

Below the Plains: Navigating Groundwater Depletion in Kansas through Collective Action

by

Melanie Michaud

A thesis

presented to the University Of Waterloo

in fulfillment of the

thesis requirement for the degree of

Master of Environmental Studies

in

Social and Ecological Sustainability (Water)

Waterloo, Ontario, Canada, 2024

© Melanie Michaud 2024

Author's Declaration:

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis,
including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

In the context of increasing groundwater depletion and the critical need for sustainable water management, my research examines Kansas's transition toward enhanced groundwater conservation through the lens of the Multi-Level Perspective (MLP) framework. This study focuses on the roles of state actors, policy entrepreneurs, local experiments like real-world labs, and the influence of landscape factors (external pressures) and cultural values in driving sustainability transitions. Kansas, facing significant groundwater depletion, provides a compelling case to explore how conservation initiatives, such as LEMAs (Local Enhanced Management Areas), emerged and gained acceptance in a traditionally depletion-oriented agricultural regime.

Guided by the research objectives to understand how policy diffusion occurred, how actors changed roles, and the state's involvement in shaping transitions, I employed a qualitative approach. My research uses document analysis, interviews, and case studies of Kansas's Groundwater Management Districts (GMDs) and LEMA policies to investigate the factors driving the adoption of conservation measures. The case of the Sheridan 6 LEMA serves as a pivotal example of a "real-world lab" that influenced the broader adoption of conservation practices across Kansas and the subsequent passage of state legislation mandating groundwater management plans for all GMDs.

The findings reveal that real-world labs like Sheridan 6 provided empirical evidence demonstrating that conservation could be achieved without economic harm, which built trust among local stakeholders and influenced the shift from depletion to conservation practices. Landscape factors like groundwater depletion and regulatory threats interacted with cultural values like preserving family legacies and local control, pushing incumbent regime actors to adopt conservation measures. Policy entrepreneurs, including state officials and GMD staff, played a central role in framing conservation in ways that aligned with these cultural values, leveraging political opportunities, and building coalitions that supported policy change. The research also challenges traditional views of the state's passive role in transitions, illustrating how state actors actively created and nurtured niche innovations, such as LEMAs.

This research contributes to the MLP literature by addressing gaps related to the role of the state and the uneven impacts of landscape pressures and cultural values on influencing conservation behaviors across the GMDs. By integrating insights from the Kansas case, this study offers broader implications for water management in other regions. It highlights the importance of empowering policy entrepreneurs, leveraging local experiments, and understanding the interaction between landscape pressures and cultural values to drive sustainability transition.

Acknowledgments

This thesis would not have been possible without the support of many people. First, I would like to thank my parents for their endless support and willingness to help me in any way possible. I especially thank my dad, who accompanied me to Kansas and Nebraska for my research. I want to thank my parents for helping me water my garden in the Oklahoma heat when I was too busy writing my thesis to do it myself. To my siblings, thank you for your comedic relief and for being a source of joy in my life while I pursued my degree.

I would also like to express my gratitude to my community in Oklahoma. Specifically, thank you to Daniel for your consistent optimism, reassurance, and emotional support throughout this process. I would like to express my gratitude to Dr. Travis Gliedt at the University of Oklahoma. Travis is largely responsible for why I came to Waterloo specifically. I am grateful to Travis for instilling a love for learning in me, introducing me to the MLP, and pushing me to pursue a Master's degree.

I am also immensely grateful for the people I have met in Waterloo, who have supported me in my thesis and been my friends. I especially want to thank Isabel for always offering wisdom, advice, friendship, and comedic relief. I would not have made it this far without Isabel's expertise and academic guidance. Beth was also an immense source of support for me in this process. Thanks to Beth for your endless soup walks, pep talks, and encouragement. Natasha was also an invaluable source of emotional support during this thesis process. I am grateful to Natasha for our friendship and being the Enneagram 2 to my Enneagram 4. I would also like to express my gratitude to Batu. Batu was my go-to friend when I wanted a break from my thesis; he always provided a source of joy in my life and helped me think about the world from new perspectives. Thank you to Nat for being a friend and giving advice about thesis writing. I would also like to express my gratitude for Ben and his friendship; Ben was another friend I enjoyed hanging out with when I wanted to escape my thesis, and I enjoyed our conversations about sports. Thank you to Deborah for being a source of wisdom and encouragement in the last months of my thesis. Finally, thank you to all the Fishbowl for their support and comedic relief.

Thank you to Dustin, as this thesis would have quite literally not happened without him. I am forever grateful to Dustin for seeing my potential and taking me on as a student. I appreciate Dustin's endless amount of patience with me as I pursued this degree. I am particularly grateful to Dustin for believing in me and my abilities even when I did not; his words of encouragement and extreme optimism, especially in the late stages of my thesis, were invaluable to my progress. I also want to acknowledge the entire Blue Range Labs for providing a community and for giving feedback on my thesis. Your support and feedback were instrumental in shaping my research. I would also like to specifically thank Isabel for providing immense input on my thesis and helping me develop into a young researcher. Isabel's influence and guidance shaped the direction of my work tremendously, and I am forever grateful to her for her mentorship and time.

I would also like to thank Graham for giving his time and feedback on my thesis. Thank you to Derek as well for his advice and feedback as both my professor and committee member.

Finally, I would like to thank the Kansans who participated in my study. Their participation greatly enhanced my research, and I am grateful to them for trusting me with their experiences.

Table of Contents

1.0 Chapter 1: Introduction	1
1.1 Problem Context	1
1.1.1 Policy Problem	1
1.1.2 Methods Problem	2
1.1.3 Research Problem	2
1.2 Research Questions	3
1.3 Research Objectives	3
1.4 Study Context	3
1.4.1 Justification for Studying Kansas	4
1.4.2 Groundwater Governance in Kansas	4
1.4.2.1 Institutional Framework	5
1.4.2.2 Organizational Arrangements	5
1.4.2.3 Primary Legislation	5
1.4.2.4 Legal Regulations	6
1.4.3.5 Stakeholder Participation	6
1.4.3 Introduction to Study Area	7
2.0 Chapter 2: Literature Review	9
2.1 MLP	9
2.1.1 Niches	14
2.1.2 Regimes	14
2.1.3 Landscape	17
2.1.4 Transition Pathways	18
2.1.5 Limitations of the MLP	19
2.2 Policy Entrepreneurs	21
2.3 Real World Labs	21
2.4 Groundwater Governance	22
3.0 Chapter 3: Research Methods	24
3.1 Critical Realism	24
3.2 Case Study Approach	24
3.3 Data Collection and Sources	25
3.3.1 Interviews	30
3.3.2 Documentary Evidence	31
3.4 Documentary Sources	32
3.4.1 GMD 4 LEMA Documents	33
3.4.2 News Articles	33
3.4.3 GMD 3 LEMA Presentations	34
3.3.4 GMD 3 Minute Meetings	34
3.3.5 Kansas Oral History Project	35
3.3.6 Scholarly Articles	35
3.4.7 Newspaper Articles	36
3.5 Thematic Analysis and Process Tracing	37
3.5.1 Step 1: Familiarization with Data	38
3.5.2 Step 2: Applying, Developing, and Reviewing Codes	38
3.5.3 Step 3: Developing Themes	39

3.5.4 Step 4: Assessing Validity of the Data and Examining Theoretical Fit	39
3.5.5 Creating Historical Narratives	40
4.0 Chapter 4: Factors Influencing Actors' Roles Changes and the Role of the State and Policy Entrepreneurs	41
4.1 1990-2000: Planned Depletion Era	43
4.1.1 Regime Beliefs, Policies, Actors	43
4.1.2 Niche Beliefs, Policies, and Actors	45
4.1.3 Policy Entrepreneurs	46
4.1.4 Landscape Pressures	48
4.2 2001-2013: Conservation Gains Momentum	49
4.2.1 Niche Beliefs, Policies, and Actors	50
4.2.2 Policy Entrepreneurs	54
4.2.3 Regime Beliefs, Policies, and Actors	56
4.2.4 Landscape Pressures	58
4.3 2014-2023: Institutional Change	60
4.3.1 Niche Beliefs, Policies, and Actors	60
4.3.2 Policy Entrepreneurs	67
4.3.3 Regime Beliefs, Policies, and Actors	71
4.3.4 Landscape Pressures	74
5.0 Chapter 5: Discussion	79
5.1 Transformation Pathway and Role of the State	79
5.2 Sheridan 6 as a Real-World Lab	84
5.3 Policy Entrepreneurs as a Contributor to Transitions	85
5.4 Landscape Level Pressures Influence Actors to Change Roles	86
6.0 Chapter 6: Conclusion	88
6.1 Main Findings	88
6.1.1 Sheridan 6 and Real-World Labs	89
6.1.2 Policy Entrepreneurs as Agents of Change	89
6.1.3 The Role of the State	89
6.1.4 Influence of Landscape Pressures on Actors' Role Changes	90
6.2 Methodological Implications	90
6.2.1 MLP Application	90
6.2.2 Longitudinal Studies	91
6.3 Policy Implications	91
6.3.1 Support for Local Experiments	91
6.3.2 Empowering Policy Entrepreneurs	92
6.3.3 Leveraging Landscape Pressures	92
6.4 Reflections	93
References	95
Appendix A. Documentary Sources	108
Appendix B. Codebooks and Supporting Literature	128

List of Figures

Figure 1. Map of GMDs, LEMAs, and aquifer level change from 1950 to 2019. Map created by Isabel Jorgensen (2024).....	7
Figure 2. Depiction of the nested MLP levels. Niche innovations are shown scaling up to the regime. Landscape changes influence the niche and regime and vice versa. The niche and regime are depicted as having a two-way influence. Contents inspired by Geels (2002).....	11
Figure 3. Depiction of transition processes in the MLP. Contents of the figure are inspired by Geels and Schot (2007).....	12-13
Figure 4. Sub-regime Alignments. The top image shows a stable, resistance to change regime, while the bottom images shows an uncoordinated regime that is susceptible to destabilization from niche innovations. Contents inspired by Geels (2004).....	16
Figure 5. Timeline of key events and windows of opportunity across the three time periods covered in the thesis.....	42
Figure 6. Estimated Usable Lifespan of Kansas Ogallala Aquifer. GMD 3 is located in the bottom left corner. GMD 1 is right above GMD 3, and GMD 4 is located in the top left corner. The map shows that GMD 3 has more areas left of water than GMDs 1 and 4. Map adapted from Kansas Geological Survey in Buchanan et al. (2023).....	76
Figure 7. Map of the GMDs and the counties in each GMD. Map adapted from the Kansas Department of Agriculture (2017).....	78
Figure 8. Depiction of Kansas's transition using the MLP.....	82-83

List of Tables

Table 1. Matrix of inclusion and exclusion criteria, sampling strategy, and search strings used for documentary sources.....	25-28
Table 2. Data Sources, Evidence, Methods, and Purpose Matrix.....	28-29
Table 3. Interview Participants	31
Table 4. State-Level Policies in the early 2000s.....	53-54
Table 5. GMD 4 LEMA Testimonies and Dates of Testimonies.....	109-113
Table 6. Titles and Dates of GMD 4 LEMA Documents.....	113
Table 7. News Articles Included in the Study.....	115-120
Table 8. GMD 3 LEMA Presentation Titles and Dates.....	121
Table 9. GMD 3 Board Minute Meetings and Meeting Dates.....	121-122
Table 10. Names, Positions Helds, and Years Held of Kansas Oral History Project Interviewees.....	122-124
Table 11. Scholarly Articles Included in the Study.....	125-126
Table 12. Newspapers Articles Included in the Study.....	127
Table 13. Inductive Codebook.....	128-136
Table 14. Policy Entrepreneurship Codebook.....	136-138
Table 15. Policy Entrepreneurship Literature Used to Inform the Codebook.....	138-139
Table 16. Deductive MLP Codebook.....	139-143
Table 17. MLP Literature Used in Codebook.....	143-144

List of Abbreviations

DWR – Division of Water Resources
GMD – Groundwater Management District
HPA – High Priority Area
IGUCA – Intensive Groundwater Use Control Area
KFL – Kearny-Finney County LEMA
KLA – Kansas Livestock Association
KOHP – Kansas Oral History Project
KWA – Kansas Water Authority
KWAA – Kansas Water Appropriation Act
KWO – Kansas Water Office
LEMA – Local Enhanced Management Area
MLP – Multi-Level Perspective
MSA – Multiple Streams Approach
SGMA – Sustainable Groundwater Management Act
WCA – Water Conservation Area

1.0 Chapter 1: Introduction

In this chapter, I outline the context, methods, and research problems this study addresses, focusing on Kansas's transition toward increased groundwater conservation. I apply the Multi-Level Perspective (MLP) framework to examine how various actors, including the state, policy entrepreneurs, and real-world labs like the Sheridan 6 LEMA, contributed to this transition. I discuss the role of groundwater management districts (GMDs) in facilitating or resisting conservation measures, highlighting the socio-political and economic factors that influence these decisions. I also explore the geographical and hydrological factors that impact groundwater depletion in Kansas and the state's efforts to balance agricultural economic growth with sustainable water use. Through the use of institutional and legal frameworks, stakeholder participation, and legislative mechanisms like Locally Enhanced Management Areas (LEMAs) and H.B. 2279, this research aims to further the understanding of behavior change, the role of the state and policy entrepreneurs in sustainability transitions, and the diffusion of niche conservation policies across Kansas.

1.1 Problem Context

In this section, I examine the critical need for groundwater conservation, particularly in agricultural regions like Kansas, through the lens of the MLP. I focus on the socio-political challenges that hinder transitions toward sustainable water management, specifically emphasizing the role of state actors and policy entrepreneurs in influencing these transitions. By applying the MLP to the case of Kansas, this research fills a gap in the literature where scholars have underapplied the MLP to agricultural and water transitions. I also address the MLP's limitations in accounting for agency and behavior change, exploring how actors in Kansas shifted from opposing to supporting conservation initiatives. These insights contribute to a deeper understanding of how sustainability transitions can occur in agriculture-dependent regions, with broader implications for water management beyond Kansas.

1.1.1 Policy Problem

The transition towards increased groundwater conservation is critical for ensuring sustainable water resources and food security, particularly in regions heavily dependent on groundwater for agricultural purposes. Groundwater is a vital resource, serving as the primary drinking water source for approximately 2 billion people and supplying irrigation water to grow half of the world's food supply (Jasechko & Perrone, 2021). However, excessive groundwater pumping, exacerbated by climate change and population growth, has led to a global decline in groundwater levels (Famiglietti, 2014). This underscores the urgent need for adopting and implementing enhanced conservation practices to secure future water availability and sustain agricultural productivity. Despite the pressing need for such transitions, moving towards increased groundwater conservation often faces substantial socio-political barriers. Reducing

water use can impose economic challenges on agricultural stakeholders, who may resist conservation measures due to potential impacts on their livelihoods (Steiner et al., 2021). Addressing these socio-political hurdles is essential for successful sustainability transitions and maintaining drinking water supplies and food security. Navigating these challenges and garnering support for conservation initiatives is crucial to facilitating effective transitions.

The Kansas's Ogallala Aquifer case provides a compelling example of a region where the agricultural and water sectors have transitioned towards increased groundwater conservation. Despite this, there is a limited understanding of how Kansas shifted groundwater users from opposing to supporting conservation initiatives. Additionally, the role of state actors and policy entrepreneurs in either facilitating or hindering this transition remains underexplored. This lack of understanding is problematic because public support is vital for successful sustainability transitions, and state actions can profoundly influence the trajectory of these changes (Roberts & Geels, 2019). Insights from examining Kansas's experience can offer valuable lessons for other regions within the Ogallala Aquifer and beyond, potentially accelerating transitions towards more sustainable groundwater management practices.

This research employs the MLP framework to analyze the transition process in Kansas. The MLP provides a theoretical approach to understanding long-term transitions in societal systems, making it particularly useful for exploring the dynamics of groundwater conservation efforts. By applying the MLP, this research aims to enhance the understanding of how transitions towards increased conservation occur and the roles played by the state and policy entrepreneurs in this process.

1.1.2 Methods Problem

Scholars have predominantly applied the MLP to transitions in the energy and transportation sectors, with limited attention given to its use in agricultural and water resource management (El Bilali, 2019). This narrow focus restricts the ability to leverage insights from the MLP to address challenges specific to sustainable management in the agriculture and water sectors. By focusing predominantly on industrial transitions, the MLP overlooks crucial opportunities for adaptation in other vital areas, such as groundwater conservation and irrigated agriculture. My research addresses this gap by applying the MLP framework to the case of irrigated agriculture and groundwater management in Kansas. In doing so, this study contributes to broadening the scope of the MLP, enabling its application to agriculture and water transitions and enhancing its utility for developing strategies for sustainable resource management.

1.1.3 Research Problem

In sustainability transition studies using the MLP, the state's role is often treated as a secondary concern rather than a central element of analysis (Johnstone et al., 2018). This is problematic because the state has a considerable capacity to shape the trajectory of a transition, either facilitating or hindering progress toward sustainability. Without a comprehensive understanding of the state's role, the full potential of its influence remains

unrealized. My research aims to address this by empirically examining how state actors in Kansas have contributed to or hindered sustainability transitions in groundwater management. This will further conceptualize the state's involvement in the MLP framework, highlighting its significance in driving transitions.

Additionally, scholars have criticized the MLP for its lack of attention to agency, particularly regarding how behavior changes occur during transitions (Huttunen et al., 2021; Geels, 2020). This inattention is problematic because sustainability transitions require the active involvement of incumbent actors who must shift their behaviors toward more sustainable practices. However, the MLP lacks the theoretical tools to explain how these behavior changes occur entirely. My research addresses this gap by examining the factors that led actors in Kansas to shift from opposing conservation measures to actively supporting them, contributing to a deeper understanding of agency and behavior change within the MLP framework.

1.2 Research Questions

1. What combination of actions and influences from real world labs, state actors and policy entrepreneurs were instrumental for Kansas's transition?"
2. Under what conditions did regime actors begin to support conservation policies?"

1.3 Research Objectives

1. To better understand how institutional structures, policies, and beliefs associated with groundwater management changed over time in Kansas.
2. To further the understanding of behavior change and actors' role changes within the MLP.
3. To further conceptualize the role of state actors within the MLP.
4. To understand how policy diffusion of LEMAs occurred in Kansas

1.4 Study Context

This section provides a rationale for focusing on Kansas as a case study in groundwater conservation efforts within the southern Ogallala Aquifer region. Kansas has experienced severe groundwater depletion, making it a critical site for examining challenges and innovations in managing water resources. Unique programs like LEMAs have positioned Kansas as a leader in groundwater governance, with its model drawing international attention. The state's mandate requiring GMDs to develop conservation plans in 2023 further solidifies Kansas's role as a pioneer in transitioning from depletion to conservation despite facing significant resistance from various stakeholders. The combination of progress and opposition makes Kansas an ideal context for studying sustainability transitions in water governance.

1.4.1 Justification for Studying Kansas

The Ogallala Aquifer forms a crucial part of the larger High Plains Aquifer system, spanning eight states across the U.S., including Wyoming, South Dakota, Nebraska, Colorado, Oklahoma, Texas, New Mexico, and Kansas (Buchanan et al., 2023). Over the past 20 years, the southern portion of the Ogallala Aquifer has experienced some of the most rapid declines in groundwater levels, making it a focal point for studying groundwater depletion (Famiglietti & Ferguson, 2021). Among the states in the southern Ogallala region, Kansas stands out due to the severity of its groundwater decline, presenting a critical case for understanding the challenges and innovations in managing this vital resource.

Kansas is particularly notable for its engagement in a real-world experiment in groundwater management. In 2013, Kansas allowed local water rights holders to collectively govern water use by creating LEMAs. This initiative, which empowers local stakeholders to limit water usage in areas experiencing severe depletion, has established seven LEMAs across the state. The LEMA program has contributed to slowing groundwater depletion rates and has drawn international attention as an innovative governance model for managing water resources. Kansas remains the only state in the Ogallala region with a program like LEMAs. It is a unique case to examine how niche conservation policies became mainstream and replaced depletion-oriented policies. The uneven spread of this innovation, with varying levels of success and resistance, makes Kansas an ideal context to study the dynamics of sustainability transitions in water governance.

In 2023, Kansas further solidified its role as a leader in groundwater conservation by mandating that GMDs develop conservation plans to address ongoing depletion. This legislative shift highlights the state's transition toward more conservation-oriented practices and sets it apart from other states in the Ogallala region. However, Kansas has also encountered significant resistance to conservation efforts, with multiple failed LEMA proposals and unsuccessful state-level legislative attempts to advance groundwater management reforms. This combination of progress and opposition provides a compelling backdrop to study how actors in Kansas navigate transitions, change roles, and overcome resistance in the shift from depletion to conservation.

1.4.2 Groundwater Governance in Kansas

Foster et al.'s (2010) principle instruments for sound groundwater governance, including institutional and legal provisions and stakeholder participation, provide a framework for analyzing groundwater governance in Kansas. Institutional and legal provisions include institutional frameworks, organizational arrangements, primary legislation, and legal regulation. The institutional framework refers to the overarching structure established by the national or state constitution and government, which sets the foundation for water management systems (Foster et al., 2010). Organizational arrangements pertain to the specific agencies and institutions responsible for managing water resources and delivering water-related services at local or regional levels (Foster et al., 2010). Primary legislation includes laws passed by

legislative bodies, such as water acts, which outline key policies, guiding principles, and mechanisms for managing water (Foster et al., 2010). Legal regulations, on the other hand, consist of rules and guidelines issued by the executive branch, providing detailed instructions on how to implement the laws and ensure compliance (Foster et al., 2010).

1.4.2.1 Institutional Framework

The Kansas Water Appropriation Act (KWAA) forms the foundation of Kansas's groundwater governance system, established under the principle of "prior appropriation"—the "first in time, first in right" doctrine. This legal framework prioritizes the rights of earlier water users, giving them seniority in accessing water resources during times of scarcity. The KWAA defines how the chief engineer allocates water rights, regulates water use, and administers water law across the state. It also provides the legal basis for the role of the Chief Engineer of the Kansas Division of Water Resources (DWR), who is responsible for overseeing water rights and regulating water use across the state.

1.4.2.2 Organizational Arrangements

The DWR, led by the chief engineer, is critical in administering Kansas's water laws and ensuring compliance with groundwater regulations. As the primary authority on water regulation in Kansas, the DWR works with local and state stakeholders to enforce water rights and oversee the adoption of groundwater conservation measures. The Kansas Water Office (KWO) and the Kansas Water Authority (KWA) are state agencies that provide recommendations for water management to the Governor and legislature.

At the local level, GMDs serve as a form of local control in Kansas's groundwater management system. Kansas has five GMDs, with GMDs 1, 3, and 4 located within the Ogallala Aquifer region. GMDs propose regulations to manage groundwater use within their boundaries, but the DWR and other state agencies must approve these proposals. Each GMD is governed by a Board of Directors, elected by local water rights holders, to represent the interests of both agricultural and municipal water users in shaping local groundwater policy.

1.4.2.3 Primary Legislation

Primary legislation guides water conservation efforts, like the Kansas Groundwater Management District Act and related laws. Key legislative mechanisms include:

- **LEMA statutes:** These statutes allow GMDs to develop locally tailored plans for addressing groundwater depletion, subject to approval by the chief engineer.
- **IGUCAs:** Created under the Kansas Groundwater Management Act of 1978, IGUCAs are tools the state can use to enforce stricter groundwater management in areas facing severe water shortages.
- **WCAs:** Provide mechanisms for water rights holders to voluntarily engage in conservation plans while maintaining economic value through flexible water use.

These legislative tools provide the legal framework for both top-down and bottom-up approaches to addressing groundwater depletion in Kansas.

1.4.2.4 Legal Regulations

Legal regulations, such as the DWR's rulings on LEMA proposals or IGUCA designations, implement the legislative mechanisms. These regulations, enacted by the executive branch, clarify the mechanisms and processes outlined in the primary legislation. For example, the chief engineer's ability to accept, modify, or reject GMD proposals for LEMAs reflects the application of legal regulations that control how the chief engineer enforces primary legislation.

1.4.3.5 Stakeholder Participation

In Kansas groundwater management, stakeholder participation is a critical governance instrument. However, participation in GMD elections is limited, particularly regarding the direct representation of municipal water users. Under the current framework, municipal water users do not have direct voting rights. Instead, municipalities with water rights in the GMDs are allocated one vote, collectively representing all municipal water users. This means water users within municipalities do not have an individual voice in GMD elections, as their municipalities represent their interests through a single municipal vote.

In contrast, voting rights the GMD Act grants voting rights to landowners or high-volume groundwater users. To vote in a GMD election, a participant must either:

- Own 40 contiguous acres of land within the GMD (outside a municipality) or
- Withdraw at least one acre-foot of groundwater annually within the GMD.

The concentration of voting rights among larger water users and landowners creates an unequal distribution of influence over groundwater management decisions. Despite being directly affected by GMD policies, municipal water users lack the same representation level. This limitation in stakeholder participation affects the governance dynamics within GMDs, as those with voting rights tend to have more direct interests in agricultural or large-scale water use.

This framework shapes the decisions made by GMD Boards, often prioritizing the interests of agricultural and high-use water rights holders over those of urban and smaller water users. While non-voting stakeholders, including municipal water users, can participate in public consultations or hearings, the power of decision-making remains concentrated among those with voting rights in GMD elections.

This limited scope of stakeholder participation highlights the challenges of ensuring equitable representation in Kansas's groundwater governance system, particularly for municipal water users.

1.4.3 Introduction to Study Area

This research focuses on the transitions toward increased groundwater conservation in Kansas, specifically examining how LEMAs, as a niche innovation, have spread throughout the state. Kansas currently has two LEMAs in GMD 1 and two in GMD 4, while GMD 3 has not adopted any LEMAs. Figure 1 depicts the locations of these LEMAs and the GMDs. A central focus of this research is the role of the Sheridan 6 LEMA in driving the diffusion of LEMAs across the state, its influence on the passage of H.B. 2279, and the overall shift in Kansas toward enhanced groundwater conservation practices.

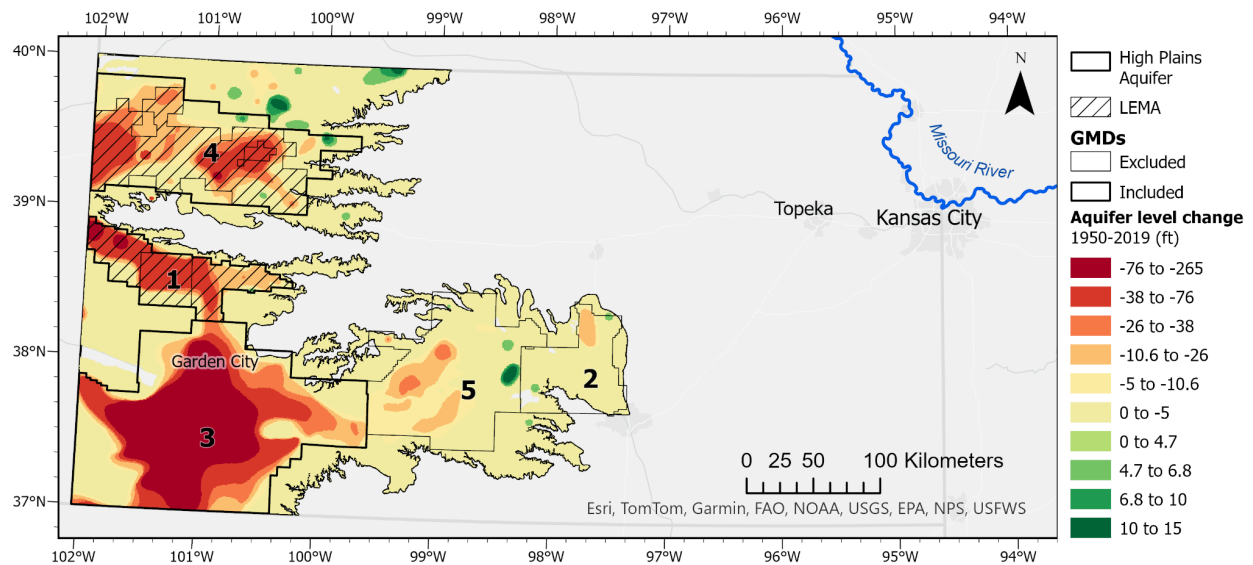


Figure 1
Map of GMDs, LEMAs, and aquifer level change from 1950 to 2019. Map created by Isabel Jorgensen (2024).

Groundwater from the Ogallala Aquifer serves as Kansans' primary drinking water source. However, the primary driver of groundwater depletion is not drinking water usage but rather irrigated agriculture, which accounts for 80-85% of all water withdrawals from the Kansas portion of the Ogallala Aquifer (Kansas State University Foundation, 2024). Producers utilize water from the aquifer primarily to grow corn and soybeans, which serve as feed for Kansas's cattle industry (Kansas Department of Agriculture, 2022). In 2023, cattle production was the top agricultural commodity in the state, contributing \$7.4 billion to Kansas's economy (Kansas Department of Agriculture, 2023). This strong economic relationship between groundwater usage, crop production, and cattle feeding underpins the state's agricultural-based economy but also accelerates groundwater depletion. Economic reliance on irrigated agriculture has led to

significant opposition to conservation efforts, as such efforts could threaten agricultural profits and economic growth in this sector.

Groundwater depletion has been most severe in GMD 3, with water levels dropping significantly since pre-development (1950) (Buchanan et al., 2023). In some regions of the state, particularly within GMD 3, only 10-20 years of groundwater supplies remain (Buchanan et al., 2023). Despite this, GMD 3 has been the most resistant to adopting conservation measures, instead advocating for the development of an aqueduct to transfer water from the Missouri River in eastern Kansas to the Ogallala region. Figure 1 depicts the severe groundwater declines and the Missouri River's location.

The western half of Kansas, which contains the Ogallala Aquifer, is a dry, arid region with minimal rainfall. Due to low precipitation levels and deep water tables, the aquifer recharge rate in western Kansas is less than one inch per year. Meanwhile, most of Kansas's population resides in the more urban and wetter eastern half of the state, while the western half remains largely rural. This geographic and hydrological contrast is critical in shaping the state's approach to water management and conservation policies.

\

2.0 Chapter 2: Literature Review

This chapter examines the MLP framework and its application to sustainability transitions, particularly in agriculture and water management. The MLP conceptualizes transitions through interactions between niches, regimes, and landscapes, where niches introduce innovations that challenge dominant regimes, and landscapes exert external pressures influencing change. I explore how water conservation practices in Kansas, such as LEMAs and H.B. 2279, function as niche innovations within this framework. Additionally, I address the limitations of the MLP, including its focus on large-scale systems while often neglecting the role of agency and behavior change in transitions. I also explore the role of policy entrepreneurs in overcoming resistance and facilitating sustainability transitions, highlighting their strategies of framing problems, building coalitions, and leveraging windows of opportunity. Furthermore, I introduce the concept of real-world labs as experimental spaces where innovations are tested and refined, framing the Sheridan 6 LEMA as an example of how such initiatives can drive actor role changes within Kansas's groundwater management system.

2.1 MLP

The MLP is a heuristic theoretical framework that conceptualizes and explains how sustainability transitions occur (Geels, 2002, 2010, 2011; Geels & Schot, 2007). The MLP is applied predominantly in the field of sustainability transition research. The sustainability transitions field emerged at the end of the 1990s due to the need to advance societal transitions towards sustainable development (Loorbach et al., 2017; Rotmans et al., 2001). Markard et al. (2012) describe sustainability transitions as long-term and multi-faceted processes where established socio-technical systems evolve towards more sustainable production and consumption patterns. Historically, most sustainability transition research on the MLP has focused on the energy and transportation sectors. El Bilali (2019) notes that scholars often overlook agro-food systems in sustainability transition research despite their importance in sustainable development initiatives. However, more recently, transitions scholars have begun utilizing the MLP to study sustainability transitions in agriculture and food systems (El Bilali, 2019; EL BILALI et al., 2018; Kamel & EL BILALI, 2022; Kaweesa et al., 2021). This study aims to contribute to the growing body of research that applies the MLP to agriculture, food, and water systems. Therefore, it is helpful to explore the origins of the MLP and its conceptual elements.

The MLP theorizes that transitions occur through interactions within and between 3 analytical levels: niches, regimes, and landscape (Geels, 2002, 2010; Geels & Schot, 2007). The interactions occur between the rules, actors, and technologies of the niche, regime, and landscape (Krigsholm et al., 2020). The MLP conceptualizes the three levels as nested systems. Figure 2 depicts these nested systems. The niche is situated at the micro-level and emerges within the meso-level regime; macro-level socio-political and ecological landscape factors influence the regimes and niches (Diep et al., 2019). Niches are spaces where

alternative ideas and practices exist to destabilize the regime and create changes within the incumbent regime (Diep et al., 2019). A transition occurs when there is a shift from one socio-technical regime to another. Many pathways lead to shifts in regimes and, subsequently, a transition. The most studied transition pathway in the MLP focuses on bottom-up, niche-driven actions. Specifically, in niche-driven transitions, the transition results from niche innovations building up internal momentum for change, while landscape changes create pressure that destabilizes the incumbent regime; the destabilization of the incumbent regime creates opportunities for niche innovations to scale up and replace the existing regime (Geels, 2011; Markard et al., 2012). Figure 3 visually conceptualizes transition processes in MLP.

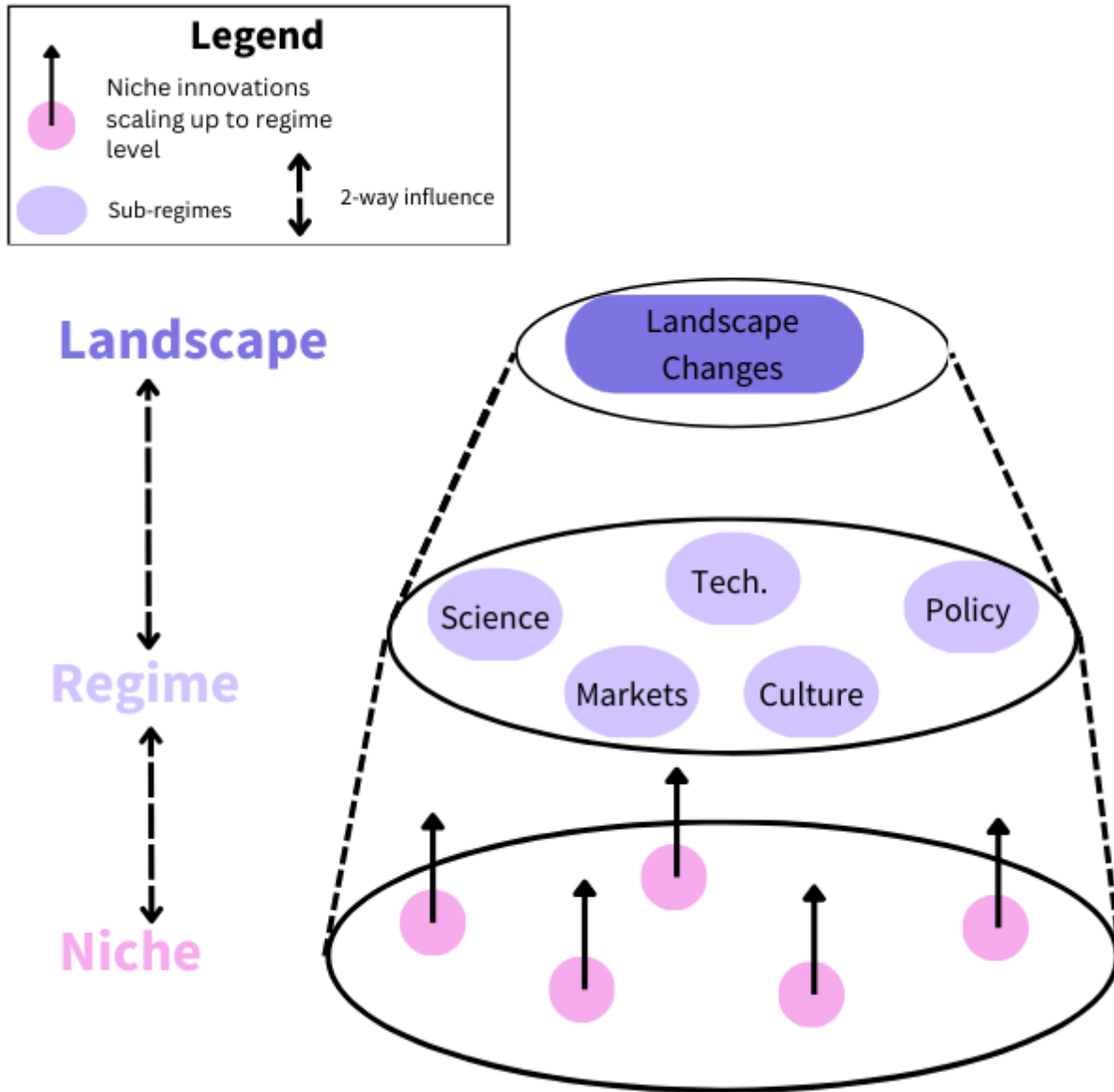
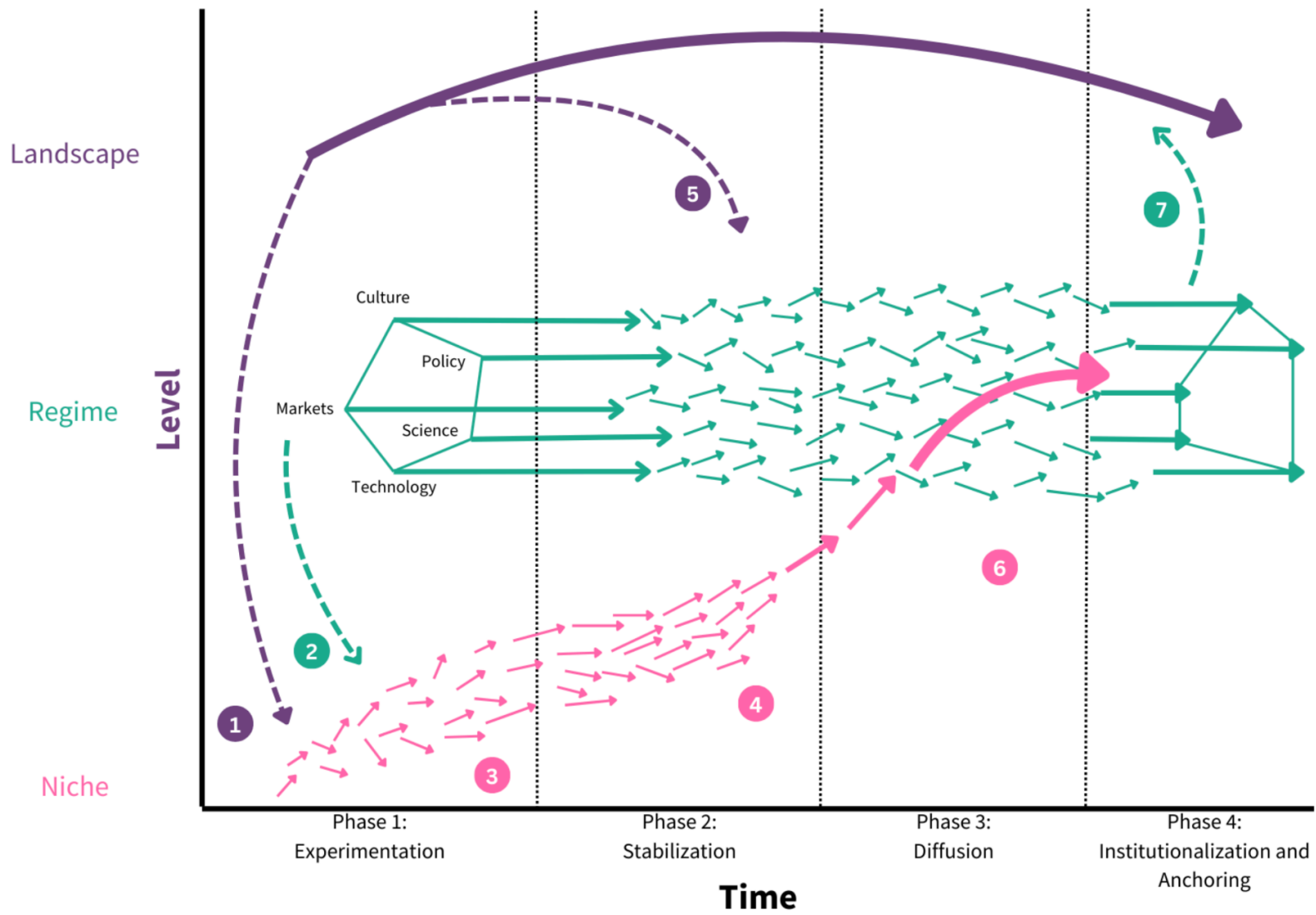


Figure 2
 Depiction of the nested MLP levels. Niche innovations are shown scaling up to the regime. Landscape changes influence the niche and regime and vice versa. The niche and regime are depicted as having a two-way influence. Contents inspired by Geels (2002).



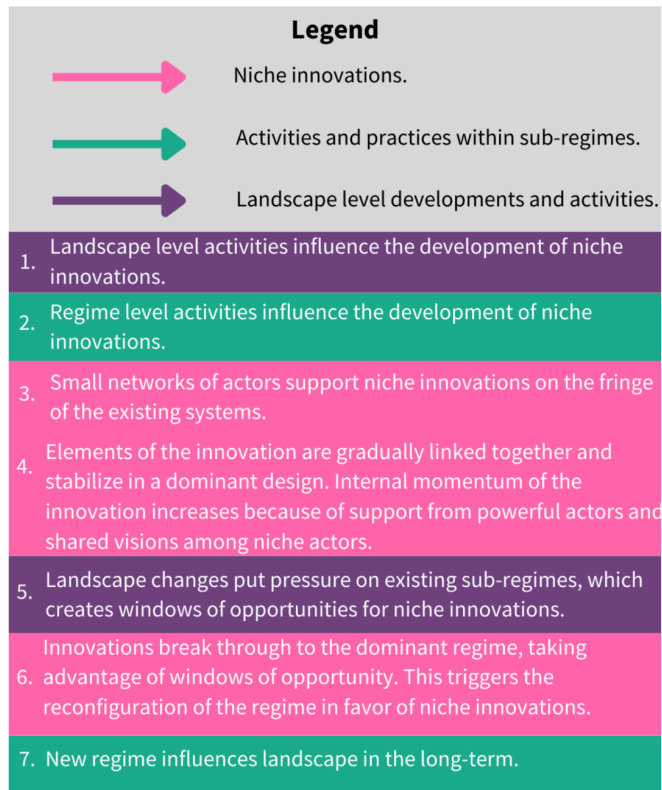


Figure 3

Depiction of transition processes in the MLP. Contents of the figure are inspired by Geels and Schot (2007).

2.1.1 Niches

Niches are specialized areas where new path-breaking, radical alternative ideas, and innovations are developed and protected from the mainstream system of the regime (Geels, 2011). Niches provide protective space for these ideas and innovations to grow and develop free from the competitive prevailing environment of regimes (Smith, 2007). Loorbach (2007) and Bui et al. (2016) further define niches as new technologies, rules, legislation, projects, or ideas developed by networks of actors. El Bilali (2019) found that niches in agricultural systems include organic agriculture, conservation agriculture, integrated farming, community-supported agriculture, alternative food networks, fair trade movements, and agriculture extension services. Within the water sector, researchers have framed niches as alternative water management systems, supply- and demand-oriented solutions, large-scale wastewater recycling, green infrastructure, irrigation efficiency technologies, rainwater harvesting, water conservation, water recycling, water education, water technology funding programs, and decentralized water systems (Diep et al., 2019; Mauw et al., 2023; Miörner et al., 2022; Nastar, 2014; Quezada et al., 2016). In this study, I frame water conservation as a niche and LEMAs, WCAs, and H.B. 2279 as niche innovations. Niches are essential for transitions because they create momentum that allows them to break through and replace the dominant incumbent regime. To understand the processes involved in niches replacing regimes, it is necessary to explore the elements of a regime.

2.1.2 Regimes

At the most basic level, regimes are the incumbent socio-technical system. As Kaweesa et al. (2021) describe, a regime is a "way of doing things" that includes how things are organized and arranged to operate within different settings. Thus, regimes encompass the mainstream activities and structures within the dominant socio-technical system (Kaweesa et al., 2021). The regime's mainstream activities and structures consist of networks of social groups and actors and informal and formal rules that are maintained to run the dominant socio-technical system (Geels, 2011).

The regime comprises many sub-regimes that comprise the entire socio-technical regime. Recent literature applying the MLP defines the sub-regimes as policy, markets, science, technology, and culture (El Bilali, 2019; Ghosh & Schot, 2019; Isgren & Ness, 2017; Kamel & El Bilali, 2022; Kaweesa et al., 2021; Nieminen et al., 2021). These five sub-regimes are the most generalizable types of sub-regimes that can apply universally in various contexts, such as energy, transportation, water, and agricultural transitions. However, the sub-regime categories and regime activities can differ based on the research context in which researchers apply the MLP. El Bilali (2019) echoes this sentiment in his findings that regimes in the agro-food sector differ based on the geography and political contexts of the case. Therefore, comparing the

regime activities and characteristics of sub-regimes identified in agriculture and water research is helpful, as these sectors are heavily involved in Kansas' groundwater transition.

When applying the MLP to agriculture and food systems, scholars have identified many actors, activities, and characteristics of sub-regimes that differ based on geographical and political contexts. For example, in his review of the literature on applications of the MLP to agro-food systems, El Bilali (2019) finds that across all geographical contexts, regimes within the agro-food sector usually consist of the practices and approaches of conventional and industrial agriculture. Järnberg et al. (2018) elaborate that regimes within the agro-food system include key government actors and their associated institutional structures, political discourses on agricultural development, dominant agriculture practices, and associated patterns of ecosystem services. In the water sector, regime practices and characteristics include water and sanitation infrastructure, desalination technologies, centralized water management approaches, large-scale dams, hydropower generation, water management policies, supply-side water technologies, and formal and informal water provisioning systems (Diep et al., 2019; Helgegren et al., 2021; Miörner et al., 2022; Narain et al., 2023). Key actors involved in water regimes include government authorities, state and municipal employees, water tanks and sludge emptying companies, private water companies, utility companies, and water management districts (Diep et al., 2019; Helgegren et al., 2021; Mauw et al., 2023; Miörner et al., 2022; Quezada et al., 2016). Regimes and sub-regimes have important interactions with regime rules that can influence the trajectory of a transition. It is first necessary to review what constitutes a regime rule to understand the dynamics of these interactions between sub-regimes and regime rules.

Geels (2004) conceptualizes regimes as sets of rules linked together. El Bilali (2019) echoes a similar sentiment in his description of regimes as coordinated networks and groups that follow shared rules and practices. Neo-institutional theory heavily influences this view of regimes. For example, Geels (2004) draws upon Scott's neo-institutional theory work (1995) to develop a typology of regime rules. As Geels (2004) explains, regimes have three types of rules: regulative, normative, and cognitive. Regulatory rules include formal rules, laws, sanctions, incentive structures, reward and cost structures, governance systems, power systems, protocols, standards, and procedures (Scott, 1995). Normative rules focus on moral concepts like values, norms, role expectations, authority systems, duties, and codes of conduct (Scott, 1995). Thus, normative rules dictate socially permissible behaviors, and interactions between actors create these rules. Changes in normative rules often occur through the development of new relationships and norms (Ghosh & Schot, 2019). Unlike regulatory rules, normative rules are often informal and not written down. Cognitive rules focus on shared ideas and concepts. For instance, cognitive rules consist of priorities, problem agendas, beliefs, paradigms, models of reality, categories, and jargon/language (Scott, 1995). Within each sub-regime of the socio-technical regime, groups of associated actors have their own rules that help to organize and guide the activities within their respective sub-regimes (Krigsholm et al., 2020). Thus, each sub-regime has its own set of regulatory, cognitive, and normative rules (Geels, 2004).

Alignments between sub-regimes and their corresponding regulative and cognitive rules are one way that sub-regimes and rules interact to influence the trajectory of a transition. For instance, because sub-regimes each have their own dynamics and co-evolve together, the actions and rules in the sub-regimes are often aligned (Geels, 2011). In transitions, alignment refers to the mutual reinforcement, coordination, and cohesiveness of rules and sub-regimes (Ghosh & Schot, 2019). A regime is strong and resistant to change when the rules and actors in each sub-regime are aligned; weaker regimes are less aligned (Ghosh & Schot, 2019). Alignment between the sub-regimes, rules, and actors can enable efficient coordination of activities within the regime, which helps provide stability and allows the incumbent regime to resist transitions (Geels, 2004, 2011; Geels & Schot, 2007). Figure 4 depicts this alignment and dealignment in the regime. However, when the sub-regimes, rules, and actors are in tension, it can create pressure that allows for a niche innovation to scale up, leading to a transition (Geels, 2011). The interconnected nature of rules also contributes to path dependency in regimes that allow the regime to block the transition from occurring. For example, because the regime rules are intertwined and co-evolved, changing one rule often requires alterations of other rules (Geels, 2004). Thus, regimes tend to follow dominant trajectories and become path-dependent, which makes altering a regime challenging (Geels & Schot, 2007). Further, the stability that regime rules provide means that regimes tend only to change incrementally and do not usually undergo transformation (Lachman, 2013). However, when regimes interact with landscape factors, transformation does sometimes occur.

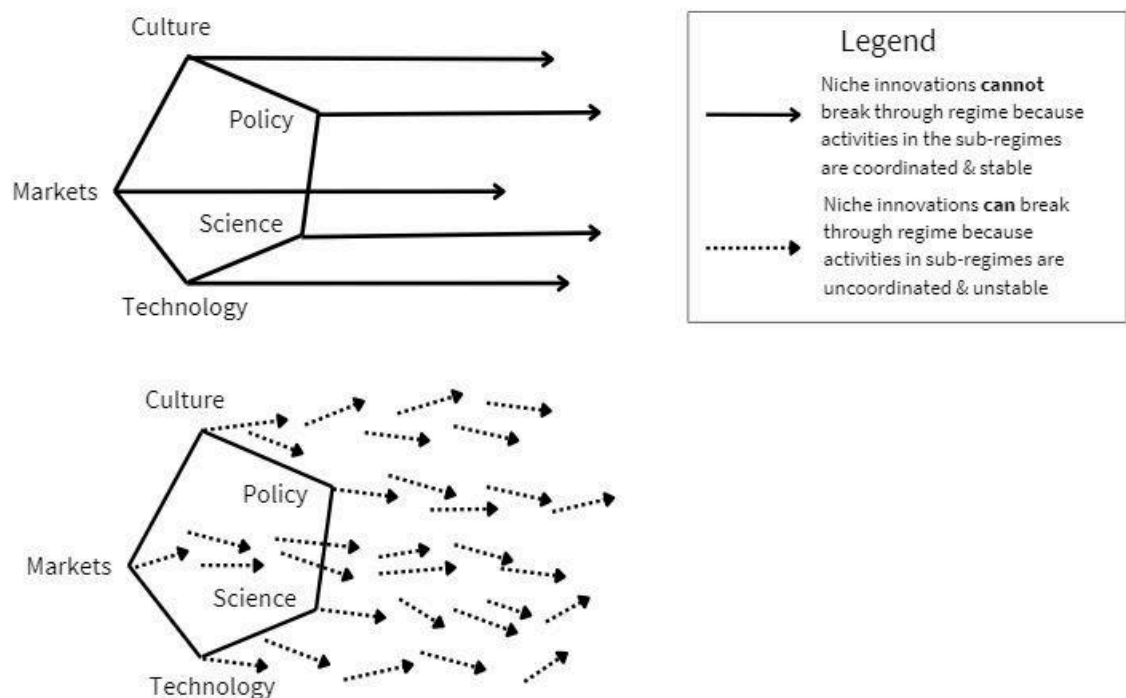


Figure 4

Sub-regime Alignments. The top image shows a stable, resistance to change regime, while the bottom images shows an uncoordinated regime that is susceptible to destabilization from niche innovations. Contents inspired by Geels (2004).

2.1.3 Landscape

Landscapes in the MLP help explain the external factors that affect the incumbent regime and developing niches and the factors that influence the transition trajectory. In the MLP, landscapes refer to exogenous trends and changes over which niche and regime actors have little control (Geels, 2002; Lachman, 2013). Specifically, landscapes within the MLP encompass demographic changes, macroeconomic trends, political developments, war and crises, cultural and societal values, and climate change (Lachman, 2013). Landscape factors within the water sector include international water research, United Nations guidelines, the millennium drought, declines in water sector funding from the World Bank, water scarcity in nearby cities, national water policies, and shifting attitudes towards water quality standards (Diep et al., 2019; Miörner et al., 2022; Nastar, 2014; Quezada et al., 2016). While the water sector accounts for landscape factors, scholars in the agro-food sector tend to overlook and treat landscape factors as a residual garbage can to house whatever does not fit into the regime and niche levels (El Bilali, 2019; Geels, 2011). However, in the research on agro-food systems that do consider landscape factors, El Bilali (2019) finds that landscape events and trends include agro-food market internalization, population growth, global financial crisis, changes in diet and lifestyle changes, neo-liberalization, international treaties and conventions, the European Union's Common Agricultural Policy, and increasing concerns about climate change. Landscape factors within food systems can also include social phenomena like poverty, inequity, and inequality (Lutz & Schachinger, 2013). While scholars account for socioeconomic landscape factors in the socio-technical landscape, they do not fully consider biophysical landscapes. Therefore, Lutz and Schachinger (2013) call for including biophysical landscape factors like soil fertility, arable land availability, and climate change. This research aims to contribute to including biophysical landscape factors within Kansas's groundwater transition context.

The landscape level has an important function in supporting niche development. The landscape level supports transitions by creating opportunities for niches to emerge, develop, and scale up to the regime level (Geels, 2018). One of the ways that landscapes support niche development is by offering them protection from dominant regimes. Landscapes protect niches by shielding them from competition in the dominant regimes and empowering them through learning and network building (Hinrichs, 2014). Landscapes can also support development in niches by introducing regulations at the landscape level that are more favorable towards niches (El Bilali, 2019). Implementing landscape-level policies that favor niches can influence the regime, which can help create regime changes and, ultimately, transitions. Specifically, El Bilali (2019) finds that introducing new landscape-level policies can cause changes in the regime rules, social practices, and norms of regime actors.

Changes and trends at the landscape level can also create opportunities for emerging niches. The emergence of community gardens in London is one example of how landscape-level trends and changes can create enabling environments for niches to develop (El Bilali, 2019). Specifically, Bell & Cerulli (2012) find that landscape-level changes in London's food system, like increased consumer awareness of the environmental impacts of industrial agriculture and increased food prices, created the conditions conducive to the emergence of community gardens as a niche. While the landscape can protect and provide opportunities for niches and create regime change, landscapes can also be locked in and resistant to change. Specifically, landscapes can have negative impacts on niche development, and they can have a stabilizing effect on regimes that inhibit transitions (Geels, 2011). It is evident that these interactions between niches, regimes, and landscapes serve to either block or spur transitions. Thus, further exploration of multi-level interactions is warranted. Further, understanding the dynamics and processes of multi-level interactions within Kansas is essential, as these interactions can help researchers better understand barriers to initiating groundwater management policy changes within Kansas.

2.1.4 Transition Pathways

Transitions refer to shifts from one socio-technical system or regime to another (Geels & Kemp, 2007). There are multiple ways that a transition can occur. Geels and Schot (2007) developed four transition pathways to explain the various mechanisms actors use to create transitions. These four pathways include technological substitution, dealignment and realignment, reconfiguration, and transformation (Geels & Schot, 2007).

The technological substitution pathways occur when landscapes put pressure on regimes, which creates problems for regime actors. Regime actors respond to these problems but are unsuccessful in resolving them. This creates windows of opportunities for new niche novelties to break through the dominant regime and replace the existing system through niche-regime linking processes (Elzen et al., 2012; Geels & Kemp, 2007). The technological substitution pathway is typically seen the most in energy transitions due to its focus on the role of renewable energy technologies in driving transitions. The dealignment and realignment pathway occurs when landscape changes destabilize the regime, leading to the dealignment of the regime. Insufficient niche development leads to the co-existence of multiple niches without a stable regime. Realignment of a new niche occurs when one niche innovation becomes dominant and outcompetes the other (Geels & Schot, 2007). The reconfiguration pathway involves multiple symbiotic novelties (innovations) within the niche implemented in the regime to solve problems. As the regime actors become more familiar with the novelty, the novelty gradually changes the regime. This can lead to the implementation of other novelties and changes in user practices and perceptions. Thus, over time and with pressure from the landscape, major reconfiguration and changes to the regime occur (Geels & Schot, 2007). The reconfiguration pathway is ubiquitous in agricultural and water transitions because these sectors function through the interplay of multiple technologies (Geels & Schot, 2007).

The final transition pathway, transformation, is unique in that it is the only pathway that focuses on the role of regime actors in driving transitions. In transformation processes, niches have little influence over regimes; instead, changes at the landscape level pressure and destabilize regimes, which leads to regime actors reorienting the regime by changing the regime rules (Geels & Kemp, 2007). In transformation processes, new regimes develop from old regimes through the reorientation of regimes and changes to regime rules (Geels & Schot, 2007).

2.1.5 Limitations of the MLP

The MLP has many limitations that this study hopes to mitigate. Geels (2011 and 2019) identifies some of the common criticisms of the MLP and notes some of the ways researchers have sought to mitigate the limitations of the MLP. Perhaps the most notable criticism of the MLP is its inattention to power and politics, which Geels (2011 and 2019) and many other scholars have noted throughout the years. The criticisms of power and politics in the MLP have also resulted in claims that the MLP neglects the role of agency and behavior changes in transitions (Geels, 2011; Pesch, 2015; Fischer & Newig, 2016; de Haan & Rotmans, 2018; Geels, 2019; Geels, 2020). The critiques about politics, power, agency, and behavior change speak to criticisms that the MLP overlooks the micro-foundations of transitions related to agency and individual and collective actors' roles in transition (Geels, 2020). Some scholars have gone as far as to argue that the MLP treats actors as passive agents within pre-existing structures (Huttunen et al., 2021). These limitations create a gap in understanding how actors create and support transitions. Geels (2011 and 2019) highlights that researchers increasingly apply political science theories and political economy frameworks, such as the Multiple Streams Approach (MSA) and the Advocacy Coalition Framework, to address the MLP's inattention to power, politics, and agency. Following the lead of Kern & Rogge (2018), I apply the MSA's concept of policy entrepreneurs to my research to further develop the MLP's conceptualization of politics and agency. I further explore policy entrepreneurs' conceptual foundations and where they fit into the MLP in section 2.2. By applying the concept of policy entrepreneurs to my research and exploring how they enabled Kansas's transition, my research aims to address the MLP's gaps in politics and agency. This will provide insights into the active role of individual and collective agencies in shaping sustainability transitions.

Geels (2011 and 2019) also states that researchers have criticized the MLP for its bias toward bottom-up explanations of transitions. Criticisms of the MLP's bias towards bottom-up transition pathways speak to issues in how the MLP conceptualizes the state's role in transitions. Most research on the state in sustainability transitions has focused on the state as a broad decision-making actor but failed to make the state the focal point of analysis (Johnstone & Newell, 2018). Research that has examined the role of the state has focused on its role in protecting and nurturing developing niches, but the focus has been more on niche development rather than the role of the state (Smith, 2007; Schot & Geels, 2008; Nill and Kemp, 2009; Witkamp et al., 2011; Smith et al., 2013). This inattention to the state's role is partially due to

the MLP's focus on bottom-up explanations, which often reduces the state's role to an incumbent actor working to maintain the regime (Geels, 2014). However, the sustainability governance and commons literature shows that the state has an important role to play in helping produce sustainable outcomes through supporting and enabling collective action schemes (Lubell et al., 2020). In overly focusing on bottom-up explanations of transitions, the MLP limits its understanding of the role of the state in governing transitions. This overall limits the MLP's ability to produce valuable insights for policymakers hoping to steer transitions toward sustainable outcomes. By exploring the role of state actors in Kansas's transition, my research aims to help contribute to a more robust conceptualization of top-down transition processes and the role of the state in the MLP. To do so, I position my research at the intersection of transition and groundwater governance literature. I explore the groundwater governance literature further in section 2.4.

Geels (2019) finds that scholars have criticized the MLP for its lack of analysis of policy processes within transitions. The insufficient analysis of policy processes in the MLP has manifested in criticism that the MLP does not explain the mechanisms through which niche innovations contribute to regime changes (Bui et al., 2016; To et al., 2018). This insufficient understanding of policy processes in the MLP has limited the understanding of how policymakers can intervene in transitions to accelerate progress. Researchers have responded to this in recent years by studying the conditions that enable policymakers to introduce policies that accelerate transitions (Geels, 2019; Roberts & Geels, 2019). The results of these studies have found that changing public opinion and public narratives about sustainable innovations can legitimize niche causes and help create support for policies that strengthen the niche (Roberts, 2017; Rosenbloom, 2018). However, the process by which public opinions, narratives, and subsequently, behaviors change is under-explored in the MLP; these topics relate to agency, which the MLP tends to neglect (Pesch, 2015; Fischer & Newig, 2016; Haan & Rotmans, 2018; Geels, 2020). This leaves a gap in understanding the mechanisms that drive public opinion changes and behavior shifts, especially within local contexts where resistance to or support for transition processes can significantly vary. This inattention to the mechanisms by which public opinions and behavior change occur is problematic because transitions inherently require incumbent actors to shift their behaviors toward more sustainable actions (Avelino & Wittmayer, 2016). It also limits policymakers' abilities to govern transitions; the lack of understanding of how niche innovations drive changes in public opinions and regime actors' behaviors limits policymakers' abilities to design policies that effectively target and support behavior changes (Geels, 2019). My research addresses the MLP's under-conceptualization of the mechanisms behind how niche innovations enable changes in public opinions and regime actors' behaviors. Because the MLP lacks the mechanisms to explore how niche innovations contribute to regime actors' shifting roles and behaviors, I apply the German concept of real-world labs to my research. Specifically, I apply real-world labs as a way to explore how niche innovations contribute to policy diffusion in the regime and behavior changes toward increased conservation in regime actors. I explore real-world labs and their application to my research more in section 2.3.

2.2 Policy Entrepreneurs

The concept of policy entrepreneurs originates in the MSA. The MSA conceptualizes the policy system of society as consisting of three streams (problems, policy, and politics) that operate independently but occasionally converge and interact to form windows of opportunity for policy changes (Kingdon, 1995). Policy entrepreneurs are individuals or groups who utilize these windows of opportunity to align the three streams and advance policy changes (Kingdon, 1984; 1995; Kern & Rogge, 2018). Policy entrepreneurs invest their resources in policy problems and solutions and utilize windows of opportunity to implement their policy solutions (Kingdon, 1984). While leveraging windows of opportunity is perhaps the most common policy entrepreneurship strategy in the MSA, much of the later works on policy entrepreneurs suggest that they use diverse strategies to effect change (Mintrom & Luetjens, 2017). In the context of sustainability, policy entrepreneurs utilize social skills, coalition-building, and strategic framing to challenge existing regimes and promote sustainable alternatives (Mintrom & Thomas, 2018). Given that policy entrepreneurs can be crucial in promoting sustainable policy shifts, I examine the role of policy entrepreneurs in contributing to and/or hindering Kansas's transition toward increased conservation.

While policy entrepreneurs originate from the MSA, there is quite a bit of overlap between the MSA and the MLP, making utilizing policy entrepreneurs in this study feasible. For example, the MLP already applies and modifies the MSA's concept of windows of opportunity to explain how landscape pressures destabilize regimes and create windows of opportunities for niche innovations to scale up (Kern & Rogge, 2018; Geels, 2019). There is also precedent in the literature for incorporating policy entrepreneurs into the MLP framework (Young & Brans, 2020; Friedman & Rosen, 2022). Researchers have even suggested that applying policy entrepreneurs to the MLP is useful in addressing the MLP's inattention to agency (Kern & Rogge, 2018; Geels, 2019). I follow this lead and incorporate policy entrepreneurs into my research to address agency limitations in the MLP and further develop the MLP's conceptualization of agency. Specifically, I examine how policy entrepreneurs in Kansas utilized windows of opportunity and translated niche innovations to the regime level. Notably, in my framing of policy entrepreneurs in the MLP, I do not engage with MSA's three streams, as other MLP studies have done (Young & Brans, 2020). This decision to focus solely on policy entrepreneurs ensures that my study stays focused on addressing agency concerns in the MLP.

2.3 Real World Labs

Real-world labs are a predominantly German concept that has gained popularity in transformative research, combining insights from transformative research and sustainability research (Singer-Brodowski et al., 2018). Real-world labs are research infrastructures where scientific and societal actors collaboratively design and conduct experiments in real-life settings. These experiments aim to initiate and support transformation processes while generating valuable knowledge to foster sustainable development (Bergmann et al., 2021). Real-world labs

test and implement innovative solutions and help bridge the gap between knowledge about a problem and taking action to address the problem (Huning et al., 2021). Research on real-world labs has also shown that they can encourage actors to change roles by providing environments where actors can reflect on old roles, test out new roles and ideas, and challenge beliefs associated with the regime (Trenks & Bögel, 2024). Given the potential for real-world labs to facilitate policy diffusion and behavior changes, I apply real-world labs to my research to help conceptualize how niche innovations contribute to policy diffusion and behavior changes in regime actors in Kansas.

Real-world labs are strikingly similar to existing MLP and transitions literature concepts, making it feasible to apply real-world labs in the MLP context. For instance, much of the literature on strategic niche management and the MLP already uses the concept of experiments and grassroots innovations to describe spaces where niche innovations are developed and tested in a real-life setting (Seyfang & Smith, 2007; Seyfang et al., 2014; Patterson et al., 2017; Pesch et al., 2018; Temper et al., 2018; Geels, 2019). This significant overlap between real-world labs and pre-existing terminology and concepts in strategic niche management literature and the MLP makes it possible to frame real-world labs as a niche innovation. Although there are varying definitions for what constitutes an experiment or grassroots innovation and how they differ from real-world labs, collaboration between scientific actors and community members appears to be a greater focus in real-world labs (Singer-Brodowski et al., 2018). With these differences in mind, I frame my real-world labs as a niche innovation where scientific actors and community members design new sustainable arrangements and innovation. In the context of Kansas, I frame the Sheridan 6 LEMA as a real-world lab and niche innovation designed with the help of scientific groups like the Kansas Geological Survey and community members like the GMD staff, Board, and members. As a real-world lab, I frame the Sheridan 6 LEMA as a space for farmers to test out new conservation practices, learn how conservation practices impacted economic revenues, and experiment with niche actor roles.

2.4 Groundwater Governance

While the MLP tends to ignore the state's role in transitions, the groundwater governance literature highlights the state's importance in supporting and hindering sustainable collective action arrangements. In the case of groundwater in California and its Sustainable Groundwater Management Act (SGMA), the state has supported collective action efforts to manage groundwater sustainably. For example, Lubell et al. (2020) find that the state's role in groundwater governance in California is to engage in "state-reinforced collective action." In California, state-reinforced collective action entailed the state supporting collective action arrangements across the state's basins by providing resources to reduce transaction costs, providing oversight of local institutions to ensure accountability, and learning how to adjust the level of resources and oversight in accordance with the needs of the different basins (Lubell et al., 2020). While the experience of the state in California's SGMA suggests that the state can help promote collective action arrangements and sustainable resource management, examples from other regions suggest that the state can also negatively impact sustainability outcomes.

For instance, in their review, Molle and Closas (2020) find that state-centered groundwater governance is largely ineffective globally due to private vested interests, political clientelism, bureaucratic competition among various agencies that rely on groundwater, and severely overallocated groundwater.

Given that state-centered groundwater governance is usually ineffective, it would be expected that Kansas would be another example of this. My research aims to explore the state's role in Kansas' transition and whether the state has defied expectations about the ineffectiveness of state-centered groundwater governance. The Kansas Ogallala Aquifer presents a unique case to study the state's role in groundwater governance because Kansas follows a mostly state-centered governance approach, and they have passed new legislation at the state level to promote sustainable groundwater use. Additionally, with help from the state, local irrigators in Kansas have pioneered LEMAs as a form of effective collective action. These developments in Kansas suggest that Kansas might be an exception to research suggesting that state-centered governance is ineffective. I explore this theme throughout my research and investigate the conditions that might contribute to the state's role in Kansas' transition. Understanding the role of the state and the conditions of Kansas' transition will allow researchers to better understand the contexts in which the state can contribute positively to sustainable collective action arrangements.

3.0 Chapter 3: Research Methods

In this chapter, I employ a critical realist philosophical approach to analyze Kansas's groundwater management transitions through the MLP framework. I use a case study approach, with GMDs 1, 3, and 4 serving as embedded units to examine the unique conditions driving conservation efforts within each district. The study relies on semi-structured interviews and document analysis, using a purposive sampling strategy to gather data from key stakeholders in groundwater management. Utilizing a hybrid inductive-deductive thematic analysis combined with process tracing, I trace the evolution of actor roles and identify the conditions under which Kansas's sustainability transition occurred. I highlight how real-world interventions, local leadership, and state-level policy contribute to shifts from planned depletion to conservation. This method provides an in-depth understanding of the dynamics between niche and regime actors. It offers insights into how critical landscape pressures and policy entrepreneurship influence transitions in water governance.

3.1 Critical Realism

This research employs a critical realist philosophical approach because of the methodological coherence between sociotechnical transitions research, the MLP, and critical realism. This research takes the position of scholars who have argued that critical realism provides a valuable philosophical position for sociotechnical transitions research because of its focus on how actors, events, and structures interact to create outcomes (Geels, 2022; Sorrell, 2018). Adopting a critical realist perspective allows this research to remain methodologically consistent with the MLP in its assumptions about reality and knowledge generation. Consistency with the assumptions of the MLP is important because this research is understood and conceptualized within the context of the MLP.

3.2 Case Study Approach

This research is structured and designed using a case study approach, which allows for an in-depth examination of Kansas's groundwater management within its specific context (Baxter & Jack, 2008). Kansas's decision to adopt locally controlled, conservation-oriented groundwater management serves as the primary case for this study, aligning with the research questions aimed at understanding processes behind sustainability transitions in this context.

I use an explanatory case study design to help understand the conditions under which Kansas's transition occurred. Explanatory case studies are particularly well-suited to answering "why" and "what" questions, which are central to this research. By utilizing this approach, the research can explore what factors motivate regime actors to change roles and what role the state and policy entrepreneurs play in transitions. The research uses a single case study with embedded units (Baxter & Jack, 2008) to facilitate a comprehensive analysis. These embedded units include GMDs 1, 3, and 4, along with state-level actions, allowing data analysis within,

between, and across these sub-units. By focusing on the differences in groundwater management across these GMDs, the research can offer detailed insights into how sustainability transitions unfolded in different local contexts. Kansas's unique approach to groundwater management, which deviates from expected norms in common-pool resource management, justifies using a single case study. (Hardin, 1968). Kansas's unexpected success in adopting collective, conservation-oriented management practices makes it an unusual and theoretically significant case (Yin, 2018).

The case is bounded geographically and temporally, with the geographical scope restricted to the western Kansas portion of the Ogallala Aquifer. Specifically, the research focuses on GMDs 1, 3, and 4, which experience minimal recharge, unlike GMDs 2 and 5, which are part of the High Plains Aquifer and experience recharge. Excluding GMDs 2 and 5 ensures that the research focuses on areas with comparable challenges and opportunities, making the analysis more relevant and coherent. The temporal boundary spans from 1990 to 2023, capturing the critical transition period, including the planned depletion policies in the GMDs and the implementation of more recent conservation initiatives.

By incorporating multiple data sources, this case study approach allows for a rigorous exploration of the processes that led to the transition to sustainable groundwater management in Kansas while comparing the differences between the GMDs' approaches and the influence of state-level interventions.

3.3 Data Collection and Sources

This section discusses the types of data collected, the process of data collection, and the relevance of the data used to the research questions and objectives of the study. This research uses a combination of semi-structured interviews and document analysis. While I discuss the document source, the search protocol, and the inclusion and exclusion criteria below, Table 1 conveys this visually. Table 2 displays the data sources used in this research, the methods of analysis applied to each, the types of evidence generated, and the purpose of including each source in the study.

Table 1.

Matrix of inclusion and exclusion criteria, sampling strategy, and search strings used for documentary sources.

Data Source	Inclusion Criteria	Exclusion Criteria	Sampling Strategy	Search Strings Used (if applicable)
GMD 4 LEMA Documents	Testimonies from 2018–2022 GMD 4	Redundant testimonies,	focused on key stakeholders in	N/A

	LEMA hearings, focusing on state actors and water rights holders; diverse perspectives considered.	administrative/legal documents (e.g., notices, motions), and documents unrelated to conservation.	GMD 4 LEMA hearings.	
News Articles (2013–2021)	Articles related to LEMAs, WCAs, and groundwater conservation efforts; local groundwater management efforts like Sheridan 6 LEMA, Wichita County WCA, Wichita County LEMA, and failed LEMA attempts in GMD 1 and 3.	National media sources, opinion pieces, articles without quotes or relevant insights, articles	Focused on selecting articles that provided insights on local conservation efforts in Kansas	"GMD 1 LEMA 2014", "Mark Rude Kansas groundwater", "Sheridan 6 LEMA", "Wichita County Water Conservation Area", "Wichita County LEMA", "GMD 1 LEMA", "GMD 4 LEMA"
News Articles (2022–2024)	Articles focused on state-level actions and legislative reforms on groundwater management; interviews with politicians, lobbyists, and other stakeholders about Kansas's groundwater reform efforts.	National media sources, opinion pieces, non-Kansas-based articles, and irrelevant media not mentioning state actions.	focused on capturing Kansas-based articles on legislative progress and groundwater depletion efforts.	"Kansas Ogallala Aquifer", "Kansas groundwater reform 2022"
GMD 3 LEMA Presentations	Presentation slides from the Kearny-Finney LEMA steering committee (2016–2018)	Duplicates or slides providing redundant information, slides not explaining LEMA development	focused on meetings during the LEMA attempt period.	N/A

	supporting the GMD 3 LEMA attempt, addressing reasons and timeline of events.	or associated organizations/agencies.		
GMD 3 Minute Meetings	Minute meetings from GMD 3 (2016–2018) that discuss the LEMA attempt or mention state and policy entrepreneurs.	Meetings not referencing LEMA discussions; irrelevant meetings from unrelated years.	focused on meetings during the LEMA attempt period.	N/A
Kansas Oral History Project Interviews	Interviews mentioning groundwater management, GMD Act, Ogallala Aquifer, covering water policy and actor roles from 1970s onward.	Interviews solely focused on GMDs 2 or 5; interviews unrelated to Kansas water policy or GMDs 1, 3, 4.	Focused on selecting interviews relevant to research questions and geographic scope.	"Groundwater management", "GMD Act", "Ogallala Aquifer"
Scholarly Articles	Articles on legal aspects of groundwater management, history of Kansas water laws, evolution of GMDs; focus on post-1945 frameworks.	Articles solely about GMDs 2 or 5, duplicates, articles already covered in Peck's works or redundant journal issue publications.	Prioritized articles by John C. Peck, followed by additional articles on relevant legal frameworks.	"Kansas AND planned depletion"
Newspaper Articles (1990–1992)	Articles discussing GMD 4's zero-depletion policy from 1990–1992, including relevant	Articles without quotes or interviews from GMD 4 actors, non-Kansas publications, and irrelevant opinions	Used keyword search to identify articles discussing GMD 4's zero-depletion policy.	"Zero depletion AND groundwater"

	quotes from GMD 4 members.	unrelated to groundwater management.		
--	----------------------------	--------------------------------------	--	--

Table 2.

Data Sources, Evidence, Methods, and Purpose Matrix

Data Source	Type of Data	Method of Analysis	Evidence Generated	Purpose in Study
Semi-structured interviews	Key informant interviews	Thematic Analysis, Process Tracing	Identification of conditions under which Kansas's transition occurred, actor role changes, timelines	To understand actor roles, transitions, and policy impacts.
GMD 4 LEMA Hearing Documents	Testimonies, decisions, and LEMA-related documents	Thematic Analysis, Process Tracing	Factors influencing conservation adoption and role changes	To explore the factors that contributed to conservation policy adoption
News Articles (2013-2021)	Local news articles on groundwater conservation and LEMAs	Thematic Analysis, Process Tracing	Factors influencing conservation adoption, the role of state actors and policy entrepreneurs in LEMAs, failed LEMA attempts	To fill gaps from interviews and hearing documents, understanding public sentiment. To understand factors influencing role changes and the role of state actors and policy entrepreneurs in transitions.
News Articles (2022-2024)	News articles covering Kansas legislative reforms and LEMAs	Thematic Analysis, Process Tracing	Insights into the role of state actors and policy entrepreneurs, factors contributing to conservation	To analyze recent legislative progress, the role of policy entrepreneurs and the state, and factors contributing to

			adoption, legislative changes	conservation adoption
GMD 3 LEMA Presentations	Presentation slides from Kearny-Finney County LEMA committee	Thematic Analysis, Process Tracing	Factors influencing farmers' role changes, insights into failed LEMA attempts	To understand factors behind role changes.
GMD 3 Minute Meetings	Minute meetings from GMD 3 Board meetings from 2016 to 2018	Thematic Analysis, Process Tracing	Insights into the role of state actors and policy entrepreneurs in Kansas's transition	To understand the role of state actors and policy entrepreneurs in transitions and fill in gaps from interviews.
Kansas Oral History Project Interviews	Interviews with key water policymakers in Kansas	Thematic Analysis, Process Tracing	Historical insights, the evolution of Kansas water policy, policy windows, the evolution of actors' roles	To understand the historical context of Kansas groundwater management policies.
Scholarly Articles	Articles on Kansas water law and management	Thematic Analysis, Process Tracing	Insights into the role of state actors, policy impacts, legislative changes	To understand the historical context of Kansas groundwater management policies and the role of state actors and policy entrepreneurs in transitions
Newspaper Articles (1990-1992)	Articles covering GMD 4's zero-depletion policy (1990-1992)	Thematic Analysis, Process Tracing	Factors influencing policy shifts toward conservation	To understand the shift in GMD 4's approach to groundwater management.

3.3.1 Interviews

This research used semi-structured interviews to gather rich, detailed information from key informants about their perspectives, activities, and roles in groundwater management. The semi-structured format allowed for follow-up questions and elaboration from participants, eliciting more comprehensive and nuanced responses (DiCicco-Bloom & Crabtree, 2006; Alsaawi, 2014). This flexibility made semi-structured interviews ideal for obtaining detailed insights aligned with the research's goals of understanding actor roles and transitions within groundwater management.

A purposive sampling approach was employed to identify key informants with specific knowledge about groundwater management in Kansas. These informants were selected based on their testimonies from H.B. 2279 hearings, ensuring they were well-informed community experts relevant to the research questions (Palinkas et al., 2015). Table 3 shows the participants included in the study. This selection process ensured diverse perspectives, contributing to a more comprehensive understanding of groundwater management practices and conservation efforts.

The interview questions were tailored to the participants' roles and the specific GMDs they were associated with, ensuring relevance and depth in responses. For instance, I asked more legal-specific questions to legal professionals, while I asked GMD 4 and GMD 1 participants about their respective LEMAs and groundwater management strategies. This differentiation in questioning ensured that each participant provided valuable insights based on their expertise and geographical context.

Although I ultimately excluded GMD 2 from the final analysis due to its different geographic context outside the Ogallala Aquifer, I kept the relevant interview portions focused on state-level groundwater management. This decision ensured that valuable insights about the broader Kansas groundwater management system were not lost while maintaining the study's primary focus on the Ogallala Aquifer.

Despite extensive outreach efforts, I only conducted eight interviews, which is a limitation of the study. The small sample size may not fully represent all relevant viewpoints. However, I took steps to mitigate this limitation. For example, I attended and transcribed a GMD 3 Board meeting, which provided additional perspectives from GMD 3, enriching the study's data. While no formal interviews with GMD 3 members were secured, the three-hour meeting transcription captured multiple perspectives from Board members, providing a more comprehensive understanding of GMD 3's groundwater management practices. This approach helped to address the lack of formal interviews and offered a broader representation of GMD 3's stance on conservation efforts.

I developed the interview guide using both the MLP literature and previous research on groundwater depletion in Kansas to ensure the questions were relevant and well-informed. This method aligns with best practices in social sciences for constructing focused and contextually

informed interview questions (Kallio et al., 2016). The combination of theoretical insights from the MLP and practical knowledge from prior studies helped guide the interview process, ensuring that it addressed the core concerns of groundwater conservation and actor transitions.

Table 3.
Interview Participants

GMD 4 staff member
Sheridan 6 member
GMD 1 staff member
GMD 2 Member
Legal professional 1
Legal professional 2
Former Chief Engineer
Playa Lakes Joint Venture

3.3.2 Documentary Evidence

After attending the GMD 3 Board meeting and conducting interviews, the next data collection phase began. The second phase involved collecting documents from seven sources. The data sources used include:

- GMD 4 LEMA hearing documents.
- News articles.
- GMD 3-minute meetings.
- LEMA presentation slides from the Kearney-Finney County Steering Committee (GMD 3).
- Kansas Oral History Project (KOHP) interviews with policymakers.
- Scholarly articles.
- Historical Kansan newspapers.

Descriptions of these data sources are in the following section.

The process of deciding which documents to include in the study was similar across the seven document data categories. I focused on including high-quality documents that pertained to the research questions. I discuss and define the criteria for high-quality documents throughout section 3.4. The first step in the process was creating a list of inclusion and exclusion criteria for documents included in the study. The research questions and objectives helped guide the inclusion and exclusion criteria. I developed search strings and keywords based on inclusion and exclusion criteria to help locate relevant documents. The next step was conducting a "first pass" review of the documents identified from search strings, skimming the document's contents, and removing irrelevant and duplicate documents. After this, a second review of the remaining documents occurred. The inclusion and exclusion criteria were applied to the documents during the second review to refine the sample further. Document collection typically ends when adding further results in redundancy (Morgan, 2022). However, a saturation point was rare due to the relatively small number of initial documents in each data source category and the restrictions resulting from the inclusion and exclusion criteria.

I use document analysis and interviews to help address the limitations associated with having a small sample size and not interviewing a GMD 3 member. Incorporating data from documents allowed for perspectives not captured by interviews to emerge. Through document analysis, I gained insight into the perspective of members of GMD 3 and further enriched my data on the perspectives of members of GMD 1 and 4. Utilizing document analysis and interviews also allows for triangulation, strengthening the study's credibility. Triangulation of the data allows the researcher to corroborate the results across different data sources, which helps to increase the dependability and credibility of the research (Moon et al., 2016). In addition to helping with triangulation, I also use document analysis to help answer the research questions and supplement the interview findings. The following sections describe the data sources used and the data collection process.

3.4 Documentary Sources

This section examines the data sources and methods used to explore Kansas's groundwater sustainability transition through a multi-method approach, primarily grounded in the

MLP framework. I draw from various qualitative data sources, including testimonies, news articles, and historical interviews, to understand how actors and institutions contribute to or hinder transitions in water conservation. Key sources include testimonies from GMD 4 LEMA hearings, local news articles, GMD 3 presentations, GMD 3 minute meetings, Kansas Oral History Project interviews, and scholarly literature. Table 2 displays a visual representation of the data sources, the type of data included, the method of analysis, the evidence generated, and the purpose of the data in the study. Table 1 depicts the inclusion criteria, exclusion criteria, sampling strategy, and search string used for each of the seven documentary sources.

3.4.1 GMD 4 LEMA Documents

I utilize testimonies from the GMD 4 LEMA hearings held in 2017 to gain insight into GMD 4 members' perspectives on conservation and the factors that motivated them to conserve. These perspectives are useful for answering my research question about the factors that motivate regime actors to change roles. THE GMD 4 LEMA hearing documents also pertain to my research question about the role of the Sheridan 6 LEMA in Kansas's transition, as the GMD 4 LEMA came five years after the Sheridan 6 LEMA. Including GMD 4 LEMA hearings allows for a deeper understanding of how the success of the Sheridan 6 LEMA influenced conservation initiatives in other areas. These testimonies offer insights into how proponents of the 2018 LEMA drew on the lessons from Sheridan 6 to gain support for further conservation efforts and explore factors that motivated individuals to shift from opposing conservation measures to actively supporting them. I focus on including documents that capture the perspectives of local irrigators in GMD 4 to understand the various factors that shape conservation behaviors in GMD 4.

3.4.2 News Articles

This research uses local news articles as a data source to answer all of the research questions. Local news articles often include various perspectives from stakeholders, including farmers, policymakers, environmental groups, and residents. These perspectives are crucial for understanding the factors influencing regime actors to transition and adopt conservation behavior and how state actors and policy entrepreneurs contribute to transitions. News articles were particularly useful in filling data gaps where interviews could not capture the full range of perspectives (Pesch, 2015; Fischer & Newig, 2016). For instance, news articles that featured quotes from GMD 3 members and state actors helped mitigate the lack of interviews from GMD 3 and the inclusion of only one interview with a state actor.

I employed a purposive sampling approach to select the news articles, ensuring that the articles chosen offered the best knowledge and were directly relevant to the study's focus on groundwater management in Kansas (Palinkas et al., 2015). The sampling strategy involved selecting articles that featured informed perspectives on LEMAs, WCAs, and groundwater management reform efforts at local and state levels. I categorized the news articles into two distinct date ranges: 2013–2021 and 2022–2024, which allowed the study to capture shifts in

focus over time. The first date range covers news articles on local groundwater conservation efforts like the Sheridan 6 LEMA, Wichita County WCA, Wichita County LEMA, and the failed LEMA attempts in GMD 1 and GMD 3. The second period, 2022–2024, concentrates more on state-level actions related to groundwater management, particularly as Kansas policymakers began to prioritize this issue in response to declining water levels.

By including news articles from both periods, I gained a more comprehensive understanding of the different attitudes toward conservation and state actors' and policy entrepreneurs' roles in driving transitions to increased conservation in Kansas.

3.4.3 GMD 3 LEMA Presentations

I included presentation slides about a proposed GMD 3 LEMA from 2016-2018 to understand the factors influencing regime actors to change roles. The presentations were from the Kearny-Finney County LEMA (KFL) steering committee, which comprised supporters of the LEMA and individuals involved in developing the now-failed LEMA. The presentations helped provide valuable insights into the perspectives of farmers in GMD 3 who initially did not support conservation efforts. These presentations allow for a deeper understanding of what factors, such as economic motivations or cultural values, contributed to these actors reconsidering their positions on water management and shifting their beliefs toward supporting conservation. Including the KFL presentation slides is particularly relevant for understanding what factors contributed to some regime actors in GMD 3 supporting conservation despite the broader resistance within the district.

I focused on including high-quality presentations that stated why the steering committee supported the LEMA. I defined "high-quality presentations" as those that provided clear, comprehensive, and authoritative insights into key actors' perspectives and decision-making processes in groundwater management. Specifically, I prioritized presentations that offered detailed explanations of why the steering committee supported the LEMA, as these presentations directly addressed the motivations and reasoning behind critical conservation decisions. Including GMD 3 LEMA presentations also helped mitigate the lack of interviews with GMD 3 personnel.

3.3.4 GMD 3 Minute Meetings

To understand the role of state and policy entrepreneurs in contributing to transitions to increased conservation, I relied upon minute meetings from monthly GMD 3 Board meetings in 2017-2018. I specifically chose to look at GMD 3 minute meetings because they are the only GMD in the Ogallala region that does not have an LEMA. The minute meetings reference policy entrepreneurs and state actors who tried to convince the GMD 3 Board to adopt a LEMA, which is relevant given my research questions. The GMD 3-minute meetings also helped me understand regime actors' beliefs. I focused on including high-quality documents that provided insight into state actors' and GMD 3 actors' perspectives on conservation. I defined high-quality

as those that offered substantial and specific information on the discussions and decisions made at the Board meetings. This included minutes that thoroughly documented the interactions between GMD 3 Board members and external actors, including policy entrepreneurs and state officials advocating for conservation measures. These documents were chosen for their ability to reflect the key arguments, objections, and motivations behind GMD 3's resistance to adopting a LEMA. This helped mitigate the lack of interviews with GMD 3 personnel, allowing the meeting minutes to act as a reliable source of insight into the beliefs and actions of regime actors.

3.3.5 Kansas Oral History Project

I include interviews from the KOHP to answer my research questions. The interviewees featured in the KOHP "Reflections on Water" series were deeply involved in Kansas water policy and decision-making processes, making them particularly valuable for this study. Many of these individuals worked in water policy roles from the 1970s onwards, which provides a crucial historical perspective for understanding how groundwater management policies evolved in the state. Their insights offer unique contributions to understanding the role of state actors, the impact of the Sheridan 6 LEMA, and the factors influencing actors' decisions to shift from supporting planned depletion to conservation-oriented approaches. Including the KOHP interviews helps mitigate a key limitation of the study: the inability to interview many former or current policymakers directly. These interviews allow the research to integrate a broader understanding of historical policy decisions, institutional influences, and stakeholder perspectives that would otherwise be missing. By incorporating the voices of policymakers and experts from earlier decades, the study gains a richer and more nuanced understanding of the long-term trajectories of groundwater management in Kansas.

I included high-quality interviews that provided key insights into Kansas's water policy, the role of state actors, and the evolution of GMDs' approaches to groundwater conservation. High-quality interviews featured participants with firsthand experience and direct involvement in shaping groundwater policies in the state, offering detailed reflections on critical events such as adopting LEMA legislation and changes in water management strategies. I included interviews that explicitly mentioned groundwater management and the Ogallala Aquifer. I excluded interviews focusing solely on GMDs 2 and 5, as these districts are not part of the case study's geographic scope. However, I included interviews that mentioned these GMDs alongside other, more relevant GMDs (1, 3, and 4) to capture potentially valuable insights. This careful selection of interviews ensured that the data from the KOHP contributed directly to understanding the historical and institutional context of Kansas's groundwater conservation transition.

3.3.6 Scholarly Articles

I included high-quality scholarly articles that comprehensively understand the legal and historical aspects of groundwater management in Kansas. By "high quality," I refer to articles that meet several key criteria: authoritative expertise, peer-reviewed publication, and relevance to the study's research questions. First, I prioritized articles written by recognized Kansas water

law and policy experts, ensuring that the authors had established credibility and extensive knowledge in the field. Second, I focused on peer-reviewed journal articles to ensure the sources had undergone rigorous academic scrutiny, guaranteeing their reliability and academic soundness. Third, I selected articles directly addressing legal, historical, and institutional developments in Kansas water management, particularly those offering insights into groundwater depletion, LEMA policies, and the Ogallala Aquifer. This approach ensures that the selected articles are exceptionally knowledgeable about the specific topics of interest, providing the most current and informed perspectives on legal and institutional developments in Kansas water law (Crowe et al., 2011).

To ensure the relevance of these sources, I established specific inclusion criteria. I focused on articles that discussed the legal dimensions of groundwater management, the history of Kansas water laws, the evolution of GMDs, or potential legal issues related to water management. I excluded articles that focused solely on GMDs 2 or 5, as these districts fall outside the Ogallala Aquifer, which is the central focus of this study.

John C. Peck, a notable Kansas water law scholar, served as a primary source for the initial selection of articles. Peck's expertise in Kansas water law, evidenced by his frequent citations in interviews and scholarly works, made his articles particularly valuable. His analysis of the KWAA and legal frameworks since 1945 provided detailed insights into how Kansas's water laws have evolved. To expand the pool of literature, I included articles published in the same journal issues as Peck's works, provided they met the inclusion criteria for authoritative expertise and relevance.

To capture additional scholarly works discussing the history and evolution of GMD approaches to groundwater management, I conducted a keyword search using the search string "Kansas AND planned depletion." To prevent redundancy, I excluded duplicates and articles already covered in Peck's works or published in the same journal issues.

The articles selected from this keyword search provided essential insights into how GMDs' beliefs and practices regarding water management have changed since 1990. These scholarly sources are crucial for understanding how the state has supported or hindered transitions toward increased conservation in Kansas. Specifically, these articles answer research questions about the evolution of state actors' roles and the factors that have driven actors to change from supporting depletion policies to conservation practices from 1990 to 2023.

3.4.7 Newspaper Articles

This study includes Kansan newspaper articles from 1990-1992 that discuss GMD 4's zero-depletion policy, developed in the early 1990s. The goal of analyzing articles about GMD 4's shift to a zero-depletion policy is to understand what factors contributed to GMD 4 adopting a more conservation-oriented approach to groundwater management.

I used the newspapers.com database to find articles about GMD 4's zero depletion policy. The research employed a purposive sampling that used keyword searches to generate articles. The search string used was "Zero depletion AND groundwater." GMD 4 developed the zero-depletion policy in 1990 and implemented it in 1992, so I included articles from 1990-1992. I excluded articles that did not include a quote or interview with someone from GMD 4 because they did not offer any new valuable insight for the study. I also excluded non-Kansan publications because the study was not interested in understanding the opinions and perspectives of groups outside Kansas.

3.5 Thematic Analysis and Process Tracing

Consistent with the research's philosophical underpinnings and the use of the MLP, I use a combination of critical realist-informed thematic analysis and process tracing to analyze interview and documentary evidence data. Thematic analysis typically identifies patterns within the data (Finlay, 2021). However, I use a critical realist thematic analysis approach to generate themes that help in:

1. Understanding the conditions under which changes in beliefs and policies occurred among actors within Kansas's groundwater management sector
2. Highlighting the influence of policy entrepreneurs, state actors, and real-world labs in contributing to these changes
3. Explaining regime actors' motivations behind adopting conservation practices

In seeking to understand the conditions under which change in Kansas occurred, this research and critical realism both assume a complex causality position where a combination of factors creates the conditions for change rather than from a single, linear cause (Angus & Clark, 2012). Complex causality aligns with the process tracing methods applied in this study; process tracing aims to uncover how the conditions and contexts interact and influence outcomes (Kaas et al., 2024). Exploring the motivations behind regime actors' decisions to support conservation practices is also methodologically consistent with critical realism. For example, in critical realism, an actor's motivation for performing an action helps explain why an action has a particular impact (Kaas et al., 2024). Critical realism and complex causality are also methodologically consistent with process tracing methods used in this study, which aim to uncover the sequences and contingencies contributing to the changes in beliefs and policies about conservation in Kansas (Kaas et al., 2024; Cochran-Smith et al., 2014; Beach & Pedersen, 2019). Combining elements of both methods, I use thematic analysis and process tracing to develop a historical narrative of Kansas's transition that identifies the conditions that contributed to Kansas's transitions, the motivations behind actors' decisions to support conservation practices, and the role of real-world labs, state actors, and policy entrepreneurs in contributing to Kansas's transition.

I use critical realist thematic analysis and process tracing in tandem rather than employing them in separate phases. I adopt Fryer's (2022) hybrid inductive/deductive coding process, facilitating a retroductive reasoning process that is pivotal in identifying the broader

conditions influencing transitions (Proudfoot, 2023). This retroductive process complements the goals of process tracing by providing a robust framework for examining how different factors interact to shape policy transitions (Punton & Welle, 2015). For the process tracing aspect, I follow Punton and Welle's (2015) guidelines; however, instead of implying causality, as Punton and Welle's (2015) guidelines do, I apply process tracing to understand the sequences of events and the strategic actions of actors that occurred in Kansas's transition. This combined methodological approach aligns with the study's critical realist philosophy and MLP framework, ensuring a rigorous analysis that respects the complexity of socio-political transitions in water management (Geels, 2022; Roberts & Geels, 2019; Kungl & Geels, 2017).

Notably, my analysis does not provide causal explanations for how Kansas's transition occurred. Instead, the intentional focus on understanding the conditions under which changes in beliefs and policies occurred and the motivations underlying regime actors' decisions to support conservation practices ensures that my analysis is methodologically consistent with critical realism and complex causality. Critical realism lacks the necessary tools to provide causal explanations; as a result of this, critical realist studies show how contexts and mechanisms "account for outcomes without actually evidencing the causal linkages in-between causes and outcomes" (Kaas et al., 2024, p.3). Focusing on how multiple factors and conditions interact to create change aligns critical realism with causal complexity. The implication of this for my research is that my results provide the conditions under which Kansas's transition; however, there is potential for other causal pathways and conditions not shown in my results that could have also enabled Kansas's transition. Thus, future research should explore whether there are other conditions that could have enabled Kansas's transition to occur.

3.5.1 Step 1: Familiarization with Data

The first step of thematic analysis and process tracing involved data familiarization. Consistent with Fryer's (2022) guidelines, I uploaded all interview transcripts, documents, and news articles into Atlas.ti, a qualitative coding software. I skimmed all the transcripts and documents and kept notes of any initial thoughts or questions.

3.5.2 Step 2: Applying, Developing, and Reviewing Codes

The coding phase started with descriptive coding (Fryer, 2022). Because descriptive coding is more data-led than theory-led, I used inductive analysis to develop the codes. These codes captured initial patterns and important events, particularly those related to the policy entrepreneurship strategies, as well as the behaviors and decisions of key actors. I also inductively coded regime actors' motivations for participating in conservation efforts and descriptively coded characteristics of the GMDs and their approaches to management. Consistent with critical realist thematic analysis, I developed deductive codes based on the MLP. To develop a coding framework for the MLP, I relied on seminal MLP literature. I also used the codebooks of studies that performed thematic analysis using the MLP to develop my codebook (El Ghmari et al., 2022; Lauttamäki & Hyysalo, 2019). Following the MLP, I organized the

highest-order codes by niche, regime, and landscape levels. Sub-codes for each level featured core beliefs and practices at each level. For inductive and deductive codes, I reviewed them and consolidated them into larger code categories where necessary. Appendix B provides more information on the coding process and the codebooks used in the study.

3.5.3 Step 3: Developing Themes

In the third stage, I focused on elucidating the conditions and motivations underpinning the changes observed in the thematic analysis, refining the inductive and deductive codes to align with broader contextual understandings of actor behaviors and policy shifts. This analysis aimed to understand the multifaceted conditions that influenced regime actors to adopt conservation policies and how real-world labs, state actors, and policy entrepreneurs facilitated Kansas's transition. To accomplish this, I engaged in retroductive reasoning to explore the necessary conditions that supported these transitions (Fryer, 2022). This involved posing critical questions such as, "Under what conditions did regime actors begin to support conservation policies?" and "What combination of actions and influences from real-world labs, state actors, and policy entrepreneurs were instrumental for the transition?" To answer these questions, I drew upon existing research on behavioral change and the strategic actions of policy entrepreneurs within policy transitions, integrating insights from previous studies with the lived experiences and perceptions of interviewees documented in the primary data. Retroduction enabled me to develop themes that encapsulated the conditions under which Kansas's transition occurred, regime actors' underlying motivations for supporting conservation, and the influence of real-world labs, state actors, and policy entrepreneurs on Kansas' transition.

3.5.4 Step 4: Assessing Validity of the Data and Examining Theoretical Fit

After developing an initial list of themes, I triangulated the data to see if the themes were valid and consistent across all relevant sources (Panton & Welle, 2015). Because not all data sources pertained to the same research question, sources were only triangulated against each other if they both pertained to the same research question. After this, I assessed the validity of my themes by investigating whether the retroductive claims have a strong logical basis in the literature (Fryer, 2022). To assess the validity of my themes and retroductive claims, I relied upon seminal literature on sustainability transitions, policy entrepreneurship, and water conservation behavior change. While assessing the validity of my themes, I also examined the theoretical fit of my themes, noting where my results deviated from the literature (Panton & Welle, 2015). By examining theoretical fit and areas where my results deviated from the literature, I identified areas where the MLP is under-conceptualized (Dutt, 2022). This helped inform my discussion section and recommendations for future research.

3.5.5 Creating Historical Narratives

I used data from the interviews and documentary sources to produce a historical narrative of Kansas's transition to increased groundwater conservation (George & Bennett, 2004). I split the historical narratives into three periods: 1990 to 2000, 2000 to 2013, and 2013 to 2023. I used the data and themes to determine the length of each period, with key events in Kansas's transition determining when one period ended and another began. Following the lead of other studies that use process tracing methods and a conceptual framework, I structured the historical narratives for each period according to the three levels of the MLP since that is the primary framework I am using (Dutt, 2022; Kungl & Geels, 2018; Roberts & Geels, 2019). Thus, the three periods have niche, regime, and landscape sections. Since my research questions also involve policy entrepreneurs, the three periods also have a policy entrepreneur section.

4.0 Chapter 4: Factors Influencing Actors' Roles Changes and the Role of the State and Policy Entrepreneurs

In this chapter, I examine the complex dynamics of Kansas's groundwater management transitions, focusing on the interplay between state actors, GMDs, and landscape factors. I explore these topics across three time periods: Planned Depletion Era: 1990-2000, Conservation Gains Momentum: 2001-2013, and Institutional Change: 2014-2023. Figure 5 shows a timeline of three events and the key events in each time period.

The analysis highlights the role of state interventions, such as the KWO's conservation proposals and policy entrepreneurs like former Chief Engineer David Pope, in pushing GMDs toward more sustainable practices. GMD 4 stands out as a hybrid actor that, despite historically supporting depletion practices, became a leader in conservation due to state guidance and strategic coalition-building. The influence of cultural values, like preserving farming legacies, and external landscape pressures, such as groundwater depletion, motivated shifts in local and state actors. However, resistance from agricultural lobbyists and certain GMD Boards, particularly in GMD 3, illustrates the ongoing tension between economic priorities, property rights, and the need for long-term sustainability. This chapter underscores the crucial role of policy entrepreneurship, political power, and environmental factors in driving transitions in Kansas's water management system.

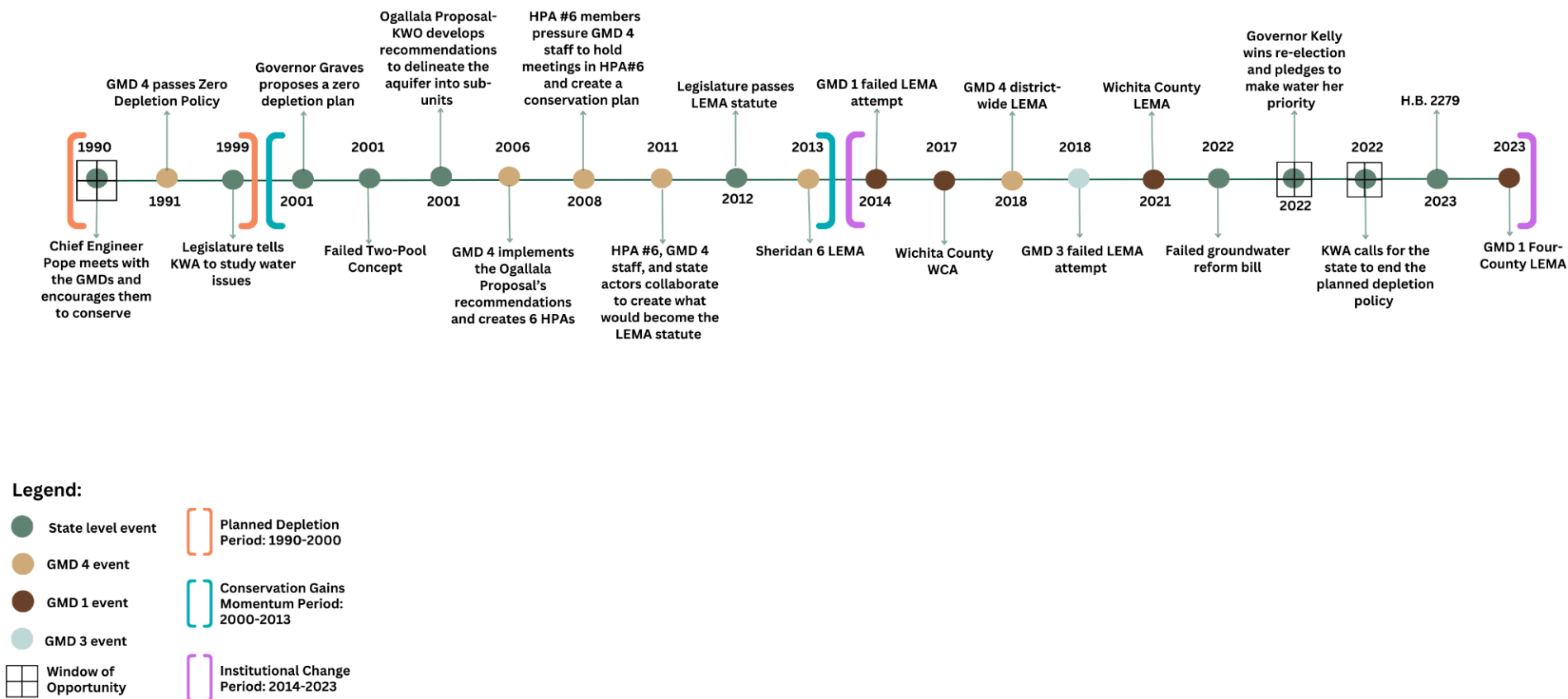


Figure 5

Timeline of key events and windows of opportunity across the three time periods covered in the thesis.

4.1 1990-2000: Planned Depletion Era

In this section, I explore the role of regime actors, niche actors, policy entrepreneurs, and landscape pressures in driving groundwater management transitions in Kansas, focusing on GMDs 1, 3, and 4. I highlight the paradox of GMD 4, which participated in depletion-focused practices while also pioneering conservation efforts by adopting a zero-depletion policy for new wells. The findings demonstrate that GMDs 1 and 3 exemplify the regime's focus on short-term economic growth through planned depletion policies, maintaining the socio-technical system of over-extraction. GMD 4, on the other hand, became a hybrid actor by partially adopting conservation policies in response to state pressure. Policy entrepreneurs, such as former Chief Engineer David Pope, were critical in pushing GMD 4 to adopt conservation measures, using soft power, strategic framing, and coalition-building to navigate resistance. Landscape pressures, including groundwater depletion exacerbated by drought, intensified the urgency for more sustainable practices, influencing key actors like Pope to promote change. Ultimately, the shift toward conservation in GMD 4 illustrates the interaction between landscape pressures, policy entrepreneurship, and the evolving role of regime and niche actors in Kansas's water management transition.

4.1.1 Regime Beliefs, Policies, Actors

The three western GMDs (GMDs 1, 3, and 4) played a pivotal role in shaping the agricultural-groundwater regime, with a strong emphasis on economic development through irrigated agriculture. A key aspect of their influence was the introduction of planned depletion policies, a reflection of the regime's values that prioritized short-term economic growth over the long-term sustainability of the aquifer. These policies, which originated in the 1980s, continued to guide GMD policies into the 1990s. Sophocleous (2000) provides a detailed description of these policies, noting their significance in the regime:

All three western GMDs initially adopted a 'planned-depletion' policy that allowed a portion of the aquifer's saturated thickness to be depleted no more than 40% for 20–25 years. Under this policy, the Ogallala is viewed as a non-renewable resource, at least within a human generation. The rationale for the 20–25 year time span and for the 40% allowable depletion is as follows (P. Dass, State of Colorado, Division of Water Resources, pers. comm., 1999): Given that loans were being made on approximately a 20- to 25-year term for irrigation system installations, a 20- to 25-year period was considered a reasonable planning period after which it was assumed the irrigation supply would be limited somewhat physically or perhaps legally restricted. Given that the aquifer had a relatively large amount of water in storage but a small amount of natural recharge, it was considered that 40% of the saturated thickness was a reasonable amount of depletion for the 20- to 25-year investment amortization period and would essentially represent the economic life of the aquifer (Sophocleous, 2000, p. 102).

The planned depletion policy and the economic rationale for choosing a 20-25-year period for depletion reflect the GMDs' interests in economic development over groundwater conservation. The focus on depletion-oriented approaches to groundwater management and the notion of the aquifer as effectively a non-renewable resource were crucial parts of the regime's approaches to groundwater management in the '80s to '20s. The quotes from the scholarly literature of the '80s to '00s and some KOHP interviews reflect these themes. By treating the aquifer as a resource to be depleted for economic gain within a set timeframe, the GMDs entrenched themselves as regime actors. GMDs 1 and 3, in particular, fully embraced this depletion-oriented approach, continuing to implement planned depletion strategies in line with the regime's broader socio-technical system focused on maximizing short-term agricultural output. While GMD 4 also participated in the planned depletion policies for existing wells, they introduced a zero-depletion policy for all new wells in the 1990s. This dual approach distinguishes GMD 4 as a hybrid actor, still primarily aligned with the regime's depletion-focused policies for existing wells while exploring niche-oriented conservation efforts for new wells. This hybrid behavior is discussed further in section 4.1.2

The fact that GMDs 1 and 3 had planned depletion policies demonstrates their status as regime actors. These planned depletion strategies, aimed at maximizing short-term economic gains from agriculture, reflect a broader adherence to the status quo of over-extraction that defines regime-level thinking. Rolfs (2006) demonstrates this, noting the GMDs' proactive stance in limiting new development early on, only to become less assertive over time when faced with the challenges of restricting existing over-extraction:

The GMD boards were quite proactive and working progressively to limit new development, and DWR's role was more of implementation of the GMD's development restrictions. But, over time, the GMD boards seemed to be less assertive and more reluctant to deal with difficult issues, such as cutting back existing development in heavily overappropriated areas. As the GMDs began to be less assertive, DWR began to be more so (Rolfs, 2006, p. 509).

Rolfs' observation highlights the GMDs' initial attempts to manage resource use. It shows how they gradually became more entrenched in the regime's logic of maintaining economic growth through continued groundwater use. This reluctance to confront over-extraction reflects the broader characteristics of regime actors, who preserve the status quo rather than shift toward sustainable practices (Geels, 2011).

Notably, one person disagreed with the idea that GMDs were regime actors in the 1980s and 1990s who viewed the aquifer as a non-renewable resource and operated planned depletion policies. David Pope, who was responsible for developing the planned depletion policies in GMD 3, stated in a KOHP interview,

It [the planned depletion policy] effectively closed about two-thirds of the geographical area of GMD #3 by that one policy in July of 1978. Now, that is sometimes referred to as the 40 percent depletion over a 25-year period. One of my regrets over time, even though I wasn't totally responsible for those numbers. I did come up with the concept by

observing what was being done in Colorado and New Mexico pretty recently, and it was what had been upheld by the courts in those states was setting a reasonable rate that water could be withdrawn from the Ogallala [Aquifer] because that had never been done before. The part that I say that I have some reservations about the terminology and how that was done, our goal was to close those areas that were fully developed and that had water level declines. It was really not to say it's okay to deplete 40 percent in 25 years. There wasn't much new development after that point (Pope, as cited in KOHP, 2019a).

Pope's statement reflects that he disagrees with the idea that the GMDs' planned depletion policies were evidence of their beliefs in the aquifer as a non-renewable resource meant to be drained. However, despite Pope's disagreement with this view, Pope later goes on in the interview to acknowledge that the planned depletion policies did not create a sustainability attitude or philosophy in GMD 3 (Pope, as cited in KOHP, 2019a). This idea that the planned depletion policies did not foster a culture of sustainability supports the point that the planned depletion policies in the regime reflect a depletion-oriented and short-term focused approach to groundwater management.

4.1.2 Niche Beliefs, Policies, and Actors

In the 1990s, the chief engineer and the DWR were niche actors focused on conservation, while the GMDs focused their efforts on planned depletion policies. Scholarly literature from the '80s to '00s shows that state actors increasingly focused on conservation. For example, the chief engineer, David Pope, closed off areas to appropriation and granted far fewer water rights than his predecessors did in the decades prior (Peck, 1995). For instance, Peck (1995) notes,

In the early 1980s, DWR began to become more restrictive in the granting of permits and in enforcing conditions. David Pope, Chief Engineer since 1983, has been much busier than his predecessors in holding hearings on various matters, in part due to requirements in the Act and in part due to Pope's willingness to grapple with the difficult issues that arise when a limited resource must be shared by numerous persons and interests (Peck, 1995, p. 754).

Peck's statements demonstrate how, in the 1980s, the actions of the chief engineer and DWR focused on increasing water conservation, showing how the roles of the chief engineer and DWR evolved. This description of the changing role of the chief engineer and the DWR and their growing interest in conservation is consistent with other scholarly literature and KOHP interviews.

While state actors were undergoing a transition from regime to niche actors, GMD 4 was also becoming more interested in conservation policies. In 1991, GMD 4 partially defected from the dominant planned depletion practices of the regime when staff at GMD 4 implemented a new zero-depletion policy for new wells in the district. The introduction of this policy signified a notable shift in GMD 4's approach to groundwater management: the district was simultaneously engaging in planned depletion practices for existing wells while also preventing future depletion.

In introducing new conservation policies while maintaining planned depletion policies, GMD 4 shifted from a regime actor to a hybrid actor, supporting both depletion practices (regime) and conservation policies (niche). This shift in approaches demonstrates GMD 4's focus on conservation in the '90s. Scholarly articles from the '00s support the claim that GMD 4 shifted its approach to groundwater management, focusing on conservation, in the '90s. For instance, Sophocleous (2000) notes,

The western districts recognized that their long-term goal is to reduce the rate of water use in order to prolong the life of the aquifer and to assure future economic stability in the region. Toward this end, the northwest Kansas GMD4 switched to a "zero-depletion" policy for new wells in 1991. (Sophocleous, 2000, p. 102).

This statement clearly shows that GMD 4 was undergoing a shift in its groundwater management policies, focusing on conservation as a means to ensure a long-term water supply and stable economic growth. GMD 4's manager in the '90s, Wayne Bossert, echoed a similar sentiment, expressing the district's commitment to pursuing conservation policies. Speaking about the zero-depletion policy, Bossert told *The Salina Journal* in 1990,

The board felt that declining water levels meant eventual zero depletion anyway so why not opt to reach the same goal earlier while retaining an acceptable quantity of water for future management options (Bossert, as cited in Mowery-Denning, 1990, p. 23).

Not only does Bossert's comment show GMD 4's transitioning role toward supporting conservation, but it also reflects a core belief of the conservation niche. Notably, Bossert does not say that the district's goal is to reach a safe yield but rather an "acceptable quantity of water." This statement reflects the idea that the goal of the conservation niche is to slow the depletion rate, not reach a safe yield or achieve sustainable groundwater management. Other newspaper articles from this period also reflect these themes and GMD 4's interest in conservation. Policy entrepreneurs helped achieve this transition towards an increased focus on conservation in GMD 4 in the '90s.

4.1.3 Policy Entrepreneurs

Former Chief Engineer David Pope assumed the role of policy entrepreneur, pushing the GMDs to implement conservation policies during their planned depletion era. As a policy entrepreneur, Pope identified a critical issue in Kansas groundwater management: the GMDs were not doing enough to slow groundwater depletion. He organized meetings and engaged directly with critical actors, such as GMD managers, using his influence to raise awareness of water quantity issues. By doing so, he created the conditions that led GMD 4 to shift its policies. Specifically, Pope played a crucial role in moving GMD 4 from regime actors focused on economic development through depletion to hybrid actors by encouraging the adoption of a zero-depletion policy. A 1991 *The Wichita Eagle* article explains how Pope acted as a policy entrepreneur, meeting with GMD managers and encouraging them to adopt conservation policies:

The districts had all but shut off new drilling and had made some moves to protect groundwater quality, but virtually nothing had been done to slow the pumping from wells drilled before the districts were created. And Pope said at that time that there was a general lull in activity." So after some discussions with Gary Baker, manager of District No. 3 based in Garden City, Pope organized a meeting of all five district managers and some board members. "I simply didn't want them to forget about the water quantity issues." Pope said. "I didn't threaten anyone." But Bossert said he got the message. "He really wanted the local districts to take care of the issue at their level, but I think what he didn't say was, 'You better do something, or else I'm going to have to.' He so much as said that. I heard him say that." (Pope and Bossert, as cited in Painter, 1991, p. 3F). .

This statement demonstrates how Pope acted as a policy entrepreneur by using persuasion strategies and invoking soft power to influence GMD 4 to pursue a zero-depletion policy. Pope created a sense of urgency by raising the issue of groundwater depletion with GMD managers and subtly implying potential state intervention if the GMDs did not take local action. This pressure acted as a condition that catalyzed the district to act. His approach was particularly effective in GMD 4, where the strong preference for local control and the desire to avoid state interference motivated the GMD to adopt the zero-depletion policy. Rolfs (2006) supports Pope's reputation for nudging the GMDs toward conservation, further illustrating how he used his influence to shift the narrative around groundwater management. Pope's actions created the conditions for GMD 4 to transition from a regime actor committed to economic development through groundwater depletion to a hybrid actor, incorporating elements of both planned depletion and conservation. His ability to subtly leverage potential state intervention while promoting local control showcases how policy entrepreneurs can shape transitions by aligning local values with broader sustainability objectives.

While Pope's policy entrepreneurship initially influenced GMD 4 to pursue a zero-depletion policy, GMD 4's manager, Wayne Bossert, played a crucial role in gathering support for the policy within the district and ensuring its implementation. Bossert stepped into the role of policy entrepreneur, using persistence and strategic framing to navigate resistance and keep the policy on the agenda. Despite initial setbacks, Bossert's determination helped create the conditions for the eventual success of the policy. Bossert's initial attempts to implement a zero-depletion policy failed, and it was due to his persistence as a policy entrepreneur that later attempts to pass the policy were successful. For instance, after initial attempts to pass a zero-depletion policy failed, *The Salina Journal* in 1990 reported,

Bossert and Luhman were noticeably disappointed with the committee's action addressing only those areas of intense use. "They declined to go further," Bossert said after the meeting. "They said that was a board decision. "I believe in concept we will go to the board with a recommendation on all things they (the committee) deferred," he said (Bossert, as cited in Corn, 1991, p. 3).

This demonstrates how Bossert's persistence as a policy entrepreneur helped to overcome initial failures. Rather than abandoning the effort, Bossert sought to escalate the issue to higher decision-making bodies, reflecting a core policy entrepreneurship tactic: identifying alternative venues to achieve policy goals. Bossert's role as a policy entrepreneur was crucial in creating the conditions necessary to adopt the zero-depletion policy. His ability to strategically reframe the policy and seek out higher-level decision-making venues allowed him to overcome early resistance and keep the conversation alive. This persistence reflects a core aspect of policy entrepreneurship: navigating challenges by finding alternative pathways and not giving up on long-term goals. His persistence in framing the issue as needing higher-level consideration created the conditions that eventually led to broader support within the district. By working through setbacks and continuing to seek new ways to advance the policy, Bossert played a vital role in facilitating the district's transition toward conservation practices.

Bossert also utilized other key strategies, such as collaboration and aligning policy goals with stakeholders' interests. For example, *The Salina Journal* reported:

"Bossert said getting to a zero depletion rate is going to take help from the state. He already has written to the Kansas Department of Commerce for suggestions on ways the area can remain economically viable." (Bossert, as cited in Mowery-Denning, 1990, p. 23)

Bossert linked the environmental objective of zero depletion with economic concerns by seeking the state's assistance to sustain the local economy. This tactic increased the policy's appeal to stakeholders who might have otherwise been resistant. This demonstrates the importance of framing in policy entrepreneurship: Bossert positioned conservation not as an obstacle to economic growth but as a necessary adaptation for long-term viability. This reframing helped build a coalition of support around the policy and contributed to its adoption.

The combined efforts of Pope and Bossert exemplify the conditions under which policy entrepreneurs can influence sustainability transitions. Pope's initial advocacy set the stage for change, while Bossert's continued persistence and strategic collaboration fostered an environment where the zero-depletion policy could be implemented. These actions contributed to the transformation of GMD 4 from a regime actor focused on depletion practices to a hybrid actor that began to incorporate conservation into its groundwater management approach. This scenario highlights how the strategies of policy entrepreneurs and their interactions with other actors and pressures can facilitate shifts in policy and actor roles within Kansas's groundwater management sector.

4.1.4 Landscape Pressures

Landscape factors, including persistent groundwater depletion exacerbated by drought conditions, pressured the chief engineer and GMD 4 staff to adopt more conservation policies. These pressures catalyzed a sense of urgency among key actors, notably David Pope, who saw the growing depletion as a signal that previous regulatory efforts were insufficient to curb unsustainable practices. A 1990 *The Salina Journal* article reflects this growing concern, stating:

The push toward zero depletion began two years ago, after drought prompted farmers to pump more water. State water officials began to question whether western Kansas was returning to the old days of unmonitored irrigation in the '60s and '70s, when the water table was dropping as much as five feet a year, said David Pope, chief of the Board of Agriculture's division of water resources. It had been a dozen years since groundwater management districts were formed, under mandate from the Legislature to get a handle on declines in the water table. The districts had all but shut off new drilling and had made some moves to protect groundwater quality, but virtually nothing had been done to slow the pumping from wells drilled before the districts were created. And Pope said at that time that there was a general lull in activity." So after some discussions with Gary Baker, manager of District No. 3 based in Garden City, Pope organized a meeting of all five district managers and some board members. "I simply didn't want them to forget about the water quantity issues." Pope said. "I didn't threaten anyone." (Pope, as cited in Painter, 1991, p. 3F).

This excerpt underscores how the drought intensified groundwater depletion, creating landscape pressures that prompted Pope to act. These landscape pressures created the conditions for Pope's policy entrepreneurship. He recognized that the planned depletion policies in place were no longer sufficient to address the growing crisis, and the urgency caused by drought-induced depletion provided the necessary momentum for action. Pope responded by organizing meetings with GMD managers to reignite discussions around water conservation, aiming to push the districts to reconsider their strategies and take more substantial steps to reduce depletion. The drought and its intensifying effect on groundwater depletion highlight how environmental conditions can act as landscape pressures that trigger policy changes. In this case, the depletion heightened concerns about long-term water availability and created the conditions for Pope's interventions as a policy entrepreneur. The urgency generated by the landscape pressures of drought and depletion allowed Pope to reframe the conversation around conservation, positioning himself to push for stronger measures like the eventual adoption of the zero-depletion policy in GMD 4. Pope's ability to respond to these pressures and mobilize GMD managers showcases how policy entrepreneurs can leverage environmental crises to drive policy transitions, particularly when existing measures prove inadequate.

4.2 2001-2013: Conservation Gains Momentum

In this section, I explore the role of state actors and local GMD 4 members in promoting niche conservation policies during the early 2000s, highlighting the state's pivotal role in shaping GMD 4's shift toward conservation. The findings emphasize how state actors pushed for aquifer conservation through proposals like the KWO's 2001 Ogallala Proposal, which recommended that GMDs delineate high-priority areas (HPAs) to target depletion. This state guidance significantly influenced GMD 4, pushing the district to adopt more focused conservation strategies, as seen with the development of the Sheridan 6 LEMA. Additionally, GMD 4 staff, led by Wayne Bossert, acted as policy entrepreneurs, building coalitions and strategically framing conservation in ways that aligned with local values of control and autonomy, further facilitating the shift toward niche behaviors. The results demonstrate how interactions between state

interventions and local actors' beliefs created the conditions for developing new conservation frameworks, such as the LEMA statute. External pressures, including groundwater depletion and the threat of state intervention, combined with cultural values like preserving family legacies, motivated HPA #6 members to adopt conservation measures. This interplay between landscape pressures and local beliefs illustrates how state policies and local dynamics jointly contribute to sustainability transitions in Kansas's groundwater management system.

4.2.1 Niche Beliefs, Policies, and Actors

In the early 2000s, state actors actively promoted conservation policies, aligning themselves as niche actors determined to address the depletion-oriented regime. Their consistent support for conservation initiatives underscores the state's influential role in fostering niche policies centered on water conservation. Table 4 provides additional details on these policies and initiatives. For example, the Kansas Legislature and Governor Graves endorsed the KWA's efforts in studying long-term aquifer planning in 1999, subsequently informing the KWO's 2001 recommendations for managing depletion in the GMDs. This situation illustrates how state-level niche actors contributed to setting the stage for conservation policies to emerge locally.

The influence of state actors also extended to some local actors within GMD 4, helping shift their roles from hybrid actors, balancing depletion and conservation, into fully dedicated niche actors. KWO's 2001 Ogallala Proposal was crucial for this shift, as it recommended that the GMDs and the DWR identify aquifer sub-units, study depletion in these areas, and set conservation goals accordingly. A former chief engineer explained how these state recommendations directly shaped GMD 4's priorities:

So there was there was a study in the early 2000s [KWA study and KWO report]. But it recommended the GMD to delineate sub-basins or sub-areas to sort of say identify your high-priority areas. That was the intent, you know. We have some areas that are more overdeveloped than other areas. So the idea was, you know, where do we really need to get started? And let's let's focus on those areas first. So, GMD 4 identified six high-priority areas, which they call HPAs. And, you know, looking at the greatest development, the most significant declines. Here's what we're gonna focus on. They had six of them. And then Wayne Bossert, who was a manager at the time, you know, went out. We built the groundwater model of the district, and it sort of said, okay, what's going to happen if we keep pumping like we were doing? We ran some scenarios that said, Okay, if we do a reduction, what happens? If we do reductions in these high decline areas what happens? And they found that if they did a 20% reduction in each of the high-priority areas while leaving everything around the same, even 50 years out, the benefits of the reduction stayed in the area that was reducing pumping. (Former chief engineer, 2023).

This scenario underscores how state-driven conservation guidelines encouraged GMD 4 to implement more targeted conservation strategies, beginning with identifying HPAs. This

foundational work eventually supported the development of the LEMA statute, leading to GMD 4 implementing the state's first LEMA twelve years later. This approach highlights the state's role in guiding local efforts to focus on urgent conservation needs and lays the groundwork for future conservation actions.

By 2006, GMD 4 began implementing the state's advice by delineating six HPAs. They held outreach meetings in each HPA to engage residents and encourage them to develop conservation plans. A former chief engineer recounted how these outreach efforts unfolded:

Wayne [GMD 4's manager] went out, I think in the later 2000s, you know, 2008 and 2009, each of these areas multiple times, and showed them the data, what it said about where they were and where they're going, and asked, 'Do you want to do anything?' So the Sheridan is called the Sheridan 6 LEMA because it's the number six of HPAs. That group [Sheridan 6] wanted to do something—that was the only group that really wanted to move forward (Former chief engineer, 2023).

This illustrates how GMD 4's outreach efforts, informed by the state's conservation focus, created the conditions for HPA #6 to engage in the conservation process. It also demonstrates how GMD 4 staff and state actors created the conditions for HPA #6 to transition to niche actors supporting conservation. While not all HPAs shifted towards proactive conservation roles, HPA #6's willingness to develop a conservation plan demonstrates how local dynamics, influenced by state guidance, shaped regional conservation efforts.

GMD 4 staff's outreach in HPA #6 progressed from 2008 to 2010, as they collaborated with HPA #6 to develop a conservation plan. Their conservation plan reflects niche actors' beliefs: a desire for local control and a distrust in the state government. Statements from a former chief engineer interviewed for the study illustrate the conditions that influenced the development of this conservation plan:

They [HPA #6] wanted to, you know, cut pumping 20% somehow, but they wanted everybody to do it. So, so me and my attorney started exploring, I was Chief Engineer at the time, how can we do this? And so, we tried to do it through a management program combined with regulations. When you formulate regulations, the Attorney General has to sign off saying this is consistent with the statute. And he said or she [the Attorney General], I can't remember who it was at the time, said no you can't do this for regulations because the statutory provision to do this is IGUCAs. So use the IGUCA statute was what he or she, whoever it was said. So I'm working with the group [the Sheridan 6 HPA group] and other staff to try and get them to trust the IGUCA process. I [as chief engineer] told them [Sheridan 6 HPA group] yes, I can't guarantee you ahead of time what I will do based on the hearing record because, as a hearing officer, I can't do that. You've got to hear it, and you have to base it on what you hear. But I said, you know, if you bring this plan, and you've got the science behind it, it should go, but they couldn't trust the process. (Former chief engineer, 2023).

This statement reveals that HPA #6 members hesitated to proceed with an IGUCA due to concerns that the chief engineer might impose restrictions exceeding their proposed 20% cutback. Their distrust stemmed from the legal constraints that prevent the chief engineer from making guarantees before hearing all evidence, potentially leading to more stringent restrictions based on scientific data. The members of HPA #6 advocated for a conservation plan that would allow them to maintain greater local control over water use restrictions, reflecting their strong preference for local governance and their mistrust of the state-driven IGUCA process. This example highlights how local conditions and actor beliefs played a crucial role in shaping the strategies adopted for groundwater management. Interviews from the KOHP, testimonies from the GMD 4 LEMA hearings, and relevant scholarly literature corroborate the significance of local control preferences and distrust in the chief engineer and IGUCA process as key factors influencing the development of conservation strategies in HPA #6.

Because HPA #6 members were unwilling to proceed with an IGUCA due to their desire for local control and distrust of state mechanisms, they sought to create a new legislative mechanism to implement their conservation plan. GMD 4's manager, Wayne Bossert, and other local actors collaborated with state actors to pass the LEMA legislation through the Kansas legislature in 2012. This law, rooted in niche beliefs about local control, allowed GMDs to design their own conservation plans, with the chief engineer only responsible for approving or rejecting the plan. A former chief engineer explained the legislative process:

And so, Wayne [GMD 4's manager at the time] proposed, and I supported him through the legislative process, that we create another mechanism to do this. And it's LEMAs, local enhanced management areas. And, you know, my attorney sort of wrote the statute and I gave some input. Wayne developed the concept it flew through the legislature and it's a lot the same as the IGUCA statute, except it does one fundamental thing differently. That's critical. So, the GMD develops the plan- what the problem area is, what their goal is in terms of percentage reduction, and their method for allocating the water to accomplish that goal. And they present that to the chief engineer and there's a list of requirements that have to go with the plan. And then the chief engineer conducts the hearings, just like the IGUCA, but the question is not what should we do about it? It's should the GMD's plan be approved or not? So again, a lot of the same methods [in the IGUCA and LEMA], it's just the GMDs that are in control of the process. So we got that statute [LEMA statute] in 2012. It flew through the legislature. (Former chief engineer, 2023).

This account highlights how the desire for local control and the need for a mechanism aligning with local beliefs created the conditions for developing the LEMA legislation. The collaboration between local actors like Bossert and supportive state officials enabled the passage of the LEMA statute, empowering GMDs to manage their conservation efforts more autonomously. Without this shift in local motivations and the establishment of a legislative framework reflecting their preferences for self-governance, the Sheridan 6 LEMA in 2013 might not have been possible.

Table 4.
State-Level Policies in the early 2000s.

Policies and Developments	Description
Legislature tasks KWA to study water issues (1999)	The legislature tasked KWA with studying water issues and making recommendations about long-term aquifer planning (GMD 4, 2006).
KWA produces list of recommendations (2000)	KWA recommends using the state water plan to develop a state water policy for sustainable groundwater management and to produce aquifer sub-units of similar areas in the aquifer (GMD 4, 2006).
Governor Bill Graves Proposes a Zero-Depletion Plan (2001)	Governor Graves proposes to reach zero depletion in the aquifer by 2020.
Two-Pool Concept (2001)	Following KWA's recommendation to use the state water planning process, KWO developed a two-pool concept, which would have divided the remaining water in the aquifer into a Usable Pool and a Conservation Pool. The Usable Pool would have been for current water rights holders to fully deplete, while the Conservation Pool would have been for drinking water, managed according to safe yield requirements and prior appropriation (Peck, 2002). Once the Usable Pool ran out, essential water users would be required to buy senior water rights from the Conservation Pool (Peck, 2002).
Western Kansans Reject the Two-Pool Concept (2001)	Western Kansans strongly opposed both Governor Graves's zero-depletion plan and KWO's Two-Pool concept, causing KWO to abandon the idea.
Management Advisory Committee for the Ogallala Aquifer (2001)	Following opposition to the Two-Pool concept, KWO created a Management Advisory Committee for the Ogallala comprised of local western Kansas stakeholders. They are tasked with developing solutions to address depletion.
2001 Ogallala Proposal	The Management Advisory Committee and KWO develop recommendations and guidelines for how the GMDs should address depletion. The core recommendations were to divide the aquifer into sub-units of similar characteristics; GMDs and DWR should study depletion rates in the sub-units and create goals to conserve water; and the GMDs and DWR should categorize sub-units based on priority

	and focus most on high priority and high decline sub-units.
--	---

4.2.2 Policy Entrepreneurs

GMD 4 staff acted as policy entrepreneurs by strategically framing groundwater depletion in ways that resonated with local irrigators, leveraging fundamental beliefs that both niche and regime actors shared: a desire for local control and minimal state involvement in groundwater management. This framing of the issue created a sense of urgency among locals. Failing to act on depletion could invite unwanted state intervention, thus motivating local actors to adopt conservation measures to avoid external control. For instance, at a November 2008 meeting about developing a conservation plan in HPA #6, a resident asked, "What happens if the State independently addresses the problem?" (GMD 4, 2008). GMD 4's staff responded, "No way to predict when or how the State might address the problem in the absence of local efforts." (GMD 4, 2008). This interaction reveals how GMD 4 framed depletion as a problem that required local action, emphasizing that by acting locally, residents could maintain control over the process, a framing that resonated with their desire for autonomy. KOHP interviews, news articles, and interviews with GMD 4 staff support GMD 4's use of problem framing to galvanize local action.

GMD 4 staff's strategic use of local knowledge positioned them as policy entrepreneurs capable of identifying the right audiences for their conservation messages. From 2008 to 2010, as GMD 4 staff met with residents of HPA #6 to develop a conservation plan, they used their understanding of the community's social dynamics to promote conservation to those they knew would be most receptive. In a 2020 Kansas Oral History Project interview, Lon Frahm, former president of GMD 4, reflected on the success of the Sheridan 6 LEMA:

They [the GDM 4 staff] realized that whole Sheridan County area, the make-up of the farms is different, and their attitudes are a little different... There's a whole bunch of guys that are kind of mid-sized, not really big, not really small, and they had a cohesive, what you'd call a 'follow the leader' lot. One has a new farming practice, and everyone is quick to copy it. They all went to the same church, and they all drank at the same bar... I think that's [the social dynamics in Sheridan 6] the whole reason it [the Sheridan 6 LEMA] happened (Frahm, as cited in KOHP, 2020a).

This statement highlights how GMD 4 staff recognized the unique social fabric of the Sheridan County community and used this knowledge to drive collective conservation efforts. By identifying Sheridan County as a place where social cohesion would encourage collective action, GMD 4 staff framed conservation in ways that resonated with the community's shared values. The social cohesiveness of Sheridan County provided the conditions for collaboration, and GMD 4's awareness of this dynamic enabled them to promote a conservation plan where it had the highest likelihood of success. While further research could explore this idea more

deeply, Frahm's statement suggests that shared values and strong community ties were significant conditions for forming the Sheridan 6 LEMA. Future studies could investigate the role of social cohesion and cooperation as crucial conditions influencing the formation of LEMAs in other regions.

While GMD 4 staff initially acted as the primary policy entrepreneurs, their efforts enabled the rise of policy entrepreneurs within HPA #6 itself, who then pressured GMD 4 staff to move forward with a conservation plan. Scott Ross, former water commissioner for the DWR, recounted how Mitchell Baalman and Brent Rogers from HPA #6 took on policy entrepreneur roles by persistently pushing GMD 4 staff to act:

Mitchell Baalman and Brent Rogers rose to the occasion and, from my perspective, forcefully challenged the Board to bring together the people in the Sheridan area and begin a dialogue to address the problem. Mitchell was simply not going to let it go (Ross, as cited in Transcript of Second Hearing for the GMD 4 LEMA, 2017, p. 122).

This example shows how Baalman and Rogers, motivated by the worsening depletion crisis, GMD 4's framing of depletion, and the fear of state involvement, took on policy entrepreneur roles pushing for conservation. Baalman and Rogers transitioned from regime to niche actors by taking on leadership roles and advocating for conservation. As policy entrepreneurs, their persistence in pressuring the GMD 4 staff to further address depletion enabled the initiation of collective action and the push for a conservation plan within HPA #6. Rather than a direct causal relationship, this reflects how specific conditions, such as depletion pressures, values of local control, local leadership, and GMD 4's framing of depletion, created a context in which Baalman and Rogers felt compelled to lead the push for conservation. Their persistent efforts demonstrate how local policy entrepreneurs can influence institutional actors like GMD 4 staff to address pressing environmental challenges and drive transitions toward conservation.

As the conservation plan for HPA #6 developed, GMD 4 staff further solidified their role as policy entrepreneurs, particularly in building trust among residents. Peck et al. (2019) described the process, emphasizing the importance of GMD 4 staff's efforts to build trust among residents:

In April 2011, after a series of back-and-forth trials over two and half years, the locals and the GMD4 identified a proposal on which they agreed. Important to this endeavor was the amount of time, effort, and patience invested by the GMD4 staff to communicate clearly to, and collaborate with, the local water users. The key to this endeavor was the creation of a partnership of trust (Peck et al., 2019, p. 39).

Trust-building is a fundamental strategy in policy entrepreneurship. GMD 4's efforts to foster collaboration and build trust among local stakeholders created the conditions necessary for the conservation plan's acceptance. Without this foundation of trust, the local actors in HPA #6 may not have committed to the plan. This trust-building process represents an essential condition that helped facilitate the development and eventual implementation of the conservation plan, ultimately leading to the establishment of the Sheridan 6 LEMA.

To implement HPA #6's conservation plan, GMD 4 staff continued their role as policy entrepreneurs to develop and pass the LEMA legislation through the legislature without amendment. GMD 4 staff utilized policy entrepreneurship strategies like coalition building, solution seeking, and networking with government officials to achieve this. Peck et al. (2019) described the events leading up to the legislation:

DWR legal counsel and staff, with assistance from GMD4 legal counsel and staff, drafted the statutory language for the bill to be introduced; both entities agreed on its content. Before the start of the January 2012 legislative session, legislators were contacted and informed about the situation and the bill. Securing the legislature's cooperation would not be enough; the governor's office would also need to be brought on Board. On July 21, 2011, the GMD4 board requested support for the proposed legislation from the governor's recently created Ogallala Aquifer Advisory Committee (OAAC). Bossert presented the locally-created management concept at the OAAC's first meeting in August 2011; the OAAC agreed to support it. (Peck et al., 2019, p. 40).

This description underscores Bossert's role in creating the LEMA concept and demonstrates how his solution-seeking strategy enabled the development of a concrete response to groundwater depletion. GMD 4 staff built coalitions by bringing together diverse stakeholders, including the DWR, legal counsel, legislators, and the governor's office. The coalition-building efforts of GMD 4 staff created the necessary conditions for advancing the LEMA legislation by aligning the interests of key stakeholders, which minimized opposition and increased political support. By reaching out to the governor's Ogallala Aquifer Advisory Committee and securing support ahead of the legislative session, GMD 4 staff effectively used their networking skills to gain political backing. These strategic actions enabled the smooth passage of the LEMA statute, highlighting how the entrepreneurial efforts of GMD 4 staff created the right conditions for success.

4.2.3 Regime Beliefs, Policies, and Actors

From 2000 to 2013, GMDs 1 and 3 continued to act as regime actors, continuing to deplete the aquifer and opposing most state-sponsored conservation efforts. For instance, GMDs 1 and 3 and the larger western Kansas population successfully resisted the KWO's Two-Pool concept in 2001, described in Table 4. Their resistance to this conservation policy reflects their role as regime actors and demonstrates a fundamental belief of the regime: minimal state involvement in groundwater management. Stover et al. 2002 describe regime actors opposition to the Two-Pools concept, stating,

Western Kansans strongly resisted the proposal by Governor Graves, and were skeptical as to the practicality of the "two pools" idea. The Atlas on the Kansas High Plains Aquifer was a welcome report until management strategies were considered based on its findings. Then the report received much more criticism. State leadership was rejected. Local community leadership did not acknowledge depletion was a priority problem. (Stover et al., 2002, p. 4).

This statement demonstrates that most of western Kansas were not interested in conservation policies like the Two-Pool concept, reflecting their position as regime actors. What this statement does not depict, however, is that much of the opposition to the Two-Pool concept resulted from western Kansans feeling like the state was overly involved in pushing and designing the policy. Scholarly articles also reflect that the Two-Pool policy was essentially the state's idea. One particularly illuminative example of this comes from a 2020 KOHP interview with Lon Frahm, former president of GMD 4:

LF: By the time I was on the Board in the mid-nineties, it was pretty clear that local control was a nice phrase, but it was really not local control. The state, through one of the arms or the other, was essentially telling us what we were supposed to be doing, and perhaps we didn't assert ourselves enough at the time. Again, we didn't have meters. It wasn't a big issue. But, you know, as time went on, it was really obvious that Topeka, in one arm or the other, was taking more authority. It was almost like we were—I don't know if puppets is the right word, but local control really didn't exist except for in name...

RB: Absolutely. Some of these ideas that we've talked about already, particularly the two pools concept, that came directly from the Water Office. (Frahm, as cited in KOHP, 2020a).

This conversation reflects that regime actors opposed the Two-Pool approach because they felt they did not have local authority in designing the policy and felt that the state was overly involved in creating and pushing the policy. This desire for local control and minimal state involvement are core beliefs of both the niche and regime, showing that local control is an integral part of the culture in western Kansas.

While GMD 4 staff was making a substantial effort to push conservation initiatives and conducting outreach meetings with the HPAs, GMD 1 and 3 staff were overall less interested in pursuing conservation to the same intensity as GMD 4. A 2020 Kansas Oral History Project interview with Lon Frahm, former president of GMD 4, conducted by Rex Buchanan, reflects this sentiment:

RB: northwestern Kansas GMD was far more progressive than the other two GMDs in the Ogallala region in terms of looking at these issues.

LF: GMD 4 was at the forefront actually and was respected, I think, regionally, and not just in the state. It set the model for a lot of research and ideas. At the same time, GMD 3 down at Garden City was kind of—I call them "the cowboys." They were at the complete other end, dragging their feet and not paying attention.

RB: Right. So in spite of everything that we just talked about, about whether or not local control works, certainly Wayne and the Board and the GMD was out there, throwing out ideas, talking about ideas, maybe not always pursuing them all the way, but having a conversation about how to deal with this, a conversation that was not taking place in other parts of the state, don't you think?

LF: I think that's very true. I think Wayne was leading the Board, not the Board leading Wayne, absolutely. (Frahm, as cited in KOHP, 2020a).

This conversation demonstrates that GMD 4 was always the most progressive GMD, pursuing conservation more intensely than the other GMDs. The intensity at which GMD 4 staff pursued conservation while the other GMDs acted like "cowboys" reflects GMD 4's staff position as niche actors and GMDs 1 and 3 positions as regime actors. It is worth noting that multiple sources used the term "cowboys" to describe GMD 3, with some also saying that GMD 3's proximity to the Texas panhandle causes them to act like "cowboys." The impact of this cowboy attitude and proximity to Texas on conservation behaviors are areas that future research should seek to explore more empirically.

While GMD 4 staff, Board, and HPA #6 transitioned to niche actors, much of GMD 4 remained regime actors. When GMD 4 staff conducted outreach meetings with the HPAs, only HPA #6 was interested in developing conservation plans, demonstrating that much of GMD 4 was still regime actors. The disinterest of the other HPAs in implementing conservation plans demonstrates their role as regime actors.

4.2.4 Landscape Pressures

Landscape-level factors, such as the impairment case in the 2000s, acted as external pressures that played a pivotal role in developing the conservation niche and motivating members of HPA #6 to transition from regime actors to niche actors supporting conservation efforts like LEMAs. The threat of mandatory water shutoffs for junior water rights holders due to over-appropriation and impairment of senior water rights directly influenced GMD 4 water users' perception of the risks posed by continued depletion. As Peck et al. (2019) noted:

Water users would need compelling reasons to reduce their own water use on a more voluntary basis. Simultaneous developments provided those reasons. One involved a request that had been submitted to DWR seeking the administration of water rights. Under the Act, when a senior water right is not receiving its full quantity of water due to use by a junior water right, the senior may file a complaint with DWR. DWR will then investigate, and, if the junior right is found to be impairing the senior right, DWR can lawfully curtail the junior's use. The pending request involved water right holders in GMD4, where the water supply had been over-appropriated (more permits had been granted than the system could sustain). If the matter had proceeded to completion, a significant number of water rights would have to have been shut off. The juniors were spared this draconian result, however, because the complaint was withdrawn. Nevertheless, this incident made two things strikingly clear to local water users: the fact of over-appropriation and the considerable independent power of DWR. (Peck et al., 2019, p. 38).

Landscape pressures, such as the potential impairment case and the looming threat of government intervention, highlighted the over-appropriation of water resources. It underscored the power of the state to curtail junior water rights, pushing local actors to prioritize voluntary conservation. The fear of DWR's power to shut off water rights galvanized local actors in HPA

#6 to preemptively adopt conservation measures, moving them from regime actors to niche actors dedicated to conservation. The landscape pressure helped create the conditions for water users to reconsider their practices. It ultimately prompted shifts toward conservation, reinforcing the role of landscape factors in driving actor transitions.

Landscape-level factors like groundwater depletion interacted with cultural values and beliefs, such as preserving agricultural-based communities and passing down farming as a profession to their children, motivated HPA #6 members to support conservation, transitioning from regime to niche actors. Other sources, such as GMD 4 LEMA testimonies and KOHP interviews, demonstrate how these values and desires motivated HPA #6 members to conserve. These cultural values intertwined with the practical realization that continued groundwater depletion would devastate small-town economies tied to irrigated agriculture, as illustrated by a Sheridan 6 farmer interviewed for the study:

And we knew that if something didn't change, the writing was on the wall. We're gonna run out of groundwater. Biggest thing was, you know, up here, a lot of our small town communities, you drive up and down Main Street. 80% of them are tied back to irrigated agriculture to businesses, whether it's the fuel guy bring your fuel out irrigation motor or the crop insurance salesman or whatever it may be. We as a community realized that our towns were going to dry up over time if we didn't try and prolong the aquifer (Sheridan 6 Farmer, 2023).

This statement reflects how the realization that groundwater depletion was an economic and social threat to small-town communities motivated action. The fear of aquifer depletion and its potential to devastate businesses tied to irrigated agriculture created an urgent need for a solution. This economic threat, combined with the cultural commitment to sustaining agricultural livelihoods, encouraged HPA #6 members to shift their roles from regime actors to niche actors focused on conservation. These pressures created the conditions necessary for HPA #6 members to recognize that maintaining the status quo was unsustainable. The interaction of cultural values, economic concerns, and the looming threat of depletion prompted collective action in HPA #6 and the eventual implementation of the Sheridan 6 LEMA. In this context, landscape pressures created an environment in which local actors were motivated to change their practices. This aligns with the idea that landscape pressures can force regimes to adapt or collapse (Geels, 2011).

Furthermore, the depletion of the aquifer also interacted with cultural values related to preserving family legacies, which acted as a powerful motivator for HPA #6 members to conserve water and transition to niche actors. The desire to pass down irrigated agriculture to future generations became a central motivator, as depletion threatened this way of life. For example, a Sheridan 6 farmer's testimony at the 2017 GMD 4 LEMA hearing expressed this concern:

In closing, I just want to say that as a 4th generation farmer with two sons and grandkids that will be 5th and 6th generation farmers, I would rather pump a short amount of water for a lot of years, rather than a lot of water for a short amount of years. (Moss, 2017, p. 1).

This statement highlights how depletion made farmers more acutely aware of the long-term risks to their ability to sustain multi-generational farming. As aquifer levels continued to decline, farmers like Moss recognized that if current water-use practices persisted, future generations could not continue farming. The landscape pressure of groundwater depletion thus interacted with cultural values, such as the desire to preserve family farming legacies, creating a powerful motivator for farmers to shift their practices. These combined pressures acted as conditions that encouraged regime actors to reconsider their priorities, leading them to become niche actors. Rather than continuing to maximize water use in the short term, farmers began to see conservation as essential to preserving their livelihoods and ensuring future generations could continue farming. In this way, environmental pressures heightened awareness of the consequences of inaction, while cultural values reinforced the necessity of change.

4.3 2014-2023: Institutional Change

In this section, I explore how different actors and policies have shaped groundwater conservation efforts in Kansas. The Sheridan 6 LEMA inspired the GMDs to consider similar initiatives, though resistance from key actors limited broader adoption. Cultural values, such as preserving farming legacies, and the efforts of policy entrepreneurs like Governor Laura Kelly helped shift some actors toward supporting conservation.

However, institutional opposition, particularly in GMD 3, slowed progress. Agricultural lobbyists and GMD Boards resisted conservation policies, citing concerns over state interference and property rights. Groundwater depletion played a critical role in driving actor transitions, with regions experiencing more severe depletion adopting conservation measures, while areas with higher water reserves, like parts of GMD 3, resisted change. This section highlights the complex interplay of cultural values, political power, and environmental pressures in shaping Kansas's transition.

4.3.1 Niche Beliefs, Policies, and Actors

In the years following the Sheridan 6 LEMA, the conservation niche grew as GMD 1 and 3 members sought to replicate the Sheridan 6 LEMA. The attempt to implement conservation measures in these GMDs signifies the growing interest in conservation and highlights the influence of Sheridan 6 in contributing to actor role changes. For example, in 2014, the GMD 1 manager advocated for a district-wide LEMA. However, this LEMA ultimately failed due to insufficient support from GMD members. This failure highlights the persistence of regime beliefs that still opposed conservation, although the narrow margin by which it failed indicates shifting public opinion. A former chief engineer interviewed for the study explained the outcome:

There's no requirement to put LEMAs to a vote but they [GMD 1] wanted 2/3rds of the public, landowners, and water rights owners to support it. They didn't get that support. So, they didn't move forward at that time. (Former chief engineer, 2023).

While the LEMA was unsuccessful, the fact that it was introduced and voted on reflects a shift in beliefs within the GMDs, with an increasing number of actors moving toward supporting conservation. The fact that the LEMA passed in three of the five counties in GMD 1 and failed by only one vote in Wichita County demonstrates this growing interest in conservation (Dillon, 2018). The near success in Wichita County, in particular, underscores that public opinion regarding conservation was gradually evolving, with more community members considering it necessary.

Momentum for conservation continued to build in GMD 1 following the 2014 LEMA failure. In 2017, members of Wichita County who had supported the earlier LEMA attempt joined together to develop a WCA, transitioning from regime actors to niche actors. Like the members of Sheridan 6, cultural values, such as the desire to pass down farming to future generations, influenced Wichita County WCA members' decisions to prioritize conservation over depletion. This is reflected in reporting by the group *Stewarding Our Aquifer*, which attended one of the planning meetings for the WCA:

Before the planning even began, each member was asked at a meeting to go around the room and express just why this extensive conservation was important to them. What the group found is that it is about continuing a legacy and knowing that their community will have a chance to thrive for generations to come. Starting this voluntary movement is an effort to be the tipping point where the Wichita County WCA members become the majority in the community for the economy hopes will remain and be nurtured. (Stewarding Our Aquifer, 2017)

This statement demonstrates that cultural values, particularly the desire to preserve a farming legacy, were key drivers in motivating Wichita County WCA members to shift their roles from regime to niche actors supporting conservation. This belief in conserving water for future generations aligns with broader cultural values in parts of other GMDs, such as GMD 3, where actors began pursuing a LEMA from 2016 to 2018 for similar reasons.

Public opinion toward conservation continued to evolve in western Kansas as some GMD 3 members sought to create a LEMA in part of GMD 3, signaling an increasing acceptance of conservation practices. In 2016, LEMA supporters established a steering committee to develop a LEMA in Kearny and Finney counties of GMD 3. Like earlier conservation efforts in the state, local actors who recognized the need to preserve water resources for future generations drove the LEMA campaign. Presentation slides from a 2017 steering committee meeting illustrate the committee's motivation:

Everyone on the committee has a succession plan for the next generation. We all have sons and daughters, grandsons and granddaughters. We would like that succession plan

to have irrigation sustainability for all inside the proposed LEMA for future generations (Northern Kearny Finney County Local Enhanced Management Area, 2017).

This sentiment reflects the cultural values of preserving a family legacy in irrigated agriculture, which motivated some members of GMD 3 to transition from regime to niche actors supporting conservation policies. Although the LEMA ultimately failed due to a lack of support from the GMD 3 Board, supporters formed a WCA, just as supporters of GMD 1's failed LEMA had done earlier.

While some GMD 1 and 3 members slowly transitioned to niche actors, GMD 4 underwent a district-wide shift toward conservation. Following the success of the Sheridan 6 LEMA, the GMD 4 Board initiated and implemented a district-wide LEMA in 2018. This transition meant that most GMD 4 members actively began conserving water, marking a significant shift from regime actors focused on maximizing water use to niche actors prioritizing conservation. LEMA testimonies indicate that cultural values, such as preserving agricultural-based communities and maintaining family farming legacies, strongly motivated this change. Additionally, the success of the Sheridan 6 LEMA, particularly the economic study demonstrating that conservation did not harm profits, was a critical factor in convincing GMD 4 actors to support a district-wide LEMA (Golden, 2018). My interview with a GMD 4 staff member, in which I asked about the role of Sheridan 6 LEMA in contributing to the GMD 4 LEMA, reflects this:

MM: So, the Sheridan 6 LEMA and its success helped basically to get more people on Board for a GMD 4 LEMA?

GMD 4 staff: Yeah, I agree because it [the economic impact of Sheridan 6] was studied- there was an economic study, if you're familiar with that. And so yeah, we were parading the data big time. (GMD 4 staff member, 2023).

This exchange shows how the economic study created the conditions for regime actors to change their behavior and support conservation practices. The study provided real-world proof that conservation could be economically viable, which helped overcome skepticism. By trusting that conservation would not harm their livelihoods, regime actors who had previously focused on short-term water use felt more confident about transitioning to niche conservation practices.

Really, it was, you know, there were people that were like, "Okay, yeah, we trust you. We can make this work", and others were like, "No, I don't trust you. There's no way this is gonna work." And then when they see the data, and then it is working, and they are being more profitable with less resources, then they're like, "Well, maybe I should have listened to her." And that's how that's how you gain their trust. I mean, so one guy was in the GMD 4 LEMA- actually, he was part of the lawsuit against us. Oh, he just did not want anything to do with it. He hated it. He was mad about it. And then a couple of years later, he comes in again and says, "This is the best thing that I ever did. You made me manage my water", and I was like, "Well, thank God." (GMD 4 staff member, 2023).

This statement shows how first-hand experience and real-world data convinced regime actors that conservation did not lead to adverse economic outcomes. Initially, many regime actors feared that conservation would harm their economic growth, and this fear kept them from engaging in conservation efforts. However, the success of Sheridan 6 and the data demonstrating profitability through conservation reduced these fears and built trust. With their concerns eased, regime actors could shift their priorities and commit to water conservation. This trust and awareness of the long-term benefits enabled GMD 4 to adopt district-wide LEMA in 2018. The fear of economic decline, often mentioned by LEMA opponents, gradually subsided as farmers saw the positive results supported by empirical evidence.

In 2021, more members of GMD 1 transitioned from regime actors to niche actors with the passage of the Wichita County LEMA. The experience of practicing conservation through the Wichita County WCA and the rapid depletion of groundwater levels created the conditions for this transition. After years of involvement in the WCA, the desire to continue farming and ensure that future generations could participate in irrigated agriculture motivated original members to convert it into a LEMA. The WCA's success and the visible participation of other community members in conservation efforts influenced regime actors who were not initially part of the WCA to support the LEMA. My interview with a GMD 1 staff member reflects this growing support:

"I mean, it was the same people behind the Wichita County WCA that were working directly with the Board and saying we want to make a LEMA happen. And in doing that, you know, you then had a lot of areas outside of Wichita County WCA saying, 'Okay, well, now we are gonna do it.' And the folks in Wichita County were saying, 'Hey, we're doing it, you're doing it.' So it really snowballed the whole thing." (GMD 1 staff member, 2023).

This quote demonstrates how the actions of WCA members, combined with the social influence of seeing other community members adopt conservation practices, created the conditions for regime actors to transition to support the LEMA. As WCA members led the charge for conservation, their success encouraged others to join, resulting in a collective shift toward conservation. Social pressures and group norms played a crucial role in this transition, as actors who were initially resistant saw the positive outcomes of conservation efforts and the growing support within their communities. The social dynamics of this transition, particularly the influence of community leaders and peers, helped shift beliefs from opposition to support for conservation practices. The interaction of social pressures, environmental realities like groundwater depletion, and the desire to preserve agricultural livelihoods for future generations created the necessary conditions for regime actors in GMD 1 to embrace the LEMA. These combined factors highlight the importance of community influence and social dynamics in driving actor transitions toward conservation.

As support for conservation grew in GMDs 1 and 4, some state actors began to show renewed interest in creating state-level conservation policies. In 2022, two Kansas House representatives sought to pass groundwater reform legislation that would have restructured

state agencies overseeing water management and mandated that the GMDs implement conservation policies (Kite, 2022a). Although this bill ultimately failed due to resistance from regime actors, the fact that politicians introduced it suggests a shifting attitude toward conservation among some state actors. However, more widespread support from regime actors would be required to pass state-level conservation legislation.

In November 2022, Kansas Governor Laura Kelly provided political backing to rally more state actors behind conservation efforts. Upon her re-election, Kelly made a public pledge to make water her top priority during her second term, marking a significant shift in her policy focus:

"I give you my word that protecting our water supply will remain a top priority in Topeka over the next four years... I refuse to allow the can to be kicked any further down the road." (Kelly, as cited in Kite, 2022b).

Kelly's pledge to prioritize water signified her transition from a regime actor who had not previously focused on water during her first term to a niche actor dedicated to conservation. Two critical factors enabled this transition: her political capital and the shifting public opinion on water conservation. Kelly's unique position as a second-term governor with no plans to seek future office gave her the political freedom to challenge powerful agricultural lobbyists, who had previously opposed stricter water management policies. In an interview with the *The Topeka Capital-Journal*, Kelly explained how her second-term status gave her the agency to act:

I decided that, should I be re-elected, that I would elevate water to be one of my highest priorities because it's sort of an interesting moment in time and one that we've never experienced, where you have a governor in their second term, who never plans to do anything else, never be on the ballot again... So, I've got political capital and I can afford to spend it because it'll be a very politically sensitive issue. (Kelly, as cited in Harvel, 2024).

Kelly's acknowledgment that groundwater depletion was a politically sensitive issue highlights why previous governors may have avoided addressing it: they feared backlash from powerful agricultural interests and voters. However, her statements make clear that the political capital provided by her second term gave her the agency to take on this contentious issue, creating the necessary conditions for her transition from a regime actor focused on short-term concerns to a niche actor championing long-term water conservation. By leveraging her political freedom, Kelly became crucial in Kansas's shift toward prioritizing water conservation, signaling a broader shift in state-level conservation efforts. Changing public opinion about the importance of addressing depletion also played a crucial role in Kelly's transition. More water rights holders were becoming receptive to conservation, as evidenced by the spread of LEMAs and WCAs across the GMDs. Kelly noticed this shift firsthand while campaigning in western Kansas, where depletion became a dominant issue in her discussions with voters:

Kelly said the issue became a top priority while campaigning in western Kansas. It didn't take long for residents to bring up water. 'It didn't matter if it was northwestern or

southwestern. Even though I thought they were going to be talking about schools and roads and health care, it always went to water almost immediately everywhere" (Kelly, as cited in Harvel, 2024).

This statement reflects the growing awareness among western Kansans that groundwater depletion was a pressing issue. As Kelly engaged with voters, the rising concern about water sustainability among her constituents enabled her to prioritize conservation without facing the same level of resistance that her predecessors faced. With public opinion increasingly favoring conservation efforts, Kelly had the agency to promote water policies more confidently, knowing she had the backing of those most affected by depletion. Former governors, in contrast, have noted in news articles how the lack of political and public support for conservation during their terms hindered their ability to address the issue. Kelly's experience illustrates how the changing attitudes toward water depletion and her political capital provided the conditions for her shift from a regime actor to a niche actor focused on promoting conservation-based policies.

Kelly's backing of conservation catalyzed further support among other actors. In December 2022, energized by Kelly's commitment to water, the KWA recommended that the state end its policy of planned depletion. Reporting from the *Kansas Reflector* details this:

The Kansas Water Authority...voted Wednesday to place language in the body's annual report to the governor and legislature saying the 'policy of planned depletion of the Ogallala Aquifer is no longer in the best interest of the state of Kansas.' The report will also recommend the state create a formal process to establish goals and actions to 'halt the decline of the Ogallala Aquifer while promoting flexible and innovative management within a timeframe that achieves agricultural productivity, thriving economies and vibrant communities — now and for future generations of Kansans.' (Kite, 2022c).

The KWA's formal acknowledgment of the planned depletion policy marks a critical transition for the agency from regime to niche actor, signaling a significant shift in public and institutional opinion. This was the first time a state agency formally called for an end to planned depletion policies, demonstrating how rapidly attitudes toward groundwater management were changing (Condos, 2022). This decision reflects how rapidly public and institutional attitudes toward groundwater management evolved, especially following Kelly's leadership on the issue. Kelly's political backing created the conditions that allowed the KWA to take this unprecedented step, demonstrating how leadership from key actors can influence public agencies and catalyze significant policy change.

The KWA's call to end planned depletion created a window of opportunity for other state actors to transition to niche actors and pursue state-level conservation policies. For example, Kansas House Representative Lindsay Vaughn, who had unsuccessfully tried to pass groundwater reform legislation in spring 2022, used the momentum from the KWA's recommendation to reintroduce a new conservation bill, H.B. 2279, in 2023. This time, Vaughn and Kansas House Representative Jim Minnix formed a coalition with GMDs 1 and 4 and former Chief Engineer David Barfield to draft legislation that required all GMDs to identify priority areas,

develop conservation plans, and implement them by 2026. The bill passed in 2023 with the support of agricultural lobbyists.

Several factors motivated both niche and regime actors to support H.B. 2279. A fear that depletion would wreck the state's economy and that GMD 3 was not doing enough to prevent this motivated niche actors to support this bill. A GMD 4 staff member who helped draft the bill explained this sentiment:

It [H.B. 2279] was targeted at GMD 3. It was very much targeted at GMD 3. And so when she's [Representative Vaughn] is like, "we've got to do something about this [GMD 3's lack of conservation policies]." And she came up with the idea for 2279, and she called me up, and she goes, "I'm gonna send you some language." But she goes, "what this bill is going to do is to require all the GMDs do what you have done with GMD 4." (GMD 4 staff member, 2023).

This statement reflects how concern over GMD 3's insufficient conservation efforts motivated niche actors to draft and support H.B. 2279, driven by the belief that inaction would jeopardize future water availability. Representative Minnix echoed this concern, particularly regarding the need to prepare for future generations:

We're proud to prepare for future generations... I think water issues, we need to look at it with a long timeframe. This is not just what we can do in the next three, four weeks ... Ultimately, it's where Kansas can be better off here in the next five, 10, 20, 30 years. (Bahl, 2023).

Minnix's statements indicate that the desire to conserve water for future generations was a critical factor motivating niche actors to support the bill. On the other hand, regime actors, such as agricultural lobbyist groups, were motivated by a different concern: the fear that GMD 3's lack of conservation policies would lead to state-mandated conservation measures. A statement from Aaron Popelka, a lobbyist for the Kansas Livestock Association (KLA), captures this perspective:

Aaron Popelka, a lobbyist for the Kansas Livestock Association, said the group had concerns some GMDs weren't doing enough to encourage conservation. That, he worried, would increase the likelihood of state mandates — something his organization hopes to avoid. "We think this bill strikes a good balance, providing some carrot, if you will, for the locals to get involved. (Kite, 2023).

Popelka's statement reveals that agricultural lobbyists supported H.B. 2279 because they saw it as a way to compel GMD 3 to conserve water without the state imposing harsher mandates on all GMDs. Thus, while both niche and regime actors were motivated to support the bill due to GMD 3's lack of conservation, their reasons differed: niche actors were concerned about long-term water availability, while regime actors feared unwanted government intervention. The fact that agricultural lobbyists supported the bill and that the state had now effectively banned

planned depletion practices, a core feature of the regime, signifies a transition from planned depletion to conservation.

Following the passage of H.B. 2279, GMD 1 implemented a four-county LEMA, placing the entire district under a LEMA and marking a significant shift toward increased conservation. This demonstrates how actor transitions can occur as LEMAs gain momentum, creating a "snowball effect" that spreads across districts and changes cultural attitudes. A GMD 1 staff member described how the success of other LEMAs contributed to this change in GMD 1:

You see the snowball effect of Sheridan 6, and then the rest of the district-wide LEMA in GMD 4, and then you had Wichita County WCA and then Wichita County LEMA, and now the whole district is in a LEMA. So it's, you kind of get into this sense of, well, my neighbor is doing it, maybe I can do it, you know, and that's just part of change culture. It's going to take time to turn the ship around and move in a different direction (GMD 1 staff member, 2023)

This statement reveals how witnessing the success of conservation efforts in other districts helped shift GMD 1 members' attitudes toward adopting conservation practices. The social pressure created by neighboring communities' participation in LEMAs was a powerful motivator, illustrating the role of social influence and group norms in driving actor transitions. This dynamic mirrors the experience in Wichita County, where some residents needed to see their neighbors succeed in conservation efforts before supporting the LEMA. Similarly, in GMD 4, residents were persuaded to back the district-wide LEMA after seeing the economic study on Sheridan 6, which proved that conservation did not have negative economic consequences. As more communities adopted LEMAs and experienced the benefits of conservation firsthand, the cultural resistance to conservation weakened. The success stories from Sheridan 6, Wichita County, and GMD 4 provided real-world examples of how conservation could be economically viable and sustainable, creating the conditions necessary for regime actors in GMD 1 to transition to niche actors. This collective momentum reduced opposition and paved the way for further transitions in GMD 1.

4.3.2 Policy Entrepreneurs

GMD 4 staff acted as policy entrepreneurs when developing the district-wide LEMA in 2018. They employed evidence-gathering strategies to alleviate concerns that conservation efforts would harm economic outcomes, drawing on data to build GMD 4 members' trust. For instance, GMD 4 staff used data from Golden's (2018) economic study of the Sheridan 6 LEMA, which showed that conservation had not led to lower crop yields. In an interview for this study, a GMD 4 staff member explained how they leveraged this data:

We were parading the [Sheridan 6 LEMA] data big time (GMD 4 staff member, 2023).

By actively using data from Sheridan 6, the GMD 4 staff addressed fears about the economic impacts of conservation and built trust between the staff, the Board, and GMD 4 members. They

understood that GMD 4 members' needed not only to trust the staff's guidance but also to believe in their own ability to implement conservation measures. As the staff member explained:

The trust and the fact that they learned that they can do it. They can not only trust in us, saying we believe you can do this, but believe in themselves and trust in themselves to make it work for them (GMD 4 staff member, 2023).

This approach illustrates how GMD 4 staff acted as influential policy entrepreneurs by aligning evidence with stakeholders' values and fostering trust through transparency and localized data. By drawing on the success of Sheridan 6, they built credibility and reassured stakeholders that conservation could align with economic sustainability. Building trust through evidence-based data aligns with Mintrom's (2000) findings that trust is critical for policy entrepreneurs when gaining stakeholder buy-in for new policies. The GMD 4 staff's actions created the conditions necessary for broader support of the district-wide LEMA. Demonstrating that conservation could be both economically viable and achievable helped shift regime actors' attitudes and paved the way for regime actors to transition to niche conservation behaviors. Their ability to frame conservation in a way that resonated with local actors' economic concerns and cultural values highlights the central role of policy entrepreneurs in driving sustainability transitions.

When the GMD 3 Board rejected the LEMA attempts, the chief engineer and DWR also stepped in as policy entrepreneurs, seeking solutions to build consensus. They proposed using a facilitator to bridge the divide between LEMA supporters and the GMD 3 Board. Excerpts from the GMD 3 minute meetings capture these solution-seeking strategies:

Mr. Barfield [the chief engineer] mentioned there might be a need for a facilitator in the LEMA process... Jackie [DWR employee] again questioned the directors on a plan on how to work through conserving...the state would be willing to match funds, or find funds, for a facilitator to develop the conservation plan (Southwest Kansas Groundwater Management District No. 3, 2018a).

This demonstrates how the chief engineer and DWR acted as policy entrepreneurs by offering practical solutions, such as providing a facilitator, to break the impasse. By proposing state funding to reduce barriers, they used resource mobilization strategies to make it easier for the GMD 3 Board to adopt a conservation plan. Despite their efforts, the GMD 3 Board ultimately did not hire a facilitator, and the LEMA supporters, with the help of the chief engineer, formed a WCA instead. This reflects Mintrom's (2000) framework, where policy entrepreneurs adapt to challenges and continuously seek solutions to move forward, even when initial plans are blocked.

Governor Kelly's decision to prioritize water issues during her second term also reflects her role as a policy entrepreneur. Kelly recognized a window of opportunity provided by her second-term political capital and leveraged this moment to elevate water as a critical issue. Explaining her decision, she told reporters:

I decided that, should I be reelected, that I would elevate water to be one of my highest priorities because it's sort of an interesting moment in time and one that we've never experienced, where you have a governor in their second term, who never plans to do anything else, never be on the ballot again...So, I've got political capital and I can afford to spend it because it'll be a very politically sensitive issue (Kelly, as cited in Harvel, 2024).

Kelly's ability to identify and capitalize on this unique political moment illustrates a key strategy of policy entrepreneurship: recognizing windows of opportunity and acting decisively. With no future electoral ambitions, she had the freedom to tackle politically sensitive issues, such as water conservation, that her predecessors avoided. Using her second term to tackle water issues, Kelly demonstrated her ability to disrupt the existing regime of planned depletion and introduce new conservation priorities.

Following Kelly's pledge to prioritize water, the KWA seized the opportunity created by her announcement and recommended that the state end its planned depletion policy. This action reflects how policy entrepreneurs can leverage political momentum to scale niche innovations. Kelly's commitment acted as a landscape-level change, disrupting the long-standing regime of planned depletion and creating the conditions for policy entrepreneurs like the KWA to push forward conservation policies. KWO director Connie Owen described the significance of this moment:

It is enormous...because there has yet to be any state entity that has publicly acknowledged the problem ... and made a statement that we can no longer behave as we have been (Owen, as cited in Condos, 2022).

By aligning their recommendations with the political window opened by Kelly, the KWA positioned themselves as policy entrepreneurs, scaling up and translating niche conservation policies into regime-level policies. This demonstrates how landscape-level shifts, such as Kelly's commitment, create opportunities for policy entrepreneurs to act (Kingdon, 1984). Kelly's political leadership and the momentum it generated enabled actors like the KWA to propose significant policy changes that might have been politically untenable in the past. By recognizing and seizing this political opportunity, Governor Kelly played a pivotal role in setting the stage for broader water conservation efforts, demonstrating how policy entrepreneurs can disrupt entrenched regimes and catalyze lasting policy change.

Capitalizing off the window of opportunity created by Governor Kelly and the KWA, niche actors acted as policy entrepreneurs, developing legislation that mandated that the GMDs develop conservation plans. Niche actors formed coalitions, relied on local knowledge, and formed alliances with some regime actors to pass the bill and catalyze a transition from planned depletion to conservation. An excerpt from my interview with GMD 4 staff demonstrates how niche actors formed diverse coalitions to advance H.B. 2279:

But it [H.B. 2279] was targeted at GMD 3. It was very much targeted at GMD 3. And so when she's [Lindsay] is like, we've got to do something about this. And she came up with

the idea for 2279, and she called me up, and she goes, "I'm gonna send you some language." But she goes, "what this bill is going to do is to require all the GMDs do what you have done with GMD 4. So I want to know exactly how you did it." And so she and I, and then GMD 1 staff– But we sat down with Lindsay as well as David Barfield, who was the chief engineer. So the four of us sat in an office at the statehouse and hashed out that Bill word for word. And we got it down. And so she [Lindsay] typed it up and sent it to all of us because it was very made known whatever you do, do not harm GMD 4 or GMD 1 because they're doing good things. And of course, I emphasized and continue to emphasize and will continue the local control aspect. (GMD 4 staff member, 2023).

This statement highlights how GMD 1 and GMD 4 staff, Representative Lindsay Vaughn, and former Chief Engineer David Barfield acted as policy entrepreneurs by forming a coalition to draft a bill explicitly targeting GMD 3's resistance to conservation efforts. Governor Kelly's focus on water conservation and the KWA's recommendation to end planned depletion created political momentum and provided a window of opportunity for the coalition to form. Additionally, the proven success of LEMAs in GMD 4 and GMD 1 provided evidence-based examples that the coalition could use to strengthen their case, creating conditions that made it easier for them to overcome opposition. By drawing on these successful local efforts, the coalition built credibility. It framed the bill as necessary to bring all GMDs in line with the conservation strategies already working in GMD 4 and GMD 1. The policy entrepreneurs behind H.B. 2279 designed the bill to transition Kansas from a planned depletion model to a regulated conservation approach. The bill required all GMDs to adopt conservation strategies that had already been successful in GMD 4 and GMD 1, effectively using the conditions created by local conservation successes to influence broader policy change. By combining the political opportunity provided by Governor Kelly with local knowledge and coalition-building, policy entrepreneurs could align state policies with proven conservation strategies. This process illustrates how policy entrepreneurs use enabling conditions, such as political windows of opportunity and successful niche innovations, to form coalitions and push for systemic changes in a regime. In this case, the coalition of niche actors leveraged local success stories, growing public concern over groundwater depletion, and political backing to overcome resistance and drive a transition in groundwater management in Kansas. The ability of policy entrepreneurs to connect local successes with broader policy goals demonstrates how transitions can emerge from well-coordinated actions in response to favorable conditions.

Furthermore, the coalition's focus on preserving local control and successful practices in GMD 1 and GMD 4 demonstrates the entrepreneurial strategy of embedding niche solutions into broader policy changes. This is crucial for creating legitimacy and trust, which is vital in gaining support for transitions (Mintrom & Norman, 2009). By involving local actors in drafting the bill and ensuring that it reflected local successes, the policy entrepreneurs could frame the policy in a palatable way to broader stakeholders, including those resistant to change, such as the agricultural lobbyist groups. For instance, the Kansas Farm Bureau supported the legislation, stating in the *Kansas City Star*,

The legislation is a cause for hope. The momentum is there, it's growing... There's probably more momentum now than I've seen in my entire career to address these issues. But now is the time to prove that some of these measures will be implemented with definable and positive results. (Barackman and Bernard, 2023).

This statement highlights the importance of building alliances across sectors, a common strategy for policy entrepreneurs. By gaining the support of agricultural lobbyists, niche actors demonstrated that the bill aligned with broader economic and environmental interests, reducing the perceived risks of conservation and amplifying pressure on the resisting regime actors, like GMD 3, who opposed the bill. The opposition from GMD 3 reflects resistance from regime actors deeply embedded in the status quo. In contrast, the support from agricultural lobbyists suggests a growing recognition of the need for conservation practices, which is critical in shifting the regime. This interaction illustrates how policy entrepreneurs leverage allies within the regime to disrupt its stability, creating opportunities for niche innovations to scale up and transition from localized practices to broader, institutionalized policies. By embedding local successes into the policy and involving influential regime actors, such as agricultural lobbyists, the policy entrepreneurs in this coalition created the conditions necessary to facilitate the adoption of conservation measures at a larger scale. This strategic use of alliances, local control, and proven practices allowed the coalition to overcome resistance and catalyze a broader transition, moving Kansas away from planned depletion and toward conservation-based water management.

4.3.3 Regime Beliefs, Policies, and Actors

From 2013 to 2022, the governor and the legislature primarily acted as regime actors, mostly disinterested in water issues. This disinterest in water issues manifested in the policies enacted by Governor Brownback from 2013 to 2018. Brownback developed a 50-year vision plan for conservation for the Ogallala, but he cut taxes instead of funding the plan. Brownback's tax cuts defunded the state water plan, which provides money for conservation projects. A KOHP interview with Ed Flentje, former legislator, conducted by Rex Buchanan, where they discuss Governor Brownback's tax cuts, illustrates the deprioritization of water at the state level:

E.F.: It's priorities. Brownback became convinced that tax cuts—

R.B.: Tax cuts are more important than anything else.

E.F.: Part of those cuts came from the Water Plan financing. **R.B.:** Water may be important to you, but it's just not as important as the overriding feature here.

E.F.: And we'll [Brownback Administration] talk about it [water issues]. I mean a lot of talk and action on the periphery, encouragement to groundwater management districts, terrific (Flentje, as cited in KOHP, 2019b).

This dialogue demonstrates how water became less of a priority to the governor. It reveals that while the governor was willing to discuss conservation, he was unwilling to fund it, demonstrating his deprioritization of water issues in favor of tax cuts. Other KOHP interviews also reflect this sentiment that the state and the legislature were less interested in water issues

from 2013 to 2022. The defunding of the state water plan, which set aside funds for conservation initiatives, represents the further mainstreaming of regime-planned depletion practices at the state level. In contrast, while the state became less interested in conservation, GMDs 1 and 4 became more involved in conservation in the '10s. This role change from the state supporting conservation and the GMDs opposing it in the '90s to now vice versa demonstrates how actors change roles over time.

Meanwhile, at the GMD level, regime resistance to conservation from GMD 3's Board prevented LEMAs from diffusing in GMD 3. When locals tried to develop and propose a LEMA in part of GMD 3, the Board shut this down, as the Board and the LEMA supporters were unable to reach a consensus on a LEMA, and the Board was unwilling to help the locals develop a LEMA. An excerpt from the minute meetings of an April 2018 GMD 3 meeting reveals how the Board was not cooperative in helping the locals develop a LEMA:

Steve Stone [Board member] reminded everyone the Steering committee was supposed to bring GMD3 a plan, GMD3 was not supposed to come up with a plan. Fred Jones [Board member] added the frustration he hears is the process is in a state of limbo and it would be incumbent on this body to give direction as to what to do in terms of the steering committee to get a product that GMD3 Board can agree on. Mike McNiece [Board member] asked due to this frustration of a LEMA in our district, should we focus more on WCA's? (Southwest Kansas Groundwater Management District No. 3, 2018b).

This dialogue demonstrates how the GMD 3 Board placed the burden of developing consensus on an LEMA solely on the locals, not offering to help them devise a solution as the GMD 1 and 4 staff have done for LEMAs in their district. This lack of leadership and support from the Board resulted in the termination of all LEMA discussions in GMD 3, as supporters formed a WCA with the help of the chief engineer (GMD 4 staff, 2023; former chief engineer, 2023). Other sources, like KOHP interviews and news articles, reflect that a lack of leadership and support from the GMD 3 management and Board has prevented LEMAs from forming in GMD 3.

The GMD 3 Board and staff's disinterest in LEMAs reveals core beliefs and characteristics of regime actors that help to explain why LEMAs have not successfully diffused into GMD 3. The desire to preserve agricultural communities and build a family legacy in irrigated agriculture were contributing factors that motivated former regime actors in GMDs 1 and 4 to transition from regime to niche actors supporting conservation. However, in GMD 3, these factors have a significantly lesser influence on motivating regime actors to conserve. My interview with a former chief engineer reflects this. The former chief engineer recalled previous interactions with GMD 3 staff, noting that

Instead of passing on water to the next generation, they're gonna pass on money is what I've heard some of them [GMD 3 members] say (Former chief engineer, 2023).

This observation supports the idea that saving water for future generations overall has less influence in motivating GMD 3 regime actors to conserve than in influencing GMD 1 and 4 regime actors. News articles also support this idea.

In 2022, regime actors, like agricultural lobbyist groups, acted as policy entrepreneurs to prevent niche actors from passing a bill that would have given state agencies more power in managing groundwater and mandated that the GMDs adopt conservation policies. Agricultural lobbyist groups used policy entrepreneurship strategies like lobbying politician regime actors to create an amendment that effectively killed the bill niche actors were sponsoring. A sponsor of the bill reflected on the lobbying in the *Kansas Reflector*:

"Highland [sponsor of the bill] said he knew the amendment was coming after the state's agricultural industry groups attempted to lobby him. He suspected it came directly from the industry." (Kite, 2022d).

This statement reflects how regime actors can successfully utilize policy entrepreneurship strategies like lobbying to resist change, consistent with the MLP's conceptualization of regime actors as policy entrepreneurs.

Agricultural groups' rationale for opposing the reform bill reflects critical beliefs in the regime about the role of the state in groundwater management and the value placed on property rights. Regime actors opposed the 2022 reform bill because they believed it gave the state too much power and infringed on private property rights. A statement from the Kansas Livestock Association about why they opposed the bill reflects this:

First and foremost, we want to protect those property rights, and while we do understand and are concerned about declining levels of the Ogallala Aquifer, I think, from our perspective, we're always concerned when government tries to interfere with those property rights, (Kite, 2022d).

This statement demonstrates that agricultural groups opposed the reform bill because they thought it allowed excessive state interference in groundwater management and property rights. These beliefs reveal that regime actors value minimal state involvement in groundwater management and sometimes interpret state-mandated conservation orders as infringing on their water rights. These beliefs cause regime actors to oppose state-led conservation policies. The Kansas Farm Bureau also echoed a similar sentiment, stating,

"But to make or consider wholesale changes to the structure of our water law — I don't see us being very excited about having that conversation." (Kite, 2022d).

Agricultural lobbyist groups were not the only regime actors that held these beliefs about protecting private property rights and that the state should not be involved in groundwater management. GMD 4 members who opposed the district 2018's LEMA cited protecting private property rights as the reason for opposing the LEMA.

4.3.4 Landscape Pressures

Landscape factors, like personally witnessing depletion in one's own wells, created the conditions that pressured regime actors in areas with low saturated thickness to transition to niche actors supporting conservation. For decades, western Kansas knew that eventually, the water would run out, but they believed that day was far in the future. As wells began to dry up, depletion became an unavoidable reality, forcing regime actors who pumped from wells with low saturated thickness to implement conservation measures to avoid losing the ability to farm altogether. One GMD 3 farmer's experience of running out of water reflects this sentiment:

Reality, however, rests underneath 86-year-old Rodger Funk's feet. The Garden City farmer sat at his kitchen table, a running irrigation center pivot visible out the window behind him. The wells across this vast landscape are running dry. More than a half-century ago, Funk attended a meeting where state officials told him and the few others in attendance that the water wasn't an endless river as they once thought. It is finite, they said, and it is being mined. And, one by one over the years, when it was no longer economically feasible to pump water to his crops anymore, Funk began plugging wells, making the switch to dryland farming. "Everybody believed it, I believed it — this water is going to last forever," Funk said. (Bickel, 2014).

This statement demonstrates how the public was aware of the threat of depletion. Still, regime actors did not start implementing conservation practices until depletion physically and economically forced them to change their behaviors. In this case, depletion acts as a pressing landscape shock, challenging the long-standing water use practices of the agricultural regime in Kansas. While actors like Funk initially believed the water supply would last indefinitely, the physical and economic realities of dry wells pressured them into confronting the system's limits. This pressure prompted Funk and others in similar positions to shift toward niche conservation practices, such as LEMAs, WCAs, and dryland farming, to survive. This shift exemplifies how landscape pressures, such as the drying up of wells, force regime actors to adopt niche innovations in response to environmental and economic challenges. In these cases, groundwater depletion created the conditions for actors to reconsider their practices and move toward conservation. News articles and GMD 4 LEMA testimonies similarly show that actors in GMDs 1 and 4 began supporting conservation measures only after depletion forced them to confront the unsustainable nature of their water use practices

However, while depletion forced Funk and some members of GMDs 1 and 4 to adopt conservation practices, this pressure has not had the same effect on most of GMD 3. The intent of this research is not to provide a comprehensive explanation of why GMD 3 has largely avoided conservation policies while GMDs 1 and 4 have LEMAs. Rather, this research offers two possible partial explanations for the divergence in the GMDs' approaches to groundwater management: hydrological differences between GMDs 1 and 4 and GMD 3 and discrepancies in GMD size. In the interest of transparency, preliminary results also indicate that regulatory

capture from agricultural interests in GMD 3's leadership and Board and variations in absentee landownership rates, farm sizes, farm types (i.e., family farms, locally owned farms, corporate-owned farms) may explain the discrepancy between GMDs 1 and 4's and GMD 3's approaches to groundwater management. However, these preliminary results are not further addressed in this research because the validity of these claims, particularly about discrepancies in absentee landownership rates, farm sizes, and farm types across the GMDs, cannot be quantitatively verified within the scope of this research. Claims alluding to regulatory capture in GMD 3's leadership and Board invoke themes about the relationship between structure and agency, which are outside this research's scope, and time constraints restrict this topic from being further explored; therefore, this preliminary finding is not addressed further. Future research should explore these topics more.

Landscape factors such as hydrology and the geographical size of GMD 3 partially explain why depletion has not pressured most GMD 3 members into supporting conservation as it has in GMDs 1 and 4. Despite experiencing the largest percentage declines in groundwater availability, GMD 3 still retains the highest saturated thickness compared to other GMDs (Buchanan et al., 2023). This means that even though GMD 3 has seen significant depletion, the total volume of water left in the aquifer is greater than in other areas, giving it a comparatively larger groundwater buffer despite the high depletion rate. (Buchanan et al., 2023).

Figure 6 displays this, showing that some areas of GMD 3 have 100 years of water left. As a result, most residents of GMD 3 have not yet felt the direct impacts of depletion to the extent experienced in GMDs 1 and 4. Therefore, depletion as a landscape pressure does not yet create the conditions that would push most GMD 3 irrigators toward adopting niche conservation practices, as GMD 3's hydrology offers a different set of circumstances compared to other regions. Carl Holmes's KOHP interview, where Holmes discusses the different approaches to groundwater management in GMDs 3 and 4, reflects this dynamic:

I think one of the big differences was that the depth of the Ogallala, as I recall, was quite a bit deeper, thickness-wise, than what it is in northwest Kansas. In northwest Kansas, they were into the recharge thing a lot earlier than what they talked about in southwest Kansas. In southwest Kansas, I know in some areas wells are being abandoned because the production has dropped so much, especially, I believe, up in the Scott City area. We're seeing fringes on the western side of the Ogallala in southwest Kansas with dropping wells, whereas in Plains, between Plains and Meade, which is fourteen miles, there's a fault line there. That fault line is just like an underground dam. We're right about the dam. So, think about a reservoir. If you're pumping water at the beginning of the reservoir, you're going to run out of water before they get to the dam because that's the deepest part... (Holmes, as cited in KOHP, 2020b).

This quote highlights how GMD 3's greater saturated thickness has delayed the need for conservation measures, unlike in GMDs 1 and 4, where depletion pressures are more immediate. While GMD 3 has areas of low saturated thickness, water-rich areas with long-term reserves have reduced the overall sense of urgency. In contrast, in areas of GMD 3 where the saturated thickness is lower, such as Finney and Kearny counties, depletion has exerted more

pressure on irrigators to conserve, as demonstrated by the failed LEMA attempt in these areas (KFL, 2017). This disparity underscores how landscape factors like hydrology act as conditions that drive actor transitions from regime to niche practices in some areas while slowing transitions in others. In GMD 3, more substantial water reserves in certain regions have delayed the pressures that force regime actors to consider conservation, allowing the status quo to persist longer than in regions with more immediate depletion concerns.

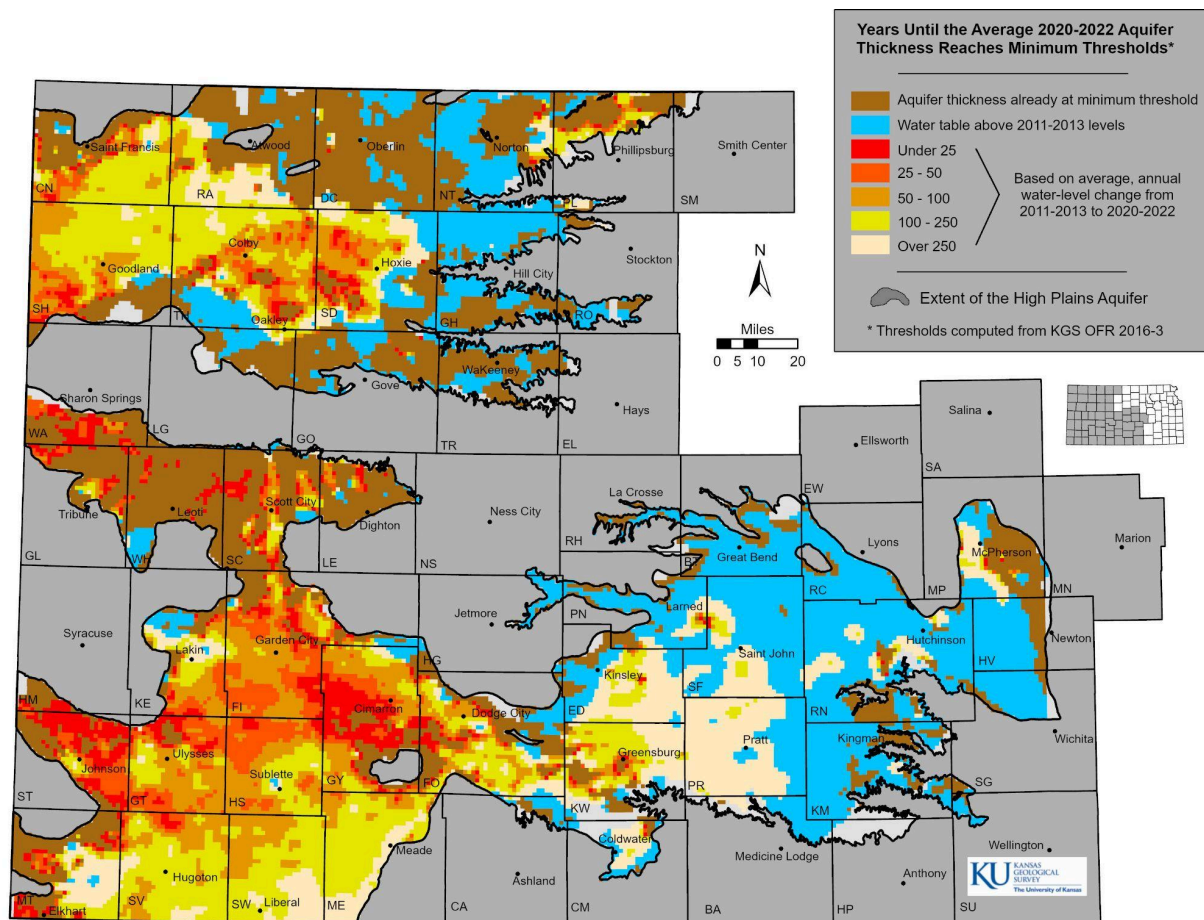


Figure 6

Estimated Usable Lifespan of Kansas Ogallala Aquifer. GMD 3 is located in the bottom left corner. GMD 1 is right above GMD 3, and GMD 4 is located in the top left corner. The map shows that GMD 3 has more areas left of water than GMDs 1 and 4. Map adapted from Kansas Geological Survey in Buchanan et al. (2023).

The range of saturated thickness across GMD 3 and the size of GMD 3 compared to the other GMDs are also landscape factors that help to reinforce planned depletion policies in the

regime. As Figure 7 shows, GMD 3 has more counties than any other GMD and has the broadest range of saturated thickness levels. An excerpt from my interview with a former chief engineer demonstrates how the range of saturated thickness levels and the size of the GMD have helped the regime resist change:

But I think one of the problems is the board is too big, and the GMD is too big. Okay. There's 15 member board. There's some water rich areas remaining in the southern tier counties of Kansas, just some big water down there. So you've got areas that are declining, but other areas that got 100 years of life. And it just feels like the board members in the big water counties are just afraid that if they support conservation elsewhere, It's going to come to them. (Former chief engineer, 2023).

As highlighted in the interview with the former chief engineer, Board members from areas with higher water reserves fear that supporting conservation in depleted areas will eventually impose restrictions on their regions, reinforcing resistance to change. The range of saturated thickness levels and the geographical size of GMD 3 act as significant landscape factors that reinforce the regime's commitment to planned depletion policies. As the largest GMD, GMD 3 encompasses counties with both severely depleted and relatively water-rich areas. This geographical diversity creates internal tensions that slow conservation efforts. Board members in water-rich areas resist conservation because they fear future regulations, while those in depleted areas face increasing pressure to conserve. This regional diversity creates a disconnect that stabilizes the regime and perpetuates planned depletion policies. The variability in saturated thickness across GMD 3 illustrates how landscape pressures can both challenge and reinforce regime stability. While depletion has pressured some areas to consider conservation, the presence of water-rich regions has enabled the regime to maintain its planned depletion approach. This is consistent with the MLP's conceptualization of landscape pressures as having the potential to reinforce and stabilize the regime (Geels, 2011). In the case of GMD 3, the hydrological diversity has acted as a stabilizing factor, preventing the regime from fully transitioning to conservation. Thus, the geographical and hydrological complexity of GMD 3, along with the fear of future regulations in water-rich areas, has created conditions that reinforce the regime's inertia and slow the adoption of conservation measures. This landscape-driven fragmentation partially explains why GMD 3 continues to resist broad conservation efforts despite localized depletion.

Groundwater Management Districts in Kansas

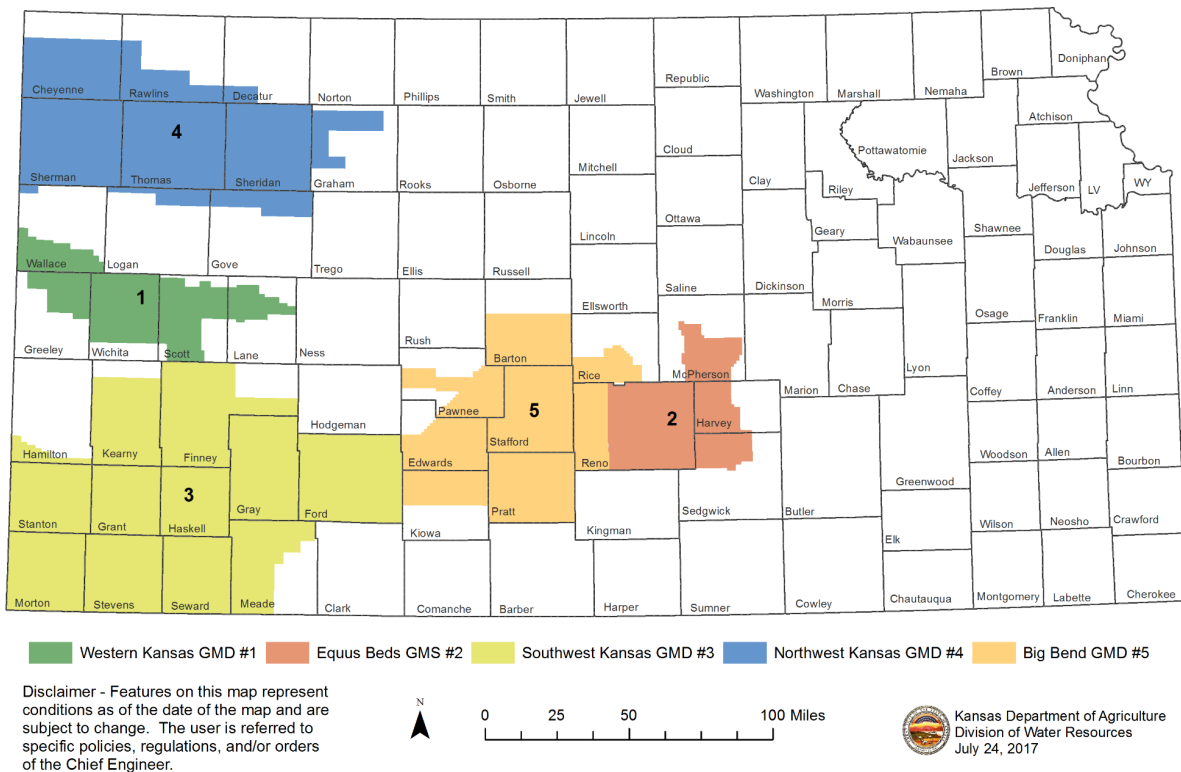


Figure 7.

Map of the GMDs and the counties in each GMD. Map adapted from the Kansas Department of Agriculture (2017).

5.0 Chapter 5: Discussion

In this chapter, I analyze how the transition toward groundwater conservation in Kansas has followed a transformation pathway in the MLP, highlighting the critical roles of policy entrepreneurs, real-world labs, state intervention, and landscape pressures. Responding to pressures such as groundwater depletion, regulatory threats, and hydrological constraints, state and local actors like GMDs 1 and 4 adjusted their practices to promote conservation. Cultural values, such as the desire to build family legacies in irrigated agriculture, played a crucial role in shaping responses to these pressures, as did the strategic efforts of policy entrepreneurs who framed conservation as essential to local control and long-term sustainability. While depletion pressures prompted transitions in GMDs 1 and 4, resistance persisted in GMD 3, where higher saturated thickness levels delayed the urgency for conservation. This variation in responses illustrates the complex interplay of landscape pressures, policy entrepreneurship, and local conditions in shaping Kansas's groundwater management transition.

5.1 Transformation Pathway and Role of the State

The transition in Kansas groundwater management unfolded over several decades, closely following the transformation pathway within the MLP framework (Geels & Schot, 2007). In this transition pathway, regime actors, rather than niche innovations, play a central role in responding to landscape pressures and driving changes within the regime (Geels & Schot, 2007). Kansas's transition resulted from the interactions between landscape pressures, policy entrepreneurs, and real-world labs converging over time and creating the conditions necessary to destabilize the existing regime. The convergence of these factors created a window of opportunity for regime actors to reorient their policies and practices toward conservation. Figure 8 depicts the transition process in Kansas.

In Kansas, landscape pressures included the threat of regulatory intervention, such as the possibility of state-mandated impairment cases and increasing concerns about groundwater depletion. The potential for the DWR to shut off junior water rights holders in response to depletion created significant pressure on irrigators to adopt conservation measures voluntarily. This fear of losing control over water rights and the threat of external regulation were powerful motivators for regime actors, particularly in GMD 4, to transition toward more sustainable water use practices.

Severe depletion in areas with low saturated thickness, especially in GMDs 1 and 4, further underscored the unsustainability of existing groundwater extraction practices. In these regions, regime actors began to face the immediate consequences of over-pumping, which made continuing with planned depletion policies untenable. However, the impacts of depletion were not uniform across all GMDs. For instance, in GMD 3, where saturated thickness remained relatively high despite significant depletion rates, many regime actors resisted adopting conservation measures. This geographical variation in landscape pressures created different levels of urgency for conservation across the state, leading to varying responses from regime actors. As Morgunova (2020) notes, landscape pressures do not uniformly affect regimes, and

in Kansas, the hydrological and geographic differences between GMDs shaped how actors responded to depletion pressures.

A key characteristic of the transformation pathway is that regime actors drive the transition, responding to landscape pressures by reorienting the regime's rules and practices. In Kansas, state actors, such as the chief engineer, the KWO, and the KWA, played a central role in initiating and guiding the shift toward conservation. For example, in the 1990s, the chief engineer used soft power and the implicit threat of regulatory action through the IGUCAs to push GMD 4 toward adopting a zero-depletion policy. This intervention enabled GMD 4 to adopt conservation measures, marking the beginning of a more widespread transition toward conservation.

In the 2000s, state actors continued to drive the creation of niche innovations by developing policy recommendations for GMDs to delineate aquifer sub-units and prioritize conservation in areas experiencing the most severe depletion. These recommendations led to the formation of HPAs and, eventually, the legislative development of the LEMA statute. The development of the LEMA statute demonstrates how state actors played an active role in creating and implementing niche innovations rather than merely nurturing pre-existing ones, as MLP literature has traditionally suggested (Avelino & Wittmayer, 2016; Johnstone & Newell, 2018). By exerting pressure through policy recommendations and regulatory threats, regime actors laid the groundwork for the eventual adoption of conservation practices across multiple GMDs. This finding aligns with the growing body of MLP scholarship on how incumbent regime actors, like state actors, can drive transitions rather than resist them, as previous MLP literature had suggested (Kump, 2023; Turnheim & Sovacool, 2020).

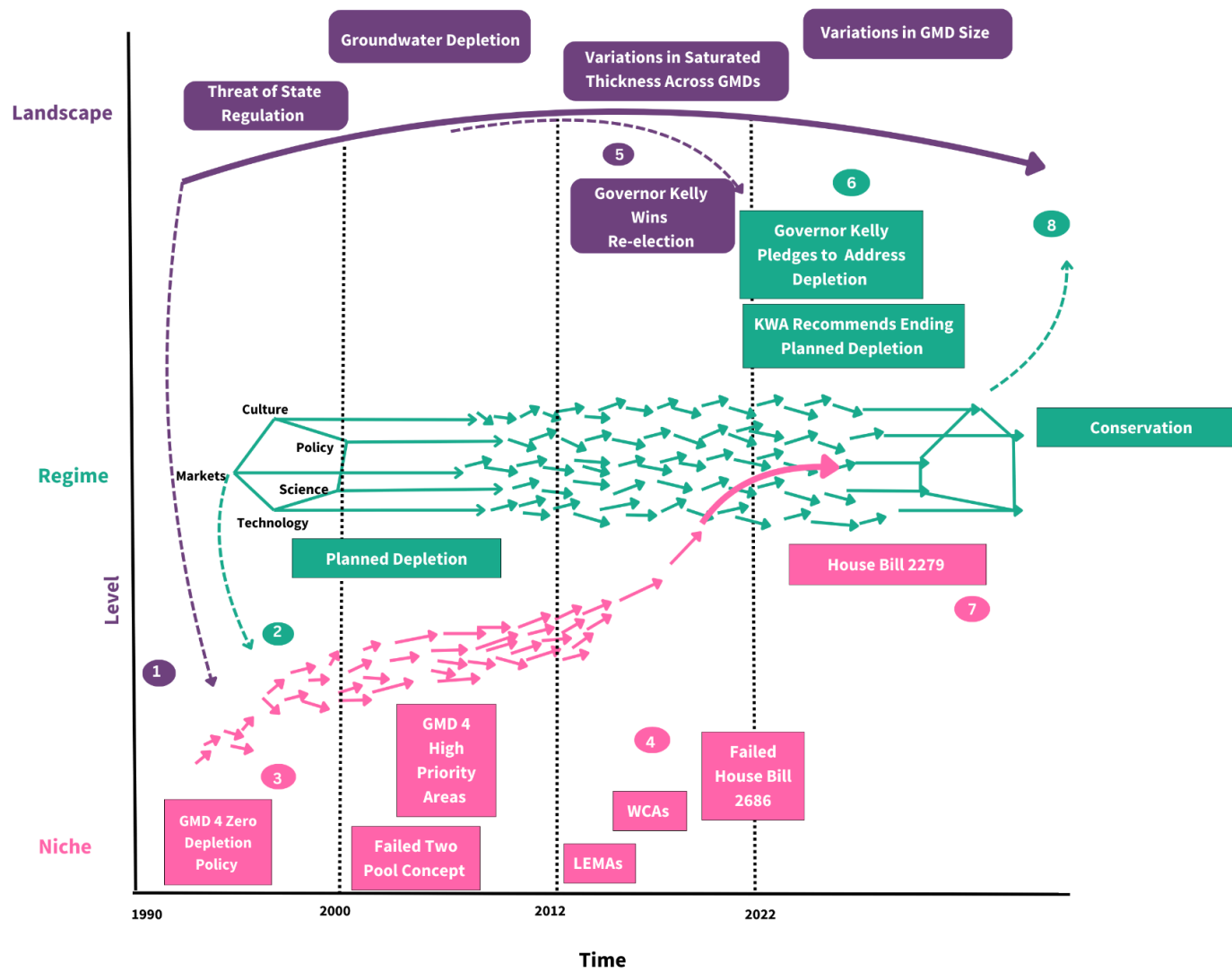
In the transformation pathway, new regimes develop from old regimes through the reorientation of regime rules in response to landscape pressures (Geels & Schot, 2007). In Kansas, the creation and diffusion of LEMAs exemplify this process. Rather than being displaced by a new, external innovation, the regime actors themselves implemented changes to the existing system, integrating niche-level innovations like LEMAs into the broader groundwater management framework. The success of the Sheridan 6 LEMA, in particular, demonstrated that conservation could be achieved without economic harm, which helped to build trust and shift broader regime behavior toward conservation practices.

The creation of H.B. 2279, which mandates that GMDs develop conservation plans by 2026, further illustrates the transformation pathway in action. This legislative development represents the scaling up of niche innovations (like the LEMA) into regime-level policies. Importantly, it was not niche actors alone who pushed for these changes, but rather a coalition of regime actors, such as Representative Vaughn, Representative Minix, KWO, Governor Kelly, and the KWA, who recognized the growing threat of depletion and the need for systemic change.

Governor Kelly played a particularly critical role by creating a window of opportunity for policy change during her second term. Her commitment to making water conservation a priority after re-election, when she no longer faced the constraints of future elections, gave her the

political capital necessary to challenge the entrenched interests resisting conservation policies. This unique political position enabled her to push for stronger groundwater management policies without fearing electoral repercussions. By seizing this opportunity, Kelly facilitated the passage of H.B. 2279, aligning regime actors behind a state-level shift toward conservation and sustainability.

Her leadership, in collaboration with the KWA, accelerated the transition by aligning political momentum with ongoing conservation efforts, showing how landscape pressures and political windows can empower regime actors to lead transitions.



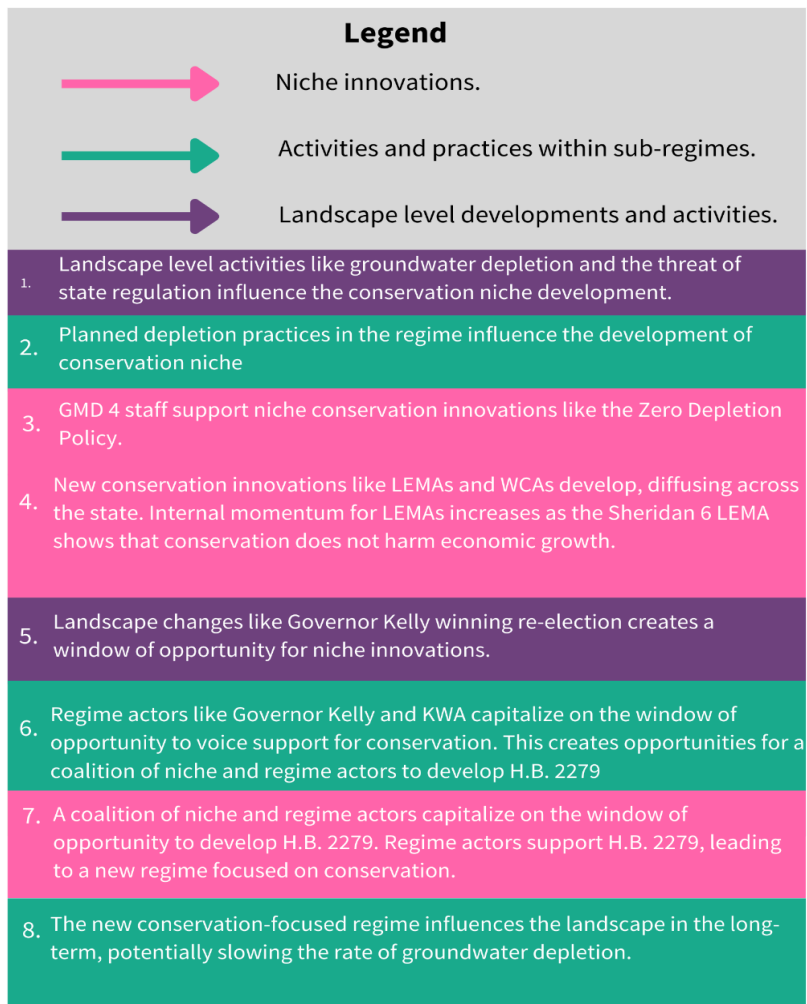


Figure 8.
Depiction of Kansas's transition using the MLP

5.2 Sheridan 6 as a Real-World Lab

The Sheridan 6 LEMA functioned as a critical real-world lab, significantly contributing to Kansas's transition toward increased water conservation and influencing regime actors to adopt niche behaviors. It provided a testing ground for conservation practices as a real-world lab, showing that water-saving measures could be implemented without economic harm. This localized experiment built trust among local irrigators and policymakers, reducing fears that conservation would negatively impact agricultural productivity and profits. The success of Sheridan 6, particularly its economic study, created the necessary conditions for regime actors in GMD 4 to shift toward supporting conservation measures, as it reduced fears about the potential economic impact of conservation.

Beyond GMD 4, Sheridan 6 was a model for other GMDs and state-level policy discussions. Its success inspired efforts to implement similar initiatives in GMD 1 and GMD 3. However, localized conditions influenced these outcomes. While GMD 1 adopted similar conservation measures, GMD 3 encountered more resistance due to its relatively higher saturated thickness and less immediate landscape pressures. This highlights how real-world labs can generate both adoption and resistance, depending on the specific conditions present in each region. The results of this study align with McCrory et al. (2022), who find that real-world labs create concrete evidence for policy diffusion, inspiring other regions but also revealing barriers to broader application. In Kansas, Sheridan 6 demonstrated how localized success can promote adoption in some areas while revealing challenges in others.

The process tracing of Sheridan 6's influence clearly illustrates how it shaped both GMD 4's conservation policies and state-level legislation, particularly H.B. 2279, which mandated the development of conservation plans across all GMDs by 2026. Sheridan 6 legitimized conservation efforts through its proven success, creating a ripple effect that extended beyond the local context. Policymakers were able to leverage the credibility of the Sheridan 6 LEMA to push for broader legislative reforms, showing a direct connection between localized success and state-level policy outcomes. By demonstrating that conservation could be practical and economically sustainable, Sheridan 6 facilitated the scaling up of niche innovations into mainstream groundwater management practices.

As a real-world lab, Sheridan 6 allowed niche innovations to be tested and scaled. Its success created momentum that brought these practices into mainstream policy discussions, particularly influencing H.B. 2279, which formalized conservation plans across Kansas. The demonstrated effectiveness of Sheridan 6 encouraged regime actors to transition from opposing conservation to actively supporting it, aligning with broader research on the transformative potential of real-world labs (Trenks & Bogel, 2024). The results indicate that real-world labs can function as critical sites where the conditions for behavior change can be cultivated, allowing for sustainability transitions to take root in broader regime practices. Future research should explore how actors can leverage the conditions created by real-world labs to promote larger

sustainability transitions, building on the lessons learned from Sheridan 6's influence on both local and state-level conservation policies.

5.3 Policy Entrepreneurs as a Contributor to Transitions

This study reveals that policy entrepreneurs were crucial in driving Kansas's water conservation transition by actively creating the conditions that allowed regime actors to shift toward conservation. In the 1990s and 2000s, these entrepreneurs used problem-framing strategies to transform landscape pressures, such as groundwater depletion and the threat of state intervention, into opportunities for local actors to adopt conservation measures. For example, the chief engineer in the 1990s framed water depletion as a direct threat to local control, motivating GMD 4 to adopt a zero-depletion policy. By linking the fear of losing autonomy with the need for conservation, the chief engineer created an environment where local actors were more inclined to embrace conservation to maintain control. The evidence from GMD 4's transition supports Mintrom and Luetjens's (2017) findings that policy entrepreneurs can trigger large-scale behavioral changes by framing problems in ways that resonate with stakeholders.

In addition to framing problems, policy entrepreneurs in GMD 4 fostered trust to create a supportive environment for conservation. The successful adoption of the Sheridan 6 LEMA relied heavily on the trust that GMD 4 staff built with local irrigators, who were initially skeptical of conservation efforts. This trust allowed local actors to see the LEMA as a locally-driven solution rather than an external imposition, thereby reducing resistance. The trust-building efforts created the conditions for a transition by lowering perceived risks and uncertainty, making it easier for regime actors to transition toward conservation. This is consistent with Koole's (2022) findings on the role of trust in advancing sustainable practices.

Policy entrepreneurs also employed solution-seeking strategies to address specific local challenges, creating conditions for conservation policies to take root. Faced with the limitations of existing regulatory mechanisms like IGUCAs, Wayne Bossert and GMD 4 staff developed the LEMA as a flexible, locally controlled alternative. This process of identifying gaps in current policy and proposing innovative, context-specific solutions reflects the role of policy entrepreneurs in shaping the conditions that facilitate a transition through creative problem-solving. By designing a solution that aligned with local needs and values, policy entrepreneurs facilitated the adoption of the LEMA. This aligns with Kingdon (1984) and Huitema et al. (2011), who note that policy entrepreneurs enable transitions by offering innovative solutions at critical junctures.

Finally, Governor Kelly and the KWA took advantage of windows of opportunity to scale niche innovations, further creating conditions conducive to regime-level change. Kelly's leadership during her second term, when she was free from electoral pressures, allowed her to prioritize water conservation, providing the political space for niche innovations like the LEMA to gain broader support. The KWA's framing of water conservation as a necessary response to emerging politics allowed niche conservation efforts to gain broader support. By aligning the

political context with conservation goals, Kelly and the KWA facilitated a favorable environment for policy reform. Additionally, the coalition-building efforts of Representatives Lindsay Vaughn and Jim Minnix and their collaboration with GMD 1 and GMD 4 staff created further the conditions for H.B. 2279 to move forward. These actors capitalized on windows of opportunity and built coalitions to push for broader adoption of conservation practices, aligning with Huitema et al. (2011) and Meijerink & Huitema (2010), who highlight the role of coalitions in promoting policy shifts.

5.4 Landscape Level Pressures Influence Actors to Change Roles

This study demonstrates that landscape pressures, such as regulatory threats and severe groundwater depletion, interacted with cultural values like preserving family legacies, sustaining agricultural communities, and the desire for local control to influence actors to change roles from regime to niche actors. For instance, process tracing reveals that in HPA #6, the threat of state-mandated regulations and an impairment case in the early 2000s, which nearly resulted in the DWR shutting off junior water rights holders in GMD 4, was a key landscape factor that motivated HPA #6 members to conserve. The fear of losing control over water rights and facing mandatory state intervention catalyzed members of HPA #6 to transition from opposing conservation to actively supporting it by creating LEMAs. This interaction between landscape pressures and cultural values reflects the MLP framework's emphasis on the destabilizing effects of external shocks on existing regimes (Geels, 2002).

Cultural values also played a significant role in shaping the response to these pressures. Members of Sheridan 6, GMD 4, GMD 1, and supporters of the failed GMD 3 LEMA were motivated by the desire to pass down irrigated agriculture to their children and ensure future generations had access to water. This desire to build a family legacy became intertwined with the recognition that depletion would make it impossible to sustain agriculture long-term. Therefore, the interaction of cultural values with depletion pressures created a powerful motivation for regime actors in GMDs 1 and 4 to transition to niche behaviors. These findings align with research by Fischer and Sanderson (2022) and Lauer and Sanderson (2020), who report the importance of family legacies and saving water for future generations in driving conservation efforts.

The interaction of landscape pressures, such as severe groundwater depletion, with local hydrological factors has also played a critical role in driving regime actors in Kansas to adopt niche conservation efforts. The results suggest that depletion pressures, particularly in areas with low saturated thickness, forced some regime actors to confront the unsustainability of their groundwater use practices. In GMD 1, GMD 4, and parts of GMD 3 with low saturated thickness, the depletion of wells acted as a landscape factor that forced regime actors to adopt niche conservation practices, as it was no longer feasible to continue pumping at the same rate. These findings support the MLP's theorization that landscape pressures destabilize existing

regimes and create opportunities for niche innovations to emerge and disrupt entrenched practices (Geels, 2002).

The results suggest that depletion is a stronger landscape pressure that influences regime actors to transition to niche actors in areas with low saturated thickness than in areas with higher saturated thickness. In GMD 3, where depletion rates are high but overall there is a higher saturated thickness level than in other GMDs, many actors have not yet felt the same urgency to conserve as those in GMDs 1 and 4. The higher saturated thickness across GMD 3 provides a larger buffer against depletion, allowing some areas to continue pumping water without facing immediate shortages. This has allowed many irrigators in GMD 3 to maintain their existing practices, contributing to the regime's resistance to conservation. Thus, the results suggest that depletion is a powerful landscape pressure that influences regime actors to transition to niche actors in areas with low saturated thickness. However, it is less of a factor in regions with higher groundwater reserves. These findings align with other studies that have found that water scarcity motivates farmers to conserve and that farmers in areas with less water are more conservation-conscious than those in water-abundant areas (Fischer & Sanderson, 2022; Sanga & Koli, 2023).

Landscape factors like hydrology and geographic size also significantly shape conservation behaviors within GMD 3. The size and diversity of GMD 3, which encompasses both severely depleted and relatively water-rich areas, create internal divisions that make it challenging to adopt a unified approach to groundwater management. The results suggest that GMD 3 Board members representing areas with abundant water fear that supporting conservation in more depleted regions could lead to future restrictions in their own areas. This fear of potential regulation reinforces the regime's commitment to planned depletion, allowing it to resist transitions toward conservation despite localized depletion in some parts of the district. This dynamic reflects the broader MLP framework, where landscape pressures can either stabilize or destabilize regimes depending on the interaction with local conditions and internal dynamics (Geels, 2011).

The findings suggest that landscape factors interact to influence the transition trajectory, and landscape pressures have not uniformly affected all regime actors; landscape pressures have led GMDs 1 and 4 to conserve, but this is not true for most of GMD 3. This brings attention to the role of cultural values and the significance of landscape factors like hydrology and GMD size in shaping the non-uniform impact of landscape pressures on regime actors. These findings expand the MLP's traditional understanding of landscape pressures, suggesting that cultural values and local biophysical features mediate the impact of landscape shocks on regime transitions. Morgunova's (2020) findings support the idea that landscape factors do not uniformly and consistently impact regimes. Future research should explore how landscape factors interact and the role of differences in cultural values and biophysical features in contributing to the landscape's unequal impacts.

6.0 Chapter 6: Conclusion

In this chapter, I summarize the key findings of the research on Kansas's groundwater conservation transition, emphasizing the importance of real-world labs, policy entrepreneurship, and the dynamic role of the state in driving sustainability transitions. The Sheridan 6 LEMA served as a critical real-world experiment that demonstrated the viability of conservation without economic harm, influencing broader adoption across Kansas. Policy entrepreneurs played a pivotal role in framing conservation as compatible with local values, building coalitions, and leveraging political opportunities to scale up conservation initiatives. Additionally, the state actively contributed to niche creation, challenging traditional views of its role in transitions. Landscape pressures, such as groundwater depletion and cultural values, were shown to influence actors' role changes, although their impact varied across regions.

Methodologically, the study challenges the MLP's assumption of uniform landscape pressures, showing the need for deeper exploration of local contexts in resource management transitions. The research highlights the value of longitudinal studies for understanding the long-term dynamics of sustainability transitions, especially in fields like groundwater conservation, where changes unfold gradually.

The policy implications suggest the importance of supporting local experiments, such as real-world labs, to foster niche learning and innovation. The Kansas case demonstrates that empowering policy entrepreneurs is essential for driving transitions. Policymakers should actively leverage landscape pressures by aligning conservation policies with local economic and cultural values to enhance stakeholder buy-in and facilitate sustainable transitions. Finally, policymakers should target conservation plans for areas with low saturated thickness before high saturated thickness areas, as the results suggest that low saturated thickness areas may be more receptive to conservation.

6.1 Main Findings

In this section, I explore the role of real-world labs, policy entrepreneurship, and the state in driving groundwater conservation transitions in Kansas through the lens of the MLP framework. I specifically focus on the influence of the Sheridan 6 LEMA as a real-world experiment, demonstrating the viability of conservation without economic harm and inspiring broader adoption across the state. Policy entrepreneurs, including the chief engineer and Governor Kelly, played a critical role in framing conservation efforts, building coalitions, and leveraging political windows of opportunity to scale up initiatives like H.B. 2279. The state was not merely a protector of niches but actively involved in creating them, challenging traditional MLP assumptions. Additionally, landscape pressures, such as groundwater depletion and cultural values, influenced actors' transitions to conservation, although these pressures impacted regions differently, emphasizing the importance of local context in sustainability transitions.

6.1.1 Sheridan 6 and Real-World Labs

The Sheridan 6 LEMA became a crucial real-world lab, facilitating Kansas's transition to increased conservation. By providing empirical evidence that conservation did not result in economic harm, Sheridan 6 demonstrated that water-saving measures could be implemented successfully. This real-world experiment helped build trust and dispel fears, influencing regime actors to support conservation practices. Sheridan 6's success resonated beyond GMD 4, inspiring other regions, like GMD 1 and GMD 3, to pursue LEMAs. This underscores the importance of real-world labs in promoting policy diffusion and helping niche innovations challenge entrenched practices. As these real-world examples spread, they became influential in shaping statewide conservation policies, such as H.B. 2279, which mandated conservation plans for GMDs across Kansas.

6.1.2 Policy Entrepreneurs as Agents of Change

Policy entrepreneurs were pivotal in Kansas's water conservation transition by creating the conditions that allowed irrigators and policymakers to shift toward conservation. Through problem-framing strategies, coalition-building, and innovative policy solutions like LEMAs, actors such as the chief engineer and GMD 4 staff reshaped the narrative around conservation, aligning it with local values of control and trust. This problem-framing played a critical role in gaining the support of regime actors, as it created conditions that made conservation a more acceptable and viable option. Policy entrepreneurs like Governor Kelly and the KWA further capitalized on political windows of opportunity, using favorable political moments to advance conservation initiatives at the state level. Their actions leveraged key opportunities to foster an environment where policy goals could gain broader support. The coalition-building efforts that led to the passage of H.B. 2279, which brought together both niche and regime actors, further demonstrate how policy entrepreneurs can align diverse interests and values to create the necessary conditions for systemic change. This underscores the role of policy entrepreneurs in fostering niche innovations and scaling them up to influence Kansas's broader agriculture-groundwater regime.

6.1.3 The Role of the State

Contrary to traditional conceptualizations of the state as merely protecting or supporting niche innovations, this research highlights the state's active role in creating niches. In Kansas, state actors like the chief engineer, the governor, the KWO, and the KWA directly shaped niche conservation practices through policy interventions, regulatory pressure, and recognizing windows of opportunity. The development of the LEMA statute and the transition of GMD 4 to conservation illustrate the state's capacity to drive niche creation from the top down. These findings challenge the MLP's assumption that niches pre-exist and that the state only protects niches rather than creates niches. Instead, the results show that the state is essential in both constructing and nurturing niches through active leadership and institutional support.

6.1.4 Influence of Landscape Pressures on Actors' Role Changes

Landscape pressures, such as groundwater depletion, regulatory threats, and hydrological factors, interacted with cultural values like preserving family legacies and maintaining local control to influence regime actors to adopt conservation practices. In areas with low saturated thickness, such as parts of GMD 1 and 4, depletion acted as a powerful landscape shock that forced regime actors to adopt niche conservation measures like LEMAs. However, in GMD 3, where overall saturated thickness remains higher, regime actors resisted conservation despite significant depletion in certain areas. The findings suggest that landscape pressures do not impact regime actors uniformly, as local hydrological factors and cultural values shape responses to these pressures. This challenges the MLP's traditional understanding of landscape pressures and highlights the importance of considering local contexts in sustainability transitions.

6.2 Methodological Implications

In this section, I discuss the methodological implications of applying the MLP framework, particularly regarding landscape factors and the value of longitudinal studies. This research challenges the traditional MLP assumption that landscape pressures uniformly impact regime actors, revealing that factors such as hydrology, geographic size, and groundwater depletion have varying effects across regions. These findings suggest the need for more localized research to understand how these factors interact with regime actors' cultural values and geographic contexts in shaping transitions. Additionally, the study emphasizes the importance of longitudinal studies to capture the gradual dynamics of sustainability transitions, particularly in resource management systems like groundwater conservation. Longitudinal studies provide critical insights into the long-term evolution of actor roles, policy impacts, and key moments where adjustments or opportunities for accelerating transitions may arise.

6.2.1 MLP Application

The findings of this study suggest significant methodological implications for applying the MLP, particularly regarding the role of landscape factors in transitions. Traditionally, the MLP conceptualizes landscape pressures as overarching, external forces that uniformly impact regimes, driving transitions in a relatively predictable way. However, this research challenges that assumption by revealing that landscape factors such as hydrology, geographic size, and groundwater depletion do not influence regime actors uniformly. The results suggest that future research on transitions should more deeply explore the interactions between landscape factors and local contexts, especially regarding resource management systems like groundwater. Specifically, researchers should investigate how differences in hydrology, geographic characteristics, and regime actors' cultural values contribute to the uneven impacts of landscape pressures across regions. This aligns with other scholars like Geels (2011) and Morgunova (2020), who have called for further exploration of the role of landscape factors in transitions.

6.2.2 Longitudinal Studies

The study's findings highlight the importance of longitudinal studies for understanding sustainability transitions. Longitudinal studies are essential for understanding the long-term dynamics of sustainability transitions, particularly in areas like groundwater conservation, where changes unfold gradually over extended periods. These studies allow researchers to track the evolution of actor roles, policy impacts, and the broader trajectory of transitions, offering valuable insights into how regime and niche actors adapt to new pressures and policies over time. This aligns with Geels and Schot (2007), who noted that sustainability transitions are often multi-decadal processes, and capturing long-term developments is crucial for a comprehensive understanding of how regimes shift toward more sustainable practices. Without a longitudinal lens, researchers risk missing key inflection points where policies may need adjustment or new opportunities for accelerating the transition could arise.

6.3 Policy Implications

In this section, I highlight the importance of supporting local experiments, empowering policy entrepreneurs, and leveraging landscape pressures in advancing sustainability transitions in groundwater management. Local experiments, such as real-world labs, provide critical spaces for testing niche innovations and building trust among stakeholders, as demonstrated by the success of the Sheridan 6 LEMA in Kansas. These labs allow actors to engage directly with new conservation practices, fostering broader adoption. Empowering policy entrepreneurs is also essential for driving transitions, as these actors play a key role in framing issues, forming coalitions, and advocating for conservation policies. Finally, policymakers must actively engage with landscape pressures, such as cultural values and economic concerns, to design strategies that resonate with stakeholders and promote the adoption of niche innovations. By aligning policy goals with these pressures, policymakers can facilitate more effective transitions toward conservation-based groundwater management.

6.3.1 Support for Local Experiments

Policymakers should actively encourage and support local experiments, such as real-world labs, to foster niche learning and innovation in groundwater management, particularly in other states within the Ogallala Aquifer, such as eastern Colorado and western Oklahoma. As the Sheridan 6 LEMA demonstrated, local experiments can serve as critical testing grounds for new policies and conservation practices, allowing regime actors to engage directly with niche innovations. These real-world labs provide an environment where actors can experience the benefits of conservation firsthand, build trust in new approaches, and ultimately begin to shift their roles from regime to niche actors.

Real-world labs are integral to sustainability transitions because they offer a framework for testing and refining niche innovations before scaling to broader applications (Schäpke et al., 2018). As shown in the Kansas case, the success of the Sheridan 6 LEMA helped pave the way for broader adoption of conservation measures within GMD 4 and across the state.

Policymakers in other states facing similar groundwater challenges could benefit from replicating this approach, creating opportunities for local stakeholders to test conservation methods tailored to their unique hydrological and socio-economic contexts. This aligns with findings in the literature on sustainability transitions, where localized experiments have been shown to facilitate learning, generate stakeholder buy-in, and contribute to the scaling-up of niche innovations (Bergmann et al., 2021; Singer-Brodowski et al., 2018; Trenks & Bögel, 2024).

6.3.2 Empowering Policy Entrepreneurs

Empowering policy entrepreneurs is essential for accelerating sustainability transitions, particularly in the context of groundwater management. Policy entrepreneurs are pivotal in recognizing windows of opportunity, framing issues to align with public and political interests, and advocating for policies that advance conservation. By leveraging their networks and influence, they can create the momentum needed to push through innovative policies. This argument aligns with the work of Kingdon (1984), who highlights the critical role of policy entrepreneurs in advancing policy change. In the case of Kansas, policy entrepreneurs like Governor Kelly and the GMD staff demonstrated the power of using influence to advocate for significant conservation reforms. Their ability to form coalitions, build trust, and engage diverse stakeholders helped overcome resistance and push through key legislation. This echoes the findings of Huitema et al. (2011), who argue that policy entrepreneurs are vital in water management transitions because they can navigate complex governance structures, overcome institutional inertia, and advocate for new policies.

Policymakers should recognize the value of these actors and create supportive environments that empower policy entrepreneurs to initiate and sustain transitions. This may include providing leadership training, offering platforms for collaboration, and creating mechanisms to facilitate the engagement of policy entrepreneurs in decision-making processes (Mintrom, 2019; Mintrom, 2000). By doing so, states within the Ogallala Aquifer region and beyond can cultivate a generation of leaders capable of driving groundwater conservation initiatives and fostering sustainable water management practices.

6.3.3 Leveraging Landscape Pressures

Policymakers must recognize and actively engage with landscape-level pressures, such as cultural values, economic priorities, and environmental changes when designing strategies for sustainability transitions. Landscape pressures play a critical role in shaping the behaviors and attitudes of regime actors and can either support or hinder the adoption of niche innovations like groundwater conservation. In Kansas, landscape factors such as the economic reliance on agriculture and the cultural importance of family legacies significantly influenced actors to either resist or embrace conservation efforts. Understanding these broader influences allows policymakers to craft policies that promote sustainability and resonate with stakeholders' immediate concerns.

For example, the fear of economic decline due to reduced water usage was a primary concern for many irrigators in Kansas, which initially hindered their willingness to adopt conservation measures. However, when actors framed policies in ways that aligned with their economic and cultural priorities—such as ensuring the long-term viability of agriculture for future generations—there was greater buy-in for conservation policies. Policymakers can leverage these landscape pressures by aligning policy objectives with these deeply held values. As the MLP suggests, landscape pressures can destabilize regimes and create opportunities for emerging niche innovations (Geels, 2011). However, these pressures must be understood and integrated into policy strategies to facilitate change effectively.

Finally, in light of the findings, policymakers should consider prioritizing areas with lower saturated thickness when implementing conservation plans. The results of this study suggest that regions experiencing more immediate and severe depletion pressures, such as those with low saturated thickness, may be more receptive to conservation initiatives. This responsiveness stems from the more direct impact of depletion on these communities, making the urgency for conservation more evident and pressing. In contrast, areas with higher saturated thickness, while still subject to depletion, may resist conservation efforts due to the perceived buffer of available water. By first targeting low saturated thickness areas, policymakers can build momentum for broader conservation initiatives, demonstrating the benefits of proactive water management. These regions can serve as real-world examples of the effectiveness of conservation policies, which might, in turn, influence other areas to adopt similar measures.

6.4 Reflections

Throughout this research process, I actively shaped the direction of the study and how I interpreted the findings. From the start, I focused on sustainability transitions, driven by my interest in understanding how policy entrepreneurship and the state could lead to systemic changes in Kansas's groundwater management. I framed my research questions around the conditions that prompted actors to move from opposing conservation policies to supporting them. This focus likely influenced how I emphasized policy entrepreneurship and state actors' roles in the transition.

I faced challenges in gathering interviews from key actors, especially in GMD 3. As a result, I relied more on document analysis and secondary sources to understand resistance and transitions within the regime. This reliance on existing narratives limited my engagement with a wider range of perspectives. I recognized that interpreting these sources meant that I might not fully capture the complexity of GMD 3 or the other GMDs. I had to remain mindful of how the voices represented in the documents could shape my understanding of the actors involved.

Initially, I entered the research with assumptions about GMD 3 that were largely shaped by media portrayals and external commentary; these voices presented the district as resistant to change. I expected to find strong opposition to conservation. However, when I attended a GMD 3 Board meeting and engaged directly with the staff and Board members, my perspective changed. While GMD 3 certainly faced significant challenges, I realized that many actors there

did not oppose conservation outright. Instead, they were constrained by political and economic structures that limited their ability to adopt conservation practices. This experience shifted my view of GMD 3 from a district resistant to change to one grappling with external barriers that reduced their agency to act.

At the same meeting, I also saw the deep animosity between GMD 3 and the state, worsened by the ridicule of GMD 3's aqueduct proposal. The external shaming reinforced their resistance and deepened their sense of isolation. After hearing their experiences firsthand, I empathized with their position. I no longer viewed them as simply resistant to change, but as misrepresented in public discourse, facing structural barriers and political tensions that limited their options. This shift in perspective challenged the assumptions I had when I first approached the district, marking a key moment of reflexivity in my research journey.

Another pivotal moment came when I read news articles about individuals who had to shut down their wells due to groundwater depletion. Reading these stories filled me with profound sadness, as I realized the human cost of this depletion. It wasn't just about losing water; these people were losing a way of life that had sustained their families for generations. This emotional response reminded me that the policies I was studying were not abstract concepts. Rather, they had real, life-altering consequences for the communities affected. This sadness reinforced the urgency of addressing groundwater issues and made me more aware of the human stakes involved in my research.

My personal values as a vegetarian also shaped my approach to the research, particularly when dealing with animal agriculture in Kansas and its role in groundwater use. Studying large-scale livestock production was difficult, as this industry conflicts with my views on sustainability and animal welfare. While I aimed for objectivity, I realized that my perspective as a vegetarian influenced how I viewed the water-intensive practices of animal agriculture. This tension forced me to reflect on my own biases and approach the subject more thoughtfully. I worked to balance my personal values with an understanding of the cultural and economic significance of livestock farming in Kansas, which deepened my engagement with the complexities of water management.

As I progressed through the research, my perspective on Kansas's groundwater transition evolved. Initially, I expected to uncover clear causal mechanisms that explained why regime actors adopted conservation measures. However, through data collection and analysis, I realized that the transition was far more complex. Multiple factors, such as cultural values, landscape pressures, local trust-building, and political opportunities, converged to drive the shift toward conservation. This realization led me to focus on and embrace complexity rather than simple cause-and-effect relationships in my results.

Finally, this research process reinforced the importance of reflexivity in academic work. By staying aware of my own biases and expectations, I approached the data with a more nuanced perspective. This reflexive approach shaped my findings and allowed me to grow as a researcher, teaching me to remain flexible and open to new insights as they emerged.

References

- Alsaawi, A. (2014). A critical review of qualitative interviews. *European Journal of Business and Social Sciences*, 3, 149-156. <https://doi.org/10.2139/ssrn.2819536>
- Avelino, F., & Wittmayer, J. M. (2016). Shifting power relations in sustainability transitions: A multi-actor perspective. *Journal of Environmental Policy and Planning*, 18(5), 628–649. <https://doi.org/10.1080/1523908X.2015.1112259>
- Bahl, A. (2023, January 23). Kansas officials try to find water conservation funding plan for Ogallala Aquifer. *The Topeka Capital-Journal*. <https://www.cjonline.com/story/news/environment/2023/01/23/kansas-officials-try-to-find-water-conservation-funding-plan-ogallala-aquifer/69816581007/>
- Barackman, J., & Bernard, K. (2023, April 20). Kansas approves measures to manage water crisis. Advocates, experts say it isn't enough. *The Kansas City Star*. <https://www.kansascity.com/news/politics-government/article274536736.html>
- Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report*, 13(4), 544–559. <https://doi.org/10.46743/2160-3715/2008.1573>
- Beach, D., & Pedersen, R. B. (2019). *Process-tracing methods: Foundations and guidelines* (2nd ed.). University of Michigan Press. <https://doi.org/10.3998/mpub.10072208>
- Bell, S., & Cerulli, C. (2012). Emerging community food production and pathways for urban landscape transitions. *Emergence: Complexity and Organization*.
- Bergmann, M., Schöpke, N., Marg, O., Stelzer, F., Lang, D. J., Bossert, M., Gantert, M., Häußler, E., Marquardt, E., Piontek, F. M., Potthast, T., Rhodius, R., Rudolph, M., Ruddat, M., Seebacher, A., & Sußmann, N. (2021). Transdisciplinary sustainability research in real-world labs: Success factors and methods for change. *Sustainability Science*, 16(2), 541–564. <https://doi.org/10.1007/s11625-020-00886-8>
- Bickel, A. (2014, July 27). LEMAs just one thing to help preserve water in the Ogallala Aquifer. *The Hutchinson News*. <https://www.hutchnews.com/story/news/local/2014/07/27/lemas-just-one-thing-to/20895190007/>
- Buchanan, R. C., Wilson, B. B., & Butler, J. J., Jr. (2023). *The High Plains Aquifer*. Public Information Circular 18, Kansas Geological Survey. <https://kgs.ku.edu/sites/kgs/files/files/PICpdfs/PIC18HighPlainsAquifer2023revision.pdf>

- Bui, S., Cardona, A., Lamine, C., & Cerf, M. (2016). Sustainability transitions: Insights on processes of niche-regime interaction and regime reconfiguration in agri-food systems. *Journal of Rural Studies*, 48, 92-103. <https://doi.org/10.1016/j.jrurstud.2016.10.003>
- Cochran-Smith, M., Ell, F., Grudnoff, L., Ludlow, L., Haigh, M., & Hill, M. (2014). When complexity theory meets critical realism: A platform for research on initial teacher education. *Teacher Education Quarterly*, 41(1), 105–122. <https://www.jstor.org/stable/10.2307/teaceducquar.41.1.105>
- Condos, D. (2022, December 15). This is the first time the Kansas Water Authority has voted to save what's left of the Ogallala. *High Plains Public Radio*. <https://www.hppr.org/hppr-news/2022-12-15/this-is-the-first-time-the-kansas-water-authority-has-voted-to-save-whats-left-of-the-ogallala>
- Corn, M. (1990, July 28). Panel takes little action to reduce aquifer depletion. *The Salina Journal*, pp. 3.
- Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology*, 11(1). <https://doi.org/10.1186/1471-2288-11-100>
- de Haan, F. J., & Rotmans, J. (2018). A proposed theoretical framework for actors in transformative change. *Technological Forecasting and Social Change*, 128, 275–286. <https://doi.org/10.1016/j.techfore.2017.12.017>
- Dicicco-Bloom, B., & Crabtree, B. F. (2006). The qualitative research interview. *Medical education*, 40(4), 314–321. <https://doi.org/10.1111/j.1365-2929.2006.02418.x>
- Diep, L., Dodman, D., & Parikh, P. (2019). Green infrastructure in informal settlements through a multiple-level perspective. *Water Alternatives*, 12(2), 554–570.
- Dillon, K. (2018, August 10). The clock is ticking on dealing with western Kansas' drying Ogallala Aquifer. *KLC Journal*. <https://klcjournl.com/the-clock-is-ticking-on-dealing-with-western-kansas-drying-ogallala-aquifer/>
- Dutt, D. (2022). Weak states, fast transitions? Exploring the role of actors, governance capacity, and tensions in Indian energy politics. *Energy Research & Social Science*, 94, 102876. <https://doi.org/10.1016/j.erss.2022.102876>
- El Bilali, H. (2019). The multi-level perspective in research on sustainability transitions in agriculture and food systems: A systematic review. *Agriculture*, 9(4), 74. <https://doi.org/10.3390/agriculture9040074>

- El Bilali, H., Hauser, M., Berjan, S., Miseckaite, O., & Probst, L. (2018). Rural livelihoods transitions: Towards an integration of the sustainable livelihoods approach and the multi-level perspective. <https://doi.org/10.15544/rd.2017.242>
- El Ghmari, H., Harbouze, R., & El Bilali, H. (2022). Pathways of transition to organic agriculture in Morocco. *World*, 3(3), 718–735. <https://doi.org/10.3390/world3030040>
- Elzen, B., Van Mierlo, B., & Leeuwis, C. (2012). Anchoring of innovations: Assessing Dutch efforts to harvest energy from glasshouses. *Environmental Innovation and Societal Transitions*, 5, 1–18. <https://doi.org/10.1016/j.eist.2012.10.006>
- Famiglietti, J. S. (2014). The global groundwater crisis. *Nature Climate Change*, 4(11), 945–948. <https://doi.org/10.1038/nclimate2425>
- Fischer, L.-B., & Newig, J. (2016). Importance of actors and agency in sustainability transitions: A systematic exploration of the literature. *Sustainability*, 8(5), 476. <https://doi.org/10.3390/su8050476>
- Fischer, A., & Sanderson, M. (2022). Water, culture, and adaptation in the High Plains-Ogallala Aquifer region. *Journal of Rural Studies*, 95, 195–207. <https://doi.org/10.1016/j.jrurstud.2022.08.004>
- Finlay, L. (2021). Thematic analysis: The ‘good’, the ‘bad’ and the ‘ugly’. *European Journal for Qualitative Research in Psychotherapy*, 11, 103–116. <https://ejqrp.org/index.php/ejqrp/article/view/136>
- Fletcher, A. J. (2016). Applying critical realism in qualitative research: Methodology meets method. *International Journal of Social Research Methodology*, 20(2), 181–194. <https://doi.org/10.1080/13645579.2016.1144401>
- Foster, S., Garduño, H., Tuinhof, A., & Tovey, C. (2010). *Groundwater governance: Conceptual framework for assessment of provisions and needs* (GW MATE Strategic Overview Series No. 1). World Bank Group. <http://documents.worldbank.org/curated/en/603871468323116801/Groundwater-governance-conceptual-framework-for-assessment-of-provisions-and-needs>
- Friedman, R., & Rosen, G. (2022). Policy entrepreneurs in green building transitions: The role of interurban coalitions. *Environmental Innovation and Societal Transitions*, 43, 160–172. <https://doi.org/10.1016/j.eist.2022.03.009>
- Fryer, T. (2022). A critical realist approach to thematic analysis: Producing causal explanations. *Journal of Critical Realism*, 21(4), 365–384. <https://doi.org/10.1080/14767430.2022.2076776>
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy*, 31(8–9), 1257–1274. [https://doi.org/10.1016/S0048-7333\(02\)00062-8](https://doi.org/10.1016/S0048-7333(02)00062-8)

- Geels, F. W. (2004). From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Research Policy*, 33(6–7), 897–920. <https://doi.org/10.1016/j.respol.2004.01.015>
- Geels, F. W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy*, 39(4), 495–510. <https://doi.org/10.1016/j.respol.2010.01.022>
- Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, 1(1), 24–40. <https://doi.org/10.1016/j.eist.2011.02.002>
- Geels, F. W. (2014). Regime resistance against low-carbon transitions: Introducing politics and power into the multi-level perspective. *Theory, Culture & Society*, 31(5), 21–40. <https://doi.org/10.1177/0263276414531627>
- Geels, F. W. (2018). Disruption and low-carbon system transformation: Progress and new challenges in socio-technical transitions research and the multi-level perspective. *Energy Research and Social Science*, 37, 224–231. <https://doi.org/10.1016/j.erss.2017.10.010>
- Geels, F. W. (2020). Micro-foundations of the multi-level perspective on socio-technical transitions: Developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. *Technological Forecasting and Social Change*, 152, 119894. <https://doi.org/10.1016/j.techfore.2019.119894>
- Geels, F. W. (2022). Causality and explanation in socio-technical transitions research: Mobilising epistemological insights from the wider social sciences. *Research Policy*, 51(6), 104537. <https://doi.org/10.1016/j.respol.2022.104537>
- Geels, F. W., & Kemp, R. (2007). Dynamics in socio-technical systems: Typology of change processes and contrasting case studies. *Technology in Society*, 29(4), 441–455. <https://doi.org/10.1016/j.techsoc.2007.08.009>
- Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, 36(3), 399–417. <https://doi.org/10.1016/j.respol.2007.01.003>
- George, A. L., & Bennett, A. (2005). *Case studies and theory development in the social sciences*. MIT Press.
- Ghosh, B., & Schot, J. (2019). Towards a novel regime change framework: Studying mobility transitions in public transport regimes in an Indian megacity. *Energy Research & Social Science*, 51, 82–95. <https://doi.org/10.1016/j.erss.2018.12.001>
- GMD 4. (2008, November 10). *Meeting minutes of the Sheridan 6 HPA group*. <https://gmd4.org/SD6/SD6-Comments-01.pdf>

- Haan, F. J., & Rotmans, J. (2018). A proposed theoretical framework for actors in transformative change. *Technological Forecasting and Social Change*, 128, 275–286.
- Hardin, G. (1968). Tragedy of the commons. *Science*, 162(3859), 1243–1248.
- Harvel, J. (2024, January 3). Kansas water conservation to be top issue of 2024, Gov. Laura Kelly says. *The Topeka Capital-Journal*.
<https://www.cjonline.com/story/news/politics/state/2024/01/03/kansas-water-conservation-to-p-issue-2024-governor-laura-kelly/72083153007/>
- Helgegren, I., McConville, J., Landaeta, G., & Rauch, S. (2021). A multiple regime analysis of the water and sanitation sectors in the Kanata metropolitan region, Bolivia. *Technological Forecasting and Social Change*, 166. <https://doi.org/10.1016/j.techfore.2021.120638>
- Hinrichs, C. C. (2014). Transitions to sustainability: A change in thinking about food systems change? *Agriculture and Human Values*, 31(1), 143–155.
<https://doi.org/10.1007/s10460-014-9479-5>
- Huitema, D., Lebel, L., & Meijerink, S. (2011). The strategies of policy entrepreneurs in water transitions around the world. *Water Policy*, 13(5), 717–733.
<https://doi.org/10.2166/wp.2011.107>
- Huning, S., Räuchle, C., & Fuchs, M. (2021). Designing real-world laboratories for sustainable urban transformation: addressing ambiguous roles and expectations in transdisciplinary teams. *Sustainability Science*, 16(5), 1595–1607.
<https://doi.org/10.1007/s11625-021-00985-0>
- Huttunen, S., Kaljonen, M., Lonkila, A., Rantala, S., Rekola, A., & Paloniemi, R. (2021). Pluralising agency to understand behaviour change in sustainability transitions. *Energy Research and Social Science*, 76. <https://doi.org/10.1016/j.erss.2021.102067>
- Isgren, E., & Ness, B. (2017). Agroecology to promote just sustainability transitions: Analysis of a civil society network in the Rwenzori region, western Uganda. *Sustainability*, 9(8).
<https://doi.org/10.3390/su9081357>
- Järnberg, L., Enfors Kautsky, E., Dagerskog, L., & Olsson, P. (2018). Green niche actors navigating an opaque opportunity context: Prospects for a sustainable transformation of Ethiopian agriculture. *Land Use Policy*, 71(November 2017), 409–421.
<https://doi.org/10.1016/j.landusepol.2017.11.053>
- Jasechko, S., & Perrone, D. (2021). Global groundwater wells at risk of running dry. *Science*, 372, 418–421.
- Johnstone, P., & Newell, P. (2018). Sustainability transitions and the state. *Environmental Innovation and Societal Transitions*, 27, 72–82. <https://doi.org/10.1016/j.eist.2017.10.006>

- Jorgensen, I. (2024). Map of GMDs, LEMAs, and aquifer level change from 1950 to 2019.
- Kaas, J., Cecchini, M., & Beach, D. (2024). Elucidating the Social – Developing Social Process Tracing as an Integrative Framework. *Sociological Methods & Research*.
<https://doi.org/10.1177/00491241231220732>
- Kallio, H., Pietilä, A. M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. *Journal of Advanced Nursing*, 72(12), 2954–2965. <https://doi.org/10.1111/jan.13031>
- Kamel, I. M., & El Bilali, H. (2022). Agri-food sustainability and food security in Egypt. In *World Sustainability Series*. https://doi.org/10.1007/978-3-030-98617-9_7
- Kamel, I. M., & El Bilali, H. (2022). Sustainability transition to organic agriculture through the lens of the multi-level perspective: case of Egypt. *Organic Agriculture*, 12(2), 191–212.
<https://doi.org/10.1007/s13165-022-00391-5>
- Kansas Department of Agriculture. (2017). Groundwater management districts. Division of Water Resources.
<https://www.agriculture.ks.gov/divisions-programs/division-of-water-resources/managing-kansas-water-resources/groundwater-management-districts>
- Kansas Department of Agriculture. (2022). Kansas Agriculture. Department of Agriculture.
<https://www.agriculture.ks.gov/kansas-agriculture>
- Kansas Division of Water Resources. (2017, December 12). *Transcript of Second Hearing for the GMD 4 LEMA*.
<https://www.agriculture.ks.gov/home/showpublisheddocument/6216/638468960928970000>
- Kansas Oral History Project. (2019a, September 19). *Interview of David Pope by Rex Buchanan*. Kansas Oral History Project.
https://ksoralhistory.org/interview/interview-of-david-pope-by-rex-buchanan-september-19-2019/?_sfm_interview_data_kohp_collection=125
- Kansas Oral History Project. (2019b, June 14). *Interview of Ed Flentje by Rex Buchanan*. Kansas Oral History Project.
https://ksoralhistory.org/interview/interview-of-ed-flentje-by-rex-buchanan-june-14-2019/?_sfm_interview_data_kohp_collection=125
- Kansas Oral History Project. (2020a, June 18). *Interview of Lon Frahm by Rex Buchanan*. Kansas Oral History Project.
https://ksoralhistory.org/interview/interview-of-lon-frahm-by-rex-buchanan-june-18-2020/?_sfm_interview_data_kohp_collection=125
- Kansas Oral History Project. (2020b, September 3). *Interview of Carl Holmes by Rex Buchanan*. Kansas Oral History Project.

https://ksoralhistory.org/interview/interview-of-carl-holmes-by-rex-buchanan-september-3-2020/?sfm_interview_data_kohp_collection=125

Kansas State University Foundation. (2024, July 30). The last drop. Kansas State University Foundation. <https://ksufoundation.org/impact/good-for-k-state/the-last-drop/>

Kaweesa, S. H., El Bilali, H., & Loiskandl, W. (2021). Analysing the socio-technical transition to conservation agriculture in Uganda through the lens of the multi-level perspective. *Environment, Development and Sustainability*, 23(5), 7606–7626. <https://doi.org/10.1007/s10668-020-00936-2>

Kern, F., & Rogge, K. S. (2018). Harnessing theories of the policy process for analysing the politics of sustainability transitions: A critical survey. *Environmental Innovation and Societal Transitions*, 27, 102–117. <https://doi.org/10.1016/j.eist.2017.11.001>

Kingdon, J. W. (1984). *Agendas, alternatives, and public policies*. Little, Brown.

Kingdon, J. W. (1995). *Agendas, alternatives, and public policies* (2nd ed.). Longman.

Kite, A. (2022a, May 16). Why an ambitious effort to overhaul Kansas water management fell short. *Kansas Reflector*. <https://kansasreflector.com/2022/05/16/why-an-ambitious-effort-to-overhaul-kansas-water-management-fell-short/>

Kite, A. (2022b, November 16). Kansas Gov. Laura Kelly pledges focus on water: ‘Waiting for a miracle is not an option.’ *Kansas Reflector*. <https://kansasreflector.com/2022/11/16/kansas-gov-laura-kelly-pledges-focus-on-water-waiting-for-a-miracle-is-not-an-option/>

Kite, A. (2022c, December 15). ‘It’s time to deal with this’: Kansas Water Authority wants to save Ogallala Aquifer. *Kansas Reflector*. <https://kansasreflector.com/2022/12/15/its-time-to-deal-with-this-kansas-water-authority-wants-to-save-ogallala-aquifer/>

Kite, A. (2022d, March 1). ‘Shooting themselves in the foot’: Committee guts Kansas bill to protect water. *Kansas Reflector*. <https://kansasreflector.com/2022/03/01/shooting-themselves-in-the-foot-committee-guts-kansas-bill-to-protect-water/>

Kite, A. (2023, February 9). House bill calls for western Kansas to create plans to save the Ogallala Aquifer. *Kansas Reflector*. <https://kansasreflector.com/2023/02/09/house-bill-calls-for-western-kansas-to-create-plans-to-save-the-ogallala-aquifer/>

- Koole, B. (2022). Veganism and plant-based protein crops: Contentious visioning almost obstructing a transition. *Environmental Innovation and Societal Transitions*, 42, 88–98. <https://doi.org/10.1016/j.eist.2021.12.003>
- Krigsholm, P., Riekkinen, K., & Ståhle, P. (2020). Pathways for a future cadastral system: A socio-technical approach. *Land Use Policy*, 94, 104504. <https://doi.org/10.1016/j.landusepol.2020.104504>
- Kump, B. (2023). Lewin's field theory as a lens for understanding incumbent actors' agency in sustainability transitions. *Environmental Innovation and Societal Transitions*, 46. <https://doi.org/10.1016/j.eist.2022.11.008>
- Kungl, G., & Geels, F. W. (2018). Sequence and alignment of external pressures in industry destabilisation: Understanding the downfall of incumbent utilities in the German energy transition (1998–2015). *Environmental Innovation and Societal Transitions*, 26, 78–100. <https://doi.org/10.1016/j.eist.2017.05.003>
- Lachman, D. A. (2013). A survey and review of approaches to study transitions. *Energy Policy*, 58, 269–276. <https://doi.org/10.1016/j.enpol.2013.03.013>
- Lauer, S., & Sanderson, M. R. (2020). Producer attitudes toward groundwater conservation in the U.S. Ogallala-High Plains. *Groundwater*, 58(4), 674–680. <https://doi.org/10.1111/gwat.12940>
- Lauttamäki, V., & Hyysalo, S. (2019). Empirical application of the multi-level perspective: Tracing the history of ground-source heat pumps systems in Finland. *Sustainability: Science, Practice, and Policy*, 15(1), 82–103. <https://doi.org/10.1080/15487733.2019.1678372>
- Loorbach, D., Frantzeskaki, N., & Avelino, F. (2017). Sustainability transitions research: Transforming science and practice for societal change. *Annual Review of Environment and Resources*, 42, 599–626. <https://doi.org/10.1146/annurev-environ-102014-021340>
- Lubell, M., Blomquist, W., & Beutler, L. (2020). Sustainable Groundwater Management in California: A Grand Experiment in Environmental Governance. *Society & Natural Resources*, 33(12), 1447–1467. <https://doi.org/10.1080/08941920.2020.1833617>
- Lutz, J., & Schachinger, J. (2013). Do local food networks foster socio-ecological transitions towards food sovereignty? Learning from real place experiences. *Sustainability*, 5(11), 4778–4796. <https://doi.org/10.3390/su5114778>
- Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research Policy*, 41, 955–967.
- Mauw, T., Smith, S., & Torrens, J. (2023). Sustainability transitions in Los Angeles' water system: The ambivalent role of incumbents in urban experimentation. *Journal of*

- Environmental Policy and Planning*, 25(4), 368–385.
<https://doi.org/10.1080/1523908X.2022.2156487>
- McCrory, G., Holmén, J., Schäpke, N., & Holmberg, J. (2022). Sustainability-oriented labs in transitions: An empirically grounded typology. *Environmental Innovation and Societal Transitions*, 43, 99–117. <https://doi.org/10.1016/j.eist.2022.03.004>
- Meijerink, S., & Huitema, D. (2010). Policy entrepreneurs and change strategies: Lessons from sixteen case studies of water transitions around the globe. *Water Policy*, 13(5), 717–733. <https://doi.org/10.2166/wp.2011.107>
- Mintrom, M. (2000). *Policy entrepreneurs and school choice*. Georgetown University Press.
- Mintrom, M., & Norman, P. (2009). Policy entrepreneurship and policy change. *Policy Studies Journal*, 37(4), 649–667. <https://doi.org/10.1111/j.1541-0072.2009.00329.x>
- Mintrom, M., & Luetjens, J. (2017). Policy entrepreneurs and problem framing: The case of climate change. *Environment and Planning C: Politics and Space*, 35(8), 1362–1377. <https://doi.org/10.1177/2399654417708440>
- Mintrom, M., & Thomas, M. (2018). Policy entrepreneurs and collaborative action: Pursuit of the sustainable development goals. *International Journal of Entrepreneurial Venturing*, 10(2), 119–137.
- Miörner, J., Heiberg, J., & Binz, C. (2022). How global regimes diffuse in space – Explaining a missed transition in San Diego’s water sector. *Environmental Innovation and Societal Transitions*, 44(December 2021), 29–47. <https://doi.org/10.1016/j.eist.2022.05.005>
- Molle, F., & Closas, A. (2019). Why is state-centered groundwater governance largely ineffective? A review. *Wiley Interdisciplinary Reviews: Water*.
<https://doi.org/10.1002/wat2.139>
- Moon, K., Brewer, T. D., Januchowski-Hartley, S. R., Adams, V. M., & Blackman, D. A. (2016). A guideline to improve qualitative social science publishing in ecology and conservation journals. *Ecology and Society*, 21(3), Article 17. <https://doi.org/10.5751/ES-08663-210317>
- Morgan, H. (2022). Conducting a qualitative document analysis. *The Qualitative Report*, 27(1), 64–77. <https://doi.org/10.46743/2160-3715/2022.5044>
- Morgunova, M. (2020). Why is exploitation of Arctic offshore oil and natural gas resources ongoing? A multi-level perspective on the cases of Norway and Russia. *The Polar Journal*, 10(1), 64–81. <https://doi.org/10.1080/2154896X.2020.1757823>
- Mowery-Denning, L. (1990, July 22). Slowing the flow: Groundwater district seeks ways to stop mining of Ogallala. *The Salina Journal*, 23–24.

- Moss, G. (2017, November 20). Written testimony submitted for the GMD 4 LEMA hearing, Kansas Division of Water Resources. *Kansas Department of Agriculture*.
<https://www.agriculture.ks.gov/home/showpublisheddocument/6358/638468991379630000>
- Mukumbang, F. C. (2023). Retroductive theorizing: A contribution of critical realism to mixed methods research. *Journal of Mixed Methods Research*, 17(1), 93–114.
<https://doi.org/10.1177/15586898211049847>
- Narain, V., Vij, S., & Karpouzoglou, T. (2023). Demystifying piped water supply: Formality and informality in (peri)urban water provisioning. *Urban Studies*, 60(6), 1066–1082.
<https://doi.org/10.1177/00420980221130930>
- Nastar, M. (2014). What drives the urban water regime? An analysis of water governance arrangements in Hyderabad, India. *Ecology and Society*, 19(2).
<https://doi.org/10.5751/ES-06570-190257>
- Nieminen, J., Salomaa, A., & Juhola, S. (2021). Governing urban sustainability transitions: Urban planning regime and modes of governance. *Journal of Environmental Planning and Management*, 64(4), 559–580. <https://doi.org/10.1080/09640568.2020.1776690>
- Nill, J., & Kemp, R. (2009). Evolutionary approaches for sustainable innovation policies: From niche to paradigm? *Research Policy*, 38(5), 668–680.
- Northern Kearny Finney County Local Enhanced Management Area. (2017, April 12). Presentation to GMD #3 Board [Presentation].
- Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42(5), 533–544. <https://doi.org/10.1007/s10488-013-0528-y>
- Painter, S. (1991, May 26). Zero depletion: Plan to limit water use divides Kansans. *The Wichita Eagle*, 1F, 3F.
- Patterson, J., Schulz, K., Vervoort, J., Van der Hel, S., Widerberg, O., Adler, C., Hurlbert, M., Anderton, K., Sethi, M., & Barau, A. (2017). Exploring the governance and politics of transformations towards sustainability. *Environmental Innovation and Societal Transitions*, 24, 1-16. <https://doi.org/10.1016/j.eist.2016.09.001>
- Peck, J. C. (1995). The Kansas Water Appropriation Act: A fifty-year perspective. *Kansas Law Review*, 43, 735–777. <https://ssrn.com/abstract=2174074>
- Peck, J. C., Illgner, R., Wiley, J., & Owen, C. C. (2019). Groundwater management: The movement toward local, community-based, voluntary programs. *Kansas Journal of Law & Public Policy*, 29(1), 1–49.

- Pesch, U. (2015). Tracing discursive space: Agency and change in sustainability transitions. *Technological Forecasting and Social Change*, 90, 379–388.
- Pesch, U., Spekkink, W., & Quist, J. (2018). Local sustainability initiatives: innovation and civic engagement in societal experiments. *European Planning Studies*, 27(2), 300–317. <https://doi.org/10.1080/09654313.2018.1464549>
- Proudfoot, K. (2023). Inductive/deductive hybrid thematic analysis in mixed methods research. *Journal of Mixed Methods Research*, 17(3), 308–326. <https://doi.org/10.1177/15586898221126816>
- Punton, M., & Welle, K. (2015). Straws-in-the-wind, hoops and smoking guns: What can process tracing offer to impact evaluation? *CDI Practice Paper* 10, Brighton: IDS.
- Quezada, G., Walton, A., & Sharma, A. (2016). Risks and tensions in water industry innovation: Understanding adoption of decentralised water systems from a socio-technical transitions perspective. *Journal of Cleaner Production*, 113, 263–273. <https://doi.org/10.1016/j.jclepro.2015.11.018>
- Roberts, C. (2017). Discursive destabilisation of socio-technical regimes: Negative storylines and the decline of the American railroads. *Energy Research & Social Science*, 31, 86–99. <https://doi.org/10.1016/j.erss.2017.05.032>
- Roberts, C., & Geels, F. W. (2019). Conditions for politically accelerated transitions: Historical institutionalism, the multi-level perspective, and two historical case studies in transport and agriculture. *Technological Forecasting and Social Change*, 140, 221–240. <https://doi.org/10.1016/j.techfore.2018.11.019>
- Rosenbloom, D. (2018). Framing low-carbon pathways: A discursive analysis of contending storylines surrounding the phase-out of coal-fired power in Ontario. *Environmental Innovation and Societal Transitions*, 27, 129–145. <https://doi.org/10.1016/j.eist.2017.11.003>
- Rotmans, J., Kemp, R., & Van Asselt, M. (2001). More evolution than revolution: Transition management in public policy. *Foresight*, 3(1). <https://doi.org/10.1108/14636680110803003>
- Sanga, U., & Koli, U. (2023). Mental models of sustainable groundwater management among farmers in semi-arid regions of Maharashtra, India. *Groundwater for Sustainable Development*, 21, 100904. <https://doi.org/10.1016/j.gsd.2023.100904>
- Schäpke, N., Stelzer, F., Caniglia, G., Bergmann, M., Wanner, M., Singer-Brodowski, M., Loorbach, D., Olsson, P., Baedeker, C., & Lang, D. J. (2018). Jointly experimenting for transformation?: Shaping real-world laboratories by comparing them. *GAIA - Ecological Perspectives for Science and Society*, 27(S1), 85–96. <https://doi.org/10.14512/gaia.27.s1.16>

- Schot, J., & Geels, F. W. (2008). Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda, and policy. *Technology Analysis & Strategic Management*, 20(5), 537–554. <https://doi.org/10.1080/09537320802292651>
- Scott, W. R. (1995). *Institutions and organizations*. SAGE Publications.
- Seyfang, G., & Smith, A. (2007). Grassroots innovations for sustainable development: Towards a new research and policy agenda. *Environmental Politics*, 16(4), 583–603. <https://doi.org/10.1080/09644010701419121>
- Seyfang, G., Hielscher, S., Hargreaves, T., Martiskainen, M., & Smith, A. (2014). A grassroots sustainable energy niche? Reflections on community energy in the UK. *Environmental Innovation and Societal Transitions*, 13, 21–44. <https://doi.org/10.1016/j.eist.2014.04.004>
- Singer-Brodowski, M., Beecroft, R., & Parodi, O. (2018). Learning in real-world laboratories: A systematic impulse for discussion. *GAIA - Ecological Perspectives for Science and Society*, 27, 23–27. <https://doi.org/10.14512/gaia.27.s1.7>
- Smith, A. (2007). Translating sustainabilities between green niches and socio-technical regimes. *Technology Analysis & Strategic Management*, 19(4), 427–450. <https://doi.org/10.1080/09537320701403334>
- Smith, A., Kern, F., Raven, R., & Verhees, B. (2014). Spaces for sustainable innovation: Solar photovoltaic electricity in the UK. *Technological Forecasting and Social Change*, 81, 115–130.
- Sophocleous, M. (2000). The origin and evolution of safe-yield policies in the Kansas groundwater management districts. *Natural Resources Research*, 9(2), 99–110. <https://doi.org/10.1023/A:1010139325667>
- Sorrell, S. (2018). Explaining sociotechnical transitions: A critical realist perspective. *Research Policy*, 47(7), 1267–1282. <https://doi.org/10.1016/j.respol.2018.04.008>
- Southwest Kansas Groundwater Management District No. 3. (2018a, July 11). *Minutes of the regular meeting of the Board of Directors*.
- Southwest Kansas Groundwater Management District No. 3. (2018b, April 12). *Minutes of the regular meeting of the Board of Directors*.
- Steiner, J. L., Devlin, D. L., Perkins, S., Aguilar, J. P., Golden, B., Santos, E. A., & Unruh, M. (2021). Policy, technology, and management options for water conservation in the Ogallala Aquifer in Kansas, USA. *Water*, 13(23), 3406. <https://doi.org/10.3390/w13233406>
- Stewarding Our Aquifer. (2017, July 13). Taking initiative. *Medium*. <https://medium.com/stewardingouraquifer/taking-initiative-31a1a2ea517c>

- Stover, S., Huntzinger, T. L., & Wilson, B. (2002). Towards sustainable management of the Ogallala High Plains Aquifer [abstract]. In *Allocating and Managing Water for a Sustainable Future: Lessons from Around the World (Summer Conference, June 11-14)*.
<https://scholar.law.colorado.edu/allocating-and-managing-water-for-sustainable-future/49>
- Stutchbury, K. (2022). Critical realism: An explanatory framework for small-scale qualitative studies or an 'unhelpful edifice'? *International Journal of Research & Method in Education*.
<https://doi.org/10.1080/1743727X.2021.1966623>
- Temper, L., Walter, M., Rodriguez, I., Kothari, A., & Turhan, E. (2018). A perspective on radical transformations to sustainability: Resistances, movements and alternatives. *Sustainability Science*, 13, 747–764. <https://doi.org/10.1007/s11625-018-0543-8>
- To, L. S., Seebaluck, V., & Leach, M. (2018). Future energy transitions for bagasse cogeneration: Lessons from multi-level and policy innovations in Mauritius. *Energy Research & Social Science*, 35, 68–77. <https://doi.org/10.1016/j.erss.2017.10.038>
- Trenks, H., & Bögel, P. M. (2024). Empowering citizens for the energy transition: Facilitating role change through real-world experiments. *Sustainability Science*, 19(3), 715–737.
<https://doi.org/10.1007/s11625-023-01453-7>
- Turnheim, B., & Sovacool, B. K. (2020). Forever stuck in old ways? Pluralising incumbencies in sustainability transitions. *Environmental Innovation and Societal Transitions*, 35, 180–184.
- Witkamp, M. J., Raven, R. P. J. M., & Royakkers, L. M. M. (2011). Strategic niche management of social innovations: The case of social entrepreneurship. *Technology Analysis & Strategic Management*, 23(6), 667–681. <https://doi.org/10.1080/09537325.2011.585035>
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). SAGE Publications.
- Young, J., & Brans, M. (2020). Fostering a local energy transition in a post-socialist policy setting. *Environmental Innovation and Societal Transitions*, 36, 221-235.
<https://doi.org/10.1016/j.eist.2020.05.003>

Appendix A. Documentary Sources

GMD 4 LEMA Documents

19 LEMA documents from the GMD 4 LEMA were included in this analysis, representing a comprehensive range of perspectives on groundwater management. The testimonies came from 51 unique individuals and state agencies, ensuring that diverse viewpoints were considered. By including a wide array of stakeholders, this research provides a robust understanding of the various factors that shape attitudes toward groundwater conservation in GMD 4. I obtained all documents and testimonies from the Kansas Division of Water Resources' website. I performed an initial review of all testimonies and documents. Then, I excluded all testimonies that provided identical or redundant information from the analysis to ensure the data reflected various unique perspectives and insights. I also excluded administrative documents, such as legal notices, motions, and procedural memos, as they did not directly address the research questions related to the perspectives and roles of water rights holders in shaping conservation efforts. The testimonies are shown in Table 5, and the titles of the LEMA documents included in the study are shown in Table 6. While the names of the people who gave testimonies are publicly available, I chose to refer to them by their initials instead of their full names to offer them some anonymity. Thus, Table 5 has the initials of people who gave testimonies for the GMD 4 LEMA. For people who share the same initials, I provided their first name and the initial of their last name. Some individuals gave testimony more than once, so I listed all the dates they gave testimony in Table 5.

The research focuses on the GMD 4 LEMA documents from 2017 to 2018, excluding other LEMAs in Kansas and GMD 4. This allows for a concentrated analysis of the first district-wide LEMA that followed Sheridan 6, providing detailed insights into the processes that shaped the transition to increased conservation within a defined context. Limiting the scope to this specific LEMA also ensures that the findings remain relevant to the broader questions about the evolution of conservation policies in Kansas.

I excluded testimonials and documents for the Sheridan 6 LEMA documents from this analysis because the unit of analysis for this study is the GMDs as a whole, not individual counties within them. Because the GMD 4 LEMA covers almost all of the district, it provides a more comprehensive reflection of the entire GMD 4 area. Therefore, analyzing the district-wide LEMA allows a more accurate representation of the dynamics within GMD 4 as a whole rather than focusing on a smaller subsection such as Sheridan 6. I excluded the Wichita County LEMA in GMD 1 for this reason as well. Furthermore, because one of the research goals is to explore opposition to conservation efforts, the low level of resistance faced by Sheridan 6 LEMA makes it less relevant compared to the district-wide GMD 4 LEMA, which encountered more opposition and resistance. This is also why I excluded the Four-County LEMA in GMD 1, as it also encountered less resistance. Further, some of the LEMA hearings for the Four-County LEMA in GMD 1 were still ongoing during the data collection and analysis period for this study, so I decided to exclude the Four-County LEMA in GMD 1 for this reason as well. To help mitigate this potential loss of information by excluding the Sheridan 6 LEMA testimonies and documents

and GMD 1 LEMAs testimonies and documents, I use new articles that capture the perspectives of stakeholders involved in these LEMAs.

Table 5

GMD 4 LEMA Testimonies and Dates of Testimonies

Testimonies	Dates of Testimony
GMD 4 Testimony	11/14/2017
S.R. Testimony	8/23/2017 9/16/2017 11/14/2017 12/11/2017
B.S Testimony	9/13/2017 9/16/2017 12/11/2017 12/18/2017
Sh.S. Testimony	8/23/2017
Max M. Testimony	9/5/2017
L.K. Testimony	9/7/2017 12/11/2017

D.S. Testimony	9/7/2017 12/10/2017
Jon F. Testimony	9/11/2017 9/16/2017
J.H Testimony	9/16/2017
P.H Testimony	9/16/2017 12/6/2017
Mike M. Testimony	9/16/2017 12/11/2017 12/11/2017
L.W. Testimony	9/16/2017
C.M Testimony	9/16/2017
H.M Testimony	9/16/2017
G.J. Testimony	11/9/2017
G.M. Testimony	11/20/2017
Kansas Livestock Association Testimony	11/14/2017
Kansas Farm Bureau Testimony	11/22/2017
B.G. Testimony	12/7/2017

S.M. Testimony	12/7/2017
B.F. Testimony	12/11/2017
D.I. Testimony	12/8/2017
S.F. Testimony	12/10/2017
J.W. Testimony	12/7/2017 12/11/2017
S.J.S. Testimony	12/10/2017
F. B. Testimony	12/12/2017
D.W. Testimony	12/12/2017
D.F. Testimony	12/12/2017
D.K. Testimony	12/12/2017
C.H. Testimony	12/12/2017
T.H. Testimony	12/12/2017
James F. Testimony	12/11/2017
C.E. and J.E Testimony	12/12/2017
Joan M. Testimony	12/12/2017

K.W. Testimony	12/18/2017
J.S. Testimony	12/20/2017
T.S. Testimony	12/8/2017
R.L. Testimony	12/11/2017
B.W. Testimony	12/11/2017
B.R. Testimony	12/11/2017
L.G. Testimony	12/11/2017
K.S. Testimony	12/11/2017
L.L. Testimony	12/11/2017
I.S. Testimony	12/11/2017
A.P. Testimony	12/11/2017
J.B. Testimony	12/11/2017
J.M. Testimony	12/11/2017
B.B. Testimony	12/11/2017
K.V. Testimony	12/11/2017
S.Z. Testimony	12/11/2017

M.S. Testimony	12/11/2017
----------------	------------

Table 6

Titles and Dates of GMD 4 LEMA Documents

Document Title	Date
S.R. Testimony for Initial Hearing	8/23/2017
S.S. Testimony for Initial Hearing	8/23/2017
M.M Testimony for Initial Hearing	9/5/2017
L.K. Testimony for Initial Hearing	9/7/2017
D.S. Testimony for Initial Hearing	9/7/2017
J.F. Testimony for Initial Hearing	9/11/2017
B.S. Testimony for Initial Hearing	9/13/2017
GMD 4 Testimony for Second Hearing	11/2/2017
S.R. Testimony for Second Hearing	11/14/2017
Kansas Livestock Association Testimony for Second Hearing	11/14/2017
G.J. Testimony for Second Hearing	11/9/2017
G.M. Testimony for Second Hearing	11/20/2017
Kansas Farm Bureau Testimony for Second Hearing	11/22/2017
Transcript of Initial Hearing	9/16/2017
Transcript of Second Hearing	12/11/2017
Written Testimony	11/22/2017-12/11/2017
Written Testimony	12/12/2017
Written Testimony	12/13/2017-12/22/2017
Additional Written Testimony	12/8/2017- 12/20/2017

News Articles Inclusion and Exclusion Criteria and Search String Justification

Including news articles from 2013 to 2021 helps mitigate the potential loss of information from relying solely on GMD 4 LEMA hearing documents. Table 7 shows these new articles included in the study. I included 59 news articles in total, with 20 news articles from 2013 to 2021. News articles during this period provide valuable insights into the failed LEMA attempts in GMD 1 (2014) and GMD 3 (2018), which are relevant for answering the research questions regarding the role of policy entrepreneurs and the state in contributing to or hindering transitions. News articles from this period also help to understand factors that motivated former regime actors to support LEMAs in GMDs 1, 3, and 4. News articles were indispensable in this regard because they frequently featured quotes from GMD 3 members, thus providing insight into their perspectives when direct interviews were not possible. Including news articles from this period also helped to mitigate the potential loss of information from excluding LEMA testimonies and documents from the Sheridan 6 LEMA and Wichita County LEMA.

I also included 39 news articles from 2022 to March 2024 to better understand the role of the state and policy entrepreneurs in Kansas's transition. I specifically chose the dates 2022 to March 2024 to search for articles because some state actors started becoming more involved in advocating for conservation legislation during this period. I excluded articles after March 2024 because this was when I was analyzing the data and, therefore could not add more data. Table 7 shows the news articles included in the study from this period. Since I could only interview one state actor (a former Chief Engineer), news articles became a critical source for examining how state actors influenced the passage of groundwater reform bills. These articles often included interviews with lobbyists and policymakers, providing essential insights into how these regime actors impacted Kansas's groundwater management transition.

I included nearly twice as many news articles from 2022 to March 2024 than from 2013 to 2021; however, I did not intentionally include fewer news articles from 2013 to 2021 than from 2022 to March 2024. Rather, the discrepancy in the number of news articles is due to a lack of media coverage on groundwater issues from 2013 to 2021. This potential limitation could mean that the study is biased toward more recent events.

The search protocols for finding articles differed between the two periods to best capture the specific events and trends during these timeframes. For articles from **2013 to 2021**, I used specific search strings related to each LEMA or WCA, such as "GMD 1 LEMA 2014" or "Mark Rude Kansas groundwater, "Sheridan 6 LEMA", "Wichita County Water Conservation Area", "Wichita County LEMA", "GMD 1 LEMA", and "GMD 4 LEMA." This approach aimed to collect data on local conservation efforts and key individuals involved in Kansas's groundwater management.

For the articles from 2022 to 2024, I employed a broader search approach, beginning with the search string "Kansas Ogallala Aquifer" in the news section of Google. I then refined the search results using specific inclusion criteria to ensure that the articles selected focused on legislative progress, GMD activities, or stakeholder interviews. Articles from non-Kansas sources, national media, and opinion pieces were excluded, as the focus was on capturing

Kansas-based perspectives. The final selection of articles provided substantive discussions on the latest legislative actions regarding groundwater depletion and interviews with stakeholders, making them highly relevant to the research questions.

Table 7

News Articles Included in the Study

News Article	Publisher	Year
Kansas and Army Corps Revive Study to Ship Water from Missouri River to Ogallala Aquifer	circle of blue	2013
Kansas Farmers Commit To Taking Less Water From The Ground	NPR WGCU	2013
Western Kansas farmers worry as Ogallala Aquifer disappears	The Topeka Capital-Journal	2014
LEMAs just one thing to tap into for saving water	The Hutchinson News	2014
Failed Ballot Measure is Setback for Ogallala Water Conservation in Western Kansas	circle of blue	2014
Is An Aqueduct A Practical Answer To Western Kansas' Water Crisis?	NPR KCUR	2014
A Depleting Aquifer Disrupts The Future of Farming In Western Kansas	Central Standard	2015
Host of issues clogging aqueduct idea	Associated Press	2015
Testy exchange occurs during aqueduct meeting in Salina	Salina Journal	2015

No mincing words: Sheridan County's water conservation program is working	The Hutchinson News	2016
4 new water conservation areas approved	Farm Progress	2016
Kearny Finney LEMA- what does it mean for irrigators?	The Hutchinson News	2017
Solving the High Plains water crisis: With his wells declining, one Kansas farmer takes path to extend the life of the Ogallala	The Hutchinson News	2017
Taking Initiative	Stewarding Our Aquifer	2017
The clock is ticking on dealing with western Kansas' drying Ogallala Aquifer	The Journal Kansas Leadership Center	2018
Kansas farmers are running out of water. Can they pull off an environmental miracle in Charles Koch's home state?	The Counter	2018
Kansas Farmers Minimize Water Use As The Southern Great Plains Become More Arid	American Academy for Advancement of Science	2019
Water Conservation on the Farm	Kansas Living Magazine	2020
Farmers Trying to Save The Ogallala Aquifer Face Tensions From Peers, But Their Profits Are Improving	High Plains Public Radio	2021
Can Kansas find a way to maintain its water supply? Lawmakers are searching for answers amid drought in western US	The Topeka Capital-Journal	2021

You've Probably Never Heard Of The Ogallala Aquifer, But You've Eaten Food Thanks to It- And It Is Under Severe Duress	Kansas City Mag	2022
Officials plan to truck 6,000 gallons of water from Missouri River across Kansas	Kansas Reflector	2022
Hauling River Water Across Kansas	Progressive Farmer	2022
'It's time to deal with this': Kansas Water Authority wants to save Ogallala Aquifer	Kansas Reflector	2022
Bipartisan solutions would save water for Kansas farmers	The Kansas City Star	2022
We can solve our water crisis together, or all starve together	The Kansas City Star	2022
Kansas Gov. Laura Kelly pledges focus on water: 'Waiting for a miracle is not an option'	Kansas Reflector	2022
Hope springs from Kansas governor's proposal to restore water funding	Kansas Reflector	2022
Why an ambitious effort to overhaul Kansas water management fell short	Kansas Reflector	2022
This is the first time the Kansas Water Authority has voted to save what's left of the Ogallala	High Plains Public Radio	2022
Western Kansas land value could lose billions as water levels decrease	The Topeka Capital-Journal	2022

'Shooting themselves in the foot': Committee guts Kansas bill to protect water	Kansas Reflector	2022
Declining Ogallala Aquifer Prompts Test to Transfer Water From Missouri River	Progressive Farmer	2022
This city in Kanas really conserves its water, but that still might not be enough to survive	High Plains Public Radio	2022
Kansas Water Office releases 2022 Water Plan	Farm Progress	2022
Western Kansas farmers are pushing to save the Ogallala Aquifer before it's too late	The Wichita Eagle	2023
Kansas water experts urge action	The Associated Press	2023
New report shows western Kansas water supply continues to decline, pushing state to act	The Topeka Capital-Journal	2023
Ogallala Aquifer is fading: Will KS politicians finally act?	The Kansas City Star	2023
With the Ogallala Aquifer drying up, Kansas ponders limits to irrigation	KCUR	2023
Kansas is running out of water. Is this the year lawmakers find a solution?	The Topeka Capital-Journal	2023
Audit finds western Kansas keeps losing water, despite local efforts	Kansas Reflector	2023
House bill calls for western Kansas to create plans to save the Ogallala Aquifer	Kansas Reflector	2023

Why do they grow so much corn in western Kansas	The Kansas City Star	2023
Kansas approves measures to manage water crisis. Advocates, experts say it isn't enough	The Kansas City Star	2023
Governor's new adviser on Kansas water crisis working to influence policy talks	Kansas Reflector	2023
House bill calls for western Kansas to create plans to save the Ogallala Aquifer	Kansas Reflector	2023
Will Ogallala Aquifer go the way of the buffalo? Conservation must be collective effort	The Hutchinson News	2023
Getting Serious About Water Woes on the High Plains	Kansas Public Radio	2023
Kansas legislation got 'watered down' but will help aquifer conservation efforts	Kansas Reflector	2023
Warning about aquifer's decline sets up big fight in Kansas	Associated Press	2023
Western Kansas water supply still declining and needs action	The Topeka Capital-Journal	2023
Governor Kelly Announces \$18 Million Investment in Water Quality, Quantity, and Infrastructure	Governor Press Release	2023
'This is do or die': Western Kansas farmers push to save the Ogallala aquifer before it's too late	High Plains Public Radio	2023

Producer panelists share thoughts on irrigation, water conservation	High Plains Journal	2023
Agriculture built these High Plains towns. Now, it might run them dry	Kansas Reflector	2024
'We're running out of water': How Kansas farmers are adapting as a crucial aquifer goes dry	Stateline	2024
Gov. Laura Kelly said she has 'political capital' to spend on water issues this year	The Topeka Capital-Journal	2024
Kansas Makes Historic Investment in Preserving the Ogallala Aquifer	The Kansas Living Magazine	2024

GMD 3 LEMA Presentations

All presentations used in the study were sourced from the KFL steering committee website. Table 8 shows these presentations. I conducted an initial review of all available presentations on the website. This initial review helped identify the presentations that would be subjected to further inclusion and exclusion criteria. Presentation slides were included if they met specific criteria such as, explaining why the steering committee supported the LEMA. These criteria align with the research questions, which aim to identify the factors that influence actors to change roles.

I excluded presentation slides that were duplicates or provided redundant information. After applying these inclusion and exclusion criteria, two presentation slides were included in the analysis. These presentations were crucial in helping identify key themes around actor role transitions and opposition to conservation practices in GMD 3.

Table 8*GMD 3 LEMA Presentation Titles and Dates*

Title of Presentation	Date
Northern Kearny Finney County LEMA: Presentation to GMD #3 Board	April 12, 2017
Northern Kearny Finney County LEMA: Informational Meeting	April 19, 2017

GMD 3 Minute Meetings

Based on the GMD 3 LEMA presentation slides, I deduced that the discussion about GMD 3's failed LEMA began in 2016 and ended in 2018. Using this knowledge, I reviewed GMD 3 Board minute meetings from 2016 to 2018. I included all minute meetings that provided reasons why GMD 3 leadership did not support a LEMA, why supporters wanted a LEMA, or meetings where the chief engineer or DWR was speaking. I used these topics as my inclusion criteria because they pertain to my research questions about understanding factors that motivate actors to change roles and support conservation and the role of state actors and policy entrepreneurs in Kansas's transition. I excluded minute meetings that did not reference the LEMA or only gave an update about the progress of the LEMA but did not feature any further discussion from stakeholders about the LEMA. Thus, I included seven total GMD 3 Board minute meetings, which are shown in Table 9.

Table 9*GMD 3 Board Minute Meetings and Meeting Dates*

December 2017
January 2018
March 2018

April 2018
May 2018
June 2018
July 2018

Kansas Oral History Project

For the KOHP interviews, I conducted an initial screening of all interview transcripts. I used keywords such as “groundwater management,” “GMD Act,” and “Ogallala Aquifer” to screen the interviews. I included interviews that discussed the Ogallala Aquifer or mentioned GMDs 1, 3, or 4. I excluded interviews that did not reference groundwater or only discussed GMDs 2 or 5. These inclusion and exclusion criteria were developed to align the interviews with the geographical and topical scope of the study. This systematic approach ensured that the interviews were relevant to the research questions. After screening the interviews and applying the inclusion and exclusion criteria, I included 13 interviews in the study, listed in Table 10. Table 10 also provides each person’s job position to demonstrate their relevance to this study. By including these KOHP interviews, the research benefits from a more comprehensive understanding of the institutional and actor-level dynamics that have shaped Kansas’s transition toward increased conservation.

Table 10.
Names, Positions Helds, and Years Held of Kansas Oral History Project Interviewees

Name	Positions Held and Years Held
Lon Frahm	Board President of GMD 4 1993-2013
Mike Dealy	Hydrologist for GMD 3 1979-1984 Manager of GMD 2 1984-2006

Edward Flentje	Director State Planning and Research, Governor's Office 1975-1979 Secretary, Department of Agriculture 1986-1988
Joe Harkins	Secretary, Department of Health and Environment 1979-1982 Director, Kansas Water Office 1982-1991 Director Kansas Water Office 2003-2004 Commissioner, Kansas Corporation Commission 2007-2011
Mike Hayden	State Representative, Kansas House of Representatives 1973-1987 Chair, House Ways and Means 1979-1982 Speaker, Kansas House of Representatives 1983-1986 Governor, State of Kansas 1987-1991 Secretary, Department of Wildlife and Parks 2002-2011
Dave Heinemann	State Representative, Kansas House of Representatives 1969-1994
Carl Holmes	State Representative, Kansas House of Representatives 1985-2012
David Pope	Manager, GMD 3 1976-1978 Assistant Chief Engineer, Department of Agriculture 1978-1983 Chief Engineer, Department of Agriculture 1983-2007
Leland Rolfs	Agency Counsel, Kansas Water Resources Board 1978-1980 Special Assistant Attorney General, Attorney General's Office 1978-2008

	Agency Counsel, Department of Agriculture, 1978-2008
Tracy Streeter	Executive Director, Kansas Conservation Commission 1994-2004 Director, Kansas Water Office, 2004-2018
John Strickler	Acting State Forester, Kansas State University 1965-2000 Special Assistant for Environment and Natural Resources, Governor's Office 1987-1989 Secretary, Department of Wildlife and Parks, 1988-1989 Secretary, Department of Wildlife and Parks, 1995-1995
John Peck	Professor, University of Kansas School of Law 1978-2019
Ken Grotewiel	State Representative, Kansas House of Representatives 1983-1994 Assistant Director, Kansas Water Office, 2003-2007

Scholarly Articles Inclusion and Exclusion Criteria

I included a total of 17 scholarly articles, which are shown in Table 11. I developed inclusion criteria to focus on the legal dimensions of groundwater management, the history of Kansas water laws, the evolution of GMDs, or potential legal issues related to water management. I excluded articles that solely focused on GMDs 2 or 5, as these GMDs are not within the Ogallala Aquifer, which is the primary focus of this study. The inclusion criteria were essential for ensuring that the articles selected were relevant to the geographic and thematic boundaries of the research, allowing for consistency in addressing the research questions.

To capture additional scholarly works discussing the history and evolution of GMD approaches to groundwater management, a keyword search was conducted using the search string "Kansas AND planned depletion." This specific search string was chosen because "planned depletion" refers to a critical policy approach adopted by the GMDs in the 1970s-2000s. The planned depletion strategy, which involved managing the aquifer with the expectation of gradual water decline, provides essential historical context for understanding how GMDs evolved in their approach to conservation. This search string yielded 98 articles, which I

screened using the established inclusion and exclusion criteria. Duplicates, as well as articles that were already covered in Peck's works or published in the same journal issues, were excluded to prevent redundancy.

Table 11

Scholarly Articles Included in the Study

Paper Title	Authors	Year
Groundwater Management in Western Kansas	Edward D. Jenkins	1983
Land Use Related Adjustments to Aquifer Depletion in Southwestern Kansas	M. Duane Nellis	1984
Legal Aspects of Kansas Water Resources Planning	John C. Peck and Doris K. Nagel	1989
The Kansas Water Appropriation Act: A Fifty-Year Perspective	John C. Peck	1995
Local Groundwater Management Effectiveness in the Colorado and Kansas Ogallala Region	Stephen E. White and David E. Kromm	1995
The Origin and Evolution of Safe Yield Policies in the Kansas Groundwater Management Districts	Marios Sophocleous	2000
From safe yield to sustainable development of water: the Kansas Experience	Marios Sophocleous	2000
Property Rights in Groundwater- Some Lessons from the Kansas Experience	John C. Peck	2002
Groundwater Management in Kansas: A Brief History and Assessment	John C. Peck	2006

Groundwater Management in GMD4: Has It Succeeded?	Wayne Bossert	2006
Kansas Groundwater Management Districts: A Lawyer's Perspective	Michael K. Ramsey	2006
Comparing and Contrasting the Roles of the Division of Water Resources and the Groundwater Management Districts in the Groundwater Management and Regulation	Leland E. Rolfs	2006
Comparative Water Law and Management: The Yellow River Basin in Western China and the State of Kansas in the Western United States	Burke W. Griggs, John C. Peck, and Xue Yunpeng	2009
From desert to breadbasket... to desert again? A metabolic rift in the High Plains Aquifer	Matthew R. Sanderson and R. Scott Frey	2014
Legal Challenges in Government Imposition of Water Conservation: The Kansas Example	John C. Peck	2014
Structural impediments to sustainable groundwater management in the High Plains Aquifer of western Kansas	Matthew R. Sanderson and R. Scott Frey	2015
Groundwater Management: The Movement Toward Local, Community-Based, Voluntary Programs	John C. Peck, Rick Illgner, Jakob Wiley, and Constance Crittenden Owen	2019

Kansan Newspaper Articles

To find newspaper articles from 1990 to 1992 about GMD 4's Zero Depletion Policy, I used the Newspapers.com Database. I used the search string "Zero depletion AND groundwater" to find newspaper articles. I chose this search string because it pertained to GMD 4's Zero Depletion Policy. I only included Kansan newspaper articles that interviewed members of GMD

4 staff and excluded articles that were not from Kansas publishers or did not interview GMD 4 staff. This ensured that the newspapers included reflected the perspectives of GMD 4 members, which is important for understanding the factors that motivated GMD 4 to adopt a zero depletion policy. I included seven newspaper articles in total, as shown in Table 12.

Table 12

Newspapers Articles Included in the Study

Article Title	Publisher	Year
Panel takes little action to reduce aquifer depletion	The Salina Journal	1990
Slowing the Flow: Groundwater district seeks ways to stop mining of Ogallala	The Salina Journal	1990
Zero Depletion: Plan to limit water use divides Kansans.	The Wichita Eagle	1991
Daring idea: Conserving water hard to swallow	The Wichita Eagle	1991
Aquifer management more than measuring water	The Salina Journal	1991
Water district directors stall on groundwater mining	The Parsons Sun	1991
Irrigation district strives for 'zero depletion' of aquifer	The Salina Journal	1992

Appendix B. Codebooks and Supporting Literature

Table 13 shows the inductive codebook for my data. I categorized the codes into three levels: a main code group, code, and sub-codes. I provide a definition for each of these three levels. This codebook aims to understand the factors that motivated actors to change roles and barriers to actors' role changes.

Table 14 shows my codebook for the role of policy entrepreneurs in contributing to Kansas's transition. There are three code levels: main code group, code, and sub-code. The main code group level examines policy entrepreneurs' influence on successful and unsuccessful Kansas conservation policies. The second level of codes refers to the specific policy entrepreneurs who contributed to developing and advocating for the policy in the main code group. The sub-codes show the specific strategies each policy entrepreneur used when advocating for a policy. I coded the strategies inductively, and then I validated the strategies by matching the strategies I identified in the data with those found in the policy entrepreneurship literature. The definitions for the strategies are from the policy entrepreneurship literature. This approach of identifying the strategies inductively and then validating them deductively using policy entrepreneurship literature helps strengthen my analysis's rigor. The literature I used to validate my inductive findings and develop definitions for the sub-codes is shown in Table 15.

Table 16 contains a deductive codebook based on the MLP. I used this codebook to identify the role of the state in Kansas's transition and the factors that motivate regime actors to change roles and adopt conservation practices. I also used this codebook to understand how Kansas's transition occurred. I grouped the codes by niche, regime, and landscape because those are the three levels of the MLP. There are codes and sub-codes for each level, which I define in the codebook. To develop the codebook, I used seminal MLP literature, which is shown in Table 17.

Table 13
Inductive Codebook

Main Code Group	Definition	Code	Definition	Sub-code	Definition
Resistance to Role Change	Instances where actors resisted adopting new roles and conservation practices	Institutional resistance	How organizational structures and governance frameworks within GMDs and related agencies hinder the adoption of new roles or conservation policies.	GMD Board leadership	Leadership on GMD Boards are reluctant to embrace new roles or policies
				Failure of local control	Situations where local control fails to promote or enforce conservation measures, leading to continued depletion of the aquifer.
				Regulatory capture	Instances where agricultural industries dominate the legislature and GMD boards,

					creating policies and decisions that favor the interests of large agricultural entities over the need for groundwater conservation, contributing to resistance against role changes.
		Economic Concerns	Farmers and other stakeholders often resist role changes because they fear that conservation measures will lead to reduced agricultural output, loss of income, or increased costs,	N/A	N/A
		Cultural Resistance	Instances where ingrained norms and beliefs shape resistance to conservation	Cowboy mentality	People used this term to describe GMD 3. It is an identity that emphasizes self-reliance, rugged individualism, and resistance to external control. This mentality contributes to the district's preference for local decision-making and opposition to state-imposed conservation measures.
				Anti-state involvement	A deep-seated mistrust of state intervention in local affairs, particularly in groundwater management. This resistance is rooted in a cultural preference for local control and autonomy, leading to opposition against state-mandated conservation policies.
				Taking of a property rights	A belief that conservation policies represent an infringement on property rights, particularly the right to use water as they see fit. This perception fuels resistance to adopting new conservation roles and practices.
GMD 3 Characteristics	Description of GMD 3	Cultural	Cultural beliefs and norms prominent in GMD 3	Cowboy mentality	People used this term to describe GMD 3. It is an identity that emphasizes self-reliance, rugged individualism, and resistance to external control. This mentality contributes to the district's preference for local decision-making and opposition to state-imposed conservation measures.
				Anti-state involvement	A deep-seated mistrust of state intervention in local affairs, particularly in groundwater

					management. This resistance is rooted in a cultural preference for local control and autonomy, leading to opposition against state-mandated conservation policies.
				Taking of a property rights	A belief that conservation policies represent an infringement on property rights, particularly the right to use water as they see fit. This perception fuels resistance to adopting new conservation roles and practices.
				feel judged by state for water transfer plans	Some actors in GMD 3 feel that the state unfairly criticizes or judges their water transfer plans, which they see as necessary for economic survival. This perception exacerbates resistance to adopting conservation roles.
		Policy	Policies and approach to groundwater management in GMD 3	Water transfer	Refers to GMD 3's policy approach of pursuing water transfer projects from the Missouri River, instead of adopting conservation policies.
				Voluntary conservation only	A policy preference in GMD 3 for voluntary, rather than mandated, conservation measures.
				"Managed depletion"	Similar to planned depletion, this policy involves the deliberate use of groundwater resources to manage the decline over time rather than prevent it.
		Geography & hydrology	The physical geographical and hydrological features of GMD 3 and how they influence its management	Closest to Texas	Instances where people said that GMD 3's proximity to Texas influences its water management strategies and cultural beliefs
				Largest GMD and Board	Instances where people mentioned how the fact that GMD 3 is the largest GMD and has the largest Board influenced its management.
				Most variation in saturated thickness	GMD 3 experiences significant variation in groundwater levels, with some areas having abundant water and others facing severe depletion. This hydrological diversity leads to uneven support for conservation measures across the district.

				Worst rate of decline	GMD 3 has the highest rate of groundwater decline among the districts, yet resistance to conservation persists
		Ag characteristics	Details of agricultural production in GMD 3	Absentee land ownership	Instances where people said that GMD 3 had high absentee landownership rates, which made them more resistant to conservation
				“Industrial feel”	Term used to describe the agricultural practices in GMD 3. It refers to large-scale, industrial farming operations. People said GMD 3 was more industrial than the other GMDs and that this contributed to their resistance to conservation.
GMD 4 Characteristics	Description of GMD 4	Culture	Cultural beliefs and norms prominent in GMD 4	Rancher Mentality	People used this term to describe GMD 4. Cultural identity within GMD 4 that emphasizes self-reliance, stewardship of the land, and a preference for autonomy in decision-making.
				Preference for Local Control	Strong preference for managing groundwater resources locally, without state intervention.
				Pass Down Farming to Kids	Desire to maintain agricultural practices so that they can be passed down to future generations. This intergenerational focus influences decisions related to groundwater management, as stakeholders are motivated to ensure that water resources are available for their children.
		Policy	Policies and approach to groundwater management in GMD 4	Historically Progressive	References to GMD 4’s progressive history of conservation policies in groundwater management
				Anti-Water Transfer	GMD 4’s policies tend to oppose the transfer of water rights out of the district.
				Extend Life of Aquifer	A core policy goal in GMD 4 is to extend the usable life of the Ogallala Aquifer through conservation measures.
		Geography & hydrology	The physical geographical and hydrological features of GMD 4 and how they	Northern GMD	This code reflects the geographic location of GMD 4 within the northern part of the state, which

			influence its management		impacts its hydrological conditions and the strategies it employs for groundwater management.
				Consistently Low Saturated Thickness:	Low saturated thickness in GMD 4- influences conservation policies in the district.
		Ag characteristics	Details of agricultural production in GMD 4.	Landowners Actively Involved in Management	Agricultural landowners are deeply involved in groundwater management decisions
GMD 1 Characteristics	Description of GMD 1	Culture	Cultural beliefs and norms prominent in GMD 1	Preference for Local Control	Strong preference for managing groundwater resources locally, without state intervention
				Pass Down Farming to Kids	Desire to maintain agricultural practices so that they can be passed down to future generations. This intergenerational focus influences decisions related to groundwater management, as stakeholders are motivated to ensure that water resources are available for their children.
		Policy	Policies and approach to groundwater management in GMD 1	Anti-Water Transfer	GMD 1's policies tend to oppose the transfer of water rights out of the district.
				Extend Life of Aquifer	A core policy goal in GMD 1 is to extend the usable life of the Ogallala Aquifer through conservation measures
		Geography & hydrology	The physical geographical and hydrological features of GMD 1 and how they influence its management	Smallest GMD	GMD 1 is the smallest of the groundwater management districts in Kansas, which affects its management strategies
				Lowest Saturated Thickness of All GMDs	GMD 1 has the lowest saturated thickness in the aquifer, meaning it faces severe water scarcity. This hydrological challenge necessitates strict conservation measures to extend the life of the aquifer.
		Ag characteristics	Details of agricultural production in GMD 1	Landowners Actively Involved in Management	Agricultural landowners are deeply involved in groundwater management decisions
Sheridan 6 LEMA	The Sheridan 6 LEMA is a pivotal case of a	Characteristics of Members	Description of Sheridan 6 members	Shared Values	Instances where people mention that Sheridan 6 members have shared values, which contributed

	locally driven groundwater conservation initiative in Kansas.				to its success
				Sell to the Same Feed Yard	Sheridan 6 members sell feed to the same feed yard, which creates shared economic interdependence and interest in maintaining water resources. This economic connection reinforces the commitment to collective action in water conservation.
		Motivating Factors for Role Change and Conservation	Factors that motivated Sheridan 6 members to change roles and adopt conservation practices.	Avoid State Intervention	The desire to avoid state-mandated conservation measures motivates local actors to adopt their conservation practices. By taking proactive steps, stakeholders aim to maintain local control over water management and avoid more stringent state regulations.
				Pass Down Farming to Kids	Desire to maintain agricultural practices so that they can be passed down to future generations. This intergenerational focus influences decisions related to groundwater management, as stakeholders are motivated to ensure that water resources are available for their children
				Depletion	The recognition that continued depletion will threaten the viability of agriculture compels actors to change their roles and embrace conservation
				Preserving Local Economy:	The need to maintain the local economy, which is heavily dependent on agriculture, motivates stakeholders to adopt conservation practices.
GMD 1 Failed LEMA 2014	Refers to the unsuccessful attempt by GMD 1 to establish a LEMA in 2014	Motivating Factors for Role Change and Conservation	Factors that motivated supporters of the GMD 1 failed LEMA to change roles and support conservation practices.	Success of Sheridan 6	The initial Sheridan 6 LEMA served as a motivating factor for actors in GMD 1 to consider and attempt their own LEMA.
Wichita County WCA 2017	Refers to the Water Conservation Area (WCA) established in Wichita County in 2017.	Motivating Factors for Role Change and Conservation	Factors that motivated members of Wichita County WCA to change roles and support conservation practices	Depletion	The recognition that continued depletion will threaten the viability of agriculture compels actors to change their roles and embrace conservation
				Passing down farming to	Desire to maintain agricultural practices so that they can be passed down to future

				kids	generations. This intergenerational focus influences decisions related to groundwater management, as stakeholders are motivated to ensure that water resources are available for their children
				Preserving local economy	The need to maintain the local economy, which is heavily dependent on agriculture, motivates stakeholders to adopt conservation practices.
GMD 3 Failed LEMA 2018	Refers to the unsuccessful attempt by some residents of GMD 3 to establish a LEMA in 2018.	Motivating Factors for Role Change and Conservation	Factors that motivated members of the GMD 3 failed 2018 LEMA to change roles and support conservation practices	Passing down farming to kids	Desire to maintain agricultural practices so that they can be passed down to future generations. This intergenerational focus influences decisions related to groundwater management, as stakeholders are motivated to ensure that water resources are available for their children
				Depletion	The recognition that continued depletion will threaten the viability of agriculture compels actors to change their roles and embrace conservation
GMD 4 2018 LEMA	Refers to the successful establishment of a district-wide LEMA in GMD 4 in 2018.	Motivating Factors for Role Change and Conservation	Factors that motivated members of the GMD 4 LEMA to change roles and support conservation practices	Depletion	The recognition that continued depletion will threaten the viability of agriculture compels actors to change their roles and embrace conservation
				Sheridan 6 economic study	The economic study conducted in Sheridan 6, which demonstrated that conservation did not harm profitability, played a significant role in convincing GMD 4 actors to adopt conservation practices. This empirical evidence was crucial in overcoming skepticism and building support for the LEMA.
				Passing down farming to kids	Desire to maintain agricultural practices so that they can be passed down to future generations. This intergenerational focus influences decisions related to groundwater management, as stakeholders are motivated to ensure that water resources are available for their children
				Preserving	The need to maintain the local

				local economy	economy, which is heavily dependent on agriculture, motivates stakeholders to adopt conservation practices.
Wichita County LEMA 2021	Refers to the establishment of a Local Enhanced Management Area (LEMA) in Wichita County in 2021.	Motivating Factors for Role Change and Conservation	Factors that motivated members of the Wichita County LEMA to change roles and support conservation practices	Seeing neighbors conserving	The observation that neighboring areas were successfully implementing conservation practices inspired actors in Wichita County to pursue their own LEMA. This "social proof" helped to build momentum for local conservation efforts.
				Experience conserving in WCA	Previous experience with conservation efforts in the Wichita County WCA provided the knowledge and confidence needed to transition to a LEMA. The WCA served as a foundation that made the leap to a more formalized conservation plan possible.
				GMD 4 2018 LEMA	The success of the GMD 4 LEMA motivated members of Wichita County to support a LEMA.
H.B. 2686	This code refers to House Bill 2686, an unsuccessful piece of legislation introduced in Kansas in 2022 focused on groundwater management and conservation.	Motivating Factors for Role Change and Conservation	Factors that motivated supporters of H.B. 2686 to change roles and support conservation practices	Depletion	the ongoing depletion of groundwater resources was a central motivator for the development of this bill. The need to address depletion was critical for ensuring the long-term availability of water in the state
				Lack of conservation in GMD 3	The perceived inadequacy of conservation efforts in GMD 3 was a significant concern that prompted the push for more comprehensive state-level conservation policies.
H.B. 2279	This code refers to House Bill 2279 passed in 2023,, a significant piece of Kansas legislation aimed at advancing groundwater conservation efforts across the state	Motivating Factors for Role Change and Conservation	Factors that motivated supporters of H.B. 2279 to change roles and support conservation practices	Depletion	the ongoing depletion of groundwater resources was a central motivator for the development of this bill. The need to address depletion was critical for ensuring the long-term availability of water in the state
				Lack of conservation in GMD 3	The perceived inadequacy of conservation efforts in GMD 3 was a significant concern that prompted the push for more comprehensive state-level conservation policies.

				Avoiding more intense state involvement	By implementing H.B. 2279, actors aimed to proactively address groundwater depletion in a way that would minimize the need for even more stringent state intervention in the future.
--	--	--	--	--	--

Table 14
Policy Entrepreneurship Codebook

Main Code Group	Definition	Code (Actors)	Definition	Sub-code	Definition
Policy Entrepreneurs' Influence: Zero Depletion Policy	Influence of leaders in driving role changes toward conservation through the Zero Depletion Policy	Actor: GMD 4 Manager	Strategies the GMD 4 manager used to drive role changes through the Zero Depletion Policy	Strategies-problem framing	"Framing a problem in a politically—and culturally—acceptable and desirable manner" (Frisch Aviram et al., 2019).
				Strategies-venue shopping	"To move decision-making authority to a new policy arena (for example: from local to national or from courts to government)" (Frisch Aviram et al., 2019).
				Strategies-persistence	The sustained effort and determination in advocating for, promoting, and implementing policy changes, despite encountering resistance, obstacles, or setbacks" (Pagliarello & Cini, 2023).
		Actor: Chief Engineer	Strategies the chief engineer used to drive role changes through the Zero Depletion Policy	Strategies-persuasion	"Using persuasive argumentation" (Frisch Aviram et al., 2019).
Policy Entrepreneurs' Influence: High Priority Areas	Influence of leaders in driving role changes toward conservation through the High Priority Areas initiative	Actor: GMD 4 Staff	Strategies the GMD 4 staff used to drive role changes through the High Priority Areas initiative	Strategies-problem framing	"Framing a problem in a politically—and culturally—acceptable and desirable manner" (Frisch Aviram et al., 2019).
				Strategies- local knowledge	Using local knowledge and local experiments to promote policy changes (Mintrom, 1997).
				Strategies- trust building	"Developing trust in relationships and support networks" (Frisch Aviram et al., 2019).

		Actor: KWA	Strategies the KWA used to drive role changes through the High Priority Areas initiative	Strategy- policy pressure	the deliberate use of external or internal forces to create a sense of urgency or necessity for policy change
		Actor: HPA #6 Members	Strategies HPA #6 members used to drive role changes through the High Priority Areas initiative	Strategies-coalition forming	Building strategic alliances and groups of supporters to advance policy change (Meijerink and Huitema, 2010).
Policy Entrepreneurs' Influence: LEMA Statue and Sheridan 6 LEMA	Influence of leaders in driving role changes toward conservation through the LEMA Statue and Sheridan 6 LEMA	Actor: GMD 4 Staff	Strategies GMD 4 Staff used to drive role changes through the LEMA Statue and the Sheridan 6 LEMA	Strategies-solution-seeking	"Offering a solution, a specific policy program" (Frisch Aviram et al., 2019).
				Strategies-coalition forming	Building strategic alliances and groups of supporters to advance policy change (Meijerink and Huitema, 2010).
				Strategies-evidence gathering	Engaging with others to gather data to show the feasibility of a policy (Frisch Aviram et al., 2019).
		Actor: DWR and Chief Engineer	Strategies DWR and Chief Engineer used to drive role changes through the LEMA Statue and the Sheridan 6 LEMA	Strategies-coalition forming	Building strategic alliances and groups of supporters to advance policy change (Meijerink and Huitema, 2010).
Policy Entrepreneurs' Influence: GMD 4 LEMA	Influence of leaders in driving role changes toward conservation through the GMD 4 LEMA	Actor: GMD 4 Staff	Strategies GMD 4 staff used to drive role changes through the GMD 4 LEMA	Strategies- trust building	"Developing trust in relationships and support networks" (Frisch Aviram et al., 2019).
				Strategies-solution-seeking	"Offering a solution, a specific policy program" (Frisch Aviram et al., 2019).
Policy Entrepreneurs' Influence: GMD 3 Failed LEMA	Influence of leaders in driving role changes toward conservation through the GMD 3 failed LEMA	Actor: DWR and Chief Engineer	Strategies the DWR and Chief Engineer used to drive role changes through the GMD 3 failed LEMA	Strategies-resource mobilization	The process by which policy entrepreneurs actively gather, leverage, and deploy various types of resources, such as financial capital, human capital, political support, and information, to advance their initiatives (Clough et al., 2019).
Policy Entrepreneurs' Influence: H.B.	Influence of leaders in driving role changes toward conservation through H.B. 2279	Actor: Governor Kelly	Strategies Governor Kelly used to drive role changes through policies and H.B. 2279	Strategies-recognizing windows of opportunities	Identifying and exploiting strategic moments to push policy change (Huitema et al., 2011).

2279				Strategies-policy pressure	the deliberate use of external or internal forces to create a sense of urgency or necessity for policy change
		Actor: KWA	Strategies the KWA used to drive role changes through policies and H.B. 2279	Strategies-recognizing windows of opportunities	Identifying and exploiting strategic moments to push policy change (Huitema et al., 2011).
				Strategies-policy pressure	the deliberate use of external or internal forces to create a sense of urgency or necessity for policy change
		Actor: GMD 1 and 4 Staff and former chief engineer	Strategies the GMD 1 and 4 staff and former chief engineer used to drive role changes through policies and H.B. 2279	Strategies-coalition forming	Building strategic alliances and groups of supporters to advance policy change (Meijerink and Huitema, 2010).
		Actor: Rep. Vaughn and Minnix	Strategies Rep. Vaughn and Minnix used to drive role changes through policies and H.B.2279.	Strategies-coalition forming	Building strategic alliances and groups of supporters to advance policy change (Meijerink and Huitema, 2010).
				Strategies- local knowledge	Using local knowledge and local experiments to promote policy changes (Mintrom, 1997).

Table 15.

Policy Entrepreneurship Literature Used to Inform the Codebook

Clough, D. R., Fang, T. P., Vissa, B., & Wu, A. (2019). Turning lead into gold: How do entrepreneurs mobilize resources to exploit opportunities? <i>The Academy of Management Annals</i> , 13(1), 240-271. https://doi.org/10.5465/annals.2016.0132
Frisch Aviram, N., Cohen, N., & Beeri, I. (2020). Wind(ow) of change: A systematic review of policy entrepreneurship characteristics and strategies. <i>Policy Studies Journal</i> , 48(3), 612-644. https://doi.org/10.1111/psj.12339
Huitema, D., Lebel, L., & Meijerink, S. (2011). The strategies of policy entrepreneurs in water transitions around the world. <i>Water Policy</i> , 13(5), 717–733. https://doi.org/10.2166/wp.2011.10
Meijerink, S., and D. Huitema. 2010. Policy entrepreneurs and change strategies: lessons from sixteen case studies of water transitions around the globe. <i>Ecology and Society</i> 15(2): 21. http://www.ecologyandsociety.org/vol15/iss2/art21/
Mintrom, M. (1997). The State-Local Nexus in Policy Innovation Diffusion: The Case of School Choice. <i>Publius</i> , 27(3), 41–59. http://www.jstor.org/stable/3330596

Mintrom, M. and Norman, P. (2009), Policy Entrepreneurship and Policy Change. Policy Studies Journal, 37:649-667. <https://doi.org/10.1111/j.1541-0072.2009.00329.x>

Mintrom, M., & Thomas, M. (2018). Policy entrepreneurs and collaborative action: pursuit of the sustainable development goals. In Int. J. Entrepreneurial Venturing (Vol. 10, Issue 2).

Table 16.
Deductive MLP Codebook

Main Code Group	Definition	Code	Definition	Sub-code	Definition
Niche	A protected space where new, innovative ideas, practices, or technologies can develop and mature away from the dominant regime's market pressures and societal norms. In the context of Kansas, the niche is the conservation niche focused on developing conservation practices.	Niche Innovations	Refers to new and innovative approaches or methods developed to address specific challenges within a niche context. In the case of groundwater management in Kansas, these innovations include programs and practices aimed at conservation.	LEMAs	LEMAs are designated areas within Kansas where local stakeholders collaboratively manage groundwater resources, implementing tailored conservation strategies to mitigate depletion.
				WCAs	WCAs are voluntary agreements among water rights holders within a designated area to implement conservation practices. These agreements are designed to extend the life of the aquifer while maintaining agricultural productivity.
		Real-world labs	Experimental spaces where new practices, such as conservation methods, are tested in real-world conditions. These labs allow for learning, trust-building, and the diffusion of successful practices.	Policy diffusion	The process by which successful policies or practices tested in real-world labs spread to other areas, influencing broader policy adoption and implementation.
				Trust building	The process of creating and reinforcing trust among stakeholders through transparent and successful implementation of niche innovations in real-world settings.
				Niche learning	The acquisition of knowledge

					and insights gained from the practical application of niche innovations within real-world labs, which can be used to refine and improve broader sustainability practices.
		Scaling up and translating	The process of expanding successful niche innovations from localized experiments (like LEMAs) to broader applications, integrating them into mainstream policy and practice.	N/A	N/A
		Niche beliefs	The underlying values and motivations that drive stakeholders within a niche to adopt and support innovative practices	Local control	The preference for managing groundwater resources at the local level, allowing stakeholders to make decisions that reflect the unique needs and values of their communities.
				Passing down farming	The cultural value of ensuring enough water to pass down irrigated agriculture to future generations and create family legacies in irrigated agriculture.
				Preserving economies	The belief that local economies dependent on irrigated agriculture need to be sustained and that conservation will help to ensure the economic sustainability of communities dependent on irrigated agriculture.
Regime	Refers to the dominant socio-technical system that governs practices, rules, and behaviors in a particular domain. In the case of Kansas groundwater management, the regime consists of established policies, beliefs, and actors that maintain the status quo of groundwater use and management.	Policies	Policies within the regime context refer to the formal rules and guidelines dictating Kansas groundwater management practices.	Planned Depletion	A groundwater management policy where the depletion of the aquifer is allowed to continue in a controlled manner, prioritizing short-term economic gains, particularly in agriculture, over long-term sustainability.
		Beliefs	Beliefs within the regime represent the underlying values and assumptions that shape the attitudes of key actors toward groundwater management. These beliefs support the	Local control	The belief that local stakeholders, particularly those in agricultural sectors, should have primary authority over groundwater management decisions, often opposing state intervention.
				Conservation	The assumption that

			continuation of current practices and resist transitions to more sustainable approaches.	harms economic growth	implementing conservation measures would negatively impact agricultural productivity and economic growth, making stakeholders reluctant to support such initiatives.
				Protecting property rights	The belief that individual property rights, particularly water rights, should be protected against state regulations or conservation policies that could limit their use.
		Regime resistance	Refers to the active opposition by regime actors to changes that threaten the status quo, particularly those that would lead to a shift from planned depletion to conservation-oriented policies.	Economic resistance	Resistance based on the fear that changes in water management, particularly toward conservation, would lead to economic losses, especially in the agricultural sector.
				Political resistance	Opposition rooted in the desire to maintain political control and avoid state mandates or regulations that could diminish local authority or change established practices.
				Policy adaptation within regime	The process by which regime actors modify existing policies slightly to appear responsive to pressures without making substantial changes that would disrupt the status quo.
				Actors: GMD 3 Boards	The governing boards of GMD 3 who have historically resisted the adoption of conservation measures in favor of maintaining planned depletion and local control.
				Actors: Ag lobbyists	Representatives of agricultural interests who advocate for policies that protect the economic interests of the farming community, often opposing state-led conservation initiatives that might limit water use or impose new regulations.
Landscape	Refers to the broader external environment that exerts pressure on regimes and niches, influencing their stability and potential	Landscape factors	Refers to specific external pressures or influences that impact the regime and niche developments in Kansas groundwater	Governor Kelly's re-election	Governor Kelly's re-election represents a political landscape factor, providing a window of opportunity for pushing conservation policies without the constraints of

	for change.		management		future electoral pressures. This moment allowed for stronger state leadership in groundwater management.
				Regulatory threats	Refers to potential or actual interventions by the state, such as the enforcement of stricter groundwater management rules, which create pressure on local actors to adopt conservation practices or face legal consequences.
				Cultural values and legacies	Cultural values and legacies encompass the deeply held beliefs and traditions within Kansas's agricultural communities, such as the importance of passing down farming practices to future generations. These values can either support or resist changes in groundwater management practices, depending on how they align with proposed policies.
				Depletion	Refers to the significant reduction of groundwater levels in the Ogallala Aquifer, which serves as a critical landscape pressure in Kansas. This environmental factor creates urgency for change among actors, pushing them to consider or adopt conservation practices. Depletion acts as a catalyst for role changes within the regime as the immediate consequences of over-extraction become apparent, particularly in areas with low saturated thickness.
				Climate change	Climate change represents a broader, long-term landscape pressure that exacerbates groundwater depletion and affects the overall availability of water resources. It includes changes in weather patterns, such as increased frequency and severity of droughts, which further strain water resources and intensify the need for sustainable groundwater management practices. Climate change acts as a destabilizing force within

					the landscape, influencing both regime and niche actors in their decision-making processes.
Role of state actors	Refers to the involvement and influence of governmental bodies and officials in either maintaining the current regime or facilitating the creation of niches	Niche creation	refers to state actors' actions to foster the development of innovative practices or policies that challenge the existing regime	Top-down pressure	Top-down pressure involves the state imposing policies or regulations from above, compelling local actors to adopt new practices. This can include mandates for groundwater conservation that require compliance at the local level.
				Regulatory pressure	Regulatory pressure refers to the use of legal and administrative tools by state actors to enforce compliance with conservation measures, such as the threat of impairment cases or IGUCAs
		Regime maintenance	Regime maintenance involves the actions taken by state actors to uphold and reinforce the existing socio-technical system, often resisting changes that could disrupt established practices.	N/A	N/A

Table 17.
MLP Literature Used in Codebook

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. <i>Research Policy</i> , 31(8–9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8
Geels, F. W., & Kemp, R. (2007). Dynamics in socio-technical systems: Typology of change processes and contrasting case studies. <i>Technology in Society</i> , 29(4), 441–455. https://doi.org/10.1016/j.techsoc.2007.08.009
Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. <i>Research Policy</i> , 36(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003
Geels, F. W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. <i>Research Policy</i> , 39(4), 495–510. https://doi.org/10.1016/j.respol.2010.01.022
Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. <i>Environmental Innovation and Societal Transitions</i> , 1(1), 24–40. https://doi.org/10.1016/j.eist.2011.02.002
Geels, F. W. (2014). Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective. <i>Theory, Culture & Society</i> , 31(5), 21-40. https://doi.org/10.1177/0263276414531627

Geels, F. W. (2018). Disruption and low-carbon system transformation: Progress and new challenges in socio-technical transitions research and the Multi-Level Perspective. *Energy Research and Social Science*, 37(September 2017), 224–231. <https://doi.org/10.1016/j.erss.2017.10.010>

Geels, F. W. (2020). Micro-foundations of the multi-level perspective on socio-technical transitions: Developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. *Technological Forecasting and Social Change*, 152(December 2019). <https://doi.org/10.1016/j.techfore.2019.119894>