The Wild Alberta Food Project

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Introduction and Method

The Wild Alberta Food Project is an interdisciplinary venture created by the author of this report, Scott McKenzie. While the task of this project is to assess how regenerative agriculture (RA) can improve Alberta's food system, this report may be viewed as an argument through which this project intends to change people's minds about agriculture. To this end, an exhaustive account of RA's benefits will be relayed in conjunction with the public policy initiatives required to facilitate food system transformation in Alberta.[1]

The following question bears answering at the onset of this report to serve as a signpost for the findings revealed in steps six through nine: What is the connection between healthy soil, healthy people, economic prosperity, and regenerative agriculture? In short, a food system based on RA has healthy, carbon rich soil that uses biological fuel instead of chemical fertilizers to produce healthier more nutrient rich food than can be produced using industrial production methods.[2] Beyond the positive socioeconomic benefits of a healthier population, farmer wellbeing is improved as they witness the positive environmental outcomes that result from RA practices.[3] Instilled with increased self-efficacy and a greater capacity for change, farmers are encouraged to complete the agricultural transition process and help others do the same, creating what researchers refer to as positive feedback loops.[4] Further, there is much anecdotal evidence that farmers who transition to RA practices are able to earn more profit per acre due to fewer

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1. See Glossary of Terms for definitions of carbon sink, feedback, feedback loop, food insecurity, food system, food value chain, and regenerative farming.

2. Courtney White, "Why Regenerative Agriculture?" *The American Journal of Economics and Sociology*, 79, no. 3 (2020): 800, https://doi.org/10.1111/ajes.12334.

3. *1) Limited disturbance; 2) Armor; 3) Diversity; 4) Living roots; and 5) Integrated Animals.* See page 22 for expanded definitions.

4. Kimberly Brown, Jackie Schirmer, and Penny Upton, "Can Regenerative Agriculture Support Successful Adaptation to Climate Change and Improved Landscape Health through Building Farmer Self-Efficacy and Wellbeing?", *Current Research in Environmental Sustainability* 4 (January 2022): 1, accessed December 20, 2022, https://doi.org/10.1016/j.crsust.2022.100170.

input costs and a more resilient landscape better equipped to handle the negative effects of climate change like drought, and increasingly frequent catastrophic weather events.[5] When combined with a growing market for RA products, visible corporate support from large corporations like Nestle, Pepsi, McCain, and Cargill, and increased acceptance from the financial sector, the economics of RA should be viewed as a positive rather than a negative.[6] Through public policy that incentivises ecologically responsible decisions, such as RA adoption, the interconnections between the environment, human health, and socioeconomic conditions can be managed to produce a sustainable positive feedback loop in which the quality of all three is improved.

One of the challenges facing RA is the lack of a universal definition. This can be attributed to RA practices being context specific vis-à-vis soil composition, and economic costs. However, for the purpose of this project RA may be defined as an approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple provisioning, regulating and supporting services, with the objective that this will enhance not only the environmental, but also the social and economic dimensions of sustainable food production.[7] As Alberta-specific research is aggregated, an Alberta-specific definition will emerge.

Using Repko and Szostak's stage and process model of disciplinary integration expressed in *Interdisciplinary Research: Process and Theory*, insights from the disciplines of ecology, sociology, economics, and public policy have been assembled, evaluated and integrated to

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5. Gabe Brown, *Dirt to Soil,* (Toronto: Chelsea Green Publishing, 2018), 178.

6. Diana Bach, Nova Sayers, and Hannah Weatherford. *White Paper: The Business Case for Regenerative Agriculture.* NSF (www.nsf.org, April 2020 2020). https://www.nsf.org/knowledge-library/white-paper-the-business-case-for-regenerative-agriculture.

7. Loekie Schreefel et al., "Regenerative Agriculture – the Soil Is the Base," *Global food security* 26 (August 2020): 6, accessed December 10, 2022, https://doi.org/10.1016/j.gfs.2020.100404.

produce a more comprehensive understanding of how regenerative agriculture can improve Alberta's food system. The following report provides an exhaustive account of this process and consists of ten steps:

1. Define the problem or state the research question.
2. Justify using an interdisciplinary approach.
3. Identify relevant disciplines.
4. Conduct a literature search.
5. Develop adequacy in each relevant discipline.
6. Analyze the problem and evaluate each insight or theory.
7. Identify conflicts between insights or theories and their sources.
8. Create common ground between concepts and theories.
9. Construct a more comprehensive understanding.
10. Reflect on how an interdisciplinary approach has enlarged your understanding of the problem.[8]

Although there are numerous Alberta-based RA ventures (Regenerative Agriculture Lab, The Simpson Centre, to name a few), New Zealand is widely considered to be the global leader in RA research. Consequently, multiple insights reflected in this report are gleaned from New Zealand's highly collaborative and comprehensive white paper titled *Regenerative Agriculture in Aotearoa New Zealand – Research Pathways to Build Science-Based Evidence and National*

8. Allan F. Repko and Rick Szostak, *Interdisciplinary Research: Process and Theory,* 4th ed. (Los Angeles: Sage, 2021).

Narratives, henceforth referred to as New Zealand's *White Paper.*[9] For reference, a report is considered to be a white paper if it is government sponsored.

While reading this report it will be helpful to consult the appendices as indicated. Particularly Appendix C, which contains a collated and annotated list of identifiers for all theories and subsequent disciplinary conclusions and assumptions used during the integration process. If you have downloaded this as a .docx file, you need only hover the curser over an identifier to view the corresponding annotation in the appendix.

1. The Problem: Alberta's Food System

The impact of population growth and poor environmental stewardship has humanity facing several food system related crises including climate change and global food insecurity. The earth cannot bear the environmental cost of feeding an additional four billion people by the end of the century unless agricultural practices undergo dramatic change. Further exacerbating these issues and exposing food system fragility is the COVID-19 pandemic which undermined food supply chains. Globally, poor diets are the leading cause of disease, accounting for 20% of premature disease related deaths.[10] The nature and severity of the challenges connecting agriculture and food value chains to nutrition, health, and global ecosystems can no longer be overlooked. The argument for food system transformation is now irrefutable.[11]

Of all Canadian provinces, Alberta has the most beef cattle, the second largest number of farms and farmed area and is one of Canada's largest crop producers. Consequently, Alberta is

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9. A White Paper may be thought of as a collaboration between all stakeholders across a given area of inquiry, such as food systems.

10. Patrick Webb et al., "The Urgency of Food System Transformation Is Now Irrefutable," *Nature Food* 1, no. 10 (October 2020): 584, accessed February 2, 2023, doi:10.1038/s43016-020-00161-0.

11. Webb et al., "The Urgency," 584-85.

responsible for the highest level of both agricultural and total greenhouse-gas (GHG) emissions.[12] Figure 1.1 below illustrates that in 2020 Alberta emitted over 256.5 megatonnes of carbon dioxide, 106.9 megatonnes more than the next largest emitter, Ontario. Moreover, of the top five emitters, Alberta is the only province that saw an increase in emissions between 2005 and 2020. To be fair, according to UCalgary affiliate The Simpson Centre, Alberta's agricultural sector produced only approximately 10% of these emissions and even reduced its emissions by 7.4% between 2005 and 2019.[13] Nevertheless, the prospect of agricultural carbon sinks lowering this number to 0%, and also significantly offsetting Alberta's total GHG emissions is tantalizing, and one of the main drivers of RA support.

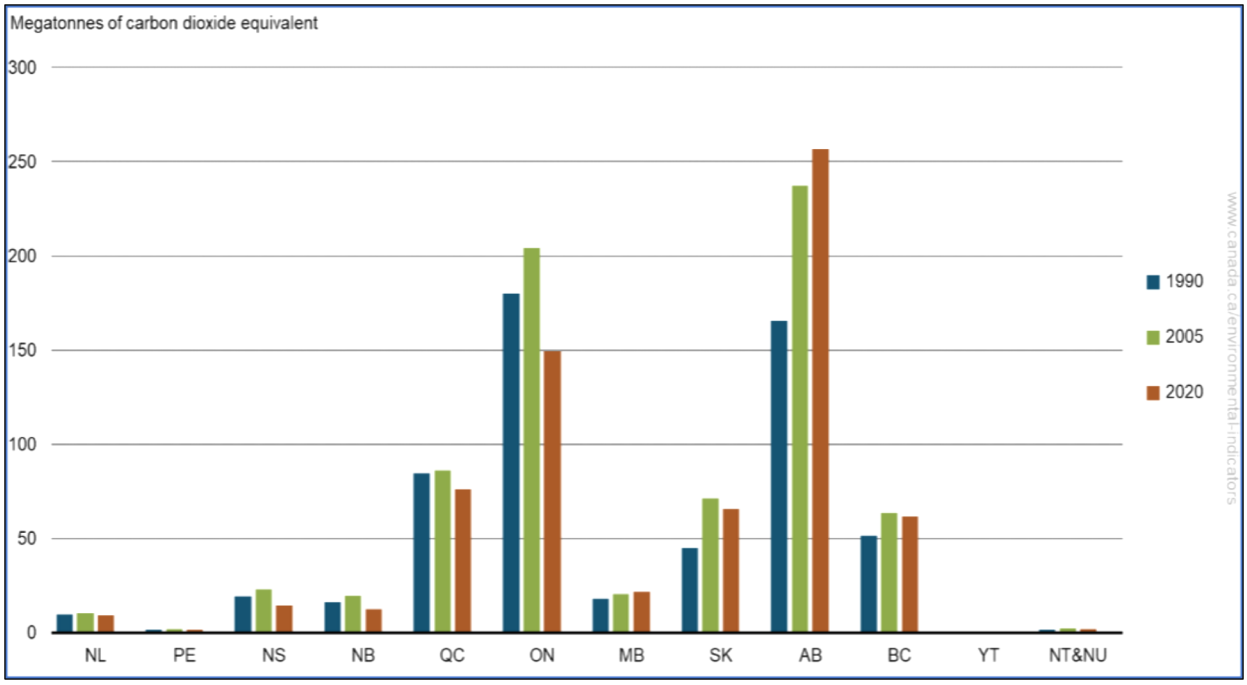

Figure 1.1 GHG emissions by province.[14] Source: Canada.ca 2020.

12. Nimanthika Lokuge, and Sven Anders, "Carbon Credit Systems in Agriculture: A Review of Literature," *The School of Public Policy Publications* 15, no. 1 (April 2022): 1, accessed October 14, 2022, https://journalhosting.ucalgary.ca/index.php/sppp/article/view/74591.

13. The Simpson Centre, *Alberta Agriculture Carbon Report Card,* 2021, https://simpsoncentre-dashboard.ca/carbon/carbon-report-card/#report-card.

14. See Appendix B for detailed breakdown of GHG emission statistics. https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html.

Figure 1.2 below illustrates that in 2021, Alberta had the highest rate of food insecurity in Canada at 20.3%, with a particularly concerning 6.3% of Albertans experiencing severe food insecurity and another 9.4% experiencing moderate food insecurity.[15]

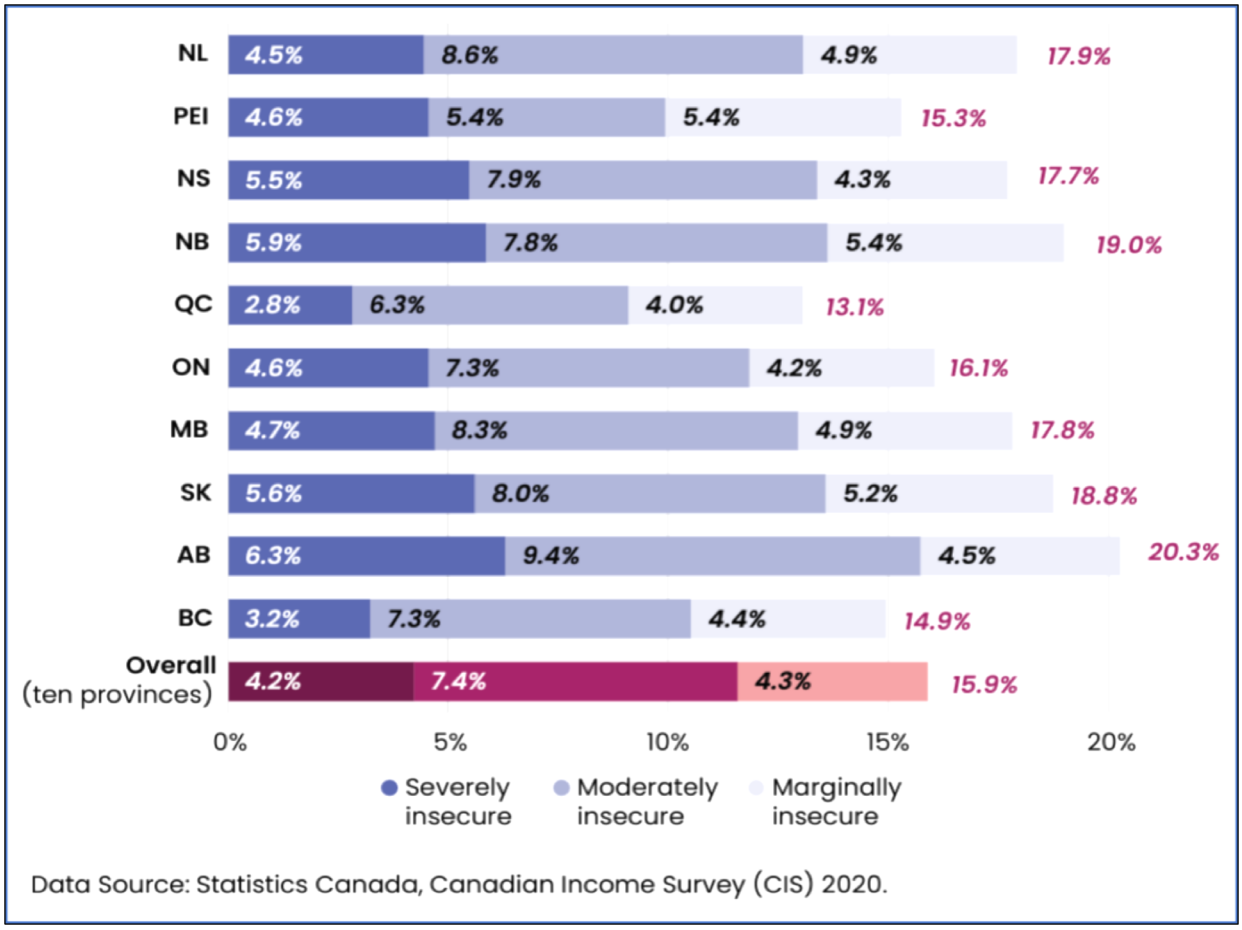

Figure 1.2 2021 Household food insecurity in Canada by province. Source: Tarasuk, Li, and St. Germain 2022.

Compared to pre-pandemic levels, Alberta saw a 73% increase in food bank usage since 2019, more than double the national rate of increase and the highest rate in the country.[16]

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15. Valerie Tarasuk, Tim Li, and Andrée-Anne Fafard St-Germain, *Household Food Insecurity in Canada, 2021.* Toronto: University of Toronto PROOF, 2022. https://proof.utoronto.ca/wp-content/uploads/2022/08/Household-Food-Insecurity-in-Canada-2021-PROOF.pdf.

16. "2022 Alberta Hunger Count Findings Atypical Compared to National Trends," Release: Food Insecurity in Alberta Highest in Canada, Food Banks Alberta, October 27, 2022, accessed October 19, 2022, https://foodbanksalberta.ca/release-food-insecurity-in-alberta-highest-in-canada/.

Compounding the urgency of the problem is the rate of degradation witnessed since 2011 when Alberta's rate of food insecurity was just 8.1% and ranked third lowest in Canada behind only Manitoba and Newfoundland.[17]

A 2018 Alberta Health Services report, named poor nutrition as a leading cause of chronic diseases such as heart disease, diabetes, and cancer. Using fruit and vegetable consumption as an indicator of overall nutrition in Alberta, the study concluded that 2 of 3 Albertans were not eating enough fruits and vegetables at an estimated cost to the province of at least one billion dollars annually.[18] A 2021 multidisciplinary study of nutrition among Alberta children indicated that this trend is not slowing and is being propagated across generations, as Alberta's youth nutrition was given an overall D grade.[19] The relationship between poor nutrition, chronic disease, and financial cost is further highlighted in a 2021 study which concluded that the treatment of chronic disease consumes 67% of all direct health care costs nationally and adds up to $190 billion annually.[20] Adopting healthy lifestyles such as healthy eating, active living, not smoking, and moderate alcohol consumption can prevent up to 80% of type-2 diabetes and cardiovascular disease, and 40% of cancers.[21] Among these lifestyle risk

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17. Statistics Canada, "Percentage of Households with Food Insecurity, by Province/Territory, CCHS 2011-2012," last modified November 27, 2015, https://www150.statcan.gc.ca/n1/pub/82-625-x/2013001/article/11889/c-g/desc/desc04-eng.htm.

18. Alberta Health Services, *Evidence Review: Nutrition-related Chronic Disease Prevention Interventions,* Nutritional Services, Population and Public Health. AHS: 2018, 13, https://abpolicycoalitionforprevention.ca/evidence/albertas-nutrition-report-card/#1569263476904-f213cc81-2fbd.

19. Kim Raine, Candace Nykiforuk, and Katerina Maximova, *Alberta's 2021 Nutrition Report Card: On Food Environments for Children and Youth,* Publication financed by the Government of Alberta through Alberta Innovates, Edmonton: University of Alberta School of Public Health, 2021, https://abpolicycoalitionforprevention.ca/evidence/albertas-nutrition-report-card/ - 1569263476904-f213cc81-2fbd..

20. Siyuan Liu, et al., "The Economic Burden of Excessive Sugar Consumption in Canada: Should the Scope of Preventive Action Be Broadened?", *Canadian Journal of Public Health* 113, no. 3 (June 2022): 332, https://doi.org/10.17269/s41997-022-00615-x.

21. Jessica R Lieffers, et al., "The Economic Burden of Not Meeting Food Recommendations in Canada: The Cost of Doing Nothing," *PLOS ONE* 13 no. 4 (April 2018): 2, accessed October 19, 2022, https://doi.org/10.1371/journal.pone.0196333.

factors for chronic diseases, an unhealthy diet has been shown to have the greatest impact.[22] Diabetes Canada predicts a 42% increase in Alberta diagnoses (either type 1 or 2) by 2032 at an additional estimated yearly cost of $692 million to the health care system.[23] To avoid this, and several other costly inevitabilities associated with the trends highlighted here, Alberta must transform the underlying food system contributing to the proliferation of such trends. Fortunately, a viable option exists and is already being implemented around the world, and indeed within Alberta as well: regenerative agriculture.

Achieving transformation will require a major shift in mindsets – particularly regarding more critical evaluations of the status quo, and roles and responsibilities of public sector actors versus businesses in influencing dietary demand. Additionally, because Alberta's environmental health, human health, and economic prosperity are interconnected outcomes, exerting significant influence on one another, transforming Alberta's food system will require environmental, social, and economics changes.[24]

To conclude, the economic burden of an increasingly unhealthy population stemming from poor nutrition combined with high levels of GHG emissions and the highest rates food insecurity in Canada, signal that Alberta's food system is problematic and must change. In light of these concerns and substantial current literature illustrating the numerous benefits of regenerative agriculture, *The Wild Alberta Food Project* seeks to answer the following question: How can regenerative agriculture improve Alberta's food system?

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22. Liu et al., "The Economic Burden," 332.
23. Diabetes Canada, *Diabetes in Alberta: Backgrounder,* Ottawa: Diabetes Canada, 2022, 1, https://www.diabetes.ca/DiabetesCanadaWebsite/media/Advocacy-and-Policy/Backgrounder/2022_Backgrounder_Alberta_1.pdf.
24. Webb et al., "Urgency," 584.

2. An Interdisciplinary Approach

The Wild Alberta Food Project satisfies all four commonly used justifications for using an interdisciplinary approach:

1. Both the problem and research question are complex, insofar as they each contain components that fall within the research domains of multiple disciplines, i.e., the production (ecology) and consumption (sociology) of food.[25]
2. Fixing a problematic food system would be impossible without insights from ecologists regarding the RA practices. Further, ecologists must work with economists to establish a viable economic framework for implementation.[26]
3. No single discipline has yet to comprehensively address this problem because by definition, a system contains multiple components, each of which must be addressed to address the whole.[27]
4. Implementing a sustainable, equitable, and economically feasible food source while significantly reducing atmospheric carbon levels has not yet been achieved. This is known to be true based the scientific evidence highlighting climate change and the inability of our current food systems to feed the planet's growing population.

Figure 2.1 below appears in New Zealand's *White Paper*, and reflects a cross-sector – produce, dairy, sheep, and beef – survey of 60 participants from all levels of the food value chain regarding the most pressing research needs facing RA. Researchers found that the areas of greatest need fell into six categories: economy and access to markets (blue), environment

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25. Allen F. Repko, Rick Szostak, and Michelle Phillips Buchberger, *Introduction to Interdisciplinary Studies.* 3rd ed., Sage, 2021, 260.
26. Repko, Szostak, and Buchberger, *Introduction,* 260.
27. Repko, Szostak, and Buchberger, *Introduction,* 260-261.

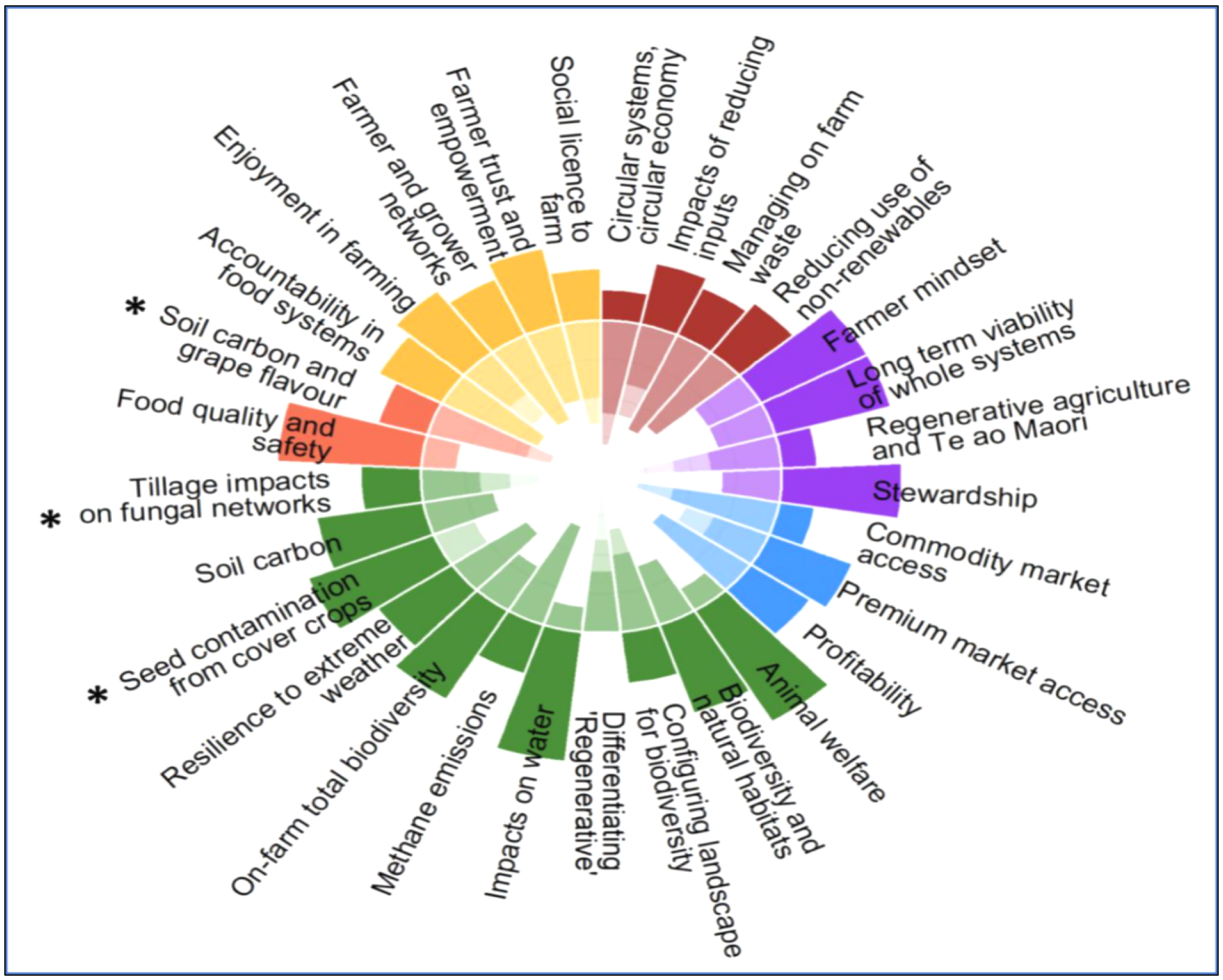

Figure 2.1 Importance ratings given to 29 research areas relevant to RA in New Zealand. Source: Grelet et al. 2021.

(green), food quality (orange), social and farmer wellbeing (yellow), culture and values (purple), and integrated circular systems (red).[28] Although not representative of Alberta's specific research needs, this visual aptly conveys the inherent interdisciplinarity of transforming a modern industrial food system to one based on RA practices. Thus, *The Wild Alberta Food Project* must employ an interdisciplinary approach if we hope to effect meaningful change because the problem exists across numerous disciplines and involves dozens of stakeholders including

28. Gwen Grelet et al., *Regenerative Agriculture in Aotearoa New Zealand – Research Pathways to Build Science-Based Evidence and National Narratives,* (New Zealand: Our Land and Water, 2021) 31.

farmers, medical doctors, transportation companies, market speculators, environmental scientists, politicians, and consumers.

3. Potentially Relevant Disciplines

Potentially relevant disciplines to *The Wild Alberta Food Project* were identified using tables 2.2 and 2.3 in Repko and Szostak's *Interdisciplinary Research: Process and Theory*. Disciplinary perspectives were cross referenced with their corresponding illustrative phenomena to create the following list: biology, chemistry, sociology, psychology, economics, and political science.[29] A cursory literature search revealed that improving Alberta's food system via regenerative agriculture falls within each of these disciplines' research domains. Additionally, based on this search, ecology and health sciences were added to the list of potentially relevant disciplines.

4. Literature Search and Most Relevant Disciplines

A comprehensive literature search revealed that the list of nine potentially relevant disciplines should be reduced to four: ecology, sociology, economics, and public policy. What follows is an explanation of how these disciplines were arrived at as most relevant to *The Wild Alberta Food Project*.

Ecology has been chosen to represent the physical sciences because it easily subsumes biological and chemical considerations while focusing on the relationship between the environment and humanity.

Although integral to framing the problem, i.e., highlighting medical concerns related to Alberta's current food system, health science is not among the most relevant disciplines to this

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29. Repko and Szostak, *Interdisciplinary Research*, 39-43.

project. Therefore, the improvement to physical health that accompanies better nutrition, an associated benefit of RA practices will be subsumed by sociology, as a healthier population is undoubtedly a social phenomenon.

Psychology was initially targeted to account for mindset-related phenomena both in farmers and anyone else along the food value chain but did not adequately address these phenomena vis-à-vis the requirements of this project. Instead, farmer mindsets tend to fall within the purview of sociology and are strongly linked with farmer wellbeing which is an essential component underlying RA as a social movement. The mindsets of others along the food value chain, e.g., corporations and consumers, are more adequately addressed by the discipline of public policy because they are largely future mindsets effected through public policy.

Political science was dropped because its perspective overly focuses on "decisions based on the search for or exercise of power and [the ensuing power struggles]."[30] In its place is public policy, which has a larger scope and therefore better fits the needs of this project because the policy initiatives required for the scaling of RA cannot be power grabs. Such policy would be antithetical to the holistic nature of RA. Furthermore, not all policy will be enacted by governments. Rather, there will be an ongoing interplay of policy directives between social, environmental, economic, and political stakeholders. Governments will be an essential apparatus for scaling RA, but they must not garner excessive influence through implementing unilateral policies without taking into account policy directives emanating from each of the other three spheres involved in this project. Thus, all policy consideration will fall within the discipline of public policy.

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30. Repko and Szostak, *Interdisciplinary Research*, 39.

Following the completion and subsequent analysis of a comprehensive literature search, the most relevant disciplines to our project were found to be ecology, sociology, economics, and public policy.

5. Disciplinary Adequacy

Developing disciplinary adequacy in each relevant discipline is required to validate the integrated conclusion at the end of this report. Competency in each selected discipline is displayed below through analysis of how the disciplinary perspectives and theory-based insights contribute to answering *The Wild Alberta Food Project's* research question: How can regenerative agriculture improve Alberta's food system?

Ecology

Ecologists seek to understand the vital connections between plants and animals (including humans) and the world around them. Ecology also provides information about the benefits of ecosystems and how we can use Earth's resources in ways that leave the environment healthy for future generations.[31] Thus, The *Wild Alberta Food Project* is most directly an ecological undertaking. The manner in which RA addresses the host of problems facing Alberta's food system is ecological: carbon sequestration in the soil, and the regeneration of land through increased biodiversity. This venture will rely on ecologists' expertise regarding the mechanics of regenerative agriculture.

Sociology

31. "What Is Ecology?," Ecological Society of America, Fall 2019, accessed November 21, 2023, https://www.esa.org/about/what-does-ecology-have-to-do-with-me/.

The recurring sociological theme of social change underlies the multiple reasons for sociologists to be interested in RA.[32] The sociological perspective views the world as a dynamic social construct frequently undergoing change. Due to sociology's interest in subcultures, its perspective will be invaluable in assessing RA as a social movement. Furthermore, sociology's interest in how bureaucracies shape human life will be helpful in assessing the role of public policy in improving Alberta's food system via RA. Lastly, the notion that a healthy environment will promote a healthy society permeates the *Wild Alberta Food Project* and drives its interdisciplinarity.[33]

Economics

Any attempt to improve a food system without first considering the economic costs and benefits will likely fail. This is true regardless of a projects' scope: a farmer's decision to use a single new technology to increase crop yield would be made after considering the economic consequences. Even if the technology did not increase yields but instead reduced carbon emissions, the farmer would still first consider the economic viability of the action. As Alberta regenerative farmer Ron Hamilton repeatedly stated, "farming is a business" and business is part and parcel of economics. Hence, the discipline of economics is inextricably bound to the *Wild Alberta Food Project*.

Public Policy

Of the disciplines chosen for this venture, public policy is the most nebulous, as its function is both undefined yet necessary at each stage of progression. Public policy creators such

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32. Edgar A. Burns, "Thinking Sociologically About Regenerative Agriculture," *New Zealand Sociology* 35 no. 2 (2020) 189, accessed November 12, 2022, https://web.p.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=0&sid=0d738fe4-f406-4dbd-930d-dec25ea21eb1%40redis.

33. Repko, and Szostak, *Interdisciplinary Research*, 39-43.

as government officials must not only approve of actions taken by the other disciplines but must also facilitate disciplinary integration. Public policy earned its status as a *most* relevant discipline through its ubiquitous presence among relevant literature in which a common theme is: Yes, this action is beneficial but there is no governing body to ensure its completion or verification. Whether for monitoring and verifying feedbacks, or incentivizing the adoption of RA practices, *The Wild Alberta Food Project* is impotent without extensive consultation with public policy officials and experts.

6. Analysis of Disciplinary Insights[34]

This step is the crux of *The Wild Alberta Food Project*, as it reveals the most insightful research pertaining to RA's ability to improve Alberta's food system. The aim of this analysis is to reveal through disciplinary means what RA is, and what it *can* be for Alberta.

In essence, *The Wild Alberta Food Project* is an argument trying to convince people that regenerative agriculture can improve Alberta's food system. Therefore, although this step is not a traditional summary of research, its theory explications include enough summary detail to ensure their insights function as strong premises within a cogent inductive argument. To clarify, each theory-based insight is a premise in *The Wild Alberta Food Project's* argument, and therefore must be conveyed with sufficient detail to ensure that the conclusion of this argument does not – in the logical sense – beg the question, i.e., give one cause to ask "what additional evidence do you have to support this claim?"[35]

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34. See Appendix B for a complete list of disciplinary insights; See Appendix C for a complete list of theory identifiers and corresponding annotations.

35. Martin P. Golding, *Legal Reasoning,* Toronto: Broadview, 2001; Stan Baronett, *Logic,* 4th ed., New York: Oxford, 2019, 160.

Following the explication of all theory-based insights, to facilitate comprehensive and transparent integration, the most important disciplinary information and data will be identified and analyzed to produce a collated list of disciplinary conclusions and assumptions to be used throughout the integration process which is explained in greater detail at the conclusion of this step.

Ecology

> *"Recognize that soil health is plant health is human health."*
>
> *– Paul Hawken*

1. ***Climate change mitigation (CCM) theory*** states that RA can improve Alberta's food system by removing excess carbon from the atmosphere and storing it in the soil. *CCM theory* assumes that climate change will negatively affect Alberta's food system and accelerate without human intervention. To understand why this theory is integral to *The Wild Alberta Food Project*, one must consider how climate change will affect Alberta's food system. The Government of Canada lists seven potential outcomes currently facing prairie provinces regarding climate change:

- Increased frost-free periods may provide opportunities for the expansion of warm weather crops such as corn and soybeans as well as a potential northwards expansion of agricultural production where soils permit.
- Reduced precipitation later in the growing season, coupled with increased heat will cause stress to plants and may have a negative impact on yields.
- More frequent spring flooding, summer droughts and extreme weather events are expected.

- Reduced streamflow, less snowmelt to recharge rivers and earlier peak flows could lead to reduced access to water for irrigation during the summer and greater competition for groundwater reserves.
- A warmer climate may bring new pests and diseases.
- Increased temperatures could affect livestock health, resulting in reduced milk, egg and meat production and even fatalities; increased cooling costs for producers.
- Higher CO_2 levels may result in greater productivity from crops such as wheat, barley, canola, soybeans, and potatoes.[36]

Thus, the ability of RA to sink carbon in the soil and mitigate the negative outcomes of climate change, will be increasingly important.

While most proposed solutions to climate change, such as renewable energy, seek to slow GHG emissions, it is possible to mitigate GHG emissions by removing carbon that is already in the atmosphere, which is where RA factors in.[37] Of the two primary atmospheric carbon sinks – oceans and land – oceanic sinks are much more expensive and ecologically precarious. In contrast, the viability of sequestering significant amounts of carbon in soil, by altering agricultural practices has been demonstrated conclusively.[38]

The mechanics of carbon sequestration are as follows: as plants grow they extract CO_2 from the atmosphere through photosynthesis; carbon is returned to the soil as organic matter in the form of fungal and bacterial microbes, decaying plant and animal tissue, and chemical

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36. Canada.ca, Agriculture and Agri-Food Canada, *Climate Change Impacts on Agriculture.* Last modified January 31, 2020, https://agriculture.canada.ca/en/environment/climate-scenarios-agriculture.

37. Serge Wiltshire, and Brian Beckage, "Soil Carbon Sequestration through Regenerative Agriculture in the U.S. State of Vermont," *PLOS Climate* 1, no. 4 (April 2022): 2, accessed October 6, 2022, https://doi.org/10.1371/journal.pclm.0000021.

38. Wiltshire and Beckage, “Soil Carbon,” 2.

products formed through decomposition; these areas of carbon rich materials collectively make up the soil's organic carbon (SOC) total. When topsoil is disturbed through tillage or other means, this organic carbon is lost through respiration and oxidation, which is why a central tenet of RA is limited disturbance of the topsoil.[39]

An important issue raised by Wiltshire and Beckage is the contentious nature of quantifying SOC levels. For instance, some contend that SOC is capable of offsetting 20-35% of anthropogenic GHG emissions by 2040, while others argue it could be anywhere between 4.6% and 27.2% of yearly GHG emissions over that same time period.[40] It is therefore critical to Alberta's food system that measuring SOC is done in a consistent, reliable manner with proper oversight in place to monitor this important ecological feedback. Regardless of the exact amount of carbon sequestration, it is clear that *CCM theory* is fundamental to *The Wild Alberta Food Project.*

2. ***Soil recarbonization (SR) theory*** holds that it is possible to quickly (~5 years) and naturally create more soil through recarbonization. Like *CCM theory*, *SR theory* assumes that although climate change is progressive, its effects can be mitigated through human intervention. Accelerated soil development is achieved through the soil recarbonization process that results naturally from RA practices. *SR theory* will prove increasingly integral to a healthy and prosperous Alberta food system as the global population increases and the fertile soil required to grow food is at a premium.

Author, film-maker, scholar, and conservationist, Courtney White, believes that humanity is facing a soil crisis as nearly 25% of the earth's agricultural land is degraded beyond the point

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39. Wiltshire and Beckage, "Soil Carbon," 2.
40. Wiltshire and Beckage, "Soil Carbon," 2.

of being useful to provide food. Beyond the obvious food implications, the global ecosystems have lost an inestimable number of pollinators, and 100-300 million people are currently at risk of catastrophic flooding and hurricanes due to the degradation of coastal soil.[41] Echoing this troubling sentiment is the pioneering 2019 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report composed by 145 experts from 50 countries based on 15,000 scientific and government sources, which concluded that one million animal and plant species are now threatened with extinction, and that biodiversity is declining globally at rates not previously witnessed in human history.[42] The impact of these grim realities on Alberta's food system is significant: without soil, there is no food. White, aptly puts this into perspective by pointing to the numerous instances in human history in which social and political conflicts are exacerbated when there are more people to feed than can be supported by the land. He goes so far as to claim that "Civilizations do not disappear overnight, and they do not choose to fail. More often, they falter and then decline as their soil washes away over generations."[43]

How does *SR theory* intend to build soil quickly? The answer is through converting atmospheric carbon into soil carbon in a four-step process that requires only sunlight, green plants, water, nutrients, and soil microbes:

1. *Photosynthesis*: The process by which light energy is transformed into biochemical energy. CO_2 from the air and water from the soil are used to create glucose and oxygen.

41. White, "Why Regenerative," 800.
42. IPBES (2019), *Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services,* (Paris: IPBES, 2019), https://doi.org/10.5281/zenodo.3553579.
43. White, "Why Regenerative," 801.

2. *Resynthesis*: Through a complex series of chemical reactions, glucose is resynthesized into numerous carbon compounds, including carbohydrates (cellulose and starch), proteins, organic acids, waxes, and oils, all of which provide fuel for living organisms.
3. *Exudation*: This process is essentially the "capture" process in which carbon compounds are exuded directly into soil by plant roots to nurture microbes and other organisms and is essential to the creation of soil from lifeless dirt. There is a direct correlation between the density and health of plant roots and the amount of carbon captured.
4. *Humification*: This refers to the creation of hummus, a chemically stable type of organic matter composed of large, complex molecules made up of carbon, nitrogen, minerals, and soil particles. Hummus is the dark, rich layer of topsoil associated with healthy farmland. When carbon is safely stored as hummus it is highly resistant to decomposition and can remain intact for hundreds or thousands of years.[44]

The desired outcome is the creation of carbon-rich hummus, and though it sounds complex, the processes involved are the processes that create life, which is something the Earth does very well.[45]

Innovative North Dakota farmer, Gabe Brown, has become synonymous with regenerative agriculture. Despite the multitude of RA definitions, in nearly all instances, his pioneering five principles of turning dirt into soil are included. All inquiries into the on-farm entry point for RA should be met with these five principles:

1. *Limited Disturbance*: Limit mechanical, chemical, and physical disturbance of soil because tillage destroys soil structure, and pesticides negatively impact biodiversity.

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44. Christine Jones, "Building Soil Carbon with Yearlong Green Farming," *Evergreen Farming,* September 2007, accessed January 7, 2023, https://www.amazingcarbon.com/PDF/Jones-EvergreenFarming(Sept07).pdf.

45. White, "Why Regenerative," 804.

2. *Armor*: Armor on the soil surface blocks weed growth, buffers the heat and cold, and feeds biota. Residue and living plants serve as cover.
3. *Diversity*: Diversity in both plant and animal species – no monoculture.
4. *Living Roots*: Growing roots loosen and aerate soils and support soil ecosystems. The temperature control of cover increases the root-growing season.
5. *Integrated Animals*: Use intensive grazing. Create an animal impact on croplands and pastures similar to the impact bison and other grazing species once had. The grazing animals should consume about 30% of the vegetation and pack what remains. If you want a healthy ecosystem on your farm, you must provide a habitat for not only farm animals but also for pollinators, predator insects, earthworms, and all the microbiology that drive ecosystem function.[46]

When Brown purchased his farm in 1991 it was essentially a plot of dirt, degraded over time via industrial agricultural practices. After several lean years of trial and error, Brown eventually discovered what would become the central tenets of RA and transformed his dirt into a 5000-acre ranch with crop yields 20-25% higher than the average yields in his county. Healthy soil is generally 6-8% soil organic matter (soil carbon), but research shows that if left undisturbed indefinitely this number could climb much higher.[47] Brown's soil organic matter increased from 1.9% in 1991 to 6.1% by 2010. As a result, his soil's water-infiltration rates increased from 0.5 inches per hour in 1991 to more than 10 inches per hour in 2010, which is an incredible amount of water that is sinking into his soil rather than staying on the surface and washing the soil away.[48]

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46. Brown, *Dirt to Soil,* 1.
47. White, "Why," 805.
48. White, "Why," 805.

Part of Brown's genius was grounding his anecdotal evidence in empirical science through rigorously testing his soil's carbon-retention rates over time. By 2010, while conventional farmers in his country had 10-30 tons of carbon per acre stored in the top 48 inches of their soil, Brown's soil contained an incredible 96 tons of carbon per acre.[49] Brown's story, illustrates the viability and potential benefits of soil recarbonization to being a focal point for improving Alberta's food system via RA.

Although there is currently no means for Alberta producers to ascertain and track the carbon levels in their soil, a University of Alberta project called *The Database on Alberta Soil Health*, is for the first time harnessing information from thousands of soil samples into a single database to discover the health of Alberta's agricultural soils. The final product will be a free web-based app that anyone can access to obtain location-specific soil information.[50] Soil scientist and project leader Derek MacKenzie spoke with the media in the spring of 2022:

> [Our venture] moves beyond the traditional idea of soil quality, which considers factors like fertilizer and herbicide used to drive production but tends to skip over the idea that there should be a natural microbial community driving nutrient availability in soil. Instead, we're looking at soil health, which is more about carbon being stabilized in soil and the microbial communities that carbon supports. Those are what make soil a functional ecosystem, and that can lead to more sustainable agriculture not just here, but globally.[51]

This homegrown project could potentially solve two of the most pressing challenges facing RA: (1) How do you take the universally championed principles of RA and apply them to particular geographical locations without a region-specific formula for soil regeneration? The extent to

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49. Center for Regenerative Agriculture and Resilient Systems, California State University Chico, last modified in 2023, accessed January 7, 2023, https://www.csuchico.edu/regenerativeagriculture/demos/gabe-brown.shtml.

50. At the time this report, no launch date for the app was available, although the preliminary research that began in 2022 was slated to last two years.

51. New Soil Database will help Alberta Farmers Plot out Sustainable Practices, University of Alberta, July 6, 2022, accessed January 7, 2023, https://www.ualberta.ca/folio/2022/07/new-soil-database-will-help-alberta-farmers-plot-out-sustainable-practices.html.

which soil differs from region to region is significant enough to render the RA practices successful on one farm, unsuccessful on another, e.g., farm A's soil is optimized by weekly rotational ruminant grazing, while farm B's soil requires daily ruminant rotation and could in-fact be harmed by weekly rotation. Thus, when farmers interested in adopting RA practices inquire about the specific process, they learn that it is different for each farm and that they must figure it out themselves. One cannot blame them for saying, "no thanks". (2) How can the carbon levels in soil be measured and shared in a transparent reliable manner? The answer to both questions lies in the use of artificial intelligence (AI), which according to MacKenzie, can efficiently pinpoint specific patterns for regenerative agricultural practices based on the soil's composition.[52]

In response to (1), the AI proposed by MacKenzie could provide farmers with a region-specific formula and steps that will enable them to successfully and efficiently achieve soil recarbonization. In response to (2), which is partially rooted in public distrust, the ability of AI to accurately track this vitally important environmental feedback and relay this information transparently through a free public app would mitigate misinformation and instil public trust.

Additionally, from a public policy perspective, this technology could be used to inform ecologically responsible policy decisions based on geographically specific environmental feedbacks.

SR theory has considerable breadth, touching on elements of both other ecological insights like *water conservation theory*, and public policy insights like *geocentric research theory*. This feature of *SR theory*, combined with the transformational elements of soil

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52. Bev Betkowski, *New Soil Database will help Alberta Farmers Plot out Sustainable Practices,* Folio, University of Alberta (July 2022), accessed January 7, 2023, https://www.ualberta.ca/folio/2022/07/new-soil-database-will-help-alberta-farmers-plot-out-sustainable-practices.html.

recarbonization and the promise of locally-developed industry changing technology, indicates *SR theory's* prominence as both a foundational ecological insight into improving Alberta's food system, and a theory through which common ground may be established within, and across disciplinary lines.

3. ***Management intensive grazing (MiG) theory*** contends that producers can improve their soil quality by manipulating the length of time ruminants – cattle, sheep, goats etc. – graze on a single paddock before being rotated to another.[53] An underlying assumption of *MiG theory* is that humans can effect positive ecological change, which can be amplified through public policy decisions. It bears mentioning that the change is ecological, not merely environmental, because the effects of management-intensive grazing (MiG) impact human life and function as an important and sustainable feedback early in the food value chain.

Continuous grazing systems are marked by wide open pastures where the most desirable plants are frequently over-grazed and seldom have the leaves required for photosynthesis and natural regrowth, thereby necessitating the use expensive chemical fertilizers to provide what the plant should be able to obtain naturally, and at no cost.[54] Conversely, MiG systems balance forage supply – perennial grasses, legumes, and other plant life – with animal demand, which, when done correctly results in evenly grazed, fertilized, and stomped paddocks that contain nutrient dense, carbon packed, and biologically fueled soil.[55]

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53. A paddock may be considered an area of land in which livestock are enclosed within a larger pasture; It is in virtue of the frequency of animal rotation that it is called management-intensive; Casey J. Shawver et al., "Soil Health Changes Following Transition from an Annual Cropping to Perennial Management-Intensive Grazing Agroecosystem," *Agrosystems, Geosciences & Environment* 4, no. 2 (May 2021): 4, accessed January 12, 2023, https://doi.org/10.1002/agg2.20181.

54. Steve Kenyon, "Kenyon: How Intensely Should You Graze Cattle?" *Canadian Cattlemen: The Beef Magazine,* July 12, 2019, accessed November 7, 2022, https://www.canadiancattlemen.ca/features/kenyon-how-intensely-should-you-graze-cattle/.

55. Shawver et al., "Soil Health," 1.

For MiG to be successful, paddock size must be appropriate for the number of animals, and the animals must be rotated before they overgraze. Counter-intuitively, the higher the stock-density, i.e., the ratio of animal to land, the more beneficial it is for the land because it receives a more even stomping. According to Alberta rancher and author, Steve Kenyon, if every plant gets stomped equally it levels the playing field for the most desirable plants in the fight for survival.[56]

As it relates to food systems, MiG increases pasture yields and produces healthier animal products because it aids seedling development and nutrient recycling that over time create a polyculture of nutrient rich forage plants. While industrial, nutrient-deficient food grown from dirt requires *chemistry,* nutrient-dense food grown from soil requires *biology*, which, according to Kenyon is a natural by-product of MiG because "manure is the best compost available, urine is the best biological tea you can buy [and] even phlegm and saliva from the animals add biology to the soil."[57] According to *MiG theory*, as the animals rotate paddocks, evenly distributing natural fertilizer and the various elements of life, they function as a holistic soil management system.

Management-intensive grazing is integral to RA's ability to sequester carbon, which, according to both *CM* and *SR theory*, is increasingly vital to a healthy Alberta food system. A 2016 University of Texas A&M project studying the role of ruminants in reducing agriculture's carbon footprint in North America concluded that ruminant livestock, although often derided as methane gas-filled climate change instigators, are an important tool for achieving sustainable agriculture, and that with appropriate grazing management ruminants can sequester more than enough carbon in the soil to offset their GHG emissions. This is significant because the methane

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56. Kenyon, "Kenyon: How Intensely Should You Graze Cattle?"
57. White, "Why", 805; Kenyon, "Kenyon: How Intensely Should You Graze Cattle?"

gas released by cattle is more than 25-times more effective at trapping heat in the atmosphere than CO_2.[58]

Despite the significant upside, only 10% of Alberta ranchers currently use rotational grazing techniques. As previously stated, Alberta has more beef cattle than any other province, which makes grazing management practices particularly relevant to Alberta's food system.[59] Theorists and producers alike believe that governments should play an increased role in promoting MiG through public policy initiatives incentivizing its adoption.[60]

4. ***Increased nutrient density (IND) theory*** references multiple independent peer-reviewed comparisons of commercially and regeneratively produced food, with respect to their nutrient density to argue that RA practices produce food with superior nutritional profiles than food produced using industrial agriculture (IA) practices. Further, this is witnessed across multiple agricultural sectors.[61] *IND theory* assumes there is a causal link between the nutrient density in food, human nutrition and health, and the overall quality of food systems.

A 2022 Washington State University study measured nutrient density in food produced from regionally paired RA and IA farms in ten different locations across the US. Notably, prior to listing their findings, researchers affirmed: "As each of the regenerative farms had [previously] been conventionally farmed and had soil organic matter content similar to its paired

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58. Richard W. Teague et al, "The Role of Ruminants in Reducing Agriculture's Carbon Footprint in North America," *Journal of Soil and Water Conservation* 71, no. 2 (March 2016):162, accessed October 6, 2022, https://doi.org/10.2489/jswc.71.2.156.

59. Katie Willis, *Grazing Livestock Could Reduce Greenhouse Gases in the Atmosphere, Study Shows*, Folio, University of Alberta, March 17, 2021, accessed January 7, 2023, https://www.ualberta.ca/folio/2021/03/grazing-livestock-could-reduce-greenhouse-gases-in-the-atmosphere-study-shows.html.

60. Teague, et al., "The Role of Ruminants," 162.

61. David R. Montgomery et al., "Soil Health and Nutrient Density: Preliminary Comparison of Regenerative and Conventional Farming," *PeerJ* 10, no. e12848 (January 1, 2022): 1, accessed December 6, 2022, https://doi.org/10.7717/peerj.12848.

conventional farm before conversion to regenerative practices, our analyses show that such practices can increase topsoil organic matter and enhance soil health after less than a decade of fully adopting regenerative practices."[62] This statement supports *SR theory's* claim that soil can be regenerated quickly using RA practices.

Generally, findings were consistent with previous studies[63] regarding both crops and meat: RA produced crops with higher levels of vital phytochemicals (known to reduce the risk of chronic disease), vitamins, and other minerals related to human health; regeneratively produced grain had more beneficial micronutrients, whereas conventionally grown wheat contained more cadmium, nickel, and sodium – metals considered detrimental to human health; also, regeneratively sourced cattle yielded substantially better fatty-acid profiles than their conventional counterparts.[64]

Based on their findings, researchers concluded that "soil health appears to influence phytochemical levels in crops, indicating that regenerative farming systems can enhance dietary levels of compounds known to reduce the risk of various chronic diseases."[65] Given the current and projected chronic disease health concerns facing Alberta's population, this conclusion underscores the importance of *IND theory* to improving Alberta's food system.

5. ***Water conservation (WC) theory*** maintains that agricultural land sustainability can be increased through increased water conservation via the soil management practices inherent to regenerative agriculture, e.g., no tillage. A general assumption of *WC theory* is that humans can positively impact social conditions by prioritizing ecological responsibility, a sentiment

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62. Montgomery et al., 11.
63. See Davis, Epp, and Riordan, 2004; Garvin, Welch, and Finley, 2006; Fan et al., 2008; Murphy, Reeves, and Jones, 2008; and Davis, 2009.
64. Montgomery et al., "Soil Health," 12-14.
65. Montgomery et al., 14.

witnessed in regenerated soil's increased ability to capture and store water as a means to mitigate the effects of drought.[66]

Gabe Brown credits improved soil structure for the 1900% increase in water infiltration rate on his farm, which now has dense and well-aggregated soil due to increased biodiversity. On several occasions his farm successfully weathered what were catastrophic downpours to his neighbours using conventional IA practices, such has heavy tillage. In one instance, having just received 13.6 inches of rain in 22 hours, a visiting neighbour skeptical of Brown's claim that his fields went unscathed, exclaimed in shock that he could drive a truck across Brown's field and not make a rut.[67] This is only anecdotal evidence, but the science underlying Brown's story, and countless others like it, is sound.

Paul Hawken, one of the most notable faces of RA, states in his stunning 2021 book *Regeneration: Ending the Climate Crisis in One Generation*: "What matters most to a farmer is not how much water falls from the sky, but how much soaks into the ground."[68] In light of the federal government's estimated outcomes of climate change for prairie provinces listed above, improving the ability of Alberta's agricultural lands to capture and store water in huge underground reservoirs is vital to improving and sustaining Alberta's food system.

6. ***Increased soil biodiversity (ISB) theory*** argues that biodiversity is essential to a healthy food system. The underlying assumption of *ISB theory* is that ecologically responsible decisions increase human wellbeing via positive ecological feedbacks.

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66. Preston Sullivan, *Drought Resistant Soil,* ATTRA (National Center for Appropriate Technology, 2002), https://attra.ncat.org/wp-content/uploads/2022/10/drought-resstant-soil.pdf.

67. Brown, *Dirt to Soil*, 128.

68. Paul Hawken, *Regeneration: Ending the Climate Crisis in One Generation,* (New York: Penguin, 2021) 98.

Soil is a primary repository of earthly biodiversity, containing roughly 25% of all species. It also provides multiple functions vital to sustaining human life, such as nutrient cycling, waste decomposition, climate regulation, and pathogen resistance. In short, *ISB* theory advocates that maintaining biodiversity in the soil also improves the diversity and functioning of above ground human systems. If we do not protect soil biodiversity, surface biodiversity and food production cannot be guaranteed.[69]

As it pertains to improving Alberta's food system via RA, *ISB theory* offers another voice reminding us that soil health matters, and healthy soil is produced when animals are present within it and on top of it. As is now apparent, food produced using the biochemical fuel provided by living organisms is healthier than food produced from chemically dependent plants.[70]

Sociology

"Regenerative agriculture is at the heart of a regenerated society since it is the source of our food, nutrition, and well-being."

- Paul Hawken

1. ***Social movement (SM) theory*** argues that RA is a social movement deserving of more attention from social science scholars because it is farmer-led and has the potential to significantly mitigate climate change by reducing atmospheric carbon. To achieve this, *SM theory* maintains that not only must biophysical changes occur, but also shifts in social discourses and socioeconomic frameworks.

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69. Carlos A. Guerra, et al., "Tracking, Targeting, and Conserving Soil Biodiversity" *Science* 371, no. 6526 (January 2021): 239, accessed January 21, 2023, https://doi.org/doi:10.1126/science.abd7926.

70. Hawken, *Regeneration*, 99.

What makes RA a social movement? According to leading RA sociologist and creator of *SM th*eory, Edgar A. Burns, "sociologically speaking, farmers' interest in regen ag and willingness to travel far to attend events, read and watch accounts of other farmers who have switched to regen ag, and spend time and effort in support networks about innovating their farming practice, can be called a social movement."[71] Because RA is a farmer-led social movement, sociological expertise about other social movements, e.g., labour, gender, sexuality, and racial inequalities is applicable to the food production changes instigated by RA.[72] Further, Burns believes that RA's outcome will be shaped by the effects of activism, counter-movements, and state involvement.[73] Therefore, because RA is a social movement, a sociological perspective should be at the center of its study.[74]

Within its classic macro sociological perspective *SM theory* maintains its focus on the individual farmer at the movement's center. The RA movement did not originate as an academic theory, and its spread has not been caused by scholars and scientists, but rather through "farmers themselves advocating for change through field days, seminars and virtual meetings."[75] It is for this reason that RA has such an optimistic prognosis, and why Burns thinks sociologists ought to pay it more attention. Farmers, often thought to be at odds with the intelligentsia, are spearheading a scientifically verified and supported movement, which if successful, could markedly impact the future of our species. Thus, with the highest of stakes, *SM theory* advocates

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71. Edgar A. Burns, "Research Needed: Business Opportunities in the Farmer-Led Regenerative Agriculture Movement in New Zealand," *New Zealand journal of applied business research* 18, no. 1 (2022): 9, accessed November 1, 2022, https://doi.org/10.34074/jabr.18101.

72. Burns, "Thinking Sociologically," 189.

73. Burns, "Thinking Sociologically," 189. See Richard P. Gale, "Social Movements and the State: The Environmental Movement, Countermovement, and Government Agencies," *Sociological Perspectives* 29, no. 2, accessed January 7, 2023, (April 1986): 202-07, https://doi.org/10.2307/1388959.

74. Burns, 190.

75. Burns, 201.

that farmers and their wellbeing receive appropriate consideration, as through RA they are primary agents of societal amelioration.

The question of RA's importance to society is a fundamental question guiding *The Wild Alberta Food Project*, which *SM theory* will help ensure does not miss the forest for the trees, i.e., does not get lost in the mesmerizing science of RA, thereby losing focus of RA's societal implications.

2. ***Social innovation (SI) theory*** is an emergent way of solving social problems, which, due to their innate complexity and context-specific nature render a single definition of *SI theory* near*y* impossible. Nevertheless, for the purpose of this project one may understand *SI theory* as an intention to improve a specific social problem through social innovation, which entails new ideas borne of intentional and intensive collaboration. *SI theory* is progressive, and often attempts to solve complex problems others cannot. For this reason, it is also inherently interdisciplinary. The primary assumption of *SI theory* is that all social problems can be solved socially (the process of collaboration) through social solutions (the innovation).[76]

Alberta-based Regenerative Agriculture Lab (RAL) is a social innovation venture initiated by *Rural Routes to Climate Change*, aimed at mitigating climate change through RA. As noted above in multiple ecological insights, climate change mitigation will be increasingly essential to improving and sustaining Alberta's food system. Hence, the work done by the RAL aligns with the prime directive of *The Alberta Wild Alberta Food Project.*

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76. TEPSIE, "Social Innovation Theory and Research: A Summary of the Findings from TEPSIE," *The Theoretical, Empirical and Policy Foundations for Building Social Innovation in Europe*, European Commission, 7th Framework Programme, Brussels: European Commission, DG Research, accessed February 1, 2023, https://iupe.files.wordpress.com/2015/11/tepsie-research_report_final_web.pdf.

Phase one of the RAL, depicted in figure 6.1 below, "launched in March 2021 and brought together a small set of producers to identify practical and feasible efforts needed to achieve a desired, transformational future for the [agriculture] sector."[77] In November of 2022, in Olds, Alberta, the RAL assembled a larger group of roughly 35 experts and stakeholders from each level of Alberta's food value chain to complete phase two of their venture.

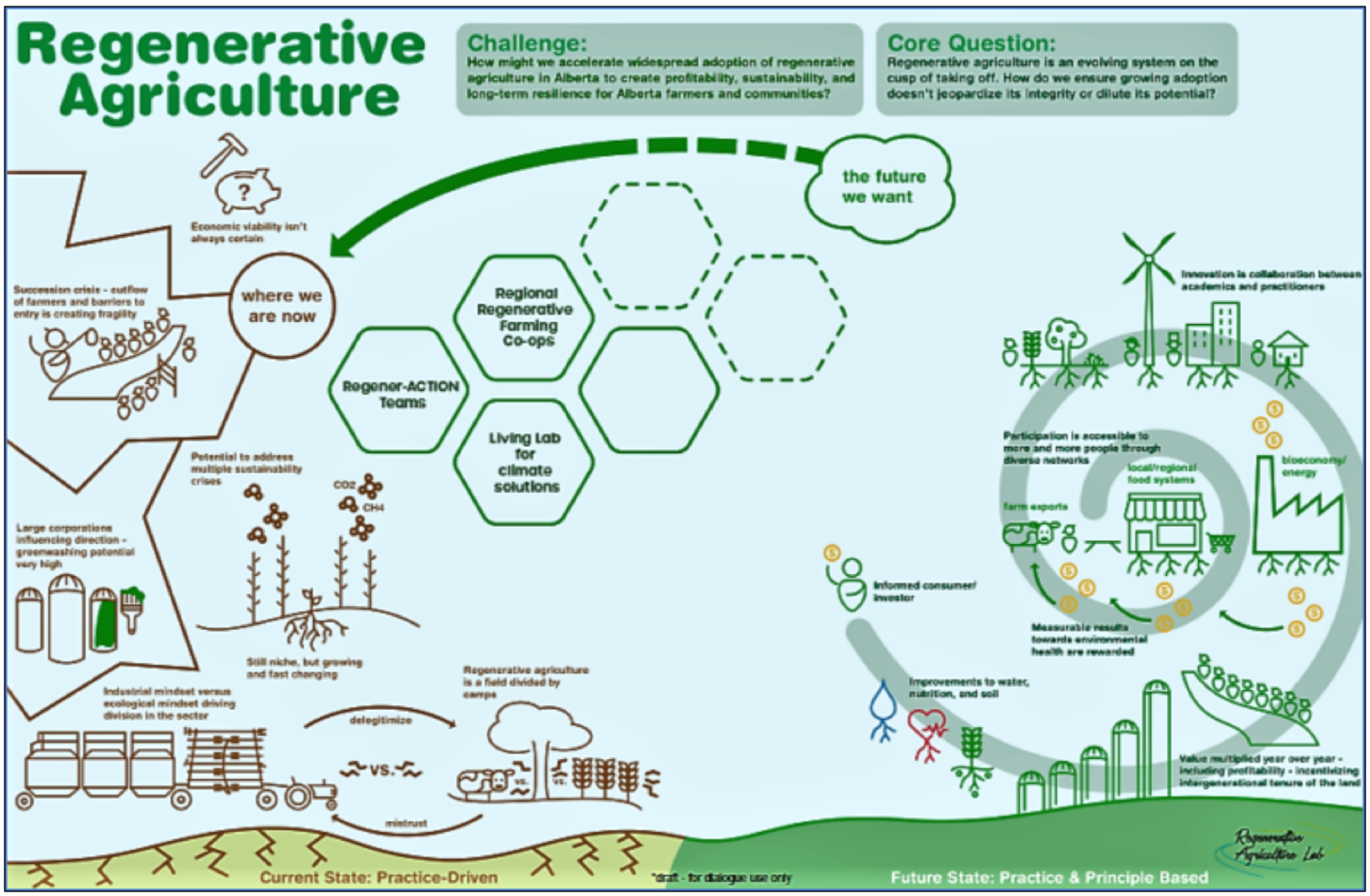

Figure 6.1 Phase one of the RAL illustrating the current state of affairs and desired future for RA in Alberta. Source: RAL 2021.

Although the results of phase two have not yet been made public, through project facilitator, Keren Perlo, RAL graciously shared the framework for their "RAL Theory of

77. Regenerative Agriculture Lab (RAL), Rural Routes to Climate Solutions, 2021, accessed November 30, 2022, https://rr2cs.ca/regenerative-agriculture-lab/.

Change" which identified three axes along which change is required to facilitate the widespread adoption of RA Alberta: knowledge, social, and economic.[78]

Change along the knowledge axis entails relaying to farmers the quantifiable benefits of RA to their specific sector (beef, grain, etc.), in their specific ecological location. If such information is made available to farmers, the RAL hypothesizes that farmer adoption of RA practices will increase. To increase demand, consumers must also be made aware of RA's benefits. Education of both the producer and consumer is vital.[79]

Farmers helping farmers, and the ensuing social momentum (reduced stigma, increased social approval) highlight the change required along the social axis. Increased social pressure among consumers will increase and drive further demand once a critical mass of consumers begin purchasing RA products.[80]

Change along the economic axis requires that financial institutions mitigate risk for farmers who want to adopt RA practices but are nervous to make the necessary financial investments. There must also be increased market access to allow consumers to purchase RA products, thereby permitting a sustainable livelihood for producers. Most notably, the RAL hypothesize that "[i]f farmers are compensated socially (e.g., status and approval) and economically for making positive environment contributions (soil, water, biodiversity) and for sequestering carbon, then they are likely to improve and maintain regenerative agricultural practices."[81]

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78. RAL, *RAL Key Insights and Assumption,* internal memorandum, received February 4, 2023, 6.
79. RAL, *RAL Key Insights*, 6.
80. RAL, 6.
81. RAL, 7.

Although the axes of required change represent only a fraction of the RAL's work, they illustrate the significant challenges facing the widespread adoption of RA in Alberta and emphasize the necessity of an interdisciplinary approach to improving Alberta's food system. Thus, *SI theory*, as a collaborative and inherently interdisciplinary tool, will be foundational to *The Wild Alberta Food Project's* integrated conclusion.

3. ***Sustainability transitions (ST) theory*** provides a conceptual lens through which RA in Alberta is viewed as a social movement and niche production method operating within the dominant regime of global industrial agriculture. Underlying *ST theory* are two assumptions: (1) food production methods impact social wellbeing; and (2) the prevailing global industrial agri-food system is unsustainable.

In a case study of agricultural (beef) transition in Alberta, *ST* theorists' Davidson et al., examine the current landscape of Alberta's beef sector, and conclude that the prognosis of niche agricultural production methods like RA is favourable in light of the ecological contradictions inherent to the dominant industrial regime.[82] Presently, Alberta's beef sector is a culturally embedded, highly modern, privatized and industrially expansive stakeholder in a global agri-business marketplace governed by neoliberal principles incentivizing production, often at the expense of food safety.[83] Researchers point to the industry crippling 2003 and 2012 outbreaks of bovine spongiform encephalopathy (BSE), or mad cow disease, as being symptomatic of an unsustainable export-based regime that does not guarantee regional food-security. Furthermore, according to Davidson et al., beef producing families are becoming increasingly disenfranchised,

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82. Debra J. Davidson, Kevin E. Jones, and John R. Parkins, "Food Safety Risks, Disruptive Events and Alternative Beef Production: A Case Study of Agricultural Transition in Alberta," *Agriculture and Human Values* 33, no. 2 (2016): 359, accessed January 10, 2023, https://doi.org/10.1007/s10460-015-9609-8.

83. Davidson, Jones, and Parkins, "Food Safety Risks," 363-64.

with many of the farmers interviewed expressing "feelings of exclusion and helplessness" as large corporate producers drive down the cost at auction and effectively push them out of the industry unless they are able to recover lost profit by more processing a larger number of animals. Though prolific, the sector's reliance on high volume export-based production methods has increased the risk of infectious food-born illness events and rendered the sector increasingly vulnerable to supply chain disruptions as a consequence.[84]

Despite Alberta's industrial beef industry being deeply entrenched, *ST theory* illustrates its vulnerabilities and suggests it will need replacing. Researchers point to positive social interactions within Alberta's beef sector, high levels of trust, engagement, and reciprocity among entrepreneurs – necessary components to niche expansion – as reasons to believe RA can succeed in Alberta.[85] *The Wild Alberta Food Project* will rely on *ST theory* to simultaneously validate the unsustainability of Alberta's food system while providing guidance on how best to facilitate niche expansion.

4. ***Farmer wellbeing (FWB) theory*** places farmers at the center of the RA movement because it is through them as stewards of approximately 33% of Earth's ice-free land that change will be affected regarding two of the most pressing issues facing humanity: climate change mitigation and sustainable food production. An assumption of *FWB theory* is that the social and psychological aspects of RA are as important as the environmental-based outcomes.[86]

In two separate studies led by Nicola Cherry of the University of Alberta Division of Preventative Medicine, Cherry concluded that farmers with prolonged exposure to widely used commercial phenoxy herbicides are at greater risk of asthma and poor overall respiratory health,

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84. Davidson, Jones, and Parkins, 364.
85. Davidson, Jones, and Parkins, 369.
86. Schreefel, "Regenerative Agriculture," 2.

and higher rates of mental health illness, when compared to farmers with limited or no exposure to the same herbicides.[87]

Farmers have been asked to meet the seemingly contrary societal demands of improving the health and sustainability of agricultural lands and increasing food production to support a growing global population, all while adapting to the impacts of climate change on agriculture.[88] Many farmers cite the increasing frequency of devastating weather events associated with climate change as significantly detrimental to their psychological health, which is troubling considering they must make landscape decisions (fertilizer use, soil cover, etc.) every day that reverberate through the entire food value chain.[89] These mental effects amplify the considerable stressors already associated with farming, such as the long hours, financial pressures created by inconsistent income, and isolation (social and physical).[90]

Recent research suggests that farmers who adopt RA practices have increased confidence and greater ability to effectively manage the landscape and respond to challenges as they arise.[91] The result is increased self-efficacy, an important contributor across multiple occupational settings to individual wellbeing.[92]

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87. Nicola Cherry et al., "Mental Health in Alberta Grain Farmers Using Pesticides over Many Years," *Occupational Medicine (Oxford)* 62, no. 6 (2012): 400-06, accessed December 12, 2022, https://doi.org/10.1093/occmed/kqs136; Nicola Cherry et al., "Pesticide Use and Asthma in Alberta Grain Farmers," *International journal of environmental research and public health* 15, no. 3 (2018): 526-39, accessed December 12, 2022, https://doi.org/10.3390/ijerph15030526.

88. Kimberly Brown, Jackie Schirmer, and Penny Upton, "Can Regenerative Agriculture Support Successful Adaptation to Climate Change and Improved Landscape Health through Building Farmer Self-Efficacy and Wellbeing?", *Current Research in Environmental Sustainability* 4 (January 2022): 1, accessed December 20, 2022, https://doi.org/10.1016/j.crsust.2022.100170.

89. Brown, Schirmer, and Upton, "Can Regenerative," 1-2.

90. Brown, Schirmer, and Upton, 2.

91. Hannah Gosnell, "Regenerating Soil, Regenerating Soul: An Integral Approach to Understanding Agricultural Transformation," *Sustainability science* 17, no. 2 (June 2021): 603-20, accessed January 2, 2023, https://doi.org/10.1007/s11625-021-00993-0.

92. Brown, Schirmer, and Upton, "Can Regenerative," 2.

The distinguishing characteristic of *FWB theory* is that in contrast with the majority of RA scholarship, which views social objectives as outcomes of RA, *FWB theory* recognizes the social aspect of the farm as integral to overall farm success, i.e., it recognizes the relationship between a farmer's social and economic wellbeing, and the landscape as interdependent.[93] Many of the factors driving the need for agricultural transformation, such as climate change and land degradation, are also decrease farmer wellbeing. Without the resources to deal with such stressors, farmers become even less capable to engage in agricultural transformation. This "loss cycle", as researchers refer to it, stands in contrast to the "gain cycle" or "self-amplifying feedback loop" witnessed in farmers who adopt RA. As farmers engage in practices that improve soil health and they witness the effectiveness of such actions they develop an increased sense of self-efficacy and capacity to further change farming systems, thereby creating a positive feedback loop.[94]

FWB theory suggests the adoption of RA practices increases farmer wellbeing "through improvements in their relationships, reduced stress, increased feelings of optimism and positive biophilic emotions."[95] The challenge, it seems, is breaking farmers out their debilitating loss cycles and allowing them to adopt RA practices, which, when recursive, are self-sustaining due to positive feedbacks experienced by the farmers. Hence, *The Wild Alberta Food Project* recognizes increased farmer wellbeing as part and parcel of an improved Alberta food system.

5. ***Regenerative agricultural education (RAE) theory*** has two primary elements: first, it claims education must be reformed to include the role of RA in climate change mitigation; and second, it suggests that in order to maximize the benefit of including RA in school curriculums,

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93. Brown, Schirmer, and Upton, 2.
94. Brown, Schirmer, and Upton, 4.
95. Brown, Schirmer, and Upton, 4.

transdisciplinary research methods should be taught to students so they may become versed in addressing the complexity inherent to issues like climate change and food production sustainability.[96]

The absence of RA in social science environmental discourses is troubling and needs to change, according to sociologist and *RAE theory* progenitor, Edgar A. Burns. As a first step, Burns contends that "schools and university instructors need to be familiar with the role of [RA], inserting into curricula its potential importance for carbon sequestration, biodiversity, and water-soil care."[97] *RAE* theorists hold the collective belief that new ways of seeing and thinking will lead to new ways of managing and farming. It is therefore essential that education shift from aspirational talking about sustainability to actually understanding how to implement regenerative farming. The good news, according to Burns, is that there are numerous examples of RA's successful implementation that may be used as case studies during the education process. In addition, Burn's asserts that education must incorporate the policy requirements to deliver the science of RA and shape desired behaviour, indicating an assumption of *RAE theory* that education can impact policy outcomes.[98]

Through education, paradigmatic change in attitudes about agricultural practices are possible, which is essential if the farmer-driven RA movement is to become the status quo. To this end, the insights of *RAE theory* will factor significantly in improving Alberta's system. In

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96. C. Francis et al., "Transdisciplinary Research for a Sustainable Agriculture and Food Sector," *Journal of Agronomy* 100, no. 3 (2008): 771, accessed January 3, 2022, https://doi.org/10.2134/agronj2007.0073.

97. Edgar A. Burns, "Placing Regenerative Farming on Environmental Educators' Horizons," *Australian journal of environmental education* 37, no. 1 (June 2021): 29, https://doi.org/10.1017/aee.2020.21.

98. Burns, "Placing," 29-30.

particular, *The Wild Alberta Food Project* recommends that Alberta follow in the footsteps of one Australian university offering a "world-first degree in regenerative agriculture."[99]

6. ***Increased food security (IFS) theory*** argues that a food system based on RA practices will be regenerative throughout the food value chain and "spiral up" beneficial social, economic, and environmental outcomes such as food security, mitigation of the financial cost of chronic diseases, and improve the land for future generations.[100] The assumption of *IFS theory* is that through RA, socio-economic dimensions will develop that contribute to food security.

One of the social benefits frequently mentioned in RA discourses but seldom expounded on is RA's positive impact on food security, which, as noted above, is presently a problem in Alberta. The prevailing sentiment is that a food system based on RA practices will be more localized, and thus instilled with an underlying social justice imperative resulting in people making more equitable decisions that prioritize the common good. *IFS theory* proponents point to Toronto as an example of a community in which people from many regions and cultures share a particular place and are developing socially inclusive creative food economies.[101] The goal, however, is to scale RA such that it no longer applies only to small communities of like-minded individuals committed to the equitable distribution of food.

In the journal of *Global Food Security*, Schreefel et al. provide a marginally better account of RA's path to increasing food security. They first identify the following recurrent themes of RA: it enhances and improve soil health, optimizes resource management, alleviates

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99. Burns, "Placing," 31.

100. Bob Doherty et al., "Transformations to Regenerative Food Systems—an Outline of the FixOurFood Project," *Nutrition Bulletin* 47, no. 1 (March 2022): 113, accessed November 1, 2022, https://doi.org/10.1111/nbu.12536.

101. Patricia Allen, "Realizing justice in local food systems," *Cambridge Journal of Regions, Economy and Society*, 3, no. 2 (July 2010): 295-308, accessed November 1, 2022, https://doi.org/10.1093/cjres/rsq015.

climate change, improves nutrient cycling, and increases water quality and availability. They extrapolate that RA can enhance food security in three ways: (1) it contributes to provisioning, e.g., food, feed, and fibre; (2) it contributed to regulating, e.g., climate regulation, soil erosion and water purification; and (3) it supports nutrient cycling and soil formation.[102]

Figure 6.2 below, illustrates the desired theoretical functioning of the UK-based *FixOurFood Project* aimed at improving the York food system via RA. Notice that one of their food system outcomes is food availability. *The Wild Alberta Food Project* may glean from this

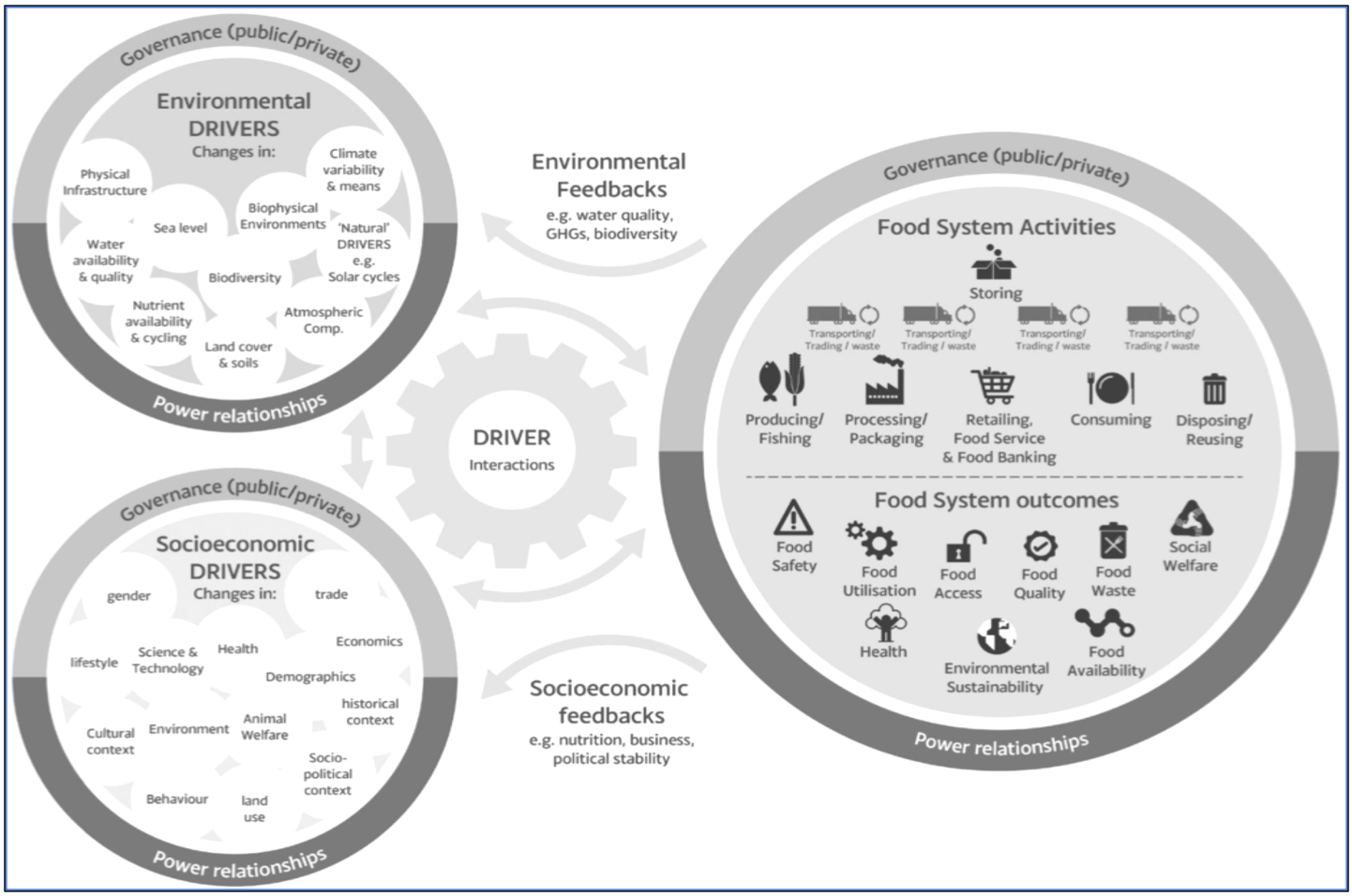

Figure 6.2 Conceptual framework of the *FixOurFood Project*. Source: Doherty et al. 2022.

102. Schreefel et al., "Regenerative Agriculture – the Soil is the Base," 6.

illustration the complexity of food system improvement but perhaps also the necessity of public policy to play a key role in managing food security, as it would be naïve to predicate such an important social function on the kindness of others and the property of regeneration spiralling upward through the food value chain.

Although hopeful that increased food security is indeed a natural by-product of RA, *The Wild Alberta Food Project* recommends that the equitable distribution of food be overseen by government and guaranteed through public policy. Nevertheless, *IFS theory* is widely believed by scholars, and therefore its insight into how RA can improve Alberta's food system is at least valid, if not sound.

Economics

> "I had spent so much time chasing yield and pounds, I had not paid enough attention to profit."
>
> – Gabe Brown

1. ***Regenerative agriculture momentum (RAM) theory*** assumes that social movements and trends are good for business, and therefore argues that financial stakeholders should look capitalize on the trend of RA now that it has become a social movement. *RAM* theorists like Bach, Sayers, and Weatherford point to the consumer staying power of previous trends in food production such as organic, and non-GMO.[103] The RA movement is about much more than the health benefits of individual human consumers – it contains added ecological imperatives aimed

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103. Diana Bach, Nova Sayers, and Hannah Weatherford, *White Paper: The Business Case for Regenerative Agriculture,* NSF (April 2020): 2-3, accessed January 10, 2023, https://www.nsf.org/knowledge-library/white-paper-the-business-case-for-regenerative-agriculture.

at mitigating climate change and regenerating degraded land to help feed the planet. Hence, economic forecasters believe it should surpass these previous trends in duration and impact by several magnitudes. The time is right to get in on RA, so-to-speak, because it is likely to generate a significant economic windfall.[104]

A 2021 *Food Business News* survey concluded that two of three people in the US, UK, and China think companies should invest in sustainability at all levels of the food value chain.[105] A 2019 *World Grain* survey indicated that 55% of consumers are interested in learning more about RA, and more importantly, that young people – tomorrow's buying force – were two to three times as likely to be aware of RA.[106] Large corporations like General Mills, Wal-Mart, Nestle, McCain, Cargill, and Pepsi, to name only a few, have all committed significant resources to RA and are "urging their suppliers to adopt more regenerative practices to both build resilience to climate change impacts and to reduce emissions by enabling soil to capture and store – rather than release – carbon dioxide."[107]

Though companies many large companies have made commitments to sustainability, *The Wild Alberta Food Project* believes that to credibly address that climate crisis, there needs to be a corporate shift beyond commitments, initiatives, and endorsements of social justice. There must be follow up and accountable oversight to prevent greenwashing if meaningful change is to be effected through corporate market forces. This is not to say that these initiatives are not

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104. Bach, Sayers, and Weatherford, *White Paper*, 3.

105. *Food Business News*, www.foodbusinessnews.net/articles/13554-top-trends-driving-the-global-food-industry in Bach, Sayers, and Weatherford, 3.

106. *World Grain*, www.world-grain.com/articles/12098-consumers-show-interest-in-regenerative-agriculture in Bach, Sayers, and Weatherford, 3.

107. Bach, Sayers, and Weatherford, 2.

welcome, only that they must be validated. There is reason to believe that an accurate system of incentivization and validation of corporate initiatives is achievable through public policy.[108]

Often, the first questions raised within RA discourses relate to its economic viability. *RAM theory* claims that not only is RA viable, but it is indeed the future of the agriculture sector. Thus, *RAM theory* provides an integral piece of information *The Wild Alberta Food Project* will utilize in determining how RA can improve Alberta's food system. If Alberta transforms its food sector into one predominantly using regenerative practices, the belief among financial speculators is that corporate support will be high, as RA presents an opportunity for brands to define themselves as leaders in a marketplace increasingly impacted by consumer demand for sustainable products.

2. ***Profit over yield (POY) theory*** addresses farmer concern regarding the economic uncertainties involved in transitioning to RA practices by illustrating that greater profit per acre is not only possible, but likely. In assessing the economic viability of RA to improve Alberta's food system, *The Wild Alberta Food Project* combed through stacks of scholarship attesting to the various ways in which economic prosperity was a by-product of RA. Among the least speculative accounts were a 2020 study by William Waterfield in the *International Journal of Agricultural Management* and the always compelling anecdotal evidence provided by Gabe Brown in *Dirt to Soil*.

Waterfield's study is intriguing because it aims to answer a question pertinent to *The Wild Alberta Food Project*: *"*Regenerative Agriculture – Another Passing Fad or a System Fit for

108. Hawken, *Regeneration*, 215.

the Future?"[109] Waterfield, through quantifiable scientific means, concludes that, "No regenerative agriculture is not a passing fad but a system of agriculture that is truly sustainable with the potential benefits for consumers and the wider environment."[110] He attributes this conclusion to several on-farm areas of savings for farmers, including: reduced requirements of expensive machinery and their maintenance, including fuel consumption; for livestock farmers, a reduction of feed costs, capital costs, and operating costs associated with increased and year-round grazing; due to increased soil organic matter levels in soil, farmers can expect a significant reduction in fertilizer costs.[111]

These savings can offset the lost income associated with higher production levels, which at first may be difficult for RA producers to match. Where Waterfield's study distinguishes itself is by acknowledging that the potential for significant profit increases due to RA practices allowing farmers to diversify their operation and implement value added, or new enterprises.[112] This notion aligns with the above sociological insights regarding farmer wellbeing and self-efficacy. A regenerative farmer is free to act on their entrepreneurial instincts, and by their own hand, based on their own decisions, increase profit in whatever manner they so choose. The result is a farmer with increased self-efficacy operating within a positive feedback loop.

Gabe Brown offers anecdotal evidence of this phenomenon in a *Dirt to Soil* chapter titled "Profit Not Yield," in which he laments the twenty-plus years prior to switching to regenerative practices that were consumed with maximizing production of low-margin livestock to eke out

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109. William Waterfield, "Regenerative Agriculture - Another Passing Fad or a System Fit for the Future?", *International journal of agricultural management,* vol 9 (September 2021): 21, accessed January 10, 2023. https://doi.org/10.5836/ijam/2020-09-19.

110. Waterfield, "Regenerative," 21.

111. Waterfield, 21.

112. Waterfield, 21.

barely enough profit to get by. Finally, after four years of "hell" marked by drought and hail, he was forced to make a change because he was going to lose everything.[113]

His focus switched to profit per acre. Higher profit per acre is accomplished by "stacking enterprises" through biodiversity, which makes a regenerative farm much more resilient to market fluctuations in comparison to a big industrial farm specializing in one or two products.[114] In fact, Brown's cash flow statement is not in dollars and cents, but rather in carbon, and it's distribution, because it is carbon that operates as the primary determinant of profit per acre. Details aside, Brown concludes that "Anyone can be profitable on their land base if they are willing to avoid the pitfalls of the current production model, focus on regenerating their ecosystem, and strive for profit not yield."[115]

Ultimately, there is both scientific and anecdotal evidence that suggests farmers who switch to regenerative practices can be more profitable than those who do not. To this end, *The Wild Alberta Food Project* will use *POY theory* to reinforce the economic practicality of adopting RA practices. Not only can RA ecologically benefit Alberta's food system, it can also bring economic prosperity, which in turn can contribute to improving social conditions. At every turn, *The Wild Alberta Food Project* is met by the notion that within a regenerative food system, positive feedback loops operate to reinforce the benefits of RA.

3. ***Pest Reduction (PR) theory*** contends that regenerative farming systems provide greater ecosystem services and profitability for farmers than input-intensive methods of production due

113. Brown, *Dirt to Soil*, 173.
114. Brown, 190.
115. Brown, 196.

in-part to significantly lower pest levels.[116] *PR theory* assumes that farm-level practices can positively impact farm profitability.

Pest problems in agriculture often result from low biodiversity inherent to industrial monocultures like the vast fields of canola, wheat, and corn seen in the prairies. In a 2018 study of the US Northern Plains, researchers found that pests were 1000% more abundant in insecticide-treated corn fields than in insecticide-free regenerative farms.[117] They also found that regenerative fields had 29% lower grain production but 78% higher profits than traditional production systems.[118]

PR theorists conclude that RA fundamentally challenges the current food production paradigm that maximizes gross profits at the expense of the net gains for the farmer. By promoting soil biology, organic matter, and biodiversity, regenerative farmers require less costly inputs like pesticides and fertilizers and managed their pest populations more effectively. In agreement with *POY theory*, researchers also conclude that soil organic matter is a more important driver of farm profitability than yields, in part due to regenerative farms unique marketing and diversified income streams derived from a single plot of land.[119]

The Wild Alberta Food Project will use *PR theory* to highlight the difference between gross profits and net farmer gains, a distinguishing feature of RA that further validates its ability to improve Alberta's food system both socially and economically.

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116. Claire E. LaCanne, and Jonathan G. Lundgren, "Regenerative Agriculture: Merging Farming and Natural Resource Conservation Profitably," *PeerJ* 6 (2018): 1, accessed January 11, 2023, https://doi.org/10.7717/peerj.4428.

117. LaCanne, and Lundgren, "Regenerative", 1.

118. LaCanne, and Lundgren, 1.

119. LaCanne, and Lundgren, 7.

4. ***Social financing (SF) theory*** argues that transforming unsustainable industrial food systems into regenerative food systems is possible through social financing, which has increasingly become a viable financial catalyst for RA adoption. Underlying *SF theory* is the assumption that increased financial investment improves food systems.

Social financiers are not driven solely by financial profit, but also seek to provide a positive social and environmental impact through their investments.[120] To this end, *SF* theorists claim that "Investing in regenerative agriculture has the potential to address not only the food supply but also climate change, peace and conflict resolution and the water supply."[121] In virtue of its wide-ranging benefits RA is one of the most attractive investment opportunities for people and companies looking to create positive change. Of equal importance, according to *Forbes* business analyst Devin Thorpe, investments in RA also generate healthy financial returns when their investments are predicated on soil quality improvement, a quantifiable feedback that indicates to financiers like Farmland LP the quality of land management and subsequent likelihood of a positive return on investment.[122]

Despite the potential of social financing to help alleviate the financial stressors of transforming agricultural production systems, *SF* theorist, Phoebe Stevens, emphasizes that the ability of private social financing to solve broad societal issues has yet to be proven, and therefore "government's role in supporting more holistic outcomes for regenerative food systems should not be ignored."[123] In agreement, a 2022 multi-disciplinary study into "Integrating

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120. Phoebe Stephens, "Social Finance Investing for a Resilient Food Future", *Sustainability* 13 no. 6512 (June 2021): 1, accessed January 12, 2023, https://doi.org/10.3390/su13126512.

121. Devin Thorpe, "How investing in Regenerative Agriculture Can Help Stem Climate Change Profitability," *Forbes, Entrepreneurs,* (December 2018): 1, accessed January 13, 2023, https://www.forbes.com/sites/devinthorpe/2018/12/12/how-investing-in-regenerative-agriculture-can-help-stem-climate-change-profitably/?sh=4edf28793e5c.

122. Thorpe, "How Investing", 6.

123. Stephens, "Social Finance", 13.

ecosystem markets to co-ordinate landscape-scale public benefits from nature," conclude that with the right support and design, it may be possible to integrate multiple sources of private investment with public funding to start delivering the levels of funding needed to address climate change and biodiversity loss.[124]

The Wild Alberta Food Project can extrapolate from *SF theory* that social financing should not be unduly relied upon to address broad societal problems. Rather, it should be used as a tool to financially support the social movement of RA, in conjunction with appropriate public policy to facilitate RA adoption. Ultimately, *SF theory* adds another economically optimistic account of RA's viability to improve Alberta's food system via RA, albeit with a caveat of public policy involvement.

5. ***Carbon credit market (CCM) theory*** contends that by adopting RA practices that generate carbon offsets, farmers can simultaneously supplement their income while realizing long-term ecological benefits. *CCM theory* assumes that market forces can instigate positive ecological outcomes.

In 2007, provincial government legislation regulating GHG emissions gave large GHG emitters four options: (1) Increase efficiency; (2) Pay a carbon price set by the province; (3) Purchase offsets from other facilities who emit less GHG than their limit; and (4) Pay for emissions reductions in other segments of Alberta's economy, including agriculture.[125] With this

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124. Mark S. Reed et al., "Integrating Ecosystem Markets to Co-Ordinate Landscape-Scale Public Benefits from Nature," *PLOS ONE* 17, no. 1 (January 2022): 24, accessed February 12. 2023, https://doi.org/10.1371/journal.pone.0258334.

125. Agriculture Environmental Stewardship Department of Alberta, *Agricultural Carbon Offsets,* 2023, https://www.alberta.ca/agricultural-carbon-offsets.aspx.

legislation, the first carbon credit market, anywhere, was established and has since produced over 14 million tonnes of carbon offset valued at over $210 million.[126]

Although *The Wild Alberta Food Project* believes these numbers could be significantly higher, the mere existence of a voluntary government-regulated market apparatus that rewards farmers for using RA practices is a boon for scaling RA in Alberta. For large emitters, purchasing carbon offsets from RA farmers is an economically sound strategy if the offsets can be purchased for less than the government-set carbon price associated with option (2) above. As long as sufficient oversight is in place to verify farmer offsets there is minimal need for government intervention. Essentially, the market works to incentivize the adoption of RA practices. This is an excellent example of public policy positively directly producing positive economic and ecological outcomes.[127]

According to *CCM* theorist, Tom Goddard, since the market's inception in 2007, there are many lessons to be learned about monetizing carbon offsets, including:

- We need to move from reductionist science to integrative or systems science.
- National inventory or other efforts for GHG accounting should be utilised.
- Operational policy is needed for protocols. Science is not enough.
- Implementation needs more than a protocol: It needs a registry, verification, oversight, private sector involvement, new business models, and understanding.

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126. Tom Goddard, "Climate-Change Policy for Agriculture Offsets in Alberta, Canada," in *Regenerative Agriculture: What's Missing? What Do We Still Need to Know?*, 95-104, eds. David Dent and Boris Boincean, (Springer International, 2022), 95, https://doi.org/10.1007/978-3-030-72224-1_8.

127. Tom Goddard, "Climate-Change Policy," 95-96.

- Verification methodology that is practical and cost effective is needed for biological systems.[128]

Each of these lessons can be addressed by government funded research initiatives, the focal point of *geocentric research theory* discussed in the public policy section below.

CCM theorists believe that the planets are aligning for soil carbon credit initiatives to attract public, private and government attention. Goddard argues that, "Governments have the opportunity to develop agriculture policies to protect soil carbon with the full support of society at large."[129] Further, he points to the international conventions, corporate strategies, and public support that underly compelling arguments for public policy development to incentivize and accelerate changes in agricultural practices that reduce GHG emissions and promote biodiversity, food security, and food sustainability.[130]

The usage of Alberta's carbon credit market could be significantly increased by addressing the needs identified by Goddard through government funded research and development, with a focus on assimilating the UofA-developed soil composition monitoring technology. As *The Database on Alberta Soil Health* takes shape, and accurate real-time data is made readily available to the public through a free app, *The Wild Alberta Food Project* believes Alberta's carbon credit market could potentially be the x-factor that pushes RA adoption past the tipping-point required for wholesale agriculture system transformation in Alberta. Hence, *CCM theory's* insights are essential to this project.

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128. Goddard, 101.
129. Goddard, 103.
130. Goddard, 103.

Public Policy

"The simplest step to restoring degraded land is removing constraints on natural regeneration"

– Paul Hawken

While the majority of disciplinary theory-based insights thus far have explored how the various benefits of RA can improve Alberta's food system, public policy theory-based insights are guided by the question: How can public institutions – primarily governments – use public policy to facilitate agricultural transformation and allow Albertans to partake in the numerous benefits listed above.

1. ***Government incentivization (GI) theory*** claims that agricultural transformation requires the creation of government policies that encourage the adoption of RA practices. *GI theory* assume that the best way to motivate people is through monetary gain.

According to *GI* theorists, "policy changes should reward producers for adopting and maintaining environmentally sustainable management practices for both crop and livestock production and discourage the use of land management practices that require high energy inputs and irrigation, and that degrade soils, reduce biodiversity, and increase GHG emissions."[131] Further, they maintain that if policy changed only minimally to financially incentivize what amount to Gabe Brown's five principles of RA mentioned above – no-till farming, increased crop diversity, more perennial forages (food for grazing livestock), and management-intensive grazing – such policies would lead to mixed agronomic systems that facilitate the reintroduction of grazing animals as a vital element of regenerative food production.[132]

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131. Teague, et al., "The Role of Ruminants," 162.
132. Teague, et al., "The Role of Ruminants," 162.

GI theorists draw attention to the need for the government of Alberta to create and leverage incentives as a primary tool of agricultural change. *The Wild Alberta Food Project* believes that incentivizing RA practices is the most important aspect of public policy. The hope is that through well-conceived meaningful incentives, RA is adopted widely enough to become the dominant agricultural system in Alberta. Once this occurs, it is argued in this report that a regenerative system will only get stronger over time through positive feedback loops.

2. ***Increased social science research (ISSR) theory*** asserts that further research into both bio-physical, and socioeconomic processes is needed for farmers and businesses within and beyond the rural sector to secure opportunities surrounding regenerative agriculture. Underlying *ISSR theory* is an assumption that without RA as part of an ecological reorientation, farming will eventually become a noneconomic enterprise, i.e., not profitable.[133]

According to *ISSR* theorist Edgar A. Burns, "RA needs validation, new insights, adjustment of missteps, market appreciation, new information and scientific research."[134] The expansion of research-based information will support accurate decision making and encourage further investment from both on and off-farm stakeholders.

At its core, *ISSR theory* is concerned with maximizing the economic value of RA by increasing research and ensuring prospective investors have access to all of the relevant information needed to make an informed decision. There is also an element to *ISSR theory* that believes time is of the essence if governments are to capitalize on the social RA movement. To best leverage Alberta's RA sourced products, will require government action, and the first step is

133. Burns, "Research Needed," 1-4.
134. Burns, "Research Needed," 11.

to approve and fund a significant amount of research, particularly into the developing a more robust socioeconomic account of RA.

ISSR theory supports *The Wild Alberta Food Project's* belief that gathering RA knowledge and data must be prioritized by governments to facilitate the scaling of RA within Alberta.

3. ***Geocentric research (GR) theory*** builds onto *ISSR theory*, utilizes *social innovation (SI) theory*, and is the most important public policy theory-based insight to *The Wild Alberta Food Project*. An assumption of *GR theory* is that increased knowledge will yield better policy. *GR theory* is based on New Zealand's 2021 *White Paper*, a transdisciplinary initiative involving intensive collaboration between more than 70 New Zealand-based organizations, and over 200 people from all levels of the food value chain, including "farmers and growers, researchers, private consultants, industry levy bodies, banks, retailers, not-for-profit organizations, and overseas researchers and educators."[135]

Although there are collaborative Alberta-based research ventures into RA, such as the aforementioned *Regenerative Agriculture Lab*, there is nothing comparable to the New Zealand *White Paper*. Alberta has the necessary experts and the public interest to justify the Alberta government funding an initiative like that of New Zealand's *White Paper*.

The Wild Alberta Food Project recommends the Government of Alberta commission an Alberta RA *White Paper* that includes the following components:

1) What is RA in Alberta?

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135. Gwen Grelet et al., *Regenerative Agriculture in Aotearoa New Zealand – Research Pathways to Build Science-Based Evidence and National Narratives,* New Zealand: Our Land and Water, 2021.

- It is clearly outcome-based, but which outcomes are the most important? In NZ, social wellbeing and soil health were the most important outcomes based on a survey of people working in major agricultural sectors.[136]
- Collaboration with indigenous leaders will be vital to establishing what RA in Alberta should look like, as the indigenous have extensive experience in living *with* nature, rather than against it.[137]
- Identify the core principles of RA and delineate them from the practices of industrial agriculture. See Figure 6.3 below.[138]
- To accurately gauge the transformation process the extent to which Alberta farmers are already using RA practices must be known, e.g., livestock grazing practices. This information will allow policy makers to know what is working well, and what is not.[139]

136. Grelet et al., *Regenerative*, 10.
137. This is an area of this project that requires significant follow up and consultation.
138. Grelet et al., *Regenerative*, 14.
139. Grelet et al., 16.

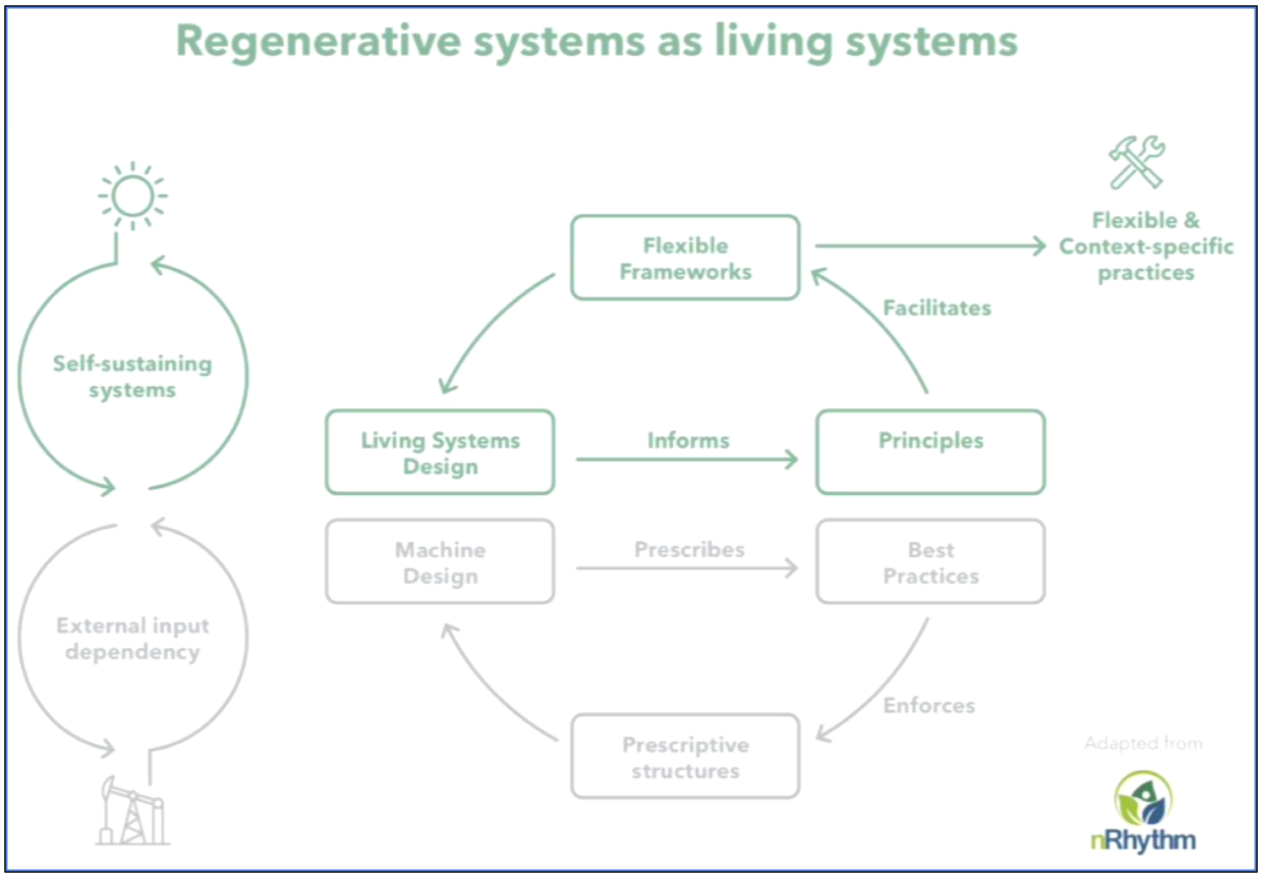

Figure 6.3 The differences between practice-focused and principles-led ag systems. Source: Grelet et al. 2021.

- To accurately gauge the transformation process the extent to which Alberta farmers are already using RA practices must be known, e.g., livestock grazing practices. This information will allow policy makers to know what is working well, and what is not.[140]
- Alberta's unique biophysical context must be researched to provide an updated, accurate account of factors such as the composition and carbon levels of Alberta's soil. The previously noted University of Alberta project employing AI for this purpose

140. Grelet et al., 16.

would be vital to this section of Alberta's *White Paper*. A taxonomy of Alberta's native biodiversity should also be provided here.

2) What is the current economic forecast of RA in Alberta?
   - Can Alberta's regenerative products be competitive overseas?
   - What niche/premium markets currently exist both in Alberta and abroad?[141]
3) What are the research needs of RA in Alberta? These can be attained by using focus groups and discussions with people from a range of occupations across Alberta's agri-food system. Based on the NZ *White Paper*, it will be helpful in Alberta to:
   - Develop a 'Regenerative Agriculture Continuum' that helps farmers identify where they sit and assists them in exploring their RA options.
   - Develop a list of principles that outline the purpose and desired outcomes of RA.
   - Develop and present – using accessible language – a list of practices for farmers that is specific to different sectors and regions.[142]

The Wild Alberta Food Project recommends Alberta-specific research in the following areas:

- The impact of RA on freshwater outcomes.
- The impact of RA on food quality and safety.
- The relationship between RA and farmer joy, self-efficacy and wellbeing.
- The long-term viability of RA, including the impact of reducing inputs, long-term resilience to financial instability and climate change, and the impact on future generations.

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141. Grelet et al., 27.
142. Grelet et al., 29.

- The impact of RA on animal welfare.
- The average on-farm biodiversity total on RA farms.
- Soil carbon levels of RA farms, IA farms, and farms using practices from each.
- The impact of RA on farm and landscape resilience to extreme weather.
- Accountability in food systems.
- The relationship between farmer support and farming learning network, i.e., are farmers who feel more supported in their agricultural practices more or less likely to participate in farmer-led learning?
- The profitability of RA farming systems.[143]

4) What are the knowledge gaps for RA in Alberta and what scientific metrics are needed?[144] This component in particular will require intensive collaboration, as survey results are shared to illuminate potential gaps in knowledge that must be addressed for RA's successful implementation.
5) What research designs can be used to maximize social progress? Transdisciplinary research designs are critical to any research intentionally seeking to create change, which holds true for RA in Alberta, as research designs must facilitate collaboration between multiple disciplines, indigenous peoples, science, and adaptive farm management. Experienced RA researchers recommend including the following five transdisciplinary elements in RA research designs:

    1. Work with large RA farms that have been successful for many years.

143. Grelet et al., 30-31.
144. Grelet et al., 36.

2. Collaborate with RA farmers that have achieved increased profit due to RA practices because they can demonstrate ecological, economic, and social components of operational sustainability.
3. Embed researchers with RA farmers from the start until the end of operational transitioning.
4. Discover chart which practices have been used and which inputs applied to selected farms.
5. Combine field studies, small-scale experiments, and simulations of modeling approaches, incrementally.[145]

Alberta RA research should be designed to include the further development of scalable environmental monitoring systems – like the UofA project mentioned above – including remote sensing technologies and apps to be used by farmers. Developing farmer-enabled systems could create data-driven feedback loops between producers and consumers that would be beneficial in four ways:

- Testing RA claims and validating current RA narratives can meet increasing consumer demand for outcome verifications.
- Immediate assessment of on-farm RA outcomes can serve as a highly efficient incentive for farmers to maintain their course.
- Showcasing RA outcomes through food quality and carbon sequestration data might make consumers more likely to adopt healthier diets.
- Enabling consumer behaviour changes driven by both consumers and producers.[146]

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145. Grelet et al., 38.
146. Grelet et al., 40.

Given the scope and potential impact of the above recommendations, *GR theory* simultaneously illustrates the potentially enormous impact of meeting RA research demands and the potential of government policy to expedite social change. As such, *GR theory*, as an extension of *increased social science research theory*, and utilizing *social innovation theory* method, will provide *The Wild Alberta Food Project* with the transdisciplinary research framework necessary to facilitate the transformation and improvement of Alberta's food system via RA.

Disciplinary Summaries

Below are the disciplinary conclusions and assumptions that will be used during the integration process (steps 7-9). Both conclusions and assumptions have been integrated disciplinarily to an extent that is appropriate. For each discipline, conclusions will be listed in order of most to least integrated and assumptions will be listed in order of their potential to facilitate interdisciplinary integration. In the left-hand column of each table, each conclusion and assumption is given an identifier, e.g., ecological conclusion #1 is assigned the identifier EC1, while ecological assumption #1 is assigned EA1. Contributing insights to each disciplinary conclusion and assumption are identified in the right-hand column and hyperlinked to their Appendix C annotation. Throughout integration, conclusions and assumptions will be referred to by their identifiers, which will also be hyperlinked to their full description in Appendix C.

Summary of Ecological Theory-Based Insights

Conclusions:

Identifier	Conclusion	Contributing Insights
EC1	RA can improve Alberta's food system through soil recarbonization: a natural by-product of regenerative practices that simultaneously mitigates climate change through carbon sequestration, stores vast amounts of water underground, increases soil nutrient levels and biodiversity, all of which function to produce healthier, more resilient food. In short, by working *with* nature instead of against it, RA practices lead to healthier soil capable of growing healthier plants and producing healthier animals. + healthier humans for integration	• CCM • SR • MiG • IND • WC • ISB
EC2	RA can improve Alberta's food system through soil recarbonization, i.e., through improving soil quality, which is a natural by-product of RA practices. The soil is the point of entry for food system improvement via RA.	• SR • MiG • IND • WC • ISB
EC3	RA can improve Alberta's food system through management-intensive grazing: a regenerative practice that evenly pounds carbon, manure, and other biology into the ground which is then used as fuel to produce diverse plant forages including the most desirable plants because they have not been overgrazed.	• MiG • ISB • IND
EC4	RA can improve Alberta's food system through regenerative soil-management practices (no tilling, year-round cover crops) enabling soil to store vast amounts of water underground, thereby significantly reducing the effects of drought: one of multiple climate change impacts predicted to affect the prairies.	• WC • CCM • SR
EC5	RA can improve Alberta's food system by mitigating the increasingly devastating effects of climate change by removing excess carbon from the atmosphere and storing it in the ground.	• CCM • SR
EC6	RA can improve Alberta's food system by producing more nutrient dense, healthier food than the current industrial agricultural systems.	• IND • SR

EC7	RA can improve Alberta's food system by increasing Alberta's soil biodiversity, which is a natural by-product of regenerative practices.	• ISB • SR

Table 6.1 Ecological conclusions derived from theory-based insights.

Assumptions:

Identifier	Assumption	Contributing Insights
EA1	There is a causal link between the nutrient density in food, human nutrition and health, and the overall quality of food systems.	• IND
EA2	Humans can positively impact social conditions by prioritizing ecological responsibility.	• WC
EA3	Industrial agriculture is unsustainable and has negative ecological consequences.	• CCM • SR • MiG • IND • WC • ISB
EA4	Humans can effect positive ecological change, which can be amplified through public policy.	• MiG
EA5	Although climate change is progressive, its negative effects can be mitigated through human intervention.	• CCM • SR
EA6	Food systems improve as ecological conditions improve.	• CCM • SR • MiG • IND • WC • ISB

Table 6.2 Ecological assumptions derived from theory-based insights.

Summary of Sociological Theory-Based Insights

Conclusions:

Identifier	Conclusion	Contributing Insights
SC1	RA is a farmer-led social movement that can mitigate climate change, produce healthier food, and increase food security. Integral to the movement's success is the improvement of farmer wellbeing achieved through regenerative practices. As farmers witness the positive environmental effects of RA on their land, they develop an increased sense of self-efficacy and a greater capacity for change, resulting a self-reinforcing positive feedback loop. The movement's success can be facilitated through public policy including education reform to include in school curricula the role of RA in climate change mitigation and food production sustainability, as well as the transdisciplinary research methods required to address the complexities inherent to such issues. With proper education and policy initiatives, the prognosis for RA is favourable in light of the ecological contradictions inherent to the dominant industrial regime.	• SM • FWB • SI • ST • RAE • IFS
SC2	RA can mitigate climate change. Widespread adoption of RA will require changes in knowledge, social discourses and attitudes, and economic frameworks.	• SI • SM • ST • RAE
SC3	Education curricula at all levels must be reformed to include both the role of RA in climate change mitigation and food production sustainability, and the transdisciplinary research methods required for students to adequately address the complexities inherent to such issues. Furthermore, education must incorporate teaching the policy required facilitate food system transformation. The education reforms required to turn the farmer-led social movement of RA into the status quo will require help from public policy initiatives.	• RAE • SM
SC4	RA is a farmer-led social movement that can significantly mitigate climate change by reducing atmospheric carbon. Hence, because RA is a social movement, a sociological perspective should be at the center of its study.	• SM

SC5	As the individuals responsible for creating and maintaining the RA movement, farmer social and economic wellbeing is integral to ecological success. As farmers engage in RA practices, they develop an increased sense of self-efficacy and a greater capacity for change, which creates a self-reinforcing positive feedback loop	• FWB
SC6	The prognosis for RA is favourable in light of the ecological contradictions inherent to the dominant industrial regime.	• ST
SC7	RA can increase food-security by improving soil health.	• IFS

Table 6.3 Sociological conclusions derived from theory-based insights.

Assumptions:

Identifier	Assumption	Contributing Insights
SA1	Social problems can be solved socially through collaboration and innovation.	• SI
SA2	Industrial agriculture is unsustainable and has negative social consequences.	• SM • FWB • SI • ST • RAE • IFS
SA3	RA has ecological, social, and economic benefits.	• SM • FWB • SI • ST • RAE • IFS
SA4	Food production methods impact social wellbeing.	• SM • FWB • SI • ST • IFS
SA5	Education impacts social movements and policy outcomes.	• RAE • SI
SA6	The social and psychological aspects of RA are of equal importance as the environmental-based outcomes.	• SM • FWB • RAE

SA7	Food systems improve as social conditions improve	• SM • FWB • SI • ST • RAE • IFS

Table 6.4 Sociological assumptions derived from theory-based insights.

Summary of Economic Theory-Based Insights

Conclusions:

Identifier	Conclusion	Contributing Insights
ENC1	At a minimum, the RA movement is economically viable due to steadily increasing corporate support as brands look to capitalize on increasing consumer demand for sustainable products. Beyond the corporate and public support needed for economic subsistence, farmers who adopt RA often see their profits increase because their input costs significantly decrease. Increased biodiversity eliminates the need for costly pesticides and fertilizers, while also enabling farmers to diversify and stack their income streams, resulting in a biologically and financially resilient farm. Although the rise of social financing, and increased acceptance by venture capitalists offers some financial stability for RA farmers, Alberta's government can expedite positive economic outcomes by funding the research and development necessary to fully leverage the existent carbon credit market apparatus.	• RAM • POY • PR • SF • CCM
ENC2	At a minimum, the RA movement is economically viable due to steadily increasing corporate support as brands look to capitalize on consumer demand for sustainable products. To guard against greenwashing, public policy initiatives can validate corporate practices and reward those who make good on their commitments, which in turn incentivizes further corporate support in a positive feedback loop.	• RAM • POY
ENC3	Regenerative farmers can be more profitable than industrial farmers by promoting increased biodiversity below and above ground, thereby better managing their pest populations, using fewer costly pesticides and fertilizers, and diversifying their income streams. The result is a biologically and financially resilient farm.	• POY • PR • SF
ENC4	Although the rise of social financing offers another stream of financial support to farmers looking to adopt RA, public policy and government funding should remain stabilizing factors throughout food system transformation.	• RAM • SF

Table 6.5 Economic conclusions derived from theory-based insights.

Assumptions:

Identifier	Assumption	Contributing Insights
ENA1	Social movements create profit.	• RAM • SF • POY
ENA2	Farm-level practices can positively impact farm profitability.	• POY • PR • SF
ENA3	Industrial agriculture is unsustainable and will increasingly have negative economic consequences.	• RAM • POY • PR • SF
ENA4	Increased financial investment, i.e., market forces, can improve food systems.	• RAM • SF • CCM
ENA5	Food systems improve as economic conditions improve.	• RAM • SF • POY

Table 6.6 Economic assumptions derived from theory-based insights.

Summary of Public Policy Theory-Based Insights

Conclusions:

Identifier	Conclusion	Contributing Insights
PC1	The Alberta government can help facilitate RA in Alberta through public policy initiatives, beginning with the commissioning of an Alberta-specific *White Paper of Regenerative Agriculture* to determine where Alberta currently sits on the continuum of regenerative outcomes, and identify the research required for RA to become Alberta's dominant agricultural system. Ultimately, through sound public policy derived from comprehensive Alberta-specific research, utilizing Alberta developed technology to transparently measure, track, and share environmental feedbacks, the Alberta government can validate, and incentivize both RA adoption, and RA investment.	• GI • ISSR • GR
PC2	The government of Alberta can help improve Alberta's food system via RA by funding research initiatives, and incentivizing RA adoption.	• GI • ISSR • GR
PC3	Further research into both bio-physical, and socioeconomic processes is needed for farmers and businesses within and beyond the rural sector to secure opportunities surrounding regenerative agriculture. RA needs validation, new insights, adjustment of missteps, market appreciation, new information and scientific research. The expansion of research-based information will support accurate decision making and encourage further investment from both on and off-farm stakeholders. At its core, *ISSR theory* is concerned with maximizing the economic value of RA by increasing research and ensuring prospective investors have access to all of the relevant information needed to make an informed decision.	• ISSR

Table 6.7 Public policy conclusions derived from theory-based insights.

Assumptions:

Identifier	Assumption	Contributing Insights
PA1	Alberta's current industrial agricultural system is ecologically, socially, and economically unsustainable.	• ISSR • GR • GI
PA2	Research positively impacts policy, and good policy produces good ecological, social, and economic outcomes.	• ISSR • GR
PA3	Without RA as part of an ecological reorientation, farming will eventually become a non-profitable enterprise.	• ISSR
PA4	People are primarily motivated by monetary gain.	• GI
PA5	Food systems improve as public policy improves	• ISSR • GR • GI

Table 6.8 Public policy assumptions derived from theory-based insights.

7. Conflicts

Identifier	Conflict Description	Contributing Conclusions / Assumptions
Conflict 1	Conflict between the disciplines of sociology and ecology regarding which disciplinary perspective should take precedence in assessing how RA can improve Alberta's food system.	• SC4 • EC2
Conflict 2	Inconsistent assumptions regarding which disciplinary-based conditions corresponding to food system improvement.	• EA6 • SA7 • ENA5 • PA5
Conflict 3	Conflict between the economic and ecological perspectives regarding the production of positive social conditions.	• PC3 • EA2
Conflict 4	Is RA a social movement, or is it a series of practices that improve soil health?	• EC1 • SC1

Table 7.1 Conflicts between disciplinary conclusions and assumptions.

Given the nature of this project, which is in many ways a *response* to multiple existential crises facing humanity – climate change, and food production sustainability in the face of a growing population – the contributing insights are largely free of conflict, insofar as they are collectively aimed at safeguarding the species. The majority of people, experts and lay-people alike, are in agreement when it comes to RA: "Yes, RA sounds great, but how do we make it work for everyone?" The *how* of this statement indicates the potential for disciplinary and theoretical divergence, as there are many components involved in the *how* of RA.

Conflict 1 consists of differing ecological and sociological perspectives. SC4 believes a sociological perspective should center the study of RA because RA is a social movement, while

EC2 suggests the soil should be the main focus of inquiry. These conflicts will be resolved in step eight using Repko and Szostak's technique of *transformation*.[147]

Each of the four assumptions within Conflict 2 claim that food systems improve as the conditions corresponding to their discipline improve. These fundamental disciplinary assumptions are not necessarily in conflict, but they are not overtly in agreement, either. Finding common ground here through Repko and Szostak's technique of *organization* will be helpful in developing a more comprehensive understanding how RA can improve Alberta's food system in step nine.[148]

In Conflict 3, PC3, despite being a public policy conclusion, expresses the economic perspective that market forces consisting of rational individuals dictate societal outcomes. As such, it is rational to use research to maximize the economic value of the RA. In contrast, the ecological perspective underlying EA2 – and the majority of other ecological conclusions and assumptions – is that positive socioeconomic outcomes are generated by ecological responsibility. Therefore, it should be the ecological outcomes that are maximized. This conflict will be addressed in step eight using the *organization* technique to create common ground.[149]

Conflict 4 between EC1 and SC1 is included here because at this juncture, two insights have emerged as *most* essential to *The Wild Alberta Food Project*: the importance of soil health, and the importance of farmer wellbeing. Although these insights are not directly oppositional, their reconciliation through *extension* will facilitate a smoother, more decisive integration result in step nine.[150]

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147. Allen F. Repko, and Rick Szostak, *Interdisciplinary Research*, 285.
148. Allen F. Repko, and Rick Szostak, 285, 288.
149. Repko and Szostak, 288.
150. Repko and Szostak, 283.

8. Common Ground

Identifier	Common Ground Description	Technique(s) used
Res. 1	Causal relationship between conflicting perspectives was established and used to create common ground: According to *FWB theory*, improved farmer wellbeing is predicated on improved soil quality.	• *Trans.* • *Org.*
Res. 2	One of the inconsistent assumptions was invalid and through *extension* and *organization*, the other three worked together toward a common goal.	• *Ext.* • *Org.*
Res. 3	Through *organization*, common ground was created by defining the causal relationship between conflicting views regarding how RA may best facilitate positive social outcomes.	• *Org.*
Res. 4	Through *extension*, the most fundamental ecological and sociological conclusions were integrated to provide a starting point for understanding *what* RA is.	• *Ext.*

Table 7.2 Common ground between conflicting disciplinary conclusions and assumptions.

Using Repko and Szostak's techniques of creating common ground (see note for brief technique descriptors), the above conflicts will be reconciled to enable the integration of disciplinary conclusions and assumptions presented in step nine.[151]

Conflict 1 is between ecological and sociological perspectives regarding which perspective is more fundamental in addressing and growing RA. Resolution to this conflict is achieved through *organization*, which suggests defining the causal relationship between conflicting terms or insights as a means to create common ground.[152] The sociological

151. *Redefinition*: involves modifying or redefining *concepts* in different texts, and contexts to bring out a common meaning. *Extension*: the focus of extension is conceptual and involves increasing the scope of what we are talking about. *Transformation*: this technique is used to modify concepts or assumptions that are in strict disagreement by extending the scope of underlying assumptions. *Organization*: this technique creates common ground by clarifying how certain phenomena interact in causal relationships.

152. Repko, and Szostak, 288.

perspective on RA is farmer-centric, which, through the techniques of *extension* and *redefinition* becomes farmer wellbeing-centric. *Farmer wellbeing (FWB) theory* argues that the relationship between farmer wellbeing and landscape quality (henceforth *redefined* as soil) is interdependent, meaning that the outcomes of one affect the outcomes of the other. However, *FWB theory* also claims that improved farmer wellbeing is a *function of* increased soil quality, improving only after farmers witness the positive effects of RA practices. Thus, because the sociological perspective is predicated on soil health it is in agreement with the ecological perspective.

An unintended consequence of resolving Conflict 1 is that Conflict 2 has also been resolved, as two of its four assumptions, EA6 and SA7, can be combined and rephrased as, "Food systems improve as ecological outcomes and farmer wellbeing improve," leaving only ENA5 and PA5. On its face, ENA5's claim that food systems improve as economic conditions improve, is weak, as there is no guarantee that food system improvement is a function of economic prosperity. However, PA5's claim that food systems improve as public policy improves is much stronger and is supported by *increased social science research theory* and by *geocentric research theory*, both of which argue that a food system is improved through comprehensive research informing positive public policy outcomes. Thus, the conflict between these four disciplinary assumptions is resolved, as it has been illustrated that food systems get better when ecological outcomes, farmer wellbeing, and public policy initiatives improve. This resolution does not, however, suggest that economic conditions have no bearing on food system quality, only that economic prosperity in and of itself, though perhaps necessary, is not a sufficient condition of food system amelioration.

Conflict 3 consists of differing viewpoints regarding how RA may best facilitate positive social outcomes. PC3, maintains that public policy initiatives should focus on maximizing the

economic value of RA, while EA2 claims is the associated socioeconomic benefits of RA can only be realized if policy maximizes ecological responsibility. By using the technique of *organization*, this conflict is easily resolvable. Ecological responsibility is an essential predicate of *any* economic value being derived from RA, let alone maximizing it. By extending its scope, PC3 can be transformed and rephrased as: *it is only through public policy initiatives designed to maximize ecological responsibility that the economic value of RA can be maximized*. Conflicting views have been organized to reveal their causal relationship, thereby creating common ground and resolving their conflict.

Conflict 4 asks whether RA is a social movement or a series of practices that improve soil health. This conflict is intriguing because it contains the two most important disciplinary conclusions to this project, EC1 and SC1, and neither seems provide a satisfactory of *what* RA is. However, through *extension* these primary, yet somehow lacking disciplinary conclusions are integrated to form one of the foundational components of a more comprehensive understanding of RA: *RA is a farmer-led social movement that improves soil health through regenerative agricultural practices*. One cannot properly conceive of RA, nor its potential to improve Alberta's food system without first reaching this most essential conclusion.

9. A More Comprehensive Understanding

How can regenerative agriculture improve Alberta's food system?

Fundamentally, regenerative agriculture is a farmer-led social movement that improves soil health through regenerative agricultural practices. RA practices can improve Alberta's food system by improving both the quality of Alberta's soil and the wellbeing of Alberta's farmers:

the two essential components from which the numerous benefits and positive feedback loops of RA are derived.

With regard to soil quality, the process of improving Alberta's food system via RA begins with improving Alberta's soil through recarbonization: a natural consequence of RA practices that simultaneously mitigates climate change through carbon sequestration, stores vast amounts of water underground, and increases soil nutrient levels and biodiversity.[153] Consequently, the bio-fueled food produced using RA practices is nutrient-dense, and healthier than the chemical-dependent food produced using industrial agricultural practices. Regeneratively produced food is also much more resilient to the negative impacts of climate change, such as increased drought and catastrophic weather events. By working with nature instead of against it, regenerative agriculture produces healthier soil; healthier soil produces healthier plants; and healthier plants produce healthier animals; all of which combine to produce healthier food and ultimately, healthier humans. Through RA, the improved collective health of Alberta's population would alleviate the unsustainable financial burden of nutrition-related chronic disease on the healthcare system. Here, the progression from positive ecological outcome, to positive social outcome, to positive economic outcome is illustrative of how RA can improve Alberta's food system.

With regard to farmer wellbeing, because RA is a farmer-led and farmer-maintained social movement, improving the wellbeing of farmers is an essential element of improving Alberta's food system via RA. Fortunately, improved farmer wellbeing is a natural consequence of regenerative practices, allowing farmers to *care* for their land instead harming it through

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153. *Limited disturbance, no tillage, cover-crops, increased biodiversity*, *living roots, and integrated animals*. See Gabe Brown's five principles, above.

persistent extraction. As they witness the positive environmental impacts of regenerative practices on their land, they develop an increased sense of self-efficacy and a greater capacity to adapt to change, the result of which is further adoption until their operation is fully regenerative. This process illustrates RA's natural tendency to establish self-reinforcing positive feedback loops.

The Alberta government can facilitate the RA movement's success through public policy initiatives, beginning with the commissioning of an Alberta-specific *White Paper of Regenerative Agriculture* to determine where Alberta currently sits on the continuum of regenerative outcomes, and identify what research is needed to facilitate RA becoming Alberta's dominant agricultural system. The *White Paper* should include an account of how new technology can be assimilated to fully leverage Alberta's existent carbon market apparatus, which, although a relatively unknown variable, could be the x-factor in RA adoption reaching the tipping-point necessary to supplant the current industrial agricultural regime.

Further policy initiatives should be aimed at reforming all levels of education to facilitate necessary mindset shifts. Educators should teach students about the role of RA in climate change mitigation and food production sustainability, and also the transdisciplinary research methods required to address the complexities inherent to such issues. Through enacting sound public policy informed by comprehensive Alberta-specific research, and by utilizing Alberta-developed technology to measure, track, and share environmental feedbacks, the Alberta government can validate and incentivize both RA adoption, and RA investment.

With these policies in place, given the rise of social financing and its increasing acceptance among venture capitalists, the outlook for regenerative agriculture in Alberta is positive, particularly in light of the environmental, social, and economic unsustainability inherent

to the current industrial regime. At a minimum, the regenerative movement is economically viable due to steadily increasing corporate support as brands look to capitalize on increasing consumer demand for sustainable products. It is more likely, however, that farmers who adopt regenerative practices will see their profits increase due to a significant reduction in the cost of inputs, as much of their heavy machinery no longer requires fuel and maintenance and can be sold to offset the revenue loss that may accompany early transition. Once fully operational, increased biodiversity eliminates the need for costly pesticides and fertilizers and enables farmers to diversify and multiply income streams, which further increases their self-efficacy and overall wellbeing. The collective result is a biologically and financially resilient agricultural sector operated by happy, purpose-driven managers of food system transformation.

There is a widely-held belief among RA advocates that once RA practices become regionally recursive, the ecological and socioeconomic benefits will only increase over time, creating a regenerative food system that essentially functions within a single integrated positive feedback loop. For this reason, scaling regenerative agriculture to reach the recursive tipping-point should remain a primary focus of interdisciplinary and transdisciplinary research and innovation.

Further Recommended Research:

- Further research is needed to create a comprehensive taxonomy of foods and food volumes that can be produced in Alberta. If Alberta is to undertake substantive agricultural system transformation and widely adopt regenerative practices, Alberta's food system will become significantly more regionalized, raising questions about food

variety and availability. Though total food volume should remain stable, given Alberta's geographic limitations, the need to import produce from warmer climates will persist.

10. Reflection

During the early days of October 2022, a full month into an eight month-long capstone project, and desperate to find a topic that met the requirements of Repko and Szostak's integrationist model of interdisciplinary research, I finally, and half-heartedly, landed on regenerative agriculture, primarily because it seemed practical. All I knew about my new topic was what I gleaned from its depiction in the excellent Netflix documentary, *The Biggest Little Farm*.

Seven months later this practical topic arrived at by default has altered my life's direction. Over the past seven months I have gained an understanding of Alberta's agricultural landscape and made important connections within it. My future focus within the legal realm will be environmental law. What I have learned during this process is that Alberta is surprisingly well-situated to transition to an RA-based food system; there are several RA initiatives currently underway within this province, including the UofA project that is very close to unveiling what would be ground-breaking technology that could address some of the most challenging problems facing RA surrounding data management and environmental feedback verification. Despite these strengths, the Alberta RA movement lacks organization and direction. It is my future goal to address these deficiencies by facilitating a much-needed unification of Alberta-based RA groups within a single government funded organization dedicated to scaling RA in Alberta. Thus, an interdisciplinary approach to Alberta's problematic food system has not merely challenged my bias towards this problem, it has replaced it with a belief that I can be part of its solution.

The conclusion I arrived at in step nine was eye-opening, particularly because it differed greatly from anything I had come across in my research – which consisted primarily of multiple and single disciplinary perspectives. Although undoubtedly flawed, the IDS-generated conclusion conveyed in step nine, is frankly, a much better conclusion and answer to this project's research question than any conclusion I discovered during the research process. Of course, disciplinary expertise and perspectives enabled the more comprehensive integrated conclusion I arrived at and should not be discounted. Nevertheless, I have learned from this process that unintegrated disciplinary insights cannot adequately address certain complex problems, such those pertaining to food system transformation.

To conclude, of the all the information gleaned during this process that could be applicable beyond the classroom, the result of integration is what impacted me the most. As such, I plan to experiment with integration in as many capacities and contexts as possible. In essence, the successful integration achieved in this project will certainly widen my overall perspective to better appreciate and utilize diversity as a helpful tool in all walks of life.

Glossary of Terms

Carbon Sink: land that has captured and *sunk* atmospheric carbon within its soil.

Feedback: A consequence of an action, or a series of actions, often as quantifiable data.

Feedback Loop: A pattern of behaviors resulting from multiple consistent feedbacks that become self-reinforcing. Can be either positive or negative.

Food Insecurity: Inadequate or insecure access to food due to financial constraints.

Food System: A food system is a web of interrelated human activities connecting food production, processing, distribution, and consumption with human health and the environment. Although the geographical scope of food systems range in size from household to global, the focus of this project will be on the region of Alberta. At a regional level, an integrated food system creates shorter, place-based connections between producers and consumers across all facets of the food supply chain from agricultural production techniques through processing, distribution, retail, consumption, and waste management. Benefits associated with a regional food system include environmental benefits, economic development, human health and well-being, and social equity.[154] Ultimately, the goal is a *secure* food system that affords Albertans the opportunity to lead long, happy, and healthy lives.

Food Value Chain: A food value chain consists of all the stakeholders who participate in the coordinated production and value-adding activities that are needed to make products.

Defining a sustainable food value chain:

A *food value chain* (FVC) consists of all the stakeholders who participate in the coordinated production and value-adding activities that are needed to make food products.

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154. Washington State University, *Food Systems Program,* September 2022, https://s3.wp.wsu.edu/uploads/sites/2206/2022/09/What-is-a-Food-System.pdf.

A ***sustainable*** *food value chain* is a food value chain that:

• is profitable throughout all of its stages (economic sustainability);

• has broad-based benefits for society (social sustainability);

• has a positive or neutral impact on the natural environment (environmental sustainability).[155]

Recursive: Repetition of an action or actions in order to produce a particular result. As it relates to this project, once RA adoption reaches a tipping-point, RA practices will become recursive in their ability to positively impact the environment, and socioeconomic conditions.

Regenerative Farming: An approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple provisioning, regulating and supporting services, with the objective that this will enhance not only the environmental, but also the social and economic dimensions of sustainable food production.[156]

155. FAO, https://www.fao.org/sustainable-food-value-chains/what-is-it/en/#:~:text=A%20food%20value%20chain%20(FVC,needed%20to%20make%20food%20products

156. Schreefel et al., "Regenerative Agriculture," 6.

Appendix A

Greenhouse gas emissions by province and territory, Canada, 1990, 2005 and 2020			
Province or territory	1990 greenhouse gas emissions (megatonnes of carbon dioxide equivalent)	2005 greenhouse gas emissions (megatonnes of carbon dioxide equivalent)	2020 greenhouse gas emissions (megatonnes of carbon dioxide equivalent)
Newfoundland and Labrador (NL)	9.6	10.5	9.5
Prince Edward Island (PE)	1.8	1.9	1.6
Nova Scotia (NS)	19.5	23	14.6
New Brunswick (NB)	16.2	19.8	12.4
Quebec (QC)	84.5	86.3	76.2
Ontario (ON)	180	204.4	149.6
Manitoba (MB)	18.3	20.5	21.7
Saskatchewan (SK)	45.1	71.3	65.9
Alberta (AB)	165.6	237.1	256.5
British Columbia (BC)	51.7	63.6	61.7
Yukon (YT)	0.6	0.6	0.6
Northwest Territories (NT)	1.8[A]	1.7	1.4
Nunavut (NU)[A]	n/a	0.6	0.6
Note: [A] 1990 emissions data for the Northwest Territories include emissions for Nunavut, which was part of the Northwest Territories until 1999. n/a = not applicable. Data are presented as rounded figures. However, all calculations have been performed using unrounded data. The years selected correspond to the first (1990) and last (2020) years of the dataset and to the base year (2005) for Canada's GHG emission reduction targets.			

Source: Environment and Climate Change Canada (2022) National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada (www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/inventory.html).			
Available on the Environmental indicators website (www.canada.ca/environmental-indicators).			

Appendix B

Ecological Snapshot:

Theory	Author	Insight into Problem	Assumptions
Climate Change Mitigation (CMT) Theory	Wiltshire and Beckage (2022)	Understanding carbon cycles is critical to mitigating anthropogenic climate change.	Climate change is progressive.
Soil Recarbonization (SR) Theory	White (2020); Jones (2007)	It is possible to quickly and naturally create more soil. Soil has the potential to sequester vast quantities of carbon, thereby making it critically important in the fight against climate change.	Climate change is progressive. Humans can positively affect ecology.
Intensive Grazing (IG) Theory	Teague et al. (2016); Kenyon (2019); White (2020); Shawver (2021)	Cattle managed properly, adhering to intensive-grazing practices, result in more C sequestration than emissions, elevate soil carbon levels, minimize damage from tillage, and enhance biodiversity.	Humans can positively affect ecology through policy.
Increased Micro-Organisms (IMO) Theory	Brown (2018); White (2020)	Getting plants to grow in dirt requires one gets the chemistry right. Getting plants to grow in soil requires one gets the biology right: the micro-organisms within the soil.	Humans can change dirt to soil. Humans can positively affect ecology.
Water Conservation (WC) Theory	Sullivan (2002); White (2020)	An important co-benefit of increasing the carbon content of soils is its improved capacity to hold water: a 1% increase in organic matter can add as much as 60,500 litres of water per acre.	Humans can impact the water holding capacity of soil. Humans can positively affect ecology.
Soil Essentiality (SE) Theory	Brown (2018)	Our lives depend on soil. There are five tried and true Ag practices that create healthy soil: 1) Limited disturbance; 2) Armor; 3) Diversity; 4) Living roots; and 5) Integrated Animals.	Humans can change dirt to soil. Humans can positively affect ecology.
Increased Nutrient Density Theory	Montgomery et al. (2022); White (2020); Hawken (2021)	Preliminary comparisons suggest the potential for regenerative agricultural practises that build soil health to enhance the nutritional profile of crops and livestock, and thereby influence human health and risk of chronic diseases; A significant co-benefit of increasing topsoil via RA is the production of healthy, nutrient-dense food.	There is a direct correlation between soil carbon levels, increased nutrient density, and better nutrition.

Sociological Snapshot:

Theory	Author	Insight into Problem	Assumptions
Social Movement Theory	Burns (2020)	RA is a farmer-led social movement. Thus, a sociological perspective ought to be at the center of its study. Change is possible to reduce the impacts of climate change.	RA is a social movement that has the potential to mitigate climate change.
Social Innovation Theory	Regenerative Agriculture Lab (RAL)	Widespread adoption of RA in Alberta requires changes along three axes: 1) farmer and consumer knowledge; 2) farmer and consumer social mindset; 3) operational and attitudinal shifts in farmers and consumers toward economic risks and social compensation (i.e., triple bottom line accounting).	RA has environmental, social, and economic benefits. People working together can provoke change.
Sustainable Transition Theory	Davidson et al. (2015)	Innate problems in the dominant industrial agriculture (IA) regime exist in Alberta, such as increased risk of food-borne illnesses (BSE), present an opportunity for niche food production methods such as RA. Whether transition will occur has yet to be seen, but there is certainly opportunity.	The unsustainability of industrial ag has negative social consequences.
Improved Nutrition Theory	Multiple Authors	RA leads to improved regional nutrition.	
Farmer Wellbeing Theory	Brown (2021; 2022) Burns (2021)	Farmer wellbeing should be at the center of the RA movement.	
Farmer Motivation Theory	Burns, *Farmer Motivation* (2021)	The focus should be centered on those who are going to be the ones actually making the changes, if adoption of the needed techniques is going to occur. Farmer motivation must be the central focus in order to spur widespread adoption.	RA is a farmer-led social movement.
Environmental Education Reform Theory	Burns, *Placing Regenerative Farming* (2021)	Schools and university instructors need to be familiar with the role of RA, inserting into curricula its potential importance for carbon sequestration, biodiversity and water-soil care. An urgent shift is needed from aspirational talking about sustainability to actually understanding and implementing RA.	Education and educational institutions impact social movements.
Mental Health Degradation Theory	Cherry et al. (2012)	Exposure to organophosphates and certain other pesticides has been related to symptoms of mental ill-health. There is particular interest in whether	Synthetic chemicals are bad. Pesticides are bad.

		exposure over many years may result in chronic mental ill-health.	
Physical Health Degradation Theory	Cherry et al. (2018)	Lifetime exposure to phenoxy herbicides is associated with an increased risk of asthma.	Synthetic chemicals are bad. Pesticides are bad.
Food Security Theory	Schreefel et al. (2020)	The objectives of RA in relation to socio-economic dimensions are general and lack a framework for implementation. RA could enhance food sec. by contributing to provisioning (food, feed, and fibre), regulating (climate regulation, soil erosion, etc.) and supporting (nutrient cycling and soil formation).	RA can produce socio-economic dimensions that contribute to food security.
Transdisciplinary Education Theory	Francis et al. (2008)	Students must develop the capacity to deal with future complexity, and uncertainty, and thus be prepared to search out an answer difficult questions that have not yet been asked. In connecting scientists and consumers with the origins of their food and building awareness of the importance of the natural environment we encourage wider support by society for research towards long-term sustainable agriculture in food supplies	Educational institutions affect policy outcomes. Research methods affect outcomes.
Necessary Food System Transformation Theory	Webb et al. (2020)	The urgency of food system transformation is now irrefutable	Climate Change is Progressive

Economic Snapshot:

Theory	Author	Insight into Problem	Assumptions
Regenerative Agriculture Movement Theory	Bach et al. (2020)	RA is a trend that has turned into a movement. Companies, farmers, and consumers alike can contribute to the creation of a more resilient and sustainable future by re-thinking our current food system and supporting a regenerative one.	Social movements are profitable.
Social Financing Theory	Stephens (2021)	One factor that is holding back RA food systems is their lack of access to financial capital. In response to this financing gap, social financiers have turned their attention to regenerative food systems.	Investment in RA will generate greater social and ecological resilience in our food system.
Pest Reduction Theory	LaCanne and Lundgren (2018)	RA fundamentally challenges current food production paradigm that maximized gross profits at the expense of the net gains for the farmer. By promoting soil biology, organic matter, and biodiversity, regenerative farms require less costly inputs like pesticides, insecticides, and fertilizers, and managed their pest populations more effectively. Ultimately, soil organic matter is a more important driver of farm profitability than yields. The net profit to the farmer is a key driver of RA systems.	There is a difference between gross profits and net gains for the farmer. Farm-level practices can positively affect farm profitably.
Regional Ecosystem Market Theory	Reed et al. (2022)	With the right support and design, it may be possible to integrate multiple sources of private investment with public funding to start delivering the levels of funding needed to address the twin challenges of climate change and biodiversity loss.	Environmental benefits can be quantified and represented in the market.
RA Investment Theory	Thorpe (2018)	Investing in RA has the potential to address not only the food supply but also climate change, peace and conflict resolution and the water supply. This impact investing strategy could be the biggest lever for creating positive change available to investors today. It also appears to generate healthy financial returns.	Through investment, the market can positively affect the social conditions, such as food systems, and food supply.

Public Policy Snapshot:

Theory	Author	Insight into Problem	Assumptions
Increased Social Science Research Theory	Burns (2022)	Further research is needed for farmers and businesses in and outside of the rural sector to secure opportunities around RA that farms *with* the environment rather than exploiting the environment. RA needs validation through public policy enacted based on research.	Less physical science research, more social science research is needed to grow RA.
Geocentric Research Theory	Grelet et al. (2021)	We recommend that RA research be designed to not only test and/or explain RA claims, but also to inform/support the transformation of NZ agriculture and food system, enabling direct data-based feedback between scientists, producers and consumers, which can in turn inform an Alberta specific narrative.	Collaboration among experts will produce sound policy.
Alternative Albertan Agriculture Theory	Cannon (2023) – This source is embargoed until February 24, 2023.	Overall, this research seeks to bring a greater awareness to alternative farming and help inform public debate on local food systems in Alberta.	Research positively impacts policy.
Precautionary Principle Theory	Ikerd (2022)	The sustainability of human life on earth may depend on public policies based on the precautionary principle rather than an economic cost-benefit analysis.	The market is not a good driver of human sustainability.
Transdisciplinary Outcome Spaces Framework Theory	Mitchell et al. (2007)	Beginning at the end, that is, starting with a richly articulated picture of where we would like to be at some defined point in the future has powerful consequences for transdisciplinary research.	Research structure impacts policy initiatives.
Bottom-Up Agricultural Offsets Theory	Goddard (2021)	Good policy development needs to have bottom up as well as top down traits, including decentralized, decision-making, multi-stakeholder, deliberation, formal review and continuous learning. In Alberta, involvement of a wide range of scientists, along with policymakers and industry representatives has been proven to yield robust protocols.	Good policy yields good outcomes.

Appendix C

Identifier	Annotation
CCM	***Climate change mitigation theory*** states that RA can improve Alberta's food system by removing excess carbon (C) from the atmosphere and storing it in the soil. *CCM theory* assumes that climate change will negatively affect Alberta's food system and will accelerate without human intervention.
SR	***Soil recarbonization theory*** holds that it is possible to quickly (5-10 years) and naturally create more soil through recarbonization. Like *CCM theory*, *SR theory* assumes that although climate change is progressive, its effects can be mitigated through human intervention, which is in this case through accelerated soil development via the recarbonization inherent to regenerative agriculture.
MiG	***Management intensive grazing theory*** contends that producers can improve their soil quality by manipulating the length of time ruminants – cattle, sheep, goats etc. – graze on a single paddock before being rotated to another. An underlying assumption of *MiG theory* is that humans can effect positive ecological change, which can be amplified through public policy decisions.
IND	***Increased nutrient density theory*** references multiple independent peer-reviewed comparisons of commercially and regeneratively produced food, vis-à-vis their respective nutrient density, to argue that RA produces food with superior nutritional profiles than industrial agriculture (IA), and does so across multiple agricultural sectors. *IND theory* assumes there is a causal link between the nutrient density in food, human nutrition and health, and the overall quality of food systems.
WC	***Water conservation theory*** maintains that agricultural land sustainability can be increased through increased water conservation via the soil management practices inherent to regenerative agriculture, e.g., no tillage. A general assumption of *WC theory* is that humans can positively impact social conditions by prioritizing ecological responsibility, a sentiment witnessed in regenerated soil's increased ability to capture and store water as a means to mitigate the effects of drought.
ISB	***Increased soil biodiversity theory*** argues that biodiversity is essential to a healthy food system. The underlying assumption of *ISB theory* is that ecologically responsible decisions increase human wellbeing via positive ecological feedbacks.
SM	***Social movement theory*** asserts that the recurring sociological theme of social change underlies the multiple reasons for sociologists to be interested in RA. Foremost, because RA has the potential to significantly mitigate climate change by reducing atmospheric carbon. To achieve this, *SM theory* maintains that not only must biophysical changes occur, but also shifts in social discourses and socioeconomic frameworks. Additionally, because RA is a farmer-led social movement, sociological expertise about other social movements, e.g., labour, gender, sexuality, and racial inequalities is applicable to the food production changes instigated by RA.
SI	***Social innovation theory*****:** For the purpose of this project one may understand *SI theory* as an intention to improve a specific social problem through social innovation, which entails new ideas borne of intentional and intensive collaboration.

ST	***Sustainability transitions theory*** provides a conceptual lens through which RA in Alberta is viewed as a niche production method operating within the dominant regime of global industrial agriculture. Underlying *ST theory* are two assumptions: (1) food production methods impact social wellbeing; and (2) the prevailing global industrial agri-food system is unsustainable.
FWB	***Farmer wellbeing theory*** places farmers at the center of the RA movement because it is through them as stewards of approximately 33% of Earth's ice-free land, that change will be affected regarding two of the most pressing issues facing humanity: climate change mitigation and sustainable food production.
RAE	***Regenerative agriculture education theory*** holds that education must be reformed to include the role of RA in climate change mitigation. Additionally, to maximize the benefit of including RA in school curriculums, transdisciplinary research methods should be taught to students so they may become versed in addressing the complexity inherent to issues like climate change and food production sustainability.
IFS	***Increased food security*** **theory** argues that a food system based on RA practices will be regenerative throughout the food value chain and "spiral up" beneficial social, economic, and environmental outcomes such as food security, mitigation of the financial cost of chronic diseases, and regenerate the land for future generations. The assumption of *IFS* theory is that through RA, socio-economic dimensions will arise that contribute to food security.
RAM	***Regenerative agriculture momentum theory*** assumes that social movements and trends are good for business, and therefore argues that financial stakeholders should look capitalize on the trend of RA now that it has become a social movement.
POY	***Profit over yield theory*** addresses farmer concern regarding the economic uncertainties involved in transitioning to RA practices by illustrating that greater profit per acre is not only possible, but likely.
PR	***Pest Reduction theory*** contends that regenerative farming systems provide greater ecosystem services and profitability for farmers than input-intensive methods of production due in-part to significantly lower pest levels.
SF	***Social financing theory*** argues that transforming unsustainable industrial food systems into regenerative food systems is possible through social financing, which has increasingly become a viable financial catalyst for RA adoption.
CCM	***Carbon credit market theory*** contends that by adopting RA practices that generate carbon offsets, farmers can simultaneously supplement their income while realizing long-term ecological benefits. *CCM theory* assumes that market forces can instigate positive ecological outcomes.
GI	***Government incentivization theory*** claims that agricultural transformation requires the creation of government policies that encourage the adoption of RA practices. *GI theory* assume that the best way to motivate people is through monetary gain.

ISSR	***Increased social science research theory*** asserts that further research into both bio-physical, and socioeconomic processes is needed for farmers and businesses within and beyond the rural sector to secure opportunities surrounding regenerative agriculture. Underlying *ISSR theory* is an assumption that without RA as part of an ecological reorientation, farming will eventually become a noneconomic enterprise, i.e., not profitable.
GR	***Geocentric research theory*** builds onto *ISSR theory*, utilizes *social innovation (SI) theory*, and is the most important public policy theory-based insight to *The Wild Alberta Food Project*. An assumption of *GR theory* is that increased knowledge will yield better policy.
EC1	RA can improve Alberta's food system through soil recarbonization: a natural by-product of regenerative practices that simultaneously mitigates climate change through carbon sequestration, stores vast amounts of water underground, increases soil nutrient levels and biodiversity, all of which function to produce healthier, more resilient food. In short, by working *with* nature instead of against it, RA practices lead to healthier soil capable of growing healthier plants and producing healthier animals.
EC2	RA can improve Alberta's food system through soil recarbonization, i.e., through improving soil quality, which is a natural by-product of RA practices. The soil is the point of entry for food system improvement via RA.
EC3	RA can improve Alberta's food system through management-intensive grazing: a regenerative practice that evenly pounds carbon, manure, and other biology into the ground which is then used as fuel to produce diverse plant forages including the most desirable plants because they have not been overgrazed.
EC4	RA can improve Alberta's food system through regenerative soil-management practices (no tilling, year-round cover crops) enabling soil to store vast amounts of water underground, thereby significantly reducing the effects of drought: one of multiple climate change impacts predicted to affect the prairies.
EC5	RA can improve Alberta's food system by mitigating the increasingly devastating effects of climate change by removing excess carbon from the atmosphere and storing it in the ground.
EC6	RA can improve Alberta's food system by producing more nutrient dense, healthier food than the current industrial agricultural systems.
EC7	RA can improve Alberta's food system by increasing Alberta's soil biodiversity, which is a natural by-product of regenerative practices.
EA1	There is a causal link between the nutrient density in food, human nutrition and health, and the overall quality of food systems.
EA2	Humans can positively impact social conditions by prioritizing ecological responsibility.
EA3	Industrial agriculture is unsustainable and has negative ecological consequences.

EA4	Humans can effect positive ecological change, which can be amplified through public policy.
EA5	Although climate change is progressive, its negative effects can be mitigated through human intervention.
EA6	Food systems improve as ecological conditions improve.
SC1	RA is a farmer-led social movement that can mitigate climate change, produce healthier food, and increase food security. Integral to the movement's success is the improvement of farmer wellbeing achieved through regenerative practices. As farmers witness the positive environmental effects of RA on their land, they develop an increased sense of self-efficacy and a greater capacity for change, resulting a self-reinforcing positive feedback loop. The movement's success can be facilitated through public policy including education reform to include in school curricula the role of RA in climate change mitigation and food production sustainability, as well as the transdisciplinary research methods required to address the complexities inherent to such issues. With proper education and policy initiatives, the prognosis for RA is favourable in light of the ecological contradictions inherent to the dominant industrial regime.
SC2	RA can mitigate climate change. Widespread adoption of RA will require changes in knowledge, social discourses and attitudes, and economic frameworks.
SC3	Education curricula at all levels must be reformed to include both the role of RA in climate change mitigation and food production sustainability, and the transdisciplinary research methods required for students to adequately address the complexities inherent to such issues. Furthermore, education must incorporate teaching the policy required facilitate food system transformation. The education reforms required to turn the farmer-led social movement of RA into the status quo will require help from public policy initiatives.
SC4	RA is a farmer-led social movement that can significantly mitigate climate change by reducing atmospheric carbon. Hence, because RA is a social movement, a sociological perspective should be at the center of its study.
SC5	As the individuals responsible for creating and maintaining the RA movement, farmer social and economic wellbeing is integral to ecological success. As farmers engage in RA practices, they develop an increased sense of self-efficacy and a greater capacity for change, which creates a self-reinforcing positive feedback loop
SC6	The prognosis for RA is favourable in light of the ecological contradictions inherent to the dominant industrial regime.

SC7	RA can increase food-security by improving soil health, optimizing resource management (limiting waste), improving nutrient cycling, and improving water quality and availability.
SA1	Social problems can be solved socially through collaboration and innovation.
SA2	Industrial agriculture is unsustainable and has negative social consequences.
SA3	RA has ecological, social, and economic benefits.
SA4	Food production methods impact social wellbeing.
SA5	Education impacts social movements and policy outcomes.
SA6	The social and psychological aspects of RA are of equal importance as the environmental-based outcomes.
SA7	Food systems improve as social conditions improve.
ENC1	At a minimum, the RA movement is economically viable due to steadily increasing corporate support as brands look to capitalize on increasing consumer demand for sustainable products. Beyond the corporate and public support needed for economic subsistence, farmers who adopt RA often see their profits increase because their input costs significantly decrease. Increased biodiversity eliminates the need for costly pesticides and fertilizers, while also enabling farmers to diversify and stack their income streams, resulting in a biologically and financially resilient farm. Although the rise of social financing offers another stream of financial support to farmers looking to adopt RA, public policy and government funding should remain stabilizing factors throughout food system transformation.
ENC2	At a minimum, the RA movement is economically viable due to steadily increasing corporate support as brands look to capitalize on consumer demand for sustainable products. To guard against greenwashing, public policy initiatives can validate corporate practices and reward those who make good on their commitments, which in turn incentivizes further corporate support in a positive feedback loop.
ENC3	Regenerative farmers can be more profitable than industrial farmers by promoting increased biodiversity below and above ground, thereby better managing their pest populations, using fewer costly pesticides and fertilizers, and diversifying their income streams. The result is a biologically and financially resilient farm.
ENC4	Although the rise of social financing offers another stream of financial support to farmers looking to adopt RA, public policy and government funding should remain stabilizing factors throughout food system transformation.

ENA1	Social movements create profit.
ENA2	Farm-level practices can positively impact farm profitability.
ENA3	Industrial agriculture is unsustainable and will increasingly have negative economic consequences.
ENA4	Increased financial investment improves food systems.
ENA5	Food systems improve as economic conditions improve.
PC1	The Alberta government can help facilitate RA in Alberta through public policy initiatives, beginning with the commissioning of an Alberta-specific *White Paper of Regenerative Agriculture* to determine where Alberta currently sits on the continuum of regenerative outcomes, and identify the research required for RA to become Alberta's dominant agricultural system. Ultimately, through sound public policy derived from comprehensive Alberta-specific research, utilizing Alberta developed technology to transparently measure, track, and share environmental feedbacks, the Alberta government can validate, and incentivize both RA adoption, and RA investment.
PC2	The government of Alberta can help improve Alberta's food system via RA by funding research initiatives, and incentivizing RA adoption.
PC3	*ISSR theory* is concerned with maximizing the economic value of RA by increasing research and ensuring prospective investors have access to all of the relevant information needed to make an informed decision. Further research into both bio-physical, and socioeconomic processes is needed for farmers and businesses within and beyond the rural sector to secure opportunities surrounding regenerative agriculture. RA needs validation, new insights, adjustment of missteps, market appreciation, new information and scientific research. The expansion of research-based information will support accurate decision making and encourage further investment from both on and off-farm stakeholders.
PA1	Alberta's current industrial agricultural system is ecologically, socially, and economically unsustainable.
PA2	Research positively impacts policy, and good policy produces good ecological, social, and economic outcomes.
PA3	Without RA as part of an ecological reorientation, farming will eventually become a non-profitable enterprise.
PA4	People are primarily motivated by monetary gain.
PA5	Food systems improve as public policy improves.
Conflict 1	Conflict between the disciplines of sociology and ecology regarding which disciplinary perspective should take precedence in assessing how RA can improve Alberta's food system.

Conflict 2	Inconsistent assumptions regarding which disciplinary-based conditions corresponding to food system improvement.
Conflict 3	Conflict between the economic and ecological perspectives regarding the production of positive social conditions.
Conflict 4	Is RA a social movement, or is it a series of practices that improve soil health?
Res. 1	Causal relationship between conflicting perspectives was established and used to create common ground: According to *FWB theory*, improved farmer wellbeing is predicated on improved soil quality.
Res. 2	One of the inconsistent assumptions was invalid and through *extension* and *organization*, the other three worked together toward a common goal.
Res. 3	Through *organization*, common ground was created by defining the causal relationship between conflicting views regarding how RA may best facilitate positive social outcomes
Res. 4	Through *extension*, the most fundamental ecological and sociological conclusions were integrated to provide a starting point for understanding *what* RA is.

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