption.

II. PROJECT/STUDY DESCRIPTION (please provide a concise narrative description of the proposed activity in terms that will allow the IRB or other interested parties to clearly understand what it is that you propose to do that involves human subjects. This description must be in enough detail so that IRB members can make an informed decision about proposal).

Up to 15 Kansas cattle producers will be interviewed to understand their current grazing practices. The questions asked of producers will focus on how they started using their practices and the decision making process associated with grazing practices. Each interview will last 60-90 minutes and take place at the producer's farm.

III. OBJECTIVE (briefly state the objective of the research – what you hope to learn from the study)**:**

The purpose of this study is to fully understand the barriers and social constraints associated with the adoption of grazing BMPs in order to help producers overcome them.

IV. DESIGN AND PROCEDURES (succinctly outline formal plan for study)**:**

Location of study:	**Each producer's farm**
Variables to be studied:	**Current grazing practices, barriers and social constraints**
Data collection methods: (surveys, instruments, etc – **PLEASE ATTACH**)	**in-depth interviews, field notes**
List any factors that might lead to a subject dropping out or withdrawing from a study. These might include, but are not limited to emotional or physical stress, pain, inconvenience, etc.:	**Inconvenience**
List all biological samples taken: (if any)	
Debriefing procedures for participants:	**Following the interviews, participants will be debriefed by the researcher to ensure accuracy**

V. RESEARCH SUBJECTS:

Source:	**Contact local Extension agents to begin, then snowball sampling from participants**
Number:	**20**
Characteristics: (list any unique qualifiers desirable for research subject participation)	**Kansas and Oklahoma cattle producers**
Recruitment procedures: (Explain how do you plan to recruit your subjects? Attach any fliers, posters, etc. used in recruitment. If you plan to use any inducements, ie. cash, gifts, prizes, etc., please list them here.)	**Contact local Extension agents to begin, then snowball sampling from participants**

VI. RISK – PROTECTION – BENEFITS: The answers for the three questions below are central to human subjects research. You must demonstrate a reasonable balance between anticipated risks to research participants, protection strategies, and anticipated benefits to participants or others.

Risks for Subjects: (Identify any reasonably foreseeable physical, psychological, or social risks for participants. State that there are "no known risks" if appropriate.)

No known risks

Minimizing Risk: (Describe specific measures used to minimize or protect subjects from anticipated risks.)

Benefits: (Describe any reasonably expected benefits for research participants, a class of participants, or to society as a whole.)

Producers will have the opportunity to share their experiences and opinions with the researcher. Although the responses of the participants will be confidential the findings will be used to help Extension improve communication strategies.

In your opinion, does the research involve **more than minimal risk** to subjects? ("Minimal risk" means that "the risks of harm anticipated in the proposed research are not greater, considering probability and magnitude, than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.")

☐ **Yes** ☒ **No**

VII. CONFIDENTIALITY: Confidentiality is the formal treatment of information that an individual has disclosed to you in a relationship of trust and with the expectation that it will not be divulged to others without permission in ways that are inconsistent with the understanding of the original disclosure. Consequently, it is your responsibility to protect information that you gather from human research subjects in a way that is consistent with your agreement with the volunteer and with their expectations. If possible, it is best if research subjects' identity and linkage to information or data remains unknown.

Explain how you are going to protect confidentiality of research subjects and/or data or records. Include plans for maintaining records after completion.

All interviews will be kept confidential and all recordings will be destroyed at the conclusion of the study. Interviews will contain gender-neutral pseudonyms and transcripts will remove any identifying information such as blog name and other specific details that could jeopardize participant confidentiality. The computer with the recordings will be kept in a file cabinet inside a locked room..

VIII. INFORMED CONSENT: Informed consent is a critical component of human subjects research – it is your responsibility to make sure that any potential subject knows exactly what the project that you are planning is about, and what his/her potential role is. (There may be projects where some forms of "deception" of the subject is necessary for the execution of the study, but it must be carefully justified to and approved by the IRB). A schematic for determining when a waiver or alteration of informed consent may be considered by the IRB is found at

http://www.hhs.gov/ohrp/policy/consentckls.html

Even if your proposed activity does qualify for a waiver of informed consent, you must still provide potential participants with basic information that informs them of their rights as subjects, i.e. explanation that the project is research and the purpose of the research, length of study, study procedures, debriefing issues to include anticipated benefits, study and administrative contact information, confidentiality strategy, and the fact that participation is entirely voluntary and can be terminated at any time without penalty, etc. Even if your potential subjects are completely anonymous, you are obliged to provide them (and the IRB) with basic information about your project. See informed consent example on the URCO website. It is a federal requirement to maintain informed consent forms for 3 years after the study completion.

Answer the following questions about the informed consent procedures.

es o

Are you using a written informed consent form? If "yes," include a copy with

. this application. If "no" see b.

. In accordance with guidance in 45 CFR 46, I am requesting a waiver or alteration of informed consent elements (See Section VII above). If "yes," provide a basis and/or justification for your request.

. Are you using the online Consent Form Template provided by the URCO? If "no," does your Informed Consent document has all the minimum required elements of informed consent found in the Consent Form Template? (Please explain)

. Are your research subjects anonymous? If they are anonymous, you will not have access to any information that will allow you to determine the identity of the research subjects in your study, or to link research data to a specific individual in any way. Anonymity is a powerful protection for potential research subjects. (An anonymous subject is one whose identity is unknown even to the researcher, or the data or information collected cannot be linked in any way to a specific person).

. Are subjects debriefed about the purposes, consequences, and benefits of the research? Debriefing refers to a mechanism for informing the research subjects of the results or conclusions, after the data is collected and analyzed, and the study is over. (If "no" explain why.) Attach copy of debriefing statement to be utilized.

***It is a requirement that you maintain all signed copies of informed consent documents for at least 3 years following the completion of your study. These documents must be available for examination and review by federal compliance officials.**

IX. <u>PROJECT INFORMATION</u>: (If you answer yes to any of the questions below, you should explain them in one of the paragraphs above)

Does the project involve any of the following?

es o

. Deception of subjects

. Shock or other forms of punishment

. Sexually explicit materials or questions about sexual orientation, sexual experience or sexual abuse

. Handling of money or other valuable commodities

. Extraction or use of blood, other bodily fluids, or tissues

. Questions about any kind of illegal or illicit activity

. Purposeful creation of anxiety

. Any procedure that might be viewed as invasion of privacy

. Physical exercise or stress

. Administration of substances (food, drugs, etc.) to subjects

. Any procedure that might place subjects at risk

. Any form of potential abuse; i.e., psychological, physical, sexual

- **Is there potential for the data from this project to be published in a journal, presented at a conference, etc?**
- Use of surveys or questionnaires for data collection
- **IF YES, PLEASE ATTACH!!**

X. SUBJECT INFORMATION: (If you answer yes to any of the questions below, you should explain them in one of the paragraphs above)

Does the research involve subjects from any of the following categories?

es o

- Under 18 years of age (these subjects require parental or guardian consent)
- Over 65 years of age
- Physically or mentally disabled
- Economically or educationally disadvantaged
- Unable to provide their own legal informed consent
- Pregnant females as target population
- Victims
- Subjects in institutions (e.g., prisons, nursing homes, halfway houses)
- Are research subjects in this activity students recruited from university classes or volunteer pools? If so, do you have a reasonable alternative(s) to participation as a research subject in your project, i.e., another activity such as writing or reading that would serve to protect students from unfair pressure or coercion to participate in this project? If you answered this question "Yes," explain any alternatives options for class credit for potential human subject volunteers in your study. (It is also important to remember that: Students must be free to choose **not** to participate in research that they have signed up for **at any time** without penalty. Communication of their decision can be conveyed in any manner, to include **simply not showing up** for the research.)
- Are research subjects **audio** taped? If yes, how do you plan to protect the recorded information and mitigate any additional risks?
- Are research subjects' images being recorded (video taped, photographed)? If yes, how do you plan to protect the recorded information and mitigate any additional risks?

CONFLICT OF INTEREST: Concerns have been growing that financial interests in research may threaten the safety and rights of human research subjects. Financial interests are not in them selves prohibited and may well be appropriate and legitimate. Not all financial interests cause Conflict of Interest (COI) or harm to human subjects. However, to the extent that financial interests may affect the welfare of human subjects in research, IRB's, institutions, and investigators must consider what actions regarding financial interests may be necessary to protect human subjects. Please answer the following questions:

es o

Do you or the institution have any proprietary interest in a potential product of this research, including patents, trademarks, copyrights, or licensing agreements?

Do you have an equity interest in the research sponsor (publicly held or a non-publicly held company)?

Do you receive significant payments of other sorts, eg., grants, equipment, retainers for consultation and/or honoraria from the sponsor of this research?

Do you receive payment per participant or incentive payments?

If you answered yes on any of the above questions, please provide adequate explanatory information so the IRB can assess any potential COI indicated above.

XII. PROJECT COLLABORATORS:

KSU Collaborators – list anyone affiliated with KSU who is collecting or analyzing data: (list all collaborators on the project, including co-principal investigators, undergraduate and graduate students)

Name:	Department:	Campus Phone:	Campus Email:
Audrey Holderness	**Communications and Agricultural Education**	**785-532-1192**	**audreyeh@ksu.edu**
Peter Tomlinson	**Agronomy**	**(785) 532-3198**	**ptomlin@ksu.edu**
Gerad Middendorf	**Sociology, Anthropology, and Social Work**	**(785) 532-4960**	**middendo@ksu.edu**
Lana Barkman **Amber Campbell**	**Agronomy** **Agronomy**	**(785) 532-6101** **(785) 532-3037**	**lanaann@ksu.edu** **archibbs@ksu.edu**

Non-KSU Collaborators: (List all collaborators on your human subjects research project not affiliated with KSU in the spaces below. KSU has negotiated an Assurance with the Office for Human Research Protections (OHRP), the federal office responsible for oversight of research involving human subjects. When research involving human subjects includes collaborators who are not employees or agents of KSU the activities of those unaffiliated individuals may be covered under the KSU Assurance only in accordance with a formal, written agreement of commitment to relevant human subject protection policies and IRB oversight. The Unaffiliated Investigators Agreement can be found and downloaded at http://www.k-state.edu/research/comply/irb/forms/Unaffiliated%20Investigator%20Agreement.doc

The URCO must have a copy of the Unaffiliated Investigator Agreement on file for each non-KSU collaborator who is not covered by their own IRB and assurance with OHRP. Consequently, it is critical that you identify non-KSU collaborators, and initiate any coordination and/or approval process early, to minimize delays caused by administrative requirements.)

Name:	Organization:	Phone:	Institutional Email:

Does your non-KSU collaborator's organization have an Assurance with OHRP? **(for Federalwide Assurance and Multiple Project Assurance (MPA) listings of other institutions, please reference the OHRP website under Assurance Information at: http://ohrp.cit.nih.gov/search).**

o

If yes, Collaborator's FWA or MPA #

es

Is your non-KSU collaborator's IRB reviewing this proposal?

o

If yes, IRB

es approval #

C. Exempt Projects: 45 CFR 46 identifies six categories of research involving human subjects that may be exempt from IRB review. The categories for exemption are listed here: http://www.hhs.gov/ohrp/policy/checklists/decisioncharts.html. If you believe that your project qualifies for exemption, please indicate which exemption category applies (1-6). Please remember that only the IRB can make the final determination whether a project is exempt from IRB review, or not.

Exemption Category: **45 CFR 46 101(b)(3)**

XIII. CLINICAL TRIAL ☐**Yes** ☒**No**

(If so, please give product.)

Export Controls Training:

-The Provost has mandated that all KSU faculty/staff with a full-time appointment participate in the Export Control Program.

-If you are not in our database as having completed the Export Control training, this proposal will not be approved until your participation is verified.

-To complete the Export Control training, follow the instructions below:

Click on:

http://www.k-state.edu/research/comply/ecp/index.htm

1. **After signing into K-State Online, you will be taken to the Export Control Homepage**
2. **Read the directions and click on the video link to begin the program**
3. **Make sure you enter your name / email when prompted so that participation is verified**

If you click on the link and are not taken to K-State Online, this means that you have already completed the Export Control training and have been removed from the roster. If this is the case, no further action is required.

-Can't recall if you have completed this training? Contact the URCO at 785-532-3224 or comply@ksu.edu and we will be happy to look it up for you.

Post Approval Monitoring: The URCO has a Post-Approval Monitoring (PAM) program to help assure that activities are performed in accordance with provisions or procedures approved by the IRB. Accordingly, the URCO staff will arrange a PAM visit as appropriate; to assess compliance with approved activities.

If you have questions, please call the University Research Compliance Office (URCO) at 532-3224, or comply@ksu.edu

INVESTIGATOR ASSURANCE FOR RESEARCH INVOLVING HUMAN SUBJECTS

(Print this page separately because it requires a signature by the PI.)

P. I. Name: Lauri M. Baker

Title of Project: An analysis of barriers and social constraints to adopting best management practices in grazing systems

XIV. ASSURANCES: As the Principal Investigator on this protocol, I provide assurances for the following:

Research Involving Human Subjects: This project will be performed in the manner described in this proposal, and in accordance with the Federalwide Assurance FWA00000865 approved for Kansas State University available at http://ohrp.osophs.dhhs.gov/polasur.htm#FWA, applicable laws, regulations, and guidelines. Any proposed deviation or modification from the procedures detailed herein must be submitted to the IRB, and be approved by the Committee for Research Involving Human Subjects (IRB) prior to implementation.

Training: I assure that all personnel working with human subjects described in this protocol are technically competent for the role described for them, and have completed the required IRB training modules found on the URCO website at:
http://www.k-state.edu/research/comply/irb/training/index.htm. I understand that no proposals will receive final IRB approval until the URCO has documentation of completion of training by all appropriate personnel.

Extramural Funding: If funded by an extramural source, I assure that this application accurately reflects all procedures involving human subjects as described in the grant/contract proposal to the funding agency. I also assure that I will notify the IRB/URCO, the KSU PreAward Services, and the funding/contract entity if there are modifications or changes made to the protocol after the initial submission to the funding agency.

Study Duration: I understand that it is the responsibility of the Committee for Research Involving Human Subjects (IRB) to perform continuing reviews of human subjects research as necessary. I also understand that as continuing reviews are conducted, it is my responsibility to provide timely and accurate

review or update information when requested, to include notification of the IRB/URCO when my study is changed or completed.

Conflict of Interest: I assure that I have accurately described (in this application) any potential Conflict of Interest that my collaborators, the University, or I may have in association with this proposed research activity.

Adverse Event Reporting: I assure that I will promptly report to the IRB / URCO any unanticipated problems involving risks to subjects or others that involve the protocol as approved. Unanticipated or Adverse Event Form is located on the URCO website at: http://www.k-state.edu/research/comply/irb/forms/index.htm. In the case of a serious event, the Unanticipated or Adverse Events Form may follow a phone call or email contact with the URCO.

Accuracy: I assure that the information herein provided to the Committee for Human Subjects Research is to the best of my knowledge complete and accurate.

(Principal Investigator Signature)	**(date)**

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Lauri Baker
Communications & Ag Ed
307 Umberger

Proposal Number: 7684

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 04/10/2015

RE: Proposal Entitled, "An analysis of barriers and social constraints to adopting best management practices in grazing systems"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: ii.**

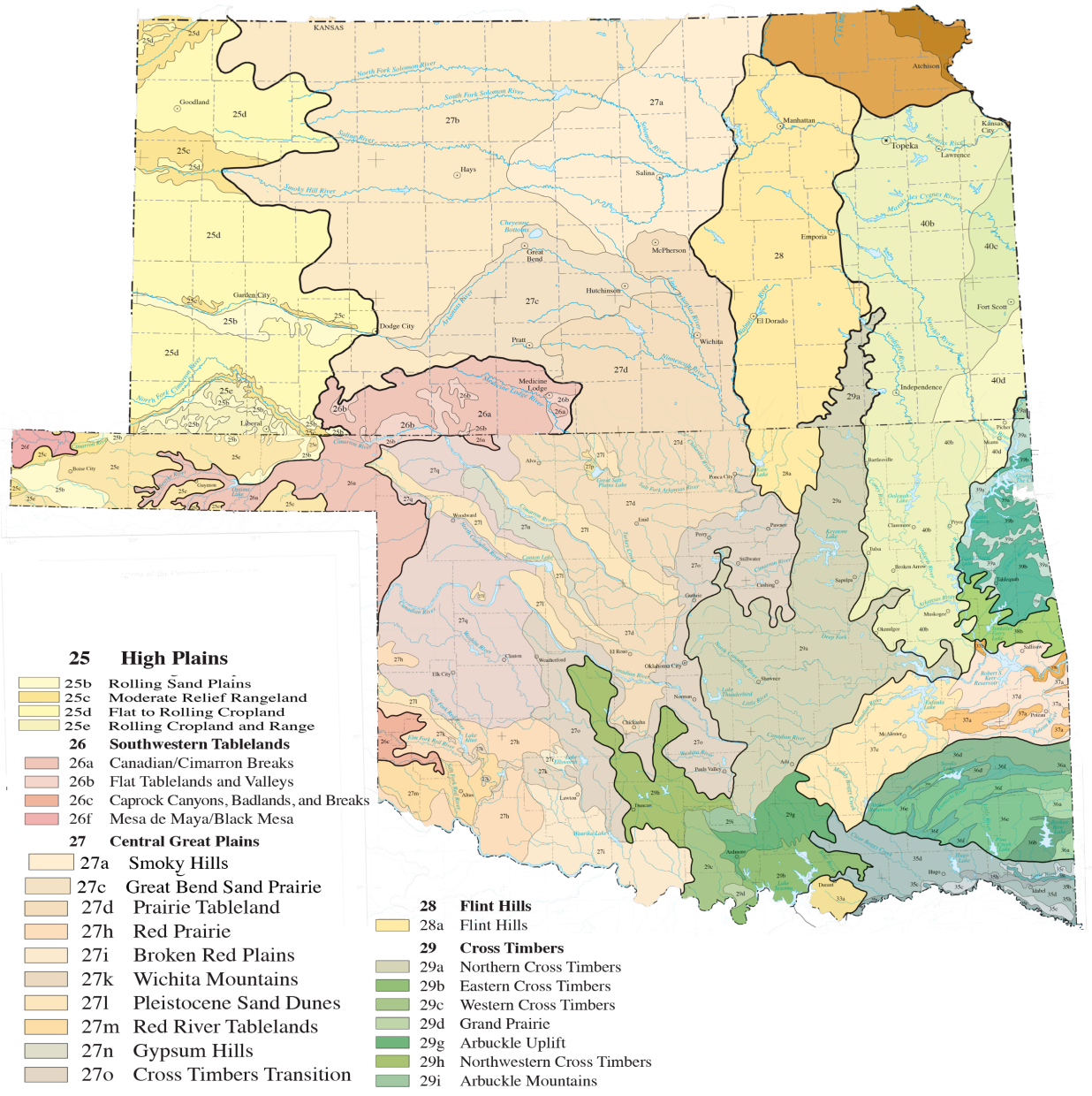
Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

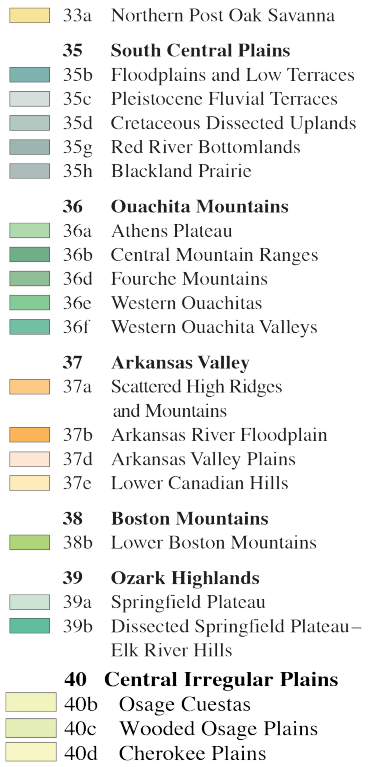
Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

203 Fairchild Hall, Lower Mezzanine, Manhattan, KS 66506-1103 | 785-532-3224 | fax: 785-532-3278 | k-state.edu/research/comply | comply@ksu.edu

Appendix C - EPA Ecoregion Maps

Figure 4. Study Area Ecoregions





26. Southwestern Tablelands

During the Permian Period several thousand feet of brick-red shales, siltstone, sandstones, and gypsum were deposited in this region. Erosion has exposed these deposits giving the region its characteristic red butte and mesa appearance. Unlike most adjacent Great Plains ecoregions, little of this region is in cropland and much of its elevated tableland area is in sub-humid grassland and semiarid rangeland. The region has many spring-fed streams, and stream bottoms tend to be sandy, and the water is more mineralized than in adjacent regions.

27. Central Great Plains

The Central Great Plains are slightly lower, receive more precipitation, and are somewhat more irregular than the Western High Plains (25) to the west. Once a grassland, dominated by mixedgrass prairie with scattered low trees and shrubs in the south, much of this region is now in cropland, with the eastern boundary of the region marking the eastern limit of the major winter wheat growing area of the United States. Subsurface salt deposits and leaching contribute to the high salinity found in some streams.

28. Flint Hills

The Flint Hills ecoregion is the largest remaining intact tall grass prairie in the Great Plains. This region is characterized by rolling hills composed of shale and cherty limestone, rocky soils, and by humid, wet summers. Average annual precipitation ranges from 28 to 35 inches. The Flint Hills marks the western edge of the tallgrass prairie. Erosion of the softer Permian limestone has left the more resistant chert (or flint) deposits, producing the hilly topography and coarse soils of the area. This rocky surface is difficult to plow; consequently, the region has historically supported very little cropland agriculture. The natural tallgrass prairie still exists in most areas and is used for range and pasture land. However, some cropland agriculture has been implemented in river valleys and along the periphery of the Flint Hills, especially in the northwest corner where the topography is more level. This northwest edge is transitional between the cherty, rocky soils of the Flint Hills and the silty, loamy, loess-formed soils of the Smoky Hills (27a).

Figure 4. The ecoregions in this study. Adapted from Chapman et al., 2001 and Woods et al., 2005.

Appendix D - Informed Consent

KANSAS STATE UNIVERSITY

INFORMED CONSENT

PROJECT TITLE:	An analysis of barriers and social constraints to adopting best management practices in grazing systems

APPROVAL DATE OF PROJECT: _____ EXPIRATION DATE OF PROJECT: _____

PRINCIPAL INVESTIGATOR: CO-INVESTIGATOR(S):	Lauri Baker, PhD: Audrey Holderness, Peter Tomlinson, PhD, Gerad Middendorf, PhD.
CONTACT AND PHONE FOR ANY PROBLEMS/QUESTIONS:	Lauri Baker, 784-532-1140, lmbaker@ksu.edu
IRB CHAIR CONTACT/PHONE INFORMATION:	Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.
SPONSOR OF PROJECT:	USDA/AFRI
PURPOSE OF THE RESEARCH:	The purpose of this study is determine the barriers and social constraints producers face in the process of choosing whether or not to adopt BMPs for grazing systems.
PROCEDURES OR METHODS TO BE USED:	In-depth interviews

ALTERNATIVE PROCEDURES OR TREATMENTS, IF ANY, THAT MIGHT BE ADVANTAGEOUS TO SUBJECT:

LENGTH OF 60-90 minutes

STUDY:	
RISKS ANTICIPATED:	No known risks
BENEFITS ANTICIPATED:	Producers will have the opportunity to share their experiences and opinions with the researcher. Although the responses of the participants will be confidential the findings will be used to help Extension improve communication strategies.
EXTENT OF CONFIDENTIALITY:	All interviews will be kept confidential and all recordings will be destroyed at the conclusion of the study. Interviews will contain gender-neutral pseudonyms and transcripts will remove any identifying information such as blog name and other specific details that could jeopardize participant confidentiality. The computer with the recordings will be kept in a file cabinet inside a locked room.
IS COMPENSATION OR MEDICAL TREATMENT AVAILABLE IF INJURY OCCURS:	No

TERMS OF PARTICIPATION: I understand this project is research, and that my participation is completely voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

(Remember that it is a requirement for the P.I. to maintain a signed and dated copy of the same consent form signed and kept by the participant

Participant Name: _____

Participant Signature: _____ **Date:** _____

Witness to Signature: (project staff) _____ **Date:** _____