Innovative Flint Hills cattle ranchers' decision-making regarding herd productivity and rangeland management practices: a qualitative study

by

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Abstract

Innovative rangeland management practices in the beef industry improve ecosystem health while benefiting herd productivity of a cattle ranching operation. Despite the proven benefits, some ranchers choose not to adopt these practices. The purpose of this study was to better understand Flint Hills, Kansas ranchers' decision making in balancing herd productivity and rangeland health. The Flint Hills region is the largest remaining tract of native tallgrass prairie in the U.S. and has a long history as grazing land for cattle.

Two conceptual frameworks were used to guide this study: Diffusion of Innovations Theory and Good Farmer Theory. Diffusion of Innovations Theory describes how innovations are adopted through specific populations over time. Adopter categories are innovators, early adopters, early majority, late majority, and laggards. Attributes of innovations are relative advantage, compatibility, complexity, trialability and observability. Good Farmer Theory analyzes the lenses through which producers view themselves and others as "good farmers."

Twelve semi-structured interviews were conducted with cattle ranchers in the Flint Hills region of Kansas who are perceived as innovators or early adopters in their rangeland management practices. Interview questions related to how producers view herd productivity and rangeland management practices on their operations; specific rangeland management practices they are currently utilizing or considering trying next; and the social constructs driving perceptions of good rangeland management in their communities.

Results show the innovative producers in this study utilize systems thinking in the context of economics and ecosystem, ecosystem and cattle, and ecosystem preservation as a necessity. Producers have an adaptive management style, utilizing visual evidence, regular adjustments, and input sensitivity, to make decisions regarding rangeland management on their

operations. Flint Hills producer interviewees' perceived benefits and barriers to current and potential rangeland management practices impact implementation of rangeland management practices. In addition, producer decision-making is impacted by multiple spheres of influence, including peer pressure, selective influence by ranchers and experts they respect, and shared stories and information gathering. Visual indicators and community norms are used by producers in this study to determine "good" rangeland management standards. Producers also use visual evidence and shared stories and information gathering to make informed decisions on how to manage their individual operations.

Future research in this topic area should explore how early majority, late majority and laggard Flint Hills producers perceive and make decisions regarding rangeland management practices on their operations. In addition, further research should dive into how producer decision making is impacted by influential organizations and Extension events. This study confirmed and expanded on how producer perceptions of rangeland management practices impact implementation on their own operations.

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Dedication

This study is dedicated to my grandma and grandpa, Ronnie and Kay Curry, who instilled a love of agriculture that runs generations deep. I am so thankful to have had such great examples of leadership, community service, and passion for producing food that led to my love for producer communications.

Chapter 1 - Introduction

Overview

Beef Industry and Grazing Lands in the United States

The U.S. beef cattle industry is the world's largest fed-cattle industry, with the U.S. also being the world's largest consumer of beef (Economic Research Service, 2022). There are estimated to be 700,000 cattle farms, ranches and feedyards throughout the country (Gosnell et al., 2021). The current U.S. herd was estimated to be 91.9 million cattle as of January 1, 2022. The average size beef cow herd is estimated to be 44 head (Economic Research Service, 2022). The beef production system can commonly be broken down into three sectors: cow-calf, stocker/backgrounder, and feedlot. Of these, cow-calf and stocker operations feed cattle on pasture (Gleason & White, 2019). In the U.S., beef cattle spend approximately two-thirds of their lives grazing rangeland not suited for crop production (Tribe, 2021). Therefore, cow-calf and stocker operations rely heavily on range and pasture forage conditions from grasslands (Economic Research Service, 2022). More than 90% of beef farms and ranches are family owned (Economic Research Service, 2022), and 78% of farmers and ranchers say they want to pass their operations to future generations, with 58% of operations being in the family for at least three generations (Beef Checkoff, 2018).

Rangeland, otherwise known grazing land, is defined as a type of land found mostly in arid and semiarid regions, managed as a natural ecosystem to support natural vegetation of grasses, grass like plants, forbs, or shrubs (Havstad et al., 2015). In total, the U.S. has approximately 770 million acres of rangeland (Forest Service Shield, n.d.), amounting to about 31% of the total land area (Havstad et. al., 2015). Privately owned range and pastureland equals more than 528 million acres or 27% of total acreage of the 48 adjoining U.S. states (Natural Resources Conservation Service, n.d.). The central U.S., or Great Plains, has approximately 321

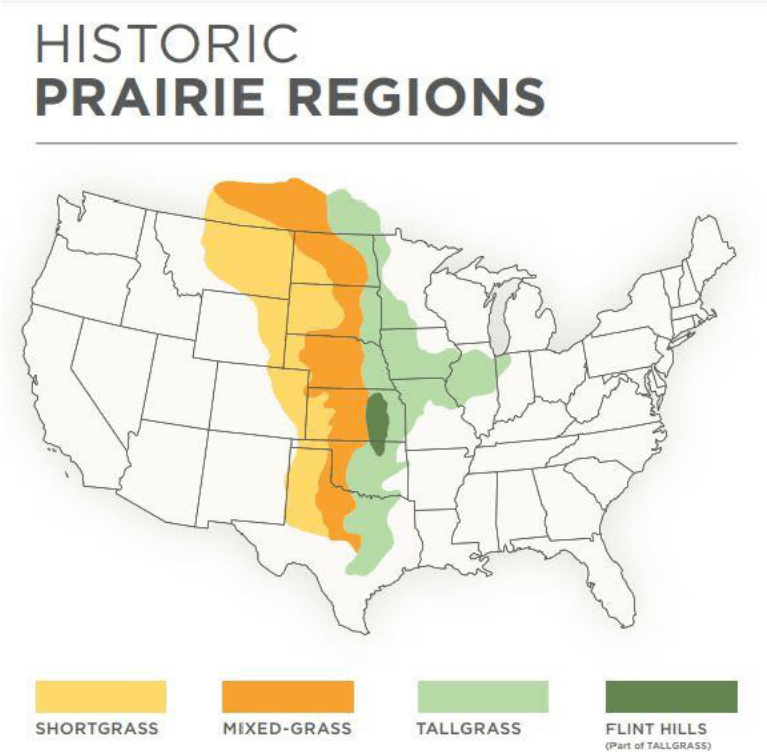
million acres in parts of 10 states (Klemm, 2020). Rangeland makes up about 50% of the total land area of the Great Plains, mostly consisting of grasslands. Since the start of European American settlement, livestock grazing has been the primary use for rangeland in the Great Plains (Encyclopedia of the Great Plains, n.d.). Grazing ruminant livestock on grassland is often the only viable form of agricultural production in these areas (Steiner et al., 2014).

The Kansas Beef Industry and Kansas Grazing Lands

Overwhelmingly, the beef industry is the single largest sector in Kansas agriculture, contributing approximately $14.8 billion and 66,789 jobs to the state's economy (Rumbaugh, 2021). There are more than 27,000 cattle farms and ranches in the state of Kansas (KSBeef, n.d.), with 6.5 million cattle on ranches and in feedyards within the state (Kansas Livestock Association, 2022). Kansas has the third largest number of cattle on ranches and feedyards in the U.S. (Kansas Department of Agriculture, n.d.).

About 17.5 million acres in Kansas, or approximately 33% of the state's land, in Kansas are comprised of rangeland and pastureland (Kansas State University Rangeland Research, n.d.). Within Kansas' rangeland acreage lies the largest remaining intact tallgrass prairie remaining in the U.S., the Flint Hills. The Flint Hills, illustrated in figure 1, spreads across east-central Kansas, extending from northern Kansas down into northern Oklahoma (Obermeyer, 2012). The Flint Hills provide over one million cattle with a forage source every year, due to the high productivity of the tallgrass prairie (Beam, 2010).

Figure 1.1. Map of the Historic Prairie Regions n.d. (from Flint Hills Discovery Center).



Rangeland Management Practices

The goal of rangeland management is "to develop economically viable, forage-based, beef-production systems for both cow-calf and stock operations" (*Rangeland Research, n.d.*, para. 1). There is high importance placed on assessment of range response to efficient forage conversion, including energy and protein supplements or planted forage to complement native range, and product and assessment of range response and sustainability (*Rangeland Research, n.d.*). Tools helpful to maintaining or improving range conditions include, but are not limited to, proper grazing management, prescribed burning, herbicide application, and reseeding (*Encyclopedia of the Great Plains*, n.d.). K-State Research and Extension suggests several best management practices (BMPs) for grazing, including setting proper stocking rates, controlling grazing distribution, utilizing planned periodic rest, prescribed burning, weed and brush

management, alternative forages, and managing fertility of grazing lands (King & Baker, 2018). According to Kansas State University's Rangeland Research webpage, goals of rangeland management and research emphasize developing economically viable, forage-based beef production systems within the state, by using many different techniques to establish the highest productivity and well-being for the cattle that reside on Kansas rangeland (*Rangeland Research*, n.d.). BMPs can help increase the overall sustainability of the environment, the cattle industry, and economies of rural areas as well as individual operations (King et al., 2017). The sustainability of beef operations must balance economic, environmental, and social concerns (Gleason & White, 2019).

Conservation Importance & Public Perceptions of Cattle Ranches

Only 4% of the original tallgrass prairie ecosystem in the U.S. is intact, with the largest remaining tract in the Kansas Flint Hills (*Flint Hills Discovery Center*, n.d.). While the public has some knowledge regarding livestock production, there is still a knowledge gap between producer and consumer (Rumble & Buck, 2013). This loss of tallgrass prairie, combined with a growing concern surrounding how the agricultural industry impacts the environment, has led to a push towards agricultural policies and programs to encourage conservation on producers' operations (Gillespie et al., 2007). In 1982, the U.S. Department of Agriculture Food Safety Inspection Service partnered with beef industry leaders to kickstart decades of improvement towards a healthy and environmentally conscious beef product to meet consumer concerns. This work would take shape in the form of the Beef Quality Assurance program, which includes metrics and indicators of sustainability (Gosnell et al., 2021). For beef production to improve, focus must be placed on improving land management, with a focus on increasing calf weight produced per unit of land while also considering conservation, biodiversity, and soil health interests (Gleason & White, 2019).

Producer Decisions

Producers consider a variety of factors when deciding whether to implement a new practice on their operation. Factors can include their perceptions of new practices, including if they are relevant or feasible (Campbell & King, 2022). Perceptions surrounding a practice are often determined by how producers learn about and experience the specific practice and its characteristics as well as the circumstances surrounding the individual producer in their social circles (Pannell et al., 2006). One of the most frequently cited reasons for non-adoption is lack of familiarity with BMPs or suggested lack of effective communication and outreach to certain populations (Gillespie et al., 2007).

Theoretical Framework Introduction

The two theories used to guide this study are the Diffusion of Innovations (DOI) Theory and Good Farmer Theory. DOI is defined by Rogers (2003) as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). Adopter categories are innovators, early adopters, early majority, late majority, and laggards. The five attributes of innovations, or factors contributing to likelihood of adoption, are relative advantage, compatibility, complexity, trialability and observability (Rogers, 1995). Good Farmer theory refers to how producers perceive themselves and other producers as "good" (Burton, 2020). According to McGuire et al. (2013), "A farmer's person, role, and social identities are complex, dynamic, and often context specific" (p. 58). Both theories can contribute to gaining a better understanding of innovative practice adoption in agricultural operations.

Statement of the Problem & Need for Research

For effective communication and promotion of new practices and technologies, outreach and Extension professionals must consider the farm and personal characteristics of those they are encouraging to adopt said practices (Campbell & King, 2022). While there have been significant

communications and outreach efforts to promote BMPs among beef producers, it is unexplained why some producers who are aware of more sustainable practices choose not to implement them on their operation (Gillespie et al., 2007). King et al. (2017) suggest future research address how producers process information related to BMPs as well as the social constraints associated with the adoption of BMPs. There is an opportunity to consider how the intersecting roles of place, animals, land, and objects impact the meaning of 'good farming' and associated identities among cattle ranchers (Burton et al., 2020).

Research needs to be conducted to better understand producers, their perceptions of their operations and current practices, and how they perceive potential practices so that outreach and communication efforts may help increase overall sustainability of beef cattle production moving forward (Campbell & King, 2022). Further research is needed on ways to enhance the adoption likelihood of practices and technologies, as BMPs seen as difficult or impossible to implement by producers will not help the beef cattle industry become more sustainable (Campbell & King, 2022). Moreland and Hyland (2013) also acknowledge a need for improved communications between developers or researchers and the end users in terms of innovative practices in the beef cattle production system. A producer's tendency to adopt a new practice can vary depending on their approach to how they manage their operations, their motivations, and their values; therefore, studying specific types of producers and tailoring communication efforts toward their specific wants and needs may increase adoption levels (Bohnet et al., 2011). Innovative producers are more likely to adopt rangeland management practices on their operations (Bohnet et al., 2011), so perhaps understanding their perceived motivations and barriers behind their management style will help improve communications regarding rangeland management practices to other producers with different management styles.

Purpose of the Study

The purposes of this study are to: 1) evaluate beef producers' perceived motivations and barriers regarding rangeland management practices, and 2) determine how different influences impact their decision making on their operations. The target population for this study was innovative and early adopter beef producers in the Flint Hills region of Kansas. By utilizing this population, the researchers aim to gain a better understanding of what practices innovative and early adopter beef producers are using and what factors influence their land and herd management. Gaining a greater understanding of how these producers view rangeland BMPs will allow communication and outreach professionals to better develop information on BMPs to present to non-adopters.

Research Objectives

The research objectives used to guide the study are as follows:

1. Determine how Flint Hills, Kansas beef producers connect rangeland management practices and herd productivity.
2. Discover Flint Hills beef producers' perceived barriers and benefits of innovative rangeland management practices based on Diffusion of Innovations factors of adoption.
3. Find common themes related to being a "good farmer" in the eyes of Flint Hills beef producers.
4. Analyze how producers connect the rangeland management practices being implemented on their operations and consumer perceptions of the beef industry.

Definitions of Key terms

Best management practices (BMPs) – practices agricultural producers can voluntarily adopt to better manage resources and mitigate environmental pollution (King & Baker, 2018).

Cow-calf operations – Cow-calf operations' main purpose is to maintain a herd of beef cows for raising calves. Most operations birth calves in the spring and raise them to wean at 3 to 7 months. After weaning, calves can move through the value chain in various ways (*Economic Research Service,* 2022).

Conservationist-minded Producers – the idea of being a "good farmer" that focuses on sustainable production and innovative practices (Phillips & Gray, 1995).

Early Intensive Stocking – a common practice that stocks young animals at a greater density for the first half of the growing season and then removes the animals for the last half of the growing season, allowing the early-season vegetation to be utilized at the highest nutrition levels (Owensby et al., 2008).

Fed-cattle – When cattle are fed grain, silage, hay and/or protein supplement to produce a USDA quality grade carcass that is Select or better for market (*Economic Research Service,* 2022).

Migratory Grazing – A grazing method where wildlife or livestock move along environmental planes to access resource abundance and escape areas of scarcity (Behnke, 2021).

Multispecies Grazing – also known as mixed grazing, this grazing method means having more than one species of livestock grazing on the same pasture (Nolan & Connolly, 1977).

Prescribed Fire – The purposeful burning of rangeland as a means of ecosystem management (Hiers et al., 2020).

Productivist-minded Producers – the idea of being a "good farmer" that relates to productivity, input sensitivity, and continuously increasing yields (McGuire et al., 2012).

Rangeland – otherwise known as grazing land, is a type of land found predominantly in arid and semiarid regions and managed as a natural ecosystem supporting vegetation of grasses, grass like plants, forbs, or shrubs (Havstad et al., 2015).

Rotational Grazing – Alternating periods of grazing and rest (or no grazing) by moving livestock between two or more subunits of pasture (Briske et al., 2011b).

Social Context – the specific circumstances or general environment that serves as a social framework for individual or interpersonal behavior. Context frequently influences the actions and feelings of individuals or groups that occur within it (American Psychological Association, n.d.).

Sericea Lespedeza – Scientific name *lespedeza cuneata,* an introduced perennial legume that is an invasive species known to invade and decrease grass production on rangeland and introduced pastures (Cummings et al., 2007).

Stocker/Backgrounding program – Calves may enter a stocker or backgrounding program after being weaned. In a stocking program, calves will graze on grass for 3 to 4 months before being moved to a feed lot (*Economic Research Service,* 2022). Backgrounding is extremely similar to stocking, with the potential addition of calves being moved to a dry lot and fed dry forage, silage, and grain (*Economic Research Service,* 2022).

Woody Encroachment – the aggressive increase in cover and dominance of native trees, shrubs and bushes increasing aggressively in grasslands and savannas globally, leading to grassland degradation (Ratajczak et al., 2012).

Limitations of the Study

The biggest limitation to this study is the fact that findings cannot be generalized to other populations or rancher types (Creswell & Poth, 2018). In addition, some producers initially contacted for the study were unable to be interviewed because of time constraints or unwillingness to participate. Producers were interviewed based on snowball and convenience sampling; therefore, it is unclear if the sample interviewed is truly representative of all innovative ranchers in the Flint Hills region.

Basic Assumptions

Researchers assumed the following in this study: each participant understood the purpose of the study, each participant answered questions with honesty and accuracy, each participant was an accurate representative of the target audience, and their response can be used to further the future of communication and outreach about rangeland management practices in the Kansas Flint Hills. The researchers also assume that ranchers involved with the Tallgrass Legacy Alliance fall into the innovator and early adopter categories within Diffusion of Innovations Theory, as researchers did not establish criteria that producers had to meet prior to interviewing. Additionally, the researchers assume the contacts provided by snowball sampling were within the target audience because we specifically asked them to provide contacts within the target region and who were a similar type of producer.

Chapter 2 - Review of Literature

Overview

The purpose of this chapter is to introduce the theoretical framework that guided this study and review current and past literature relating to the study's focus. The chapter begins with a summary of the conceptual framework, which includes Diffusion of Innovations Theory and Good Farmer Theory. After the summary of each theory, this chapter reviews literature regarding rangeland management, the Flint Hills ecoregion, sustainable beef production, herd productivity, producer management styles, and producer decisions and social systems in beef production and ranching.

Diffusion of Innovations Theory

Diffusion of Innovations Theory describes the process of how an innovation is adopted, the different groups of individuals who adopt an innovation over time, and the attributes of innovation which lead an individual to choose to implement it. Promoting an innovative practice or new idea can be difficult and may take several years from the time the innovative practice becomes available to when it is actually adopted. Diffusion is defined as the process of how an innovation is communicated through various channels to and among members of a social system over time. Innovation is defined as an idea, practice, or object perceived as new by an individual (Rogers, 2003).

While DOI research has been around since the 1940s, DOI Theory emerged as one of the first social science theories in 1962 (Rogers, 2003). One of the first pioneers of diffusion research was Gabriel Tarde, a French lawyer and judge who is regarded as laying the foundation for sociology and social psychology (Katz, 1999). Tarde used the word "imitation" to describe what is now known as "adoption." He found adoption of an innovation typically

followed an S-shaped curve of implementation once opinion leaders in a context began using the practice or innovation (Tarde, 1969).

DOI Theory can explain some of the variation in adoption of rangeland management BMPs. Categories producers fall into in terms of rangeland management practice adoption are innovators, early adopters, early majority, late majority, or laggards (Rogers, 2003). Innovators are known as venturesome, with the ability to understand and utilize complex technical knowledge. They may be managing differently than those in neighboring operations due to their adventurous nature and are more willing to accept setbacks that may come with new practice adoption. Early adopters are often more involved at a local level than innovators, and they may be known as the type which other producers check in with before adopting a new practice (Rogers, 2003). “In one sense, early adopters put their stamp of approval on a new idea by adopting it” (Rogers, 2003, p. 283). The other producer types, early majority, late majority, and laggards, are more skeptical of innovative practices and take on more of a “follow-the-leader" approach to practice adoption, sometimes with extreme caution and skepticism (Rogers, 2003).

Attributes of innovations, or factors that contribute to the likelihood of adoption, are relative advantage, compatibility, complexity, trialability and observability (Rogers, 1995). Relative advantage is how an innovation is perceived as being better than the idea it replaces, such as rotational grazing replacing more traditional grazing practices. Compatibility is how much an innovation is perceived as agreeable with a potential adopter’s existing values, past experiences, and needs. An example of compatibility is choosing management practices and calving seasons that agree with the operation’s already in place marketing strategy. Complexity is how difficult an innovation is perceived to understand and use; for example, managing sheep and goats along with cattle on the same land area. Trialability is how an innovation may be tested out on a smaller or limited scale or using a new management strategy on a single pasture before

using it on the entire operation. Observability refers to how visible the results of an innovation are to others (Rogers, 2003).

DOI Theory has been used to study disaster preparedness practice adoption in previous research (Coppock, 2020). Rural sociologists recognize that farmers' participation in local organizations can be directly tied to where they fall on the diffusion of innovations scale (Colman, 1968). This aligns with research that found ranchers use social networks to influence the innovation adoption decisions of their peers (Rogers, 2003; Toledo et al., 2014). To shift cattle producers' views of conservation topics, targeted outreach and policy efforts are recommended (Raynor et al., 2019). There is a need to develop communication strategies related to sharing information regarding barriers of BMP adoption (King et al., 2017).

Good Farmer Theory

Producers in the agricultural industry strive to live up to the idea of being a "good farmer," and their definition of this often varies with their ideals and experiences (King & Settle, 2021). The concept of a "good farmer" differs greatly from person to person, despite the fact their occupation and identity is typically closely linked (King & Settle, 2021). Some ideas central to producers' perceptions of each other include community participation, respectability, and farming ability. One overarching theme in the perception of good farming is a constant increase in productivity (Phillips & Gray, 1995). Another theme in good farming has to do with the idea of being a conservationist and putting higher emphasis on sustainability practices (King & Settle, 2021).

"Another possible area where the 'good farmer' may be affected is through the development of new communication technologies and social media platforms which could lead to dramatic changes in social interaction – both within the farming community and between farmers and non-farmers" (Burton et al. 2021, p. 164). This means that being a "good farmer" is

impacted by more than just perceptions within the farming community, but also consumers and institutions promoting food "quality" (Burton et al., 2021). Farming practices are better understood when viewed as a socially, politically, and culturally constructed operation for each specific producer and population (Phillips & Gray, 1995). For example, in the dairy industry, producers are interested in being viewed as a good role model and teacher (Wilmes & Swenson, 2019). Studies in recent years have been used to better understand producers' decision making and adoption behaviors. These studies have found adoption decisions are impacted by producer identity, specifically related to conservation decisions (Lequin et al., 2018; Sulemana & James, 2014; Van Dijk et al., 2016; Warren et al., 2016). Related to good farming, producers' preferred landscape visuals are closely tied to their understanding and implementation of management practices on their operations (Burton, 2012).

Rangeland Management

There is limited availability of additional land to be turned into grazing land for beef cattle without deforestation; therefore, increases in productivity rely on increased numbers of animals grazing per unit of land (Campbell & King, 2022). Well-managed grazing lands help maintain healthy soil nutrients and support everyday function of the land (Steiner et al., 2014), as well as encourage more productive or nutritious forages to allow producers to increase stocking rates and herd efficiency (Godde et al., 2017). It is imperative for producers to optimize management techniques that create positive impacts on the environment while minimizing negative effects. Grazing management and other rangeland management practices can benefit the land and environment in additional ways, including reducing invasive or encroaching species and minimizing habitat fragmentation (Steiner et al., 2014). Rangeland management practices that can increase sustainability and profitability for operations in the Southern Great Plains include rotational grazing, setting proper stocking rates, or animal unites per unit of land area, drought

management and improved watering systems (King et al., 2017). To set a proper stocking rate, producers must consider the carrying capacity, or a stocking rate that can be sustainable over a period of time for a given area of land. For sustainable cattle production on rangeland, the number of cattle and their forage demands has to be balanced with forage production, and recommended stocking rates for rangeland are based on the moderate utilization of range (Redfearn & Bidwell, n.d.)

One major threat to grasslands is woody encroachment (Briggs et al., 2002). Woody encroachment, or the spreading of trees and shrubs within perennial grasses, does have a negative impact on livestock production (Scholes et al., 1997), due to expected negative effects on grazing and productivity. To control woody encroachment, conservation management must be a collective effort among landowners (Walker and Salt, 2006). There are multiple other invasive species, like sericea lespedeza, or *lespedeza cuneata,* declared a noxious weed in Kansas in 2000 (Ohlenbusch et al., 2007). Sericea lespedeza damages pasture quality for both cattle grazing and wildlife (Alexander et al., 2021). Prescribed burning, or intentionally burning rangeland (Heirs et al., 2020), can be used as a management tool to control invasive species, and increase the nutritional value of native grass for cattle grazing (Liu, 2014; Kansas Department of Health and Environment, 2010; Twidwell et al., 2021).

Though rangeland management BMPs are known to be beneficial for the overall sustainability of an operation, researchers and Extension professionals' express frustration at the low levels of practice adoption among farmers and ranchers (Pannell et al., 2006). A study conducted with beef producers in Kansas and Oklahoma in the summer of 2014 found some of the barriers to adopting best management practices in grazing systems to be lack of land, lack of control, and time and labor constraints (King et al., 2017). Rangeland management practices,

such as setting proper stocking rates, can have a major impact on overall profitability of an operation as well as individual animal performance (Redfearn and Bidwell, n.d.).

The Flint Hills Ecoregion

Because of the shallow rocky soil, the land in the Flint Hills is not suitable for crop production (Sampson and Knopf, 1994). Therefore, the Flint Hills is still known as the largest unplowed region of tallgrass prairie in the U.S. The region is 60 miles wide, spanning from southern Nebraska to northern Oklahoma (U.S. Department of the Interior, n.d.). The Flint Hills is a temperate grassland with forbs and grasses (*Flint Hills Discovery Center,* n.d.). Historically speaking, the summer grazing season in the Flint Hills is a time-honored tradition, dating back to the mid-1800s when driving cattle from the Southwestern U.S. to markets in the eastern U.S. was prevalent (Anderson, 1953). Livestock grazing continues to be a common practice used throughout the native Great Plains prairies (Knapp et al., 1998; Di Bella et al., 2014), including the Flint Hills. Livestock that graze on rangeland rely primarily on the quality and quantity of forage produced for nutrition (Mulliniks et al., 2016).

Sustainable Beef Production

Beef sustainability balances economic, environmental, and social concerns (Gleason & White, 2019). BMPs must maximize both ecosystem services and farm profitability to provide economic and environmental sustainability to the operations choosing to implement them (DeLonge & Basche, 2018). While practice implementation may have an upfront cost, implementing BMPs has been shown to be economically beneficial over an extended period of time (Boyer et al., 2004). By increasing the sustainability and resilience of beef cattle systems, producers can in turn increase their production efficiency (Steiner et al., 2014). Sanders et al. (2002) found that BMPs are a realistic and effective way to conserve soil while improving productivity of land used for agriculture. Regarding managing sustainable beef, four areas of

concern include *herd productivity, producer management styles, producer decisions and social systems,* and *public perceptions.*

Herd Productivity

Productivity of agricultural animals is defined as the quantity and quality of production of an animal during a specific period, and can be determined by heredity as well as species, breed, and age as well as feeding and maintenance conditions (Farlex, n.d.). Cattle producers consider cattle well-being to be a top priority (Armstrong, 2018). Because cattle grazing relies on rangeland for a primary source of nutrition, rangeland management is essential to beef cattle production in native grassland areas like the Flint Hills (Grings et al., 1996; Grings et al., 2005). Factors influencing producer decisions on raising cattle come from many different sources including price fluctuations, gestation periods for cattle, and climate or grazing conditions (*Economic Research Service,* 2022).

Quality and composition of diet has been known to impact herd productivity (Godde et al., 2018). Because these cattle are mainly relying on rangeland, grazing management decisions can have a huge impact on diet quality, which can in turn lead to difference in weight gains (Plechaty et al., 2016). Innovations in the beef industry in terms of pasture management, such as rotational grazing or prescribed burning, are known to improve feed efficiency and reproductive efficiency (Moreland & Hyland, 2013). Utilizing more intensive grazing practices can increase livestock production per unit of land (Baulcombe et al., 2009). In addition, increasing reproductive efficiency has been directly linked to reducing costs per unit of product, or number of head, in an operation (Dziuk & Bellows, 1983).

Producer Management Styles

Management is defined as "the sum of decisions and actions made by a manager who then becomes the focal point of the success or failure of any program" (Dziuk & Bellows, 1983,

p. 355). Producers' management decisions are often based on a complicated combination of both long-term and short-terms concerns (Scarnecchia, 1990, Ritten et al., 2010). One study found three styles of management approaches: "Production Maximizers," who place their main priority on working hard on the farm and are less prone to share information, "Networking Entrepreneurs," who plan strategically to balance work and home life and enjoy sharing information through social interaction, and "Environmental Stewards," who place high importance on nature while still making a living (Brodt et al., 2006). Producer management styles may also vary based on how much they monitor the changing conditions on their operations as well as how often they modify management decisions or practices (Teague et al., 2013); Hawkins, 2017; Augustine et al., 2020). Augustine et al. (2020) researched grazing management with producer groups ranging from traditional rangeland management or nonadaptive management to collaborative adaptive management or adaptive management styles. Adaptive management uses a systematic approach to grazing management to monitor operation decisions and modify practices to benefit rangeland health and overall profitability (Brennan and Ehlert, 2021).

Producer Decisions & Social Systems

When considering a new BMP, producers undergo a decision-making process based on expectations and perceptions of rangeland management BMPs, which depend on a producer's individual characteristics and circumstances within their community and individually, as well as the characteristics of the specific practice (Pannell et al., 2006). In addition, Kennedy & Brunson (2007) found that an important influence on rancher's individual decision-making process regarding rangeland management practices are their personal and management goals for their operation. Adopters of BMPs typically have access to more information, are more highly diversified, and have greater resources to put towards rangeland management on their operations

(Gillespie et al., 2007). Characteristics of non-adopters include less contact with the Natural Resources Conservation Service (NRCS), less college education, and less dependence on beef as a major source of income (Gillespie et al., 2007). King and Baker's study suggests producers draw on their own and peers' experiences to make management decisions (2018). Gillespie et al. (2007) notes that research topics needing closer attention are the reasons for non-adoption and adoption rates of best management practices in beef production.

Public Perceptions

While the cattle industry relies on consumers to purchase beef products, there is often a knowledge gap between producer and consumer, with some consumers sharing inaccurate beliefs about the industry being inaccurate (Rumble and Buck, 2013). In order to increase the consumption of beef products, consumers must be provided with a product they consider desirable (Oesterreicher et al., 2018). Because consumer concerns regarding a sustainable beef product are growing, efforts to develop and encourage sustainable rangeland management have increased. This combined with agricultural companies' growing interest and commitments to source more sustainable beef has led to pressure for producers to implement more sustainable practices on their operations (Ahlering et al., 2021).

How Theories Relate to the Need for Research

Diffusion of Innovations and Good Farmer theories overlap related to rangeland management because existing suggestions for further research include how producers perceive grazing best management practices (BMPs) and what barriers relate to BMP implementation (King et al., 2017). Research regarding producer perceptions of relative advantage, compatibility, perceived complexity, trialability, observability, and riskiness of different rangeland management practices should also be investigated. This is because livestock producer beliefs surrounding the specific practice and the social norms around it may impact their likelihood to

implement it on their operations (Campbell & King, 2022). In addition, the concept of being a "good farmer" has been utilized to examine producers' decision-making behaviors throughout a number of different practices (Burton et al., 2021). Most studies regarding BMPs do not investigate the communications aspects of education and implementation or how producers process information associated with BMPs (King & Baker, 2018). Past research also recommends understanding how producers learn new information and who they seek out as information sources (Wilmes & Swenson, 2019). Most of the research studies mentioned above utilized semi-structured interviews to gain access to this information.

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Chapter 3 - Methods

Overview

The purpose of this study was to evaluate Kansas Flint Hills beef producers' perceived motivations and barriers regarding rangeland management practices and how different influences impact their decisions making regarding BMPs. This chapter provides an overview of the methodology used to conduct this study including the research design, population and sample, instrumentation, data collection, and demographic information collected from participants. The research objectives used to direct this study are as follows:

1. Determine how Flint Hills, Kansas beef producers connect rangeland management practices and herd productivity.
2. Discover Flint Hills beef producers' perceived barriers and benefits of innovative rangeland management practices based on Diffusion of Innovations factors of adoption.
3. Find common themes related to being a "good farmer" in the eyes of Flint Hills beef producers.
4. Analyze how producers connect the rangeland management practices being implemented on their operations and consumer perceptions of the beef industry.

To best address the research objectives, an in-depth understanding of producer perceptions regarding rangeland management and herd productivity was essential, so qualitative data collection methodology was used. A qualitative research design can be used to gain a more complex understanding of the issue and context surrounding this topic area (Creswell & Poth, 2018). Data collected from qualitative research can be rich information, with detailed and specific pieces allowing for a fuller understanding of the issue (Flick, 2009). The data for this study were collected during in-depth phone interviews with ranchers in the Flint Hills ecoregion of Kansas.

Research Design

This study followed a qualitative research design in order to produce descriptive data from participants' own words (Taylor et al. 2015). A qualitative approach to research was a good fit for this study because it aims at understanding how people view and experience the world around them (Corbin & Strauss, 2008). In addition, qualitative research is utilized when researchers want to understand contexts or settings within an issue in which the variables cannot be easily measured through quantitative research (Creswell & Poth, 2018). Qualitative methodology was used for this particular study because based on previous literature, a deeper understanding of decision-making factors regarding rangeland management practices is needed. Talking to producers directly about these issues allowed us to identify common themes and ideas among producers. We used a phenomenology approach, which describes common meaning between multiple individuals lived experiences of a phenomenon or concept (Creswell & Poth, 2018). Researchers chose phenomenology because we needed to deeply explore the thinking process behind producer decisions regarding rangeland management practices on ranching operations.

I conducted in-depth phone interviews with participants in the intended target audience: innovative and early adopter cattle ranchers with operations in the Kansas Flint Hills Ecoregion. In-depth interviews with semi-structured open-ended questions were utilized to allow for participant elaboration, as well as flexibility for me to obtain more information (Wimmer & Dominick, 2014). Follow-up and clarification questions were also asked as needed through interview questions covered topic areas surrounding rangeland management practices and herd productivity goals for producers' operations, perceived motivations and barriers of implementing rangeland management practices, and the social context impacting producer decisions. Interviews spanned from 20-60 minutes in length. See Appendix A for the interview guide.

Population & Sample

The target population of this study was beef producers implementing innovative rangeland management practices on their grazing operations within the Flint Hills Ecoregion of Kansas. We chose this population was chosen because the Flint Hills Ecoregion is known to be used for grazing beef cattle on natural tallgrass prairie. I planned to interview at least 10 individuals from this region. Creswell (2018) recommends using a group of individuals who have all experienced the phenomenon, meaning the group may vary in size from 3 to 4 individuals up to 10 to 15 individuals. The Kansas State University Institutional Review Board (IRB) approved this study prior to data collection.

We initially utilized nonprobability purposeful sampling, meaning we selected a population that would inform our understanding of the research problem (Creswell & Poth, 2018). We chose the Tallgrass Legacy Alliance (TLA) organization for initial participant sources. TLA is an organization created by local ranchers, agricultural and conservation organizations, and state and federal agencies with the purpose of preserving the tallgrass prairie in the Flint Hills (LLC, Outdoor Resources, n.d.). Roger Wells with TLA suggested initial participants for this study (R. Wells, personal communication), who were then initially contacted by email to gauge interest in participating. From these contacts, convenience sampling was utilized to determine participants, as any producer contacted could agree or disagree to participate. From there, snowball sampling was utilized, which means each producer interviewed was then asked to recommend fellow producers to interview who have a similar management style to their own (Etikan, 2016). Criticisms of snowball sampling include the fact that it is distinctly different from more probability-based sampling methods, and it relies on selection bias, thus it is dependent on a researcher's or participant's personal contacts (Parker et al., 2019). However, we justified utilizing this method as we were aiming to interview a

particular group of producers, specifically those who are perceived as being innovative with their rangeland management practices in the Flint Hills. Snowball sampling then continued until the interviews reached saturation, or the researcher no longer finds new information that adds to the understanding of the phenomena (Creswell, 2018). In this study, saturation was reached when 12 participants had been interviewed.

Instrumentation

Validity

To establish validity, I recruited two other peers, an advisor and a fellow graduate student, to assist in the coding process. By bringing in "someone who is familiar with the research or phenomenon explored" (Creswell & Miller, 2000, p. 129), the peers can review the data and help come to conclusions through peer debriefing sessions (Lincoln & Guba, 1985). Throughout the coding process, we each memoed each coding session, and multiple coding meetings were held throughout the coding process to compare findings and establish consistency throughout the data set. By participating in these methods, an audit trail was created, describing the research process from start to finish throughout the study (Flick, 2009). In addition, an undergraduate researcher was recruited to examine the data analysis process and findings to ensure findings were accurate and not skewed (Creswell & Poth, 2018).

Reliability

Reliability of the data was established by checking the coding software as well as checking definitions and cross checking the codes throughout the data analysis process. Reliability was assessed by utilizing intercoder agreement, or having multiple coders assign and cross check coding themes and categories throughout the research process. Multiple meetings were held throughout the research process in which the researcher and coding assistants discussed the data and ensured consistency in findings throughout the data set. We used

triangulation, or utilized multiple different sources, methods, investigators and theories, throughout the research study to provide evidence to validate accuracy of findings by using information from previous studies and other researchers to corroborate findings (Creswell & Poth, 2018). Following the conclusion of coding the data set, I followed up with two producers who were interviewed to discuss whether the themes found within the data set seemed like an accurate description, otherwise known as member checking (Rohling et al., 2016; Stebner, Ray et al., 2015; King & Baker, 2018). Interviewees contacted agreed that the themes discussed in Chapter 4 echoed what they felt to be accurate information for their producer group.

Data Collection

All data was collected from the phone interviews via audio recordings and interviewer notes from December 2022 to February 2023. The recordings were captured then transcribed using the professional transcription service, Rev. We assigned each participant a pseudonym, and all identifying information was removed from the interview transcripts for the purpose of confidentiality.

Demographic Information

To better understand characteristics of producers interviewed, the researcher asked questions regarding personal demographic information as well as characteristics of the interviewees' operation. Eleven interviewees were male. One interviewee was a male/female husband and wife team, considered a dyadic, or joint, interview, as they were both knowledgeable about the research topic and were interviewed together (Mavhandu-Mudzusi, 2018). Age of interview participants ranged from 34 to 74. Most interviewees identified themselves as the primary owners or co-owners of their operations, with one participant not stating his role and one stating he was a co-manager of the operation. Producers also indicated a range in years they have been ranching, with the newest producer indicating 10 years of

experience and the most experienced producer indicating 75 years of ranching experience. Half of the producers (n = 6) indicated 30-40 years of ranching experience. Table 3.1 identifies the sample (n = 12) and their personal characteristics.

Table 1. Personal Characteristics of Interviewees (*n*=12).

Code Name	Age	Gender	Role in Operation	Years Ranching
Cody	68	Male	Owner/manager	48
Conrad	34	Male	Not stated	10
Dylan	75	Male	Owner	75
Grant	38	Male	Co-owner	12
Jason	38	Male	Co-owner	38
Jay	74	Male	Owner	53
Justin	72	Male	Owner	43
Max	36	Male	Owner/manager	36
Nick	51	Male	Owner/manager	33
Seth	53	Male	Owner/manager	35
Skylar	52,51	Female, Male	Owner/manager	37
Tom	58	Male	Co-manager	35

Operation types within the sample were cow-calf (*n* = 4, 33.3%), both cow-calf and stocker (*n* = 4, 33.3%), cow-calf, stocker and feeder (*n* =2, 16.7%), and stocker (*n* = 2, 16.7%). Most interviewees indicated ranching as their sole source of income, with only one producer

stating that it was less than 100% of his income at 85-95%. Producers within this sample varied in the amount of land they own versus the amount of land they lease, with one producer stating he leased 100% of his land and one producer stating he owns 100% of his land. Total acres in their operation ranged from 3,500 to 23,000 acres. Head of cattle on their operations ranged from 500 to 9,500 head. Table 3.2 identifies interviewees' operation characteristics.

Table 2. Interviewees' Operation Characteristics (*n*=12)

Code Name	Operation type	% of income	Owned vs. Leased acreage	Total Acres
Cody	stocker	100%	10% owned	22,000
Conrad	stocker, cow calf	100%	100% leased	7,100
Dylan	cow calf	100%	80% owned	5,200
Grant	cow calf	100%	33% owned	15,000
Jason	cow calf, stocker	85 to 95%	25% owned	6,000
Jay	cow calf	100%	90% owned	2,200
Justin	stocker	100%	50% owned	12,000
Max	cow calf, stocker, feeder	100%	mostly owned	10,000+
Nick	stocker, cow calf	100%	33% owned	3,500
Seth	cow calf, stocker, feeder	100%	5% owned	23,000
Skylar	cow calf, stocker	100%	40% owned	7,000
Tom	cow calf	100%	100% owned	6,000

Interviewees indicated currently utilizing one or more of the following rangeland management practices: mechanical tree removal, spot spraying, aerial spraying, prescribed burning, patch burning, rotational grazing, mob grazing, early intensive grazing, bale grazing, collars or invisible fencing, multispecies grazing, migratory grazing, and supplemental feeding.

Data Analysis

We first reviewed the interviews to confirm proper transcription by the professional service, created pseudonyms, and removed all identifying information from each transcript. The research team of three used the software NVivo to code each interview. The process of data analysis included identifying codes, reducing codes to themes, and then relating the themes between each other (Creswell & Poth, 2018). Codes are used to label phrases or categories of information from participants that provide description and meaning to the researcher's inquiries (Creswell & Poth, 2018). Utilizing Glaser's constant comparative method (1965), we identified major themes and connections between transcripts.

Because this is a qualitative research study, the researchers' subjectivity should be analyzed and established before data analysis begins. This step provides insight into the perception of data analysis for readers as well as helps inform researchers of potential bias that may come up throughout data analysis, as done in previous research (Creswell, 2014; King & Baker, 2018). I, the lead researcher for this project, have degrees in animal science and agricultural communications and a strong passion for the beef industry and producer communication. I may have a positive bias towards producer operations and education. The advisor on this research study has a degree in agricultural communications and is actively involved in extension. She may have a positive bias towards extension and research related to natural resources and the environment. The research assistant recruited to help with this project

has a degree in environmental science and did not grow up around agriculture; therefore, he may have positive bias towards environmental issues. The undergraduate researcher recruited to check the themes coders found also has a background in the agriculture industry through her education, leading to potential positive bias towards it.

Transcribed interviews were coded by three members of the research team to look for common themes surrounding the following research objectives:

1. Determine how Flint Hills, Kansas beef producers' connect rangeland management practices and herd productivity.
2. Discover Flint Hills beef producers perceived barriers and benefits of rangeland management practices based on Diffusion of Innovations factors of adoption.
3. Find common themes related to being a "good farmer" in the eyes of Flint Hills beef producers.
4. Analyze how producers connect the rangeland management practices being implemented on their operations and consumer perceptions of the beef industry.

Summary

Throughout this chapter, the purpose of the research was restated, and the research objectives used to guide this study were discussed. Research design, data collection procedures, and participant demographic information were provided. In addition, I presented the methods of data analysis that were utilized and discussed the study's reliability and validity. In the next chapter, I present the results found for each research objective discussed in previous chapters.

Chapter 4 - Results

Introduction

The purpose of this study was to evaluate Kansas Flint Hills beef producers' perceptions regarding herd productivity and rangeland management, perceived barriers and motivations regarding practice implementation, and social context and community influences that may impact producer decision making. The research objectives utilized to guide this study are as follows:

1. Determine how Flint Hills, Kansas beef producers connect rangeland management practices and herd productivity.
2. Discover Flint Hills beef producers' perceived barriers and benefits of innovative rangeland management practices based on Diffusion of Innovations factors of adoption.
3. Find common themes related to being a "good farmer" in the eyes of Flint Hills beef producers.
4. Analyze how producers connect the rangeland management practices being implemented on their operations and consumer perceptions of the beef industry.

Throughout this chapter, we will discuss the findings of qualitative interviews conducted with innovative beef producers within the Flint Hills region of Kansas, and common themes that were established throughout these interviews. If at least half of the participants referenced the same topic in their individual interviews, this established a theme for the study.

RO1: 1. Determine how Flint Hills, Kansas beef producers connect rangeland management practices and herd productivity.

The main themes found for Research Objective #1 were *Everything is Connected* and *Adaptive Management*. Under the umbrella of *Everything is Connected*, researchers identified three sub-themes: *economics & ecosystem*, *ecosystem & cattle*, and *ecosystem preservation is a*

necessity. Within *Adaptive Management*, the three sub-themes that were identified were *visual evidence informs decision making*, *regular adjustments in management*, and *input sensitivity causes adaptive management*.

Everything is Connected

Participating interviewees view their operations from a systems thinking approach, meaning the way in which an individual can identify a system and realize how specific parts are connected and impact one another (Church et al., 2020). Cody, quoted below, discussed the factors that go into making decisions regarding rangeland management practices on his operation:

> There's a myriad of factors. The impact of what we're doing on the range land ecology, the impact of what we're doing on cattle and their productivity, back to, to put it simply, making money at it, besides being a good neighbor to our community.

In addition, producers recognize that an increase in ecosystem health and cattle health leads to a decrease in management stress, or, as Skylar can be quoted discussing, happiness. Skylar stated, "I guess one of the big motivations is the happier our cows get, the healthier they get, and the happier our cows get, the healthier our prairie gets, and the healthier we get, happier we get too."

Within the scope of *Everything is Connected,* three sub-themes were prominent: *economics and ecosystem*, *ecosystem and cattle*, and *recognizing ecosystem preservation as a necessity*.

Economics & Ecosystem

Many interviewees acknowledge that to have a sustainable ranching operation, there must be a connection between economic sustainability and environmental sustainability. When asked what his goals were related to herd productivity on his operation, Cody answered, "To be

economically viable, ecologically sustainable, that would be a pretty ... That would encompass practically everything." Expanding on this idea, Tom, quoted below, discussed the idea of both environmental and economic sustainability for a successful operation:

> But yeah, it's part of doing what's best for the interest of the soil health. And at the same time, the other side of the sustainability, is having the economic wherewithal to stay in business and if we can reduce our input, that's great.

In addition, several interviewees noted there must be a positive impact financially and environmentally for them to implement rangeland management practices on their operations. Grant, quoted below, discusses how he determines which rangeland management practices he implements on his operation:

> ...the way I see this is you have maybe the ecology component and then you have the financial component... Generally speaking, I know I think, in range land management, there's still enough low-hanging fruit, if you will, that the projects that work are the projects that can click both boxes at the same time. So, if you can match any ecological standpoint and then get better results financially for it, those are the things we're looking at.

To consider implementing new rangeland management practices producers have not tried before, several producers note interest coming from the potential for increased ecological benefit while reducing inputs. When asked about potential benefits of new rangeland management practices, Justin stated, "And so I guess you have an increasing interest on preserving the long-term viability of both the grass and the various animals, the birds, and insects and all that, that are out there, of preserving that. But at the same time, having an economically viable operation."

Ecosystem & Cattle

Along with the connection Flint Hills ranchers are making between economic and ecosystem decisions on their operations, interview participants also stated seeing a connection between healthier rangeland and an impact on herd productivity. Dylan, quoted below, discussed how their operation views wildlife as an indicator of rangeland health and in turn leads to higher herd productivity:

> And we're trying to, this may sound strange, but we're trying to measure the health of the ecosystem out there by the prairie chicken population, feeling that they're sort of an umbrella species and that if they thrive then the large herbivore [cattle] that's part of that ecosystem will also thrive.

According to some of the interviewees, a motivating factor or benefit to utilizing rangeland management practices is that herd productivity can be increased by healthier rangeland. Skylar noted that as a result of innovation, "I also think our reproductive rates are higher." When discussing managed rotational grazing, Grant, quoted below, noted how increasing grass productivity can in turn allow for more cattle grazing on the same amount of acreage:

> This is an opportunity to get the acres that have the potential highest animal units in them, one, back to the native biome, which satisfies some of the ecological things, but two, just gives us more animal units to graze. And so, that's what drives that decision. And I think that's a good decision. Like I said, I think that's how multiple, multiple influence spheres, if you will, get to have a win.

Tom also hinted at the concept of ecosystem health and herd productivity being connected when he stated, "Like I say, it's mainly to increase our pairing capacity and production, mainly the grass production. And that's what we're trending to do. And I think with

the proper management we can probably increase our herd by 50%," when discussing his rangeland management goals.

Another area discussed by interview participants during the decision-making process is the idea of balance or finding a "happy medium" in the management of the ecosystem and cattle. Jason, quoted below, discussed this process at length:

> ...here's the thing, I always feel like there's a happy medium between what's good for the land and what's good for the cattle... But that thick tallgrass is great, but it doesn't have near the protein quality in it that say the short grass is going to have after it was just burned. So I don't know, a tall pasture full of a lot of legumes, and forbs might be another rancher's nightmare because he is going to see pink eye and less nutritional grass. And so I don't know, I'm kind of just in between. I sacrificed a little on my cow side for the native prairie, but I do know that I am making a conscious sacrifice I should say, by doing that.

Ecosystem preservation is a necessity

The third sub-theme under *Everything is Connected* researchers found through participant interviews is the idea that innovative Flint Hills ranchers recognize preserving the natural ecosystem is directly connected to their operations' continued survival. While the two previous sub-themes recognize that management decisions have a direct impact on ecosystem health and herd productivity, this subtheme shows interviewed producers acknowledge they must preserve the land and ecosystem they are operating on, or they will no longer be able to run cattle on it. Justin recognized this concept when discussing how the land could be utilized otherwise when he stated, " ...if one can increase the economic viability of utilizing native grass as native grass, then that reduces the chance that it's going to be killed and converted the crop land."

When asked what motivated him to start rangeland management practices on his operation, Grant, quoted below, stated:

> Survival, honestly. So, I would say our first large scale implementation of anything that was really positive, other than maybe an NRCS project here or there, but managed rotations on all grass all summer long was probably one of the biggest things we did, I think, in terms of seeing a boost that we could measure. We started that in the last drought in 2012, not because we wanted to but because we had to. And then, as it started raining again, we saw that we were seeing enough good things that we kept going. So, that's kind of how that started. Now, in terms of tackling the woody species that we're doing, it's the same deal. I don't see us being able to just go buy more acres to grow because land is incredibly frustratingly high for somebody of a younger generation. So, we've got to do better with the acres that we already own or control, not just go find more.

Conrad echoed the sentiment of lack of land and acknowledging that producers must take proper care of the acres producers they have access to:

> Well, they're not making any more of it, any more land. I mean, at the end of the day, I mean, it's our job to be able to try to leave this better than it was, for future generations. And in order to do that, one, of course we got to stay in business, and we got to be profitable. And two, we've got to take these lands that are frankly degraded substantially from what would've been generations back, or before settlement. And we've got to try to get them back into a healthy functioning state, because they will continue to degrade.

Flint Hills ranchers also note disaster preparedness is a necessity to taking care of the land. Max discussed the idea of being able to handle disastrous conditions without going under financially because of his meticulous attention to rangeland health: “Goals have been, number

one is drought preparedness. I like to be prepared in that situation so that when that happens, I'm able to withstand it without greatly affecting my cash flow or the business's cash flow."

Adaptive Management

The second theme that emerged from participants regarding how Flint Hills producers connect rangeland management practices and herd productivity was the idea of adaptive management. Adaptive management is a strategy used to manage complexity and should use flexibility and feedback to inform producer decisions on their operations (Derner & Augustine, 2016). Producers in this study indicated utilizing adaptive management styles when making decisions regarding rangeland management on their operations. One example of this is when Skylar stated:

> [We] are really fluid and flexible on that, which would be we move around and shuffle around just according to what the plants need, the animals need, the wildlife needs. We're just in a state of flux all the time.

Max also indicated utilizing an adaptive management style when he stated:

> My yearlings won't be on the same pasture every year. My yearlings will move to different pastures. It's more what I have going on, what I've got bought, what I've got cows that need to go, I just shuffle things around and make them work.

Conrad, quoted below, discussed a specific example of an adaptive management style in this statement:

> And so she's able to take soil samples for us and look at the biology of the system, the microorganisms that we have there and what should be there, based on intact healthy sites. And those can help determine what kind of interventions we need to make, as far as our grazing management. And that goes back to graze period. Does it need more rest? Does it need less rest? Impact is, do we need to just stack them on there at higher

densities and lay more of that material down? If we have a lot of rank grass that's choking out the ability for solar energy to be captured in the new materials, we will generally want to go through there with a larger number of cattle, or at least in higher densities, to knock the forage down.

Within *Adaptive Management,* the three sub-themes that emerged were *visual evidence prompts informs decision making*, *regular adjustments in management*, and *input sensitivity causes adaptive management*.

Visual Evidence Informs Decision Making

According to this study's interviewees, innovative producers utilize visual evidence to make informed decisions to evolve the rangeland management practices on their operations. Conrad discussed in detail one example of using visual evidence to determine soil health on his operation:

> And one way we'd like to look at that is, we'll get down and we'll pull back the litter matter that's laying on the soil surface and we'll see if, as we pull back that layer of litter and get down to the soil, there should be a slow transition from full leafs, all the way down the smaller, and smaller, and smaller particles as you get closer to soil surface until you can't see the difference basically between the plant particle and the soil humus itself. And that breaking down of that material as the material breaks down, that breakdown is being done by those soil microbes and that's that recycling of nutrients. So, if we're not seeing that breakdown of litter, if that litter is just building up over the years, then that shows that we've done something to negatively impact us, particularly the fungal population in the soil and there's a lot of things that could be causing that.

Producer interview participants discussed using visual evidence on their own operations to determine whether they are meeting their goals related to rangeland management and

ecosystem health. According to several producer interviewees, seeing success is a key motivator for continued rangeland management practice implementation. When asked about what motivated him to continue rangeland management practices on his operation, Seth reaffirmed this idea when he stated, “When I see if it works.” Jason, quoted below, discussed the continued motivation he found from witnessing the diversity of plants increasing on his operation through rotational grazing:

> My main goals are the species of grasses and forbs and legumes. I want to see more and more of those. And when we first started rotational grazing, that was the first thing we saw was a lot of these forbs and different plants that the cattle really liked, they never got a chance to express themselves. And once we started to rotate around, we noticed that they were, and they were getting more and more prevalent. And that was a good, encouraging sign, which kept us wanting to do that.

When asked about continued motivation to implement and continue utilizing rangeland management practices on their operations, some producers discuss the idea of seeing progress as a key motivator. Tom recognized visual evidence of success as a driver of continued rangeland management in the below statement:

> Seeing progress. This last year, we've got three pastures that are located kind of out by themselves with a total of 400 acres. This year we put 68 pairs out there and I was thinking, "Oh, that's way too many." We did our rotation, weaned some very nice calves off of there and still had great looking grass. So, it gives me hope that this, I mean, we're seeing a little success there.

Regular Adjustments in Management

As a part of their adaptive management styles, many interviewees indicated making regular adjustments to the day-to-day operations of their ranch. Some producer participants, like Cody, quoted below, discussed how making adjustments allows them to meet their goals:

> We've modified some of those practices and tweaked them a little bit. I would say we have not completely materially changed everything, but we sure have changed a few things. And, I think that's helped our success also, is not just doing one thing is trying to change things around.

Max, quoted below, specifically discussed his management plan related to prescribed burning and how it changes from year to year depending on the specific needs:

> I don't burn and I like burning and I'm not against burning at all, but I don't do it every year on the same ... I should rephrase that. Sometimes I do it every year on the same pasture if I have a certain thing I'm trying to eliminate and I'll do it. But I try to burn everything at least every third year. And some pastures all burn three years in a row if there's a lot of problems with other things.

While meeting their goals was indicated by interviewees as an area of importance, others also stated the importance of meeting the needs of both the land and cattle under their management. Skylar discussed staying flexible with their rotational grazing plan to balance ecosystem, wildlife, and cattle needs in the statement below:

> …most of the grasslands around us are not given appropriate rest times. And so there's always a set stocking rate or a set amount of days, grasses, everybody grazes no matter what. And [we] are really fluid and flexible on that, which would be we move around and shuffle around just according to what the plants need, the animals need, the wildlife needs. We're just in a state of flux all the time.

Conrad, quoted below, also noted the direct impact management style can have on what he calls ecosystem function, and how they take that into consideration on their operation:

> ...we're more focused on what you might call ecosystem function. So we're really focused on function, or another word would be rangeland health assessments. So we're looking at how much precipitation are we capturing? Are we seeing a lot of runoff? A lot of reels or inner reels developing on the landscape from water moving off the land instead into the soil. And management has a major impact on that. And so we can adjust management if we don't have a good ground cover.

Input Sensitivity Causes Adaptive Management

The third sub-theme that emerged from Flint Hills producer interviews was input sensitivity causing adaptive management. Producers in this study noted being extremely aware of inputs and consciously lowering inputs through adaptive management decisions. For example, when describing his operation, Jason stated, "...we just try to keep the inputs, like everybody else, as low as we possibly can, compared to when we sell our cattle." In addition, Grant described his goals related to herd productivity as "low-cost fertility," and Justin stated, "Dominantly having the cheapest possible cost of gain."

Some producers credit the reason they are so input sensitive as profitability being the driving factor behind the other decisions they make for their operations. When asked about potential benefits of implementing rangeland management practices, Nick, quoted below, offered a specific example of making decisions keeping lowering financial inputs in mind:

> If we can keep the sericea out, and not have to spend money on spray... Sprays cost me 35 bucks an acre, and I don't have to spend 35 bucks an acre to spray, that's money back in my pocket. And the sheep then, even if they break even, I'm still making money.

When asked what factors he considers when deciding what rangeland management practices to implement on his operation,Tom, quoted below, discussed a specific instance of making management decisions to lower cost inputs:

> Fence is not cheap. That's why we're looking at other ways especially in some of our Riley County pastures where it's nothing but rock. It's incredibly expensive to build fence over there and almost impossible to put up electric fence.

Skylar also discussed utilizing adaptive management to lower inputs when they stated:

> We try to intervene as little as possible. We use cattle and fire as our primary tools for range management, both management of time and access of cattle for the range, and fire applied at different times of the year and the different intervals. And then what we can't achieve with that, we will supplement with some other interventions like tree removal or brush control.

Summary of Results for RO1

When determining how Flint Hills, Kansas beef producers connect rangeland management practices and herd productivity, the common themes we found amongst interviewees were *Everything is Connected* and *Adaptive Management.* This means producers in this study indicated an understanding of the connection between finances to ecosystem health to herd productivity. In addition, several participants indicated using a flexible, adaptive management style to make decisions on their operations.

RO2: Discover Flint Hills beef producers' perceived barriers and benefits of rangeland management practices based on Diffusion of Innovations factors of adoption.

Producer participants were asked questions specifically relating to the rangeland management practices they had considered trying but have not yet implemented. They were also

asked about the perceived barriers and benefits of implementing rangeland management practices on their operations. Barriers and benefits are analyzed below based on the Diffusion of Innovations Theory specific factors of adoption, also called attributes of innovations: *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability* (Rogers, 2003).

Innovative practices producers in this study noted they were interested in trying were virtual fencing or collars, migratory grazing, fall burning, intensive rotation, multispecies grazing, summer burning. Some producers said they were not interested in trying new practices that they were not already using.

Relative Advantage

Relative advantage is how an innovation is perceived as being better than the idea it replaces (Rogers, 2003). Regarding the barriers related to relative advantage of rangeland management practice adoption, some producers indicated inputs versus reward as the biggest limiting factor. Skylar discussed this idea when they stated, “Money is almost always the limiting factor, just if we have enough money to start a new enterprise or to implement some practice.” Nick, quoted below, stated a specific instance of consideration of implementation regarding rotational grazing:

> The rotation, even on 90-day cattle, has made a huge difference in gains and the pastures. And as I say, I'd like to do more of that. It just doesn't always work to do, just doesn't always work, because you've only got [cattle] out there for 90 days, so it's hard to spend the money to move the waters and do the infrastructure stuff that you might need to make that easier, more accessible. And then if it's on leased land, you really don't want to spend a lot of money on leased land putting in the infrastructure. So those are some concerns.

Other producers noted the idea of there needing to be a cost-benefit ratio to consider implementation. Justin, quoted below, discussed this concept specifically relating to mob grazing in the following statement:

> The high intensity where you have a huge amount of paddocks and mob grazing and move cattle every few days, have experimented with some of that, and then absolutely did not think there was a cost-benefit ratio for doing it.

Regarding the benefits relating to relative advantage, producers in this study noted the benefits of fewer inputs or stress reduction because of implementing new practices on their operations. For example, when discussing benefits of migratory grazing, Skylar stated, “It's also improved our health and happiness as well. We're horseback, enjoying our ranch and enjoying happy, healthy cattle instead of building fence or working on stuff like that.”

Some producers noted the relative advantage benefits to adopting new practices in terms of ecosystem health or improved productivity. Cody stated, “I think the [practices] that we haven't tried, where we would hope that it would improve range land health and productivity while still being financially viable.” In some cases, producers in this study noted actually deciding to implement innovative practices because of the relative advantage they hoped it would bring their operation. For example, when asked what factors he considers when deciding what rangeland management practices to use, Nick stated:

> A lot of it's based on cost. The sheep came into the equation trying to eat some weeds and the sericea lespedeza, so we don't have to spray. That's kind of where we got onto the sheep. And then the 90-day, it's mostly based on all about the money. The 90-day cattle is the biggest, quickest return for the least amount of labor. And then if I leave enough grass, I can run back in there in the fall or winter with some other stockers and almost get a second season out of those pastures. So that's why we do what we do.

Max discussed the relative advantage of lowered chemical costs and better range health related to multispecies grazing:

> The big benefit is when you're used to spending a hundred thousand on chemical and if you could cut that out and actually return that as a positive into the operation, you could return $50,000 positive or $20,000. Any positive number, that's a huge benefit, if that makes sense. That's probably the biggest one is trying to cut back the chemical, just from a financial side that is. And then the other one I think would probably just health of the range and little less chemicals would be better to cut out. I would like to see different species that we can eliminate pretty hard in there. I'd like to have some more legumes and different things in the pasture to help make that better, get better water usage put down. And all those animals put down more fertilizer on the ground. Anything you're putting out there that's an animal and eating something that's just putting it back down. So that would be a definite benefit.

Grant discusses the relative advantage of a fall burn:

> The fall deal, I'd like to see it in terms of controlling woody encroachment. I think that's probably the biggest threat we have in the Flint Hills at the moment is woody encroachment, even more so than say old world blue stem. And so, that would be the benefit there.

Compatibility

Compatibility is how much an innovation is perceived as agreeable with a potential adopter's existing values, past experiences, and needs (Rogers, 2003). When discussing the barriers to compatibility of practice implementation on their operations, some producers discussed the culture or peer pressure behind making certain rangeland management practice

decisions, which relates to social compatibility. Grant, quoted below, discussed this concept relating to fall burning in the below statement:

> So, the fall burning, the barrier would be getting more people on board. Flint Hills generally is a culture burn community. And so, we don't burn a section of grass when we burn. We might go burn 30 or 40,000 acres. And that's part of the reason why we've had so much success burning is because it's such a... burning watersheds, sharing fire from past fence lines. The same reason that it works in the spring, and we have so much success in the spring are going to be why it would maybe be more difficult in the fall because especially in stocker grass, I don't know if there'd be enough regrowth yet to carry a fire, let alone if they want to fall burn a lot of yearling grass.

While not specifically discussing fall burning, Conrad also discussed the barriers related to prescribed burning on his operation related to social norms in this statement:

> I mean, even with burning pastures, I mean there's a lot of outfits that will try to almost require that you burn your pastures, because of that extra cattle gain they get, without ever asking, "Does the landscape actually need it and is it the best thing for the health of the system on that particular year, in that particular circumstance?" So, there's a lot of outside pressures from cattle owners, at least when you're custom-grazing other people's cattle.

Another issue with compatibility on their operations discussed by some interviewees was lack of labor to help implement a practice. Seth reflected this idea when he stated, “And we've tried bringing in goats and sheep. The main issue I got there is labor.” Max also noted labor as a barrier to practice implementation when he stated, “There's other things I'd like to try, but I'm just not prepared to put out that much extra labor at this point in time.”

Grant, quoted below, discussed in particular how changing his calving season would impact his entire operation's marketing strategy, being that he is a seedstock producer, meaning the change would not be compatible with his operation:

> The yearling, the changing the calving season, the implement would be because we sell seed stock, we have a fixed marketing window. So, for example, I know I market my bulls the third Friday of March. That's how it's been. That's how our customers are trained. If we move to more of like a summer type calf, we would have to drastically change that. And so, that's why that one's a little stickier.

When looking into benefits of innovative rangeland practices related to compatibility, Seth discussed how practices being compatible with his operation and ecosystem impacts adoption:

> Well, I mean the rotational graze deal is kind of the pastures that's got oil field damage or former farmland pastures that are more or less going back or fields that end up leasing that somebody's been ran off of. You can sure speed up the recovery of the grass with the rotational grazing versus either a short season or I guess you'd say a continuous stock deal.

When asked about the benefits of migratory grazing, Skylar discussed the compatibility of the practice with the wildlife and ecosystem:

> The wildlife is free to behave in their normal behaviors and they aren't constricted by fencing or activities that would disturb them usually. Certainly, water has changed too. The cattle loaf less at water sources, and they tend to water sequentially, and then travel on to other areas and loaf in other areas, upland areas, which is certainly better for the prairie. They are depositing fertility up in high spots and not loafing and loitering in high fertility areas around water.

Complexity

Complexity is how difficult an innovation is perceived to understand and use (Rogers, 2003), for example, trying to reboot the herd instinct in cattle to reduce the amount of fencing in an operation. The complexity of different practices was commonly discussed by interview participants as a barrier to practice implementation, with several producers feeling a lack of knowledge might potentially lead to failure. Knowledge, skill, and technical details can all relate to the complexity of an innovation. When asked about barriers to rangeland management practice implementation, Jason discussed this concept at length:

> I would say the biggest barrier is always time and probably time and knowledge. Just knowing what practices, you do and how they're going to affect other parts of the ecosystem and plant communities and animals and things like that. I don't ever remember really getting taught about all the different parts of the prairie area that this animal used or that animal used.

Another example of need for knowledge can be seen when Max, quoted below, discussed interest in implementing multispecies grazing on his operation:

> And probably the other thing on that would be skill. My knowledge of small ruminants and poultry especially and stuff like that is so far away. The learning curve is just ... I'm not at that. And I suppose that's probably a major thing for us is just all that would lead into labor along with it. Having the knowledge and the labor and then economically whether it'd be worth moving into that segment.

When discussing the complexity of innovative rangeland management practice implementation, Skylar discussed how reducing the complexity of how they manage their cattle has benefited their operation:

> Skylar and I, our management, like we were talking about how we manage the grass cattle numbers, everything, is we do it by watershed. It's more of a bigger picture than just separate pastures. And so, we've removed interior fence in a lot of the places. And so, we have big, long pastures with water points along the way for more migratory grazing so the animals move on grazing paths and things like that. We're implementing some of those techniques as well. And it seems to be better for water, wildlife, our animals, everything.

Trialability

Trialability is how an innovation may be tested out on a smaller or limited scale (Rogers, 2003), or using a new practice on a single pasture before using it on the entire operation. Some producers indicate a lack of ease of trialability as a barrier to certain rangeland management practice implementation. For example, Cody discussed the difficulty to undo certain practices should he choose to use them: “Some of the barriers are fear of financial problems. In other words, we do something on a pretty large scale, and it doesn't work, that it might take a lot of finances to, quote, unquote, ‘fix it.’”

When specifically discussing his interest in multispecies grazing, Max noted this issue with being able to trail run this practice because of a lack of time and labor the below statement:

> The small [ruminants] have been on my back of my mind for few years, but there's a lot of holdups to those. Our acreage all lays in basically two chunks. They're about 12 miles apart, but they're all pretty much all connecting. But that's good. But that's probably been the hardest part. I wouldn't mind trying something like that, but at this point I don't ... If the right person was involved, I would maybe reconsider it, but it seems like a stretch to move out into that, especially time wise. I do the majority of the daily work just by myself. So, adding more to that, that's a zero. That's not happening. We don't have the

time for that. There's also chickens and stuff. I've always thought those interested me as to how people can incorporate that whole system together. But it's nothing I'm ready to dive into just due to labor shortages probably.

Justin also noted an issue with trialability because of lack of labor and time to put into what it takes to make these practices successful in the below statement:

> That tends to work better if somebody has a lot of free labor, either their own or their kids. But for us, on our scale, and there's normally about 7,000 acres of pastureland actively managed, some of the stuff is a little bit further out and I'd probably rent that out. But for our pastures, I mean, currently there is about 70 miles of barbed wire fence. And if we are going to go in and set up electric fences and move them every few days, you're talking about 4, 5, 6 miles of fence. And the electric fence that has to be set up and taken down every few days.

Observability

Observability refers to how visible the results of an innovation are to others (Rogers, 2003). Observability was less indicated by interviewees as a barrier to implementation of new practices. Grant was one producer who noted in his interview when discussing potentially implementing new practices that, “If I saw somebody else do it and it worked, I'd maybe consider it.”

In addition, Justin gave a lengthier answer to needing to see successful intensive rotational grazing for his type of operation before he considering implementing when he stated, “Some people are and such, but I'm just not aware of people that have done this long term, on a larger scale, than they were accounting for their unpaid labor costs.”

When discussing the benefits of innovative rangeland management practices regarding observability, some producers in this study note hearing or seeing the benefits of different

practices. For example, when discussing the potential benefits of multispecies grazing, Jason noted:

> Oh, for sure, just the reduction in spraying. And that's a huge thing. I've heard people say that that is definitely something they've noticed. And for sure the marketing selling of them, they're tremendously valuable. So, they're basically able to produce a lot more with a lot less land.

Skylar also discussed benefits of innovative rangeland management practices in terms of observability when they stated:

> We've seen other operations that have successful sheep enterprises. I don't know... But I mean, everything's just based on being profitable and sustainable, I guess.

Summary of Results for RO2

As we discovered innovative Flint Hills beef producers perceived barriers and benefits of rangeland management practices based on Diffusion of Innovations factors of adoption, we analyzed interviewees' responses related to *relative advantage, compatibility, complexity, trialability,* and *observability.* Producers considered the relative advantage of new practices when discussing implementation, along with compatibility and complexity. Participants referenced trialability and observability less often or did not reference them.

RO3: Find common themes related to being a "good farmer" in the eyes of Flint Hills beef producers.

Regarding what it means to be a "good farmer" in the eyes of Flint Hills beef producers, three themes were identified: *Preservation/Stewardship, Positive Visual Indicators of Rangeland Management,* and *Influence*. Under the theme *Preservation/Stewardship,* two sub-themes were identified as *future-focused* and *appreciation for place.* Within the theme *Positive Visual Indicators of Rangeland Management* the sub-themes identified were *free of invasive species* and

vegetation condition. In the theme *Influence,* the sub-themes identified by researchers were *peer pressure, selective influence,* and *shared stories and information gathering.*

Preservation/Stewardship

Throughout innovative Flint Hills producer interviews, participants discussed the idea of preserving the land, or being a steward. When discussing stewardship of the land, preserving the ecosystem was seen by producer interviewees as a large component. Justin confirmed this idea when he stated, "And so I guess you have an increasing interest on preserving the long-term viability of both the grass and the various animals, the birds, and insects and all that, that are out there."

Conrad, quoted below, elaborated on the idea of reviving the ecosystem to a healthier state utilizing rangeland management practices:

> I am a grass nerd, and I don't think we've begun to even really realize what all the potential is in these grazing practices, that are not centered around the idea of trying to sustain something but really trying to rejuvenize it and bring it back to a much higher functioning level.

Within the theme of *Preservation/Stewardship,* two sub-themes were identified: *future-focused,* and *appreciation for place.*

Future-focused

The second sub-theme under the umbrella of a preservation or stewardship mindset, indicated by producer interviewees, was the idea of being future-focused, or looking past their own operations to future generations of their own family or further down the line.

For example, Cody discussed the idea of living longer to achieve what he considers ideal land condition:

> I guess personally, I feel like we're not near where we want to be yet, but we want to keep trying to do better, I guess you could say. I don't think I'll live to be 120, but maybe if I live that long, I could get things the way I want it.

Along with several other producers, Justin noted the idea of taking good care of the land when he stated, “Preserving the resources for future generations is extremely important. And probably, as I get older, it's an increasing importance. And so, where you would not be breaking anything out, and you want to preserve the grass.”

While several producers noted the idea of preserving the land for future generations, multiple other interviewees went into specifics, discussing the idea of specifically leaving the land for their children to take over. For example, Nick stated, “Well, I'll try to take as good care of the land as we can and leave it better than we found it, for our kids to take over the operation.”

Because some producer interviewees indicated a deep want to pass the land on to their children, they noted the importance of both profitability and maintaining a healthy ecosystem. Conrad goes into detail on this concept:

> Well, they're not making any more of it, any more land. I mean, at the end of the day, I mean, it's our job to be able to try to leave this better than it was, for future generations. And in order to do that, one, of course we got to stay in business, and we got to be profitable. And two, we've got to take these lands that are frankly degraded substantially from what would've been generations back, or before settlement. And we've got to try to get them back into a healthy functioning state, because they will continue to degrade.

Grant expanded on this concept in his interview as he discussed that whether or not his children choose to come back to the operation, he wants to leave his operation in a condition where that is possible:

> ...there is this marketplace component, obviously, because these ranches are businesses. And I always wanted people to think of it in those terms, but two, especially in those terms, I have four younger kids. I don't know if they want to come back or not. But if it is to be an option, the Flint Hills have to be intact. And even now, we have aerial photos of what trees looked like even 30, 40 years ago to what they are now. And it's a problem. It's a problem. So, there's also that. If we want it to be around, we have to take care of it.

Appreciation for place

Along with wanting to preserve the Flint Hills for future generations, multiple interview participants noted a deep appreciation for the Flint Hills and the land, leading them to make more environmentally conscious decisions regarding rangeland management. Tom affirmed this idea when he stated, “We're passionate about the land. We love the Flint Hills.” Dylan also discussed his love for the land when he stated, “So the Flint Hills makes you appreciate the perfect grass cattle grazing environment. It's a summer grazing place. It's kind of the ideal situation for cattle.”

Because interviewees indicate an appreciation for the land and the Flint Hills region, several of them recognize the issues facing the region today, making upkeep and restoration crucial. For example, Conrad acknowledges his ranch's one-of-a-kind situation in this statement:

> And I think it's hidden more here, the degradation and the breakdown of the function of this ecosystem. But it's happening and it's happening rapidly, and it's going to catch up to us one day and you'll reach a point where it's going to be hard to preserve what we have here, which is extremely unique. I mean, it's the last major remnant of the tallgrass prairie in North America. And so, it's worth protecting and it's worth showing to everybody, to the world, what it's capable of doing and how it can function.

Jason added to this sentiment of appreciation when he discussed the wildlife diversity of the landscape of the Flint Hills in this statement:

> And then the more you're out in nature and the more you're learning about the different animals and bugs and plants and this and that, you just have more of appreciation for them. So, you want to see them more and more and more and encourage them as much as you possibly can to have a great little ecosystem out there. And you just appreciate it once you know what you're looking for. That I would say would be my primary motivation for just trying to preserve this beautiful landscape that we've got the privilege of trying to take care of.

Positive Visual Indicators of Rangeland Management

Visual indicators are one way that producer interviewees perceive operations and how a manager is taking care of their land, both on others and their own operations, to determine whether they are a "good" manager or producer. When asked specific questions, producers noted several areas of how they assess the condition of the rangeland, including: *free of invasives* and *vegetation condition.*

Free of Invasives

One indicator of good rangeland management, according to interviewees, is a "clean" landscape, or natural rangeland free of invasive species. When asked what he likes to see in a pasture, Tom stated:

> I like to see an undisturbed stand of native grass. Yeah, we'll drive by some places that have been well managed in our neighborhood. Some ranches have been here since the 1850s. If I'm giving a tour to someone, I'll point theirs out and say that's what it's supposed to look like.

Dylan echoed the same sentiment when he stated, “I think the neighbors, when they drive by, notice how clean and open our prairie is. How much it looks like the prairie did in 1890.”

Some producers also indicated good visuals in a pasture to be a specific lack of invasive species. Justin confirmed this idea with the statement keep:

> To not see seeded trees and regular tree and brush invasion. To not see Sericea lespedeza and such. And to not see a lot of weeds, bad weeds, out in the pastures, which would be an indicator of poor pasture management.

In addition, Grant noted the importance of controlling invasives as a part of good rangeland management when he stated, “Not seeing a bunch of little cedar trees... seeing the things... not seeing cedar trees, seeing the invasive under control with a little bit of grass left behind. That's probably the eyeball test, I guess, if you will.”

Vegetation Condition

Another visual indicator of good rangeland management, according to some interview participants, is the condition of the vegetation. Some producers indicated vegetation height and others discussed plant diversity. Dylan discussed this idea when he stated:

> Well, I think I like to see a pasture evenly grazed. I like to see not a concentration of cattle on the southern end of pastures where the pasture gets grazed down heavier. You'd like to see it managed that way so that doesn't happen.

Jay discussed the idea of not grazing a pasture too short when he stated:

> Well, I like to see some growth at the end of the growing season. There still needs to be plant growth still there when the cattle are gone. Didn't all go in the cow's belly. Take half and leave half.

“Take half and leave half” was also discussed by Nick, who described grass condition as the biggest indicator of good rangeland management:

Okay, so certain times of the year... I guess right now, when I drive by a pasture and there's quite a bit of forage left, that's an indicator that they're not over grazing and taking care of that pasture. That's probably the biggest indicator of what I consider good management, leave half and take half, and they're at least leaving half in the pasture.

Influence

The third theme we identified related to how producer interviewees view a "good farmer", refers to the spheres of *Influence* impacting how they make management decisions on their operations. Within this theme, we discovered three sub-themes: *peer pressure, selective influence,* and *shared stories and information gathering.*

Peer Pressure

When asked questions about if or how neighboring producers impact their management decisions, some interviewees acknowledged peer pressure as a factor. After stating he believes peer pressure is important to maintaining good management practices on his operation, Jay elaborated on why there is a need to be perceived as a good manager with the statement, "Peer pressure. A good manager is a good person. One and the same, in this community or in agriculture. It's Puritanical but it's true."

Other producers discussed how they wanted their land to appear to neighbors as they drove by, stating positive visual indicators they strived for. Nick, quoted below, discussed this concept in detail:

> I guess, part of us all wants to have the best pastures and the cleanest and the nicest looking place, just for pride's sake. But also, in our country, a lot of this ground... There's a lot of leased ground. We lease a lot of ground. And so, if the landlords are out driving around or looking, you want them to be happy with what they see also. And so yeah, you kind of want your place to look as good or better than the neighbors, if you can.

Jason also discussed visuals on his operation as a point of concern for what his neighbors will think of him and his management style when he stated:

> Yeah, I don't want them to see an overgrazed short stubble pasture. And I'll be honest with you, sometimes after we do a fall fire for the Sericea control and it grows back short, and then we go in the wintertime, it'll look like an overgrazed pasture. And if they didn't know that's what we did, I've had my own friends, we've been driving around and they've pointed out, "oh boy, look at that pasture. They overgrazed the heck out of that." And I had to educate them on what had happened and why it looked that way and there's a reason for it. So yeah, I worry about what the neighbors think. I think that that's that peer pressure to take good care of your land, but also having a good plan lets you get around. It's just going to look like that and they're going to scratch their heads this year, but hopefully your plan will work out and in a few years down the road look better.

While researchers did not ask specific questions regarding perceptions of owned versus leased land for ranching operations, some producers acknowledged a difference in how the land is taken care of, or the added or lack of peer pressure that comes from managing their own land versus managing leased land. For example, while Jason, quoted below, acknowledges that people who own their land might be more mindful of ecosystem health and preservation, he discussed how taking good care of leased ground often influences future landowners to work with him:

> People who own their land are going to be leaning more towards taking it easier, more conservationist minded, I would assume. Not all of them, but I would assume they would be thinking that way. And people that are typically renting are going to be more concerned with their side of the situation, which is their bottom dollar and the cattle health. And I've honestly aimed more towards the conservation just all around. And what I've noticed is that's gotten my foot in the door a lot with future leases just because they're

seeing that I'm running the pastures that I lease as well, if not better, than my own pastures that I own. And that's really kind of just without words shown and impressed them. But yeah, you see all sides to it.

Selective Influence

Another aspect regarding the influence behind being perceived as "good," according to some producers, indicated giving selective respect to producers or sources of information who interviewees admire and trust. For example, when asked if his neighbors influence how he manages his land, Cody stated, "It depends on the neighbor. People I really respect and value their judgment, then I do consider what they say and think. It would be a select group." Skylar indicated being influenced by certain local producers in the statement:

> Definitely. I mean, not necessarily the next-door neighbors, but we've definitely started visiting with other producers in our region that do some of the practices we do and that manage things more the way we do. We get a lot of good information through interaction like that.

Jay discussed wanting people who he respects to think highly of his management when he stated, "People you respect, I want them to have a positive thought when they go by. Certainly not a negative."

Other producers noted sources of information outside of their local producers as influencing how they manage their day-to-day operations. Justin, quoted below, reflected this idea when asked if interactions with his neighbors influence how he manages his operation:

> Maybe not neighbors, per se, but some good friends of mine that are experts about pasture management, be it the people with The Nature Conservancy, or there's a [name] with the Tallgrass Legacy Alliance and such. And there's some rangeland specialists connected with the Extension service. And so, it's input from those people, the people

> that are professionals or very knowledgeable about pasture management. And that's what I listen to, hard. But as far as neighbors, it would hardly come up in the conversation with neighbors, I guess.

Shared Stories and Information Gathering

An idea that continued to emerge throughout interviews related to ranchers making decisions about rangeland management practices based on stories shared by local producers or those who producers admire. Conrad, quoted below, discussed the value of listening to the experiences of producers who have been managing land in the Flint Hills their entire lives:

> I especially like talking to some of the old timers that have been around for a long time, and they can talk back to the way things look throughout their life, good and bad. I mean, there's an immense amount of knowledge to anybody that's lived in this landscape their whole life. Whether or not you think their country looks very good or not, they can tell you how that soil type, or how that hillside responds to drought, or to fire, or to any number of factors. So, I mean, there's all kinds of good tidbits of information, and perspective, and context, that people can provide. Generally, the overall practices that they use may not really appeal to us in general, but their site knowledge is invaluable.

Specific stories were also noted as instances that changed how interviewees thought about land management. For example, Dylan shared a story from his neighbor regarding drought preparedness:

> I've got a neighbor when he says that the best time to prepare for the next drought is when you're in the middle of an existing one. Meaning that we've got a chance to go in and clean out the silt and ponds when they're dried up, clean it out so that they'll hold more water the next time we get rains, that kind of information sticks and we follow it.

In addition to neighbors or local producers, some participants noted field days or organizations as great places to share stories and learn about different management styles. When asked if neighbors have influenced his management decisions, Cody discussed field days specifically as a source of information:

> I guess I get more, a lot of information, I guess you could say, from field days. I get a lot from the different kinds of field days, also from publications, talking to people at different meetings, and seeing what other people do, maybe not your neighbors, but maybe just a little farther removed, and then some neighbors that I feel like do an excellent job.

Justin reaffirmed using different sources of information to share information and gain knowledge in the statement below:

> Well, when you're at around 43 years and you hear from neighbors of what's going on, and then also, there's information about the importance of preserving our native grass. Up in Manhattan, that Flint Hills Discovery Center. And then there's the Tallgrass Prairie, about 50 miles south of Manhattan, 20 miles south of Council Grove. And there are several organizations celebrating and encouraging knowledge about the native grass.

Summary of Results for RO3

Common themes related to being a "good farmer" in the eyes of Flint Hills beef producers were *Preservation/Stewardship* mindset, *Positive Visual Indicators of Rangeland Management,* and spheres of *Influence* producers indicated impacting their management decisions.

RO4: Analyze how producers connect the rangeland management practices being implemented on their operations and consumer perceptions of the beef industry.

"Seeing is believing"

The last question interview participants were asked regarded public perception of cattle operations like their own. When asked, "So far in our conversations, we've really just been talking about neighbor ranchers and pasture owners. Not everyone gets to drive by and see the pastures cattle are raised on. What connections do you make between our conversation today and the public's perception of the beef industry?" interviewees answered this question in multiple different ways and facets, but one theme emerged. This is the idea that "seeing is believing."

Some producer participants' answers suggested that the closer the public is to cattle ranching operations like theirs, the more knowledgeable they are about rangeland management practices. For example, Cody, quoted below, discussed the fact that locals likely had a higher opinion of cattle ranching operations than those who live further removed:

> The farther away we get from where we are, I think it's hard for the public to understand what we're doing. Their perception of what we're doing, if they live in Kansas, it's obviously different than if they live farther away. So, I would say the perception, people understand what we're doing fairly well locally, probably not as well as we get farther away. And, I don't know how to define farther away, but I think the local people understand it pretty well.

Other producer interviewees discussed the concept that many people more removed from production agriculture think of cattle operations as large, commercial operations. Jason, quoted below, discusses the visibility of feedlots in this statement:

> It's an interesting thing. Cattle get a very nasty light shined on them due to environment issues or things like that. And the truth's always somewhere in between. If all you drove by and saw was feedlots, then you would think all cattle are feedlots. But at the same time, if it wasn't for cattle, there would be no need for native range pasture, which gives tremendous amounts more wildlife habitat than say a plow field is, currently right now. So, I wish there was that connection being made.

Jay, quoted below, also noted the sentiment of public perception leaning towards the larger, commercial operations, but then expanded and discussed the idea that family farms, or operations represented by the ranchers interviewed in this study, are less easily viewed by the public:

> I think the public perception of the beef industry is, in many ways, the large commercial operations. And they're a lot more sympathetic to the family farm. They're not as visible. You can't smell them. So, I think there's both out there, but over the years, when the media has said that family farms are in trouble, the public opinion has been very favorable to the family farm.

Supporting the theme of increasing public visibility, Conrad stated, “We've got to be able to show that grazing livestock are not the enemy.” One way two producers, Nick and Skylar, noted their attempts to tackle this issue was through offering agritourism encounters for the public. Nick, quoted below, discussed his experience with offering an Airbnb to the public and the opportunity that presented for them to see a cattle ranching operation up close:

> So, my wife runs an Airbnb at our place, and so we have a lot of people, I say a lot, from towns, that just want to come out for the weekend, relax. And so, it's important to make it look as nice as we can to let them know that we're trying to take care of things... Just trying to do the best we can, so that when somebody from the outside that doesn't know

what we're doing can look at it and think these guys are doing a good job and taking care of things.

Summary of Results for RO4

Producers in this study recognize “visibility” as a factor impacting the public’s perception of cattle ranching and the beef cattle industry. Thus, *Seeing is Believing* emerged as a common theme among interviewees, suggesting that the public seeing or gaining access to ranching operations could improve public perceptions of the cattle industry, specifically ranching.

Chapter Summary

This chapter discussed themes and sub-themes we found during interviews with innovative Flint Hills cattle ranchers. These results are further assessed to provide conclusions and recommendations for agricultural communications practitioners and extension professionals as well as future research in the next chapter.

Chapter 5 - Conclusions and Recommendations for Practice & Research

This study gave insight into producer perceptions regarding rangeland management practices and herd productivity and provided context to social structures surrounding how innovative Flint Hills beef producers make decisions. The four research objectives used to guide this study were as follows:

1. Determine how Flint Hills, Kansas beef producers connect rangeland management practices and herd productivity.
2. Discover Flint Hills beef producers' perceived barriers and benefits of innovative rangeland management practices based on Diffusion of Innovations factors of adoption.
3. Find common themes related to being a "good farmer" in the eyes of Flint Hills beef producers.
4. Analyze how producers connect the rangeland management practices being implemented on their operations and consumer perceptions of the beef industry.

Discussion

To gain a better understanding of innovative Flint Hills cattle ranchers' decision-making process regarding rangeland management practice implementation on their operations, we asked producers a series of questions related to their rangeland management and herd productivity goals, perceived barriers and benefits of rangeland management practices, and the social context and community norms that make up their environment. We then used producers' answers to these questions to develop themes related to the research objectives. If at least half of the participants referenced the same topic in their individual interviews, this established a theme for the study. Conclusions based on overarching themes are presented in the following sections.

RO1: Determine how Flint Hills, Kansas beef producers connect rangeland management practices and herd productivity.

Producers in this study showed that they utilize systems thinking on their operations to make decisions regarding rangeland management practices. This is unsurprising, as Schiere et al. (2004) found that processes in the agricultural industry can often be explained by using a systems thinking approach, meaning that all parts in a system or operation are connected and impacted by their context. However, not all agricultural producers are systems thinkers (Church et al., 2020). Management decisions must be beneficial, from economics to cattle health, for producers in this study to consider them effective and continue to implement. If producers in this study sacrificed any of these areas, whether that be cattle health or productivity, ecosystem health, or finances, they noted being self-aware of what they were giving up to gain in another area. This aligns with Diffusion of Innovations Theory literature suggesting that innovators have the ability to understand and utilize complex technical knowledge (Rogers, 2003). Producers in this study also recognize the importance of maintaining and rejuvenating the Flint Hills ecoregion, which is not surprising given the fact it is the largest remaining piece of natural tallgrass prairie in the U.S. (U.S. Department of the Interior, n.d.). If interviewees want to continue running their operations in the Flint Hills, they view land, and grass, preservation as a necessity. Good Farmer Theory's conservationist mindset places a high value on taking care of the land as a way of weighing whether a producer is "good," whereas a productivist mindset focuses on a constant increase in productivity (Burton et al., 2021). Because producers in this study balance ecosystem preservation with a major focus on input sensitivity, they use both mindsets when making decisions on their operations as well as assessing their peers.

Because producers in this study are using a systems-thinking approach to their operations, they are often using an adaptive management style. Adaptive management is

described as a systemic approach to management (*Adaptive Management*, n.d.). In adaptive management, "Managers act with the expectation of the action resulting in specific impacts. They must, therefore, have and be using mental models or conceptualizations that at the very least contain cause–effect relationships'' (Lynam and Stafford Smith, 2004, p. 69). Derner & Augustine (2016) noted that rangeland ecosystems are typically varied in resource availability, and in turn an adaptive management style is both crucial and challenging to handle for producers. In addition, utilizing adaptive management may allow producers to improve rangeland health, herd productivity, and operation profitability by allowing flexibility to changing conditions from year to year (*Adaptive Management*, n.d.).

As a part of their adaptive management style, several producers in this study use visual evidence to make informed adaptive management decisions for their operations. This aligns with findings from King & Baker (2018), as they found that producers process information through visual evidence. They also found that high-level adopters in the study preferred visual observations (King & Baker, 2018), which agrees with this study, as the intended interviewees were producers who are perceived as innovative in the Flint Hills. By using visual evidence of success or failure, interviewees adjust their current practices to what best suits their goals related to both rangeland management and herd productivity. Additionally, producers in this study indicated being extremely input sensitive, whether that be in money, time or labor. Even though producers in this study are regarded as innovative stewards of the land, several of them identify profitability as the driving factor on their operations. Therefore, interviewees' adaptive management style includes serious considerations of inputs. This relates to results in a previous study that showed implementation of conservation practices could be limited by the finances of cattle ranchers in the eastern Great Plains (Raynor et al., 2019).

RO2: Discover Flint Hills beef producers' perceived barriers and benefits of rangeland management practices based on Diffusion of Innovations factors of adoption.

Most of the perceived barriers interviewees discussed were input-related, whether that be time, money, or labor. This ties back to research objective one's finding that producers are extremely input sensitive because they consider many input-related factors to be barriers to adoption.

Because producers in this study are cognizant of barriers, some producers discussed directly to abstractly the importance of benefits needing to outweigh the barriers for producers to consider adoption. This is consistent with the fact that the most frequently referenced attribute of innovation was relative advantage for this sample. This is interesting, as innovators are more known to accept potential setbacks in the present for a benefit long-term. However, this aligns with early adopter's said characteristics, who are more cautious about adopting practices than innovators (Rogers, 2003). Cattle ranchers must continue to improve efficiency while managing the costs of production to efficiently to produce an economically viable product (Eidson et al., 1998), which shows why they value the relative advantage of new practices they are considering adopting.

Compatibility and complexity were the next most common attributes of innovation producers referenced regarding new practice adoption. Less frequently mentioned were observability and trialability. Although few interviewees specifically reference observability and trialability as barriers, observability and trialability tie back into RO1's findings regarding visual evidence and RO3's finding regarding shared stories and information gathering. Producers in this study utilize and include their social networks in their decision making, which overlaps with the concepts of trialability and observability related to others' land. This aligns with King and

Baker's research stating producers draw on their own and peers' experiences to make decisions on their operations (2018).

RO3: Find common themes related to being a "good farmer" in the eyes of Flint Hills beef producers.

Based on this study sample's dedication to rangeland management, it is likely these producers fall on the conservationist side of Good Farmer Theory, meaning their idea of a "good farmer" places a higher emphasis on sustainability and ecosystem health than solely on profitability (King & Settle, 2021). Each rancher in this study acknowledged the importance of ecosystem health and preservation in some way. However, producers in this study also showed varying levels of commitment to preservation of the ecosystem or stewardship of the land. Some producers noted profitability as the driving force behind their decision-making process, where others placed ecosystem sustainability as the number one priority. This is consistent with results from Campbell and King (2022) who found producers vary in their level of commitment to sustainability and intensive practices they utilize on their operations.

These innovative Flint Hills cattle ranchers have a future-focused mentality. They want to preserve the land for future use, even noting their desire to pass it down to future family members or generations. In addition, some producers express a deep appreciation for the Flint Hills ecoregion and the grazing environment they raise cattle on. Ryan et al. (2003) also found one of the strongest motivators towards BMP adoption is producers' connection to the land and the want to maintain its health and productivity for future generations. These two concepts combined with being a good steward of the land are the primary motivations behind why these producers utilize the rangeland management practices that they do.

In terms of visual indicators of "good farming," producers in this study are much more concerned with land visuals than they typically are with cattle condition visuals. When asked

questions regarding what they like to see when they drive past their neighbors' pastures, most producers in this study described visuals of a healthy ecosystem, rather than cattle health or productivity indicators. Several interviewees had to be prompted on what they consider good visual indicators of cattle, and answers were much more general than the descriptors of good rangeland visuals. When prompted specifically on cattle visuals, most producers gave basic answers regarding cattle health or even said they typically don't look at cattle.

Interviewees were also asked if what they perceive as good rangeland management is normal to see in their area. Throughout the interviews, there was no true consensus of answers, with 5 producers saying that good rangeland management is not normal to see in their area, four producers saying it is about half and half, and three producers saying good rangeland management is common to see in their area. Though these producers operate in the same ecoregion, this aligns with previous research findings that show producer perceptions and management decisions often reflect their individual operation characteristics and circumstances in their specific social circles (Pannell et al., 2006).

In addition, community norms and social context are impacting how producers in this study view themselves as well as neighboring operations. Within their spheres of influence, some producers note peer pressure as a motivator to better manage the land. Some interviewees indicated caring what their neighbors think of their pastures or management, causing them to take better care of their land. This relates to King and Settle (2021) research findings that showed producers relied deeply on both peers and neighbors for information. Other interviewees are more selective in who they choose to acknowledge pressure from, noting respected producers or organizations as trusted sources of information. If the producer trusts and respects the source, then they value the source's opinion of their land or operation. They don't acknowledge feeling pressure or influence from every neighbor or rancher. Producers connect ideas of community

participation, respectability, and farming ability to determine the quality of other producers (Phillips & Gray, 1995).

Shared stories, whether that be with neighbors, fellow producers, or information collected at field days and different organization events, are valued sources of information. Producers in this study, even those who did not feel peer pressure from other ranchers, consider this information when making management decisions on their own operations. Specific examples of shared stories that influenced producers' decision-making included drought preparedness, new practice suggestions, tips and tricks of ranching, organizations to be involved in, and where to find sources of information. A study done on prescribed burning in the Flint Hills also discussed sharing of personal experiences and information regarding innovative rangeland management through immediate neighbors or smaller, informal groups (Rosen et al., 2023). King and Baker (2018) also noted that past experiences, whether themselves, family, or community members, impacted producers' decision-making processes.

RO4: Analyze how producers connect the rangeland management practices being implemented on their operations and consumer perceptions of the beef industry.

Many studies have found agricultural producers and the public need a better relationship (King, 2008; Sharp & Smith, 2003). Producers in this study connected rangeland management practice implementation and consumer perceptions of the beef industry through several different lenses. Some interviewees identified the large, commercial feedlot industry as more visible to the public than ranching operations. A theme that most interviewees spoke of was that if the public could see, or had more access to, the family-owned ranching/grazing operation, they would understand or appreciate it better. Producers in this study noted the reason Flint Hills pastures or operations may not be visible to the public is due to a lack of access. Unless the public is visiting a ranch in person, these types of operations are less visible to the general public due to location

and distance from the operations. Therefore, some producers in the study believe offering opportunities for public visibility is a great way to show the public how beef cattle are raised. Some noted specific examples of agritourism as a way of educating consumers and giving added access and visibility to their operations, including a dude ranch, an Airbnb, and ranch exposure events like Symphony in the Flint Hills.

Implications

The results of this study should be utilized by communications practitioners and Extension to better understand how innovative producers are making decisions regarding rangeland management practices, and, in result, provide better support to ranchers looking to adopt said practices. Innovators and early adopters are considered essential groups to get on board with new practices to begin the spread of adoption and implementation (Rogers, 2003); it is important to gain insight into what their perceptions are regarding rangeland management practices. Because ranchers in the study view multiple facets of management as connected, communications efforts regarding rangeland management practice implementation should take this into account to develop and update outreach materials and education. Communications efforts and educational materials should explain practices from a systematic approach when providing information to this group of producers about BMPs. Communications efforts and educational programs should attempt to address producer concerns and barriers, especially input barriers, related to innovative rangeland management practice implementation. King et al. (2017) affirmed that agricultural communicators should be conscious of producers' barriers to adoption, like cost, time, and social constraints.

Education or training for producers on rangeland management practices should take into consideration that some ranchers are utilizing adaptive management styles. Because visual evidence and shared stories are seen by these producers are valuable sources of information,

organizations and communication practitioners should be creating opportunities and using existing events for producers to gather with one another, both with neighbors and other producers in surrounding areas, rather than attempting to be the sole source of information. Because social context clearly impacts how these producers are making decisions on their operations, communication practitioners, Extension professionals, and other organizations should continue to make attempts to better understand relationship dynamics with producers and their peers, that way their efforts to provide information on practice implementation can be better suited to their audience. Campbell and King (2022) discuss the importance of recognizing context, farm and individual characteristics in developing effective communication regarding new practices and technologies.

Further Research

For this study, we only studied innovative, conservation-minded producers. We did not study more productivist-minded producers, who may have different approaches and mindsets related to rangeland management. Further research should dive into how productivist ranchers in the Flint Hills view rangeland management practices and herd productivity to gain a better understanding of how they make decisions. In addition, the Flint Hills ecoregion is notably unique, as acknowledged by several interviewees. Research like this study should be expanded outside of this region to gain a better understanding of how other producers make decisions regarding rangeland management practices to see if geographic region impacts producers' management styles or decisions. This study could be expanded into other areas that do not have the rare, “native” ecosystem compatible with cattle grazing to see if the ranchers make different decisions regarding rangeland management. Because mixed methods, or combining qualitative and quantitative research, can help illustrate the complex aspects of a phenomenon (Östlund et

al., 2011), we recommend developing quantitative methods to complement and further develop and assess the information found in this study.

Another interesting topic of discussion not specifically asked by researchers was the concept of owned land versus leased land. Some ranchers in this study discussed how owning versus leasing the land may impact their motivations regarding rangeland management on their operation as well as new practice implementation. Further research should be utilized to explore this concept more in-depth, as no questions were developed to cover this topic in this study. Fulton and Vanclay (2011) noted a need to study the social dynamics between renters and owners of ranching operations to observe adoption rates of conservation practices on grazing lands. Previous research also recommends addressing adoption rates of conservation practices for leasers versus owners of ranching lands (Raynor et al., 2019). We asked specific questions about neighboring operations, but further research should expand the social context into a larger community setting, as in how Rosen et al. (2022) studied regarding prescribed burning among a larger community in the Flint Hills.

Local producer organizations were mentioned by producers in this study as a means of sharing stories and seeing visual evidence to make decisions on their own operations. Research should be expanded on the depths to which these organizations impact producer perceptions and decisions and how producer-to-producer networking at such events shapes community norms and behaviors. In addition, because shared stories and visual evidence were frequently noted by interviewees as highly valued sources of information, research should conduct a more in-depth exploration of how this type of information gathering impacts producer choices. Because producer interviewees see ranch and grazing land visibility as related to public understanding, further research on how visibility, or lack of, shapes public perception of cattle ranching should be explored. In addition, while *Seeing is Believing* was a theme referring to the public's view of

cattle ranching, we think research should be done to explore how visuals drive behavioral change in the ranching community.

Producers in this study noted valuing increased public visibility through ranch tours or access opportunities, believing it will improve the overall public perception of ranches and rangeland management practices. Oesterreicher et al. (2018) also found that consumers connected to the "tour a ranch near you" messaging, meaning the public also values this type of interaction. Future research should dive into this topic further, exploring how public visibility and opportunities to connect the public to ranching operations could impact public perception and agriculture of the beef cattle industry.

Summary

This research adds to the understanding of how many factors are influencing Flint Hills ranchers' decision-making on their operations. While results are not generalizable to other populations, they are helpful in gaining insight as to how innovative and early adopter producers in natural grazing situations are viewing and implementing rangeland management practices. This research also expands on the literature regarding the connection producers make between occupation and identity and how perceptions of "good" management impact the everyday decisions on their operations. This research should be used to further communications and Extension outreach efforts to continue to encourage and improve new practice adoption and BMP implementation. Future research should include expanding this study to other producer populations along the diffusion of innovations scale as well as to other ecoregions within the state of Kansas and beyond.

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Appendix A - Interview Guide

The below interview guide was used to conduct the interviews with study participants.

Research Objectives

1. Determine how Flint Hills, Kansas beef producers connect rangeland management practices and herd productivity. (DOI + GOOD FARMER?)
2. Discover Flint Hills beef producers perceived barriers and benefits of rangeland management practices based on Diffusion of Innovations factors of adoption. (DOI)
3. Find common themes related to being a "good farmer" in the eyes of Flint Hills beef producers. (GOOD FARMER THEORY)
4. Analyze how producers connect the rangeland management practices being implemented on their operations and consumer perceptions of the beef industry.

Semi-structured interview guide

Thank you for meeting with me today. As we discussed via email, I'm interviewing several Kansas Flint Hills beef producers about their operations, rangeland management practices, and views on herd productivity. We have only an hour to visit today so that all producers get the same amount of time to share their thoughts on the questions we are going to discuss. If I notice we are running short of time, I will move us along, so you have a chance to weigh in on all the questions. Okay?

For research purposes, I am going to record our discussion. Your name will not be associated with any information reported or further research. It stays with the research team of five at Kansas State. We will assign you a pseudonym, so all of your responses will remain confidential. If there is a question you prefer not to answer, please just say so. You may also stop the interview at any time.

Is it okay if I start recording?

Basic Demographic Information

What is your name?

For recording purposes and if you're comfortable sharing, what is your age and gender?

Ranch Characteristics

To get us started, can you please describe your operation?

Prompts:

Where is your operation located?

What is your role in the operation?

What type of operation (stock, cow/calf, replacement heifer , etc.) ?

Is ranching your sole source of income?

How much of your land do you own versus lease?

How many total acres are in your operation?

How many head of cattle?

How many years have you been ranching?

Herd Productivity & Rangeland Management – Diffusion of Innovations + Good Farmer Theory

These next few questions will help me understand how you make decisions regarding herd productivity.

Productivity is defined as ***the ratio of output to input.*** What are your goals related to herd productivity?

Rangeland management practices are defined as ***the use of grazing land to ensure consistent livestock production and, at the same time, conserve range resources***. What rangeland management practices are you currently using? What factors are you considering when making these decisions?

Rangeland Management Practice Implementation

These next few questions will help me understand how you make decisions regarding rangeland management practices.

What are your goals related to rangeland management? What range/grazing practices have you considered trying but haven't yet? What are the barriers to implementation? What are the successes and benefits?

Considering those barriers and successes, what most motivated you to start these practices? What motivates you to continue?

Visuals Related to Perceptions of Range Management being a "good farmer"

I'm studying the relationship between what ranchers see on other people's land, and how those visuals affect community norms (their own decisions about land management). I'd like to know more about how you view your operation compared to neighboring operations or those you drive by.

When you drive by other ranchers' properties, what do you like to see?

Describe what you consider as visual indicators of good (in terms of cattle/land management).

Do you consider what you like to see to also be "good" range management?

Is what you just described considered normal in terms of rangeland management practices for your area? If not, what do you consider normal to see in your area?

Does what your neighbors think when they drive by your pastures influence you and how you manage your land? Explain.

Have interactions or discussions with your neighbors influenced your rangeland management decisions? How so?

Producer to Public Communication

So far in our conversations, we've really just been talking about neighbor ranchers and pasture owners. Not everyone gets to drive by and see the pastures cattle are raised on. What connections do you make between our conversation today and the public's perception of the beef industry?

Is there anything else you would like to add?