

## A REVIEW AND EXPLORATION OF THE SOCIOECONOMIC BENEFITS OF WRITTEN GRAZING MANAGEMENT PLANS

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#### TABLE OF CONTENTS

- METHODS
- 6 WHO WAS SURVEYED
- 7 LITERATURE REVIEW
- 12 SURVEYS OF THE ECONOMIC BENEFITS
- 17 CONCLUSION
- 20 REFERENCES

### FOREWORD

The U.S. Roundtable for Sustainable Beef (USRSB) has identified air and greenhouse gas emissions, land resources, water resources, employee safety and well-being, animal health and wellbeing, and efficiency and yield as priority indicators for sustainability within the U.S. beef industry by sector. The USRSB has engaged stakeholders to collaboratively develop goals for each beef industry sector. Sectors include cowcalf, feedyard, packer and processor, and retail and food service. For the cow-calf sector, three of the six priority indicators (air and greenhouse gas emissions, land resources, and water resources) utilize the implementation of a grazing management plan as their primary metric to assess sustainability. Their goal is to have 385 million acres operating under written grazing management plans by 2050. This paper was commissioned by USRSB to assess socioeconomic benefits of written grazing management plans.

The U.S. Roundtable for Sustainable Beef (USRSB) is a multi-stakeholder initiative developed to advance, support and communicate continuous improvement in sustainability of the U.S. beef value chain. The USRSB achieves this through leadership, innovation, multi-stakeholder engagement and collaboration.

Prepared for the U.S. Roundtable for Sustainable Beef.



Grazing systems are complex adaptive social-ecological systems in which management processes that promote learning and increased understanding of the system are tightly linked to socio-economic benefits (Prieser et al., 2018; Gosnell et al., 2020). A grazing management plan (GMP) is both a process and a tool to help producers make informed decisions and implement management actions to achieve predetermined goals. Most GMP guidelines require producers to conduct a ranch resource inventory, set goals and objectives, select management actions to achieve goals, and develop contingency plans to account for future risks. However, regular monitoring of economic and ecological outcomes resulting from management actions is critical for producers to continuously learn and improve management over time. Evaluating monitored data allows producers to assess the effectiveness of previous management and adjust management actions accordingly to move the operation toward desired outcomes. The steps involved in developing a written GMP and more importantly executing the plan, should align with the phases and processes involved in implementing adaptive management strategies to produce desirable social and economic outcomes.

Beneficial environmental, social, and economic outcomes are required for a system to be considered sustainable. Social sustainability at the ranch scale can be measured in terms of human health, learning and adaptation, community relations, equity and inclusion, land ownership, tenure, and succession (Gosnell et al., 2021). Socio-economic benefits that can be realized from planned grazing include increased productivity, reduced input costs, reduced veterinary expenses, financial well-being, and payments for ecosystem services (Gosnell et al., 2020). Ultimately, achieving social and economic sustainability requires promoting the resilience of social-ecological systems (Adger, 2007). Building social-ecological system resilience necessitates learning and adaptation in decision making, which are fundamental drivers of social resilience (Adger, 2007; Biggs et al., 2012; Keck and Sakdapolrak, 2013; Pauley et al., 2019). Thus, sustainable grazing management assures monitoring, evaluating, and adjusting management actions through the implementation of adaptive management strategies encourage learning and facilitates the ability to adapt in the face of disturbances, uncertainty, and change. THE STEPS INVOLVED **IN DEVELOPING A** WRITTEN GRAZING MANAGEMENT PLAN AND MORE **IMPORTANTLY EXECUTING THE PLAN, SHOULD ALIGN WITH** THE PHASES AND **PROCESSES INVOLVED IN IMPLEMENTING ADAPTIVE** MANAGEMENT **STRATEGIES TO PRODUCE DESIRABLE** SOCIAL AND ECONOMIC OUTCOMES. Michael Miller/Texas A&M AgriLife Marketing and Communications

#### THE PURPOSE OF THIS PAPER IS TO:

Comprehensively review and synthesize the literature to explore and clearly articulate the relationships between grazing management planning, adaptive management, learning, social resilience, social-ecological system resilience, and economic benefits of creating and executing a written grazing management plan.

B

Assess the perceptions of producers and agricultural economists on the economic benefits of written grazing management plans.



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# METHODS

Following methods similar to that of Gosnell et al. (2021), we conducted an integrative literature review, and surveyed a group of livestock producers and agricultural economists to provide supplementary findings (Snyder, 2019; Torraco, 2005). We searched for relevant literature using Google Scholar during Fall 2023 and Winter 2024 using the following search terms: social-ecological systems, social-ecological resilience, complex adaptive systems, social resilience, adaptive capacity, adaptive management, and grazing management. References of articles were searched to identify additional relevant articles. The literature review focused on social resilience, social principles for building resilience, adaptive capacity, and adaptive management from an individual perspective rather than that of communities or institutions. The purpose of the literature review is to provide a high-level overview of concepts related to potential social resilience focused outcomes of grazing management planning and to synthesize the literature to identify connections between concepts and future research questions leading to new knowledge. To establish clear relationships between the grazing management planning and social resilience concepts, we focused on articles that provided transparent descriptions of concepts such as resilience, adaptive capacity, and provided linkages to the other concepts of interest such as learning and adaptive management. The literature review excluded articles that discussed adaptive cycles and panarchy from a purely theoretical perspective.

#### HOW THE SURVEY WAS CONDUCTED

In Fall 2023 and Winter 2024 we surveyed 77 livestock producers and 15 agricultural economists. Producers surveyed are located across the Southern, Great Plains, and Western United States. Out of 77 producers surveyed, 17 responded resulting in a 22% response rate. Fourteen of the producer respondents (82.35%) were from Texas with two from Oklahoma (11.76%) and one from North Dakota (5.88%). Together, the producers have over 600 years of grazing management experience. Only two of the 17 have been in business 10 years or less, and six of the 17 have been ranching more than 40 years. Ten out of 17 responding producers (58.82%) have written grazing management plans in place. The survey was sent to 15 agricultural economists who are primarily livestock economists and work in the areas of management and marketing. All of the economists are located in the Southern region of the U.S. Out of 15 economists surveyed, 12 responded resulting in an 80% response rate. Survey respondents were selected using purposive sampling to represent individuals known to be knowledgeable and experienced in their field.

77 LIVESTOCK PRODUCERS AND 15 AGRICULTURAL ECONOMISTS WERE SURVEYED.



PRODUCERS WHO HAVE A WRITTEN GRAZING PLAN

59%

#### PRODUCER RESPONSE RATE

22%

WERE FROM TEXAS. The remaining were from

82% OF PRODUCERS

82%

Oklahoma and North Dakota

Survey questions focused on producer and economist perceptions of the value and benefits of written grazing management plans, importance of written plans to economic success, appropriate planning horizons for written plans, frequency of review and adjustment of written plans, and contribution of written plans to reduced production risk and improving profit. The producer survey was used with a group of agricultural economists with a couple of changes: state of origin, how many years of experience do you have managing a grazing operation, and do you have a written grazing management plan were excluded. The limitation of this sampling method is that it is not intended to be statistically representative and therefore generalizable to the larger population of producers and economists. Rather it is intended to gather exploratory data on perceptions from producers who are known by the authors to be actively managing grazing operations and economists who are actively engaging with producers.

RESULTS

### LITERATURE REVIEW OF THE SOCIAL BENEFITS OF WRITTEN GRAZING MANAGEMENT PLANS

#### Social-ecological systems, ecosystem services and why they are important

Grazing systems are complex social-ecological systems (SES) consisting of interlinked human (social) and natural (ecological) systems that produce ecosystem services, which are essential for maintaining a functioning ecosystem and meeting the needs of a growing human population (Hruska et al., 2017). Ecosystem services are benefits that humans derive from natural systems, which include more commonly associated services such as forage production, clean water, soil carbon sequestration, and wildlife habitat, but also include cultural services like, aesthetics, educational and recreational services. (Millennium Ecosystem Assessment, 2005). Ecosystem services are produced from the complex interactions inherent in SESs and serve as the connection between the social and ecological subsystems (Biggs et al., 2015). SESs are considered complex adaptive systems (CAS) characterized by many interacting components, feedback between the social and ecological subsystems, emergent properties, and non-linear behavior (Preiser et al., 2018). These characteristics create a considerable amount of uncertainties, which affects the ability of producers to know how their management practices will impact forage and animal production in the future (Biggs et al., 2012). The following sections will outline the potential contributions of GMPs to improving resilience of ecosystem service production via enhancing adaptive capacity, which is a fundamental component of social resilience.

### RESILIENCE AND ITS IMPORTANCE IN GRAZING SYSTEMS

Resilience is defined as the capacity of a system to cope with or adjust to changing SES conditions while maintaining the same function, structure, identity, and feedbacks (Folke, 2006; Cinner and Barnes, 2017). The resilience of ecosystem services is defined as "the capacity of the SES to sustain a desired set of ecosystem services in the face of disturbance and ongoing changes in SES" (Biggs et al., 2012, pp. 423). The resilience of ecosystem services is one strategy for assessing the resilience of SES. Another strategy for assessing SES resilience is social resilience, which incorporates the concepts of adaptation and learning, or the degree to which a system can enhance the capacity for learning and adaptation in addition to the capacity to absorb disturbance and maintain function (Folke et al., 2002).

Variability in the amount and distribution of rainfall across the United States is expected to increase resulting in increased frequency and intensity of disturbances such as drought (Polley et al., 2013). Drought conditions will potentially impact riparian systems, soil water content, soil carbon, plant growth, plant community composition, and species distributions, which ultimately impact the production of ecosystem services such as forage production (Polley et al., 2013). Drought conditions can also negatively impact producers economically. Edwards et al. (2018) found that drought significantly increases financial stress and reduces household income for farmers and the impact of drought on economic outcomes increases as the effect of drought on farm productivity increases. Interestingly, they also found that when droughts have only a small impact on farm productivity, drought occurrence is not associated with reduced economic outcomes. Therefore, increasing the resilience of operations by implementing adaptive management strategies may reduce the impact of drought on forage production and therefore reduce the social and economic impacts of drought.

### PRIORITIZING LEARNING AND SYSTEMS THINKING

Seven principles have been identified that enhance the resilience of ecosystem service production (Biggs et al., 2012). Three of these principles relate to the biophysical (ecological) system being managed and the rest relate to the governance (social) system. We focus on two of the principles related to SES governance, which include fostering complex adaptive systems thinking, and encouraging learning and experimentation. Complex adaptive systems thinking refers to the recognition that the properties of CAS, which include non-linear relationships, interconnectedness, feedback, and emergent properties, results in an elevated level of uncertainty and unpredictability (Biggs et al., 2015). Successfully managing CAS with incomplete knowledge therefore requires adaptive management approaches that leverage learning to account for and reduce uncertainties over time. Complex adaptive systems thinking enhances ecosystem service resilience by promoting holistic thinking and acknowledgment of the dynamic complexity and uncertainty of SESs, and emphasizing the importance of management approaches that enable continuous learning and adaptation of management actions over time to enhance ecosystem service production. Ultimately, complex adaptive systems thinking is a cognitive paradigm that



DROUGHT SIGNIFICANTLY INCREASES FINANCIAL STRESS AND REDUCES HOUSEHOLD INCOME FOR FARMERS AND THE IMPACT OF DROUGHT ON ECONOMIC OUTCOMES INCREASES AS THE EFFECT OF DROUGHT ON FARM PRODUCTIVITY INCREASES.

Edwards et al. (2018)

provides the foundation for implementing adaptive decision-making (Biggs et al., 2015).

Due to the characteristics of complex SES, management is always based on incomplete knowledge. Therefore, mechanisms that promote learning will contribute to sustaining ecosystem service production in the face of disturbance. Adaptive management is one approach to managing SES that facilitates and supports learning (Biggs et al., 2015). Long-term monitoring, a central component of adaptive management, provides information about changes occurring in natural resource management systems, which facilitates learning about dynamic complexity. Learning provides the foundation for adapting management actions to sustain the production of ecosystem services in the face of disturbance and change. It is likely that understanding SESs as CAS (the first principle) emerges from and is reinforced by adaptive management approaches that are learning-focused (the second principle).

#### SOCIAL RESILIENCE

Social resilience has been defined in many ways. Obrist et al. (2010) define social resilience as a managers' reactive and proactive capacity to deal with disturbance, change, or uncertainties (Obrist et al., 2010). Reactive capacity describes the capacity of managers to cope with and adjust to adverse conditions, while proactive capacity describes the capacity of managers to increase their proficiency in dealing with adverse conditions (Obrist et al., 2010). Keck and Sakdapolrack (2013) outline three dimensions of social resilience: coping capacities, adaptive capacities, and transformative capacities that encapsulate social resilience. Coping capacities refer to how managers use readily accessible resources to handle immediate threats such as adjusting to real-time weather events or rotating based on ocular forage estimates. Coping capacities are reactive strategies to regain a former level of well-being after a disturbance has taken place. Adaptive capacities address proactive strategies that involve long-term planning to learn from the successes and failures of previous experiences and adjust future actions accordingly. Adaptive capacities would include the creation and implementation of a grazing management plan that includes actions such as monitoring grazing exclusion cages to adjust utilization to inform future management. The purpose of adapting is to maintain some level of well-being in the face of future disturbances. Finally, transformative capacities refer to individual's abilities to create new institutions that enhance individual well-being and resilience towards future disturbances. Examples of transformative capacities include being open to completely changing your production enterprise to meet your environmental condition and profitability goals.

Maclean et al. (2013) explain that CAS researchers describe social resilience in terms of the adaptive and learning capacities of individuals emphasizing that adaptive management and ongoing learning are critical elements to building social resilience. Social resilience is a key component of SES resilience and the resilience of ecosystem services. It addresses the ability of people to manage natural resource systems through disturbances and requires, in part, enhancing one's knowledge, skills, and learning to increase their capacity to adapt when faced with challenges (Maclean et al., 2013). The remainder of this section will focus on the adaptive capacity dimension of social resilience and expand on the contribution of grazing management plans to adaptive capacity and therefore social resilience.

#### ADAPTIVE CAPACITY

It is commonly agreed that producers that operate with an elevated level of adaptability and flexibility within their management strategies tend to be more successful and resilient. Adaptability or adaptive capacity is the capacity of managers in a system to mobilize resources to respond to disturbances and influence resilience (Walker et al., 2004; Folke et al., 2010; Engle, 2011). Walker et al. (2004) also describes adaptive capacity as the capacity to maintain SES function by learning from previous experiences adjusting responses to the changing conditions. Grazing managers have the unique ability to influence adaptive capacity and implement proactive adaptations therefore impacting SES resilience (Engle,

#### SOCIAL RESILIENCE

is a managers' reactive and proactive capacity to deal with disturbance, change, or uncertainties.

Obrist et al., 2010

#### THREE DIMENSIONS OF SOCIAL RESILIENCE:

A COPING CAPACITIES

**B** ADAPTIVE CAPACITIES

#### **C** TRANSFORMATIVE CAPACITIES

Keck and Sakdapolrack (2013)

2011). Resilience frameworks consistently advocate management as a mechanism for influencing adaptive capacity. The decisions and actions implemented by managers influence SES whether intentional or not, and management approaches such as adaptive management can enhance SES operational resilience through flexible and informed decision making (Olsson et al., 2004; Atkinson et al., 2007).

#### ADAPTIVE MANAGEMENT AND ITS CONTRIBUTION TO ADAPTIVE CAPACITY

Grazinglands encompass approximately 655 million acres (about the area of India)

of the United States landscape (Bigelow and Borchers, 2017). These grazinglands are extremely heterogeneous spatially due to variability in soils, plant communities, and productive capacity as well as temporally as abiotic factors such as precipitation and temperature impact seasonality of productivity. Thus, grazingland systems and their associated management are extraordinarily complex and knowledge about the quantity and quality of available resources are often incomplete. In complex adaptive systems, where knowledge is incomplete and uncertainty is high, an iterative learning-focused management process that is informed and adaptive

based on the ongoing learning process will promote sustainability and resilience of natural resource systems (Atkinson et al., 2007). Adaptive management, which has been promoted as a decision-making framework in CAS, is a structured and iterative process of adjusting management actions based on monitoring and evaluating resource responses to prior management actions (Holling, 1978). The purpose of adaptive management strategies is to develop an improved understanding of the complexity inherent in the CAS and therefore improve decision-making over time (Walters, 1986; Williams, 2011; Allen et al., 2011; Herrick et al., 2012). Resilience research established the foundation of adaptive management with the goal of increasing adaptive capacity through implementing adaptive management strategies (Engle, 2011). McDaniels and Gregory (2004) suggest that fostering learning through structured decision processes is essential for enhancing adaptive capacity.

Adaptive management implementation involves management goals and objectives, a (mental) model of the system being managed, a range of alternative management options, monitoring and evaluating resource responses to management actions, adjusting actions, and, if necessary, a collaborative structure for stakeholder engagement for collaborative adaptive management strategies (Hess et al., 2012). We often call this the "planning process". The USRSB's GMP template provides an outline for producers to engage in the planning process by describing their goals and objectives, management tasks, monitoring plans, and contingency plans. Thus, the USRSB GMP template aligns well with adaptive management phases and processes. Monitoring key resources provides data that serves as the foundation for learning in adaptive management. Ahlering et al. (2021) identified 20 common ecological and socioeconomic indicators that can be monitored to assess ranch-level sustainability. In order to enhance one's understanding of the SES, the monitored data must be evaluated to assess the efficacy of the management actions in achieving management objectives (Hess et al., 2012), meaning care should be taken to monitor metrics that provide direct decision-making insights. During the adjustment phase, results of the evaluation are synthesized and used to modify management actions, which provides the mechanism for incorporating learning

655M ACRES

> Grazinglands encompass approximately 655 million acres (about the area of India) of the United States landscape.

into future decisions (Hess et al., 2012). It is important to note that management goals and objectives must also be routinely revisited and revised based on the increasing understanding of system dynamics. The implementation of adaptive management strategies that enable flexibility and learning under uncertainty may increase drought resilience and reduce the risk of incurring economic losses during drought conditions (Derner and Augustine, 2016; Derner et al., 2022).

#### SOCIOECONOMIC BENEFITS OF IMPROVED ADAPTIVE CAPACITY IN GRAZING MANAGEMENT

The literature examining the relationship between developing written GMPs and beneficial socioeconomic outcomes by way of resilience is limited. This section will review economic outcomes in the grazing management literature and will consider any rotational or flexible grazing management as exhibiting features of planned or adaptive grazing. Long-term studies have shown that net revenue increases with increasing stocking rate in continuously grazed systems (Dunn et al., 2010; Irisarri et al., 2019). However, the economic effects of planned or adaptive grazing management strategies are more nuanced.

Case studies have shown that implementing planned adaptive grazing management can increase grazing capacity and improve profitability (Barnes and Howell, 2013; Grissom and Steffens, 2013). However, experimental evidence suggests that planned adaptive grazing may reduce animal production and contribute minimally to enhancing profitability (Augustine et al., 2020; Harmel et al., 2021). Augustine et al. (2020) evaluated continuously and adaptively managed stocker enterprise in a semi-arid rangeland in Northeastern Colorado and suggest that the reduced animal production in the adaptive management treatment was due to reduced selectivity and animals consuming lower quality forages. Harmel et al. (2021) evaluated a cow-calf enterprise in sub-humid Texas Blackland Prairie, comparing rest rotational grazing strategies with conventional season long approaches. After the 5-year study there was no statistical difference in profitability between the two systems. The profitability limitation in the rotational system was attributed to a prioritization of reducing stocking rates on the rest rotational system to facilitate increased standing forage through the winter months to reduce hay feeding and variable costs. However, stocking rates were not increased enough in a timely manner to compensate for increases in forage production in following years and thus impacted the number of calf sales and subsequent revenue as compared to the conventional system that maximized carrying capacity. If more timely adaptive management were applied due to monitoring forage productivity and flexibility in stocking rate adjustments, system profitability would have increased.

A meta-analysis examining the effects of various grazing management strategies found that stocking rate and the

length of studies were the primary variables influencing the effect of grazing management strategies on livestock production (di Virgilio et al., 2019). The only two grazing strategies found to impact livestock production were continuous and short-duration grazing. Not surprisingly, in continuous grazing systems, stocking rate was the main driver of livestock production effects. In short duration grazing systems, there was a higher probability of observing negative effects on livestock production. However, study length was the primary variable influencing livestock production with longer study periods decreasing the probability of observing negative livestock production effects. Many grazing studies have been conducted over relatively brief time periods, which may not allow for lagging beneficial outcomes to be detected.

Interestingly, the adoption of rotational or short duration grazing strategies in the Western United States is more likely to occur when producers' top operational goals are not the value livestock production (Roche et al., 2015). However, Che et al. (2023) conducted a survey of producers in North Dakota, South Dakota, and Texas and found that over 76% of producers who have adopted rotational grazing practices experienced an increase in profits. Additionally, the majority of adopters believed that rotational grazing increased drought resiliency (>80%), grazing season length (>80%), carrying capacity (>70%), and animal productivity (>70%). Modeling studies have also shown that short duration grazing strategies that implement extended periods of recovery and adapt to changes in forage quantity and quality are capable of mitigating risk of income loss associated with increased climate variability and maximizing income while maintaining rangeland condition (Jakoby et al., 2014, 2015).

A modeling study evaluating long-term economic effects of alternative grazing studies found that, compared to continuous grazing, multi-paddock grazing increases long-term profitability due to improved ecological conditions and the enhanced ability to sustain higher stocking rates over time (Wang et al., 2018). Derner et al. (2020) utilized an 80-year dataset to evaluate the impact of climate and management on livestock production and found that planning for proactive adjustments to grazing management would contribute to reduced production risk and increased profitability. A follow-up study examining the influence of flexible stocking (annual stocking rate adjustments) on economic returns showed that livestock production and gross economic returns were similar between moderately stocked and flexibly stocked continuously grazed systems over a 7-year period (Derner et al., 2024). The variable findings in the literature suggest that more research is needed to assess resilience as the facilitating agent between planned, adaptive grazing and beneficial economic outcomes. The following section explores producer and economist perceptions on the financial value of written grazing management plans.



### SURVEYS OF THE ECONOMIC BENEFITS OF WRITTEN GRAZING MANAGEMENT PLANS

#### Value of Written Grazing Management Plans and Importance to Economic Success

Eight of the 17 (47%) producers viewed a written grazing plan as being either quite or extremely valuable to their operation and seven of the 17 producers (41%) viewed the written plan as being quite or extremely important to their economic success. In contrast to the producers, all economist respondents viewed a written grazing plan as at least somewhat valuable to an operation and important to economic success. Ten of the 12 (83%) economists viewed a written plan as being either quite or extremely valuable and important for success (Figure 1).

#### Most Appropriate Planning Horizons for Grazing Management Plans

Of the producers who have grazing management plans in place, two (20%) indicated that a 10 or more year planning horizon was the most appropriate. Four (40%) believed a five year planning horizon was appropriate, and one (10%) believed a two year planning horizon was most appropriate. Three (30%) producers with grazing management plans in place indicated a one-year planning horizon was most appropriate. Of the producers who do not have grazing man-

**Figure 1.** A) Producer perception of the importance of written grazing management plans to economic success by whether they have written grazing management plans in place; B) Economist perception of the importance of written grazing management plans to economic success; C) Producer perception of the value of written grazing management plans to operations by whether they have written grazing management plans in place; D) Economist perceptions of the value of written grazing management plans to approximately provide the statement plans in place; D) Economist perceptions of the value of written grazing management plans to operations.



agement plans in place, three (43%) indicated that a five year planning horizon was appropriate and another three indicated that a two year planning horizon was the most appropriate. Only one producer without a GMP in place believed that a one year planning horizon was most appropriate.

The economists had a wide range of responses on the most appropriate planning horizon. Five of 12 (42%) responded that one-year was the most appropriate horizon while 2 indicated that 2 years was the most appropriate. Five of 12 indicated that a 5-year planning horizon was most appropriate. None of the economists viewed a 10-year planning horizon as most appropriate. The economists tended to indicate a slightly shorter planning horizon than the ranchers.

#### Top benefits of Having a Written Grazing Management Plan

The two most frequently mentioned benefits listed from the 17 responding producers included estimating forage production or evaluating pasture/rangeland health and ensuring adequate stocking rates or planning grazing rotations. Producers also indicated that being prepared for and responding to drought and market conditions was another top benefit along with setting goals and identifying key areas for monitoring to track progress towards achieving goals. Finally, producers indicated that one of the top five benefits of having a written GMP is controlling costs or reducing feed costs. Economists indicate that one of the top benefits of having a written plan is to provide some organization of thought and understanding of needs for the operation. They also indicate that the planning process itself is the benefit of having a written grazing management plan. Others indicated that it helps producers prepare for and minimize loss during unexpected events. Finally, one of the benefits noted by multiple economists is the ability to optimize livestock production and improve profitability.

One producer responded that having a written grazing management plan "drives accountability" and one of the economists said it brings "clarity of vision." Those two statements encapsulate the comments from both groups. Peter Drucker, known as the father of modern business management, is often quoted as saying "if you can't measure it, you can't manage **Figure 2.** A) Producer perceptions on grazing management plan review frequency; B) Economist perceptions on grazing management plan review frequency; C) Producer perceptions on grazing management plan adjustment frequency; D) Economist perceptions on grazing management plan adjustment frequency.



it." Most of the comments from both producers and economists could be summarized as targeting these ideas from Drucker.

#### Importance of the Written Plan vs. The Planning Process

All the producers and an overwhelming majority of the economists surveyed, 10 of 12 (83%), viewed the planning process as more important than the written plan. But the responses were more mixed when asked if a plan had to be written to be valuable or of use. Seventy-six percent of producers indicated that a plan did not have to be written to be of use. The economists had a split decision with 50% responding that a grazing management plan had to be written to be valuable. The economists tended to put more value on the concrete written plan than did the producers.

#### Frequency of Review and Adjustment of Written Plans

Eight economists (67%) responded that management plans should be updated or adapted yearly or seasonally, with four indicating that yearly is sufficient and four indicating that seasonally is more appropriate (Figure 2). Twenty-five percent of economists indicated that monthly or weekly adjustments are the most appropriate. Sixty-five percent of producers indicated that updating or adapting the plan monthly or more frequently is the most appropriate, with three producers indicating that daily adjustments to management plans are the most appropriate. Compared to economists, producers tended to indicate that more frequent adjustments are appropriate for adapting to changing conditions. Although, the frequency of adjustment may depend on the type of grazing system in use.

All producers and economists indicated grazing plan effectiveness should be reviewed at least annually (Figure 2). Nine of the 17 (82%) of producers and 75% of economists responded that plan effectiveness should be reviewed seasonally or more frequently. Again, the producer respondents tended to believe that the effectiveness of grazing plans should be reviewed more frequently compared to producers plan effectiveness, with eight producers and only one economist indicating that a timeline of monthly or shorter is the most appropriate. **Figure 3.** A) Producer perceptions on whether and by how much written grazing management plans can improve profits; B) Economist perceptions on whether and by how much written grazing management plans can improve profits; C) Producer perceptions on whether and by how much written grazing management plans can reduce production risk; D) Economist perceptions on whether and by how much written grazing management plans can reduce production risk; D) Economist



#### Economic Importance of Written Grazing Management Plans

To assess the economic importance of written grazing management plans, producers and economists were asked whether written grazing management plans can reduce production risk and increase profits. Follow-up questions were asked to quantify the magnitude of effect, if any. All producer and economist respondents indicated a written grazing plan increased profit. Of the producers who have grazing management plans in place, seven (70%) indicated that profit could be improved by more than 10% (Figure 3). The remaining three producers indicated that profit could be improved by 5-10%. Of the producers who do not have written GMP in place, two (29%) indicated that profit could be increased by more than 10%, three (43%) believe that profit could be improved by 5-10%, and the remaining two believed that profit could be improved by 2-5%. Seven of the economists (58%) indicated that profit could be improved by 5-10% and four (33%) indicated that profit could be improved by more than 10%. Ultimately, fifteen (88%) of the producers and eleven (92%) economists indicated that written GMPs can improve profit by at least 5%.

15 USRSB REPORT

Fifteen of the producers (88%) and all the economists indicated that a written plan reduced production risk (Figure 3). Of the producers who have a written GMP in place, eight (80%) indicated that written GMPs can reduce production risk by more than 10% while one producer indicated that production risk can be reduced by 5-10%. Interestingly, one producer with a GMP in place believed that written GMP cannot reduce production risk. Of the producers who do not have a written GMP in place, three (43%) indicated that production risk can be reduced by more than 10% and two (29%) indicated that production risk could be reduced by 5-10%. One producer indicated that production risk can be reduced by 2-5% and one indicated that written GMPs cannot reduce production risk. Six (50%) of economists believed that written GMPs can reduce production risk by more than 10%, five believed that production risk can be reduced by 5-10%, and one indicated that risk can be reduced by 2-5%. Ultimately, fourteen (82%) or producers and eleven (92%) of the economists believed that a written plan would reduce risk by five percent or more, and half of the economists indicated that risk could be reduced by more than 10 percent.

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# CONCLUSION

### SOCIAL BENEFITS OF WRITTEN GRAZING MANAGEMENT PLANS

Developing a GMP can provide the framework for implementing management practices that align with adaptive management phases and processes, which allows for increased adaptive capacity, social resilience, and SES resilience (Figure 4). Enhanced adaptive capacity and social resilience enables producers to successfully manage operations through future disturbances such as increasing frequency and severity of extreme weather events. Thus, enhancing adaptive capacity and social resilience may contribute to reducing the impact of disturbances on ranch productivity, which may mitigate negative economic impacts resulting from drought conditions. With predictions of increased variability in precipitation patterns, the capacity to reduce the magnitude of impact on productivity and profitably manage through such disturbances should be of the utmost importance to producers.

Although developing written plans is an important first step, it is critical that plan execution is followed by monitoring and evaluating the impact of management actions on key resource areas to facilitate informed decision-making. Iterative evaluation of monitoring data and informed adjustment of management actions ENHANCING ADAPTIVE CAPACITY AND SOCIAL RESILIENCE MAY CONTRIBUTE TO REDUCING THE IMPACT OF DISTURBANCES ON RANCH PRODUCTIVITY, WHICH MAY MITIGATE NEGATIVE ECONOMIC IMPACTS RESULTING FROM DROUGHT CONDITIONS. **Figure 4.** Conceptual representation of the relationships between grazing management plans, adaptive management, adaptive capacity, and social-ecological system resilience.



promotes learning and understanding of complex natural resource systems, which are two principles of enhancing the resilience of ecosystem services and, ultimately, successfully managing through disturbances. Additionally, written plans should be revisited and revised regularly to incorporate enhanced knowledge of system dynamics gained through iterative cycles of adaptive management implementation, which will continue to inform and improve decision making over time.

#### ECONOMIC BENEFITS OF WRITTEN GRAZING MANAGEMENT PLANS

The majority of both producers and economists indicated that a written plan could reduce production risk and increase profits by more than 5% with more than half of the producers indicating a potential profit increase of more than 10%. To assess whether a 10% increase in profits is enough to make a material difference in financial outcomes, we examined data from a set of representative ranches maintained by the Agricultural and Food Policy Center (AFPC) at Texas A&M University. Each year the AFPC estimates future financial performance for over 90 farms and ranches across the country. The data is developed with farmers and ranchers and is designed to be representative of production conditions in each region. The latest estimate for 2024 indicated that two of the representative ranches were projected to be in negative financial condition over the next 6 years (Outlaw, 2024). A 10% increase in profits, as indicated by the survey results, improved the financial condition of one of the two ranches from a negative to a positive financial outlook over the next 5 years. Applying the survey results for profit improvement to some real ranch data indicates that profit improvement WRITTEN PLANS SHOULD BE REVISITED AND REVISED REGULARLY TO INCORPORATE ENHANCED KNOWLEDGE OF SYSTEM DYNAMICS GAINED THROUGH ITERATIVE CYCLES OF ADAPTIVE MANAGEMENT IMPLEMENTATION. of the magnitudes suggested by producers and economists is enough to make a significant difference in financial outcomes. In a typically low margin business like cattle production there are not likely many other ranch changes that could be made to generate a 10% profit improvement.

The Beef Cattle Standard Performance Analysis (SPA) tool was created to gather data needed to evaluate production and financial performance from individual ranches and inform management decisions. An analysis of 45 ranches over the 2007-2011 period indicated that the biggest cost area on the participating ranches was feed, with almost one-third of total costs being feed-related (Bevers, 2012). Feed included any grazing leases, supplemental feed and hay purchases, and feed production costs like fertilizer. Several producer survey respondents in our exploratory study indicated that having a written grazing management plan allowed them to minimize stored feed or better manage feed resources. Therefore, written grazing management plans likely allow better cost controls over the largest single area of costs on the ranch, contributing to reduced costs and improved profits.

#### CONSIDERATIONS AND SUGGESTED FUTURE DIRECTION FOR THE USRSB

The value of written GMPs can be described in different ways whether it be in terms of enhanced resilience to increasingly variable weather patterns, reduced production risk, or increased profit. There was broad agreement among producers and economists that written GMPs reduce production risk and increase profit potentially by 10% or more. Although the sample size of our survey was small, if this finding were supported by a larger research effort, it would suggest that written GMPs provide a substantial economic benefit to producers. Currently, there is a significant gap in the literature surrounding the economic benefits of grazing management planning or having a written grazing plan. Research studies primarily focus on comparing alternative grazing strategies rather than evaluating the benefits of developing a written plan. For this review, we assumed that any rotational or adaptive grazing management treatments being studied had developed and implemented a GMP. However, rotational grazing strategies can be implemented without a written GMP in place. While adaptive grazing strategies are likely to, and should, have a GMP in place, it is not always the case. Therefore, more research is needed to evaluate and understand the economic benefits of the planning process or having a written GMP.

The implementation of GMPs encourages a process of continuous improvement through adaptive management processes. Specifically, written GMPs that include monitoring key resource areas and adjusting management actions according to monitored data provide the foundational components of adaptive management, which contributes to increased adaptive capacity and ultimately facilitates improvements in three of the USRSB high-priority indicators. The implementation of GMPs on 385 million acres of land will provide the starting point for increasing the sustainability of grazingland systems. However, more research is needed to fully understand the relationship between grazing management planning and sustainability outcomes.

While the literature supports the theory that adaptive management implementation improves adaptive capacity and social-ecological system resilience, more research is needed to understand the relationship between developing a written GMP and the adoption of adaptive management. Although the establishment of GMPs is the first step to realizing the benefits of grazing management, we must understand whether the establishment of a written GMP is enough to encourage producers to be more adaptive in their management. Future research efforts should focus on understanding what specific components of GMPs are needed to facilitate adaptive management implementation, how producers value and perceive the benefits of GMPs, and what drives producers to adopt or not adopt GMPs. Additionally, future research should investigate linkages between GMP development and implementation, learning and systems thinking, and social-ecological resilience.



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THERE WAS BROAD AGREEMENT AMONG **PRODUCERS AND ECONOMISTS THAT** WRITTEN GMPS **REDUCE PRODUCTION RISK AND INCREASE PROFIT POTENTIALLY** BY 10% OR MORE. **ALTHOUGH THE** SAMPLE SIZE OF OUR SURVEY WAS SMALL, **IF THIS FINDING** WERE SUPPORTED **BY A LARGER RESEARCH EFFORT IT WOULD SUGGEST** THAT WRITTEN **GMPS PROVIDE A SUBSTANTIAL** ECONOMIC BENEFIT TO PRODUCERS.



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TEXAS A&M UNIVERSITY Center for Grazinglands and Ranch Management 268