Perceptions of Science and Expertise Among Alternative Ranchers in Alberta, Canada: A Qualitative and Actor-Network Analysis

by

Kira Konstantinovna Dlusskaya

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Department of Resource Economics and Environmental Sociology
University of Alberta

Abstract

Raising animals has been an important aspect of human food systems for millennia, but with growing climate concerns, the management of animal agriculture, including beef production, needs to adhere to environmental best practices. Determining what these practices are has been the subject of much academic literature, but scientific consensus on the subject has been elusive, with various alternatives to conventional management being taken up by ranchers. Alberta is Canada's largest beef producer, with close to 40% of the country's cattle herd, making it an ideal place to conduct research with ranchers. This study looks at how ranchers in Alberta relate to scientific information and expertise, asking the question *How are science, scientists, and scientific institutions perceived among alternative livestock management practitioners in the Canadian prairies?* This qualitative study sought out alternative ranchers who choose various management practices, such as Holistic Management and Adaptive Multi-Paddock grazing. Through in-depth interviews with twenty alternative ranchers, as well as participant observation, this study contributes a qualitative component to the literature relating to grazing management and lay-expert interaction in alternative agriculture.

Several key themes arose from an inductive analysis of the interview data. Firstly, the ranchers were keenly interested in new findings and practices related to their operations, and they engaged with scientific output with a pragmatic and critical eye. Secondly, ranchers valued situated, specific, and experience-based insights into grazing management much more highly than generalized claims. Thirdly, ranchers chose to pursue alternative grazing management approaches due to an overall disillusionment with conventional practices, frequently due to personal observations and experience. Lastly, ranchers felt motivated to pursue actions that were in alignment with or mimicking Nature and felt strongly about supporting ecosystem health,

particularly at the local level. In addition to an inductive component, the study includes an Actor-Network analysis, which aims to incorporate (more than) human associations into an analysis of alternative agricultural systems. This component includes a discussion about the preferred associations formed by ranchers, cattle, pastures, and technologies associated with alternative grazing management. It then follows the history of Holistic Management in Alberta through a selected sub-sample of interviews as well as participant observation data. These two avenues of analysis complement one another and provide additional insight into the dynamics surround alternative grazing management, lay-expert interaction, and innovation adoption.

Preface

This thesis is an original work by Kira Dlusskaya. No part of this thesis has been previously published. The thesis received research ethics approval from the University of Alberta Research Ethics Board under the title “The Discourse of Evaluating New Information Among Alternative Beef Ranchers in the Canadian Prairies,” Pro00094895 and Pro00094895_REN1. It is also connected with the Agricultural Greenhouse Gases Program (Grazing System Effects on Carbon Sequestration & Storage, Greenhouse Gas Emissions & Biodiversity in Canadian Prairies, Pro00078581).

Dedication

This thesis is dedicated to my mother, Dr. Elena Dlusskaya, and to my grandmother, Dr. Irina Dlusskaya. You showed me where we belong.

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I would like to thank my parents for supporting my curiosity and explaining to all their scientist friends what it is that I am studying over the years. I am so lucky to have two parents who understand the academic struggle.

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Lastly, I have been in constant amazement at the wealth of experience that the ranchers who contributed to this study were willing to share with me. Thank you for digging deep and waxing philosophical with me – your time and honesty are so very appreciated. May the grass always be greener on your side of the fence.

Contents

Glossary of Terms

AMP: Adaptive Multi-Paddock Grazing

AGGP: Agricultural Greenhouse Gases Program

ANT: Actor-Network Theory

HEP: Human Exemptionalist Paradigm

NEP: New Environmental Paradigm

STS: Science and Technology Studies

Chapter 1: Introduction

What is the best way to feed ourselves? In the contemporary western context, we often rely on scientific expertise to point us in the right direction for this and other complex questions. This includes consumers, who seek out the latest in health and nutrition information and producers who seek information about the best agricultural practices. In recent decades, a multitude of sources has identified animal agriculture, particularly beef production, as undesirable for a variety of health and environmental reasons. As early as 1971, Diet for a Small Planet forcefully made the argument that beef was the single worst food for humans and devastating in its environmental impacts (Lappé, 1971). Such claims were later supported by the Food and Agriculture Organization (FAO) of the United Nations in the 2006 report entitled Livestock's Long Shadow (Steinfeld et al., 2006). Faced with such high-level criticism, the beef industry went on the defensive to fight 'misinformation,' but there were some producers who were already choosing modes of animal agriculture that sought to address the concerns raised by Lappé and the FAO. Regenerative agriculture is one movement that seeks to reconcile raising and eating animals with environmental stewardship, with some proponents, such as Allan Savory, going so far as to say that without animal agriculture the climate and the planet are doomed (Savory, 1983, 2013).

In this tense discursive climate, beef producers are faced with tough choices about which sources of information to trust in order to make decisions about their day to day and long-term grazing management practices. It may be tempting to rely on science to 'take the politics out of it' and come up with 'the objective best practices,' but social research has shown that things are not so simple (e.g. de Saille, 2015; Jasanoff, 2008; Wynne, 1992, 2006). Science and

Technology Studies (STS), in particular, has forcefully made the case that science is never politically neutral (e.g. Callon, 2017; Latour, 1999; Michael, 2017; Solomon, 2008). As a qualitative study rooted primarily in constructivist social theory and STS, the purpose of the present inquiry is not to check whether participants understand a 'real' definition of science as determined by a given authority, but rather to allow participants to explore what that complex term means to them based on their experiences and interpretations. In this study, I will look at how ranchers in Alberta relate to scientific information and expertise in general, asking the question *How are science, scientists, and scientific institutions perceived among alternative livestock management practitioners in the Canadian prairies?*

I have conducted a qualitative study that sought out alternative ranchers who choose practices similar to those promoted by Allan Savory's Holistic Management (HM), such as Adaptive Multi-Paddock (AMP) grazing, Management Intensive Grazing (MIG), grazing as a part of permaculture, and more. This research is part of the larger Agricultural Greenhouse Gases Program (AGGP), which sought to compare one type of high-intensity rotational grazing, AMP, with conventional grazing methods on a large number of parameters related to greenhouse gas cycling and other environmental indicators. The AGGP recruited 37 ranchers from across Alberta, Saskatchewan and Manitoba who adhered to a strict set of practices termed Adaptive Multi-Paddock (AMP) grazing using a questionnaire and then paired them with an adjacent ranch to control for weather and landscape variation. This is the largest paired study of this type to test the claims made by proponents of AMP, Holistic Management, or similar grazing systems.

Based on the socio-economic and political factors related to ranching, I limited recruitment into this smaller study to ranchers operating within Alberta, starting with AMP

ranchers who took part in the AGGP study and then expanding recruitment to a total of twenty ranchers who made decisions on their operations. Ranchers were included in the study based on the self-identification as 'alternative' in some way, though determining the extent to which their practices were similar to or different from the average Alberta ranch was not in the scope of a social science inquiry. As Chapter 4 will show, there was a measure of diversity within this group as well, and it is the extent to which the ranchers feel alternative that makes a difference in their responses, which is why this term is helpful in discussing the study findings. The majority of data collection took place during the spring of 2020 as COVID restrictions came into effect. Eighteen interviews were conducted, transcribed, and analyzed inductively using NVivo12. The results of these interviews, as well as participant observation at the 2019 Western Canada Conference on Soil Health and Grazing, inform the findings of this study and aim to contribute to the AGGP by providing additional insights into a group of practitioners who would potentially benefit from that project's findings.

This chapter (Chapter 1: Introduction) provides some background on the beef industry in the Alberta context as well as the scientific and public debates surrounding alternative grazing management practices. Chapter 2: Literature Review will deal with the literature related to range management, trust, expertise, and the lay-expert divide as it relates to scientific communication. Chapter 3: Methods explains in detail how participants were recruited, and how the data were collected and analyzed. Chapter 4: Findings Based on Inductive Analysis presents the findings of the inductive qualitative data analysis, the major themes that arose from the data, and their implications. Chapter 5: Actor-Network Analysis takes on a more theoretical approach to the study findings by undertaking to trace associations in alternative ranching systems and following the history of the interessement of ranchers by Holistic Management in Alberta. Chapter 6:

Conclusion ties these two avenues of analysis together and explores their implications for scientists and policy makers. Also included in the last chapter is a reflection on the study as a whole, limitations, and recommendations for future research.

Beef production in Alberta, Canada

Alberta is the westernmost of the prairie provinces, with an area of 662, 000 km^2 and a population of 4.4 million people, most of whom live in the two major urban centres of Calgary and Edmonton (Statistics Canada, 2017, 2021a). The province is comprised of multiple ecological biomes, including the Rocky Mountains and foothills, boreal forest, aspen parkland, desert, and grassland ecosystems. Its largest industries include oil and gas extraction and processing, as well as agriculture and associated industries. Alberta contains over 40, 600 farms, which cover 50.3 million acres[1] (Statistics Canada, 2017). Despite the increasing amount of land under agriculture in the province, the number of individual farms has been steadily declining since the 1940's, while the average farm size has increased. As of the 2016 census, the two largest categories of farming in the province were oil and seed cropping (13,451 operations) and cattle ranching and farming (12,693 operations) (Statistics Canada, 2021b). Furthermore, Alberta is home to the largest beef cattle herd in Canada by far, with approximately 40% of all beef cattle in the country being raised there.

The beef sector in Alberta was significantly affected by the outbreaks of COVID-19 in major meat processing plants. Although there are 22 large beef processing plants across Canada, three of these account for more than 85% of the country's total processing capacity, and two of them are located in Alberta. Both of these reported COVID-19 outbreaks and had to shut down at

[1] Equivalent to 203, 557 km^2, or 30.7% of the province's total area.

some point during the pandemic, highlighting the vulnerability of the processing sector (Powell, 2020). The global effects of transportation restrictions and bottlenecks, volatile demand, and unpredictable labour availability also impacted beef producers in Alberta, who received lower prices for their cattle even as consumers paid more for beef at the grocery store (OECD, 2020; Powell, 2020). It was in the midst of these market upheavals that I conducted the interviews that form the basis for this study.

The beef in beef production

Food, and meat consumption in particular, is consistently connected to morality, both in religious and secular terms. Whether it is enshrined in divine teachings, as in the Abrahamic faiths, or part of an Indigenous way of relating to the land, or part of the discourse surrounding ethical behaviour in light of global climate change, how we obtain, process, and consume our food is closely linked with 'good' behaviour and righteousness. Is it any surprise, then, that the beef industry has come under such scrutiny from environmental activists, ethicists, and governments? The United Nations' Food and Agriculture Organization's report entitled Livestock's Long Shadow (Steinfeld et al., 2006) encapsulates the environmental standpoint that eating meat is bad for the planet. Of course, the report did not create this notion, but it cemented it in the most official of places – the UN. This generalized and global frame has been much critiqued in recent scholarship (e.g. Katz-Rosene & Martin, 2020), but the mainstream media has certainly picked up on the idea, and many 'top 10' lists of positive steps to help the environment contain some reference to reducing meat consumption.

At the same time, the global agri-food system is undergoing progressive 'meatification' as the demand for meat is rising in developing countries and remains high in developed countries (Weis, 2020). Although non-meat protein alternatives are gaining popularity, sustainable meat

production is a priority for any country whose economy relies on animal agriculture. Canada is a major world producer of beef in particular, and the province of Alberta is home to a significant portion of beef operations. Beef is a major part of the province's landscape and identity, with 'I heart Alberta beef' bumper stickers and the Calgary Stampede as just two salient examples. The deep-seated importance of beef to the province provides a strong economic and cultural impetus to protect the industry, and its environmental profile is key to its image.

The 'greening' of Alberta beef has been a priority for government, industry, and academic research, as evidenced by the recent appointment of a Chair in Beef Production Systems funded by the Beef Cattle Research Council (BCRC) and the Hays family with the goal of increasing "economic, environmental, and social sustainability of Canadian beef production," funded to the tune of $2.5 million (*BCRC-Hays Chair in Beef Production Systems: Investment in Beef Production Research Expertise*, 2021). This position is only the latest addition to a strong beef research program at the university. In addition to the academic focus on improvement, industry organizations such as the Alberta Beef Producers Association promote the message that Alberta beef has always been sustainable and healthy (Alberta Beef Producers, n.d.). However, despite the mainstream industry's message that all Alberta beef is healthy and good for the environment, alternative beef production methods have long attracted some Alberta ranchers.

In 2013, Allan Savory presented a talk at the world-famous TED conference that proposed a radical and, to some, counterintuitive way of addressing two major global problems: desertification and climate change (Savory, 2013). Savory is a grazing management consultant and he claimed that by strategically applying his way of managing grazing animals on the landscape, we could have our steak and eat it, too. By mimicking the natural movement of large herds of animals across the grasslands, we could increase the amount of protein available in the

diet as well as drastically improve ecosystem health and carbon sequestration. Animals were to be moved across the landscape swiftly in dense herds, using herding or fencing, instead of the typical approach of leaving them to roam on a large pasture for the duration of the grazing season. This method is so effective, says Savory, that we could reverse climate change and sequester enough carbon to take the levels down to pre-industrial levels. What an incredible proposal!

Indeed, the proposal's credibility was called into question shortly after the talk was released and revived a debate that had been going on for decades in the grazing management community about the best ways to manage livestock and agricultural systems. The commonsense wisdom of grazing management indicates that it is the stocking rate that most affects range and pasture health – the more animals are on a given piece of pasture, the worse off it is. Savory addressed this notion in the TED talk in dramatic fashion by recounting his experience as an advisor in Zambia in the 1960's who was attempting to address desertification by first ordering the displacement of local nomadic populations, and then by (successfully) recommending the culling of 40,000 elephants, with tragic results. These actions were completely ineffective in reversing the desertification problem. While nobody was advocating for the culling of elephants in 2013, limiting the number of cattle on the landscape was seen as a way to reduce negative impact on the ecosystem. Major academic reviews of the literature seemed to indicate that it was stocking rate and not management style that had the most impact on ecosystem health (D. Briske et al., 2008, 2011; D. D. Briske, Bestelmeyer, et al., 2014; Byrnes et al., 2018; di Virgilio et al., 2019). Furthermore, study after study did not find any measurable benefits for fast rotational grazing systems such as Adaptive Multi-Paddock (AMP) grazing and Holistic Management (Garnett et al., 2017; Nordborg & Roos, 2016).

Nevertheless, practicing ranchers and some researchers continue to advocate for versions of the system proposed by Savory. They cite a variety of arguments for why the conventional studies fail to validate the claims made by these systems regarding environmental outcomes. These critiques follow two main lines of argumentation: firstly, the scientific studies oversimplify the system and therefore do not apply it correctly, and secondly, they fail to account for the experience of the rancher and socio-economic aspects of the system. In essence, the studies are not testing the grazing management systems as they are applied on real operations that use them. Furthermore, the argument goes, you cannot argue with results. The results in question are typically evidenced by visual assessments of range health[2] and the perceptions of ranchers.

One published account by a practicing beef rancher who adheres to HM practices, Sheldon Frith (Frith, 2020) presented in Green Meat? Sustaining Animals, Eaters, and the Planet (R. Katz-Rosene & Martin, 2020) as Chapter 5: The Evidence for Holistic Planned Grazing, takes this argument on in detail. As with other authors who have written in support of alternative grazing practices, the benefits observed are not exclusively, or even primarily, ecological. Frith readily admits that scientific support for the ecological benefits of what he terms Management-Intensive Grazing or Holistic Planned Grazing is scarce. However, this is far outweighed in his account by the plentiful anecdotal evidence of improved livelihoods and autonomy for ranchers and pastoralists around the world, and beautiful photographs that showcase HPG pastures side-by-side with neighbouring land. This effect is described as 'propagandization' (Heiberg & Syse,

[2] A representative sample of visuals can be found at www.holisticmanagement.ca.

2020) and broadly echoes other proponents of HM and similar practices, who tout its socio-economic and psychological benefits (Mann et al., 2019; Sherren et al., 2010, 2012).

The general argument presented by Frith (2020) is that although there may be scientific debate about the details, there is enough anecdotal, experiential, and experimental evidence to conclude that large-scale adoption of HPG or similar agricultural strategies would be good for the environment and producers, as well as provide consumers with a high-quality protein source. He seeks to provide both anecdotal evidence and the few examples of peer-reviewed studies that have been published in support of these types of grazing systems. The reason for the paucity of scientific evidence, he argues, is that it is difficult to control for the multitude of variables present in a complex and adaptive system, so the science is simply lagging behind. Anyone who tried HPG or similar practices swears by them, and so they must meet those ranchers' needs. The argument is a compelling one, though it is vulnerable to critiques regarding fallacies along the lines of survivor bias and 'majority rule,' or 'since everyone agrees, it must be true.'

The argument is that much more compelling for some, since it is put forward by a practicing rancher, not someone who studies the practice in theory, from an academic perspective and does not have 'skin in the game'. In some ways, that distinction may prove to be the most salient of all, as ranchers rally around a method that was developed on the ground by other ranchers and subject to real time economic, environmental, and social pressures. Allan Savory may be debated in the academic journals, and his claims soundly refuted by some, but it is up to ranchers to vote with their time and money for the system that seems most promising to them. That is why it is crucial for scientific studies to take ranchers' experience into account, since it will determine the ultimate impact of the research findings.

Conclusion

Beef producers in Alberta use a variety of approaches to grazing management that make sense for their unique operation, and these choices have a significant impact on the ecosystems around them. The large number of cattle operations in the province leads to a substantial cumulative impact on the environment, and so improving range health through best practices makes a difference at the local, regional, and global level. However, the debate surrounding the efficacy of various practices in improving pasture health and productivity makes these decisions challenging, especially as producers continue to experience economic pressures from market volatility and input costs.

The broader argument about beef essentially boils down to 'beef production is all bad' (vegetarian) vs. 'beef production is already sustainable' (conventional industry) vs. 'it's not the cow, it's the how' (alternative meat production). On all sides of this dilemma, scientific publications and discourses are mobilized to legitimize adopting or discontinuing a given practice, such as hormone use, grain finishing, or raising beef cattle at all. This study explores the perspectives of alternative beef ranchers as they navigate this murky discursive landscape to make decisions that impact their very real agricultural landscape. Through in-depth, open-ended interviews the ranchers considered how they interact with scientific and other information related to grazing management, shedding light on complex themes surrounding (dis)trust, identity, and ontology. With their valuable contribution and guidance, this study seeks to clarify the alternative producer's perspective on grazing management, science, and Nature.

Chapter 2 – Literature Review

Introduction

This study relies on a variety of disciplines for explanatory power, including political science, Science and Technology Studies (STS), Actor-Network Theory (ANT), and psychology, however, it is primarily rooted in the field of environmental sociology. The questions asked of the study participants touched on their relationship with science and expertise, but also on their ontology and epistemology, or ways of being in and knowing the world. Consequently, it is important to situate the findings of the study in the environmental sociological literature related to worldview, as well as the conversation around expertise and lay-expert interaction. However, since the subject of inquiry closely relates to the debates surrounding grazing management practices, especially alternative grazing management systems such as Holistic Management, a brief overview of the pertinent literature is included to contextualize the study. Although ANT-based analysis will comprise part of the present study, this literature is not discussed in this chapter and has instead been included in Chapter 5 for clarity.

The current chapter will correspond primarily with the analytical sections in Chapter 4: Findings Based on Inductive Analysis, however, the corresponding sections are not in the same order. I will begin by describing the state of range science in which the debates surrounding best grazing management practices take place. This brief outline will help situate the conversations that transpired during the interviews, as well as the controversy around Allan Savory's TED talk, which will be covered in more detail in Chapter 5. In the following section I will address the topic off the Human Exemptionalism Paradigm (HEP) and the New Environmental Paradigm (NEP), as well as the NEP scale. This established pair of concepts will serve to introduce the field of environmental sociology as well as to provide a context for the final section of Chapter 4

which looks at the relationship between humans and Nature in the study data. The next and final section will introduce the various ways publics have interacted with science, starting with the crucial role scientific reasoning played in the history of the West in North America, the region where this study was situated. After this historical background of the roles of science, I will introduce literature related to the various ways trust and trustworthiness have been conceptualized in social sciences. The final subsection will focus on studies that analyze lay-expert interaction, especially as this relates to environmental expertise and agricultural lay publics.

Grazing Management and Sustainability

The subject of the environmental sustainability of animal agriculture is central to the questions asked in the present study. Is it possible to raise animals for human consumption in an environmentally sustainable, or even regenerative, way or not? And if we are to continue to eat animals, what are the best practices we need to follow? When it comes to raising beef cattle on pasture, as the participants of this study choose to do, the field most concerned with best practices is range management, though many disciplines add valuable insights. It is not within the scope of this study to provide a full overview of this extensive field, but the recent debates surrounding rotational grazing systems provide a starting point for exploring the way study participants experience science and scientists, as well as scientific uncertainty.

As the history of European cattle farming in Western North America stretched to 100 years in the late twentieth century, several retrospective studies were published about the best practices that have been established over that time. These retrospectives concluded that light to moderate grazing intensity is best, based on decades of past research (D. Briske et al., 2008; Holechek et al., 1999). This approach relies on limiting the number of cattle who have access to

the pasture and relying on large grazing areas to prevent overgrazing and pasture deterioration, whether that involves continuous or rotational grazing. Under continuous grazing, cattle have access to the same relatively large grazing area throughout the whole grazing season. When managed in this way, cattle will repeatedly graze desirable plant species, which can lead to high weight gains per animal in the short term, but result in the deterioration of soils and increase in weed species over time (Bailey et al., 2010). Rotational grazing involves moving the cattle between pastures throughout the grazing season and describes a great variety of management practices and moving frequencies. Some ranchers move cattle as infrequently as once or twice per grazing season, while some high-intensity rotational grazing systems require daily moves. Slow rotational grazing, with a handful of cattle moves per season has received scientific support from studies indicating that allowing pastures to rest aids with pasture regeneration and ecosystem health (Popp et al., 2004; W. R. Teague & Dowhower, 2003), and this method has been generally accepted into the conventional grazing management literature (D. Briske et al., 2011; Byrnes et al., 2018; McWilliams, 2013; Roche et al., 2015; Wilmer et al., 2018). High-intensity rotational grazing, on the other hand, has remained a contested area of research that has drawn attention from both fervent supporters and staunch critics. It is within this fraught context that ranchers make grazing management decisions.

Since the 1950's, alternative grazing approaches have been advocated and tested in Europe and elsewhere. The earliest source typically cited by alternative grazing practitioners is André Voisin, a French biochemist and farmer, who published several books promoting what (in English) was coined Rational Grazing. This system entails more frequent moves than previous grazing management recommendations (Lecomte & Voisin, 2014 [1958]; Voisin, 1959, 1988[1957]). From the early days, alternative grazing management was about more than just

agricultural production. Early authors such as Wendell Berry (Berry, 2002; Peters, 2007; Smith, 2003) and Aldo Leopold (Knight & Riedel, 2002; Meine & Knight, 2006) inspired agroecological movements throughout North America and beyond. For instance, the theories and practices that constitute the permaculture movement hearken to the environmental ethics proposed by Berry and Leopold, among others (Holmgren, 2002; Mollison, 1990). As Chapter 4 will show, these thinkers are still valued by alternative grazing practitioners.

Within this context, Holistic Management (HM) entered the scene in North America in the 1970's and landed on fertile ground. HM is not simply a grazing management system but rather a decision-making framework that incorporates economic, ethical, environmental, and social considerations (Savory & Butterfield, 1999). The framework advocates for a holistic perspective (thus the name), which is linked with systems thinking (Mann et al., 2019) and mimicking nature to optimize ecosystem health and increase productivity (Butterfield et al., 2006; Savory, 1983; Savory & Parsons, 1980). Typically, an HM operation would entail cattle moves as frequent as once per day but ranging up to a week or more depending on environmental conditions, weather, landscape attributes, and other considerations. Cattle are moved in tight herds to maximize herd effect, which is meant to mimic the way herds of wild herbivores move across open grasslands in search of food and to avoid predation (Savory, 2013). Adaptive management, which changes based on environmental and other parameters, is an inherent attribute of the system, and this can make defining what is and is not HM a challenge for researchers. According to Savory, the main originator of the system (also called the Savory Method, especially in early publications), this adaptive approach and mimicking nature has substantial positive effects on the landscape, including reversing desertification and allowing

ranchers to substantially increase the number of cattle on their operation (Estabrook, 2018; Savory, 2013).

As alternative systems making substantial claims tend to do, Savory's Holistic Management approach has had a polarizing effect on range management literature (Sherren & Kent, 2019). Savory has argued from the start that conventional grazing management expertise is flawed, and he expressed in no uncertain terms his conviction that his method is the correct one for supporting grassland health (Savory, 1983; Savory & Butterfield, 1999; Savory & Parsons, 1980). He has remained remarkably consistent in his arguments since then and has drawn the criticism of the scientific community over the years. Recently, the fantastic claims that he made in his 2013 TED talk (Savory, 2013) renewed the debate surrounding HM. As mentioned earlier, the adaptive and responsive nature of the HM practices has posed significant challenges to researchers hoping to systematically evaluate the approach and compare it to other grazing management systems (e.g. R. Teague & Barnes, 2017).[3] Another difficulty is the multiple names and method combinations used by ranchers, meaning that there is a very limited number of 'pure' HM operations. As a result, the study samples tended to be small, or demarcated the management practice in some way other than HM, such as high-frequency rotational grazing, Adaptive Multi-Paddock (AMP) grazing, mob grazing, and more. The present study is no exception, with participants self-identifying as HM, AMP, permaculture, mob grazing, and other alternative affiliations, though rigorous screening processes were used to recruit participants with similar on the ground practices.

[3] This is the main issue which was successfully addressed by the AGGP study at the University of Alberta through innovative sampling design.

Partly as a result of this ambiguity, comparing the different studies attempting to verify the effectiveness of alternative grazing methods is also challenging. However, several meta-analyses have been attempted (D. Briske et al., 2008, 2011; D. D. Briske, Bestelmeyer, et al., 2014; Carter et al., 2014; Nordborg & Roos, 2016). These studies tend to find that these alternative grazing systems present no measurable benefits to using HM or similar systems over soundly managed continuous or slow rotation systems. Some of the authors have resorted to strong words against the continued use and promotion of these systems despite the lack of scientific support (D. D. Briske, Ash, et al., 2014; D. D. Briske, Bestelmeyer, et al., 2014; Carter et al., 2014). Notably, the studies used in these critical meta-analyses struggled to incorporate the adaptive nature of the grazing management recommendations, relying on consistent timed moves (e.g. every two days or every three days) (D. Briske et al., 2008). This feature has left studies that seem to refute the claims of HM open to criticism from scholars and practitioners who emphasize the adaptive nature of these alternative systems (Frith, 2020; Mann et al., 2019; Mann & Sherren, 2018; Sherren et al., 2010; Sherren & Kent, 2019; Stevens, 2008). However, the challenges in identifying and recruiting sufficient samples of alternative ranching operations whose practices render them comparable for research purposes, as well as collecting the relevant environmental data has resulted in a limited number of studies to date (Frith, 2020; Sherren et al., 2010, 2012; R. Teague et al., 2013; R. Teague & Barnes, 2017). The present study (funded by the Agricultural Greenhouse Gases Program or AGGP) being conducted through the University of Alberta is unique in its relatively large number of participants and geographic range (37 ranch pairs across Alberta, Saskatchewan, and Manitoba).

The AGGP is a large-scale project that aims to evaluate a wide variety of environmental indicators, and well as economic and social dimensions, of Adaptive Multi-Paddock (AMP)

grazing, a category of alternative grazing management that relies on fast cattle moves through small paddocks, typically created using a mixture of permanent and electric fencing. The project's primary focus on agricultural greenhouse gases (GHGs) follows a line of inquiry that is related to global carbon sequestration and emission reduction efforts. Carbon sequestration can be accomplished in a variety of ways, the most straightforward of which to measure is the technique of pumping carbon dioxide underground into sealed caverns for long-term storage (Sexton & McKaskle, 2012). This approach allows for a simple measurement of how many tons of GHGs were pumped underground. Other approaches to sequestration are more difficult to track since they rely on the concept of additionality. Additionality requires demonstrating that there is 'additional' GHG sequestration as the result of an intervention, which involves calculating the differences between projected and actual emissions or carbon present in the soil. This method is by its nature somewhat uncertain, because it is impossible to measure something that has been averted, such as emissions that would have happened without an intervention (Dhanda & Hartman, 2011; Machaqueiro, 2017). However, predictive statistical models have been shown to be sufficiently accurate, prompting the rise of a multitude of carbon trading markets where private and public actors can purchase carbon credits and emission offsets (e.g. Carbon Fund, n.d.; Verra, n.d.). Specifically related to grazing systems in North America, a project in Montana aims to develop a practice-based (as opposed to outcome-based) program to pay ranchers for carbon sequestration (WSE, n.d.), using another verified carbon credit provider (Native, n.d.). Finally, a protocol has been developed by the Climate Action Reserve specifically for the Canadian grasslands and includes plans for a tool to facilitate carbon sequestration tonnage (Climate Action Reserve, 2019), and this protocol draws on studies like the one conducted by the AGGP for its recommendations.

The AGGP can inform these types of initiatives by providing additional research data to determine the sequestration potential of specific grazing management practices. By using sophisticated measurement techniques, the AGGP aimed to shed light onto the potential for AMP to demonstrate additionality for the purpose of carbon trading, among other goals. The project has resulted in several publications to date, some of which indicate that AMP does provide some benefits to pasture health after all (Bork et al., 2021; Shrestha et al., 2020), while others do not conclusively show the same benefits in the field as in laboratory experiments (Ma et al., 2021). One notable finding was that water infiltration rates on AMP managed pastures were superior to conventionally managed pastures (Döbert et al., 2021). Overall, it appears that the project has contributed valuable findings and data to the literature on grazing management, but by no means decisively resolved the debate about the effectiveness of alternative grazing management practices.

HEP, NEP, and Agricultural Producers

Traditional sociology has sought to systematically explore the way society is organized, with a focus on human behaviour and interaction. The concomitant assumption that humans are exempt from natural limits is a major component of the modernist worldview. Through continued progress, the narrative goes, humans can overcome natural limits and shape the physical world to suit our needs. Just as technological progress in transportation or manufacturing has helped us overcome limits in speed and productivity, social progress can continue to improve society so that we are not subject to the cruelties and discomforts of natural phenomena. This view is termed the Human Exemptionalism Paradigm, or HEP (Dunlap & Van Liere, 1978; Foster, 2012). Since the post-modern turn in particular, this paradigm has meant a

virtually complete exclusion of biophysical explanations for human behaviour, as the constructivist focus on how we create and co-create our realities has come to dominate the field.

Environmental sociology as a field developed out of a desire to reintegrate the natural world into the study of society. Though forays in this direction took place since the early years of sociology and also spawned fields of study such as human geography and human ecology, the field of environmental sociology in particular gained traction starting in the 1970's, as the environmental crisis was brought to the public consciousness by breakthrough books such as Silent Spring (Carson, 2003[1962]) and the countercultural movements of the 1960's. Natural limits seemed to be asserting themselves. In the Unites States, environmentalist social movements pushed the fragility of the environment and natural limits into the public consciousness, though one significant impact of this was to galvanize conservative opposition to these movements in defense of what Pirages and Ehrlich (1974) termed the Dominant Social Paradigm (DSP), a concept very similar to HEP. Throughout the 1980's environmental programs and funding for environmentally-oriented sociology was cut and progress stalled until the 1990's, when renewed awareness of environmental problems on a global scale and a changing political climate led to a consolidation of the field (Dunlap, 2008; Dunlap & Catton, 1994).

One of the key concepts Dunlap and his colleagues had introduced to the field of sociology that pushed it towards an environmental focus was the New Environmental Paradigm (NEP) Scale (Dunlap, 2008; Dunlap et al., 2000). This scale is comprised of a set of Likert-type questions (measuring agreement and disagreement with a statement) that fall into three assessment categories: "existence of ecological limits to growth, importance of maintaining the balance of nature, and rejection of the anthropocentric notion that nature exists primarily for human use." (Dunlap, 2008). The scale in all of its iterations is used primarily in quantitative

studies and has shown impressive internal consistency and applicability across populations and countries (Dunlap, 2008; Hawcroft & Milfont, 2010). In Canada, the NEP scale was used in a Saskatchewan study which measured pro-environmental attitudes among conventional and organic crop farmers, finding that organic farmers tended to express more NEP attitudes than conventional farmers, but also indicating that the majority of farmers are adopting alternative practices piecemeal (Abaidoo & Dickinson, 2002). Furthermore, a study using the NEP scale in Mexico indicated that although farmers were interested in sustainability, they preferred mechanical efficiency to 'going back to nature' (Orduño Torres et al., 2020). These findings indicate that a more in-depth, qualitative approach may be needed to fully explore the ways in which farmers express attitudes related to NEP, and what attracts them to pro-environmental practices.

One theory that has been proposed to explain the attractiveness of alternative grazing practices such as Holistic Management is repeasantization theory (Heiberg & Syse, 2020; van der Ploeg, 2018), which proposes the distinction between three types of agricultural production, not limited to animal agriculture. The first, capitalist agriculture, seeks efficiencies of scale through the commodification of agricultural production and labour and aims to increase agricultural production through expanding the land base used for operations; this type of agriculture corresponds to the corporate model of conventional agriculture. Entrepreneurial agriculture is speculative in nature and seeks to increase profits from agricultural production through the use of technology to the exclusion of agricultural labour and is also represented to some extent in modern industrial agriculture. Peasant agriculture, on the other hand, is distinct because it relies on 'economies of scope' for long-term profitability rather than economies of scale and is defined by increased autonomy for agricultural producers (van der Ploeg, 2018).

Intensive grazing systems that seek to increase per-acre production while maintaining ecological resilience fit well within this theoretical framework, and the attraction of increased autonomy is one logical reason for producers to pursue alternative practices and opt out of the conventional agro-economic system.

Notably, Heiberg and Syse (2020) conducted a series of in-depth interviews about what they termed Management-Intensive Grazing (MIG) with alternative beef producers in Alberta and relied on repeasantization theory to explain how these producers have created successful businesses using this alternative production model. Published in the Journal of Organic Agriculture, their study asked ranchers about their reasons for choosing MIG as well as several general questions about their operation. It was clear from their findings that ranchers felt more in control of their farm operation due to the reduced reliance on synthetic inputs and the ability to market a differentiated product such as grass-finished, natural, or organic beef (Heiberg & Syse, 2020). However, the study took for granted certain outcomes, terms, and definitions, likely in connection to the Journal's overall stance in support of Organic Agriculture. The efficacy of MIG at improving overall ecosystem health and productivity was taken for granted, making only a brief reference to the controversy surrounding Allan Savory as a polarizing public figure. Furthermore, terms such as 'natural' were used without a clear explanation of what is involved. The scope and focus of that study did not include an exploration of these themes but formed a key area of inquiry in the present study.

Another framework which has been proposed to explain the adoption of various practices by farmers is identity theory, which posits that individuals in a society are motivated to create and protect a positive self-identity (P. J. Burke & Stets, 2009; Rodriguez, 2019). Identity theory has been applied to agricultural producers in a variety of ways that relate to environmental

practice adoption (J. Burke & Running, 2019), some of which also incorporate theories related to innovation adoption. In particular, the theory of planned behaviour has shown some consistency with identity theory in studies related to environmental innovation in agriculture (Burton, 2021; Fielding et al., 2008). Like the NEP scale, however, these studies primarily rely on quantitative methods, though J. Burke and Running (2019) also incorporated interviews in their research. Based on their findings, it appears that crop farmers have a strong in-group identity and "see themselves as good farmers and good environmental stewards," having put some pro-environmental adaptations into practice on their operations (J. Burke & Running, 2019, p. 3). This self-identification as a 'good farmer' is further explored by Burton (2019), who traces the history of this positive identity term (in English) from its early roots to present day. Especially interesting in the context of the present study are the changing qualities of what makes a farmer 'good,' which range from early notions of citizenship and godliness to modern notions of 'tidiness' and technological efficiency, to the present imperative to feed far-off populations. As Chapter 4 will show, alternative ranchers view the conventional notions of a 'good farmer' is with some skepticism while constructing their own positive self-identity.

Sciences and Publics

Science, Modernity, and How the West Was Won

The modern worldview is linked inextricably with science and the scientific method in much sociological literature; arguably, the scientific paradigm is the backbone of modernity (Szerszynski, 1996). The ethos of progress, development, and dominion over Nature fueled not only philosophical and industrial developments, but also the colonial ambitions of European empires. The desire to rationally control peoples and resources through the irrefutable logic of science contributed greatly to the westward expansion of European settlement in North America,

where this study's focus lies. This modernist ethos was most clearly illustrated in the campaign of Manifest Destiny prevalent in the United States of America, but Canadian ambitions to subdue and settle the West were also a major government agenda throughout the nineteenth and early twentieth century.

Although it is not the primary focus of this study, it is important to note the connections between scientific rationalism and the subjugation and genocide of Indigenous peoples in the Canadian prairies. An excellent resource on the Canadian history of colonial policy, especially as it relates to Indigenous health has been published by Daschuk (2013). In addition to health and food policy, the settlement of the West relied on scientific rationale to manage landscapes and make them suitable for modern life through agriculture and natural resource development, as well as transportation routes. The historical legacy of colonial land management pervades settler-Indigenous relations in the Canadian prairies (Daschuk, 2013; Kepkiewicz & Dale, 2019). It would be strange if it were otherwise, given how ingrained the disenfranchisement of Indigenous peoples was even in the exploratory stages of Western settlement. Even relatively modest and non-grandiose geologists saw Indigenous land management as a threat and nuisance while promoting systems of agriculture that sought to reshape the landscape (Bryson, 1997).

Modern industrial agriculture is one consequence of the modernist imperative to reshape the landscape to suit the needs of Western development and settlement. This notion of a command-and -control approach to ecosystems for the purpose of agriculture is central to the industrial agriculture model. Particularly with the advent of the Green Revolution after WWII and throughout the Cold War, the reliance on synthetic inputs such as fertilizers and pesticides, as well as heavy machinery, became not only an economic draw, but a moral imperative to 'feed the world' (Cullather, 2013). Although developed in a Cold War climate, this imperative still

resonates in the West, as indicated by recent studies (J. Burke & Running, 2019). Even critiques of industrial agriculture still refer to this persuasive rhetoric (Chiras et al., 2002; Stewart & Stewart, 2020). Although it has been framed as an apolitical endeavour, science has not historically been above the fray. As substantial STS literature has shown (e.g. Latour, 1999, 2008, see also Chapter 5), this is a necessary part of how science is done, and recognizing this fact is key to a healthy democracy (Swyngedouw, 2010).

And yet, despite the critical lens through which we must sometimes view scientific expertise, we rely on the tools of science to know our present world and make predictions about what comes next. Wynne, for instance, for all his qualms with the nuclear scientists in Britain after the Chernobyl accident, turns to the IPCC for reliable information and predictions about the changing climate (Wynne, 2010). Certainly, this study must also carefully walk the line, commenting on the perception of science, even skepticism regarding scientific output, avoiding the appearance of both science-denial and undue judgement of the study participants who prefer their own observations to peer-reviewed articles. Wynne strikes the right balance, calling attention to the politicization of climate science while also pointing out the urgent problems to which it draws our collective attention. He rightly notes the social factors such as political will and collective agency that go into acting on those urgent problems, though he only hints at the way forward. In a poignant final turn of phrase, he urges us to look at the "neglected human worlds and their needs, which slavish one-dimensional literalism of existing science and policy cannot yet bring itself to imagine" and to consider that "practitioners themselves are often able to [achieve more poetic ways of understanding scientific knowledge] in their own specialized and informal scientific worlds." (Wynne, 2010, p. 301) This assertion fits well with the aim of the

present study to better understand the ways in which agricultural producers, practitioners of range management, understand and mobilize scientific knowledge.

Trust, Trustworthiness, and the Information Deficit Model

In the 1990's a new kind of crisis arose in the policy sphere: it appeared that the public had begun distrusting science-based policy and scientific expertise in general. This crisis has only intensified in the 21st century, as some have argued we have entered an era of post-truth (Baron, 2018; Visvizi & Lytras, 2019). However, as Wynne and others have argued, supported by a chorus of critical theorists, perhaps the public has a good reason for that. Wynne also further problematized this 'crisis' by pointing out that the idea that publics had previously unquestioningly trusted science is not supported by evidence (Wynne, 1996). Perhaps it is not that the distrust is new, but the institutional awareness of this distrust and the increased opportunity to pursue alternatives to prescriptive scientific authority: the democratization of expertise. In the age of climate change denialism and anti-vaxxers, the discussion about those who reject science or scientific research often frames these individuals and groups as wrong in their beliefs (Swyngedouw, 2010). This is an important social conversation. However, it is far too simple to assume that those who reject scientific findings are always in the wrong. Thinking more broadly, one finds that denying scientific claims is how the very work of science progresses (Solomon, 2008). Several distinctions must be made to clarify the issue. One distinction is whether it is the findings of scientific research being 'denied' or the scientific method itself. There is a big difference between finding issue with the way a study was conducted and claiming that an entire field of study is a hoax or conspiracy.

One popular explanation for why publics may doubt, deny, or mistrust science is the information deficit model, which posits that lay publics lack the information necessary to

understand and therefore trust experts; if the publics had more information, knowledge, or understanding about the matter at hand, they would agree with the experts or scientists. This theory has been refuted and problematized extensively (e.g. Dietz, 2013; Slovic, 1987; Williams & Macnaghten, 2019), but it is an intuitive one and carries explanatory power in some situations, leading it to persist in the policy and scientific communication spheres. As Williams and McNaghten (2019) point out, it can be better understood as a plurality of deficit models, in which the important question to ask is 'Who is said to lack what?' When framed in this way, the model(s) may have some use, and the concept of *institutional* deficit, proposed by STS scholars, can shed light on the causes of public (dis)trust. Lack of public trust in science as a simple case of an information deficit has long been shown to be inaccurate, yet 'informing' the 'public' is still seen as an effective way to fix societal ills. Both the idea of a single, homogeneous 'public' and casting the 'public' as ignorant and passive, or worse, dangerous, does not support the implementation of best practices. This is especially important when the stakes of implementation (or not) are high, such as with environmental stewardship and climate change mitigation (Turnhout & Gieryn, 2019; Williams & Macnaghten, 2019).

Science has a major role in knowledge creation in modern and contemporary society, and so it is framed as common sense to trust science, scientists, and scientific institutions. As recent scholarship indicates, trust may mean different things to different people in different contexts (Hardin, 2006; Resnick et al., 2015). Trust seems to be comprised of a variety of expectations that one actor has for another, such as believing that actor has the "right intentions" towards them, or will behave in a desirable way, which essentially creates a tautological loop: trust is the perception of trustworthiness (Hardin, 2006, p. 17). For the purposes of the analysis, it is then appropriate to distinguish 'trust' as something that is perceived by the subject, while

‘trustworthiness’ is a presumed quality of the object within a given relationship. In a simple decision matrix, trust is only a sound decision if the source is also trustworthy. And as Cook et al. put it:

> “Trust is most likely to emerge in contexts in which the parties find themselves in ongoing relationships. […] In many settings, unequal power may make it nearly impossible for the more powerful to convince the less powerful of the credibility of their trustworthiness. Yet when the relationship becomes personal and long-lived, trustworthiness may develop.” (Cook et al., 2005)

Trust implies the perception that the source is trustworthy, but it is important to disaggregate the two, since perception may or may not be accurate. This definition also highlights the importance of power differentials to the trust relationship. According to a line of analysis of public trust in science within psychology, the public evaluate the persuasiveness of a given source based on likeability, trustworthiness, expertise, and power (Kelman, 1958), though these four concepts have some overlap. In this context, trustworthiness indicates the source’s “intent to communicate truthfully” and expertise is “the source’s knowledge and training on the relevant topic” (Wallace et al., 2020).

Being context-dependent, seeking out evidence to verify the trustworthiness of a source would also logically be influenced by the riskiness of a given trust decision: the more risk is involved, the more important it is to verify trustworthiness. That is to say, the riskier the situation, the more implicit trust is reduced (Resnick et al., 2015). In lower risk situations, there is less motivation to question trustworthiness (Cook et al., 2005; Hardin, 2006; Sligo & Massey, 2007). The present study looks at trust in a context that can encompass a range of risk levels, as

ranchers make trust decisions that relate to their livelihood. In discussing risk and decision making, it is important to keep in mind the different ways in which experts and laypersons define and evaluate environmental risk, for example. While scientific and statistical models for risk assessment can provide precise evaluations, these do not necessarily encompass all of the ways in which laypersons experience and evaluate the same situations (Slovic, 1987; Wang et al., 2020).

Environmental risk is a common subject for scholars examining lay-expert interaction, and it has been examined from a wide variety of perspectives. The strong objectivist tradition of environmental risk analysis defines risk analysis as, for example, "a body of knowledge (methodology) that evaluates and derives a probability of an adverse effect of an agent (chemical, physical, or other), industrial process, technology, or natural process" (Molak, 1997, p. 1). However, even this volume grudgingly admits that 'risk' and 'adverse effect' are value judgements, and recent scholarship has been concerned with "vaguely defined terms such as 'quality of life' and 'sense of community'" (Molak, 1997, pp. 1–2). As indicated by Slovic (1987), however, it is precisely these factors and not necessarily the unidimensional metrics of annual deaths or life expectancy reduction per hour of exposure that matter to publics. Failure by publics to agree with objectivist experts on the matter of risk then becomes an issue of informing the public with more vigour about the objectivist calculation of risks. More recent literature indicates that these metrics continue to be in use (Kathleen et al., 2006), even as social scientists publish persuasive studies advocating for a more comprehensive consideration of publics than a simple information deficit approach (Tom et al., 1997).

Another aspect of risk and risk expertise is the potentially changing nature of the environmental risks we experience. Ulrich Beck made a powerful argument regarding the

changing nature of modernity itself when it came to environmental risk. Although industry was promoting the notion that continuing progress was reducing risks over time, leading to a potentially 'risk-free society', it was not actually removing risks but merely transforming them from acute, visible ones to diffuse ones that were more difficult to measure and control (Beck, 1989). For example, individual accidents or spills are overshadowed by the risks of ambient and chronic pollution, or carbon dioxide accumulation. Consequently, the distribution and pervasiveness of risk makes risk avoidance the chief preoccupation of society (Beck, 1992). Although Beck has been much critiqued for overlooking the unequal distribution of risk (e.g. Tom et al., 1997), the concept of diffuse risks that are difficult to block out and pervade the public consciousness is extremely relevant to the present study, since these are the types of risks participants (and scholars) ascribe to industrial agriculture. As experts struggle to define, measure, and communicate the risks associated with agricultural inputs, lay publics may understandably lose trust in their proclamations and institutions.

The Shifting Lay-Expert Divide

Although we frequently take the terms for granted, identifying who 'counts' as an expert and who is a lay person is a complex and often unconscious process. In concrete case studies, as with Wynne's (1992, 1996) nuclear scientists and with Callon's (1984) marine biologists, the distinction at first appears clear-cut. Experts are those highly educated individuals who conduct research and speak on behalf of others from a position of intellectual authority, typically affiliated with an institution such as a university. However, even in these examples what appears clear soon becomes muddled. 'Expertise' is shown to be a leaky construct, and who has more of it is a contested issue. For instance, Wynne's Cumbrian sheep farmers certainly had expert knowledge of their flocks, and Callon's scallops declined to cooperate with the scientists' expert

suggestions, undermining their authority. These are simplified and distilled narratives, yet even here expertise is a murky and context-specific concept.

Expertise is an elusive concept that tends to be context-specific, but certain positions and attributes such as professional affiliation, education type and level, and amount of experience in a certain field come together, such that some individuals are considered experts. Scientific experts typically would have advanced degrees in their discipline from an accredited institution as well as a professional affiliation with a relevant organization such as a university, government, non-governmental organization, or corporation. In the field of animal agriculture, these are certainly not the only experts, but they represent a type of expertise that resembles the lay-expert divide in Wynne's (1992, 1996) case study: educated scientists that speak with scientific authority and are frequently communicating expertise in collaboration with government bodies. In the Cumbrian case, the nuclear scientists communicated expertise related to nuclear isotopes in the soil, during a defined period of time following the Chernobyl nuclear accident. In the context of alternative grazing management practices, scientific experts come from a variety of disciplines, such as rangeland management, soil science, animal science, and more. Furthermore, their involvement is not limited to a specific incident, but is ongoing. Defining scientific expertise in this context is not straightforward, which is one of the reasons a qualitative approach that allows study participants to elaborate on their views is appropriate to address the question of how alternative ranchers relate to science and scientific expertise.

The way in which people evaluate and incorporate scientific information into their everyday lives is not as simple as following the recommendations provided by scientific consensus on a given topic. The field of inquiry into the ways publics access and evaluate scientific information has drawn the attention of social scientists, especially after the Chernobyl

nuclear accident in 1986, but has its roots deeper in the study of power, knowledge, and authority with important contributions by Michel Foucault and others (Foucault, 1994). Although scholarship about the lay-expert divide and public trust proliferates, there is far less attention paid to the way in which scientific information is taken up by professionals and practitioners.

The communication of science refers to the way in which experts communicate knowledge to lay publics and is typically conceptualized in a unidirectional way. This is an integral role of scientific institutions, if research findings are to be of use to the broader society and ranges from policy recommendations to popular publications to public engagement (Wynne, 2006). One of the ways in which science communication has been problematized is the treatment of publics, in particular populations marginalized along gender, sexuality, racial, economic, and class lines. Aspects of this history were discussed above, however, scientific communication continues to grapple with these issues. The analyses which problematize science communication and public engagement tend to focus on those excluded groups who are under-engaged or disengaged, which is presumed to be an undesirable outcome (Dawson, 2018; Levitas, 2004). Furthermore, as Levitas (2004) notes, disengaged publics are framed as having "the wrong attitudes and values, which they then pass onto their children" (p. 49). As Dawson (2014, 2018) shows, this creates a cycle of disengagement from scientific institutions such as museums and science centres, in which certain publics feel that these centres are "not designed for us" (Dawson, 2014, p. 981). As Lidskog (2008) demonstrates, disengagement and exclusion from science perpetuate inequality in environmental risk outcomes, among other things. Furthermore, broader alienation of publics from scientists and scientific institutions, in particular framing science as 'beyond politics,' has been linked to phenomena such as climate denialism (Swyngedouw, 2010). These findings corroborate what Wynne (1992, 1996, 2006, 2010)

observed in his research with rural populations; namely, that rurality and a perceived lack of expertise can lead to an alienating dynamic between agricultural producers and scientific experts. As Chapter 4 will show, this is a legacy of public engagement with science that continues to impact how producers relate to science, scientists, and scientific institutions.

In addition to 'conventional' public engagement (e.g., a panel discussion at a town hall ahead of a development proposal), a variety of approaches have arisen to communicate, develop, and implement scientific knowledge. One approach that aims to engage amateur enthusiasts in the collection of data for scientific research is citizen science. Within this approach, members of the general public who are interested in a specific subject can support research efforts, such as by documenting plant species, using standard scientific methods taught to them (Waterton, 2019). Another approach, co-management, is intended to tap into the expertise of Indigenous peoples for the purposes of managing natural resources. In this framework, which is gaining popularity in Canada, Australia, and elsewhere, an ongoing relationship is formed between Indigenous groups and government bodies, as well as scientific institutions, to collect data and monitor natural environments for sustainable use. Unlike citizens science, forms of knowledge outside of Western science are (ideally) mobilized (Berkes, 2012), though the implementation is often not without problems (Peach, 2016; Youdelis, 2016). When done well, collaboration with Indigenous knowledge-holders can contribute to reconciliation while also improving scientific findings (e.g. Liboiron et al., 2021). These developments are in line with the 'post-normal' practice of science proposed by Funtowicz and Ravetz (1993) in their foundational work, and point the way forward for bridging the lay-expert divide.

Conclusion

This study aims to explore a complex relationship between alternative grazing management practitioners and scientific expertise. It is therefore necessary to draw on several literatures to situate the inquiry and analysis. Firstly, a loose scientific consensus about best practices in range management points to slow rotational grazing and low to moderate stocking rates as an optimal system, though it is a lively discipline with new findings emerging all the time. At the same time a decades-long history of alternative grazing management recommendations exists, which draws in philosophical as well as environmental considerations. Secondly, since agricultural producers interact closely with large areas of land, including plants and animals, soils, and more, environmental sociology literature pertaining to the NEP sheds light on the way producers relate to their environment. Lastly, as the final three sections show, the relationships between experts and publics have been fraught for a very long time. The perceived crisis of public-science relations and trust makes it seem as though there was a time 'before', when the public trusted scientists and experts implicitly and completely, but multiple scholars have cast doubt on this notion. Various publics have grounds far beyond an information deficit to (mis)trust scientific experts, especially in areas that relate to land management. As Chapters 4 and 5 will show, the ranchers who took part in the present study hold informed and nuanced opinions about science, scientists, and scientific institutions and contribute their own expertise to the conversation.

Chapter 3: Methods

The methods used in any given study depend on the question being posed; they must be capable of answering that question in a satisfactory way. For the purposes of this study, I chose a qualitative approach, which can contribute to existing literature on the topic of public trust in science by eliciting nuanced and in-depth individual responses. Qualitative methods do not typically rely on a large sample of participants, focusing instead on creating rich data with each participant; this can be done using methods such as interviews, focus groups, or participant observation, among others. Data analysis therefore does not rely on statistical methods, but rather on textual analysis using one or more theoretical approaches. To adequately explore how alternative ranchers experience science, scientists, and scientific institutions, it was imperative to allow study participants the space to provide detailed responses with the possibility of follow up questions. Interviews were therefore well-suited to the study since they allow interviewees to expand on their response. Initially, focus groups and on-farm interviews were proposed, so that responses within a group of their peers could be compared to individual and more private responses. However, due to the restrictions on in-person meetings due to COVID-19 and the rural residence of the participants, focus group and in-person interviews were not feasible within the timeframe of the study data collection. Remote interviews using a telephone or Zoom were offered to the participants, with most choosing the telephone option.

Recruitment for the study was done with the Agricultural Greenhouse Gas Project (AGGP) participants as a starting point. In order to manage the scope of the study, recruitment was done among those ranchers participating in the study who operated in Alberta using the Adaptive Multi-Paddock Grazing (AMP) system as defined by the AGGP study. Prospective participants were also provided with the researcher's contact information to pass along to other

ranchers using alternative management practices. This snowball sampling approach did not produce any additional leads for participants. Seven of the twenty participating ranchers were recruited based on the larger project. These participants also recommended certain other ranchers who were known to use alternative practices in their area, which provided an additional recruitment pool. Further participants were found based on a general internet search for alternative beef producers, using grass-finished and/or organic beef as a starting point, and then ascertaining whether the producers used rotational grazing similar to AMP. This mix of snowball and convenience sampling resulted in a total of 18 interviews, of which two were with couples, meaning 20 individual participants who contribute to decision-making on the ranch. Interview participants were recruited, and interviews were conducted up to the point of data saturation, when no substantially different new ideas arose out of additional interviews.

All participants were made aware of how their information would be stored and processed through an Information and Consent Document (Appendix 1). This document was reviewed and approved through the Research Ethics Board and in compliance with University of Alberta and Tri-Council regulations regarding remote interviews using the telephone or internet and personal data storage. Participants received the document in PDF format by email prior to the date of their scheduled interview and had the opportunity to ask any questions of the interviewer at the beginning of the interview. Once they were confident in their understanding of the process and gave verbal consent, the interview recorder was switched on and the participant was asked to reiterate the consent for the record. These statements were included in the transcripts. The interviewer filled out the PDF document on the participants' behalf and then sent the completed document to the participants by email for their records. These completed consent documents were also saved and stored along with the interview recordings.

Although age and gender identity information were not collected explicitly, these were extrapolated based on interview data. Of the study participants, 14 presented as men and 6 as women. Age range was estimated based on the information provided by the participants, and ranged from early 30's to late 70's or 80's. The vast majority of participants had a family farming background, many going back three to five generations in Alberta. Additionally, most participants also valued leaving the home farm for education or to try different career paths and saw this as an important life stage for themselves and their children. Nine of the twenty participants held a university degree in a field either directly or partially related to agriculture; seven were educated in the trades through either an apprenticeship or diploma program; and the remaining four completed high-school and had on the job training in a variety of fields.

The relatively small number and alternative stance of the participants do not intuitively seem to make the findings of this study generalizable to the public at large, however 'alternative' positioning exists in many spheres of life, and so the findings shed light on the underlying attitudes of those who identify as 'alternative' in some way. Qualitative methods typically do not hold generalizability of results as a key standard of academic rigor as quantitative methods often do. Instead, a group is chosen strategically because they hold specialized knowledge or have had particular types of experiences that would give them valuable insight into the research topic. For the purpose of this study, participants were sought out based on their lived experience as a rancher in Alberta who is in some way outside the conventional commodity beef system and relies on specific grazing management practices. Furthermore, several of the participants have been part of this alternative way of ranching for several decades and therefore have unique experiences and perspectives on the research topic. By interviewing a limited number of these

particular ranchers, new insights can be reached that provide a valuable contribution to the field of inquiry which would not be possible with a more superficial quantitative approach.

The interview guide (Appendix 2) was designed to take approximately 45 to 90 minutes to complete, and most interviews fell within this time frame apart from two, which lasted more than two hours. Questions followed a semi-structured interview approach with substantial room to ask follow-up questions as needed, and this frequently resulted in them being asked in a different order than outlined in the approved interview guide; this led to a more natural flow of conversation and better rapport between the interviewers and participants. The questions purposely did not include the words 'trust' and 'science' because these terms were thought to be too loaded and had the potential to prematurely influence the interview participants. Therefore, the interviewer made efforts to use the terminology chosen by the interview participant until the participant used the words 'science' or 'trust' of their own accord. This semi-structured and indirect approach led to a diversity of nuanced responses and a wealth of qualitative information, and at the same time led to a dataset in which one to one comparison between answers would not be appropriate.

It is important to note that while the study defines the rancher participants as alternative with regard to their grazing management practices, they are not marginalized members of the community in a way that strips them of social capital or influence. In fact, several participants have a substantial amount of power or influence within their communities in contexts. This power and influence manifested in a range of fields such as political involvement in their community, leadership within a professional organization, or intellectual leadership through speaking engagements and publications. Having this influence and expertise affected the participants' relationships to the research in that the interview was another way for them to be

positioned as an expert in their specific field. At the same time, as the interviewer, I was positioned in affiliation with an expertise-holding entity – the University of Alberta – but simultaneously presented as a woman who is younger than them and a student. In this way, there was no clear one-directional perception of power within the interview context, creating a relatively balanced starting point from which to build rapport.

To analyze the data, the audio recordings were first transcribed verbatim, with a set of placeholders used to represent non-verbal details such as emphasis, pauses, and non-word sounds (Appendix 3). This transcription approach yielded over 400 standard typed pages of text. The transcripts were then fully anonymized according to the parameters set out in the ethics agreement. All identifying names and locations were replaced with place holders, including the participants and their close friends and family. The first layer of analysis involved identifying sections of text that were in some way relevant to the question of science or participant worldview that could relate to science, which resulted in 235 pages of relevant text. Participants spent a significant amount of time describing their specific grazing management practices, which was not directly related to the research question, but could inform further analysis of the data.

The transcripts were then coded in NVivo using an inductive approach to elicit themes. The initial coding resulted in over 300 unique codes. An inductive approach was used to elicit codes and themes. Inductive coding and data analysis seeks to follow the patterns that arise in the textual data as opposed to deductively applying themes based on a pre-determined theory or analytical framework. This approach is especially useful in exploratory studies and inquiries that rely on open-ended interview questions. Since the interviews followed a semi-structured format and attempted to avoid leading the participants responses through word choice, an inductive

approach to data analysis is important for maintaining methodological coherence for the study as a whole.

The study also made use of participant observation at the well-attended December 2019 Western Canada Conference on Soil Health and Grazing. Held in Edmonton, Alberta on December 10-12, 2019, this conference catered to ranchers who pastured their cattle (as opposed to feedlot operators, etc.), and hosted a variety of speakers including consulting ranchers, university scientists, research laboratory scientists, industry experts, and more. The small tradeshow held in conjunction with the conference included non-profit organizations, agricultural consultants, vendors of seed and equipment, and more. Tickets were available for purchase online to any interested party, and furthermore, access to the conference location was not restricted, making this a public event. The University of Alberta Research Ethics Board does not require ethics approval for participant observation in public spaces. As an official attendee of the conference, I was able to observe the majority of the presentations, as well as speak with tradeshow table hosts and other attendees. Participant observation was conducted over the course of the first and second day in 15 to 30 minute increments to capture speaker and audience attributes at different times. These notes were taken by hand and then typed up for future reference (Appendix 4). These notes supplement the data obtained through the interviews.

In addition to analyzing the data inductively, I conducted an Actor-Network based analysis that relies on participant observation data and several key interviews with participants who were especially knowledgeable about the early promotion of Holistic Management (HM) grazing in Alberta. Three of the participants had taken one or more official HM grazing workshops in the late 1980's or early 1990's and have adhered to the system since. These participants contributed longer than average interviews (between 1 hour 7 minutes and 2 hours 3

minutes) and each have over four decades of experience with alternative grazing methods, in particular HM. A further three interviews were chosen because the participants were children of early HM adopters in Alberta and refer to the experience of growing up on this type of operation in their own grazing management practices. Together, these six interviews provide a historical and personal perspective on the progress of HM in the province.

Two Actor-Network Theory (ANT) analytical concepts were applied to the overall findings, with a particular focus on the six selected expert interviews: association tracing and interessement. Tracing associations involves identifying the assemblages and interrelations between actants that are present in an alternative grazing management system. The ANT framework emphasizes the symmetry between human and non-human actants in such a system. Interessement refers to a process of recruiting actants into a network by constructing mandatory passage points and setting network boundaries that exclude some actants. This process takes place over time and is therefore typically analyzed in a historical frame. By introducing these two types of analysis, this study responds to a gap in ANT literature, which has not yet paid adequate attention to animal agriculture in general, and especially its non-human animal contributors.

Throughout the study, careful attention was paid to methodological coherence and rigor. This study was structured around 18 interviews with 20 alternative ranching practitioners who were chosen based on ‘alternative’ self-identification from an Alberta-based participant pool using snowball and convenience recruitment methods. Interviews were conducted to the point of data saturation, when no radically different new themes came up in subsequent interviews. Additional data was collected through participant observation at the 2019 Western Canada Conference on Soil Health and Grazing. The interviews were transcribed verbatim and then

underwent inductive thematic analysis to elicit codes and themes, which corresponded with the semi-structured format of the interviews. In addition to thematic analysis, Actor-Network Theory was used to explore the connections involved in alternative grazing systems and the history of Holistic Management as a type of grazing system in Alberta. These methods were purposely chosen to adequately answer the research question: *How are science, scientists, and scientific institutions perceived among alternative livestock management practitioners in the Canadian prairies?* Due to the open and flexible nature of the methods, additional themes and avenues of inquiry were also pursued that added to the findings.

Chapter 4: Findings Based on Inductive Analysis

Introduction

This study began with a relatively simple question: *How are science, scientists, and scientific institutions perceived among alternative livestock management practitioners in the Canadian prairies?* However, during the very first interview it became evident that meaningfully answering this question meant touching on far deeper subjects related to the participants' way of interacting with the world. Over 22 hours of interviews with alternative ranchers yielded more than 400 pages of verbatim transcripts. Based on inductive coding and theming, the interviews were analyzed without *a priori* themes or frameworks to guide the process. In this way, findings were sought that more closely reflected the participants' own priorities and worldviews.

In the course of the interviews, ranchers were asked to describe their operations and the landscape ecosystems they occupy. In addition to relating the history of their land, the participants were also asked to talk about their personal history with agriculture, their education, and information gathering practices. They were further asked to describe the sources of information they prefer and why they choose some sources over others. The ranchers' information source preferences were varied and depended somewhat on age and degree of affiliation with the 'alternative' identity. Older ranchers preferred books and prided themselves on their familiarity with the works of foundational alternative agriculture experts such as Wendell Berry and Allan Savory, whereas younger ranchers were familiar with these works but preferred sources that were updated more regularly, such as podcasts and YouTube videos by practicing ranchers or other experts. Most of the ranchers were familiar with a handful of magazines targeting grass-finishing beef operations or alternative animal agriculture, such as The Grassman Farmer, edited by Joel Salatin. Despite the preference for these specialized

publications, most participants also followed mainstream beef industry publications such as Canadian Cattlemen magazine, Western Producer magazine, and radio stations geared towards the agricultural sector in order to better understand their economic prospects. In addition to print publications, ranchers participated in workshops and conferences, watched videos and documentaries, and relied on their peers for ideas and information. The interview data showed that ranchers made efforts to stay informed about what other producers were doing as well as about scientific findings related to their operation, however, they used the sources strategically, and subscribing to a source did not necessarily mean accepting all of the information therein. By further exploring these nuances with the study participants, a more detailed and informative picture emerged.

In this chapter I will explore three main topics that arose from the data. First, I will seek to answer the original research question and describe the ways in which science, scientists, and expertise play a role in the ranchers' grazing management and environmental stewardship practices. Secondly, I will use science and expertise as a launching board to explore how (dis)trust is negotiated by ranchers as they seek to make optimal decisions for themselves and their operation. Lastly, I will touch on an unexpected topic that was put forward by the interview participants as they sought to explain their decision-making process and relationship to science: their relationship with Nature and the natural world. These three broad topics facilitate a discussion of the ways in which these alternative ranchers negotiate their relationship to knowledge, expertise, and the physical world.

Finding 1: Scientists, Science, and Expertise

Literature related to public trust in science and scientific expertise frequently treats 'scientists' as clearly defined and understandable individuals and positions them as experts

(Gieryn, 1983; Latour, 1999b; Lidskog, 2008; Turnhout & Gieryn, 2019). This approach may be appropriate when dealing with specific case studies where individual scientists may be known and their identity as scientists is clearly delineated: they are present in an official capacity and may represent a government or a scientific institution such as a university. Most likely, they have a PhD in a relevant discipline. This narrow definition is useful and has facilitated many insights, however it is only one of many ways in which publics encounter 'scientists' in their pursuit of new information and insights. As the data showed, 'scientist' and 'expert' are by no means synonymous for the study participants.

While conducting the interviews, I sought to avoid influencing or triggering participants' responses to meaning-laden words related to the study by avoiding the terms 'science', 'scientist', 'university', and 'trust' as much as possible until they were introduced by the interviewee. This led to some meandering conversations and a heavy reliance on the terms 'expert' and 'researcher' on the part of the interviewer at the start of each of the interviews, and it expanded the conversation beyond the narrow definitions of 'scientific expertise.' In this section, I will explore the ways in which participants described their encounters with 'science' in the course of their lives. First, I will discuss the ranchers' encounters with science during their early lives and education; next, I will show how scientific expertise plays a role in the ranchers' personal lives in ways that impact their ranching decisions; and finally, I will illustrate the main ways in which these ranchers encounter scientists and scientific output, and how these influence their grazing management decisions.

Many of the study participants have some post-secondary education that relates to the sciences, whether these are directly linked to agriculture or to the environment in general. Through these formative experiences with scientific expertise in a traditional educational setting,

this group of ranchers typically developed an understanding of theoretical and general scientific concepts, which they then use to anchor new information and evaluate sources for validity. For instance, presentations about soil health and water retention hosted by a local forage association made more sense to one rancher because of her background in geographic information systems (GIS) and environmental science. Another rancher relies on his BSc in animal science to evaluate new practices to manage cattle and expects his children to obtain a university education before coming back to work on the family ranch. A couple who were educated in agriculture and worked for the public sector in agriculture-related roles also indicated that their education background helped them separate the wheat from the chaff when it came to new studies and recommendations regarding pasture management. The feedback from these ranchers regarding their formal education was generally positive and reflected a certain admiration for scientific expertise, though not everything they had learned at that point aids them in their current practices.

On the other hand, several ranchers who had received a post-secondary education in a non-science field, such as education, arts, or the trades were much more weary of scientific output. One rancher who holds a bachelor's degree in a non-science field put the overall attitude succinctly when he said:

> "I know enough about science and variables. You can […] twist any science study to say anything you want. […] You can promote one variable over another […] and even, with reductionist thinking, you can be one hundred percent right in your study […] but put that variable out into the world, and in a complex system, and that variable doesn't matter." (Farmer 17)

This statement reflects the general suspicion of scientific output that seems to oversimplify a complex situation. However, it also shows a way to dismiss potentially valid scientific findings that do not fit with a participant's worldview; participants regularly dismissed studies that did not support alternative grazing practices as reductionist. However, this rhetoric was used by participants from all educational backgrounds.

In this situation, it is important not to conflate correlation and causation, given that the causal mechanism is unclear. It seems possible that individuals chose to pursue advanced education in the sciences based on a predisposition and affinity for the subjects and methods of science, whereas those who chose to pursue other programs may not have had that affinity to start. On the other hand, one might expect that spending two to four years immersed in a scientific educational context would encourage a more positive disposition towards the sciences. It is also important to note that although the ranchers with a science background have a generally positive outlook on the scientific method as a mode of inquiry, they expressed regular concerns about the prevailing ways in which studies are funded and conducted in contemporary post-secondary institutions.

Most of the ranchers expressed the attitude that they are independent learners who value getting a variety of sources before settling on an opinion regarding a given subject. In line with that attitude, many of the ranchers identified as avid readers, video watchers, and podcast listeners. They also sought out the opinions of their peers, especially other ranchers who ascribe to alternative grazing management practices. In a way that is consistent with other research into farming populations (J. Burke & Running, 2019), this in-group dynamic typically discouraged discussing practices with conventional ranchers, crop farmers, and especially non-agricultural urban dwellers. The dynamic was clear in one of the major themes that arose from the data: the

concern that ‘they don’t get it.’

People who ‘don’t get it’ included consumers, government, crop farmers, conventional beef producers, and some scientists, among others. The majority of study participants related a similar story in which they attempted to explain why their practices were beneficial (to the environment, human health, etc.) only to be exasperated with the lack of understanding they encountered. The speculated reasons for ignorance among the general public were excess emotionality, intellectual laziness, and overly persuasive advertising campaigns from major corporations. Some ranchers chose to take up the mantle of educating their consumers and acquaintances, such as Farmer 19, who marshalled a substantial number of facts and statements by scientists to debate a family acquaintance about the effects of meat consumption on climate. Several ranchers also welcomed students from all age groups from elementary to post-secondary onto their farms for educational purposes. Meanwhile, others expressed frustration and exasperation at the seemingly unending flood of ignorance and misinformation about agriculture. One participant, a Forestry graduate from the University of Alberta who manages the consumer sales part of their grass-finished beef operation, described her experience of educating the public at farmers’ markets:

> “It’s hard, like for me as a producer. Like, I’d love to be able to talk to people about this […] and I’ve tried to talk to many people, and it seems like it’s just too much information for them, they just want a quick… kind of thirty second answer, and for the most part people just get overwhelmed with the info. […] I’m not good at explaining all of those different… facts. Like, I’m not the best person to be doing that, even though I’m the *farmer*, I’m not like a super expert on those facts. Yeah, and people get really emotional

about it, and then I get emotional, so… [laughs] I'm just like, I just want you to have good, you know, beef, and Canadian beef is good beef." (Farmer 6)

The frustration with having to explain 'facts' to consumers who seem set against hearing reason is evident, and echoes the narrative frequently heard among producers, that city-dwelling consumers are grossly ignorant about the realities of agriculture. This ranch follows more conventional practices than most of the study participants, and the narrative demonstrates why some of the other ranchers choose to market their cattle as hormone- and antibiotic-free, since there appears to be consumer demand for this type of product.

One rancher who is particularly market-savvy due to his past experience in corporate sales and marketing relies on the 'hormone and antibiotic free' label to market his beef to several grocery store chains, where it can fetch a higher price than commodity beef.[4] When comparing his product to commodity feedlot beef, he scoffed at needing "a scientist to tell me that if I give them this, axiopin, whatever, drug, to compensate for the useless livers that I should feel better about it. It just doesn't make sense to me! Fundamentally, it doesn't make sense." Additionally, he mentioned that "more and more consumers are saying the same thing and that's why they're choosing my product" (Farmer 12). In this case, scientific expertise is shown to be subordinate to market demand and 'common sense.'

However, far from dismissing science in favour of what is marketable, ranchers tap into the legitimizing power of science to promote their products. The same rancher who dismissed scientists condoning antibiotic use on conventional beef operations is more than happy to rely on

[4] Commodity beef is the product of the conventional beef production system, which can source cattle from a variety of cow-calf operations, but then relies on grain-finishing cattle in feedlots and processing them in large, inspected facilities. This system achieves profitability through economies of scale (e.g. Weis, 2020).

'real scientists' who provide evidence in support of the carbon-sequestering potential of grasslands under sound grazing management. He is aware of the apparent contradiction, good-naturedly acknowledging that he has "a vested interest in the model that I've created, but you know, I made a conscious decision to choose the model that I'm doing right now before, beforehand, you know?" (Farmer 12). He is not the only one who seems to draw on science when it suits him and dismiss it when it does not. Other study participants are happy to use scientific studies in the fields of nutrition, carbon sequestration, and ecology to promote their product when these studies support what they do. This pragmatic approach is not necessarily problematic and indicates some deliberation about scientific information. It would be misguided to see all 'science' as equally valid or invalid, and foolhardy to be fully in one camp or another.

This observation begs the question: who counts as an expert and when? Who counts as a scientist? As implied in the introductory section, the answer is not clear-cut, and ranchers must navigate a complex field of competing expert claims when seeking out new information about agricultural practices. The ranchers who took part in this study valued 'doing your own research,' which typically meant seeking out a variety of sources on a given subject, as opposed to conducting scientific experiments on their ranch. The participants sought out sources that 'resonated' with them and relied on 'gut checks' and other intuitive indicators of trust when choosing which practices to follow and which sources to return to again in the future. This kind of intuitive information seeking is something that all of us rely on most of the time, as our brains seek shortcuts to conscious deliberative decision-making. These shortcuts, called heuristics, are a valid and useful tool in our cognitive process in most cases (Tversky & Kahneman, 1974), and as participants indicated, often they consciously and deliberately sought out alternative grazing systems, which were then used to intuitively screen new sources. Of course, overreliance on

heuristics can also result in flawed reasoning and decision-making, and some scientifically proven phenomena are counterintuitive.

In their search for various sources about new or improved practices related to their operations, the ranchers encountered science claims in a variety of contexts. As the ranchers themselves draw on the legitimizing power of the scientific discourse, so do many speakers, consultants, and businesses that serve the agricultural sector. In this context, who 'counts' as a scientist becomes blurred. For instance, some ranchers are actively involved with university and government research projects conducted on their property. Anyone involved with these projects except for administrative staff was identified as a scientist by the ranchers, whether they are professors, contractors, or graduate students. Students on field trips were not categorized as scientists. Those conducting research or projects in conjunction with non-profit organizations were also identified as scientists, though they may or may not have held an advanced degree in a scientific discipline. This is perhaps the most straight-forward way in which ranchers encountered 'scientists.'

All of the interview participants also took part in multiple workshops, conferences, and other live gatherings that involved science claims. In these situations, speakers attempted to strike a balance between drawing on science for legitimacy and presenting themselves as relatable to the producers through a variety of means. In these situations, holding a PhD in a scientific discipline held some weight, but a BSc in a relevant discipline sufficed. For instance, the Western Canada Conference on Soil Health and Grazing (WCCSHG) in 2019 had seventeen speakers, excluding the producer panels, of whom ten had Dr. in front of their name in the brochure and seven did not. Three producer panels involving a total of ten producers also took place. This approach shows that there is interest in both scientific findings and research as well

as producer experiences and observations. It is important to note that the conference was organized by several forage associations active in the Western provinces. Forage associations cater to beef producers who pasture their cattle (as opposed to feedlots) and may include cow-calf, backgrounder, as well as grass-finishing operations. They are producer-led and also host a variety of workshops and other events for producers throughout the year. All of the study participants spoke well of these associations in general and of their local forage association in particular, and they attend the events put on by these associations regularly. In many cases, presenters who took part in the larger conference also appear as speakers at individual associations' events, so the conference is a good representation of the types of speakers the producers encounter on a regular basis and received endorsement from producer associations.

In addition to attending conferences and workshops, ranchers spent a significant amount of time consuming media sources related to their management practices via books, radio, magazines, social media platforms, podcasts, and other online media sources. The effort and time dedicated to this type of learning was reported to be high when the producers were first starting their operation or new management style, dipped after several years of operating in that manner, and rose again as producers drew closer to retirement and reduced their herd size. This dynamic was explained by the participants in the following way: at the beginning, they did not have the experience to make their own intuitive decision about what to do, so they needed the sources; once they gained confidence in their management style and increased their operation, they had less time and need to access new resources; and when they drew closer to retirement they had less energy to dedicate to cattle and more time to spend on reading. This is a logical narrative, but since this is a qualitative study, no quantitative data was collected relating to the time spent on specific media sources.

When accessing these various media sources, ranchers encountered many science claims as well. However, unlike in research settings and organized events, there was less clarity about the affiliation of a given source with mainstream scientific institutions, leading to some confusion about who was a scientist and who was not. In one case, a participant considered a business owner who holds a BSc in biology and an honorary PhD from an alternative institute to be a 'real scientist.' Although surely proficient in his business selling mushrooms and associated products, this individual is unaffiliated with any research institutions and cannot be said to be unbiased in his claims, since his business success is connected to these. Another participant was unsure whether a non-profit institution they encountered online was a university or not, further indicating the lack of clarity about the trustworthiness of internet sources. The continued reliance on science claims for legitimacy indicates that science as a concept holds some prestige, though not all information making science claims was seen as trustworthy.

Although the ways in which the information was accessed varied, the ranchers were consistently looking for several key characteristics which were relatively consistent from source to source. Firstly, participants strongly preferred current sources to older information. The theme of disdain for outdated sources was brought up consistently by different participants. In particular, podcasts and YouTube videos were valued for their up-to-date insights, while government publications were seen as hopelessly behind. When asked specifically about science and scientific institutions, most participants felt that the role of science is to 'follow and verify' and they did not expect to see innovation relevant to their practices come out of a university setting. This attitude reflects the argument that science is simply lagging behind, which is why there are few studies supporting the efficacy of management-intensive grazing or Holistic Management (Frith, 2020). The statement implies a kind of trust that science will prove them

right in the end and an expectation that the scientific method is a valid way of creating knowledge about the world. As I will discuss below, there were some notable exceptions to this attitude.

Another strong trend was the preference for producer-experts over theoretical experts. The ranchers perceived a disconnect between laboratory science especially and the practical realities of day-to-day ranch operations. Although scientists were respected when it came to general knowledge and other disciplines, the universalizing tendency of scientific knowledge was seen as inappropriate for the field of grazing management. Most ranchers expressed the attitude that their farm was a unique ecosystem environment with particular water features, soils, and weather patterns, and so statistical averages were not very meaningful. The preference for situated knowledge was expressed even when the knowledge came from a different part of the world, such as South Africa, because the acknowledgement that every farm is unique resonated with the study participants. Conversely, universalizing claims were viewed with skepticism. Scientists who chose to emphasize context and complexity were preferred over those who were deemed reductionist.

Reductionism was one of the main concerns raised about scientific publications and research. In particular, laboratory scientists and those who identified one key variable were seen as unrelatable, irrelevant, and perhaps even dangerous. Another source of concern for ranchers when it came to science was the potential for bias due to political agendas and funding. This concern is qualitatively different from the concern about reductionism, since the former questions the techniques of science, and even the scientific method in some cases, while the latter is mainly a concern about the 'pollution' of pure science by societal factors. This latter concern reflects a continued attachment to the modernist worldview that science can be separate

from human values in its search for objective truth. In fact, though scientists were sometimes criticized for being too theoretical or not considering real world situations, many of the participants also expressed a preference for a protected and detached sphere for scientific research. Some ranchers saw it as appropriate that scientists be free from the financial pressures of operating a ranch business when studying natural phenomena, and especially necessary that they are free to follow different avenues of inquiry free from the profit motive. These concerns and opinions about how science is or should be done tie into the perceived trustworthiness of scientific output. The following section addresses the questions of trust and trustworthiness in more detail.

Finding 2: "Gabe Brown isn't very smart" and other trust constructs

Ranchers can be a humble lot. Many of the men and women I talked to were quick to describe their professed shortcomings, which were mostly related to a lack of formal education. Turns of phrase like 'I'm just a farmer, I'm not a scientist' came up more than once. However, as we have seen, these ranchers have substantial expertise in their area of practice, and in fact many do have some form of post-secondary training. Those who do have training tended to be more subtle in their self-effacing comments, but the overall discursive move away from self-promotion was evident when the ranchers were referring to themselves. When discussing their practices, however, it was clear that they take pride in following what they believe the best course of action to nurture their land, take care of their animals, and provide for their families. One of the strongest findings was that the ranchers took great care to place themselves in opposition to conventional crop farming. For instance, multiple participants referred to monocropping and tilling as 'unnatural' practices that lead to a 'dead' landscape, while their method of grazing management was 'mimicking nature' and 'encouraging life.' This is a strong contrast and an

evocative statement about how these ranchers see themselves. This specific topic will be taken up in more detail in the next section.

So, how does one discursively reconcile taking pride in and actively promoting what you believe to be the way towards 'life' while not appearing to brag or self-aggrandize? One speaker from the Western Canada Conference on Soil Health and Grazing encapsulates a curious and telling approach. Gabe Brown is a mainstay at these types of events, and he attracts quite a crowd. People who have seen him before, including many of the study participants, eagerly show up to see him again, follow his podcast appearances, and read his books. Within this relatively small community he is a rock star. Brown owns a mixed farm in North Dakota, which has an open gate policy and cows grazing on the front lawn on occasion. He is a stocky man in his forties who has mastered the art of relatability when it comes to other producers and is making tremendous strides in bringing regenerative agriculture into the mainstream. He has drawn the admiration of all of the study participants for his authentic demeanour and profit-friendly approach to farm management. This is helped along by his unique but representative way of creating a discourse around himself and his operation.

Gabe Brown does three distinct things to appeal to his audience, and by all accounts they seem to work. Firstly, he routinely refers to himself in the third person, giving his audience a ready set of phrases to use when describing him – Gabe Brown takes ownership of the 'Gabe Brown' brand. In particular, he routinely says "Gabe Brown isn't very smart," reinforcing the message of humility even as he is arguably one of the biggest names in the business. Secondly, he regularly deflects universalizing claims by repeating that what worked on his farm may not work on your farm. However, he tends to swiftly follow that up with a proposal open to anyone: he will bet his farm that he can improve your farm's productivity – if you're willing to bet your

farm that he can't. And thirdly, he tells compelling stories that centre on a pro-life message in the broadest sense. Although he is talking about 'soil biology' and biodiversity, the message touches on a deep-seated moral value of supporting life that is not entirely disconnected from the pro-life v. pro-choice debates that have dominated public discourse. Though it was not part of the initial line of inquiry for this project, it is interesting to note that faith and following what God or Nature intended was brought up by many of the participants in the present study. Celebrity farmers such as Joel Salatin also openly ground their farming practices in faith, and the first sentence on Gabe Brown's official website states: "We believe that faith, family and working with the natural resources that God has provided allows us a meaningful life" (*Brown's Ranch*, n.d.). This sentiment is generally echoed by the participants in the present study, indicating that these types of statements touch on a commonly held idea and are not outliers within this community. Gabe Brown seems to be pretty smart after all.

Another popular speaker, Jim Gerrish, has a different brand that taps into some of the same sentiments. This successful rancher from Idaho used to be on faculty at the University of Missouri, specializing in crop research, but is now a 'recovering academic.' This self-identification seemed strange to me when I first heard it at a field day organized by a local producers' association, however, seeing the positive reactions of the audience to this statement made sense as well. Based on the interviews and participant observation, it seems that one can garner respect as an academic, but one builds significantly more rapport as a fellow producer. The affinity for successful producers came up across all of the interviews in a variety of contexts; ranchers routinely preferred information that came from fellow producers, especially those practicing alternative agriculture.

Unexpectedly, I found that although Allan Savory is perhaps the most widely known proponent of alternative grazing practices when it comes to general audiences, he was by no means the most talked about alternative expert among the study participants. When asked about the TED Talk that has gathered over 7.5 million views and is available in 35 languages (Savory, 2013), most participants could recall hearing something about it, and some remembered being inspired and validated by what Savory said. However, some struggled to recall the TED Talk and referred to it as old, and therefore less relevant to them, further supporting their overall preference for the most current information. The specific episode that was most recalled from the talk was Savory's experience with recommending the slaughter of tens of thousands of African elephants in his position as an environmental advisor in what was then Northern Rhodesia (now Zambia). Savory made this recommendation as part of a series of interventions to try and improve ecosystem health on the savannah in the 1960's, and the subsequent slaughter of the elephants did not prove to be beneficial, leading Savory to critically reflect on the 'best practices' of the time. In his TED talk, he refers to this incident as the biggest mistake of his career (Savory, 2013). In response to this revelation, those ranchers who deemed it important described feeling more trust for Allan Savory overall because of his openness about past mistakes. This reasoning corresponds well to Wynne's (1992, 1996) observation that when experts present a front that seeks to hide or deny doubts and mistakes, they erode public trust. In this way, being open about one's failures or challenges, as well as showing a preference for situated knowledges, was an important part of what made alternative experts appealing to the ranchers involved in this study. All of the celebrity ranchers recommended by the study participants shared this preference for situated knowledge and a professed openness about past mistakes.

Although there were several well-liked 'celebrity' ranchers, participants did not rely solely on them for trustworthy information. As part of the interviews, I asked ranchers to provide some examples of 'good,' 'high-quality,' and 'trustworthy,' sources of information that they relied on. They were not provided with a scale or a set list of options, allowing them to describe their own reasons for preferring some sources over others. For the purposes of this study, I considered how enthusiastically the respondents endorsed sources of information and asked follow-up questions to clarify how trustworthy a source is. When describing their preference for sources, ranchers considered how often they accessed a given type of resource, how much they liked and respected specific experts, the extent to which they considered the sources to be consistently truthful, and whether the interests of a given source aligned with their own interests. This set of considerations is closely related to the categories of likeability, trustworthiness, expertise, and power, as described in the psychology literature (Kelman, 1958; Wallace et al., 2020). Successful producers practicing alternative grazing management were the most trusted sources of information identified by study participants and this trust was also conferred on producer-led organizations and publications, with a few caveats. This meant that participants frequently sought out and accessed sources created by successful producers, felt that they were knowledgeable about the subject they were talking about, personally likeable (though this was downplayed), and that their interests aligned. This category was followed by 'unbiased' university scientists who had not been taken in by less trustworthy actors. Government sources were seen as not particularly good, but without implications of malignant intent, and governments were the preferred funding source for university research. Corporations and 'Big Ag' companies were actively distrusted both as sources of information and as sources of funding for scientific research. The most distrusted sources of information were activist groups that were

seen as ‘against’ agricultural producers such as PETA, vegan organizations, and some environmental groups. The distrust of these groups was so strong that some interview participants suspected their involvement in biasing otherwise ‘good’ organizations such as scientific journals and government research bodies.

When asked to elaborate on why they trust certain sources and not others, the study participants provided a variety of reasons, most of which connected to what ‘resonated’ with them based on personal observation and previous knowledge. Personability and perceived expertise also played a role, supporting the psychological framework of source likeability, trustworthiness, expertise, and power (Kelman, 1958; Wallace et al., 2020). When asked to elaborate on why certain ideas resonated with them and others did not, ranchers drew on their personal experiences and observations as ‘filters’ through which they responded to sources. For those who had a scientific education, this often formed one filter, but it was by no means the only parameter they relied on. The majority of the ranchers referred to what ‘felt natural’ or ‘felt intuitive’ when explaining why they pursued certain avenues of inquiry.

> “Interviewer: Were you looking for any kind of, I guess, quality parameters? Like, how would you say, ‘yeah, that’s a good publication or source, and yeah, this one’s maybe a little iffy,’ […]
>
> Farmer 16: That felt very intuitive.
>
> […]
>
> Farmer 15: Yeah, […] if it resonated with us, we’d look into it. If it didn’t, um, we just passed it on. Yeah, we didn’t, we didn’t look at it.” (Farmers 15 and 16)

This excerpt demonstrates the often subconscious level of initial evaluation used by the study participants when responding to a source of information, consistent with the use of heuristics (Tversky & Kahneman, 1974). However, the ranchers also responded with narratives of meaningful personal experiences that led them to trust some sources over others. Notably, participants relied more on their own experience to make decisions rather than seeking out other sources as they gained years of practice as ranchers:

> "Well, what I've found over my career is that, I, just in the last three years I've noticed that I started to make decisions more and more based on my own experience, and less and less on things I was reading about from other producers' experience, which is really interesting. It wasn't even, it didn't even happen consciously, it was just like… yeah. [laughs] Just happening naturally, I guess." (Farmer 13)

This type of transition makes sense in the context of gaining professional experience and first-hand knowledge of a given profession.

It is important to note that while ranchers relied on what they termed their 'intuition' frequently to see what sources seemed reliable and which practices might be good to put into practice on their ranch, they tempered this approach with an experimental and experiential focus. For instance, according to one couple who ran a mixed farm (Farmers 15 and 16), they followed their intuition and preference for natural practices to look for sources and potential new practices to follow, but they paid close attention to what the proponents of these practices were doing on the ground.

> "Interviewer: Ok. And were there, were there any kind of qualifications that you would look for from a source, or a speaker, or a writer, or you know, somebody who's presenting you this stuff.
>
> Farmer 15: Uh, results. If they had proof and results, then yeah, definitely interested, uh, because there are people out there that have, that share a lot of theory, […] but don't practice it, and… um… and theory's fine, but until you have the-the shovels in the ground and dealing with all the problems, yeah.
>
> F16: Yeah." (Farmers 15 and 16)

This couple also tried out practices on their own operation to see what would work and what didn't. This preference for experimentation was echoed by other interview participants as well. The majority of participants disclosed that they often did trial runs of new practices on small portions of their ranch to see whether they would be appropriate for them before investing in applying the practice to the entire ranch. In this sense, their approach to all sources, even highly esteemed ones, was 'trust, but verify.' This preference corresponds well to the stated preference for information from other producers and situated knowledge. In a continuation of this trend, personal observation was highly valued as a source for both grazing management practices and personal decisions. In this sense, the 'intuitive' decisions made by study participants are in fact experience-based and observation-based decisions, though the majority of the ranchers also relate experience of making certain decisions because it 'felt good' based on their moral stance.

Several of the ranchers interviewed related personal health-related observations and experiences that led them to align more with alternative expertise as compared to mainstream sources. One rancher described growing up on a farm in a rural area and learning that many of

her neighbours who participated in conventional agriculture practices, including fertilizer and pesticide application, had developed various forms of cancer. She attributed her aversion to 'chemicals' to this formative experience. Three other participants related personal experiences of digestive health problems that had plagued them for years before consulting a holistic nutritionist who helped them resolve the issue. They attributed their improved health to eating their own agricultural products and reducing grain consumption. Overall, the participants communicated disappointment with conventional health advice and a preference for alternative, holistic health advice, and they made the explicit connection between human health and agricultural ecosystem health. These personal experiences clearly influenced the way the ranchers took in information about grazing practices, as they discussed the way agricultural inputs, 'chemicals,' were connected to medical treatments with 'chemicals' and surgery. In this way, personal experience in seemingly disparate areas contributed to the ranchers' distrust in conventional agricultural practices.

Some participants described observing population-scale trends such as increased rates of obesity, diabetes, heart disease, and cancer and made the connection between these health trends and the advice of mainstream health authorities, including doctors and the Canada Food Guide. In particular, the advice to eat relatively more grains as compared to meat was linked to the perceived promotion of grain farmers over beef producers. Although most participants gave the government the benefit of the doubt in terms of intentions, the connection between government and conventional agriculture, especially grain farming, reflected poorly on government sources. In this way, conventional agriculture was so opposed by study participants that any affiliation with it from expert sources was seen as suspect.

The Trouble with Conventional Agriculture

When asked to describe their experience with alternative agriculture, the ranchers chose to start with a discussion of conventional agriculture. For some participants, this represented a set of practices that they used in the past but have now moved away from, while others went into agriculture with the express goal of addressing the issues they saw with the conventional agriculture system. It makes sense, when defining the 'alternative,' to start with what it is an alternative to. The Agricultural Greenhouse Gas Project, to which the present study contributes, had set out to compare AMP grazing to neighbouring ranches, juxtaposing these two options available to ranchers for the purposes of rigorous scientific comparison between grazing management systems. This is a sound approach for a biophysical study, and it yielded some notable findings for ecosystem health outcomes.

However, this was not the most relevant distinction for the ranchers I interviewed, about half of whom were part of the original study. Thus, continuous vs. rotational grazing was not the most relevant juxtaposition of practices. There is a variety of land use options available to most of these producers, but the most salient alternative identified by every participant was cropping. The prevalence of crop agriculture in Alberta means that the majority of the participants are partially or wholly surrounded by cropland in their area. Depending on the type of land their ranch is on, they have the option of transitioning to growing crops such as canola, wheat, or pulses and selling them on the relatively lucrative commodity market. This was seen as an attractive option for financial reasons, with several participants stating that they could make more money by following this route than they do with their beef operation. Some of the participants also had a portion of their land under crop for animal feed or to diversify their income stream, demonstrating some flexibility within their operation.

The ranchers ranged in their attitude towards conventional agriculture from vehement opposition to any type of cropping in their region to feeling like part of a diverse agriculture landscape that includes operations such as their own as well as cropping and feedlots. However, most participants took issue with the conventional agriculture system for one reason or another. The most frequently cited objections were tilling and the attendant release of carbon into the atmosphere, erosion, loss of biodiversity, and the reliance on fertilizers, pesticides, and other inputs. Although atmospheric carbon is of great concern for the discussion on climate change, the participants who mentioned it cared much more about the soil carbon content and its effects on water retention and plant growth. The ranchers who did discuss atmospheric carbon did so in reference to other people, as one more way to convince those others who 'don't get' agriculture that alternative meat production is good for the environment. Overall, the participants emphasized the benefits of their practices for the local, not global, environment. One distinction that became evident through the data analysis was that participants initially chose to follow alternative practices not so much because they seemed attractive in themselves, but because of disillusionment with conventional practices, and this disillusionment is related to an erosion of trust in what conventional experts and institutions were telling them.

The ranchers conveyed many stories about personal experiences that led them to become disillusioned with various aspects of conventional agriculture. These experiences fell into two broad categories: environmental and financial. The environmental reasons ranged from very localized and specific environmental risks to very broad environmental concerns. Personally, one participant recalled witnessing a parent spill pesticide on themselves and then experience a stroke soon afterwards, while another expressed concerns about a local body of water that was undergoing eutrophication due to agricultural runoff. When it came to broader environmental

concerns, one rancher's parents rejected conventional agriculture due to "a mixture of ethics, and a desire […] not do harm to the animals, and to the people that eat the food as well as the land. When there's a skull and crossbones on the stuff you're spraying on, you know, your food, it's a pause… it's a pause for thought." (Farmer 2) Another rancher recalled a documentary that resonated with her beliefs about conventional agriculture:

> "She was standing in a prairie, and she had tears in her eyes, because it was being destroyed so quickly. And mostly for traditional farming methods. […] We need to look in our own backyard and we need to realize that what we have here is as good of a sink as the Amazon, but we're destroying it by the day, by the minute. And what can we do to mitigate that? So that sort of gets me excited, that gets me interested, and that is truth. You know? […] But then what you're actually going up against is the almighty dollar!" (Farmer 9)

This statement encapsulates the perceived connection between the environmental risks the ranchers associated with conventional agriculture and its financial aspects.

Ranchers saw the profit motive of both large agri-food corporations and individual farmers as the cause of their short-sighted pursuit of maximizing annual yields. This profit motive then leads corporations and conventional farmers to seek out information that supports their practices, even going so far as to influence scientific research. The particular issues the ranchers had with conventional agriculture mostly related to its specific negative impacts on the environment, from fertilizer runoff and lake eutrophication to carbon loss from the soil. The participants also identified the compounding effects of monocultures on the landscape and the visible signs of land degradation such as soil erosion as negative outcome stemming from

conventional cropping. However, most hesitated to blame individual crop farmers for the negative outcomes of conventional agriculture as a whole. When asked to hypothesize about the reasons why conventional farmers follow what they deemed unacceptably harmful practices, a few of the participants listed short-sightedness and greed, but most sympathized with the situation of feeling 'stuck' in a financial and cognitive trap created by Big Ag companies to get profits from farmers. Several of the ranchers identified input sales in particular as a motivating factor for companies to support conventional agriculture. One rancher recalled the aggressive promotion of fertilizers in the 1950's that got his family farm involved in intensive agriculture, and the hesitancy with which his father agreed to use inputs. Another rancher described the increasing pressure from input costs as follows:

> "And every year, my fertilizer was going up, and my crop inputs were going up, but I wasn't getting the same dollars back. And I had the soil tested here, and I had 1.5 percent soil organic matter in some of my land… And I could *tell*. I'm not a soil *guy*, but I could tell my soil was dead." (Farmer 19)

Although the study participant was seeing his profits and his soil eroding away, the companies who sell fertilizer were still motivated to promote conventional agriculture. As another participant put it:

> "If someone is spending three hundred dollars an acre every year to put in a crop, right, if they've got thousand acres, that's quite a bit of money [laughs]. […] And so, there's business and industry built up around supporting that, 'cause they want their share of your three hundred thousand dollars." (Farmer 3)

This phrasing implies that companies, and not farmers, are primarily benefiting from increased inputs and therefore motivated to perpetuate their use. The hesitancy to blame other producers is consistent with an in-group identity dynamic (J. Burke & Running, 2019), but clearly created some dissonance for the study participants. Specifically, it led some of the participants to be skeptical of the sources of scientific information if they contradicted personal observation, and consequently to suspect corporate interference in scientific research. As one frustrated participant expressed:

> "I think that corporate agriculture has a lot of vested interest in annual crop production, and plant-based foods, and there's a lot of money at stake if that's refuted, and I think that's evidenced by the Eat Lancet report, the most recent food guide; I'm disappointed with those two documents and I'm leery of the quote-unquote scientific merit of them. And like the whole thing seems corrupt to me. I don't mean to sound crazy, but […] that's where I'm ending up, you know? I'm just skeptical of the whole damn thing. I'm seeing the results first-hand, on the ground, of increasing ecosystem function and health and vibrancy, and I'm across a fence line from the opposite of that." (Farmer 13)

Statements such as this beg the question, "Why do farmers pursue conventional crop farming at all?" The study participants had a variety of theories about why this was the case, and the lay-expert interaction literature has proposed explanations also.

One theory that is consistent with the study findings is Wynne's (1996) assertion that publics who appear to trust science may in fact be behaving 'as-if' they trust it because of power dynamics that leave them with little option but to behave in this way. Conventional 'Big Ag' presents just such a power dynamic, with just a handful of large seed and input suppliers

dominating the market, a highly centralized commodity distribution system, and tight profit margins. Once an operation is tied into this global system, it becomes difficult to behave in any other way than 'as-if' one trusts in this system and the associated claims of safety, sustainability, and global need. It is this system of trust and power that the alternative ranchers reject when they choose to avoid inputs or sell outside of the commodity beef market. In a sense, they have dropped the 'as-if' pretense and are operating in line with their lack of trust in the conventional system.

The way the ranchers position their operations as an alternative to conventional agriculture allows them to differentiate their product and increase autonomy, in line with repeasantization theory (Heiberg & Syse, 2020; van der Ploeg, 2018), but it also seems to give the ranchers a sense of cognitive consistency and confidence. As a consequence of moving to manage their operations in a way that aligns with their trust beliefs, the ranchers reported increased psychological well-being and improved mental health. All of the study participants reported feeling good about doing the right thing for their families, their animals, their communities, and the environment. The ranchers drew on a particular discourse to explain why they felt so strongly and positively about their grazing management practices: they felt that they were doing what Nature intended.

Finding 3: Agriculture, naturally

One theme that arose as a direct consequence of a semi-structured and flexible interview approach was the unexpected preference that the ranchers had for what I term a Nature-Life discourse. This discourse is complementary to the established concept of a New Environmental Paradigm (NEP), which is a counterpoint to the Human Exemptionalist Paradigm (HEP), as outlined in Chapter 2. Briefly, NEP places humans back into the natural world, subject to its

whims and limitations, as opposed to HEP, which is the modernist view that humans are apart from and can overcome natural limits. If given the standardized test for HEP/NEP designation, the participants of this study would fall firmly into the NEP camp, since they express the attitudes ascribed to NEP confidently and comprehensively.

Within the context of this study's qualitative approach, however, participants had the opportunity to elaborate on their NEP claims, which led to a more detailed picture of what being 'a part of Nature' means to them. Firstly, the ranchers frequently identified themselves as naturalists or nature lovers prior to their foray into alternative grazing management or agriculture. They further demonstrated this affinity by giving detailed and emotionally charged descriptions of the landscapes they cared about. Several participants also made an explicit connection between environmental health, especially the local environment, and human health. The connection was particularly emphasized between soil health and human health via the foods consumed. Participants saw themselves as the producers of 'natural' food and protectors of a 'natural' environment.

They further described their grazing management practices as 'what Nature intended' for the region, and occasionally going so far as to term their mode of production as something that 'God intended.' This ascribes agency to Nature and shows a relational conception of how humans exist in nature. In particular, the ranchers mobilized this notion of 'what Nature intended' to explain how they are doing the right thing with their operation while other agricultural producers are not. Science plays a role in providing new insights and ways of understanding Nature, but as one participant put it, "Is Nature a science?" (Farmer 9) Although scientific findings were generally valued, participants were skeptical of best practices backed by research if they appeared to contradict their views of what is 'natural.' One rancher went so far

as to give Nature an active voice when describing how grass-finished beef production is in line with natural processes and crop production is not:

> "Biodiversity is the key […] and I know I can piss off a few, a few farmers when I say this, but I'll say, you know, nature, Mother Nature hates a monoculture. […] And they'll say, 'No, she doesn't.' Yeah, she does, because as soon as you try to plant a monoculture in something, Mother Nature goes, 'You know what? I don't want that. I want weeds. […] I want grasses in there, too.' The farmer has to spray that stuff out, so it doesn't, so his crop can compete. So, Mother Nature is telling us something with that. […] She's saying, 'I don't like monocultures. […] 'I don't like monocropping. I like random. I like biodiversity.' And the only, the only way to get biodiversity is a perennial stand." (Farmer 19)

While this excerpt most explicitly anthropomorphizes Nature, other participants also felt that Nature had specific intentions for the ecosystems around them as well. These intentions were best fulfilled using a rotational grazing system that mimics how large herds of herbivores moved across the landscape prior to European settlement. The study participants communicated a strong motivation to mimic Nature, thereby gaining a sense of alignment and fulfilment. Discerning what Nature intended was a major component of the outlook underpinning the participants' environmental management decisions.

Although they varied in their approaches, all of the study participants were strongly motivated to put practices in place to protect and improve their local environment. Some of the participants also made the explicit connection that by helping their local environment they were supporting global environmental health as well. In particular, they cared about biodiversity,

water cycles, and soil health as indicators of environmental health. Soil health is especially fashionable in the alternative grazing community at this time, encouraged by advances in carbon markets and the popularization of terms like 'mycorrhizal fungi' and 'soil microbiology,' as exemplified by the speaker line up at the 2019 Western Canada Conference on Soil Health and Grazing and the substantial interest in this conference among producers. Although these terms have been known in the soil science academic community for decades, some study participants expressed excitement at the advances made in these areas of study. In this sense, scientific knowledge was seen to be catching up with what alternative experts had been saying for a long time about the interconnectedness of agro-ecological systems, although it was more specifically the communication of science that was catching up. However, a perceived lack of scientific support did not hamper participants enthusiasm for practices that were seen as natural and in support of Nature.

Many of the study participants identified as naturalists or lovers of Nature prior to any long-term experience or observations working with grazing management, indicating that their intuition preceded concrete experience. One rancher termed himself a 'grass-roots environmentalist' because of his commitment to the environmental health of the rangelands under his ownership and management. Crucially, these ranchers sought to protect their land as a way to protect themselves and others close to them, as well as for its own intrinsic value. All of the study participants expressed a strong preference for 'holistic' and 'systems-level' knowledge, as well as situated and local knowledge. In alignment with other findings (Heiberg & Syse, 2020), the study participants felt the most agency to act and support Nature at their local level, especially on their farm. They saw it as their responsibility to protect local Nature, though they occasionally referred to the positive aggregate effect of grazing practices like theirs.

In the course of asking follow-up questions, I found that eventually participants exhausted their ability to consciously account for their decisions, resulting in a sort of circular logic that equated intuitive choices with what 'felt natural' and therefore was a 'natural practice.' For instance, as part of a conversation about what types of sources the participant trusts, Farmer 8 shared that "there's a million little groups in between, that – there's always some kind of agenda, especially if they're promoting information online. […] But you just have to be aware of it, and that's why I go back to what resonates with me from a natural – what did nature intend, that's what I always go back to, to test the gut and see […] if it resonates." She also acknowledged that she looks out for bias from alternative sources, such as Holistic Management International, as well as from groups she is weary of. Her sentiment is echoed by Farmer 9, who added that through her personal experience, she gained the insights to evaluate information intuitively:

> "After a while, you can really cut through the misinformation, too, right. You just get enough of the science to know what's real. […] I think it's intuitive and instinctive for me. […] Um, that doesn't sound very scientific, but I'm also scientific. I… we've been doing this long enough, and I've read enough, and I've followed the people that know what they're talking about because they've actually done it. To me, that's important." (Farmer 9)

This aspect of decision making, relying on intuition, well-earned as it may be, relates to the discourse of 'natural' practices, as participants shared that certain practices felt intuitive because they seemed to align with what Nature intended; in some cases 'natural,' 'right,' and 'intuitive' appear very closely related. The following excerpt, which is part of a larger discussion about the validity of Allan Savory's methods, illustrates the point:

> "It really confirmed to me that I was on the right path when we were managing our ranch in a fashion that was mimicking, you know, how the bison used to come through here, and they would come and they would eat the grass, they would urinate and defecate on it, trample a little bit of it, move on and give it that rest that it needs in order to grow more grass. And we're seeing it on our ranch where we're growing more grass and sequestering more carbon as a result." (Farmer 12)

Here we can see the close connection between what was described as 'right' and 'natural,' or mimicking Nature, the recommendations of alternative grazing experts, and the reliance on personal observation to verify the efficacy of various practices.

At the same time that ranchers were describing their alternative grazing practices as natural and life-giving, they were using the inverse of this discourse to communicate that certain other practices were unnatural and life-taking. This was especially clear in the way ranchers described soil conditions under crop farming systems and pastures managed using continuous grazing. Multiple participants described the soil under crop systems as grey, dead, lifeless, and unhealthy. By contrast, they were enthusiastic about the quality of the soil on their own operations and how alive it looked. The culprits within cropping that were responsible for the perceived loss of life were chemical inputs such as fertilizer and pesticides, as well as tilling the soil. According to one participant:

> "I would say within the holistic guidelines, […] basically naturally, without chemicals, increasing the nutrient density of the soil, increasing the enzymes and the organisms in the soil, and being cognizant of, you know, how a plant uptakes, and how a plant has its own immune systems, and how a plant has its own defense systems, and how that all works

> together when it's left to do its job, but when we put those inputs, it destroys all that. It's like giving our gut bacteria penicillin. You know what that does to us. Destroys our natural bacteria, and we have to build that back up again. So, you do the same to the soil, when you put those… unnatural things into it, then you *destroy* that natural ability of it to be healthy on its own. You know, it's a healthy system, you just need to give it the ability to be healthy." (Farmer 9, original emphasis)

Once again, the rancher describes how alternative grazing management recommendations – in this case, 'holistic guidelines' – align with what they see as natural practices and how conventional agriculture goes against what Nature intended. Furthermore, the holistic approach to Nature makes a clear connection between what is natural for the land and what is natural for the human body, while highlighting the life-taking effects of artificial inputs.

Overall, the ranchers expressed a strong preference for what they perceived as 'natural,' 'right,' and 'life-giving,' which was strongly connected to the alternative grazing management practices they were employing on their operation, in a way that could be perceived as tautological. This reliance on the intuition that doing what aligns with Nature is the right thing to do further demonstrates that the participants adhere to the NEP worldview, placing humans and human systems within Nature. This is a notable finding, because it indicates that despite a profit focus inherent to operating a business, the alternative ranchers also connect to the land on an emotional and intuitive level, and they consistently communicate the desire to support ecosystems through purposefully chosen management practices.

Conclusion

In this chapter, I have outlined the findings which arose from inductive analysis of the semi-structured interviews which were conducted with alternative grazing practitioners in Alberta in order to answer the question: *How are science, scientists, and scientific institutions perceived among alternative livestock management practitioners in the Canadian prairies?* The first section most directly answers this question. Ranchers encounter science in a variety of ways and approach it in a pragmatic way that balances seeking out learning opportunities, reinforcing existing knowledge, and participating in scientific knowledge production. Although science as a concept is well-respected, its execution by scientists and scientific institutions is regularly scrutinized for potential sources of bias. By no means beholden to science, ranchers see it as one tool in their arsenal when it comes to managing their operation.

The second section explored the ways in which ranchers evaluated information sources in more depth by looking at notions of (dis)trust and describing the information evaluation process in as much detail as the participants were able to communicate. It is important to note that the absence of trust and the presence of distrust are not the same phenomenon (Hardin, 2006), and the participants' explanations supported this notion. While ambivalent about some sources, participants focused on 'Big Ag' and certain activist groups as targets for a particularly strong distrust, which also affected any organizations that were affiliated with them. Conversely, participants showed a high level of trust in other alternative agricultural practitioners and scientific experts who aligned with their preferences for situated knowledge and complexity. Furthermore, participants exhibited a preference for current information and personal experimentation when choosing new practices. In this way, (dis)trust plays a significant role in which practices participants choose to implement.

The final section of this chapter explored the way in which study participants related to the natural world through a Nature-Life discourse that situated them within the NEP worldview. Participants displayed a strong preference for and emotional attachment to 'natural' practices. In particular, this was expressed as a strong opposition to conventional agricultural practices such as using synthetic inputs, growing monocrops, and cultivating land. The participants felt that they were following what Nature intended and frequently relied on extended observation and experimentation to discern what this meant. The closely related use of terms such as 'right,' 'intuitive,' and 'natural' points to the strongly internalized notion that humans are a part of the natural world, which is the key tenet of NEP. This sense of intuition contributed strongly to the decision-making process, tempered by the commitment to experimenting with new practices to see what worked on their operation.

Through in-depth and open-ended conversations with ranchers about science, scientists, and scientific institutions, this study explored the complex themes of trust, knowledge, and Nature. Although only three major themes are discussed in this chapter, there were many potential lines of inquiry which were not followed due to the scope of this thesis, such as the ranchers' community involvement, the in-group and out-group dynamics related to alternative identity, and the ways in which participants communicated their social ethics. Further work with the data collected as part of this study, especially in combination with other data sets collected from alternative grazing practitioners in Alberta, could shed additional light on this innovative group.

Chapter 5: Exploring the Data with Actor-Network Analysis

Introduction

In addition to inductive data analysis, I will begin retracing some key relationships and associations that are important to the alternative beef production system, borrowing useful concepts from Science and Technology Studies (STS) discourse. This analysis is intended as exploratory and supplementary to the main findings in the previous chapter. Exploring how frameworks which are marginal to environmental sociology can enrich our interpretation of research findings guided my analysis, as demonstrated by the inclusion of multiple disciplines in the main literature review. Actor-Network Theory (ANT) approaches introduced by Latour and Callon, as well as Wynne's (1996) work on risk and lay-expert interaction contributed significantly to my thinking regarding how ranchers made decisions about their operations. One key aspect of ANT is the inclusion of non-human actants in the analysis. For instance, Callon's famous study considers the agency of scallops in the Bay of St. Brieuc as two scientists attempt to position themselves as experts on scallop anchoring. In this case, the scallops had a lot more to say about the proposed technological innovation than the scientists anticipated, and the anchoring attempts were unsuccessful. This inclusion of non-human agency and negotiating power is one of ANT's valuable contribution to our understanding of how humans interact with the environment.

There have been past efforts to use ANT to analyze agricultural systems, but these have not yet fully explored the various facets of ANT's explanatory power and how it can contribute to our understanding of different types of agricultural systems. In this chapter, I resume the task of tracing associations (Latour, 2005) and apply the ANT concepts of enrolment and innovation translation to alternative grazing systems. The first portion of this chapter will constitute a brief

literature review; the second portion will deal with the nature of associations and actor-networks as they relate to alternative grazing systems; and the final portion will discuss the history of Holistic Management in Alberta, using the concept of interessement to center the discussion. This chapter reframes some of the themes and findings discussed in Chapter 4 and is intended to contribute to a conversation about how to incorporate more-than-human actants into our way of thinking about innovations and decision-making.

Literature Review

The Good, the Bad and the Non-Human

Actor-Network Theory (henceforth ANT) is an analytical framework closely connected to the field of Science and Technology Studies, which has drawn the interest of multiple disciplines, including environmental sociology, business management, anthropology, geography, and others. Popularized by Bruno Latour, Michel Callon, Woolgar, and others, it draws on the intellectual traditions of anthropology and the historical approach similar to Michel Foucault and other continental intellectuals. Like many specialized fields, especially various theoretical frameworks in the social sciences, ANT relies on an extensive specialized vocabulary, such that defining terminology becomes a barrier to entry for non-specialists. In English, this is partly a consequence of translating the terms from French or German, which transforms seemingly normal words into unique terms with a discipline-specific meaning. This chapter will rely on several of these terms to make use of the substantial explanatory power of the framework, such as actant, assemblage, enrolment, interessement, obligatory passage point, translation, etc. This and the following section will provide some helpful definitions, borrowed primarily from Callon (Callon, 1984; Callon et al., 1983a) and Michael (Michael, 2017) and introduce key concepts.

ANT is a suitable framework for analyzing how new knowledge is incorporated into ranching operations. Because each ranch is an independent business, ranchers negotiate with new knowledge and practices, and they transform one another in the process. In the same way, a rancher negotiates with the cattle, equipment, pasture plant species, soil organisms, and so on. In each iteration of this process, the original idea must necessarily be transformed, so that when a version of it is finally applied, it is unlikely to be identical to the originally communicated idea. This outcome may frustrate researchers, who need a degree of uniformity to conduct rigorous data collection. There is certainly evidence that the researchers' attempts to compare ranching practices have frustrated alternative ranchers. It is therefore prudent to include this last layer of negotiation and translation in the scope of the analysis.

Actor-Network Theory and Environmental Sociology

As discussed in Chapter 2, environmental sociology has its strongest roots in North America, particularly the United States, in the 1970's, making stronger headway in the 1990's as a response to the growing climate crisis and mainstream sociology's exclusion of non-human factors from its sphere of analysis. Science and Technology Studies (STS) and Actor-Network Theory (ANT), on the other hand, developed primarily in the United Kingdom and France and owe much to the field of anthropology. The early distinction between sociology as the study of 'advanced' industrial societies and anthropology as the study of 'primitive man' stems from the modernist understanding of progress and the early history of the modern sciences. This distinction helps explain some of the differences in methods and theoretical frameworks that have since developed in sociology and anthropology respectively, with the former relying more heavily on quantitative methods. Although the lines have since been substantially blurred, these

roots continue to influence environmental sociology and ANT, which creates an apparent wedge between them.

Nevertheless, both environmental sociology and ANT are attempting to reconnect human and non-human actors when analyzing systems and phenomena, and I believe that these fields are highly complementary. In fact, ANT has been used in many fields to add greater insight and understanding, including sociology, anthropology, political science, science and technology studies (STS), and more, but often in a way that cherry-picks tools and approaches without fully 'buying into' the ANT framework (Michael, 2017; Wickramasinghe & Bali, 2011). In some ways, the present study does this as well, without fully tapping into some of ANT's sensibilities or methods. While environmental sociology reminds us that natural forces matter when it comes to the social, nature has intrinsic value, and social factors heavily influence how we experience the environment, ANT looks at the agency of non-human actants and thereby facilitates a much more symmetrical approach to the human-nature relationship. Though the approach has contributed much to social sciences, it is not without its flaws and has drawn some criticism as well.

As a framework that attempts to reconcile realism and the existence of a real world 'out there' with constructivist notions, ANT has been critiqued by realists and constructivists alike, as well as Indigenous scholars. One tenet of ANT is that assemblages include both physical things and our discourses and constructs around them. In the case of carbon, for instance, this would include the atom and some molecules in which it is a component, as well as the various social and scientific understandings and discourses around carbon. In this sense, 'carbon' as we know it did not exist before certain things were discovered about it and sociopolitical structures were constructed around it. Yet a realist lens relies on the *a priori* existence of carbon and its

properties to be discovered. This creates a paradox: how can something be an actant that asserts itself and apparently not exist before human intervention constructs it? What were the microbes before Pasteur? (Elder-Vass, 2015; Latour, 1999b) This has led some scholars to conclude that ANT's difficulties and contradictions are untenable (Elder-Vass, 2015). I would consider this argument to be irrelevant except for the most theoretical of arenas, since we cannot discuss those objects of which we are unaware, and at the moment of gaining awareness of them they enter into the sphere of co-constructed networks that fit adequately within the ANT framework. Conversely, other scholars have critiqued ANT for blurring the lines between what does and does not belong in the study of sociology, and misrepresenting what the sociology of science actually entails (Bloor, 1999), a kind of defensive boundary work which ultimately claims that ANT is unnecessary since the sociology of science is up to the task. Less confrontational scholars also point to the unresolved issues of human exemptionalism and reconciling the theoretical underpinnings of ANT (Murdoch, 2001). One thing is certain: ANT is an ongoing topic of conversation and debate for those trying to understand the relationship between humans and nature.

Though apparently revolutionary and novel from the contemporary social science perspective, the 'ontological turn' proposed by ANT taps into a way of relating to the world that is far from new. Several Indigenous scholars and thinkers have criticized the visionary status granted to Latour as an early pioneer of ANT on the basis that it strongly resembles Indigenous worldviews and relational approaches to the natural world (Watts, 2013). In fact, this approach is deeply embedded in Indigenous worldviews, whereas the ontological turn merely seems to graft new terms and adjustments onto a modernist disposition, much as Latour would deny the existence of the 'modern' (Latour, 1993). Since Bruno Latour started his academic career as an

anthropologist, conducting cultural research in Senegal, it is not entirely surprising that he would be influenced by ideas common to non-Western, non-modern worldviews, such as the inherent agency of non-human actants. Is his contribution therefore not valuable? I would argue that, as Szerszynski notes, once a gap has been created between humans and nature, "the world of thought and the world of things," (Szerszynski, 1996, p. 109) it creates a kind of paradigm shift that cannot be undone, or at least requires some complex mental gymnastics. Finding ourselves in this predicament, Latour's work, and ANT in general, provides a remedial guide to reconnecting with the non-human agency that permeates all things, for those of us who otherwise could not make the leap.

Actor-Network Theory and Agriculture

Agriculture is one of those fields where the reliance of practitioners on the non-human and the environmental is so ubiquitous that it almost goes without saying. In fact, in much of the scientific research related to agriculture, in fields as diverse and soil geomorphology and animal genomics, it is the human element that disappears behind the multiple levels of translation and rarefication that samples undergo on their way from the farm to the laboratory to the peer-reviewed publication (Latour, 1999b). Conversely, in the social sciences the environmental and physical elements lose some of their solid form and become mirrors for the social. This is by all accounts a reasonable division of labour; however, ANT offers us a way to look at the physical world and the social world as two sides of the same coin. The farm is not a farm without the social, and it certainly doesn't exist without the physical realities of air, soil, water, plants, animals, equipment, and more, depending on the type of operation. The more you try to avoid one of those realities, the more you lean on the others. The particular ontology proposed by ANT

allows us to treat the non-human actors with the same seriousness as we do the human in social research, which holds great explanatory power in an agricultural system.

ANT has been applied to agriculture in a variety of ways, including agricultural market analysis (Hopkinson, 2017; Roba et al., 2017), landscape studies (Burgess et al., 2000; Sellick & Yarwood, 2013), and policy and governance of agri-food systems (Nimmo, 2008). Further studies have also touched on the theoretical and philosophical underpinnings of applying ANT to agricultural production. For instance, Risan (2005) applies some of the concepts of relational symmetry to his encounters with dairy cows and computers on a Norwegian dairy farm, though he argues that pure symmetry which places humans, cows, and computers within the same flat ontology is difficult to grasp intuitively. It is easier to ascribe agency to a 'natural' entity such as a cow than to a cultural artifact such as a computer. Perhaps our anthropocentric view, if it is broadened, begins first with those entities most like ourselves and then extends as far as it can go, but no further. It is easier to see agency in a cow than an ant, though this too is easier than seeing agency in microbes or computers. Some examples that argue for a broader range of agency-bearing actors come from feminist scholarship, such as Haraway's Cyborg Manifesto and Companion Species Manifesto (Haraway, 2016a, 2016b) and Blue's more recent contribution to Green Meat? : Sustaining Animals, Eaters, and the Planet (Blue, 2020). These works show the creative possibilities of understanding non-human agency in a less hierarchical ways. One aspect of these contributions which will emerge later in this chapter is the blurring of the boundaries around what constitutes a 'human' actant to begin with.

Science and Technology Studies, as the name suggests, have been more focused on studying the ways in which technologies take part in hybrid networks. This was also an early focus for Latour (1996) and Woolgar (1990). Iles et al. (2016), review the state of agri-food

analysis in STS and show that substantial attention has been paid to the rise and co-production of productivist agriculture that relies on heavy inputs, networks of corporate and financial actors, machinery, and markets. As they also note, an emergent area of focus in the field is alternative agricultural systems and local knowledges and the sites of case studies are shifting from government offices and laboratories to farms and food companies. The present study contributes to this emergent part of the literature by exploring associations present on alternative ranching operations and the history of an alternative grazing management innovation among ranchers in Alberta.

ANT and Innovation

In many ways, alternative grazing management proposes a series of innovations to grazing practices, which the ranchers can choose to adopt or not. Although Holistic Management (HM) aims to frame the system as one that in a sense returns to the distant past by mimicking natural ecosystems before Western interference and likely drawing on traditional grazing management systems, the approach is innovative in the contexts in which it is applied. Since the 1950's, several systems have been proposed for explaining how and why innovation happens in some contexts and not others. ANT has long been applied to the study of innovation (Callon et al., 1983b; Michael, 2017), and the concept of translation is particularly important in this field. This section will outline the study of innovation and the way in which ANT can be used to understand the success of some innovations and not others.

Innovation is not simply the invention of something new, but rather the spread of an idea and its adoption into practice, and the several models which have been said to explain innovation tend to ask a version of the same question: how rational is the decision to adopt an innovation (Tatnall, 2011). One early model that was used to understand and predict behaviour is

the Theory of Reasoned Action (TRA), proposed by Ajzen and Fishbein (Ajzen & Fishbein, 1974, 1975), which is a positivistic model that draws on Bayesian analysis to determine the connections between behaviour intention and action. Ajzen later expanded on this model to also include an actor's perceived sense of control, terming the augmented model the Theory of Planned Behaviour (TPB) (Ajzen, 1991), and both models are still in use, especially in the fields of health research and consumer behaviour. In addition to this rationalistic approach to explaining behaviour and innovation adoption, various models have been proposed to explain individuals' motivation for adopting a technology, such as the Technology Acceptance Model (TAM), which explains motivation in terms of perceived usefulness and ease of use (Davis et al., 1989), and the diffusion of innovations model, which suggests that individuals are motivated to reduce their level of uncertainty, driving them to adopt innovations (Rogers, 1995). All of these theories hold significant explanatory power, but they also have a gap which can be addressed using a concept from ANT (Tatnall, 2011).

Translation is one of the main theoretical constructs of ANT, which was developed by Michel Callon during his early work in understanding technological innovation (Callon et al., 1983a), and it breaks open the assumption of the other models that an innovation is a meaningful unit of measurement that is either adopted or not adopted by rational actors. Contrary to this assumption, translation entails a negotiation between components of the innovation and other actants, which transforms the innovation in some way. Callon (1984) proposes four distinct steps to understand the sociology of translation:

1. Problematization: an actant seeks to become "indispensable" by defining and purporting to solve a problem (in the case of HM, pasture degradation and profitability)

2. Interessement: a series of processes in which the actant attempts to assign roles to other actants
3. Enrolment: a set of strategies that seeks to define how the various actants relate to each other. “Interessement leads to enrolment if it is successful.” (Callon, 1984, p. 211)
4. Mobilization: a set of methods to ensure that the ‘spokesmen’ for various collectives are representative

As the author himself concedes, “translation is a process, never a completed accomplishment, and it may (as in the empirical case considered) fail.” (Callon, 1984, p. 196) In the case of the scallops, an innovation is attempted by the researchers, yet the scallops and the fishermen have their own agendas (both reflexive and not). At each stage of the process, the innovation may be transformed, taken apart, added to, dropped, or passed along intact (Latour, 1996). In the case of St. Brieuc, the scallops do not attach to the apparatuses recommended by the scientists, undermining their legitimacy as a critical passage point (Callon, 1984). As Tatnall (2011) argues, while Innovation Diffusion offers substantial explanatory power when it comes to innovation adoption at the population scale, translation offers an approach that is suitable for small-scale analysis.

Tracing Associations: Reluctant Cyborgs and Empowered Minotaurs

One of the key aspects of ANT is the inclusion on non-human actants in networks and assemblages in a symmetrical fashion that relies on unruly scallops, resistant machines, and intrepid microbes for explanatory power (Callon, 1984; Latour, 1999; Michael, 2017). The agency of non-human actants helps us understand the more-than-social world and has been applied extensively in the field of STS to explore everything from the failed implementation of a transit system (Latour, 1996) to the far-reaching connections of hiking boots (Michael, 2000).

Just as the social sciences can home in on human and social elements to the exclusion of physical phenomena, the biophysical sciences can focus on biophysical phenomena to the exclusion of the human and social element. By tracing the associations between human and non-human actants and assemblages, this section will address some of the concerns of the ranchers involved in this study, who felt that the effects of ranch management were not adequately addressed in many of the research publications attempting to compare alternative and conventional grazing operations.

Donna Haraway is perhaps best known for championing a kind of hybrid approach to the way humans exist in this world. With the Cyborg Manifesto, she encapsulated the idea that humans are inextricably linked to the machines on which we rely for our everyday goods and experiences. Subsequently, the Companion Species Manifesto elaborated on this hybridized existence by enrolling animals, such as dogs and chickens, into the complex web of relations. Hybridization as an analytical and discursive tool can facilitate understanding of relations that are otherwise challenging to conceptualize, such as the complex relations that are negotiated in alternative agricultural systems, including Holistic Management.

Another useful tool that is particularly well-mobilized by Bruno Latour is metaphor through myth. His series of essays, entitled Pandora's Hope (Latour, 1999), makes especially heavy use of Greek mythology to facilitate a deeper understanding of otherwise opaque concepts. In the context of alternative grazing management systems, this approach can also be beneficial. One Greek myth that has made it into the popular Western mindset is the Minotaur – a literal hybrid between a human and a bull. The most famous story related to the Minotaur concerns his death in the labyrinth constructed by Minos, the king of Crete, to contain the beast. However, long before the story of his death, it is the story of the Minotaur's birth that is most fitting to illustrate the themes of the present study. The king of Crete, Minos, had a close relationship with

the natural world and especially the god of the seas, Poseidon. One theme in Greek mythology is that the further East one travels, the less control Civilized Man has, and the more the forces of Nature assert themselves. This is evident in the stories of Jason and the Argonauts, the Odyssey, the Medea of Euripides, and many other famous works. In another common event for the ancient mythos, Minos married a nymph, Pasiphae. Pasiphae, mother of the Minotaur, was the daughter of one of the Oceanid nymphs and the sun-God Helios. She is of Eastern origin and the aunt of Medea, thus drawing nature and wilderness connotations. It is important to remember that the cause of the Minotaur 'problem' was a broken contract between king Minos and the god Poseidon, who is displeased, but does not take the bull directly. In a move common to ancient Greek myths, Poseidon used Pasiphae to assert the primacy of natural/celestial forces in the face of human desires. When Minos received a white bull from Poseidon to be used as a sacrifice and instead chose to keep it for himself, Poseidon cursed Pasiphae to fall in love with the bull. In some versions, Daedalus was secretly commissioned to create an artificial cow to help Pasiphae consummate this love, and so she conceived the Minotaur. In other interpretations, Pasiphae's celestial origins were sufficient, and Daedalus' machine was not necessary. Daedalus was then made to design the labyrinth where the Minotaur was imprisoned, and where he was finally killed by Theseus in the more famous legend.

The discrepancy between the different versions of the myth with regard to Pasiphae's ability to conceive the Minotaur is of particular interest to the present inquiry. Is Pasiphae's power as a daughter of the gods of Nature sufficient to collaborate (albeit due to a curse) with the bull to produce a human-bull hybrid, or is it necessary to enroll the help of human-built machinery to achieve this end? The preference for one version of events over another can be a helpful parallel for the preference for Nature or for technology and human agency. In the case of

this study's participants, the preference for Nature is clear and strong. In this sense, they are siding with Pasiphae, the force of Nature. Donna Haraway famously concluded the Cyborg Manifesto with "I would rather be a cyborg than a goddess" (Haraway, 2016a, p. 68), but clearly not everyone concurs. Choosing input-based or alternative agriculture appears to be a choice much like the one faced by ancient Greek story tellers: human and machine, or human and animal? The outcome is the same – the minotaur, human and bovine, in the myth – but the preferred means tell us a lot. We can hearken to something more ancient and steeped in the primordial powers of Nature or rely on the technology of human genius – Pasiphae the Oceanid or Daedalus the inventor. The nymph's power of hybridization and permeable boundaries between species require an intuitive leap that not everyone is prepared to make, but Daedalus' technology is not without its risks. When we rely solely on that, like Icarus, we fly nearer and nearer to the fatal sun.

As described in Chapter 4, all of the study participants exhibit a strong preference for what they term 'natural' processes, and all but a handful of participants also made an effort to avoid the use of farm machinery and synthetic agricultural inputs such as fertilizers and pesticides. Nearly all of the twenty ranchers who participated in the study described wanting to mimic Nature and work with Nature to get the most out of their pastures long-term and take care of the grassland ecosystems there. Most of them also used technology sparingly on their operations, with some ranchers actively rejecting machinery such as quads for moving herds in favour of horses. However, technology is an extremely broad term, and as modern producers none of the ranchers actively rejected all technology. Some technologies, such as electric fence, are highly desirable and at this stage indispensable parts of alternative grazing management. More than half of the ranchers also brought up excitement over various types of technological

advances that would help prove that their grazing method was superior to conventional beef production in one way or another. Examples of desirable technologies include the Brix meter, which measures sugar content in plant matter; an application called MAIA Grazing, which digitizes many of the tracking and planning functions necessary for adaptively moving cattle; and electronic cattle collars, which would reduce the need for fencing. Notably, these technologies aid in monitoring the environment and moving the cattle, as opposed to altering the environment to suit producer needs, and when discussing the technologies, all of the ranchers made a point of explaining how the technologies they use or would like to implement would benefit the soil, grass, and cattle on their operation.

Taking the ANT perspective, the various actants involved in alternative grazing management form associations with one another, thereby becoming something new. In an evocative example, Latour makes the case that in a gun shooting, it is not the human who shoots and it is not the gun that shoots, but rather a gun-human assemblage, since in the joining of a human and a gun, both are transformed (Latour, 1999b). Similarly, though in a more complex way, the rancher and the herd are transformed when they undertake to form an association. The rancher-herd assemblage in an alternative grazing system then attempts to enroll other actants into its network. As the 2019 Western Canada Conference on Soil Health and Grazing suggests, one key actant to enroll in a grazing system is soil (itself a complex assemblage) and another is the pasture flora (also a diverse community). The general idea promoted by the alternative grazing community is that through careful observation and collaboration with these non-human actants, the rancher-herd can attain desirable outcomes. Given the popularity of soil biology as a workshop and presentation topic (Western Canada Conference on Soil Health and Grazing, 2019), it seems that microbes are asserting themselves once more.

One rancher encapsulated a stance that is in alignment with the majority of study participants when he described the difference between what he does and what conventional cattle producers do as a matter of perspective. The conventional producers are cow-centric, whereas he is focused on the soil, and then the grass, and how the cattle can be used to manage these resources. In fact, although all of the ranchers cared about the wellbeing of their herd, they were focused more on observing and managing the grass, with the understanding that they are trying to change the soil, and they see this as an innovation beyond conventional cattle production. As this rancher put it:

> "I actually learned the industry backwards […] I learned about the cattle, and then I learned about the grass, and now I'm learning about the soil. And really, realistically, to be a proper steward of the land, we should learn about the soil first, then what, then what grows on it, and then the livestock. And we would probably […] do a better job if we did it that way." (Farmer 19)

The statement points to a trend that was common to all the ranchers: their focus on soil health. Improving soil health was a strong theme that arose out of the interview data, and some ranchers expressed an intimate connection with soil microorganisms, both in terms of their importance for human health and in terms of an emotional connection with the organisms as indicators that the land is alive.

All of the ranchers who took part in the study also expressed a preference for conceptualizing their agroecological landscape as a complex, interconnected system with emergent functions. When asked to explain their environmental management decisions, participants referred to the way that their choices impact water, nutrient, and gas cycles, various

plant and animal species, as well as ecosystems outside of their operations. They also expressed feeling positive emotions in connection with using less invasive technology to control the environment. As one rancher put it:

> "We went back to a more agrarian way of farming, more physical labour, more connection to the land, and that whole concept of Holistic Management introducing you to how important the ecosystem is. I started to hear meadowlarks, I started to see bluebirds. I started to have hair stand up on the back of my neck during the migration of birds and I just thought this is, this whole concept of farming and connecting with nature that's just amazing; it's something that I never ever thought could happen." (Farmer 1)

These findings are closely related to those described in Chapter 4, which indicate that the ranchers correspond more closely to a NEP mindset rather than a HEP mindset. In ANT terms, the ranchers appear less motivated to enroll machinery in their agricultural actor-networks and are eager to enroll wildlife and forage plants. In this sense, the need for Daedalus' inventions is reduced, and Pasiphae's strength prevails.

Innovation Translations and Interessement

The way in which new innovative practices and technologies take hold and become popular has been of keen interest to the business and public sectors. Several explanatory models have been proposed, including the theory of reasoned action (TRA), theory of planned behaviour (TPB), the technology acceptance model (TAM), innovation diffusion, and the approach described by ANT, innovation translation. The main feature shared by all of the models except for innovation translation is the treatment of the 'innovation' as an indivisible unit that gets adopted, rejected, or passed along whole and unchanged. ANT offers a more nuanced and

realistic framework, because it untangles the innovation and problematizes this process, breaking open the 'black box' of the innovation. In the resulting process, the innovation is an actant that negotiates with others on its way, changing, adapting, or being rejected with each encounter.

Callon (1984) describes interessement as a process in which an actant secures the attachment of another through a process of isolating this other actant from other influences. For instance, the scientists sought to interesse the fishermen of St. Brieuc by positioning themselves as experts and becoming a mandatory passage point between the fishermen and scallops. According to one definition, "Translation stands for all the mechanisms and strategies through which an actor – whoever he may be – identifies other actors or elements and places them in relation to one another. Each actor builds a universe around him which is a complex and changing network of varied elements that he tries to link together and make dependent upon himself." (Callon et al., 1983a) In a complementary statement, Michael (2017) says that "[t]o translate is to redefine another's interests or identity by whatever means possible – textual, social, even coercive – so that they do one's bidding, or allow one to speak or act on their behalf (as a spokesperson). Through translation, actors become enrolled into an actor-network." As such, translation is a crucial component of 'interessement,' which Michael states "captures those practices that an actor employs to impose and stabilize a particular identity on other actors, once that identity has been problematized. First problematize the French public as failing to fulfil their desires for a more ecological France, then 'interesse' them in the identity centred on electric vehicles as the solution to this problem." (Michael, 2017)

Although Callon (1984) proposes four 'moments' of translation in his St. Brieuc case study (problematization, interessement, enrolment, and mobilization), I will show that in the case of Holistic Management, it makes more sense to view this as an iterative process rather than a

single moment in time. In Callon's study, the scientists sought to position themselves and their innovation (scallop anchoring structures) as an obligatory passage point for the scallops and the fishermen. In a similar way, Holistic Management experts sought to interesse Albertan ranchers. They did this by attempting to position Holistic Management as a mandatory passage point between ranchers, cattle, and rangelands or pastures. In this case, the other actants HM experts were attempting to separate included conventional management practices and service industries. If the interessement were successful, HM ranchers would then pass through the HM system when accessing services for their ranch and marketing their beef, whether through auction or direct to consumer sales. In the case of Callon's scallops, the scientists were unsuccessful because of the scallops' resistance to the proposed anchoring technology, as well as the fishermen's reticence. In this section, I will explore the relative success of Holistic Management in its attempted interessement of Albertan ranchers, focusing primarily on the 1980's and 1990's. As I will show, however, the events from this period have evolved in intriguing ways to influence contemporary alternative ranchers. The story or Holistic Management in Alberta comes together primarily from a handful of older farmers whom I interviewed for this project. They personally experienced the original wave of Holistic Management promotion in the area and vividly recall the experience.

Holistic Management and Interessement

The history of Holistic Management begins in Northern Rhodesia (present day Zambia) in the 1950's, as a young Allan Savory, recently graduated from the University of Natal with a BSc in zoology and botany, works to stave off desertification as a research biologist and game ranger in the British Colonial Service (Savory Institute, n.d.-b). In addition to his government work, Savory also did consulting work with resource managers. Far from striving for impartiality

and an apolitical scientific stance, Savory embraced the political and would go on to be the leader of the official opposition during Zimbabwe's civil war. He was exiled for his involvement in 1979, at which point he relocated to the United States, continuing his consulting work. After extensive consulting and non-profit work, as well as publishing several books and multiple articles about the benefits of his grazing method along with his wife, Judy Butterfield, and several colleagues, he founded the Savory Institute in Boulder, Colorado, in 2009 (Savory Institute, n.d.-a).

The development of Holistic Management as a concept and a brand appears to have taken place in the 1960's, after Allan Savory's now infamous elephant slaughter episode. According to the Savory Institute,

> "In the 1960's, Allan Savory made a significant breakthrough in understanding what was causing the degradation and desertification of the world's grassland ecosystems and, as a resource management consultant, worked with numerous managers on four continents to develop what by the 1980's had become Holistic Management." (Savory Institute, n.d.-a)

In his TED Talk, Savory recounts the details of this breakthrough, which dawned on him after he had recommended (successfully) that the slaughter of tens of thousands of African elephants would help restore the grassland ecosystem in Northern Rhodesia. Though this recommendation seemed sensible at the time – reducing grazing pressure was supposed to allow grasslands to regenerate – in this case it seemed to make the conditions worse, which led Savory to the 'significant breakthrough' of using controlled herbivore grazing to manage grasslands. Reflecting on his experience in the TED Talk, Savory states:

> "Loving elephants as I do, that was the saddest and greatest blunder of my life, and I will carry that to my grave. One good thing did come out of it. It made me absolutely determined to devote my life to finding solutions." (Savory, 2013, para. 9)

This incident appears to have divided the public response to Savory and the data collected during the course of this study shows that it is one of the most memorable facts about Savory's career for the study participants. However, Savory's honesty and repeated statements of contrition regarding the incident appear to have reinforced the alternative ranchers' trust in him, in a similar way that Gabe Brown's self-effacement does. In fact, as the next section will describe, Allan Savory's personality, as much as his ideas about grazing management, impacted the success of Holistic Management as an innovation.

Holistic Management in Alberta - 1980's and 1990's interessement

As part of his foray into North America, Allan Savory offered courses and workshops in Holistic Management, and several of the older study participants took part in these original offerings. Since Savory was teaching many of the sessions personally at the time, the participants also had an opportunity to learn about Holistic Management directly from him and have since then been able to reflect on this experience. This section draws on the experience of three ranchers who have each had over 35 years of ranching experience and who participated personally in Holistic Management workshops in the 1980's and 1990's. Two of these participants were beef producers at the time and one started out as a grain farmer. Through their narratives, I will trace the attempted interessement of farmers in Alberta by the innovation of Holistic Management. Much like in the case of the fishermen of St. Brieuc (Callon, 1984), however, the story also involves the interessement of non-human actants; in this case, cattle, pasture plants, and soil.

In the 1980's, the economic system in North America was under strain from high rates of inflation and the increased oil prices of the 1970's, which led to an increase in the prime interest rate as a measure to reduce inflation. Consequently, farmers in Alberta experienced interest rates as high as twenty or thirty percent on bank loans to buy land and agricultural inputs. The three ranchers, who experienced this period of economic strain, were highly motivated during the late eighties and early nineties to avoid debt and were looking for a way to eliminate debts incurred in the course of conventional agricultural practices. They also already expressed dissatisfaction with the risks associated with grain farming (hail, crop failure, etc.), as well as conventional pest control strategies such as insecticides. It was into this agricultural climate that Holistic Management attempted to make a foray. One farmer was struck by the synchronicity of this:

> "In 1995 we sat down at the table after the kids had gone to school, after breakfast, and I said, you know what – this isn't working. We had, we had been… we started borrowing money, finally, operating loans, in 1989, and each year it was 5000 more dollars and […] it wasn't working. The first year we had a crop failure […]. We just couldn't keep up catch-upping. *Literally* the next morning I went into town, and I picked up the mail, and there was a leaflet on the very top of the mail and it said: If you want to get off the treadmill, that agri-business treadmill, come and learn about Holistic Management." (Farmer 1, original emphasis)

This experience somewhat contradicts the standard narrative of translation as described by Callon (1984), which ascribes the responsibility for problematization to the actant trying to impose themselves on others. As the experience of these producers indicates, HM advertising tapped into a situation that was already problematized.

On the other hand, when the ranchers in question signed up for and took the courses, they experienced problematization when the instructors sought to frame the problems the producers were experiencing in terms of incorrect operational management and suggesting that the problems could be resolved if the producers implemented Holistic Management (Callon, 1984). The courses consisted of a series of four weekend-long workshops which the participants described as overwhelming but exciting. All three ranchers took multiple iterations of the course and two later became speakers who promoted a similar type of grazing management, though not by becoming certified HM instructors. As noted by one participant, however, this experience may hide a survivor bias – the majority of the farmers who attended their information session did not sign up for the full course, and most of those who took the course with them no longer practice HM.

The HM instructors also sought to interesse the farmers by placing themselves between them and other actants that were trying to enroll them, such as various agricultural services and equipment companies, banks and lending institutions, and conventional agriculture experts. The three ranchers expressed needing less conventional equipment such as tractors, artificial inputs, and large new vehicles, and more alternative tools such as electric fencing, horses, small vehicles, and tools for planning out the grazing season. While the instructors were trying to interesse the ranchers, they were attempting to enroll various non-human actors in the HM network as well. Although the instructors needed to be persuasive in order to convince the ranchers to try the HM system, the ranchers stuck with it because they saw positive results from the cattle, grass, and soil on their ranch. When describing the HM method for planning out cattle moves for the grazing season, one rancher put it plainly: “we get something that works no matter the size and it… just works.” (Farmer 14) Ultimately, the targets of the interessement were not

only the ranchers, but the cattle, grass, and soil. Applying the HM system to a given ranch is therefore an attempt to enroll these non-human actors in an alternative grazing system, an agro-ecological actor-network.

Success of a new HM-inspired operation depended on the willingness of cattle to get to market weight without relying on grain-finishing, which is successful in this regard. As the ranchers indicated, not all cattle are created equal when it comes to finishing on grass, and they had limited success with conventional breeds when first starting to implement this system. Ultimately, the original cattle herd on one operation refused to be enrolled in the HM grazing operation and a new cattle breed had to be imported, which has since proven to be more cooperative. The pastures, on the other hand, appear to have been cooperative right from the start, though all twenty of the ranchers in the study acknowledge that it takes at least two or three seasons to see significant changes to the forage composition and volume. Some ranchers consciously sought to entice native plants to grow on their pastures through strategic cattle movement as well. The three HM ranchers also express their strong commitment to soil health as the foundation of a healthy grazing system, indicating that the soil is being consciously enrolled in the system as well. This latter actor is of course also a complex network, which is being investigated by soil and climate scientists. It is proving to be an unruly assemblage, as efforts to measure soil organic carbon, for instance, continue to be fraught with uncertainty and technical difficulties.

Nevertheless, the scientists are not the only ones attempting to enroll carbon – the pasture plants are waging their own campaign, with the support of the cattle and the ranchers. In addition to the three ranchers who have primarily informed this portion of the study, nearly all of the ranchers I interviewed were motivated to sequester carbon in their agricultural soils to support

better plant growth and therefore cattle weight gain. Contrary to the hopes of climate activists, however, they were only loosely motivated by climate concerns. It is not so much the carbon that enrolled the ranchers but rather the plants that enrolled them both in their network to secure more nutrition and future growth. Perhaps it was the plants all along, motivating Allan Savory to reconsider his approach to grazing management, which over time made its way to the Alberta grasslands.

In the 1980's and 1990's, Holistic Management was offered in Alberta through in-person workshops and there were limited supports for these alternative ranchers. Furthermore, they reported feeling limited in their capacity to market grass-finished or 'natural' beef, since there were few channels to reach consumers outside of the conventional cattle auction system. Getting supplies such as electric fence was also challenging, since it was not yet a common-place product. However, despite these logistical challenges, the ideas promoted by HM, such as mimicking nature and adaptively moving cattle through small paddocks, have taken root in the grazing community, and continue to influence ranchers thirty years later.

Interessement 30 Years Later

While it is illuminating to follow the path of interessement within a time-delimited frame of a particular series of events, I was especially curious to follow the path further. I was lucky enough to talk to both those ranchers who personally experienced the entry of Holistic Management courses into Alberta and also a new generation of ranchers whose parents took the course at that time. Three of the study participants had at least one parent who took a Holistic Management course in the late 1980's to 1990's, and who subsequently recounted the influence of HM education and practices on their own worldview and grazing management strategies. Another participant is a first-generation rancher who tapped into the Holistic Management

community to acquire the skills and experience necessary to start his own operation. Their experience reflects the kind of negotiations that take place between the various actants involved in a grazing system when a new idea is introduced and attempts interessement.

When asked to recount their parents' experience of switching to alternative grazing management such as HM, the three second-generation alternative ranchers corroborate the experience of the three older study participants in the previous section. The limited resources available at the time in terms of information, supplies, and support made the transition challenging at the time, and Holistic Management filled a gap that arose from a frustration with conventional agriculture. Since then, the proliferation of the internet has made learning about various alternative systems much easier and has also created new marketing opportunities to increase the profitability of alternative agriculture. However, this increased availability of resources and supports has posed its own challenge to HM as an all-inclusive grazing management system that covers everything from how to move and feed the cattle to how to make financial decisions.

Unlike the previous generation, alternative ranchers now have easier access to their peers around the world and a wide variety of frameworks and ideas early in their ranching career. They also have the support of their parents and other experienced ranchers who are familiar with alternative grazing management. As a result, they are less dependent on a small number of formal systems such as HM or Ranching for Profit, which was another option available in the 1990's. Thus, while the older ranchers who started pursuing HM practices continue to identify as HM graziers, their younger counterparts framed HM as something that inspired their practices, or as one of several systems they draw on. For instance, Farmer 11's parents transitioned to HM

fully from being conventional grain and cattle farmers, and though it influenced him from a young age, he has since added more courses, systems, and tools to his practice:

> "We use multiple tools here. Holistic Management's definitely one of them, for some of the decision-making processes we do here. And there's also a lot of good grazing component here. We've also kind of extended that now to a lot more permaculture techniques and applying that. And another one is keyline design we're utilizing now for a lot of our waterworks and water development on the farm." (Farmer 11)

Farmer 11's experience with different courses, systems, and organizations such as Young Agrarians, which is active across Western Canada, indicates that while HM attempted to place itself between ranchers and other actors such as cattle, grass, and soil, it did not remain a 'black box', or whole unit of analysis in a network that resists problematization (Michael, 2017). Since the early days of HM in Alberta, the other actors asserted themselves and broke down the black box of HM into potentially useful components that conduct their own negotiations. In a sense, despite retaining a formal network through a body of literature and official organizations, such as the Savory Institute and Holistic Management International, the various concepts behind HM have dissipated and been taken up piecemeal by the alternative grazing community.

One technology that seems to have successfully enrolled all of the actors in the alternative grazing management network is electric fencing. With a far lower cost for producers than permanent fencing, and the promise of easy cattle moves, this technology has become indispensable to ranchers using rotational grazing in Alberta. According to the ranchers in this study, the fencing has also successfully persuaded cattle to stay within a given paddock, as herds only need a short time to adjust to this technology and it is overall not stressful for them. Based

on their observations, the pasture plants have also been successfully enrolled, though this latter part is difficult to corroborate, as outlined in Chapter 2, since ecological studies on the subject are not conclusive. In this curious turn of events, it is indeed a physical technology that seems to be asserting itself, though the ranchers may not be technology enthusiasts per se and prefer mimicking Nature. In an ongoing process, this technology may soon be supplanted by yet another, such as electronic collars.

As much as these ranchers tend to avoid conventional technologies, new tools that aid them in alternative practices are emerging as well. So, the same farmer who told me that he likes to "read about all the fancy sorting systems they have, and the new haying equipment and silage equipment […] but that's just not for [him]" (Farmer 7) also uses electric fencing and is looking at installing a walk-over scale for his herd that would weigh each animal as it passes from one pasture to the next to determine weight gain. Permaculture, too, is a system that generally discourages heavy machinery use, but tends to incorporate other technologies such as comprehensive water collection and purification systems and chicken tractors. Many of the ranchers involved in the overall study were open to some technologies but not others, indicating that although they may be reluctant, they are cyborgs, nonetheless. As far as Holistic Management goes, in the thirty years since its first forays into Alberta, it has become part of a growing network of alternative agricultural practices that still depend on technology, but it lost some of its 'black box' cohesion in the process, even as its components live on.

Conclusion

This chapter has explored some of the ways that ANT can be used to gain insights into an innovative practice and how it is taken up by ranchers. In particular, ANT provides a helpful toolkit and vocabulary for exploring the agency and influence of non-human actors in a complex

system that includes humans, domestic and wild animals, plants, microbes, technologies, and more. It is by no means a simple framework to apply, but as a counterpoint to the traditional tools and assumptions of sociology, even environmental sociology, it adds a useful reminder that humans are just one junction in a crowded actor-network. It behooves us to pay attention to the various associations formed and constantly renegotiated between the (more-than) social members of a community such as the agricultural-ecological-technological system that produces, among other things, the foods humans consume. In the end, the distinction between goddess and cyborg may be overstated.

Chapter 6: Discussion and Conclusion

Introduction

This study started out as an attempt to explore how resource users navigate an information landscape that is defined by scientific uncertainty and debate between experts. By asking the question "*How are science, scientists, and scientific institutions perceived among alternative livestock management practitioners in the Canadian prairies?"* I had sought to better understand how resource users and practitioners outside of mainstream conventional systems encounter and evaluate information to make decisions on their operations. Like any research project, this one began with a few assumptions, which quickly had to be adjusted or discarded when the data collection began. This final chapter seeks to address some of these assumptions, reflect on the findings of the research, and make a few recommendations for future research and application when it comes to alternative resource users.

Study Limitations, Reflections, and Future Research

The proposal, ethics approval, and recruitment for the study came together in early 2020, with an initial plan to conduct three to five focus groups in key areas around Alberta and then

follow up with a portion of the group participants through on-farm interviews discussing some of the same questions. The purpose of this approach was to compare the way in which ranchers discussed sensitive questions of trust in science among a group of their peers and privately with the interviewer. However, just as the data collection was set to start, COVID-19 restrictions came into effect and in-person research was suspended. The project was therefore adjusted to conducted through remote interviews, and the focus group component was removed. Although it is possible to conduct group conversations via an online platform such as Zoom, the rural location of the target study participants made this impractical due to limited internet capacity. Although all participants were given the choice of Zoom and phone interviews, all but three interviews were conducted over the phone. The removal of in-person interactions, focus groups, and on-farm observations changed the type of data collected substantially, in particular as it relates to ANT analysis. A future project incorporating the study data as well as more on-farm observations and association tracing would further contribute to the literature on ANT and alternative agricultural systems.

The recruitment process for this study also led to certain limitations. The ranchers who took part in this study self-selected to participate, and over the course of the interviews it became clear that many of them have taken part in research projects for both biophysical and social sciences in the past. Given this propensity for study participation, they would have relatively positive attitudes towards research – a fact that influences their responses to the study questions in this case. During the recruitment process, most of the ranchers I reached were willing to take part in the study, which was made more accessible due to the remote interview format. However, several ranchers I contacted did decline to participate for a variety of reasons. Some of these had to do with time commitment, since smaller operations put significant demands on the ranchers'

time. Notably, one rancher declined to participate specifically because he felt that university research led nowhere and was a frustrating waste of his time. Such self-selection is inevitable in research that includes people, as informed consent is fundamental, but in the case of this study it does influence the outcomes of the project.

One of the choices made early on with the creation of the interview guide was to avoid the use of potentially triggering terms such as 'science,' 'scientist,' etc., and 'trust.' This was done to avoid swaying the participant too early in the process, but it did make the conversation more meandering. The value of this strategy is reflected in the terms that did get used, such as 'researcher' and 'expert' as the participants picked up on these words and mirrored them in their responses. This was a challenging aspect of the data collection which led to important avenues of analysis, such as the conversation about who constitutes a 'scientist,' but also generated a substantial amount of data on tangentially related topics. Some of these topics include the family dynamics and aspirations of the ranchers; health and mental health experiences related to agricultural work; social media use and experiences; and interactions with and reflections on activism and activist organizations. Conversations about climate change also arose and were discussed to a limited extent during the interviews, but the topic was not pursued extensively due to time limitations and the scope of the interviews. However, a qualitative study with a similar group of producers relating to climate change would be fascinating, based on the conversations I had with the participants already. The topic of climate change is a fraught one for beef producers in general (see Chapter 1), but the regenerative agriculture movement has taken on the topic of climate change and agriculture from a unique perspective. As an early promoter of cattle as a tool to improve environmental outcomes, Allan Savory's influence on this conversation is evident. On the other hand, Joel Salatin's alleged climate change denial has also gotten

substantial airtime in those circles (Readfearn, 2017). Understanding how cattle producers and other involved in regenerative agriculture practices frame climate change and position themselves in the conversation would be valuable to the larger conversation about sustainable agriculture and what it means to the various parties involved.

Finally, I have encountered multiple studies that have worked with the population group whom I interviewed (e.g. Dahl, 2019; Heiberg & Syse, 2020), which has created a wealth of overlapping qualitative data in recent years. These studies focused on decision-making to some extent as well and given the small size of the alternative grazing community in Alberta likely included some of the same individuals. I believe that there is potential in collecting and amalgamating these data sets for further analysis. Since these data sets were collected over a period of several years, a temporal dimension can be added to the analysis as well. Given the labour-intensive nature of qualitative fieldwork, such an effort would create opportunities for new insights while limiting additional data collection needs and not putting any additional strain on the population group of interest, provided that ethics guidelines are followed with regard to the data.

Holistic Management and Actor-Network Theory

ANT is like HM in the sense that it makes claims on one's whole being, whole worldview. As Michael puts it, ANT is not simply a toolbox to be "'picked up' and applied across different disciplines," but rather "a complex, and oftentimes disparate, resource (closely aligned with a particular, evolving, set of sensibilities) that opens up a space for asking certain sorts of methodological, empirical, analytic and political questions about the processes of the (more-than) social world."(Michael, 2017, p. 3) However, much like HM, that is not the only way in which ANT is being taken up. Even as some ranchers continue to identify as 'HM

ranchers,' many more are looking to HM for inspiration, tools, and bits of wisdom. ANT, too, has an aging and venerable face in the person of Bruno Latour, who, like Allan Savory, has made significant contributions to shaping the field for decades. Unlike Savory, however, Latour has continued to reinvent his stance, sometimes rejecting the terms 'actor' and 'network' and 'theory', as well as the hyphen (Elder-Vass, 2015; Latour, 1999a), other times reclaiming them (Latour, 2005). His recent works and speeches have been more urgent and more political, such as the series of lectures he gave as part of the Gifford lecture series (University of Edinburgh, 2016), which were eventually published as Facing Gaia (Latour, 2017). The latest publications to date continue this trend, seeking to attribute responsibility for the climate crisis (Breitwiller et al., 2021) and recommend paths forward (Latour, 2021). In this sense he has begun to echo Savory, who has been preaching urgency since at least the 1980's (Savory, 1983, 2013). Like Savory, too, Latour has ceased to be a voice crying in the wilderness, as founts of support (and competition) have sprung up around both.

A part of this success, going from the fringes to what may be considered the mainstream – though really, it is the mainstream that has come to what used to be the fringes – tends to be losing the 'purity' and 'wholeness' of the practice. It is no longer necessary to join 'a cult', as one study participant recalled, when one can take the most relevant or attractive parts of a system and apply them to one's problem areas. In this sense, HM has permeated the alternative agriculture movement, infiltrating it piecemeal even as a smaller cohort of 'true believers' continues on. ANT, too, can be of benefit to other fields in this way. If environmental sociology is to consider critically the relationships between various more-than-human actors, ANT provides many benefits, tools, and challenges. It is a reminder to resituate ourselves and our inquiry within Nature, which really is what environmental sociology is all about.

Recommendations

In seeking to understand how alternative ranchers encounter and relate to science, scientists, and scientific institutions, this study shed light onto themes that may be of interest to several types of readers. Firstly, my aim was to fill a gap in the literature relating to lay-expert relations with a unique group of participants who can be categorized as laypersons in some regards, but as practitioners actually possess substantial experience and expertise in the areas of science that were addressed in the interviews. More than half of them also had post-secondary education in an area relevant to their practice. As such, the study may be of interest to environmental sociologists seeking to understand lay-expert interactions, especially with resource users and practitioners. In addition to being of interest to this specialized audience, the findings of this study have implications for both scientists and policy makers.

For Research Scientists

Research scientists, especially those in the fields of environmental science, ecology, natural resources, and related fields already work personally with the majority of the ranchers who participated in this study. The ranchers communicated an overall positive experience working with these scientists, but a less positive overall impression of scientists that they did not work with. This is related to an overall frustration with the limited extent to which research scientists consider producer perspectives – an understandable stance for producers whose experiences do not conform to the mainstream. The study participants also mobilized scientific knowledge to legitimize their own perspectives and practices in an occasionally self-reflexive show of confirmation bias. These observations are unlikely to be especially surprising to those who already work with producers and interact with them directly but are important to keep in mind when communicating scientific findings to this type of audience.

One opportunity that was identified through the conversations with study participants is the wealth of data that is being collected by ranchers about their own operations through various software applications. The development and spread of phone-based apps such as MAIA Grazing presents a new avenue for data collection and modelling, since large data sets are created by adaptive grazing managers over a longer time. This type of app collects data about the number of cattle, move times, weather, and other variables which could provide the materials for models to further test theories about systems that are difficult to standardize, such as adaptive management. Given the desire of the ranchers to be heard by the research community, this could be a fruitful avenue of inquiry.

For Policy Makers

As indicated by past research related to the lay-expert divide and public engagement, policy makers would be wise to approach engagement with both the *intention* to listen to public concerns and the *capacity* to act on their recommendations. Failure to do so has led to consequences such as further disengagement and alienation, as outlined in the institutional deficit model. The findings of the present study indicate that these alternative producers do not feel supported by the policies that affect their operations and are largely acting 'despite' them. Furthermore, as outlined in Chapter 4, the majority of participants felt that government science-backed recommendations such as grazing best practices and the Canada Food Guide were based on outdated information. On the other hand, those producers closer to the conventional side of the spectrum within the study sample expressed greater agreement with government experts and publications, while those who identified more strongly as 'alternative' had more qualms. One thing that the majority of producers in the study agreed on is that not all science is created equal. They expressed a sound understanding of the research and publication process and indicated that

they cared about the way in which studies are done, from funding to research methods and key variables. This level of care and engagement, combined with an analytical view of the production of science shows that these producers would not be satisfied to follow policies because of a broad explanation that they are science-based. Far from being disengaged publics, the alternative producers who took part in this study were highly engaged with science through various channels, but engagement does not necessarily equal agreement.

Conclusion

This study has brought together literatures relating to Actor-Network Theory, the New Environmental Paradigm, trust, lay-expert interaction, and public engagement, as well as range management science in order to better understand how science is mobilized in the alternative grazing management sphere in Alberta. My hope is that the findings of this study can contribute to better engagement between institutions and the publics they are meant to serve. While the 'crisis' of mistrust and skepticism regarding science is a pressing concern for our times, the findings of this study show that far from being disengaged publics, those who are choosing alternative pathways to scientifically prescribed best practices can be highly motivated and engaged with scientists, scientific institutions, and publications.

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Appendices

Appendix 1: Information and Consent Document

Information Letter and Consent Form

Study Title:

Evaluating Information for New Beef Production Management Practices among Alternative Beef Producers (Pro00094895)

Research Investigator:

Kira Dlusskaya

6-24 General Services Building

University of Alberta

Edmonton, Alberta

Canada T6G 2H1

dlusskay@ualberta.ca

780-996-9615

Supervisor:

Dr. Debra J. Davidson

5-43 General Services Building

University of Alberta

Edmonton, Alberta

Canada T6G 2H1

debra.davidson@ualberta.ca

780-492-4598

Background:

You are being asked to participate in this research project because you indicated that you are a beef rancher who uses the practices which are relevant to the study (AMP grazing or similar). The results of this study will be used in support of the primary researcher's thesis project, and are part of a larger study of the environmental consequences of various grazing management practices. This study is conducted by a multi-disciplinary team working through the University of Alberta, and is funded by a grant from the AGGP (Agricultural Greenhouse Gas Program), through Agriculture and Agri-Food Canada. Before you make a decision about participating in this study, one of the researchers will go over this form with you. You are encouraged to ask questions if you feel anything needs to be made clearer. You will be given a copy of this form for your records.

Purpose:

The purpose of this study is to learn more about alternative beef producers' perspectives on new information and decision making on the farm. By understanding how beef producers obtain and evaluate information about new farming practices, and which information gets put into practice, researchers and policy makers will be better able to understand producers' perspectives on innovation and the effects of different practices. Better understanding of farmers' perspectives on new information will help researchers and policy makers better respond to producers' needs.

Study Procedures:

Participants will be asked to review the consent form and provide verbal consent to the procedures outlined in it at the beginning of the remote interview. A copy of the completed consent form will be sent to the participant by email. Interviews may be conducted via a secure Zoom channel with a password or by phone, depending on participant preferences. The interview will be recorded and transcribed by the research team. Each interview can last between 45 and 90 minutes, depending on participant response. This time does not include any pre-interview discussion, such as reviewing this consent document. Please see below for details about information storage.

Risk:

There are no known physical risks to participating in this study over and above what participants would experience in their day-to-day lives. Please see below for more information about confidentiality.

Benefits:

We hope that the information obtained from this study will help researchers, policy makers, and producers better communicate with one another and lead to the development and implementation of best practices that work well for producers and other stakeholders. No direct benefits are anticipated for the participants of this study.

Cost of Participation:

No additional financial expenses are anticipated for the participants in this study. Participants will be reimbursed with a $10 gift card as a token of our appreciation for their time and for sharing their experiences and knowledge.

Voluntary Participation:

Participation in this study is completely voluntary and participants can withdraw from the study at any time. If the participant chooses to withdraw during or within two weeks after an interview, that data can be removed from the study if necessary, prior to the publication of any findings which contain that data.

Confidentiality and Anonymity:

As the interviews will be conducted remotely, participants may choose to be interviewed via phone or via a Zoom meeting with password protection. Zoom is a secure software application that uses encryption to protect the communication channels. A password will also be used to ensure that no third parties can join the call. The participant will need to have the Zoom app installed on their device but will not need to create an account in order to participate.

The information gathered during this research project will be audio-recorded and transcribed. The participants' names will be removed from the transcripts and each participant will have an

associated code for the purposes of the project. The audio recordings will be kept for the duration of the project and for five years afterwards as required by the university. The transcripts will be retained indefinitely for possible use in future publications for research and academic purposes. If we do so, each new project will have to be approved by a Research Ethics Board.

A separate list of names with codes will be retained in the event that a participant wishes to withdraw their interview data at a later date.

Additional Contacts:

The plan for this study has been reviewed by a Research Ethics Board at the University of Alberta. If you have questions about your rights or how research should be conducted, you can call (780) 492-2615, or email at reoffice@ualberta.ca, using the reference code Pro00094985 to identify this study. This office is independent of the researchers.

Consent Statement:

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above and will receive a copy of this consent form. I will receive a copy of this consent form after I sign it.

Participant's (or Participants') Name(s):

Name of Person Obtaining Consent:

Date and Time of Consent:

Appendix 2: Interview Guide

Remote Interview Guide

(5 min.) Welcome and Introduction

- Thank participant for agreeing to share expertise through interview
- Remind about purpose of study

10(5 min.) Ground Rules

- Recording equipment
- Confidentiality; review Information and Consent Form

20(Approx. 10 min.) Introduction/Background

- Tell me about yourself
- Education
- Family history re: farm, personal history with farm

35(Approx. 15 min.) About Farm

- Tell me about your farm – e.g. cattle type/number, size
- Tell me what the farm conditions are like.
- Would you say your farm is typical for the area you are in?

65(Approx. 30 min.) Changes

- Have there been any key changes while you have been involved with the farm?
    - Externally initiated: environmental, political, economic
        - How did you respond?
        - Did you get any new information at that time? How did you evaluate it?
    - Internally initiated: Farmer-initiated changes, Family/business changes, Management Changes
        - How did you respond?
        - Did you get any new information at that time? How did you evaluate it?
- When did you start implementing alternative grazing practices?
        - Did you get any new information at that time? How did you evaluate it?
        - Where did the information come from? Whom did you ask? How did you know if it was good information or not?
- Emotional responses to change?

85(Approx. 20 min.) Open Discussion

The key topics are

- history with farm (personal, environmental)
- changes and response
- implementation of new practices

Questions will focus on:

- how information was obtained in order to put new features/practices in place
- where the information came from
- and how the farmer determined whether it was quality trustworthy information.
- Additional follow up questions about information acquisition, trust, scientific information, institutions, as needed.
- How has this experience been for you? Have you ever participated in a study before?
    - ***feedback but also potentially relevant to experience of science/studies/academia
- Any additional comments?

90(5 min.) Thank participant for their time and remind them about various options: withdrawing from study at any time, contacting researcher with any questions, alternative contact information in case they want to discuss researcher conduct, etc.

Appendix 3: Transcription Guide

Transcription System Features

Normal text.

Emphasis

[paraverbal, non-verbal, or noise indicators] e.g. [laugh]

[laughing] [/laughing] indicates quality of speech changing for a portion of statement, '/' indicating end of change, as in computer code

… short pause

[pause] intermediate pause of 1-2 seconds

[three second pause] longer pause

An interruption, whether by same speaker or another speaker. E.g. "I was going – we went together to the workshop."

'' speaker is quoting themselves or another person. E.g. "And I was like, 'That's not how you do it!' so we kept talking…"

Repeated words with no pause: e.g. And-and; I-I-I

Repeated words with a small pause: e.g. "I, I went and…"

Appendix 4: Participant Observation Notes

Participant Observation – 2020 Conference on Grazing and Soil Health

Dates: December 12-December 14, 6:30 am to 6:30pm – additional banquet available for $50, December 13 7-8:30pm

Observation Period 1: second speaker on Day 1 – Joel Williams

Observation Duration: 60 minutes

- Spoke directly after Gabe Brown
- BSc from Australia
- Sponsored by Agriculture Solutions
- Speaker – introduced by organic org. communications person – young lady
- "We're going to be doing some rethinking" – speaker
- Simple science concepts to start – photosynthesis
- people seem to be taking quite a few notes on notepads provided
- Speaker does a lot to provide simple visual equations/concepts – then a few more formulas
- Lots of people in hats – baseball caps in neutral colours and a few cowboy hats
- Basically all attendees present as white – I think I saw one black man
- Adult attendees – many present in their 50's, grey hair, some 30yo, some up to 70yo
- Thick conference booklet – people are reading
- Carpeted ballroom type with round tables and a stage. Two projection screens.
- "feeding biology" – speaker
- Lots of little coffee cups and refillable bottles of water on the tables
- Speaker – diversity in soil
- Probably 180 people in room – max capacity, and room is very full
- About 2/3 men, 1/3 women, give or take
- A few people crossing their arms
- "The true intricate and dynamic nature of root exudates" – speaker
- "feed biology" – speaker
- Many couples – apparent families with adult children, some young children
- Cowboy gear:
    - plaid
    - hats
    - boots
    - belts
    - buckles
    - vests

    - scarf/ties
    - ‘Navajo’ prints
    - floral for women
- Speaker trying for jokes, audience laughs politely
- some yawns
- People looking down at phones (?), laptops, notes
- Low chatter
- Small holiday tree in corner – probably from hotel
- some photos taken of slides
- Speaker: “Very interesting science happening now” combining tools – gene, gene expression
- a few people are pressing lips together, furrowing brows upwards, not between brows
- Speaker using plenty of metaphors and illustrations
- Dead carbon → living carbon
- Soil death is equally important – a giggle
- He clarifies: decay is important
- Front page of an academic paper on slide up for about a minute
- Shoots, roots, and exudates
- It’s the roots that are the much more important part of building soil organic matter
- A few people standing in the back of the room
- #RootsNotShoots → on slide
- Review of host of other studies about percentage of above and below ground Org. Carbon
    - graph of many peer reviewed studies
- “Managing for Roots”
- We were very successful at breeding for yield, “but of course that comes at a cost” – speaker
- Again header of peer review paper shown
- of course it’s the classic line
    - cover crop
    - window of time is so short it’s not worth it
- Another header of academic paper pops up on slides, followed by simple visualization diagram
- Quickly followed by more paper headers
- It’s basically chemistry vs. physics
- More pressing lips and furrowed brows
- “Different schools of thought” complex carbon more secure or not?
- Another school of thought – fungi more important than bacteria?
- People using phone s – photos, reading sthg.
- Lots of metaphors for scientific concepts
- People going in and out of room more frequently now

- 10:49am
- fungi are possibly more important for carbon sequestration → was school of thought
- one lady with family wearing Mennonite head covering
- "Nothing wrong with that, but only half of the story"
- Physical pathway to trap roots and carbon in aggregate → sequester, stable
- Next header of academic paper review 2012 → highly cited paper
- Physical pathway important
- Exposure to oxygen → tillage → loss of carbon
- New tool to measure without disturbance
- Jokes about complex scientific terms by speaker "whatever that is"
- Next paper header! Followed immediately by another one
- "Creating pore space for that biology to grow"
- Side chatter among hat wearers at one table in the back – giggling
- Mycorrhizal fungi → critical driver of aggregates
- fungicides → less of these, and of aggregates
- everything is so connected.
- Applying things above ground can compromise soil structure even with no till
- 1 crop → 2 crops intercropping aggregate synthesis increased 15% - 58%
- Microbes density increases
- What is the resilience of that more diverse system?
- Monoculture → more competition as plants need same things from same place at same time
- Chatter is increasing in the back
- Another paper
- Apologize for busy slide with many graphs
- Notice the red
- Wilson, Strickland et al. Grazing and soil organic carbon
- Take-home message – transition our thinking on soil health: In addition to the old view of chemistry, physics, and biology, add the importance of plants. Plants change the soil. Plants are your tools.
- "You as farmers" speaker – assumption about attendees
- soils → then plants (arrow back with 'influence')
- Plant genetics → key driver of root depth – breed for this
- More rotational grazing – recovery for maintaining root systems
- Substantial but brief applause – seemed like a comfortable time
- Question: What about herbicides?
    - all chemicals have a specific mode of action
    - Can't say "all chemicals kill all biology"
    - Some groups of microbes may be sensitive to some chemicals, so diversity will go down

    - What we do know: under conventional management we are dampening diversity
- on slide: @integratedsoils, www.integratedsoils.com
- Questions: 7
    - Technical questions, what happens when?, what about?
    - indicates engagement
    - Audience struggles to hear questions, speaker repeats

Observation Period 2: Lunch Time Speaker on Day 1

Observation Duration: 10 min

Delayed by 30 minutes – unclear announcement

CRSB Kaley Segboer-Edge

- Emphasis on members, sponsors, producers
- Beef supply chain and beyond
- People trickling back in from lunch
- Seems to be a pre-written announcement
- Chatter in the hallway
- Projects-based, project inventory – 10 goals
- Annual survey and communicated back to members
- Outcome-based certification program not as practice-prescriptive
- Sustainability claims communicated to consumers
- Brand names used – attracting attention, turning heads
- Still chatter in the hallway
- Lots of people on phones
- Rushed for time – given 1/3 of the time originally assigned

Observation Period 3: Dr. Dwayne Beck

Observation Duration: 30 mins

- Ecosystems
- "I need a pretty girl to help me set this up" referring to projection/presentation setup
- Farmer owned research facility instead of government
- Lots of personal stories, travel stories
    - People are engaged-looking, laughing
- Emphasis on rural accent
- Historical emphasis
- "We started to do all these stupid things to take the ecosystem and we started flooding"
- "The Indians were smart enough to build on the hills"
- "White people did the European man thing and build dams"
- Russian wheat deal
- "If you go to the gov you will lose control immediately – it has to be farmer-owned"
- Dakota Lakes Research Farm
- Still a few people standing in the back
- "We have these real scientists involved in the project" "real scientists"
- "It's not looking at the big picture most of the time"
- That's really what it's about – the communities
- "The lightbulb was not invented by incrementally making candles better." – slide
- He's so loud
- "Whenever people do research they forget these things." (gotta keep soil cool and moist)
- "Almost all the irrigation in South Dakota has disappeared – too expensive"
- "Dryland – not irrigated"
- The fossil fuels are damaging and you have to pay for them
- South Dakota Lakes
    - Fossil fuel neutral by 2026
- "I have learned more by observing nature than by trying to change it"
- Nature – she – knows better
- Ecosystems that leak nutrients turn into deserts
- Showing observation-based records from own research farm area
- Alan Savory brought up
- Rumen!
- Self-deprecating humour → giggles → attention
- Suddenly lots of chatter around manure
- "Agriculture cannot do this alone! It needs all of society to get a brain transplant"
    - Comment: Good luck with that.
- People with short-term goals
    - Including gov, corp, universities

- People with long-term goals
    - Landowners, farmers, ‘society’
- Deserve to have long-term goals!
- “If we want to eat beef, why not concentrate on beef instead of barley for beef on feedlots?”
- Dakotalakes.com
- Questions: 6
    - What to do about elk+deer?
        - Hunt them?
    - $ questions
        - The 1980s were really hard. A lot of anti-agricultural thought process.
    - Paid by the university
    - “A lot of them were girls – uh – ladies.” (referring to farm research managers)
    - Go up against those bureaucrats
        - Just have to be strong and take them on up to the end of time
    - End a little early.

Day 2 – Soil Conference

Dr. Yamily Zavala talk

- Large proportion of attendees not in presentation room
- Moved to before lunch
- Tech issues
- Dr. Zavala spoke about the outfit she made which is popular in her home country in South America – it was bright blue

Observation Period 4: Dr. Allen R. Williams – Understanding Ag

Observation Duration: 45 minutes

- Advice has not failed anywhere in the world
- It's all about life!
- Birds!
- Multiple operations on one farm
- Processing plan part of farm
- Adaptive Stewardship
- Wendell Berry – farmer – philosopher
- An object seen apart from the whole is not the real thing – Nosunaba?
- "Soil Carbon Cowboys" – google it
- www.pastureproject.org – lots of videos
- Historical Ecological Perspective
- Andre Voisin
- "Ecologically correct"
- Bio-mimicry
- Rules
    - Compounding
    - Diversity
    - Disruption
- "What we thought we knew as science, it all goes out the window when you have diversity"
- Weeds grow first because they are healing something
- Introduce planned, purposeful disruptions to improve resilience
    - How? Alter stock density
    - Do not move rotations in the sun
    - "bah-oh-logy"
- Biology Stimulates Biology
- Livestock
- Manure

- Grazing – action of eating a plant stimulates the biology of the soil
- Saliva is full of microbes, so is fur and manure
- Optical refractometer
    - That's proven science – in the fruit and vegetable industry
    - We want higher Brix!
        - Science shows… etc. etc.