2023

Advancing Regenerative Agriculture in Canada: Barriers, Enablers, and Suggestions

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ADVANCING REGENERATIVE AGRICULTURE IN CANADA:

Barriers, Enablers, and Recommendations

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Foreword

This report provides a systemic overview of the state and potential future of regenerative agriculture in Canada. Regenerative agriculture consists of farming that supports life on land – e.g., prioritizing soil health, planting native seeds, protecting faunae and flora, or avoiding harmful chemicals. The biodiversity loss and climate crises are realities that hit every Canadian. The impacts of these crises on agriculture are immense: from soil degradation, lower yields and exports, to food safety. Conversely, agriculture has a tremendous effect on biodiversity loss and climate change; as one of the largest carbon emitting sectors nationwide, the industry could contribute more to the transition toward a green economy, notably through nature-based solutions.

Canada's future competitiveness depends on the capacity to adapt to our age's ongoing great challenges – climate change, the biodiversity loss crisis, and social justice, to name a few. The country will not be able to thrive without shifting its agricultural system toward sustainable development. Such a transformation will not be easy. Canadian agriculture is anchored to a model of development dating back to the 1960s and 1970s, when industrial approaches to the land were prioritized. Today's culture, practices, incentives, and business models continue to be shaped by the assumption that to be successful, farmers must invest in large, mono-cropping mechanical practices – at the expense of the environment and the sustainability of future yields. And the truth is that without those cash crops and sophisticated harvesters, Canadian farmers could not thrive. Asking farmers to shift toward (more) regenerative practices in today's context would be unfair to them and probably met with resistance.

There is only one way to move forward: gathering all the stakeholders and rightsholders involved in the food value chain and identifying levers for systems change. Current industrial practices result from choices made by multiple actors: governments, food companies, and investors to consumers. If regenerative practices have not expanded at the level of environmental resilience, which constitutes native habitat covering at least 30 per cent of land (see the Government of Canada's 30 by 30 commitment – 30 per cent of lands and waters protected by 2030), it is not because of a lack of knowledge or a lack of farmers' interest in the health of their land. Regenerative practices are known, and research abounds about their benefits. The challenges

PHOTO: Waterloo farmer's field, **Alex Thomson**

are mostly around misalignment with economic incentives. Today, Canadian farmers have little to no financial incentive to transform their practices toward the regeneration of landscapes. This motivates the importance of tackling the issue through a business school lens.

This report was developed in the **Ivey Sustainable Finance Lab**, one of the four impact labs of the **Centre for Building Sustainable Value** at the Ivey Business School. The lab specializes in designing financial products and accounting incentives that channel capital toward nature-based solutions. The research question that guided the team was simple: *Why has regenerative agriculture struggled to find its business model despite abounding evidence on the financial worth of ecosystem services and the costs of land degradation?* As you can see by the report's length, the answer is complex. The report goes beyond carbon and embraces a systems perspective to account for the holistic approach required by regenerative agriculture. Each node of the food value chain comprises a legacy from the industrial agricultural system that prevents implementing regenerative practices at a larger scale. At the core of issues are the economic incentives driving agricultural production. This is why the team dedicated a significant portion of the report to the role of investors and potential new financial instruments that would value agriculture's environmental and social impacts alongside the cash generated by crops or the speculative vision of land prices.

Who should read the report? We wrote a detailed, evidence-based account of today's Canadian (regenerative) agriculture system so that anyone interested in sustainable farming could understand the ins and outs of the industry. Written from the perspective of a business school research team, the report has an economic lens but also includes natural and social sciences insights. In the Ivey Sustainable Finance Lab, we assume that business is a social and environmental construct based on collective endeavours. When writing the report, we thought about all the stakeholders and rightsholders along the food value chain and how the report could provide an arena for those different viewpoints to meet. We aimed to include the voices of marginalized actors in the system – Black, Indigenous and people of colour, and migrant workers whose role in the industry is essential – and the marginalized perspectives of biodiversity and non-human actants. The report should benefit all the stakeholders and rightsholders mentioned in the latter: investors, banks, food companies, governments, policymakers, farmers, investors, planners, Indigenous peoples, consumers, and citizens, among others. The conclusion of the report is clear: without including a diverse set of perspectives, we will not succeed in achieving a just transition. Farmers alone will not succeed; they need the support of society. A systemic issue requires a systemic answer.

DR. DIANE-LAURE ARJALIÈS
Founder and Lead, Ivey Sustainable Finance Lab

Acknowledgments

Above all, we thank our interviewees. In addition to being important thought leaders and active decision-makers in the industry, they provided the time, effort, and insights that formed the basis for this report.

They include:

- **Bob Lambe**, Executive Secretary, Great Lakes Fishery Commission
- **Brandon Kortleve**, Planner, County of Brant
- **Carole-Anne Lapierre**, Analyste, Agriculture et systèmes alimentaires, Équiterre
- **Eleanor Mulvaney**, Chief Executive Officer, Seamans Holdings
- **Laura Palmeiro**, Head of Sustainable Finance, Danone
- **Ian Little**, Head of Conservation, Endangered Wildlife Trust
- **Dr. Manuel Piñuela**, Co-Founder and CEO, Cultivo
- **Peter Ellsworth**, Senior Director, Investor Network, Private Equity, and Paris Aligned Investing, Ceres, Inc.

Thank you also to those who chose to remain anonymous in their contributions.

We thank our research assistants Stephanie Hunter and Lavisha Dasani for their support on the carbon sinks and valuation models. Thank you to our Ivey colleagues, Tima Bansal, Jury Gualandris, Sergio Lazzarini, Matthew Lynch, and Alice Mascena for their friendly review and constructive feedback.

The authors' opinions should not be ascribed to those participating in this research process.

We gratefully acknowledge funding from the Canadian Sustainable Finance Network and the in-kind support of the Ivey Business School for the graphic design of the report.

Land Acknowledgement

The Advancing Regenerative Agriculture in Canada team acknowledges that our work, our team, and our partners are located and living on the traditional territories of many Indigenous Nations, including the Anishinaabe, the Haudenosaunee, the Lunaapeew, the Attawandaron, and the Wendat. We acknowledge all Indigenous peoples that have stewarded this land for millennia and the many diverse First Nations, Métis, and Inuit peoples who call this land home. We acknowledge the inherent rights and the treaty rights of the Indigenous peoples of Turtle Island. We acknowledge the Royal Proclamation of 1763, which serves as the basis for the treaty-making process and is the first legal recognition of aboriginal rights and titles, and all the treaties that have been signed related to this land.

With this, we respect Indigenous peoples' longstanding relationships with this land, as they are the original caretakers. We acknowledge historical and ongoing injustices that Indigenous peoples (e.g., First Nations, Métis, and Inuit) endure in Canada, and the non-Indigenous peoples on the research team accept the role we must play in Indigenous reconciliation and the responsibility to contribute towards revealing and correcting miseducation as well as renewing respectful, reciprocal relationships with Indigenous communities through our practices and community service. We are committed to building relationships and working with Indigenous Nations. We are also committed to creating safe spaces for Indigenous and non-Indigenous perspectives to meet and discuss the issues that matter to everyone.

About the Authors

Michelina Aguanno is a Ph.D. candidate at the Ivey Business School at Western University studying in the discipline of management and sustainability. She has researched the topic of conservation finance since joining the program in 2020 and previously worked as a research assistant on the Deshkan Ziibi Conservation Impact Bond project. Michelina's dissertation research explores innovation in nature-based markets, with a particular focus on agriculture as a research context. Her current project focuses on innovating financial instruments aimed at channelling private capital towards nature regeneration and enabling sustainable agriculture.

Dr. Diane-Laure Arjaliès is an Associate Professor (with tenure) belonging to the 'Sustainability,' 'Managerial Accounting and Control,' and 'General Management' groups at the Ivey Business School – a cross-disciplinary appointment that reflects her research and teaching. She is the Founder and Lead of the Sustainable Finance Lab, an Impact Lab from the Centre for Building Sustainable Value. Her ambition is to push the boundaries of knowledge and practice by investigating how fashioning new devices and collective actions can help transform financial markets toward sustainable development. She is currently leading an extensive research program on conservation finance, aiming to channel capital toward protecting ecosystems, notably through conservation impact bonds. Her work in this area has won her several academic, teaching, and professional prizes.

Marek Brooking is a Research Assistant currently pursuing a degree in Political Science. His project aims to integrate Indigenous viewpoints within the framework of sustainability and business. He spent the summer of 2022 in Western University's Indigenous-led Head and Heart Fellowship, where he built a teaching note that helps business students better understand issues surrounding Indigenous land, history, and conservation. Marek plans to attend law school after graduation.

Jean-François Obregón is a Research Fellow focusing on how to scale and finance regenerative agriculture. He was a Lead Analyst (Financials and Real Estate) at Sustainalytics and published articles on investing in the circular economy, deforestation in the Amazon, and insuring natural disaster risks. He is an urban planner whose award-winning graduate Major Research Paper at Toronto Metropolitan University (formerly Ryerson University) described new financial tools for urban parkland acquisition and how to overcome obstacles toward their use. Jean-François is working at the intersection of urban planning and sustainable finance through The Urban Hulk, his blog and consultancy.

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To cite this report:

Obregón J-F., Aguanno M., Brooking M., and Arjaliès D-L., (2023) Advancing Regenerative Agriculture in Canada: Barriers, Enablers, and Recommendations, Western University, **https://ir.lib.uwo.ca/iveypub/66/**

Ivey Sustainable Finance Lab

The financial system plays a critical role in sustainable development. As the Canadian Expert Panel on Sustainable Finance outlines, Canada's transition towards sustainability will require "...a sea change in the interactions between innovation, policy and regulation, consumer behaviours, risk management, and investment patterns. In each area, the financial system is critical in directing capital flows, managing complex risks, and unlocking opportunity."

The Expert Panel defined sustainable finance as "capital flows, risk management activities and financial processes that assimilate environmental and social factors to promote sustainable economic growth and the long-term sustainability of the financial system." The rise of sustainable finance is already significantly influencing the behaviours and practices of financial markets. This significant growth in sustainable capital – and the accompanying financial sector expertise, ingenuity, and influence – creates exciting new opportunities for finance to address complex sustainability challenges.

The **Ivey Sustainable Finance Lab** is taking advantage of these opportunities, supporting the development of new innovative financial instruments to catalyze the transition to sustainable development. Research focuses on frontier applications of sustainable finance in Canada – including ecosystem conservation, green infrastructure, blended finance, and investment in the success of Indigenous communities.

Centre for Building Sustainable Value (BSV)

The **Ivey Centre for Building Sustainable Value** (BSV) was one of the first sustainability centres in a business school globally and is recognized for its excellence and 20-year track record in research and teaching. BSV is housed at the Ivey Business School, and the Centre's work directly advances Ivey's sustainability ambitions. In March 2022, Ivey released a new strategy called Ivey Next, which made sustainability central to its purpose and mission. One of the most significant changes for Ivey is embedded in its mission statement: address critical issues facing business and society. The mission of the BSV is to *shape pathways of systems change toward an ecologically sound, fair future*. The school plans to prioritize work on three critical issues for which Ivey already has demonstrated strength in research, teaching and outreach. Sustainability is one of those critical issues. Ivey aims to be a thought leader on sustainability, where academics, businesses, and governments come to understand and address the most critical sustainability challenges we face.

Institute for Sustainable Finance (ISF) and Canadian Sustainable Finance Network (CSFN)

The **Canadian Sustainable Finance Network** (CSFN) was established as part of the Institute of Sustainable Finance's (ISF) mandate. CSFN is an independent formal research and educational network for academia, industry, and government to bring together a talented network of university faculty members and relevant members from industry, government, and civil society. CFSN will be essential to sharing learnings, opening the door to future research topics, and creating partnerships with other entities across Canada and globally.

The ISF is Canada's first-ever cross-cutting and collaborative hub that fuses academia, the private sector, and government with the singular focus of increasing Canada's sustainable finance capacity. The institute aims to align mainstream financial markets with Canada's transition to a prosperous, sustainable economy. The ISF is housed at the Smith School of Business at Queen's University in Kingston, Ontario, Canada.

Funding from the Institute for Sustainable Finance for this CSFN initiative is gratefully acknowledged.

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AAFC:	Agriculture and Agri-Food Canada
BFCP:	Blended Climate Finance Program
BIPOC:	Black, Indigenous, and People of Colour
BMPs:	Best management practices
BSV:	Centre for Building Sustainable Value
CETA:	Canada-European Union Comprehensive Economic and Trade Agreement
CCS:	Carbon capture and storage
CSFN:	Canadian Sustainable Finance Network
CUSMA:	The Canada-United States-Mexico Agreement
DNSH:	Do no significant harm
DRAP:	Duffins Rouge Agricultural Preserve
eDNA:	environmental DNA
EOV:	Ecological Outcome Verification
GHG:	Greenhouse gas
HAB:	Harmful algal blooms
IFC:	International Finance Corporation
ISF:	Institute of Sustainable Finance
ktCO2e:	Kilotonnes of carbon dioxide equivalent
MtCO2e:	Megatonnes of carbon dioxide equivalent
MCR:	Municipal Comprehensive Review
MPAC:	Municipal Property Assessment Corporation
MZO:	Ministerial Zoning Order
MW:	Megawatt
NAFTA:	North American Free Trade Agreement
OPA:	Official Plan Amendment
PC:	Protected Countryside
PMRA:	Pesticide Management Regulatory Agency
PPS:	Provincial Policy Statement
ROC:	Regenerative Organic Certification
SAI:	Sustainable Agriculture Initiative
SBTi:	Science-Based Target initiative
SCIC:	Saskatchewan Crop Insurance Corporation
SOC:	Soil organic carbon
SOM:	Soil organic matter
TBI:	Tree-based intercropping
TNFD:	Taskforce on Nature-related Financial Disclosures
ZBL:	Zoning By-law

Executive Summary

Agriculture plays a vital role in the Canadian economy, contributing over CAD 143.8 billion annually to the country's gross domestic product (Agriculture and Agri-Food Canada 2023a).[1] The most recent Agriculture and Agri-Food Canada (AAFC) survey on Agriculture Strategic issues shows that producers are primarily concerned with the rising costs of production inputs, climate change and its impacts, and labour shortages in farming (Agriculture and Agri-Food Canada 2022a).

Environmental concerns are growing, particularly in agriculture, which relies heavily on the natural environment. Farmers face pressure to produce sustainable products, lower carbon emissions, and engage in ecosystem regeneration rather than degradation or merely conservation. Regenerative agriculture emerges as a solution for sustainable land development.

A systems shift is needed to advance regenerative agriculture to respond to the sector's ecological crises, develop more resilient landscapes, and improve the industry's long-term sustainability. These goals span beyond carbon targets, requiring a shift in agricultural production mindsets and practices. This requires the support of actors, including farmers, business leaders, investors, politicians, and municipal planners. This report takes a systems perspective, identifying the critical actors in the system and the barriers and enablers to the regenerative agriculture transition. It advocates for developing financial infrastructure to incent and support the transition toward sustainable farming.

The scope of this report extends beyond the land management practices required of farmers to transition to regenerative agriculture, taking instead a systems approach to capture the perspectives of diverse agricultural players in their interactions and relationships with land. Each section focuses on critical actors and activities in the system, from land acquisition and planning to downstream food consumption. Woven throughout the report is a focus on the financial infrastructure needed to advance regenerative agriculture.

THE NEED FOR REGENERATIVE AGRICULTURE

Forces such as a growing population, demand for crop-related products, and increased exportation required industrial techniques for agricultural production. The industrialization of farming enabled higher production but, over time, resulted in ecosystem degradation and a decline in productivity. To ensure the needs of the present are not met at the expense of future generations, regenerative agriculture has emerged as a solution. Regenerative agriculture's overarching principle is farming in a way that seeks to enhance ecosystems. This can include a multitude of practices, based on local landscapes. A regenerative model creates value through ecosystem regeneration, which leverages nature's goods and services to support agricultural production.

HOW THE REGENERATION OF ECOSYSTEMS SUPPORTS FARMING

Farming requires an understanding and cultivation of natural ecosystem functions on the land. Water, biodiversity, and soil are interconnected aspects of nature that impact farming. Regenerative agriculture, which enhances ecosystem health, seeks to support these natural processes. Biodiversity (including soil microorganism, crop, and land biodiversity) supports crop pollination, produces healthy soil, purifies water, prevents erosion, provides resilience in extreme weather events, and contributes to other ecosystem services (Pilling and Bélanger 2019; Moyer et al. 2020).

Prioritizing soil health has long been considered a farming best practice; farmers who improve soil benefit from reduced fertilizer, pesticide, and irrigation costs (Anderson and Gough 2021; Ministry of Agriculture, Food and Rural Affairs 2018). Healthy soil helps with water retention and carbon capture, critical inputs in farming. Industrial agriculture practices can disrupt natural flows, reducing biodiversity, water, and soil health.

Investing in regenerative practices that restore the ecosystem's health creates value through mechanisms like carbon sequestration, risk management and developing resilience on the land, food security and subsistence, reducing costs of inputs, sustaining yields, achieving science-based targets, and increasing farmland valuation.

1 All currency figures will be represented as CAD (Canadian Dollar), EUR (Euro), or USD (U.S. Dollar).

Despite the value created by regenerative agriculture, many barriers and enablers in the system require attention if we want to shift the agriculture system toward sustainable development.

FROM A FARMER'S PERSPECTIVE[2]

A farmer's economic livelihood depends on the land's ability to produce. Thus, many farmers consider their role as stewards of the land both in terms of their identity and as a best management practice. However, agricultural production's current business models do not adequately compensate farmers for investment in the long-term health of their land. An essential challenge farmers face is the high costs of transitioning farming practices. It may take several years until farmers see results. Land ownership challenges further disrupt farmer willingness to invest in long-term outcomes on their land. Almost half of farmers rent the land they farm, making multi-year investments in soil health and ecosystems risky. There are mixed incentives depending on land tenure, which can delay investments that improve soil health. Farmers also cannot guarantee the regenerative practices of neighbours, which affects the results the farmer would see on a particular parcel. A business case around the transition to regenerative agriculture must make sense to justify farmers adopting new practices.

Financial incentives are needed to bridge the transition, overcome lagging incentives, and stabilize the economic livelihood of risk-averse farmers in the transition to regenerative practices. Farmers rely on their communities for education and support for on-farm practices. Farmers also need communities to rally support around regenerative practices and knowledge sharing.

THE NEED FOR A JUST TRANSITION

As the agriculture industry shifts to a more regenerative model, it must do so through a just transition. Sustainable development in the agricultural system is more than environmental regeneration; it also includes the social considerations of honouring cultural traditions and ensuring equitable access to land and food production. The transition to a regenerative agriculture system must honour the traditions of Indigenous communities that have long used regenerative practices. It also involves the inclusion of Black, Indigenous, and People of Colour (BIPOC) communities in food subsistence and considers the importance of the migrant worker community. The report shows that multiple perspectives of systems actors must be considered, including those often silenced.

FROM A DOWNSTREAM INDUSTRY PERSPECTIVE

The government, downstream food companies, and consumers are all interested in regenerative agriculture. For the Canadian Government, advancing a regenerative agriculture transition supports achieving environmental and climate targets, including biodiversity, by protecting, at minimum, 30 per cent of lands and waters (Conference of the Parties to the Convention on Biological Diversity 2022). The federal government has funded collaborations with scientists and practitioners to demonstrate the effectiveness of regenerative agriculture.

Downstream food companies have significantly shifted toward sustainability targets and climate change, including science-based targets. They are increasingly looking across the value chain to see how to reduce their environmental impact. Despite significant global companies' pledges, there are variable levels of reporting quality regarding outcomes at the farm, landscape, and global levels (Ewer et al. 2023). A sustainable finance taxonomy for regenerative agriculture could advance downstream activity and direct financial flows toward sustainable farming practices.

Consumers create demand for sustainably sourced and produced products at the end of the value chain. Some consumers are willing to pay a premium for food produced using regenerative agriculture practices (Saba 2021; Montgomery et al. 2022). However, farmers rarely receive this premium from wholesale or retail products. Additionally, not all consumers can afford the price premium of regeneratively grown food. The rising food costs have exacerbated this in recent years, and consumers are cutting grocery expenses (Ferreira 2023; Krashinsky Robertson 2023). Crop production also channels into animal feed and fuel markets, making the link to sustainable consumption less direct for consumers.

Actors such as financiers and insurers are interested in regenerative agriculture from a risk perspective. Threats posed by droughts, floods, pests, and disease in the agriculture sector are risky for financial institutions and insurers; the ecological crises of climate change and biodiversity loss exacerbate these risks. These downstream actors place demands on farmers for the transition to regenerative agriculture. It is in insurers and financiers' interests for farmers to practice more regenerative

2 In this report, when we refer to farmers, we also intend to include ranchers' perspectives in efforts to capture the broader category of producers.

PHOTO: Hill and field on the Oak Ridges Moraine in Ontario, Canada in 2007, **Rick Harris**

agriculture. However, those downstream actors rarely support pricing regenerative practices and other required investments.

FROM A LAND PLANNING PERSPECTIVE

A regenerative agriculture system starts with the land. Land planning and acquisition practices affect producers and can act as barriers or enablers to incenting regenerative practices. The timing of public policy to protect agriculture is crucial. Urban sprawl and increased fragmentation have pressured farmland to industrialize production. The proximity of farming to urban centres is crucial for food security and beneficial for specialty crops due to their proximity to markets (Wu, Fisher, and Pascual 2011). However, this is where farmers experience the highest competition for land use. Protecting farmland also requires the proximity of a range of support services, including large-animal veterinaries and equipment retailers (Akimowicz, Cummings, and Landman 2016) Thus, planners in rural municipalities have a pivotal role to play; urban sprawl-friendly legislative and regulatory changes accelerate land fragmentation and threaten regenerative production. To support a system of regenerative practices, land planning should resist the disappearance of farmland, tighten local supply chains, and create communities of practice.

FROM A FINANCING PERSPECTIVE

The government has a history of concessional financing and financially supporting the agriculture industry due to the variability of supply and demand at harvest time and the misaligned timing of harvest revenue and capital expenditures required for farming. In the face of a growing population, projected labour shortages in the agricultural sector (RBC 2023) and growing concerns over climate change, more investment is needed in the agriculture industry to mitigate and adapt (Huang and Wang 2014). Investing in nature-based solutions, such as regenerative agriculture and natural infrastructure, provides an opportunity to restore ecosystems and enhance the resiliency of the landscape. Current financial flows into nature fall short of where they need to be to achieve biodiversity, climate, and land restoration targets. More private capital is required to address the nature-funding gap (Rally Assets and Nature Conservancy of Canada 2020).

Several barriers make investing in the regeneration of ecosystems different than investing in typical agriculture structures. These include challenges with financing at scale, integrating ecosystem goods and services into current financial frameworks, the long-time horizons of nature-based solutions, and the need for existing reporting.

By taking the perspective of various actors across the system, the report demonstrates that shifting to regenerative agriculture is more than just a financing challenge; it requires various other conditions for success, involving the whole value chain. These include developing a standard definition of regenerative agriculture, creating a culture surrounding regenerative practices, convening actors to create communities of practice, and considering structures' implications, including land ownership and zoning and its influence over long-term land use.

There are a variety of different financial instruments available that currently seek to support the financing of regenerative agriculture. Financial tools like crop insurance, payments for ecosystem services, green bonds, blended finance, and impact bonds can be used to support the transition. The report calls for the improvement of financial infrastructure to support regenerative agriculture. It argues that the financial

infrastructure needs to consider various perspectives across the system to unlock barriers to supporting regenerative agriculture. It goes beyond current financing challenges and considers social and environmental conditions for success.

KEY IMPLICATIONS FROM THE REPORT:

***Recommendation 1:** Clarify 'regenerative agriculture' and its role in supporting current farming practices.*

The term regenerative agriculture's recent popularity has led to confusion over its meaning. It is often conflated with other terms, such as organic and sustainable farming. Many are challenged to develop a standard definition and set list of practices. In this report, we have defined regenerative agriculture according to its core farming principles, which seek to enhance ecosystems. However, there are many examples of "regenerative" practices and principles that are encapsulated in other approaches (e.g., conventional farming or organic farming). In other words, there are multiple paths to farming in ways that also maintain the health of surrounding ecosystems. In this report, we do not intend to give a standard definition, but rather view regenerative agriculture as a systemic paradigm-shift to how nature is viewed and valued in production. It is our hope to rid the term "regeneration" of its connotation as an antonym to productivity and, instead, as a channel to leverage natural ecosystem services to support production.

***Recommendation 2:** Account for the value of nature in agricultural production to create markets and translate ecosystem services into financial value.*

The value created from adopting regenerative practices can be realized through cost reduction, sustained yields, food security, resilience and risk management, and land valuation. However, this value is too rarely translated into current land or agricultural production accounting models. There is a need to develop instruments that value biodiversity to attract investment toward nature-based solutions. Current economics make implementing and scaling regenerative agriculture difficult. Decision-making tools in organizations are not equipped to handle systems-level challenges. We need to be more provocative than ethical consideration of biodiversity impacts in current investments, and instead integrate externalities into investment decisions.

***Recommendation 3:** Develop an inclusive financial infrastructure in cooperation with the various actors along the value chain.*

Infrastructure advancements are needed to redistribute the risk, overcome time horizon challenges, and support regenerative agriculture. Although more offerings of current models are required, the report encourages actors to think innovatively, developing hybrid approaches and going beyond the limitations of current offerings. The financial infrastructure must go beyond considering the economic issues and include instruments that remove other barriers identified in the report in tandem with the financial obstacles to develop a systemic response to farmers' challenges.

***Recommendation 4:** The need for a just transition. Empowering other ways of knowing and doing.*

As the agriculture industry shifts to a more regenerative model, it must do so through a just transition. This includes the perspectives of those often silenced in the agriculture systems, including BIPOC communities, migrant workers, Indigenous farming methods, and the land itself. Only through allyship and recognition of an inherited colonial structure can we build an empowering and just food system that addresses issues of food security, food sovereignty, and cultural revitalization.

***Recommendation 5:** The need for systems-level solutions to create a systems shift. Engaging a variety of actors through small actions to make significant change happen.*

This report considers the viewpoints of various actors within the system. Multiple actors have different levels of agency and influence in the system. Small changes from a variety of actors in the system can contribute to an overall systems transformation. We call for actors in public policy, planning, financial services, and the agricultural industry to help make change happen.

This includes the need for the involvement of both private and public actors. More involvement of private actors, including financiers and food companies, is required to address the nature-funding gap and enhance ecosystems for resilience in the face of ecological crises and related consequences.

Our recommendations go beyond the financial solutions required to support regenerative agriculture and call for other considerations, like communities of practice, co-benefits, and opportunities to shift the business models around regenerative agriculture to value the role of nature (including biodiversity, water, and soil health) in agricultural production.

Approaching regenerative agriculture through a systems lens

Introducing a systems lens to advancing sustainable agriculture

Systems are comprised of interacting or interdependent elements that together, achieve a collective purpose (Meadows 2008). Thinking in systems means taking the perspective of seeing the interconnections among entities and navigating the complexity. Initially, systems thinking emerged in the study of the organization of organisms in biology. Later, systems thinking was extended from the analysis of organisms to complex organized entities (Von Bertalanffy 1972). The agriculture system comprises multiple interdependent actors, actants, and activities. This goes beyond the standard understanding of an agricultural value chain, which includes sourcing products for consumption and the adjacent processes of nature, land acquisition, land management, social considerations, and financing activities. These elements are not always visible in the food value chain but are crucial components to advancing regenerative agriculture from a systems perspective.

Sustainability is inherently a systems-based concept (Gray 2010). To act sustainably, organizations and other actors need to understand the broader systems in which they are embedded and their interactions within those systems (Williams et al. 2017). A systems approach is required to go beyond the organization when considering sustainability and includes the perspectives of community stakeholders and rightsholders (Banerjee 2011).

Our interpretation of regenerative agriculture goes together with the idea of sustainable development. The Brundtland Commission defines sustainable development as meeting the needs of the present without compromising the ability of those in the future to meet their needs (WCED 1987). With regenerative agriculture, the goal is to meet the needs of the present (i.e., the economic livelihood of the farmer, providing reliable and consistent food for the masses) while protecting the ability of those in the future to meet those needs (i.e., sustaining the health of the land to be able to farm in the future). Regenerative agriculture is about sustainable farming, which promotes long-term investment in the land and enhances the ecosystem's health to ensure future production.

Adopting a systems perspective to regenerative agriculture

The agricultural system is about more than sustaining food production to feed the world; taking a systems view involves understanding the relationships among agriculture and other roles in social and ecological systems. Regenerative agriculture is not only beneficial for sustained agricultural production, enhancing soil health, and decreasing costs of inputs such as fertilizer; the benefits also spill over to neighbouring lands, water systems, humans, and habitats. Regenerative agriculture is about understanding and leveraging the natural flows in the ecosystems. Supporting the regeneration of biodiversity, water to regenerate soil advances positive farming outcomes. Benefits also accrue downstream to the food industry and society.

Regenerative agriculture plays a role in the health of human populations. Beyond feeding people, it helps reduce chemical exposure and pollution harm to support air and water quality (The Rockefeller Foundation 2021). For Indigenous peoples especially, regenerative agriculture allows for various health benefits, mainly seen through the reduction of harmful algae blooms and overall pollution, as well as improved food and water quality (Sharma et al. 2021).

Regenerative practices also play a role in developing resilient ecosystems in the battle against climate change. The increase in frequency and severity of extreme weather events brought on by climate change creates a food security risk due to effects on crop yields, quality, and local supply chains (Field et al. 2012; Lobell, Schlenker, and Costa-Roberts 2011). Facing the threat of extreme weather events during climate change, regeneration is essential to reduce uncertainty and maintain crop productivity against the threat of climate change-induced extreme weather. Regenerative systems create more resilient crops that stabilize yields in extreme weather events, such as drought (Lotter, Seidel, and Liebhardt 2003). The co-benefits of regenerative practices extend to a global level by reducing the concentration of carbon in the atmosphere, aiding in the battle against climate change (Lal 2020).

This report takes a systems thinking approach to regenerative agriculture. Multiple actors in the system with complex interactions are implicated in advancing regenerative agriculture in Canada toward more sustainable development. In this report, we aim to capture some of the diverse perspectives within the system by analyzing challenges from the viewpoint of different actors and their relationships with and on the land. By taking a systems perspective to the issue of regenerative agriculture, we set out to identify multiple opportunities for business actors, notably financiers, to unlock barriers and support a transition in farming practices. This approach can illuminate an ecology of interventions that together contribute to a system-wide transition.

The structure of this report highlights critical actors and practices implicated in the regenerative agriculture system, the benefits of regenerative agriculture to these actors, barriers they face to adopting and advancing regenerative practices, and suggestions to alleviate these barriers. It will cover the implications for regenerative agriculture at various stages, including land acquisition, land management, agricultural production, and downstream production and consumption. Identifying these components reinforces the role of systems actors beyond the on-farm practices that can hinder or advance regeneration agriculture. It is our hope that by tackling the issue of regenerative agriculture through multiple perspectives in this report, we can inspire new actors to engage with nature-based financing and regenerative agriculture.

Researching the system: Data sources and research program

This report takes a systems perspective on the advancement of regenerative agriculture. It seeks to highlight the perspectives of a diverse range of actors in the system and their primary concerns to develop a holistic view of how the system can advance toward regeneration.

The impacts of regenerative agriculture affect agri-food systems, surrounding ecosystems, social systems, and global systems. The transformation of farming practices will only be achieved by involving many actors, from farmers to agri-food companies, governments, consumers, Indigenous peoples, and investors. Adopting a systems lens allows us to highlight diverse actors' roles in the system's shift to regenerative agriculture. It also contextualizes the many interconnections and complex relationships with the land that exist in agricultural systems.

Since land is the foundation of sustaining human and non-human life, agricultural production, and all other related social and economic activities, making land visible in the system is vital. We took a land-based lens and placed the land central to our system. We then captured key activities associated with the land, including natural flows and human activities at key stages in agriculture production. This did not only include the farming of the land but also its acquisition, zoning, and financing.

Although parts of this report detail regenerative agriculture in the Canadian context, the scope focuses on Ontario as a case study. Farming is a highly geographic and land-based topic. A 2022 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Working Document states that 72 per cent of the literature reviewed is focused on a sub-national level (Pascual et al. 2022). As such, local nuances must be considered but can only sometimes be captured when generalizing to a country level.

In addition to a cross-disciplinary literature review of key academic papers, reports, and policy papers on regenerative agriculture, this report sought to engage with actors in the agriculture system, seeking diverse perspectives on the implications of regenerative agriculture. This engagement was comprised primarily of interviews conducted virtually, each lasting approximately one hour. In addition to these interviews and knowledge garnered from previous experiences, the researchers also participated in several workshops and events targeting actors in the agriculture industry, during which informal conversations with systems actors shaped their thinking.

Perspectives captured in this report include:	
Farmers and Ranchers (Producers)	Food Companies
Nature (Biodiversity, Soil, Water)	Consumers
Conservation Organizations	Insurance Companies
Government	Indigenous Peoples
Investors and financiers	BIPOC communities
City Planners	Migrant workers
Manufacturers	
We want to acknowledge the following organizations that contributed their insights in the form of research interviews:[3]	
Ceres Inc.	Équiterre
County of Brant	Great Lakes Fishery Commission
Cultivo	Seamans Holdings
Danone	Oxford County
Endangered Wildlife Trust	
Topics that were covered in secondary research include:	
Regenerative practices	Government priorities and initiatives on the landscape
Relationship between farming and the natural environment	Science-based targets for the value chain
How natural systems create value for farmers	Reduced risk and resiliency in the face of climate change
Farmland valuation	Land zoning and ties to valuation
Landownership	Traditional sources of funding
Considerations for a just transition	Novel financing instruments
	Barriers and conditions for success

The research team creating this report is part of the Ivey Business School's Sustainable Finance Lab, an impact lab hosted by the Centre for Building Sustainable Value. Within the lab, numerous projects are underway as part of a broader research program to advance financial infrastructure to support regenerative agriculture and biodiversity. This report also reflects our knowledge and experiences working in the space.

3 Please note that this list is not exhaustive. Interview participants were given the option of having their organization credited in the report or remaining anonymous. We are gracious for all interview participants that contributed their time, both those listed and unlisted.

Mapping the main ideas of the report

Figure 1 provides a visual representation of the report and the systems of actors and activities relating to agriculture that we address. Regenerative agriculture focuses on the natural systems that support the land's health. Our report makes a concerted effort to bring a land-based approach within a greater systems thinking lens. This includes attention to biodiversity, water, and social health and their role in supporting farming practices, which sometimes lack visibility in an economic-centred approach.

Chapter 3 discusses the natural flows on the land, the mutually sustaining relationships of farming and the environment, and how natural systems support agriculture and create value for farmers.

In opening chapter 2, we discuss examples of regenerative practices. Chapter 4 then focuses on the perspectives of farmers and ranchers in adopting these practices, and what concerns, opportunities, and perceived benefits influence their decision-making in practice adoption. The farmers and ranchers interviewed are central to the model with main activities concerning land acquisition, land management, and agricultural production. The discussion thus goes beyond practices in land management to topics of land ownership and land valuation in land acquisition decisions.

This report also captures historically oppressed perspectives in the agriculture systems. This includes Indigenous peoples and their cultural teachings around food production, BIPOC farmers and communities, and migrant workers, whose viewpoints are vital to a just transition for the regenerative agriculture system. Chapter 5 shares these often-marginalized perspectives and the implications for a just transition.

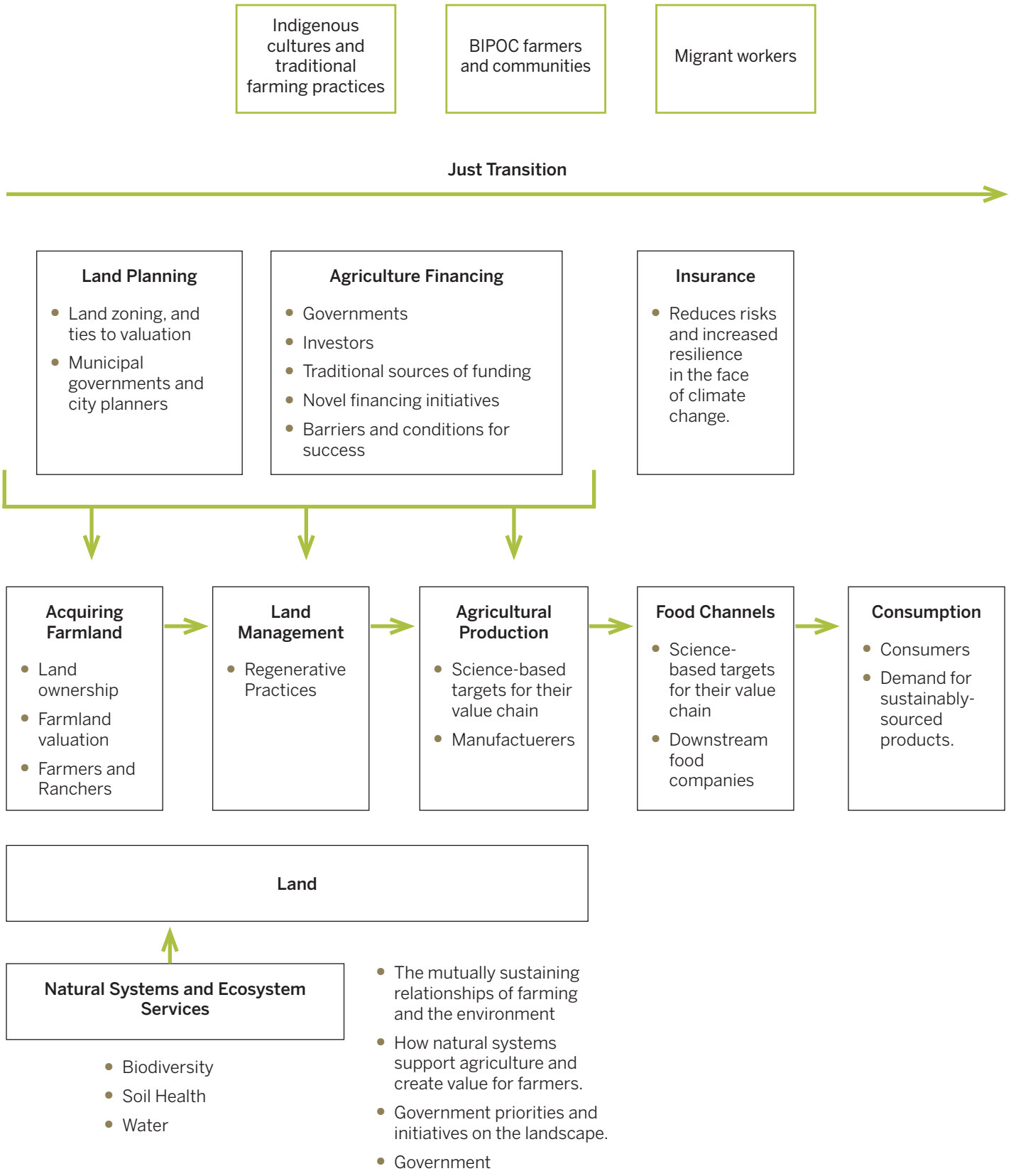
Chapter 6 captures the perspectives of the downstream industry actors, including food companies, consumers, and insurance companies, exploring their interests in a regenerative transition.

Chapter 7 addresses land zoning issues from the perspectives of land planners. It is a nod to the systemic nature of the agricultural sector and the breadth of challenges associated with transition to regenerative models, including competing land use, land zoning, and ties to land valuation to highlight incentives.

Chapter 8 focuses on the financing of agriculture. This includes financial support for agricultural land acquisition, land management and the transition to regenerative practices, and sustainable agriculture production. This section discusses the historical funding of agriculture and the implications for financing nature-based solutions in agriculture. This chapter outlines some innovative funding models, the barriers to financing regenerative agriculture, and conditions for success in advancing financial infrastructure to support land regeneration and life on the land.

Finally, Chapter 9 summarizes the key takeaways from the report. It calls for a systems solution to a systems-level problem that considers a variety of perspectives. We do not believe in a "silver bullet" solution but rather a transformation resulting from cumulative probes in the system to advance regenerative agriculture. This report focuses on a financial perspective and innovation in the financial infrastructure needed to support the transition. However, our recommendations go beyond financial solutions and address the social and cultural support needed with communities of farmers and others in the agriculture system to sustain the transition, opening avenues to new business models and value creation and capture across the system.

Figure 1: The Regenerative Agriculture System: A visual representation of the key activities in the agriculture system covered in this report.



An introduction to (regenerative) agriculture in Canada

The importance of agriculture in Canada

The agriculture sector is a significant force within the Canadian economy. According to Agriculture and Agri-Food Canada (AAFC 2020), agriculture, agri-food, and seafood contribute over CAD 143 billion annually to the country's gross domestic product (GDP).[4] Overall, Canada's food chain is responsible for one in nine jobs across the country (Statistics Canada 2022g), making a clear impact on the Canadian economy and the livelihoods of many Canadians. In 2021, the agricultural sector was the largest revenue share in the agri-food chain, with an annual CAD 39.8 billion reported. Farmer support estimates for Canada are valued at about CAD 5.7 billion as of 2019 (Kröbel et al. 2021). At 6.8 per cent of Canada's annual GDP, the agriculture sector spans roughly 200,000 farms and employs almost 2.1 million jobs. It employs more Canadians than any other manufacturing industry in the country (Statistics Canada 2022g).

Canada has a competitive edge in many areas compared to its four most significant trading partners: the United States, China, the United Kingdom, and Japan. For example, Canada's farmland and farming infrastructure was CAD 1.2 million higher than the market value of the average farm in the United States. Canada also has the most land area per farm though it has fewer farm operators than all the nations mentioned above (Chen 2022).

Canada remains highly competitive in the agricultural world. This shows Canada's primary strength within the farming industry, despite the country's smaller population compared to the aforementioned trading partners. Increasing the adoption of regenerative agriculture practices could thus boost Canada's agriculture and international competitiveness (Chen 2022).

A brief history of Canada's agriculture

Canada's vast territory and resource wealth has allowed the country to build a robust agricultural industry. At the start of the Confederation, Upper and Lower Canada colonies focused most efforts on wheat due to its initial profitability (Bertram 1973). The settlement of the Prairies and the subsequent regain of its status as a net grain exporter began in 1879 – a position it had lost in 1869 – setting the foundation for most of Canada's current agricultural system. This would allow the provinces to focus on their strengths as farm producers and build a strong foundation for industries, such as dairy and meat, and for crops, such as wheat, barley, and corn.

The wheat booms of the early 20th century immensely benefited Canada's economic development (Bertram 1973). This growth was altered due to the dust bowl of the 1930s, which decimated the crop production centres of Canada and the United States (McLeman et al. 2014). The dust bowl refers to severe multi-year droughts, with high temperatures and levels of erosion (Porter 2014). In addition to the dire economic conditions during the Great Depression, the dust bowl led to the abandonment of countless farms, especially considering that many of the regions impacted by the dust bowl were heavily reliant on agriculture. The impact was also seen macro-level, as the dust storm limited much of Canada's crop production (McLeman et al. 2014).

The causes of the dust bowl in Canada and the United States could be seen through the excessive settlement of farmland in the Prairies and Great Plains, where inexperienced farmers began farming the region. In the United States, this was motivated by the idea of "manifest destiny:" the idea that Americans were entitled or "destined" to expand westwards. Canada was motivated to compete with the United States and capitalize on the west's natural resource (Lockeretz 1978). In pursuit of their aspirations to expand westwards rapidly, the farmers in the region did little to limit erosion in their farms; for example, there were little-to-no trees as barriers to limit wind speed and little-to-no erosion-

4 All monetary values are reported in Canadian dollars unless otherwise advised.

resistant crops. While the dust bowl could be attributed to environmental circumstances, much of it could also be attributed to human-caused issues (Lockeretz 1978), reducing the resiliency of the landscape. Indigenous peoples were especially affected since they were limited in what they could farm. Therefore, when the dust bowl hit the region, many were forced to flee their ancestral lands (Hexton 2014).

The mechanization of farming throughout the 20th century enabled higher production and yields, although the heavy use of machinery also degraded the soil, taking a toll on ecosystems. After a century of land use, Canadian farmland witnessed a significant decline in soil health (Veeman 1988). At the beginning of the 1980s, 30-35 per cent of the original fertile soil had already been depleted in western Canada, the primary crop-focused region of the country (Veeman 1988). Although the nature and magnitude of the consequences of soil erosion have been salient topics in sustainable farming since the 20th century, only 18 per cent of farmers accurately perceived the degree of erosion occurring within their farms (McNairn 2013). Land degradation continues to affect farming practices, with soil erosion remaining a pressing issue in Canadian farms, threatening long-term productivity and food production on many farms (Stonehouse and Bohl 1990).

The geography of Canada's agriculture

Building and maintaining a massive agricultural industry in Canada is challenging, primarily due to its climate and inhospitable terrain (Statistics Canada 2022b). For these reasons, Canada's most notable agricultural centres are in the southern regions of the Prairies (Alberta, Saskatchewan, and Manitoba), Ontario, and Quebec.

Agricultural production differs by province. Saskatchewan is often cited as the country's "breadbasket." Its flat terrain and rich soil make the province an ideal region for crops such as wheat and canola. Due to these geographical factors, Saskatchewan holds 39.2 per cent of the total farmland and 43 per cent of the total cropland in Canada (St. Pierre and Mhlanga 2022). Alberta and Manitoba are known for growing similar crops, though these provinces also focus heavily on meat production. Combined, the three provinces of the Prairies make up more than 75 per cent of the nation's agricultural territory (Statistics Canada 2022b).

Unlike the Prairies, Ontario and Quebec have extensive dairy industries, respectively producing 33 and 37 per cent of all dairy products in Canada (Statistics Canada 2022a). Apart from dairy, Ontario's main outputs are primarily vegetables and soybeans, while Quebec focuses on meat production (Statistics Canada 2022b).

The emergence of regenerative methods

Environmental sustainability is one of the hot topics of the agricultural industry and a top strategic issue facing producers. In Canada, agriculture is responsible for approximately 10 per cent of the country's greenhouse gas (GHG) emissions – the fifth largest amount by economic sector (Government of Canada 2023). All producers have implemented environmental measures (e.g., fewer pesticides, crop rotations, and water management improvements). Seventy-three per cent of producers think they are taking the right actions to minimize the impact of agricultural activities on the environment (Agriculture and Agri-Food Canada 2022a).

Although most producers in Canada believe that farming activities positively impact the environment (Agriculture and Agri-Food Canada 2022a), industrial agriculture techniques are not sustainable. Favouring short-term productivity causes long-term land degradation. The future of farming has the potential for regeneration. Shifting to regenerative practices could help guarantee productivity over the long term by preserving land health (Masterson 2022). To achieve this transformation, the federal government pledged to invest over CAD 1 billion in its 2022 budget into a more sustainable agriculture system for Canada (Government of Canada (Press Release) 2022a). Despite Canada's pledge, advocacy still relies on non-governmental actors such as individual farmers or organizations (Sheldon 2021). As the rest of this report will show, despite an uptake of interest in regenerative agriculture, many challenges must be addressed to transform the agriculture system toward sustainable development.

What is regenerative agriculture?

A contested term and some principles

Regenerative agriculture is a contested term with no clear, commonly held definition amongst parties in the system. Newton et al., (2020) reviewed 229 journal articles and 25 practitioner websites. They found that since the 1980s, regenerative agriculture has been used to reference different concepts and has often been used interchangeably with other terms. Some of our interviewees believe regenerative farming captures core principles of land management that are no different from existing farming best practices. Others suggest that "regenerative farming" is a marketing concept whose meaning is redefined based on consumers' demands. To others, it introduces a new paradigm of land management that contrasts industrial approaches. The lack of agreement across the agriculture sector makes it difficult for farmers to adopt a standardized set of regenerative practices. The absence of a broadly accepted definition for regenerative agriculture also raises concerns around 'greenwashing', a phenomenon in which organizations inflate claims or falsely advertise their sustainable initiatives. We do not give a standard definition for regenerative agriculture in this report, but rather introduce the concept according to some key principles. We suggest that regenerative agriculture is not mutually exclusive to conventional farming practices, but rather is a systemic paradigm of farming. Regenerative agriculture is not an antonym to production. Instead, we advocate for a view of regeneration as a channel to leverage the natural function of healthy ecosystems to support sustained production.

The agri-food sector has witnessed many innovations in farming methods and movements to improve food production. Terms often conflated with regenerative agriculture include sustainable agriculture, organic farming, conservation farming, agroecology, and ecological farming. Although these terms are distinct from regenerative agriculture, many principles of regenerative agriculture can be advanced using these methods, and they share some common farming principles.

A Regenerative Paradigm to Farming:

The overarching principle of regenerative agriculture is adopting farming principles that seek to enhance ecosystems. A regenerative model creates value through ecosystem regeneration, which supports farming practices through ecosystem services. A regenerative approach recognizes and leverages the mechanisms in the natural world that provide inputs to farming and catalyze production.

Farmers embedded in a regenerative farming paradigm do not think of themselves as producers of a single commodity but as cultivators of the entire ecosystem. Resources are circulated through a web of relationships on the land, and the farmer considers the implications for farming and food production. For example, a regenerative approach to cattle ranching would consider the production of grass to feed the cattle and manure to advance the soil as core operations. The focus would be on cattle, and generating and sustaining an environment where cattle thrive.

Five commonly accepted principles of regenerative agriculture include: 1) minimize soil disturbance, 2) protect soil surface, 3) maintain living roots, 4) ensure crop diversity, and 5) integrate livestock (Ritz 2021). However, these principles are not exhaustive. As ecosystems and communities' relationships with ecosystems are localized, regenerative principles also include accommodating local landscapes, traditions, and cultural values.

Regenerative agriculture strives for healthy soil, plants, animals, and people and considers these circular outcomes core to farming practices, which go beyond a commodity view of linear production. Through a regenerative approach, farmers are still producing for economic gains, but the sale of commodities does not solely judge the value created from farming. In addition, farmers recognize the value of the health of the land in their farming practices and life on the land.

Regenerative farming goes beyond sustaining existing ecosystem health to investing in improving ecosystem health, including natural infrastructure, to support social and environmental needs. This systems approach recognizes and leverages nature's ecosystem services and invests in the latter as critical components of sustainable farming practices.

Sustainable agriculture is an overarching term that describes agriculture that sustains the needs of the present and future generations. This is consistent with agricultural production that meets the conditions of sustainable development as outlined by the Brundtland Commission (WCED 1987). Sustainable agriculture can include preserving soil health using cover crops, 4R nutrient management (using the right fertilizer source, at the correct rate, at the right time and place), reduced chemical inputs, and agricultural technology (AgTech) (Drakes-Tull 2022; The Globe and Mail 2022).

Organic agriculture is a type of sustainable farming that uses ecologically based solutions for pest control and fertilizers. Its primary principles include eliminating external inputs, veterinary drugs, and genetically modified seeds and breeds (Ewer et al. 2023). Although not explicitly regenerative, organic production can be done in a regenerative way. The Regenerative Organic Certification for "regenerative organic agriculture" was started by the Rodale Institute, Dr. Bronner's and Patagonia (see Focus Point on certifications). The demand for organic agriculture outpaces the supply and is growing at an annual rate of 8.7 per cent in Canada. (Agriculture and Agri-Food Canada 2021b)

Conservation agriculture seeks to prevent the loss of arable land. Conservation farming focuses on minimizing soil disturbance and degradation and includes practices such as no-till farming, reduced inputs, and permanent soil cover (McNairn and Mitchell 1991; Ewer et al. 2023).

Agroecology seeks to integrate ecological principles into farming practice and food systems. It can be considered a science, a practice, and a movement. (TABLE 2021). Agroecology promotes minimal external inputs and optimizing agroecosystem relationships through cover crops and rotational grazing (TABLE 2021). Agroecology greatly overlaps with organic, biodynamic, and permaculture farming (Soil Association). The Food and Agriculture Organisation of the United Nations (FAO) published the 10 Elements of Agroecology in 2019 which include diversity, synergies, efficiency, resilience, recycling, co-creation and sharing of knowledge, human and social values, cultural and food traditions, responsible governance, and circular and solidarity economy (Food and Agriculture Organization of the United Nations 2023).

Ecological farming considers the entire ecosystem when incorporating ecological practices into farming and prioritizes ecosystem health in addition to food production. Natural processes are leveraged over synthetic inputs, and other organic considerations are factored into ecological farming. The Ecological Farmers Association of Ontario defines ecological agriculture as regenerative, organic, and holistic practices that improve soil health, engage farming communities and apply practices that are knowledge-intensive and regionally-specific (Ecological Farmers Association of Ontario 2023) .

Due to the plethora of terms surrounding the potential future methods of agriculture, some may perceive "regenerative agriculture" as simply the newest term to trend in revolutionizing or providing alternative ways of farming. However, "regenerative farming" is not mutually exclusive with the above terms, and many practices overlap. Like its organic counterpart, regenerative agriculture emphasizes the need for less human contact with the land as well as the usage of more natural practices (World Economic Forum 2021). However, they differ in that organic farming does not focus on soil health and could even possess practices that actively hurt the soil (Noble Research Institute 2023; World Economic Forum 2021). Regenerative agriculture tries to preserve soil health (a vital aspect of conservation farming) and actively improves it through holistic management styles and permaculture (Rhodes 2017).

Regenerative agriculture also focuses on reducing emissions and directly addressing climate change. Though other forms of agriculture also look at ways to reduce emissions, this is often for the sole benefit of the crops, while regenerative agriculture considers both options simultaneously and as two interconnected issues (World Economic Forum 2021; Rhodes 2017).

Regenerative agriculture, and its focus on ecosystem regeneration, broadly encapsulates the most sustainable practices from each of the previously mentioned forms of farming, creating a well-rounded system with enough previously applied methods behind it. Hence, to put it simply, regenerative agriculture offers farmers a chance to combine the best aspects of each type of farming while also being able to effectively recognize economic, social, and climate-based realities (Giller et al. 2021).

Regeneration is a paradigm shift of agricultural production that extends to specific farming practices, suggesting that the exploitation of land for goods production is not a linear farming relationship. Instead, farming requires managing a web of relationships, where enhancing ecosystem health can pave the way to goods production while also generating co-benefits, including biodiversity, water quality, managed erosion, more resilient land, and sustained production in the long term.

FOCUS POINT:

Certifications

Ecological Outcome Verification (EOV) (The Savory Institute): The EOV verification tool is used to measure land outcomes that are outcome-based and context-specific. Reference Areas within ecoregions are identified based on diversity, resilience, and ecosystem function. Farms and ranches within an ecoregion are benchmarked against a Reference Area. Farmers provide peer support and can become mentors or Savory-accredited monitors (The Savory Institute 2023).

Regenerative Organic Certification (ROC): The ROC is focused on food, fibre, and personal care products. This certification is based on the USDA Certified Organic standard and managed by the Regenerative Agricultural Alliance (Ewer et al. 2023). The ROC is focused on improving soil organic matter, animal welfare, and economic stability (Regenerative Organic Alliance 2023; Regenerative Organic Certified 2019).

Sustainable Agriculture Initiative (SAI): The SAI is an industry-led platform that encourages the adoption of sustainable agriculture practices. It works with assurance schemes and standards organizations. (Sustainable Agriculture Initiative Platform 2023) The SAI Farm Sustainability Assessment tool provides recommended practices for crops at the farm level.

Examples of regenerative agriculture practices

There are two main approaches to regenerative agriculture: a process- and an outcome-oriented lens (Newton et al. 2020). A process-oriented lens incorporates regeneration into the process of agricultural production. Examples of process-based practices include no or low external inputs (e.g., fertilizers, feedstuffs), use of on-farm inputs (e.g., manure, compost), rotational livestock grazing, reduced tillage, agroforestry, and crop rotations and perennial groundcover (e.g., living mulches, cover crops).

An outcome-oriented lens considers regenerative outcomes associated with agricultural production, including improved food nutrient density, increased on-farm ecosystem services (e.g., improved water quality and increased biodiversity), improved yield and productivity, better soil health (or quality), reduced land expansion, and increased economic security for farmers.

In this report, we advocate for a view of regenerative agriculture that considers both the process and outcomes of agriculture as core to regenerative agriculture. Regenerative practices that align with both a process- and outcome-oriented approach include abandoning tillage, fostering farm plant diversity, integrating livestock, planting cover crops, and intercropping (Newton et al. 2020). This list of regenerative practices is not exhaustive, indeed there are many farming practices that would fall under a regenerative paradigm. The following Focus Point highlights a few common practices which leverage regeneration of soil and ecosystems.

PHOTO: Landscape of farmland and woodlots in autumn near Kitchener, Ontario, **jimfeng / istockphoto.com**

FOCUS POINT:

Examples of regenerative agriculture practices

Protecting soil surface

Cover crops: Cover crops are planted between main crops to protect the soil from erosion, increase water retention, and improve soil health (Clark 2015). They are planted after cash crops are harvested, and may include legumes (e.g., corn, alfalfa) and non-legumes (e.g., hairy vetch, red clover) (Bizjat et al 2021; Clark 2015). Advantages of cover crops include increasing soil carbon storage by providing organic matter (Clark 2015), nitrogen scavenging and mitigating leaching into groundwater (Curell 2015). Disadvantages of cover cropping include that many practices require specialized equipment, and cover crops may compete with cash crops for resources (Conant 2010).

Integrating livestock

Rotational grazing: Grazing livestock (e.g., chickens, cows, sheep, goats) provide farmers' fields with manure that helps to regenerate soil health, grass production, and carbon storage (Díaz De Otálora et al. 2021). Rotational grazing segments fields into smaller plots and moves animals through the field in a rotation. Animals may graze and not return to their land plot for a period of time, allowing grass to grow and form longer roots, where more carbon can be stored in the soil (McGuire 2018). Rotational grazing can be applied to orchards and crop operations, helping to reduce feed and utility expenses for livestock operations. Due to the benefits of rotational grazing for livestock management, soil health, profits, and resiliency, it can be considered a win-win-win for farmers (Spratt et al. 2021). Rotational grazing has proven more beneficial to soil organic carbon even compared to other practices such as reduced tillage, crop rotations with cover crops, and manure application (Rui et al. 2022). However, survey data shows that, while a significant portion of farmers recognize the benefits, they do not adopt rotational grazing, citing limited by capital requirements, such as additional labour and material costs like fencing, presenting a barrier to implementation (Che, Feng, and Hennessy 2023).

Mob grazing: An alternative grazing technique is mob grazing, which is a form of intensive, short-term grazing with a long rest period of often 60 days or more (Wagner, Waterton, and Norton 2023). There are many perceived benefits to this method, mainly an increase in soil health, soil carbon accumulation, and soil biodiversity. From an economic standpoint, the method provides high – and sustainable – productivity with lower external outputs because of the maximizing of sward regrowth between grazing (Wagner, Waterton, and Norton 2023). In terms of soil health, rotational grazing is often judged more beneficial than mob grazing.

Long-recovery period: Long recovery periods between grazing can contribute to an improvement in pasture regrowth and create more extensive root systems. Mob grazing advocates have also reported that it may reduce the prevalence of parasitic infection in livestock (Wagner, Waterton, and Norton 2023).

Mimic nature (Permaculture): Refers to a nature-based land management system that emphasizes replicating natural ecosystems, and by extension, harnessing the associated productivity and other environmentally friendly benefits (Donovan 2002). Permaculture, or any practice that intends to mimic nature, has been proven to increase soil health, and overall health, and could create more productive and organic crops (Biasotti 2021).

Minimal soil disturbance

No or low till: This practice promotes soil health and improves water retention by disturbing soil as little as possible, only when planting. This lowers farmers' costs associated with labour, equipment rental, and fuel usage (Farm & Food Care 2021). Specialized no-till planters and no-till drillers allow seeds to be sown in a narrow slice of soil (Ontario Soil Network 2023b). The Natural Resources Conservation Service estimates that adopting conservation tillage practices in the United States could reduce GHG emissions by 20-60 million metric tonnes of CO2 equivalent per year (U.S. Department of Agriculture 2022).

Green manure: Refers to specific crops intended to be churned into the soil to improve its texture and fertility, and reducing the need for other inputs (Blair 2016). The crops used for green manures are the same as those used for cover cropping: alfalfa, faba bean, pea, barley and oats. (Blair 2016; Bajzat et al. 2021). A cover crop becomes green manure once plowed down into the soil. Farmers build in space on their fields to plant green manure crops, which can present a challenge as farmers may not want to sacrifice short-term earnings. Nevertheless, the returns from green manures plow-downs are seen over a two to three-year period (Blair 2016). In other words, farmers use green manure maximize revenues from cash crops (Jeanroy 2022). Green manures are effective at suppressing weeds and nitrogen fixation (University of Massachusetts Amherst 2023).

Diversity

Intercropping / Companion Cropping: Planting more than one crop to reduce the risk of disease and pest problems (Agriculture and Agri-Food Canada 2021b). This practice can help reduce weeds and improve soil structure (Engels 2016). Tree-based intercropping (TBI) is a variation where trees and crops grow together and is well-suited for agriculture in southern Ontario (Thevathasan et al. 2004 via Bizjat et al. 2021).

Broad rotations: Refers to the cropping strategy of planting a multitude of crops as opposed to the typical one or two crops planted every rotation, which often rely on significant amounts of fertilizers to maintain productivity. Broadening rotations with additional crops not only reduces the need for non-natural chemicals such as herbicides by half, but also generally offers similar benefits, demonstrating that there are often little-to-no immediate economic downsides to adopting such practices. Additionally, high yields for crops such as corn and soybeans (which often saw a double-digit increase) have also been shown in research on the subject (Union of Concerned Scientists 2017).

Rotational herbal leys: Often defined as a mix of grasses, legumes, and herbs, many have proposed that this type of grass be used within a rotational framework within pastures. The primary benefits from such a framework often include an increased resilience to droughts, soil health, and importantly provides a rich source of nitrogen for both the soil and livestock alike (Wilkonson 2011).

Wetlands: Alternative Land Use Services (ALUS) helps farmers create, enhance and restore wetlands on their properties. Wetlands provide water filtration, flood and drought regulation, and improved biodiversity (Alternative Land Use Services 2021). For instance, farmers can use wetlands as water sources during droughts. Wetland creation is a multi-year process, requiring preparation and ongoing maintenance, e.g. in the case of invasive species removal (Alternative Land Use Services 2021). Wetlands help to provide wildlife habitats. For example, a pond-leveller pipe can be installed to work harmoniously with beavers' damming patterns to help avoid agricultural land flooding. (Alternative Land Use Services 2021)

Maintaining living roots

Carbon capture: A method involving taking the excess carbon in the atmosphere and putting it into the soil to provide benefits for both plant life and livestock alike. Along with improving the climate by removing atmospheric CO2 and helping to create a more environmentally sustainable agriculture sector, this method also creates greater soil quality as well as greater biodiversity (Pratt 2020).

Soil integrity (Soil Stability): A measure of resiliency to soil degradation or the ability of plant life to adapt to certain stressors. Some stressors include tillage, the energy of raindrops, shrinking, and swelling. Being aware of soil stability evidently has many benefits, which not only include the farmer being more aware of erosion in their fields but also being able to build more resilient plants (Rossi et al. 2017).

Water filtration: refers to the removal of dirt or other unwanted particles within water, most likely to be used to hydrate plant life. This process could be done conventionally or with the surrounding organisms themselves, with the latter creating a self-reliant method of creating safe water that improves any organism affected by it (Government of Canada 2015).

PHOTO: Avon Trail, 2014, **mariaklegault.com**

The principles of regeneration are familiar but have been replaced with industrial agricultural practices

Farming has long been about best managing land to meet the population's needs and stewarding the land to sustain production for generations. Agriculture has been significant to human populations around the globe and was integral to the social development of homo sapiens. Farmers have practised forms of regenerative agriculture for centuries. Leveraging the natural mechanisms of ecosystems to aid in food production, humans have long been humbled by the constraints of their natural environment and forced to operate within them.

However, as many societies began to increase in population and industrial capacity, many attempted to implement industrial practices already in use in other industries. Farming as an industry shifted into maximizing production, creating food surpluses, rather than producing what is necessary (Barlett 1987). As increased demands have been put on farmers to achieve economies of scale, provide food beyond their local communities, increase production for a growing population, and produce commodities for a global supply, farming practices have become industrialized in specific contexts, leading to abandonment of regenerative principles (Barlett 1987).

The industrialization and mechanization of agriculture in the 20th and 21st centuries were seen as a sign of progress due to their productivity. Industrial agriculture was described as increasing the quantity and quality of crops and reducing much of the manpower needed for the more traditional farms of the time, with the only real concern being the destruction of the family farm (App 1929). This perspective allows one to see why regenerative agriculture was initially abandoned; industrial farming was seen as the next phase in farming that fixed the common concerns of the time.

This was taken a step further after the Second World War, with the adoption of non-natural chemicals such as pesticides and fertilizers, again seen as a form of progress and modernization. However, the long-term ignorance toward the environmental impacts of such "modern" practices is now widely seen (Adler 2002).

The consolidation of farms and the increasing demand for food production to feed humans, animals, and biofuels place demands on farmers to achieve a high production level. The market economics of present-day farming makes it necessary for farmers to uphold industrial methods, e.g., input levels or otherwise risk losses. Farmers are challenged to transition to regenerative techniques on a farm level while still facing these demands and competing with industrial modes of production at an industry level.

Although- efficiency in agricultural production is essential to feed the world, there are risks to agricultural approaches, where yields are maximized through intensive tilling and chemical inputs (LaCanne and Lundgren 2018). Over time, conventional tilling methods have led to soil degradation, erosion, and compaction. Ground cover has also been removed, which took away organic components, reducing the soil's ability to retain water and nutrients. This produces dry, inhospitable soil (Skinner et al. 1997). Healthy soil is an essential input to farming. The industrialization of the food system led to the loss of practices like rotational grazing, which are now being rediscovered at a larger scale (Lee and Van Sice 2011).

Healthy soils function to support a variety of ecosystem services necessary for food production and quality of life. Soils support primary production on the land, nutrient cycling, water storage, food supply, water supply, water quality, biodiversity, gas regulation, climate regulation, erosion control, recreation, and other ecosystem services (Haygarth and Ritz 2009). Leveraging the natural attributes of the soil is essential to ensure the best use of soil for ecosystem services.

The current state of farming in Canada

FOCUS POINT:

A snapshot of the current Canadian farmer and state of farmland

To understand the industry's present state, one must be aware of the profile of the average farmer and the current state of farmland across Canada. This snapshot provides a baseline to understand the current state of regenerative agriculture adoption and the playing field for barriers and advancements to regenerative agriculture.

Demographics of the Canadian farmer

According to the most recent census data, the average farmer in Canada is most likely to be English-speaking (72 per cent), rural (90 per cent), and Roman Catholic (38 per cent, by plurality) (Statistics Canada 2023b). The average age within the industry is approximately 58 years (Statistics Canada 2023a). This is much higher than the national median age of 41.7 years. Furthermore, the proportion of farm operators aged 55 and older grew by 6 per cent compared to the previous census in 2016, making more than half of all operators within the "55 and older" category – the proportion of young operators was down 8.6 per cent, though is an improvement compared to 2016's 9.1 per cent decline (Statistics Canada 2023a). This potential demographic issue has been remediated through temporary foreign workers, who make up approximately one in four of all employees within the industry. Their growing prominence within the industry makes them an increasingly important demographic (Statistics Canada 2022f).

Farmer's education

According to Statistics Canada, the average farmer regularly holds some form of post-secondary education through trades, apprenticeship, or other non-university degrees (35 per cent). Such data is likely indicative of the technical nature of these educational programs, which are more useful to farmers, primarily for the maintenance of farming equipment and managing farm-related paperwork. For those who attend university, the most common fields studied are Agriculture, Business, or Health-related programs (Statistics Canada 2016a). The industry has seen a 10 per cent increase in education levels between 1996 and 2016 (Statistics Canada 2016a).

Farmer's income and socioeconomics

Some notable trends are occurring regarding the Canadian farmer's financial and socioeconomic portfolio. Starting with finances, the total income of a single-family farm, without counting farm maintenance, was CAD 163,098 in 2019. However, this is deducted to CAD 58,067 after factoring in the farm's costs. These salaries experienced decreases (1.3 per cent and 5.4 per cent, respectively), mostly due to the 12.2 per cent average net market income decline. Incorporated farms (corporate farms) were estimated at CAD 242,612 with similar deductions (Statistics Canada 2022c).

Off-farm income (pension, investment, or other outside sources) slightly increased, with unincorporated farms earning CAD 101,693. In contrast, incorporated farms were estimated at CAD 112,671, with each salary slightly rising compared to the last census. Furthermore, off-farm income accounted for 64.4 per cent of the total income of farm families, a two per cent increase from 2018 to 2019 (Statistics Canada 2022a).

Turning to off-farm work to supplement income was a reality for 47.7 per cent of Canadian farmers in 2020 (Statistics Canada 2023a). There was a 6 per cent increase in part-time off-farm work between 2015 and 2020 (Statistics Canada 2023a). Fertilizer prices increased by 21.2 per cent in 2022 due to reduced supply and higher natural gas costs, which has put pressure on margins and encouraged farmers to continue seeking off-farm work (Statistics Canada 2023c). Farmers also diversify their on-farm revenues, reducing their exposure to below-average production years.

Farm ownership

In the Canadian agricultural industry, farms can be divided into three main categories: sole ownership, partnerships, or corporations.

Sole proprietorship: **The traditional form of farm ownership is when the farm is owned by a single person or family. They fully own the land, and no outside actors are involved (Qualman et al. 2018). Sole proprietorship is the most common form of farm ownership in Canada, with more than half of the nation's farms (51 per cent) being classified as under sole proprietorship status (Statistics Canada 2016).**

Partnership: **A common form of farming where two or more individual farms share profits and costs as a collective; though the farm is not recognized as a separate legal entity, all partners have equal liability and responsibilities (Qualman et al. 2018). In 2016, Partnerships made up almost a quarter of farm total ownership in Canada (22.9 per cent) (Statistics Canada 2016b).**

Corporation: **Often seen in larger and more sophisticated farms, a corporation is where the farm itself becomes a legal entity, and the previous owners have little legal and financial liability. However, the previous owners of their respective farms no longer directly own the property (Qualman et al. 2018). In Canada, about 22.5 per cent of all farms were owned under family corporation status (a corporation only containing family members) while a much smaller 2.7 per cent of farms were non-family corporations (Statistics Canada 2016b).**

Generally, the industry has become more consolidated and corporatized. For example, not only has the number of small and medium-sized farms declined, but also an increase in the proportion of farms with sales exceeding CAD 1 million, which was 9.9 per cent in 2020 (up from 7.2 per cent in 2015). Larger, corporatized farms also account for the largest share (51 per cent) of total farm operating revenues, (Statistics Canada 2022a). Therefore, while most plots remain single-family farms, half of all reported profits are often associated with corporations, who make up only a quarter of all farms (Statistics Canada 2016a).

With all of this in mind, one could gather some notable trends, which are mainly that not only are smaller and intermediate-sized farms becoming increasingly dependent on off-farm revenues, but also that these family farms are becoming increasingly rare compared to large, corporatized farms.

Farmers' transition to sustainability

According to the most recent census, organic farming comprised 4,289 of Canada's 193,492 farms, accounting for only 2.2 per cent of total farms (Bialais 2020). It should be noted that many of these farms have only appeared in the past decade following a rapid increase in sustainable farming. It demonstrates that more must be done to encourage a more swift and notable transition (Bialais 2020). Renewable energy production is similar: it is still generally rare among the community, with 11.9 per cent of farms in Canada reporting some form of renewable energy production in 2021. However, the proportion of farms embracing renewable energy is proliferating, exemplified by the fact that the figure has doubled since the last census (Statistics Canada 2022a). Therefore, while there has been a sharp rise in sustainable practices within the industry, more support is needed for a system-wide transition.

Status of soil health in Ontario

Ontario's agricultural soils are considered moderately healthy. However, it has been noted that the health of the land in some local areas of the province is declining (Ministry of Agriculture, Food and Rural Affairs 2018). For example, it has been reported that soil organic matter (SOM) has been decreasing on 82 per cent of Ontario's farms. (Ministry of Agriculture, Food and Rural Affairs 2018) Over half of Ontario's cropland is at high erosion risk (Rotz, Fraser, and Martin 2019a).

This is significant because, although soil is renewable through the weathering of rocks and other minerals, this process far exceeds the time horizons of human lifespans. Thus, soil can be treated as a non-renewable resource that warrants protection (Food And Agriculture Organization Of The United Nations 2015). Due to current methods such as row crop practices, used to produce grain and oilseeds or field-grown vegetables, which are imperative to Ontario's agricultural output, fields have seen increased tillage, traffic, and fewer additions of organic soil, which have led to declines in soils (Statistics Canada 2018; Ministry of Agriculture, Food and Rural Affairs 2018).

This is an issue that needs to be addressed. In 2018, the Ontario Agricultural Soil Health and Conservation Strategy (2018-2030) was released and outlined various goals and initiatives to aid farmers with soil health (Ministry of Agriculture, Food and Rural Affairs 2018). However, some have criticized the strategy for its broad and unclear initiatives, lack of ambition, and no concrete fundingprograms (Rotz, Fraser, and Martin 2019b). Therefore, while the strategy is a good start, more must be done to support its implementation.

The potential of regenerative agriculture

The current agricultural industry faces sustainability-based challenges, as well as economic and social ones. Transitioning to a regenerative agricultural production system presents an opportunity to address these issues holistically.

The sector of regenerative agriculture aims to be one that operates at high-intensity production levels while sustaining soil carbon storage and flux, soil health, and biodiversity. Therefore, it has the potential to be productive in comparison to more conventional systems while removing the present drawbacks of soil erosion and higher carbon emissions (Lynch et al. 2022).

Furthermore, research has shown average age among farmers using more regenerative practices is significantly lower than that of industrial methods. For example, in the neighbouring United States, it was found that the median age was much lower, 51.3 years of age, and younger than the median for conventional methods in both Canada and the United States – which are both in the high 50s range. Such results show a clear trend: Younger people may shift toward regenerative practices. Organic farmers in the United States have also reported a larger total value of sales, which has helped smaller farms in the region and could act as a viable option for smaller unincorporated farms (Wallace 2012).

Generally, while it may prove difficult to change methods that have now been a part of the farming apparatus for decades, change is needed for environmental and socioeconomic reasons.

Summary

Key take-aways:

- **Agriculture is significant to the Canadian economy.**
- **Concerns with environmental sustainability in the industry has given rise to regenerative agriculture approaches.**
- **Regenerative agriculture in principle concerns the improvement of ecosystems to advance farming processes and outcomes. It seeks to facilitate farming practices that foster biodiversity aboveground with crops and livestock, and underground with soil health.**
- **Regenerative agriculture practices are not new, but the paradigm of farming has shifted to industrial production to match increasing demands placed on agriculture.**

Barriers:

- **The term regenerative agriculture lacks clear consensus around its definition. Further, it is conflated with terms like sustainable agriculture and organic farming. Which leads to its resistance.**
- **Increased demand for agricultural production and efficiency has driven industrial approaches to agricultural production which contrasts a nature-based, regenerative, ecosystem approach.**

Conditions for success:

- **Regenerative agriculture must meet the demands of production placed on the Canadian agriculture sector.**
- **Younger farmers entering the profession are more open to adopting regenerative agriculture techniques.**

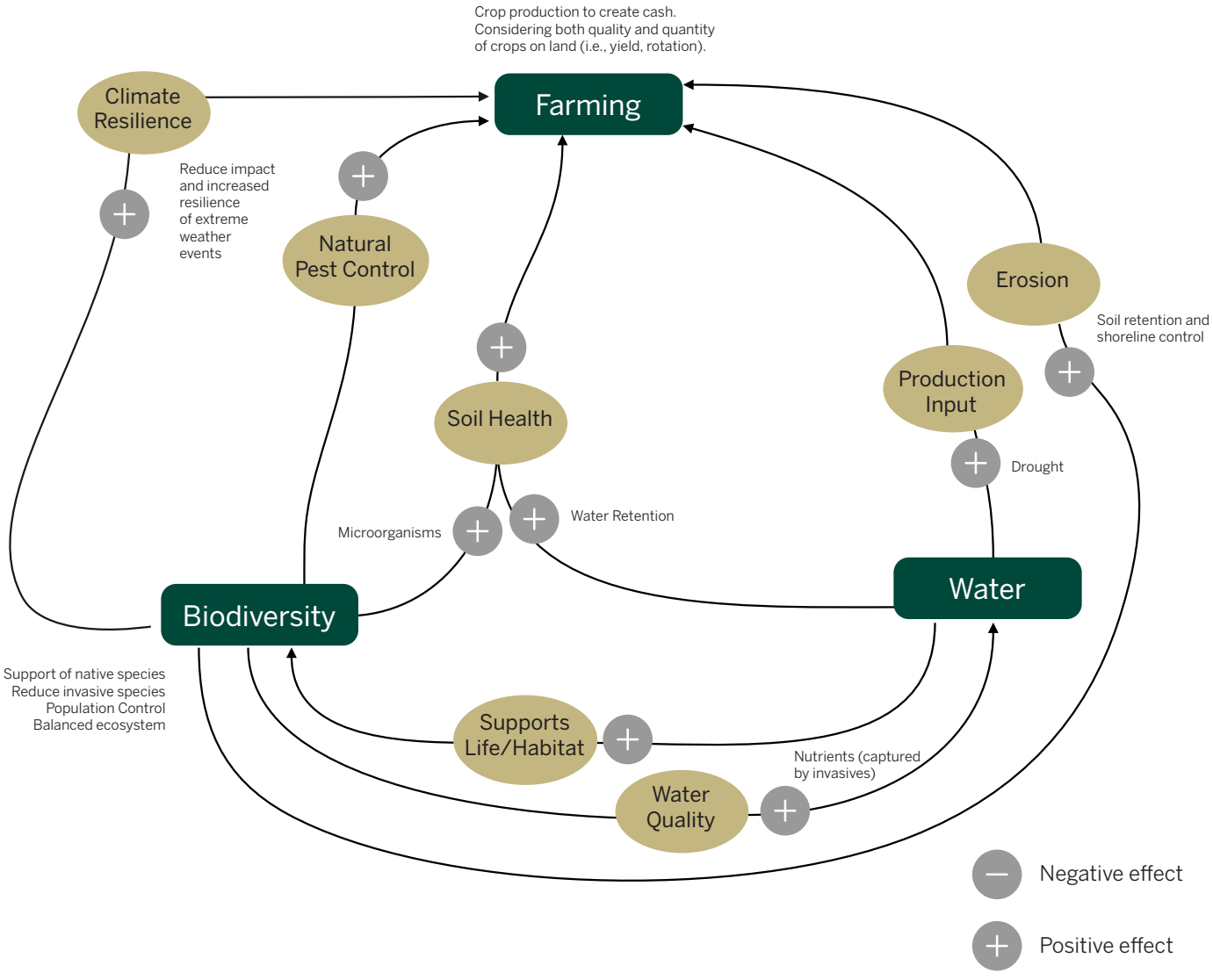
How the regeneration of ecosystems supports farming and creates value

The role of biodiversity, water, soil, and carbon in supporting farming health

From a systems perspective, farming looks at more than just the human inputs and outputs on the land and related food products the farmer is interested in; they connect biodiversity, soil, and water.

Figure 2 depicts the natural flows and interconnections between water, biodiversity, soil, and farming. Regenerative agriculture, which supports ecosystem health, seeks to leverage these natural mechanisms to link biodiversity, soil health, water, and carbon sequestration to sustained farming benefits. This section will further explore these benefits to farmers.

Figure 2: Natural Flows Diagram, positive flows of how biodiversity and water support farming.



Leveraging the natural function of a thriving ecosystem is economically beneficial for the farmer by reducing the costs of inputs, as well as beneficial for the environment by aiding soil health and reducing chemical run-offs.

Biodiversity

Beyond carbon sequestration and climate resilience, regenerative agriculture benefits include improved ecosystem services, increased biodiversity, water health, and land productivity (LaCanne and Lundgren 2018; Rhodes 2017 as cited in Bazjat et al. 2021). This is particularly relevant given our current biodiversity loss and climate change crises.

Biodiversity is an indicator of ecosystem health. Approximately 30 per cent of the landscape must be healthy to support biodiversity (Carolinian Canada 2021). Supporting biodiversity on the landscape includes sustaining native species, reducing invasive species, population control, and a balanced ecosystem. Biodiversity in farming is essential for the farming of produce as well as other plants and animals surrounding the production process. For example, biodiversity supports pollinating crops, keeps soil healthy, purifies water, and provides resilience to extreme weather events, among other services (Food and Agriculture Organization of the United Nations 2019). Soil health and microbial biodiversity below ground rely on biodiversity above the ground; without biodiverse and thriving life above ground bare soil is at risk for wind or water erosion, which harms agricultural productivity (Moyer 2020).

Biodiversity on land helps prevent erosion and run-offs that result in phosphorous loading and harmful algal blooms (Scavia et al. 2014). A biodiverse ecosystem also improves water quality by avoiding nutrient loading in water. Biodiversity is better at removing these nutrients, meaning that biodiversity helps natural ecosystems fight to lessen the impacts of nutrient pollution (Cardinale 2011), which affects water quality.

In addition to maintaining soil health, biodiversity on the land supports the function of ecosystem services that are vital inputs in the farming process. A balanced ecosystem can serve a role in natural pest control and fertilizer, reducing the cost of artificial inputs such as pesticides, herbicides, and fertilizer. For example, maintaining the residues of crops (as in roots), rather than removing these for biofuels, is an essential input into soil organic matter and has other benefits on the farm, including preventing erosion, blocking weed growth, and reducing water evaporation from soil (Moyer et al. 2020). This reduces the cost of shipping compost or other fertilizer to improve soil organic matter.

FOCUS POINT:

The role of trees in supporting farming

For many, producing food could be done through the soil and trees – a common sight in most populated areas. Food forests are defined as a diverse planting of fruit-producing trees and shrubs to replicate a natural ecosystem that can be a sufficient food source (Project Food Forest 2016).

In rural and urban settings, food forests provide an accessible and sustainable source of free food for those who need or want it. They educate many on the benefits of eating locally grown foods. Lastly, food forests can better support birds and pollinators in the region (CBC News 2020).

Along with growing food on their own accord, trees could also play a more supportive role in growing more sustainable food sources, often defined as Agroforestry (Spore 1995). This method involves planting trees or shrubs alongside agricultural produce to protect and build soil, making for a more successful crop (Current and Lutz 1995).

There are various benefits associated with the use of agroforestry. Firstly, the practice proffers improved yield and soil health from the wind and dust protection provided by the trees. Secondly, the dust protection provides many health benefits for the farmers who possess some form of agroforestry, the maintenance for which also creates employment opportunities. However, this additional labour spend may come at a price for smaller farms (Current and Lutz 1995).

Water

Water supports life and habitat, contributing to increased biodiversity on the land and the health of the biodiversity on the landscape. Water is also a key input to farming. Access to reliable water sources on the farm and retention of water in the soil is important to agricultural production. To mitigate issues with water access, farmers may turn to strategies to retain water within the soil. Soil health, in part characterized by the microbial biodiversity of the soil, helps with water capture. Regenerative farming can be used to increase water retention and aquifer recharge. This reduces flooding, drought, runoff, and erosion (Rhodes 2017, as cited in Newton et al. 2020).

FOCUS POINT:

Wetlands in Southwestern Ontario

Wetlands provide essential ecosystem services like supporting biodiversity, flood abatement, and carbon sequestration. Such landscapes offer a solution for agriculture to reduce its environmental impacts. In a two-year study of restored wetlands, Ducks Unlimited Canada found that they retained 46 per cent of total phosphorus and 47 per cent of total nitrogen (Gloutney 2022). Despite the importance of wetlands, globally, about half of all wetlands have already been lost (Zedler and Kercher 2005; Sica et al. 2016; Patino and Estupinan-Suarez 2016, as cited in Nebel et al. 2017).

Pre-colonization of southwestern Ontario by European settlers, it was estimated that approximately 25.5 per cent of the land was wetland (Snell 1987). As of 1987, about 90 per cent of this land had been converted to other uses, the most significant portion of which being agricultural production (Snell 1987). An estimated 32 hectares of wetland are lost daily in southern Canada (Gloutney 2022). In addition to converting to agricultural land, wetlands are threatened in southern Ontario due to Ministerial Zoning Orders (MZOs) facilitating real estate development on numerous landscapes since 2018.

Soil health

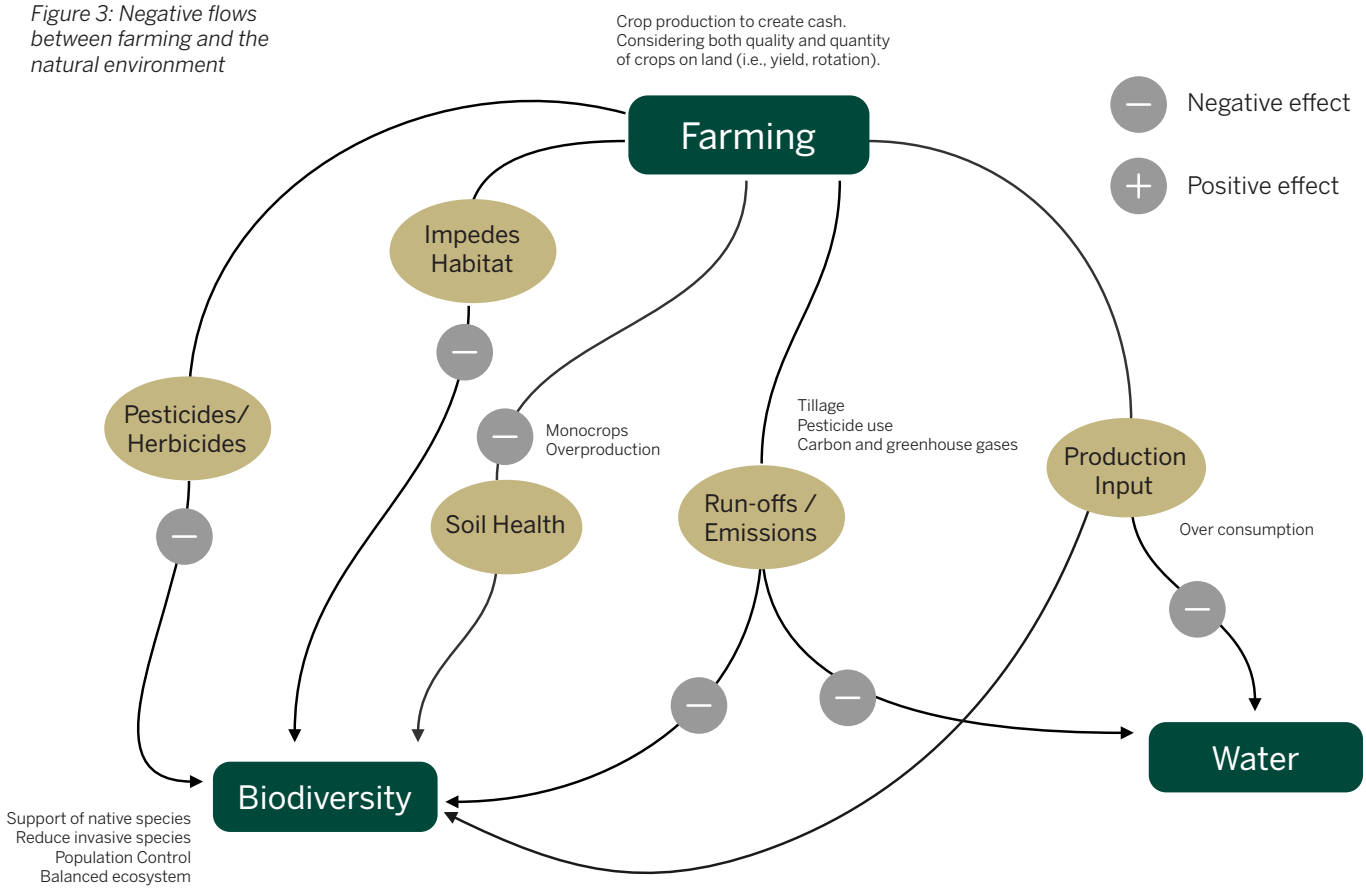
Prioritizing soil health has long been considered a best farming practice (Ministry of Agriculture, Food and Rural Affairs 2018). Monocultures are not adequate to sustain and foster healthy soil biology. However, only nine crops account for over 66 per cent of crop production worldwide (Pilling and Bélanger 2019). Since nature is a system, one must consider the other aspects of ecological systems that support healthy soil to understand regenerative farming as a tool to enhance soil health. Introducing biodiverse cover cropping benefits the farm environmentally and economically by sequestering carbon, reducing nutrient leaching, enhancing nutrient efficiency, reducing erosion, and controlling pests (Poeplau and Don 2015). Plant diversity increases both microbial activity and carbon storage in the soil (Lange et al. 2015). Healthy soil is integral to agricultural production and ecosystem services (Haygarth and Ritz 2009). Farmers who improve their soil health have reduced fertilizer, pesticide, and irrigation costs; this can benefit biodiversity and water quality (Anderson and Gough 2021, as cited in Bajzat et al. 2021). Thus, increasing soil biodiversity has economic value on the farm (Hungate et al. 2017).

Crops can help to prevent soil degradation and increase soil carbon storage (ScienceDirect 2023). Nutrient cycling through composting and applying manure, either from on-site animals or sourced locally, are other practices to prioritize. Animal manure management can help reduce methane emissions and increase soil carbon storage (Alberta Environmentally Sustainable Agriculture Council 2004). For example, livestock grazing can improve water retention, add nutrients by introducing soil microbes, and reduce demand for chemical fertilizers and irrigation. Regarding fertilizer usage, we must be sensitive to farmers' concerns over yields and lost income. When external inputs continue to be used, applying a 4R nutrient management approach is appropriate to reduce nitrogen oxide emissions and increase fertilizer costs (von Massow, Weersink, and Wagner-Riddle 2022).

The ecological impacts of industrial agriculture and their threats to productivity

Since farming relies on land use for production, farming practices must consider the mutual effects on the natural ecosystem and the interconnectedness of biodiversity, soil health, and water. Figure 3 visually represents how agriculture practices may negatively influence biodiversity, soil, and water. This section below focuses on the negative impacts of farming on water and biodiversity, and the need to mitigate them.

Figure 3: Negative flows between farming and the natural environment



Industrial agriculture's impacts on biodiversity

Agriculture accounts for about one-third of global land use (Searchinger 2019, as cited in Newton et al. 2020). About 6.3 per cent of the land in Canada is agricultural (Statistics Canada 2022g). This has significant implications for habitat and supporting biodiversity in the area. Various natural habitats (e.g., prairie lands, wetlands, and woodlots in the Carolinian Canada ecoregion of southwestern Ontario) are needed to support biodiversity. Adjustments made to the landscape to maximize productive land for agricultural purposes reduce habitat and diversity of habitat on the landscape. The competition for land use between agriculture and natural habitat to foster biodiversity is perpetuated when paired with urban sprawl and demands for residential land.

The current industrial agricultural system hurts biodiversity in various ways. This could be generally observed through productivity as the sole concern of the farm rather than the condition of the farm itself, specifically seen through commonplace practices such as monoculture, which reduce the diversity of the crops and other organisms (FoodPrint 2021). This could also be seen using artificial chemicals

such as pesticides, which industrial farms depend on to be productive, which, while being able to aid the monoculture-based status quo, actively disrupt many species both on and off the farm. For example, it has been found that industrial-based farms had fewer species around the farm than their organic, non-chemical counterparts (FoodPrint 2021). Furthermore, pesticides and other chemicals hurt the benefits of local insects and animals, threatening to lower the productivity of farms now experiencing low populations of key species such as honeybees (Ceres 2017).

Therefore, many practices utilized by the current industrial system harm biodiversity. The pollutants used for short-term productivity diminish the biodiversity of the soil in the long term, opening the possibility of further erosion and decreasing the soil's overall health and productivity. Hence, biodiversity and soil health are undeniably connected (Orgiazzi and Panagos 2018). Overall, agricultural land use that does not consider the needs of the local ecosystems threatens biodiversity and the resiliency of the landscape in response to climate change and related extreme weather events (Intergovernmental Panel on Climate Change (IPCC) 2023).

Industrial agriculture's impacts on water

Agriculture is a water-intensive industry, accounting for approximately 70 per cent of total water withdrawals worldwide (Food and Agriculture Organization of the United Nations 2019). Canada's agricultural and industrial sectors accounted for 9.2 per cent of annual global freshwater withdrawals in 2017 (The World Bank 2018). Agricultural production relies on water as a critical input to keeping land healthy and increasing crop yields. Consistent access to water is essential to ensure the farmer's food security and economic stability.

Since water is a critical input in agricultural production, farms are often placed near crucial water sources. Agricultural production also threatens the health of these nearby water sources and any downstream actors, for example, through runoffs. Excess nitrogen and phosphorous applied to fields run off into water bodies and cause eutrophication, reducing nearby water quality (Kröbel et al. 2021).

Rising temperatures will exacerbate water scarcity and arable land losses (Anderson and Gough 2021 as noted in Bazjat et al. 2021). Increased water stress will highly impact grain yield as they are sensitive to short-term stress (Pearson, Bucknell, and Laughlin 2008, as cited in Newton et al. 2020). It is estimated that reduced yields and higher input costs linked with water erosion cost the Canadian farming community CAD 3.1 billion annually, highlighting a concerning as well as increasingly expensive trend among many farms (Arnason 2019).

FOCUS POINT:

The case of algae blooms in Lake Erie

Lake Erie, one of the Laurentian Great Lakes, provides drinking water for over 11 million people, is a site for tourism, and is enjoyed recreationally by many in the region (Government of Canada and Government of Ontario 2018). However, annually, Lake Erie is faced with toxic, harmful algal blooms (HABs) (Watson et al. 2016).

The HABs have been attributed to excess phosphorus loading from local farms (Scavia et al. 2014). This runoff pollution occurs when fertilizers and other inputs spread onto farms and wash into the lake. The downstream implications of these farming practices impact the health of the lake, wildlife, and people. For example, contaminated drinking water requires higher costs for water processing with water sources from Lake Erie (Alliance for the Great Lakes 2022). Although coordination among actors is needed to respond effectively, land fragmentation challenges a coordinated response (Berardo, Turner, and Rice 2019). Nonetheless, conservation practices on farms, such as managing nutrients and soil health, are integral steps that can be taken in agricultural watersheds (Ministry of Agriculture, Food and Rural Affairs 2018).

Industrial agriculture's impacts on soil health

Soil is at the foundation of agricultural production. Soil systems are complex and often remain invisible in decision-making until their impacts affect outcomes above ground. Considering the limited timespan of humans, soil is a non-renewable resource, yet the health of the soil is integral for food production and other ecosystem services (Haygarth and Ritz 2009). Recently, soil health has been gaining prominence among scientists and farmers.

One of the key indicators of soil health is soil organic matter (SOM). SOM enhances soil's ability to store nutrients, improves soil structure, and captures carbon; healthy soil prevents erosion, helps with water retention, gives energy to organisms, and helps fight climate change (Veeken et al. 2017). Healthy soil is essential to the farmer as it increases crop yields and resilience to environmental stresses. "Soil organic matter is the single most important soil property that can be influenced through management practices." (The Mosaic Company 2021, p. 1).

Agricultural intensification from increased row crop production and decreased hay and pastureland has led to soil erosion and degradation. It is estimated that 15 to 30 per cent of soil organic carbon (SOC) in the top 30 cm layer has been lost in Canada due to industrial cultivation since European settlers arrived (Kröbel et al. 2021). The consequences of SOC loss are increased CO2 emissions to the atmosphere, reduced soil fertility and health, greater risk of soil erosion, loss of productivity, and reduced soil microbial activity and diversity (Kröbel et al. 2021).

The risks of soil erosion to agriculture are not new. In 1986, reduced yields and higher input costs linked with water erosion cost the Canadian farming community CAD 266 to CAD 424 million annually (McNairn and Mitchell 1991). Specific management practices can lead to the degradation of soil health, which has negative consequences for the farm and surrounding ecosystems. For example, unhealthy soil lacks structure, which makes it susceptible to erosion by wind and rain (Bot and Benites 2005). Conscious efforts to improve soil health with farming practices, such as adopting no-till and cover crops, have sought to increase soil health in Canada. However, SOM in Ontario is decreasing (Ministry of Agriculture, Food and Rural Affairs 2018), partly due to a shift from pastureland to crop production. Southern Ontario is especially at risk (Statistics Canada 2018).

Industrial agriculture's impacts on greenhouse gas emissions

The emissions of agricultural production contribute to climate change. Food production accounts for ~15 per cent of global GHG emissions (Newton et al. 2020). In Canada, the agricultural industry produces 73 megatonnes of carbon dioxide equivalent (Mt CO_2e) emissions, or 10 per cent (see Focus Point on Carbon Sinks) (Agriculture and Agri-Food Canada 2022c). Agricultural activity is causing an increase in nitrous oxide's atmospheric concentration, a potent GHG. Current levels are 20 per cent higher than in pre-industrial times (Kröbel et al. 2021).

Climate change poses a significant risk to the agriculture industry in Canada. The rising temperatures associated with climate change will exacerbate water scarcity and arable land losses (Anderson and Gough 2021, as noted in Bazjat et al. 2021). Additionally, extreme weather events, such as drought and floods, will impact the quantity and quality of yields from farming. The survival and success of the Canadian agriculture industry in the future will be dependent on the mitigation of such damaging impacts associated with climate change. The agriculture industry recognizes the effects of GHG emissions on agriculture. For example, the Dairy Farmers of Canada set targets for the sector to achieve net-zero GHG emissions by the year 2050 (Dairy Farmers of Canada 2022b).

FOCUS POINT:

Farming as a carbon sink[5]

A carbon sink is a natural or artificial reservoir or storage system that absorbs and holds carbon dioxide (CO2) from the atmosphere (ClientEarth 2020). Carbon sinks include forests, oceans, soils, and man-made structures such as carbon capture and storage (CCS) facilities. Carbon sinks are important because they help mitigate GHG emissions' impact on the Earth's climate system. As CO2 is a primary GHG, reducing its concentration in the atmosphere can help slow the rate of global warming and climate change.

Farming can be a carbon sink by using agricultural practices that increase the amount of carbon stored in the soil. This process is known as carbon sequestration. Permanence and leakage are the key issues to address when treating farming as a carbon sink.

Permanence is when carbon is stored in a carbon sink (Forge 2001). For example, if carbon is stored in the soil through a farming practice, such as no-till farming, the carbon will only remain stored as long as the practice is maintained (Forge 2001). If the practice is discontinued, the carbon will be released back into the atmosphere, resulting in a net increase in GHG emissions.

Meanwhile, leakage is the unintended consequence of carbon sequestration that may result in GHG emissions elsewhere. For example, if a farmer adopts a no-till farming practice and reduces carbon emissions from their farm, this may lead to increased demand for food production elsewhere. That scenario may result in deforestation or other land-use changes that release carbon into the atmosphere (Forge 2001).

There are numerous limitations to treating agriculture like a carbon sink. The amount of carbon stored in agricultural soils is limited by soil type, climate, and agricultural practices. The potential for carbon sequestration is highest in degraded or eroded soils, but it is still limited (Lal, Negassa, and Lorenz 2015). Carbon stored in soils can be lost due to erosion, tillage, and other factors. This can result in a net loss of carbon over time (Ontl and Schulte 2012). Some carbon sequestration practices may not be economically viable for farmers as they require long-term investments that may not yield immediate economic returns. Lastly, the potential for carbon sequestration in agricultural soils is limited compared to other solutions, like renewable energy or CCS (Demenois et al. 2020).

5 We thank Stephanie Hunter for contributing this Focus Point to this report.

PHOTO: Beaver Pond, **catsfive / iStock / Getty Images**

Value created by adopting regenerative agriculture practices

As discussed on previous page, industrial agricultural systems have adversely affected biodiversity, water, and habitat, affecting soil health, farming outcomes, and climate resiliency. Regenerative practices seeking to support and enhance the natural ecosystem aim to increase soil health and realize benefits for farming and society. In regenerative agriculture, value is created in the agricultural and broader ecological systems, supporting the positive feedback loops of nature (e.g., keeping the water to impact biodiversity or biodiversity to impact water). Some of these ecological and productivity benefits translate into economic benefits for farmers and others in agri-food systems.

Regenerative agriculture supports value creation in farming by leveraging a number of these natural mechanisms. Beyond the impacts of nature on the processes of farming, the next section will talk about the outcomes of value that regenerative agriculture creates.

Carbon sequestration

Regenerative agriculture can help with carbon sequestration, which helps mitigate against the effects of climate change. The Ellen MacArthur Foundation (2021) notes that if 80 per cent of the world's cropland adopted zero till, intercropping, and cover crops practices, this could lead to an annual carbon benefit of 2,500 mega tonnes of CO2. Managed grazing on half of the world's suitable pastureland could lead to a net annual carbon benefit of 1,400 mega tonnes in 2050 (Ellen MacArthur Foundation and Material Economics 2021).

The carbon sequestration potential of some regenerative farming practices is a win-win for farming and the climate. Healthy soil captures carbon (Zomer et al. 2017), keeping carbon out of the atmosphere. Additionally, carbon is beneficial for farming; carbon provides food for soil microorganisms and helps soil structure to prevent erosion, aerate the soil, and retain water (Corning et al. 2016). By maintaining healthy soil and cover crops, farms can sequester carbon in the soil, supporting healthier plants and a healthier planet.

The Science-Based Target Initiative (SBTi) is a multi-group coalition defining best practice emissions reductions and net zero reduction in line with science. The SBTi maintains a target dashboard tracking the companies with science-based targets. Of the 5,859 companies, 3,240 have set targets (Science Based Targets 2023b). Of the 69 companies under the "Food Production – Agricultural Production" sector, 34 have set science-based targets (Science Based Targets 2023b). Companies in Canada that have taken part in the SBTi, filtering for sectors of "agricultural production, food and beverage processing, and food and staples retailing," include: Agropur Cooperative, Empire Company Limited and Sobeys Inc., Maple Leaf Foods Inc., McCain Foods Limited, Nutrien Ltd., Open Farm Inc., and Riverside Natural Foods Ltd (Science Based Targets 2023b).

Nature-based markets

There is increasing interest and research about overlaying a financial markets framework over nature and biodiversity, so-called "nature markets." A nature-based market is "a system composed of transactions between separate buyers and sellers, in which the transacted good or service specifically reflects a stock of ecosystem assets or a flow of ecosystem services from terrestrial or aquatic ecosystems" (Eis and Kennedy 2022). Nature Finance is a Swiss-based organization focusing on nature in sovereign debt markets, early-stage investments, risk-related metrics, food system transition and anti-money laundering (Nature Finance 2023). The Taskforce on Nature-related Financial Disclosures (TNFD) is developing a framework against which companies can report their nature-related risks. The TNFD released its full framework in 2023 (Taskforce on Nature-related Financial Disclosures 2023). The ambition is that the TNFD will help to shift financial flows to nature-positive outcomes. McKinsey estimates that the credit market is worth less than one per cent of the annual USD 9.8 trillion value of traded goods and services (Eis and Kennedy 2022). Against this backdrop, there is financial and investor interest in the potential for more robust markets existing in the future for biodiversity and carbon credits. There is also interest in the potential of regenerative agriculture practices that can be valid for future nature markets trading activity.

Risk management and resilience

With soil quality degradation affecting the useful life of agricultural lands, regenerative practices present a risk management strategy. For instance, crop diversification through companion planting and cover crops has increased agricultural land's drought and heat wave tolerance (Rojas-Downing et al. 2017, cited in Bajzat et al. 2021). This is because the likelihood of megadroughts (droughts lasting a decade or more) will increase from 12 per cent

to a 60 per cent chance in the coming decades (Shirah and Zhang 2015). A study of Wellington County farmers by Western graduate students recognized the importance of regenerative techniques to increase resilience to climate change's impacts. Of those surveyed, 69 per cent said they had changed their farming practices in the last five years to adjust to climate change (Bajzat et al. 2021).

Additionally, regenerative practices allow the farmer to produce within the natural environment. More specifically, by relying on nature-based solutions such as non-GMOs to feed the population, one could ensure a responsible use of farming resources. Pesticides and other agrochemicals have long been associated with risks to local human and animal health, biodiversity, soil contamination, and negative effects on soil fertility (Aktar, Sengupta, and Chowdhury 2009). Degradation, defined as "deterioration or loss of the productive capacity of the soils for present and future," affects 40 per cent of all lands on the planet (United Nations Convention to Combat Desertification 2022). According to the Convention about Life on Earth, at least 40 per cent of the world's economy and 80 per cent of the needs of the poorest people on the planet are derived from biological resources, while 75 per cent of global food crops rely on animals and insects such as bees or bats to pollinate them (Convention on Biological Diversity 2020, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services 2019). Therefore, responsible land use should most certainly involve a decrease in agrochemicals.

Finally, methods associated with regenerative agriculture could maintain culturally significant and native species that current agricultural practices would otherwise harm. Pesticides and herbicides (as well as several other non-natural practices) have contributed to a notable decrease in biodiversity and, therefore, the number of native species. Between 1970 and 2016, over 68 per cent of the population size of mammals, birds, amphibians, reptiles, and fish on Earth disappeared, and more than 85 per cent of wetlands were lost (WWF 2020). Over 10,000 species become extinct yearly, an estimated rate between 1,000 and 10,000 times higher than the natural extinction rate (WWF 2017). We are facing the sixth period of mass extinction (Ceballos et al. 2015). Southern Ontario has lost more than 70 per cent of its wetland habitats, 98 per cent of its grasslands, and 80 per cent of its forests (Sierra Club Canada Foundation 2017a) Among these losses are wild pollinators, on which over 75 per cent of North America depends. Therefore, food security is inherently tied to habitat security and should be noted when considering risk management. Regenerative agriculture considers this by emphasizing nature-based practices, which by extension aid native species retention (Nestle 2023).

Reducing the costs of inputs

There are various financial benefits for farmers resulting from regenerative agriculture, such as lowered fertilizer costs, industrial machinery, and pesticides due to regenerative practices not requiring them as much as conventional methods (Pearson 2007). According to Statistics Canada, the highest expenses for farmers are currently for the abovementioned products and have increased in costs annually (Statistics Canada 2022b). Therefore, removing the need for such items could make farming much more affordable for current and aspiring farmers.

A case study of one farmer shows that when no-till methods were adopted, the costs of preparing the field went down by two thirds (Montgomery, Bansal, and Mark 2020). Cost savings were realized through the need for less chemicals, labour, fuel, and equipment. Although the transition to no-till practices comes at the expense of short-term yields in the first four-five years (as estimated by one farmer who had undergone the transition), it pays back in the long-run considering the sustained productivity of the soil.

Sustaining yields

Farmland productivity is measured in output or yield (Lindquist 2018; Food And Agriculture Organization Of The United Nations 2017). Kröbel et al. 2021 acknowledges how an historic focus on agricultural productivity (e.g., yield) has come at the expense of increased environmental externalities. Although industrial practices, such as chemical inputs, have initially increased crop yields, practices that do not simultaneously consider soil and landscape regeneration result in reduced yields over time (Rhodes 2017). Montgomery et al. (2022) document how regenerative practices, e.g., no-till, cover crops and diverse rotations, at a set of U.S. farms was positively correlated with improved soil health and nutrient density in foods. Studies show that despite lower expected yields during a three to five-year transition period, the return-on-investment on sustainable farm practices in the long-term (10 years), can be 15–20 per cent (Bugas et al. 2023).

Rising temperatures will exacerbate water scarcity and arable land losses (Anderson and Gough 2021, as noted in Bazjat et al. 2021). Increased water stress will highly impact grain yield as they are sensitive to short-term stress (Pearson, Bucknell, and Laughlin 2008, as cited in Newton et al. 2020). Over time, conventional tilling methods lead to soil degradation, erosion, and compaction. There is also the removal of groundcover, which removes organic components, reducing the soil's ability to retain water and nutrients (Skinner et al. 1997). Lacanne and Lundgren (2018) promote a shift in the food system that prioritizes natural resource conservation while using regenerative methods. In a study of 40 U.S. farm fields, Lacanne and Lundgren compared conventional and regenerative farming methods, e.g., no till, cover cropping and livestock grazing. They found a lower grain yield, but higher profitability while using regenerative methods due, in part, to improved SOM (LaCanne and Lundgren 2018).

It is essential to note the clear environmental improvements that farmers receive by adopting regenerative practices, including a decrease in soil erosion on their farms (Rhodes 2017). However, farmers must balance short-term productivity needs, e.g., yield, with long-term soil health and soil's longevity for providing food production. Therefore, implementing regenerative methods is a long-term investment into the health of the soil to ensure production remains stable in a world of rapidly changing climates.

Increasing farmland's valuation

Land valuation is a complex process considering many factors, including location, zoning, and potential uses. Farmland has a stable value and appreciates over time. Except for only two events in the past 50 years (the farm crisis in the 1980s and the recession of the early 2000s), average farmland prices have continued to increase (Levesque 2022). Many farmers view farmland through the lens of operational efficiency, which eventually leads to lower yields and return on investment over time.

For farmland, the primary factors used to determine its current value are its productivity value, the value of the residence, its location, farm outbuildings, and other buildings located on the land but not used in farm operations (Municipal Property Assessment Corporation 2023). Under the Assessment Act, the Municipal Property Assessment Corporation (MPAC) must assess land based on its current agricultural value (Government of Ontario 2023a). Municipalities use MPAC property assessments to set property tax rates annually. The value of land can be influenced by regenerative farming practices, making land more valuable due to its benefits to the soil. These benefits include health, water retention, and the quality and sustainability of food production.

A few studies have investigated the effects of regenerative practices on valuation. Although these studies do not cover a general valuation increase for all farms, it is a good first step in understanding the value mechanisms through which regenerative practices translate into a financial land valuation. Farmland is most productive when it has at least four crops in rotation over time and ideally grows a mosaic of different crops each year (Levesque 2022). Crop diversity marks the start of regenerative agriculture, which fundamentally improves soil health and, in turn, increases plant health and crop yields. Converting the land to certified organic provides a 50 percent to 200 percent price premium, generating higher returns as consumer demand for organic products outpaces supply (Wichner 2021). The three-year conversion period may seem long and winding. However, it pays dividends to the landlord, who can rent that organic, regenerative farmland to farmers specializing in select organic crops at more than double the rent rate for conventional acreage.

PHOTO: Garden Carrots, **Jean-François Obregón Murillo**

FOCUS POINT:

Farmland valuation models[6]

Understanding the financial impact of regenerative practices on farmland valuation is difficult to generalize as farmland is unique and its context is highly localized. Different financial models are applied to value farmland and could be used to assess the impacts of regenerative practices on farmland's valuation in different settings in Canada. These models include:

Comparable sales method. It is the most reliable approach when there are frequent sales and an established market for comparing properties, including various qualities from superior to inferior. Farm Credit Canada (FCC) established a system based on benchmark farm properties, estimating market value using recent comparable land sales methods (Farm Credit Canada 2022). This method involves comparing the sale prices of similar properties in the same area to determine the value of a given piece of land. This approach is one of the primary methods used to value land and is highly reliable if the market data is reliable (California State Board of Equalization 2023). Data can be obtained from property owners, real estate brokers, lending institutions, value declarations at title registry offices, property tax rolls and appropriate land interest associations (Duncan et al. 2003). A high-quality land valuation will take all features on a farm into consideration, as they add to the property's value. Elements such as irrigation, soil quality, drainage, road access, and proximity to storage facilities are essential (Land Income 2022). However, fluctuations in the real estate market may make it difficult to use past data for future valuations. Foreclosures and short sales on agricultural real estate may lower valuations.

(Discounted) Cash flows. This method involves an assessment of the cash flows that could be generated from a property, and reducing this amount to a present value using a discounting percentage. This approach can be applied to farms since income determinations are crucial and can be based on reliable market data such as commodity production rates and prices, rents, occupancy rates and operating expenses. Under this method, the cash rental approach analyzes cash rental rates paid for the land. The more complex build-up approach examines typical income potential minus variable and fixed expenses and management costs to determine the net income (Duncan et al. 2003). This method would benefit regenerative farming because its practices lead to healthier soils, higher crop yields and, potentially, higher farmer profits. This, in turn, can increase the value of the land. However, according to our interviewees, cash flow generation represents only about 50 per cent of the valuation of farmed land. This differs from commercial real estate, which is almost 100 related to cash flows. Other things then enter the valuation, including potential long-term asset appreciation, but farmers mostly value land far above its cash flow value.

Capitalization method. This involves taking the net operating income from a property and dividing it by the current market value. The net operating income is the expected annual income generated minus expenses incurred for managing the land. The current market value is the present-day value of the property according to prevailing market rates. The resulting ratio is typically expressed as a percentage. For example, if you want to purchase 100 acres for CAD 10,000/acre with a cash rent of CAD 330/acre, divide CAD 330 by CAD 10,000, and you get a cap rate of 3.3 per cent. Farm real estate cap rates typically range between two and six per cent and are subject to variance depending on the location, the overall market value of the property and other factors affecting its valuation (FarmLend 2023). The capitalization rate is an efficient land valuation method because it immediately helps identify the profitability of land and calculate its ROI over time (FarmLend 2023). In regenerative agriculture, the net operating income may be higher for land used for regenerative agriculture due to the higher yields, premium prices, and reduced costs associated with these practices. This, in turn, can lead to a higher value for the land.

Cost approach. This involves estimating the cost of the land based on the cost of the materials, labour, and other expenses associated with building a comparable property. When a property is unique and rarely sold on the market, land valuation cannot rely on the comparison or the income approaches to determine its current value. This is a three-step approach. First, the evaluator calculates the current cost of replacing structures or taxable components on the land. Next, they apply deductions for depreciation. Last, they determine the value of the land and add it to the calculations to produce an overall valuation (MPAC 2023). This approach would consider the costs of implementing the following practices for regenerative farming: cover cropping, reduced tillage, and rotational grazing. There are also potential savings from reduced inputs, such as synthetic fertilizers and pesticides.

ESG metrics. Using Environmental, Social and Governance (ESG) metrics to value land is becoming increasingly popular. A food or agriculture company can be evaluated for its ESG risk to land and its activities. In the case of regenerative farming, this would consider the positive impact of regenerative farming practices on soil health, biodiversity, and water retention. This can help increase the value of the land as companies and investors become more conscious of their investments' environmental and social impact.

To conclude, land valuation is a complex process that accounts for various factors. The presence of regenerative farming practices can make land more valuable due to the benefits they bring to soil health, water retention, and the quality and sustainability of food production. Numerous factors, like farm size, Class 1 and 2 land proportions, wooded area, organic soil, and crop heat units, affect land quality. The types of operations present lead to land valuation differences: greenhouses, vineyards, and orchards generate much more revenue than cash crops, beef, or swine farms (Deaton and Vyn 2010b). Agricultural land values vary according to several factors, e.g., what does the buyer want to do with the property, and how strict are zoning by-laws? (Slemko 2021). Even though regenerative farming practices can increase land values, it is still necessary to consider other factors like location, zoning, soil structure, biodiversity loss and climate change.

6 We thank Lavisha Dasani for contributing her work on farmland valuation to this report.

PHOTO: **Toa55 / iStock / Getty Images**

Challenges to capturing value: The role of valuation and accounting in land decisions

Most valuation processes on land revolve around two principles: the land is transformed into a commodity, or into an asset (Langford 2021; Birch and Muniesa 2020). A commodity derives value from its ability (or products made from it) to be sold in the market. An asset derives its value from the expected cash flows it could generate (Doganova 2018; Nappert and Plante 2022). What also matters is the source of the cash flows. Cash flows can result from commodity exchange; they can also be obtained through a financial agreement that does not involve the exchange of any commodity. For instance, financial products like options or futures regarding commodities such as wheat, soy or beans do not have a physical delivery commitment (MacKenzie 2011). The dominance of financialization, a modern variant of capitalism, has resulted in increasing "assetization" of land (Birch and Muniesa 2020; Nappert and Plante 2022). Since the 2008 financial crisis, a growing number of private investors have sought to invest in "underutilized" or "frontier" land (e.g., farmland in Africa), whose returns tend to be less volatile than intangible assets (e.g., subprimes) (Langford, Lawrence, and Smith 2021; T. M. Li 2014).

Land framing as an asset rather than a commodity significantly affects land decisions. When framed as an asset, the land's value is typically compared against the value of other assets (e.g., equity, fixed income), not alternative usages of the land or other commodities. For instance, investment companies owning farmland expect a return on investment that matches the bonds or the equity market, especially if this return is significantly superior to what farming usually offers. To understand the uniqueness of its approach, it is essential to understand how land decisions are typically made, particularly regarding biodiversity.

Each land parcel is unique, and its valuation processes, too. Let's look closely at one region to better understand the role of land valuation and accounting practices. Southwestern Ontario, Canada, is situated at the border with the U.S. in the Great Lakes region and is under much pressure for land development. A small, fragmented territory with 95 per cent privately owned land (Carolinian Canada 2013), it includes a dense network of factories integrated with the U.S., resulting in North America's densest highway traffic. It is also the most populated place in the country, Toronto being the fastest growing city on the continent with increasing needs for housing. The region is a perfect setting for studying conflicting regimes of valuation. There are at least five competing usages of the land: manufacturing, housing, farming, conservation, and grey infrastructure (roads, sewage, etc.). We will focus on conservation and farmland decisions since the ability to protect biodiversity is directly linked to preserving those two land usages.

Conservationists would argue that what matters first is protecting the natural habitats. Without biodiversity, there is no support for pollination, soil health degrades, and water issues arise. As a result, farming and manufacturing struggle since both rely on green infrastructure to function. Without jobs, people cannot pay for their houses and with more extreme weather events like flooding, costs increase for maintaining housing and the grey infrastructure. However, the valuation methods used to assess biodiversity and the lack of accounting recognition of natural assets make conservation the last priority when making land usage decisions.

Conservation. The typical accounting system used to value biodiversity is ecosystem service valuation (ESV), which monetizes the benefits people obtain directly or indirectly from ecological systems. Ecosystem services typically comprise four categories: provisioning (e.g., food, fresh water, fuel, genetic resources), regulating (e.g., climate, disease, and flood regulation), cultural (e.g., recreation, aesthetics, and education), and supporting (services necessary to produce other ecosystem services, e.g., soil formation, waste treatment, and nutrient cycling) (Assessment 2003). To conduct an ESV, evaluators can use the Natural Assets database, which provides a financial estimate for all land cover types and matches the data with the spatial information offered by the Ontario Ministry of Natural Resources. In 2008, the total annual estimate of the region was CAD 84 billion (Troy and Bagstad 2009). This estimate was based on the full potential of ecosystem services, not the realized ones – for instance, individuals might not use parks for recreational activities. In 2019, another estimate based on other calculation methods placed the potential value of six ecosystems in the region at CAD 19 billion per year but its realized value at CAD 9.7 billion (Aziz and Van Cappellen 2019). Those high numbers are explained by the country's eco-region being the most biodiverse.

The financial value of ecosystem services is theoretical since nobody is paying for those services. Compared to carbon

markets, creating a market is the only way to monetize biodiversity. Despite the existence of carbon markets, landowners rarely sell carbon offsets because their land parcels are too small. According to the 2021 Canadian Census, most farms in the region comprise between 10 and 60 acres. With an estimate of between 0.113 and 0.057 tonnes per acre per year and an average of CAD 23/tonne, farmers would make between CAD 25 and CAD 78 a year if they wanted to sell carbon offsets (Government of Alberta 2023). Forests have higher carbon sequestration, averaging between one and three total carbon credits (tonnes) per acre per year (EOMF 2022). However, due to high initial costs and the need for economies of scale, the Ontario Woodlot Association only encourages owners with more than 5,000 acres to apply (EOMF 2022). Based on conservation program estimates in the Hamilton region, the average woodlot size is 46.95 acres, an equivalent of CAD 46-140 per year in carbon offsets – without accounting for the costs incurred by the audit (Bee Sweet Nature Company 2019). Additionally, there are no effective protocols or registries, and the prevailing system asks for 100-year contracts, which most farmers will not sign. Despite representing billions of dollars' worth of ecosystem services per year, neither ecosystem valuation services nor carbon accounting can assign a monetary value to the ecological features of the land that results in significant cash flows. As a result, the conservation of natural habitats is rarely chosen by landowners, even if land with natural heritage features can benefit from a 100 per cent tax exemption under Ontario's conservation land tax incentive program (Government of Ontario 2014). As we will see below, other valuation methods dominate land decisions.

Farmland. The valuation of farmland relies on both public accounting and market-based mechanisms. All farmlands are classified according to the Canada Land Inventory (CLI), which comprises seven classes that indicate the degree of limitation imposed by the soil in its use for mechanized agriculture. The less work for agricultural machinery the soil needs, the higher the class or the "capability soil." (Government of Canada 2013) Classes 1, 2, and 3 and specialty croplands (e.g., for orchards), also known as "prime agricultural land," are a limited resource in Canada. Organic soils are not included in the classification. Only five per cent of the Canadian landmass comprises prime land. Only 0.5 per cent of it is Class 1. Despite representing 0.1 per cent of the total landmass, southwestern Ontario comprises half of the country's prime agricultural land, most of the region being Class 1 (Neptis 2021). The Provincial Policy Statement (PPS) and provincial plans (e.g., Greenbelt Plan, A Place to Grow: Growth Plan for the Greater Golden Horseshoe) require that prime agricultural areas be protected and designated for long term use for agriculture. Thanks to Ontario's "Farm Tax Program" and "Managed Forest Tax Incentive Program," farmland and managed forest (> 9.88 acres) are taxed at no more than 25 per cent of the municipality's residential property tax rate (OMAFRA 2023; Ministry of Natural Resources 2023).

Financial incentives alone are insufficient to ensure the adoption of environmentally friendly practices. Nebel et al. (2017) surveyed 3,256 landowners in southwestern Ontario's Upper Thames River and Grand River wetland watersheds to understand their motivation for engaging in pro-environmental behaviour. The top three motivators for landowners to enroll in a wetland enhancement program were more information on how wetland declines affected them personally, access to technical assistance, and a one-time payment to offset the initial cost of enhancement or restoration. The study's results also suggest that enrollment in voluntary land stewardship programs might be improved by providing information about the effects of ecosystem loss and financial incentives for participation.

The higher the land class (1, 2, 3 and specialty crops), the higher the farmland's price. The main criterion for classification is that the soils are well-managed and can be cropped under a large mechanized system. The classification was created in the 1960s, 1970s and 1980s when the government promoted industrial farming. One key mechanism to improve land quality, according to the classification, is installing agricultural tile drainage systems, which harm ecosystems (Spaling 1995). This practice is widely spread since farmers benefit from tax incentives when investing in this grey infrastructure, notably through amortization. In contrast, farmers willing to support ecosystems using wetlands to prevent flooding would not benefit from tax incentives. "Green infrastructure" is excluded from accounting classes. The same problem applies to public accounting, in which natural assets like lakes or forests are excluded based on an argument that their value cannot be reliably determined – unlike other municipal assets, such as roads, social housing, parks

or wastewater systems (Eyquem et al. 2022; Food And Agriculture Organization Of The United Nations 2021). Other mechanisms to increase the farmland's class include removing natural habitats to facilitate machinery usage. As a result of those market-based and accounting incentives, in 2002, 78 per cent of the natural habitat in the region had been cleared for agriculture, with only five per cent left of natural vegetation cover in agricultural and urban areas (Walton 2003; Reid 2002). Therefore, shifting agricultural practices in Canada toward regeneration would require the government to change its classification systems of the land by emphasizing soil health and biodiversity more and less on the ability to use heavy machinery on the farm.

The valuation of farmland is also based on the future cash flows associated with it. It is estimated that 40 per cent of farmland in Ontario is owned by non-users of the land (Government of Ontario 2017), with an increasing number of private and institutional investors looking for safe investments and stable returns (Ferme Ile Aux Noix 2022). Non-users are mainly retired landowners, but the investor class is proliferating. In 2021, the farmland acre in the region was sold for an average of CAD 20,400 (Farmers Forum 2023) – an increase of 23 per cent compared to 2020, while the economic value, according to Statistics Canada, was CAD 13,813 based on commodities' sales and buildings' value – an increase of 16 per cent (Statistics Canada 2023d). The differences between valuations are explained by various elements: projected commodities prices, expected rent income (including real estate on farmland), interest rates and increased scarcity. Due to the high selling prices of several million dollars for a farm, many buyers are non-farmers.

Non-farmer buyers comprise two types of investors. One group is interested in farming income (through rent or lease) and typically encourage an assetization of the land by valuing short-term profits that match other asset classes over long-term soil health. To achieve such returns, equity owners can sign a lease or partner with the farmers' managers favouring cash crops and requesting human-made draining and natural habitat removal. Those land decisions have long-term adverse effects on yields and contribute to biodiversity loss, but increase short-term commodities production and the land valuation on their books (Rotz, Fraser, and Martin 2019a). A second group of investors buys farmland, hoping the land will be rezoned, allowing for more profitable investments to flourish in its place (e.g., real estate or manufacturing). This explains why farmland near urban areas benefits from an important price premium (Farm Credit Canada 2022). On the contrary, farmland close to an ecologically protected area sees a 24.3 per cent average value loss (Deaton and Vyn 2010a) due to the perceived additional constraints associated with protecting endangered species.

The Canadian government created the prime farmland classification to "ensure these finite, non-renewable resources are protected and considered when land use decisions are made" (Government of Ontario 2022). Despite this protection, between 2000 and 2017, more than 71,660 acres of prime agricultural lands were converted to non-agricultural uses through 545 separate Official Plan Amendments (OPA) across southern Ontario, mostly rezoned for development purposes, 2.5 more times than the 2005-2009 period (Caldwell and Epp 2021). Ontario has roughly lost 41 per cent of its farmland since 1941 and 18 per cent over the past 35 years; the pressure is especially acute in southern Ontario, where the population has grown exponentially (Ontario Farmland Trust 2022; Fawcett-Atkinson 2023). Once farmland, forest, and protected areas are re-zoned as development, real estate, or grey infrastructure, they rarely revert to their original usage, and resulting biodiversity loss is rarely recuperated. Despite its ecological significance, less than 2.5 per cent of Ontario's Carolinian life zone has legal protection as a nature reserve (Jalava, Kanter, and Hodgkiss 2015). In 2017, southern Ontario had already lost more than 70 per cent of its wetland habitats, 98 per cent of its grasslands, and 80 per cent of its forests (Sierra Club Canada Foundation 2017a).

Although the analysis presented in this section applies to southwestern Ontario, findings can apply to many lands in Canada. As in many parts of the world, the valuation model and accounting systems associated with land decisions do not favour the environment. Despite offering an array of services, ecosystems do not benefit from accounting or market mechanisms that transform their monetary value into cash. Public classification of farmland incentivizes the removal of ecosystems in favour of industrial agricultural practices. The same applies to municipalities prevented from listing natural assets as part of their municipal asset portfolio. The increased transformation of (farm)land into an asset class also encourages industrial agricultural practices and the (re)zoning of farmland and natural habitats into development and real estate. The increasing presence of institutional investors in agrarian land echoes what happens

in real estate. Half of Toronto's real estate buyers are institutional investors, which results in the exclusion of the most racialized and poorest populations in the city (Lewis and Panou 2023). Despite not being our core focus, the assetization of urban areas also leads to biodiversity loss in the cities – for example, in the case of parks providing no income source to municipalities that prefer private market housing or commercial real estate (Obregón Murillo 2022). By putting more value on real estate cash flows obtained through large-scale businesses (e.g., cash crops with industrial farming), grey infrastructure, and manufacturing, the entire valuation system attached to the land is contributing to biodiversity loss.

At the core of the problem is the "exploitative" lens adopted by most capital owners and land decision-makers (e.g., governments) described above. The land is being assessed only based on the (monetary) benefits it can bring to humans. This approach is the opposite of the relationships of kinship favoured by Indigenous peoples, as we will see in Chapter 5.

FOCUS POINT:

Factors explaining farmland valuation in Canada by province

Province	State of Farmland Valuation
Prince Edward Island	In 2022, the province saw a farmland value increase of approximately 18 per cent, with farmland value being evenly distributed throughout the island (Farmland Credit Canada 2023). This growth is largely attributed to its iron-rich soil, making the province a leading potato grower and prime candidate for the farmers involved (Statistics Canada, 2021). Additionally, the potential for natural disasters such as hurricanes has done little to affect the value of the farmland itself. Generally, the small size of the province, along with its extremely rich soils for potato production, gives its farmland much value despite its size compared to other provinces (Farmland Credit Canada 2023).
New Brunswick	In 2022, the province saw some of its largest growth in cultivated farmland value of 17.1 per cent. This was only 0.1 per cent below 17.2% in 2019, its previous largest recorded annual growth between 2013 and 2022. (Farmland Credit Canada 2023) Factors influencing farmland value could be mainly attributed to the competitiveness of the province's large-scale potato industry, where land value spiked due to a limited supply of iron-rich land elsewhere. Good growing conditions and many out-of-province investors further helped drive the value of the land. This spike in growth could be seen through the general province-wide double-digit growth and the exceptional growth within the Northwest, the primary region for growing potatoes (Farmland Credit Canada 2023).
Nova Scotia	Like New Brunswick, Nova Scotia has also seen a surge in out-of-province investment in the potato industry. Due to this, the province saw an 11.6 per cent increase in farmland value in 2022, and despite some nature-based challenges, such as hurricanes, the productivity of the province's industries remained unchanged. This, along with growing demand and low supply, has steadily increased the value of farmland in the province (Farmland Credit Canada 2023).
Newfoundland	There is little information available on farm value. The province has been reported to have lost more than half of its farmland in the past few decades, the worst record of farmland loss in Canada (CBC 2022). This could be attributed to a lack of support from various levels of government, a lack of suitable soil, and a general disinterest in the practice (Cadigan 1998).

FOCUS POINT:

Factors explaining... continued

Quebec	In Quebec, the value for cultivated farmland increased by 11 per cent, with most of the value concentrated within the regions along the St-Lawrence River (Farmland Credit Canada 2023). The highest individual percentage was 19.2 per cent. The massive spike in value could be explained by increasing interest rates on equipment, competition for land in certain regions, and high demand for land especially along the Saint Lawrence River (Olson 2022). Although Quebec's land value is increasing fast, some regions have yet to experience growth in farmland value, primarily due to the lack of out-of-region buyers, which is often concentrated in the south of the province (Farmland Credit Canada 2023). Quebec represents a special case for out-of-province buyers as they must receive formal permission from the Commission de la protection du territoire agricole du Québec to buy more than 4 hectares (10 acres) of land (Winters and Lavigne 2014).
Ontario	In Ontario, the value for cultivated farmland increased by over 19.4 per cent in 2022, the highest increase out of any province – along with double-digit increases in every province region. This is due to many factors, mainly the typical nationwide issue of the supply of arable land being unable to keep up with demand, especially in regions where investors are concentrated near major urban centres (Farmland Credit Canada 2023). Like many provinces, these supply issues are common and have worsened over the past few decades, primarily due to urbanization (Ontario Farmland Trust 2022). Such a statement could be exemplified by the Ontario Greenbelt, which comprises more than 850,000 acres of farmland, and its potential risk of being developed into housing (Friends of the Greenbelt 2014). Such a move could further decrease the supply desperately needed to fulfill current demand. Therefore, the primary reason for Ontario's large farmland value increase is unabated urban expansion into farmland.
Manitoba	In 2022, the province had increased cultivated farmland value by 11.2 per cent, despite some challenges with growth in certain areas. High commodity prices and crop insurance alleviated some challenges farmers faced in struggling regions, helping to retain much of the area's value per acre within that period. Similar to the rest of the prairies, the province sees the most farmland value within the irrigated southern sectors, which see an increased demand for land and a type of diverse buyers (often composed of wheat and potato producers, increasing demand). Thus, high demand and low supply of Manitoban land has driven up its value (Farmland Credit Canada 2023).
Saskatchewan	In 2022, cultivated farmland values increased by 14.2 per cent, although they varied drastically by region. For example, the province's northeastern region reported a 24 per cent increase, while the Northwestern region only reported a 9 per cent increase. The province's value per acre can also differ by region, with the northwestern region costing CAD 800 per acre while the southeastern sector costs approximately CAD 1,000 per acre. Such conflicting results could be explained by the quality of the land and the number of properties within that sector that could be bought (Farmland Credit Canada 2023). Despite its quick and private farmland sales, the province offers some of the country's most affordable lands, unlike many other provinces (Kirby 2022). Irrigation is a major determinant in Saskatchewan's agricultural land valuation, as droughts and dry conditions have been a re-occurring issue, especially in recent years. Therefore, irrigated farmland in southern Saskatchewan has experienced the biggest rise in market value, which is catching up with high irrigation maintenance costs. Some non-irrigated farming regions have also experienced similar growth (Farmland Credit Canada 2023). Additionally, many farmers need more infrastructure to support the transportation of agricultural goods, which may make selling products slower and limit how much could be sent to out-of-province markets (Kirby 2022).

Alberta	In Alberta, cultivated farmland value increased by 10 per cent in 2022. Like many other provinces, most of the growth within the province could be found in the south, which is irrigated and has more suitable weather for larger-scale farming. Much of the value per acre could also be found in the Southern portions of the province, with the Southern and peace regions worth an average of CAD 14,900 and CAD 2,700 per acre, respectively (Farmland Credit Canada 2023). Much of this is due to the climate of each respective region, with the north being drier and more humid with little irrigation (Farmland Credit Canada 2023). The south also has many more connections to the broader market through rail, road, and air routes, allowing farmers in the area to export their goods easily. On the other hand, due to its more isolated location, the northern parts of the province struggle with market access (Farmland Credit Canada 2023).
British Columbia	Cultivated farming value increased by eight per cent in 2022, following an 18 per cent increase in the previous year. The province's southeastern Kootenay region saw a 33.6 per cent increase. Such results can be compared to Peace-Northeast's six per cent increase, which shows a clear difference in statistics regarding the northern and southern portions of the province. The south's value per acre is almost twenty times higher than the north's and is concentrated within the south and the southeastern interior, respectively. This could be attributed to their proximity to major infrastructure such as highways and major urban centres (Farmland Credit Canada 2023) and the fact that much of the southeast possesses land suitable for diverse farming options (British Columbia, 2018). Farmland located directly near urban centers saw increased competition from urban farms and hobby farming, though rising interest rates have limited this increase. Additionally, the Agricultural land reserve – a region in the province where agriculture is preserved and encouraged – has a large concentration in the south, creating greater incentive to farm in that region (Government of British Columbia 2021).

PHOTO: Managed Forest Tax Incentive Program, **Jean-François Obregon**

Summary

Key take-aways:

- Biodiversity, water, and soil health play key roles in supporting agriculture processes and outcomes.
- Industrial agriculture practices have consequences for biodiversity, soil health, water, and GHG emissions.
- Leveraging the natural flows between biodiversity, water, soil health, and carbon can support farming productivity and aggregate ecological and social benefits.
- The value created from adopting regenerative practices can be realized through cost reduction, sustained yields, food security, resilience and risk management, and land valuation.

Barriers:

- Demands placed on the agriculture production system (including a growing population, consumer preferences, and global supply) justify industrial agriculture as the dominant paradigm for farming, providing barriers for smaller-scale, localized, and regenerative production.
- Valuation models for land and agricultural production do not yet consider ecosystem services and the value of nature beyond an exploitative lens.
- Learning regenerative agriculture techniques and adopting them takes time. It is a multi-year commitment to see benefits.

Conditions for success:

- Leveraging nature-based solutions to consider the natural flows and their role in agricultural production is critical.
- Value mechanisms and accounting for nature need to be established in agricultural production to create markets to translate the value of ecosystem services into financial value. Turning ecosystem services' monetary value into cash flows remains a challenge.
- Farmers must understand what regenerative practices and ecosystem services are made up of as well as technical assistance and one-time payments available in order to buy into them.
- Established valuation techniques like discounted cash flows and capitalization rates can benefit from integrating regenerative agriculture elements.

PHOTO: Banff National Park in Alberta Canada
Don White /Getty Images

Farmers' viewpoints: The importance of understanding their daily challenges

For many farmers, land is foundational to their business and the source of their economic livelihood. Many of the farmers we interviewed also experienced a personal connection with their land by living on it, stewarding it over time, or connecting to the land from past generations. Although recent movements have demanded the uptake of "sustainable farming practices," many farmers we interviewed would argue that "sustainable farming" is just good farming; given constraints such as knowledge, resources, and demands within the system, farmers manage their land to the best of their abilities. Sustainable practices, such as investing in ecosystem health, ensure the landscape's health and agricultural production over the long term (Rodale Institute 2022; Montgomery et al. 2022).

Many highly educated and experienced farmers have historically engaged in direct information exchanges with agricultural science (Kröbel et al. 2021). Farmers are central to the transformation of agricultural practices. However, transitioning to regenerative agriculture and healthy ecosystems is not merely their responsibility. Farmers are often caught in the centre of the debate with the highest risks and costs to bear as demand increases to see a shift toward regenerative practices. Farmers play an essential role in the transition, yet understanding the risks and barriers to transition from the perspective of the farmer is integral to leveraging systems support to facilitate the change.

Farmers are already exposed to high risk due to the rising operating costs, thin margins, and environmental volatility they encounter on a regular basis. Although there are other factors in their decision-making processes, such as values, lifestyle, and connection to nature, many farmers stated that the end decisions must make economic sense to be implemented (Koontz 2001; Maybery, Crase, and Gullifer 2005; Gosling and Williams 2010). For professions that rely on natural resources, like farming and fishing, conservation concerns matter, yet subsistence and economic livelihood is a priority (Reibelt et al. 2017).

The need to create a sustainable business model

Agro-environmental policies often mean political bargaining between stakeholders. Kröbel et al. (2021) studied applied and direct-to-farmer agricultural science research initiatives focused on identifying and implementing the best environmental management practices. Asking farmers to adopt regenerative practices, e. g., reduced inputs, can be met with resistance due to concerns over yields. Thus, building a business case for regenerative agriculture is vital to persuade farmers.

This sentiment was echoed in our interviews with farmers. Farmers cared about their land's well-being but faced competing pressures with economic livelihood and supporting their families. There are many benefits of regenerative farming. At the core, the business model is needed to justify farmers adopting these practices.

The high costs of the transition

A key factor that influences farmers' transition to regenerative agriculture is the upfront cost associated with adopting new technologies and practices (Cary and Wilkison 1997; Van Herzele et al. 2013, as cited in Nebel et al. 2017, p.455). Additional costs include the potential foregone revenue or opportunity cost from regular production in the transition period. Farmers often realize these costs in the short term, whereas the benefits of a transition to regenerative agriculture, or conversely, the costs of degeneration, are often invisible until the long term.

Georgakopoulos and Thomson (2005) interviewed salmon farmers in Scotland to reveal their motivations for adopting organic practices. They found that salmon farmers denied the unacceptable levels of social and environmental costs from their activities. The authors stated that unless the risks were considered "real" by the decision-makers, costs and benefits linked to environmental issues were not a part of their deliberations. McNairn and Mitchell (1991) also found a cognitive dissonance among farmers' perceptions of the erosion problem. While they understood the risks of soil erosion, they vastly underestimated how much it affected

their operations. For instance, 70 per cent thought that soil erosion occurred at a greater rate in their township than on their farm. The decision for salmon farmers to go "organic" was based on higher potential market prices, but it was a risk management strategy due to a negative outlook for conventional salmon. The findings show that the motivations were mainly economic and had little to do with pressures from environmental groups. We can apply this thinking to motivations for why farmers consider regenerative agriculture practices due to economic factors. For instance, higher fertilizer costs have led to farmers reducing fertilizer usage to cut expenditures in the face of regular market prices (Hebert 2022).

Nebel et al. (2017) surveyed landowners in the Upper Thames River and Grand River wetland watersheds to understand their motivations for pro-environmental behaviour. They noted that financial considerations were an issue for landowners when making decisions related to environmental programs. One of the top three motivators for landowners to enroll in a wetland enhancement program was receiving a one-time payment to offset the initial cost of enhancement or restoration. Public recognition was the least motivating factor. Transaction costs can deter farmer or landowner participation in environmental programs (Noga and Adamowicz 2015; Vanclay 1992; Ducos, Dupraz, and Bonnieux 2009; Ceballos et al. 2015, as cited in Nebel et al. 2017, p.455).

Regenerative methods require more on-farm operators than conventional counterparts (Pearson 2007). This is important to mention as Canada has fewer operators per farm compared to the UK, US, and Japan (Chen 2022). Therefore, additional labour could pose a significant challenge to farmers adopting regenerative methods. Additionally, regenerative agriculture could sometimes be attributed to lower yields due to a lack of the industrialized methods commonly used in most farms in Canada today (Pearson 2007).

Incentives are lagging

These additional costs and risks associated with regenerative production necessitate an increased compensation for the farmers. However, the financial returns from regeneratively produced products are still being determined. Customers have not proven their willingness to pay more for a product grown on farms adopting "regenerative practices," however some of them are willing to pay more for "organic" products (Personal Communication 2023; De Marcellis-Warin, Peignier, and Gleize 2023). Despite the stated demand by downstream food industries for regenerative agriculture that emerged in our interviews, some farmers were uncertain that this would increase their products' payment. The uncertainty surrounding customers' willingness to pay leaves farmers bearing the risk of additional costs during production without a proven increase in compensation.

These factors contribute to a situation in which farmers are being pressured to change their practices and adopt risks in the short term, which are immediately visible (Bugas et al. 2023). The long-term benefits are often invisible at the time of the decision (Montgomery et al. 2022). As one farmer who had undergone a transition on their farm estimated, it took about four to five years to realize the benefits of a transition to regenerative practices (e.g., no-till farming). The lag in payoff from a cost-based perspective, paired with the short-term reduction in crop yields, disincentivizes farmers from acting in the present.

Although we have identified multiple sources of value creation from regenerative farming (e.g., better product, lower costs, and increased resilience), this value is realized over long time horizons. Financing regenerative agriculture plays a role in overcoming this temporal disconnect and creating incentives to invest in the present. Kröbel et al. (2021) found that bridge financing, e.g., income support, is essential to incentivize farmer adoption of sustainable agriculture. This should apply to regenerative practices used by farmers because it can take more than one year to see the results and help farmers pay the capital costs for new equipment (Kröbel et al. 2021; Bazjat et al. 2021). Such income supports are timely as farmers voice concerns over increased costs and fears of the federal government's plans to reduce emissions from fertilizer application. Similarly, implementing complex regenerative practices such as silvopasture, a technique integrating trees, forage, and livestock to maximize yield output, can take several years to realize economic benefit (Gabriel and Toensmeier 2018, as cited in Bazjat et al. 2021). To incent farmers to go beyond the low-hanging fruit of short-term economic improvements of the land and invest in multi-year regeneration on the land, bridge financing may be needed to help surmount initial costs and aid in the time lags of the transition.

Significance of landownership in adopting regenerative farming

The transition to regenerative agriculture often focuses on the on-farm management practices that reduce the harm of farming on the ecosystem or support the regeneration of life on the land. Taking a systems perspective on the challenge of transitioning to regenerative agriculture necessitates looking upstream. Landownership structure and tenure have implications for land use.

Farmers face economic pressures in adopting expensive and complicated conservation techniques, where the benefits may take three to five years to realize (Bugas et al. 2023). Although there are benefits to investing in biodiversity and soil health through regenerative practices (e.g., more resilient crops, higher yields, sustained production on the land), there are also benefits that accrue beyond the farm from regenerative practices that support ecosystem health (e.g., cleaner water quality downstream, mitigation of climate change, supporting biodiversity and habitat). As explained above, these ecosystem services cultivated on farms through regenerative practices are rarely priced. Farmers must be accurately compensated for the full extent of the goods and services they provide that accrue to society if we want the agricultural system to shift toward regenerative practices.

Additionally, farmers who do not own the land are given no guarantee that the short-term trade-offs will pay off in the long term. If uncertain, they will be farming on the land long-term. Similarly, the fragmentation of land and competing land use means that neighbouring practices also affect farms. A farmer may be less willing to transition to regenerative practices to preserve the quality of their water inputs if the upstream farmer is not doing the same.

Due to the high investment required, the outcomes that aggregate beyond farm parcel boundaries, and the time lag to see the benefits of the transition, landownership structure and tenure are important considerations for farmers when ensuring that they can realize the benefits from regeneration on the land.

PHOTO: Two Farmers Pointing Canola Field, **Lisa Blue / Getty Images**

FOCUS POINT:

Types of ownership structures on farmland

Farmland ownership in Canada often follows three key structures. Each structure has unique implications for farmers.

Total ownership

Total ownership is when the farmer has full control over their farmland, and what happens on it. Farmers with total ownership must pay for many of the costs associated with having such control over the land. The practice of owning land for agriculture is still the most popular form of ownership, with more than half of Canada's farms being owned by those who farm it (Statistics Canada 2016b). However, this figure has declined significantly since the 1990s due to the costs associated with owning land (Statistics Canada 2016b).

Hybrid ownership

Hybrid ownership is where multiple farmers or landowners pool their resources and land together to act as one farm. Equipment and other farm-related purchases are often collectively bought rather than by individual farms. Hybrid ownership involves multiple owners and stakeholders involved in the maintenance of a single farm (Grashuis 2018). This type of farm makes up approximately 15-20 per cent of Canada's farms (Statistics Canada 2016b). It appeals to those who either have limited resources or are attempting to improve their economies of scale.

Rental

Renting farmland is a practice where the farmer agrees with a landowner to conduct agriculture on the land. Leases are legal contracts that allow the farmer to use the farmland. The practice has grown in popularity and presently makes up more than 40 per cent of Canada's farmland (Farmland Credit Canada 2023). Farmers rent mainly due to the capital needed to purchase a sizeable amount of farmland (as well as what it takes to maintain the land financially) which could be used for other investments such as equipment. Larger plots of land and more parcels of land are required to achieve economies of scale in agricultural production, making rental an attractive option. With the average age of farmers rising, farmers are increasingly looking to sell their land and retire. Additionally, the rising costs of farmlands, especially in Ontario, mean that next-generation farmers need help to purchase land from their predecessors (Rotz, Fraser, and Martin 2019a). Leasing farmland, or hybrid ownership, addresses some of these barriers for many farmers. Therefore, many new to the industry may find renting attractive rather than purchasing the land. However, some restrictions could be placed on the tenant of the land, which often includes a restriction on what crops could be planted or what could be done with the land in general (Farmland Credit Canada 2023).

Green leases

Used in commercial real estate, green leases align the financial incentives of sustainability measures in contracts between landlords and tenants. Thus, the landlord and the tenant benefit from water, energy, and waste efficiency investments. The concept of a green lease can be applied to agriculture for farmers who rent land. Currently, contractual incentives may be absent for leaseholders to use environmentally conscious practices, e.g., reduced or no external fertilizer to help soil health. A green lease can be designed to preserve soil health for current and future leaseholders. A degree of periodic soil health monitoring may be necessary by the landlord to ensure the leaseholder's compliance with its terms.

Conservation easements

This is an alternative to land acquisition when a parcel's purchase price is too expensive. Easements are registered on title, ensuring that the protection passes from owner to owner. They are arranged between the landowner and another party, e.g., municipality, conservation authority, government, etc. to allow for a long-term use, typically in perpetuity, for a portion of a property that is deemed to have public benefit. Farmland easement agreements are promoted by the Ontario Farmland Trust to prevent farmland conversion to non-agricultural uses which has been promoted. It can be time-consuming and costly to apply for a farmland easement.

Over 40 per cent of all farmlands in Canada are rented (Farmland Credit Canada 2023). This means that for a large portion of the farmland, those who own the land are not the ones managing the land. As such, these farmers do not have a long-term, vested interest in the land, as they are still determining whether they will be able to farm it the next year. The short-term tenure over the land has implications for adopting regenerative practices since it may take three to five years of reduced yields to begin to benefit from investing in regeneration (Bugas et al. 2023).

Nadella (2013) surveyed 810 farmers in Manitoba and southwestern Ontario to understand the impact of tenure status on the adoption of conservation practices. Farmers were surveyed about conservation practices, including crop rotation, tillage practices, cover crops, manure applications, and variable rate input applicators on land they own and rent. Most of these farmers agreed they would use more fertilizer or manure and a more complex crop rotation on the land they owned than on the comparable land they rented.

Empirical studies in various settings have shown that landowners are more likely to adopt conservation practices than tenant farmers in the early years of ownership (Adusumilli and Wang 2019). Agricultural landowners are willing to invest to a different degree in soil conservation than renters (Ervin 1982). Generally, those renting agricultural land are less likely than owners to adopt practices that provide long-term benefits over the land (Soule, Tegene, and Weibe 2000). Overall, these studies show a connection between land tenure and ownership, and pro-environmental practices on the land.

Nevertheless, Akimowicz, Cummings, and Landman (2016) found that some farmland renters maintained the level of soil nutrients to incentivize landowners to keep renting to them. Nadella (2013) showed the need for more incentives for farmer tenants to look after their lands responsibly. This could also mean lower farmland values if more extended remediation periods are required for these properties. In another setting, the actions of tenant farmers were found to be aligned with landowners in settings with organizations governing agricultural standards (Sklenicka et al. 2015).

Existing research provides evidence that land managers in tenant ownership structures should be incentivized to have interests that align with the land's long-term health. Tenant farmers with a level of uncertainty over the tenure of their rental are incentivized to prioritize short-term yields over the health of the soil, water, and ecosystem, which is not valued in short-term production on the land. Land security of tenant farmers may explain soil conservation patterns (Boardman, Poesen, and Evans 2003), which suggests that lengthening the time horizons of tenure is essential to shift to regenerative practices.

There is an opportunity to influence farmland owners to increase the stipulations encouraging renters to adopt regenerative agriculture techniques. It would improve future tenants' soil productivity and potentially higher land values. Nadella (2013) showed a low percentage of contracts stipulating tillage and crop selection. However, we do not know the number of rental contracts stipulating no or low tillage or cover crops. Nevertheless, the adoption rate of regenerative practices like cover crops and manure application was generally higher on the owned property than on rent, except for minimal or no tillage (Nadella 2013).

Institutional investment in farmland and implications for regenerative practices

Investors in land care about the long-term use of their assets. Regenerative practices, investment in natural ecosystems, and soil health are essential for the long-term usefulness of the land. Although institutional investors are less connected with the day-to-day, they have a long-term interest in the land, incentivizing the shift towards regenerative agriculture and biodiversity.

PHOTO: Scenic landscape with aerial view of agricultural fields in springtime, Quebec, Canada
Judy Caron / Getty Images

Institutional investment in farmland has risen in prominence in Canada. As the average age of farmers continues to rise and labour shortages challenge succession plans (RBC 2023; Statistics Canada 2022a), farmers looking to retire are selling their land which in turn is being bought by investors, such as pension funds. The rise of institutional investment in farmland has been controversial. Many provinces have responded with regulations. For example, the provinces of Saskatchewan (Government of Saskatchewan 1988a; 1988b) and Manitoba (Government of Manitoba 1983; 1987) have restricted institutional ownership of farmland.

Overall, viewing land as an investment rather than an asset to produce food has implications for land management (Rotz, Fraser, and Martin 2019a). On one side of the argument, institutional investment in farmland is positive, as it supports the preservation of farmland as farmland, instead of being sold into other types of developments. This helps farmers maintain a farming business or enter the industry without investing their equity in the cost of the land.

On the other side, the disconnection between land ownership and land management poses challenges for adopting regenerative agriculture practices. These concerns echo challenges associated with the agency problem, in which agents controlling a resource are incented to act in their own best interest rather than the best interest of the principal owning the resource. When owners do not live on the land, it creates a further disconnect from the outcomes and visibility of the health of the land and surrounding ecosystems. As a solution, co-ownership structures and green lease models have arisen to ensure alignment between the interests of institutional investors tenant farmers, and the long-term health of the land itself.

FOCUS POINT:

The Case of Bonnefield and Area One Farms

Organizations like Bonnefield Financial and Area One Farms have emerged to respond to the challenges of institutional ownership of the land by employing leasing and partnership models and encouraging sustainable agriculture practices on the land.

Bonnefield Financial began in 2009 as a financing solution to farmers whose capital was tied up in the equity of their land and were otherwise challenged to meet the capital requirements of their farming operations (Bonnefield 2023). Bonnefield Financial provided a solution by buying a portion of the land and leasing it back to farmers over the long-term. In addition to acquiring farmer's existing acreage, Bonnefield financial works with farmers to acquire new acreage. This supports Bonnefield Financial's social mission to maintain access to farmland for farmers, to help mitigate against farmland being sold for alternative uses, and the barriers farmers experience in trying to acquire more land to scale their operations. Bonnefield Financial also sets Standards of Care to ensure best management practices on the land and incent farming for long-term outcomes through long-term leasing (Bonnefield 2023).

Area One Farms offers co-equity partnerships with farmers to address challenges with accessing capital for farming operation (Areaonefarms 2023). This is offered in the form of a crop share agreement or a full farm partnership in which Area One Farm invests in land, infrastructure, machinery and inputs, and the income and appreciation is shared. They also support initiatives that improve land health and productivity for long-term sustainability (Areaonefarms 2023).

These models seek to support farmers by providing capital needed to improve, expand, or sustain farming operations. This helps farmers remain in business despite high price of land and competition for land use. It also helps incent and financially support long-term investment into the health of the land, including sustainable agricultural practices (Porado 2018).

The need for "regenerative" communities of practice among farmers

Challenges of knowledge transfer in regenerative practices

Farmers are stewards of their land (Bazjat et al. 2021). Many of the farmers we interviewed shared stories of the land before they purchased it, paying homage to its generational ties. Some also shared their succession plans, viewing the land as a productive and sentimental asset to be passed down to the next generation. The economic livelihood of the farmer and future generations of farmers on the land depends on the health of the land. As such, farmers attempt to employ best management practices. However, "best practices" are subjective. As one farmer pointed out: "Best for who[m]?" Different paradigms of land management may result in different outcomes. What may be best for the short-term economic gain from the land comes into tension with what is best for the long-term economic gain from the land. What appears "best" for the farmer in terms of convenience may not be "best" for the natural environment.

The identity of a farmer is important. Some farmers we talked to pointed to their identity as farmers and land stewards as motivating factors for adopting regenerative practices on their farms. However, the identity of a farmer was also a factor that dissuaded farmers from transitioning. Some farmers mentioned the threat of alienation from their communities by adopting "green" practices.

Maintaining autonomy over their land use practices was also an important factor for farmers. Farmers are entrepreneurs and business owners, with the land central to their business. Farmers discussed their resistance to change from upstream and downstream actors that are disconnected from the land yet impose restrictions on how farmers should farm their land. Our interviews identified consumers, government regulators, and food companies as external pressures threatening how farmers farmed their land. Farmers were also sensitive to conflicts of interest of actors in the supply chain when sourcing information on their practices, for example, agronomists employed by supply companies. An independent scientist advising Health Canada's Pesticide Management Regulatory Agency (PMRA) quit his post in June 2023, citing concerns over industry influence (Thurton 2023).

Additionally, succession remains a challenge for farmers passing along knowledge of farming practices. The proportion of farms with a succession plan, which we use as a proxy for intergenerational farming, was 12 per cent in 2021 (Statistics Canada 2022a). Approximately 96 per cent of farms with written succession plans named a family member as a successor (Vanier Institute of the Family 2018). However, there has been a decline in farmers under 35 years old between 1991 and 2016, indicating less uptake in intergenerational farming (Qualman 2018). This is part of a larger trend in decreasing the number of farmers (Vanier Institute of the Family 2018). Overall, the challenges of succession create additional barriers to entry for new farmers in the industry and inhibit the passing down of knowledge and best practices.

The role of communities of practice in overcoming cultural resistance and knowledge transfer challenges

Farmers have deep, localized knowledge about the idiosyncrasies of their land and local context to a greater extent than governments and academics. Thus, it is not useful for farmers to be told how to do regenerative farming from governments and academics, but rather, from communities of peers which contain the localized knowledge. This is also a consideration for governments and academics to understand how their research and intervention can be applicable to farmers on a localized scale.

As previously mentioned, identity can act as both a barrier and enabler to regenerative agriculture adoption. Expanding the identity of a farmer to one that feeds the world to also include one that protects ecosystem services for the world is integral to lead efforts in addressing biodiversity and climate change crises. In part, a transition to regenerative agriculture is about shifting perspectives on farming. Communities of practice are relevant to this process, and can exist as self-organizing groups whereby farmers define localized rules of interaction and exert peer pressure to adopt regenerative practices (see Focus Point). Communities of practice thus play a role in strengthening the identity and sense of belonging among farmers adopting regenerative practices.

Farmers also like being involved in decision making and connecting with farmer mentors to help them with applications. No-tillage cropping systems were adopted in the mid-1980s in Canada to reduce soil degradation (Kröbel et al. 2021). Testing of the equipment was done with cooperating farmers. Further reductions occurred when this technique was combined with crop rotations, cover crops and reintroducing temporarily managed grasslands. Other organizations working with farmers also use cooperative approaches, such as conservation authorities, Ontario Ministry of Agriculture, Farming and Rural Affairs (OMAFRA), and the Ontario Soil and Crop Improvement Association (Bazjat et al. 2021). The Ontario Soil Network also holds events to connect local farmers and share knowledge on soil health best management practices, e.g. #LetsTalkSoil campaign (Ontario Soil Network 2023b; 2023a). The intervention of working with cooperating farmers through communities of practices can be used to advance regenerative agriculture practices.

FOCUS POINT:

Communities of practices

Communities of practice are based on local social networks, where farmers can share best practices for regenerative agriculture with each other. It is preferable that they be self-organized by local farmers but supported by existing multiple-actor networks, to stimulate diverse knowledge sharing and discussions on regenerative agriculture. Locally and self-organized groups define rules of interaction, sharing practices, and monitoring the outcomes of the system through the development of "polycentric" governance systems. Polycentric systems depart from the assumption that cooperative outcomes are best supported by bottom-up, outcome-based, culturally diverse groups mobilizing resources and activities in pursuit of collective gains (Ostrom 1990; Gatignon and Capron 2023).

At the Ivey Centre for Building Sustainable Value (BSV), researchers involved in Towards a Climate-Smart Food System project work with farmers, municipalities, industry associations and food processors in southern Ontario toward sustainable food production practices. Ivey professors and researchers are exploring how to implement communities of practice at a local and regional level in southwestern Ontario to strengthen the adoption of such practices. BSV researchers are taking a bottom-up approach, which is expected to promote greater engagement and motivation to pursue and adopt novel practices.

Summary

Key take-aways:

- Farmers are interested in adopting regenerative practices. Many consider the long-term sustainability of their land as integral to good land management.
- Farmers operate in a sector with high exposure to risk, e.g., weather uncertainty, seasonal production.
- For farmers to adopt regenerative practices, the business case needs to make sense. Support is required to overcome their risk adversity and enable the transition.

Barriers:

- Transitioning to regenerative agriculture comes with costs of capital requirements and potential foregone revenues in the short-term to see the effects. Incentives for farmers are lagging.
- Farmland is fragmented. Farmers are unclear whether the benefits of regenerative agriculture will accrue and benefit their operations. They are affected by the practices of other neighbours.
- Ecosystem services are difficult to convert into cash flows.
- Tenure of land management may be uncertain as almost half of farmers rent their land. This may deter investments in the long-term health of the land at the expense of short-term profit maximization.
- Increases in farmland values make it difficult for young farmers to get started.

Conditions for success:

- Financial support and economic incentives are needed to aid farmers and redistribute the short-term risk in the regenerative agriculture transition.
- Co-benefit tracking for benefits that accrue beyond the farm is needed.
- Communities of practice focussed on regenerative practices can go a long way in changing mindsets. The existence of such communities would provide a vehicle for public, private, and non-profit entities to partner with and spur the adoption of regenerative practices.
- Education and in-kind support among farmers are needed. Creating and maintaining platforms of knowledge exchange between farmers and academics and scientists can alleviate this issue.

PHOTO: Ontario farm, **Stan Shebs**

No land restoration is possible without addressing the systemic racism in the agricultural system

Significance of Indigenous land management and agricultural practices

Agriculture became economically important to many nations in North America between 250 BC and 200 AD and was present continent-wide (Doughty 2010). Maize was introduced between 800 and 1100 AD and quickly became the dominant crop of Indigenous farming societies (Tenaillon and Charcosset 2011). Indigenous farming has historically been focused on multi-crop agriculture to create a high-yield and high-protein diet (Smith 1989). Nations like the Haudenosaunee would develop their unique cropping systems with different crop combinations, with the 'Three Sisters" (see Focus Point) as a prominent example.

For Indigenous peoples, the land is the teacher, and land is kin. Indigenous worldviews hold that humans are in "kinship with the world," which is the idea that humans are in mutually sustaining relationships with all living things (Deloria 1999). The land is a source of knowledge and education; thus, reconnecting with the land is an essential principle of decolonization (Wildcat et al. 2014). Through these perspectives, regenerating the health of ecosystems is not justified through economic gains of ecosystem services. Humans' moral obligations and responsibilities are in their cultural contracts with living things. There is a principle of reciprocity. A regenerative approach to agriculture acknowledges the right for land to exist in a healthy form and leverages the natural relationships among living things to sustain agricultural production. It contrasts with the idea of manipulating the land for human gain at the expense of ecosystem health and sustenance.

According to Indigenous perspectives, environmental stewardship is not conserving the land from human intervention. This adheres to a Eurocentric view of a dichotomy between humans and nature. Through an Indigenous worldview, humans ***are*** nature; environmental stewardship does not separate humans and nature but instead fosters healthy relationships between people and their natural environment. Indigenous peoples have a long tradition of living in harmony with the landscape, balancing the use of resources from the land with the natural world's conservation of resources needed to thrive (Smithers 2019).

Indigenous land stewardship has been incredibly effective with high biodiversity and habitat preservation within Indigenous-administered regions (Schuster 2019). In Canada, 90 per cent of all protected areas within the past 20 years involve Indigenous communities and 80 per cent of all protected lands for biodiversity are under the leadership of Indigenous communities (Audette 2022). With the advancement of ecological crises such as climate change and biodiversity loss, Indigenous leadership in sustainable human-nature relationships is critical.

The use of agriculture as a tool in colonization

Indigenous erasure from the land

Over 15,000 farmers self-identify as Indigenous in Canada, roughly 2.7 per cent of the agricultural population (Gauthier 2019). Most activity relating to Indigenous-led farming is concentrated in the Prairies, though there is also a significant concentration within southern Ontario (Gauthier 2019). While the number of those self-identifying as Indigenous is relatively low, Indigenous farmers have seen the fastest overall growth among the agricultural community, increasing by 21.4 per cent between 1996 and 2016 (Gauthier 2019). The rest of the agricultural community saw a 39.3 per cent decrease in population during the same period. Likewise, Indigenous operators increased by 53.7 per cent, while others saw a decline of 30.1 per cent over the same period (Gauthier 2019).

Indigenous peoples struggled to maintain their (limited) access to land in the late 18th and early 19th centuries. Indigenous peoples made significant military contributions to the British in the American Revolution and the War of 1812. After these wars, those who lost their territories to the

FOCUS POINT:

The "Three Sisters" method and regenerative farming

The Haudenosaunee (alternatively known as the "Iroquois" or "Six Nations") is an Indigenous confederacy composed of the Seneca, Cayuga, Oneida, Onondaga, Mohawk, and Tuscarora. They reside in southern Ontario, though they have historically resided in present-day New York State. The Haudenosaunee are well-known for being well-organized in many areas, including farming, which impressed the early European explorers who travelled to the region (Mt. Pleasant and Burt 2010). The primary system of farming used by the Haudenosaunee is called the "Three Sisters" method, which involves intercropping maize, bean, and pumpkin (sometimes interchangeable with squash, beans, or corn). The intercropping of these specific foods, along with the use of mounds, allowed for an increase in both soil health and productivity (Mt. Pleasant 2016).

To better understand what makes the Three Sisters method a viable one compared to other farming methods, one must decipher what allows for the method to be so efficient. Combining the properties of three crops – maize, beans, and pumpkin – the harvest provides a nutrient-dense combination and allows complementary crops to nurture each other. For example, when intercropped with maize and bean, the flesh of the pumpkin and its amino acids create higher-quality protein for the entire harvest (Mt. Pleasant 2016). This mechanism allows for a richer harvest due to the crops' properties working together to build further soil health and proteins.

Compared to the industrial approaches to agriculture, such as monocropping, the Three Sisters method is significantly more productive in various aspects, such as energy and protein. For example, the Three Sisters method produce two to four times more energy and protein than individual monocultures or mixtures of pumpkin, beans, and maize monoculture within the same area. Although maize monoculture produce similar amounts of food to the Three Sisters method, the Indigenous approach provides much more protein than the maize one (Mt. Pleasant 2016).

Sometimes, the Haudenosaunee also used monoculture over the Three Sisters method, only if their priorities were focused on growing crops other than maize on a large scale. Nevertheless, the Three Sisters' polyculture cropping system yielded more food and supported more people per hectare compared to both conventional monocultures and monoculture mixtures (Mt. Pleasant 2016).

The Three Sisters method and regenerative practices offer many similarities. They prioritize soil health, avoid heavy machinery, and are climate-aware solutions (NRDC 2022). Therefore, using methods such as Three Sisters could prove to be a useful ally in the transition to a new sustainable type of agriculture and a pathway for combining both western and Indigenous farming methods.

PHOTO: Three Sisters, **Sarah Braun**

Americans were often compensated territory in present-day Canada and given land. However, after these conflicts, the British shifted their focus from allying with the Indigenous to selling much of their land and suppressing Indigenous culture (Government of Canada 2016).

Indigenous peoples have often been prevented from being a thriving force in agriculture. A primary example of intentional limitations to participation in the agriculture economy would be the infamous pass system (1885-1951), which limited the ability of Indigenous communities to trade and manage their finances (Carter 2019). This system's primary function was to restrict Indigenous peoples' movement off-reserve unless they were granted written permission (Carter 2019). The system was put in place as a temporary measure after the Northwest Rebellion of 1885. However, it quickly became a permanent measure to exert control over Indigenous groups and conflate demands for sovereignty and autonomy as a sign of disloyalty to the Canadian state (Monaghan 2013). Trade was, therefore, often limited between Indigenous peoples and White settlers, who were often penalized for trading agricultural goods with each other (or had to get written permission, which was slow and rigorous to get through) (Carter 2019). Indigenous farmers were also penalized for success, as government officials often seized agricultural products if the farms or even individual crops became too large (Carter 2019).

The permit system was also a significant challenge to Indigenous prosperity. While the pass system limited the ability of Indigenous peoples to move and trade freely, the permit system ensured that Indigenous peoples could only reach a basic level of agricultural output. Crops and livestock were often seized and re-distributed to White farmers, sales of farm products on reserves were outlawed (which was a key factor that limited trade, as mentioned earlier), and bands could not purchase most required farming equipment, among many other restrictions (Bateman 1996). This meant Indigenous peoples could not produce or sell crops and livestock to the market, but also narrowed bands from furthering their economic development and self-reliance (Bateman 1996).

The residential school system and its attempts to assimilate Indigenous peoples were also extended to agriculture classes. These classes were in many schools and focused on teaching Indigenous children about Western farming methods. The enforcement of Western food methods (along with other factors) resulted in the decline of traditional foods that Indigenous peoples grew for centuries (Price et al. 2022). It also resulted in excluding Indigenous farming practices that were typically regenerative (see Focus Point). Despite these setbacks, First Nations and Métis farmers are still notable in the agricultural community, despite many attempts to limit Indigenous participation in agriculture as a tool of colonization.

Discrimination against Black farmers

Black farmers have had a notable presence in the country. The arrival of the first Black individuals to Canada could be traced back as far as 1628. Many Canadians of Afro-American descent arrived through the American Revolutionary War and later the American Civil War through the underground railroad (Gallant 2001).

While Canada did not have a large population of enslaved peoples, it was still a present force within Canadian society. British Loyalists from the thirteen colonies brought many enslaved people after the American Revolutionary War. Enslaved peoples were present in Canada before their arrival and primarily used for agriculture. However, this would be short-lived as Canada began limiting slavery in the 1790s. Although slavery would be formally abolished throughout the British Empire in 1833, the de-facto abolishment of the practice within Canada had already ceased to exist decades previously (Gallant 2001). Maintaining the institution of slavery within a nation with such a cold climate was costly for those who practiced it (Gallant 2001).

Many Black settlers who fought for the British Empire during the American Revolutionary War or the War of 1812 were often rewarded with land as free peoples and started farming. However, Black farmers were often disadvantaged since their farmland was of poor quality and isolated compared to White farmers (Rawlyk 1968). Such a factor led many Black farmers to feel discouraged about their chances of success within the farming industry (Rawlyk 1968).

Today, Black farmers continue to face many challenges that result from previous historical injustices. This could be seen through the lack of information available from census data on Black populations in government censuses on the agricultural population, which rarely covers race in general. Such trends show an apparent lack of representation within the agricultural sector on this front (Igbavboa and Elliot 2019).

FOCUS POINT:

Social outcomes in farming – Black farmers in Toronto

As seen in previous sections, it is evident that the Canadian agri-food sector heavily benefits both Canada itself and the individuals who reside within it. However, in most cases, the same could not be said for Canada's Black community, where 28.9 per cent of households are reported to be food insecure – the highest percentage of any group in the country (Tarasuk and Mitchell 2020).

This issue has also been recognized by local governments in the Greater Toronto Area (GTA). An example of this would be the 2020 Toronto Strong Neighbourhoods Strategy, which promised to provide additional funding to various neighbourhood improvement areas, which included many of Toronto's Black communities, to promote local food security and propose community-based methods to tackling the issue (such as public kitchens and gardens) among other policy initiatives (City of Toronto 2020).

Many Black urban farmers have reported various instances of discrimination as well as notable challenges that limit any potential future Black farmer from even being able to start their farm (Leitao 2021). Hence, the resolution of this issue lies within Black urban farmers themselves and helps to remove the systematic barriers that have held this agricultural community for centuries.

Black-owned urban farms such as Sundance Harvest, Lucky Bug Farms, and the Toronto Black Farmers and Food Growers' Collective have all contributed to the growing trend of urban farms run by marginalized groups (Leitao 2021 sundance harvest 2023; Lucky Bug Farm 2023; Toronto Black Farmers and Food Growers' Collective 2023). These farms have seen notable success and have amassed significant amounts of attention on both social media and from investors and landowners. Lucky Bug Farm (2023) states that it does interplanting and minimal tillage. These farms are primarily used to provide food insecure individuals with culturally appropriate foods as well as share knowledge and training with the community (CONC 2016; sundance harvest 2023).

However, these farms must also deal with both rampant racism and sexism as well as a struggle to find suitable land (e.g., arable, accessible, affordable) with good infrastructure for agricultural activity (Leitao 2021). These issues prove that Black farmers still face the same setbacks historically seen within the community. While there are notable efforts by local governments to address the issue of food insecurity and the challenges that Black farmers face through policy, there is still much to be done.

The critical role of BIPOC communities in shifting the agri-food system to regenerative practices

Regenerative agriculture and more sustainable methods catalyze the revival of previously suppressed cultural farming practices. Additionally, such methods also help to increase autonomy for these groups. The Indigenous and Black communities have long been leaders in regenerative agriculture practices despite their marginalized perspectives within agricultural communities. An example of regenerative methods within the Black community would be black figures such as George Washington Carver, who not only developed the modern term of "regenerative agriculture" but also developed a method of crop rotation by adding legumes such as peanuts and sweet potatoes to restore the soil previously eroded by crops such as cotton (Reid and Weinstein 2021). Black, Indigenous, and other People of Colour (BIPOC) farming methods could significantly contribute to a more sustainable agricultural system and the fight against global climate change (Global Alliance For The Future Of Food 2021).

Shifting to regenerative practices could also help remove the colonial attitudes dominating the agricultural sector. This connection could be exemplified through the increased use of Indigenous methods of regenerative agriculture. An example of this would be the practice of agroforestry, which combines the management of trees, crops, and animals in a system that benefits all three (Heim 2020). Such methods could also be seen through the previously mentioned Haudenosaunee "Three Sisters" polyculture method (see Focus Point).

While policymakers increasingly recognize Indigenous methods, they often judge them as impossible to adopt on a large scale (Global Alliance for the Future of Food 2021). This rejection is notably explained by the Eurocentrism focus on scientific methods that associate heavy machinery usage with progress. Regenerative methods are inherently connected to decolonization and reconciliation with the Indigenous and BIPOC peoples (Layman 2022).

Creating a healthy mindset toward the land is essential for fostering an agricultural system that prioritizes environmental health. BIPOC viewpoints could serve as a guide since these groups have practiced regenerative methods for centuries. For example, research shows Indigenous groups across Canada could generally meet their nutritional needs (even in harsh environments) without needing mechanized farming, chemical fertilizers, pesticides, or other modern agricultural practices (Global Alliance for the Future of Food 2021). This notably results from the Indigenous beliefs that land is sacred and must be conserved, and that humans are responsible for protecting and stewarding the environment (Audette 2022). This can align with western Westernized notions, where the land must be preserved for the sake of its longevity in a world of increased industrialization.

FOCUS POINT:

The social benefits of regeneration – Revitalizing our Sustenance

Beyond the environmental benefits of regenerative methods initiated by these communities, another benefit is the social outcomes generated in tandem. For example, Revitalizing our Sustenance Project is an Indigenous-led initiative which started in 2020 amidst the COVID-19 pandemic and threats to food security (revitalizingoursustenance 2023). The project uses regenerative farming methods for land restoration. Beyond the ecological benefits of these methods, the project also exemplifies the many social and cultural community benefits from engaging in regenerative agriculture practices.

Revitalizing our Sustenance Project works with Indigenous and non-Indigenous youth to increase learning about sustainable agriculture, environmental restoration, and land-based learning. In addition to addressing food security concerns on-reserve and offering intergenerational knowledge-sharing opportunities, it has also benefited the local community by advancing Indigenous sovereignty (revitalizingoursustenance 2023).

The unspoken problem of migrant workers' conditions

Migrant workers represent a growing share of the Canadian workforce; the number of work permits issued for migrant work has doubled since 2005, with 613,000 issued in 2016 (Zhang, Ostrovsky, and Arsenault 2021). Since the 1960s, agriculture has been one of the critical recipients of migrant workers, with one in five individuals assigned to crop production. Transitioning from family-owned to corporate farms requires more workers (Beckford 2016). Migrant workers fill positions that tend to deter permanent residents and Canadian citizens primarily due to low wages and challenging manual labour requirements (Zhang, Ostrovsky, and Arsenault 2021). Migrant workers' role is essential to the agri-food industry as more than 40 per cent of Canadian farm operators are set to retire by 2033 (RBC 2023). Through their work, they hope to gain a pathway to citizenship and a stable income for themselves and their families (Weiler and Mclaughlin 2019).

While the federal Temporary Foreign Worker Program (TFWP) has many benefits, there are some concerning trends. Migrant workers face precarious work situations; low wages means they often volunteer for overtime (including on holidays and weekends). They also may be more reluctant to take breaks and care for themselves, in efforts to impress their managers and improve their chances of being rehired for another season (Beckford 2016). Employers typically have complete control over their food, (often poor) housing, movement, and finances. Therefore, there is a clear imbalance of power within these farms where the employee feels that their employment could be taken away at any moment (Beckford 2016). Workers are imposed with curfews, the need for informing their employers of their whereabouts outside the farm, and prohibiting visitors of the opposite sex (Preibisch 2010). This status quo ensures compliance and pressures migrant workers into doing work that could be considered unsafe (Preibisch 2010). And though these reports are almost a decade old, recent data gathered through advocacy groups have shown that these conditions have not changed despite some attempts to improve the system (Migrant Workers Alliance for Change 2022).

The Canadian government has tried to address the issues through various amendments to the ***Immigration and Refugee Protection Act*** – the governing document of Canada's migrant worker program (Government of Canada 2022). This has helped to ensure that such workers are given proper treatment and accommodation. Despite migrant workers being protected under provincial law, these issues have yet to be addressed appropriately. For example, no appeal system is in place to ensure that migrants are not wrongfully terminated from their positions and evicted from their houses, adding to the unbalanced power structure between employer and employee (Preibisch 2010). In 2023, the Canadian Federal Government introduced a pilot program that would incentivize employers to adhere to worker protection. Companies with good standing would only need to prove that they require foreign workers every three years rather than every 18 months (Osman 2023). Nevertheless, many issues still exist and must be addressed to build an agricultural system that works for everyone – particularly since migrant workers will play a crucial role in the next generation of farmers in Canada. If we are to leave behind the current agricultural status quo from an environmental standpoint, we must also do so from a socio-political perspective.

The critical role of relationships-building in regenerative agriculture initiatives

"Capital moves to nature at the speed of trust"
– Manuel Piñuela (Eng, King, and Strong 2022).

Mutually respectful relationships among communities, people, and the land are needed to advance regenerative agriculture. New forms of engagement are necessary to create safe spaces for engagement and develop trust. This is especially true in nature-based markets which face the colonial legacies of financial markets, the power dynamics within agricultural production, and the cultural insensitivity of commoditizing nature.

The IPBES Working Document references enabling more equitable decision-making processes to achieve better results (Pascual et al. 2022). It highlights the need to recognize diverse values through participatory assessments to lead to fairer project costs and benefits distribution. Involving numerous stakeholders and rightsholders in the

project can improve social-economic-ecological outcomes. The article states that payments to ecosystem services programs with substantive community engagement, and adaptation to local demands, can better align values among stakeholders and rightsholders and achieve better outcomes over time (Pascual et al. 2022). The authors emphasize the importance of prioritizing small landholders' knowledge, including women, in co-designing agrobiodiversity initiatives. They also raise how alliances of civil society, Indigenous peoples, and local communities have promoted local food systems. This validates the significance of including stakeholders and rightsholders in regenerative farming initiatives at every stage of the project.

PHOTO: Workers, **michael_swan**

Summary

Key Takeaways:

- Agriculture has historically been used as a tool of colonization and a playing field for power dynamics that have marginalized certain communities.
- Traditional agriculture practices, such as the Three Sisters Method, are examples of regenerative techniques that meet the needs of the natural ecosystems and the communities that live among them.

Barriers:

- In the current system, many farmers, and workers within the BIPOC community still face discrimination in agriculture. Such challenges are often seen through the legacy of colonialism and have yet to be properly addressed.
- Historical subjugation of Indigenous knowledges and practices through Canadian laws and programs has had profound consequences for the continuation of Indigenous agriculture traditions that are in essence regenerative.
- Migrant workers are not appropriately treated despite their essential role in the agricultural system.

Conditions for Success:

- Engaging BIPOC leadership in a just transition towards regenerative agriculture.
- Including migrant workers adequately in the transformation of the agricultural system.
- Acknowledging the cultural significance of land, crops, and farming practices.
- Creating safe space for engagement, relationship-building, and trust.

Downstream demand for regenerative agriculture: The role of the governments, agri-food companies, and consumers and financiers in the transition toward regenerative agriculture

Regenerative agriculture is a governmental priority

Like many jurisdictions worldwide, Canada is developing a national sustainable agriculture strategy that incorporates low-carbon and circular opportunities for the private sector (Agriculture and Agri-Food Canada 2023b). In November 2021, the federal, provincial, and territorial Ministers of Agriculture released the Guelph Statement: a shared vision for Canada to be recognized as a world leader in sustainable agriculture. Its guiding principles include addressing climate risks in agriculture and agri-food. It prioritizes GHG emission reductions, which is aligned with the federal government's climate plan target of reducing emissions from the application of fertilizers to 30 per cent below 2020 levels by 2030. These targets are aligned with global calls to address climate change and biodiversity loss, including the UN Sustainable Development Goals, the Paris Agreement, and the Kunming-Montreal Global Biodiversity Framework (see Focus Point). It remains to be seen how major food companies and farmers will adapt. However, the strategy's outcome may provide enabling conditions for supporting regenerative agriculture in Canada, highlighting numerous regenerative principles like soil health, water, and biodiversity (Agriculture and Agri-Food Canada 2023b).

Various government initiatives exist across the public sector to advance the adoption of regenerative agriculture. AAFC's Agricultural Climate Solutions (ACS) program funds the Living Labs and the On-Farm Climate Action Fund. Living Labs is a CAD 185 million 10-year program where industry and government scientists collaborate on improving agriculture's climate resiliency (Agriculture and Agri-Food Canada 2022b). The program addresses the benefits of shelterbelts and cover crops, which are regenerative agriculture practices, as well as recognizes increased risks to food production and income from extreme weather events and animal or plant diseases. Strengthening the health and resiliency of local ecosystems is crucial for sustained agricultural production. One of the Living Lab's project's focuses is carbon sequestration in agricultural soils (Agriculture and Agri-Food Canada/Agriculture et agroalimentaire Canada 2019). The On-Farm Climate Action Fund is a CAD 200 million, three-year fund (from 2021 to 2024) supporting farmers adopting beneficial management practices (BMPs), storing carbon, and reducing GHGs in three areas: nitrogen management, cover cropping, and rotational grazing practices (Agriculture and Agri-Food Canada 2022b).

The Ontario government has unveiled an agri-food strategy. However, its goals seem inconsistent with planning changes to spur low-density development in farm and agricultural areas. OMAFRA released ***Grow Ontario,*** the province's agri-food strategy, in November 2022. It prioritizes supply chain improvements, technology adoption, and increasing the labour force. It sets numerous targets with a 2032 deadline, e.g., increasing the production of Ontario-grown and produced food by 30 per cent and growing Ontario's agri-food exports by eight per cent annually. The province's strategy focuses on improving the efficiency of current farming operations in Ontario to increase the sector's productivity. An interest in improving the efficiency of BMPs to foster better soil health and water retention is worth noting (Ministry of Agriculture, Food and Rural Affairs 2022a). The provincial government also announced CAD 9.5 million to enhance soil mapping, monitoring, and evaluation in its 2023 budget, supporting its agri-food strategy (Government of Ontario 2023b). However, neither the Ontario provincial budget nor the agri-food strategy prioritizes prominent regenerative agriculture practices like no/low till, no/low external inputs, and rotational grazing. Furthermore, the province's agri-food growth and production goal could be at risk from land use planning changes to encourage real estate development, e.g., low-density, in agricultural and rural areas.

As of 2023, there is some support for regenerative agriculture from both the federal and provincial governments. Along with previous commitments in the federal budget mentioned earlier, the federal government dedicated CAD 182 million to partner organizations for

helping to build more sustainable agriculture in Canada (Government of Canada (Press Release) 2022b). Additionally, the government of British Columbia (with the federal government's help) introduced a funding stream for regenerative agriculture aimed at knowledge and technology-sharing (Government of British Columbia 2023b). While these may seem like small legislative steps, they represent a shift towards enacting more extensive government programs regarding sustainable farming in the future. There are multi-party examples that Canadian governments can look to for inspiration. For example, the Soil and Water Outcomes Fund has signed an agreement with the U.S. Department of Agriculture to support practices like carbon sequestration and water quality improvements. Cornell University is working with lenders and farmers on a USD 1.2 million project to encourage adopting regenerative agricultural practices in the Great Lakes basin (Gashler 2022).

Initiatives also exist across the public and civil society sectors in Canada. Farmers for Climate Solutions is a National Farmers Union of Canada program working with farmers to implement practices that reduce GHG emissions and increase carbon sequestration (Farmers for Climate Solutions 2023). The program provides farmers with training, resources, and funding to help them adopt sustainable practices. Additionally, the British Columbia Agriculture and Food Climate Action Initiative program provides training and support to farmers to adopt practices that aid in achieving climate targets (Government of British Columbia 2023a; Climate Change Adaptation Program 2023). Participating farmers develop carbon management plans and are provided resources to implement sustainable practices. Lastly, the Soil Carbon Initiative is a Prairie Climate Centre project that aims to increase soil carbon sequestration in the Canadian Prairies (Soil Carbon Initiative 2023). The project provides training and resources to farmers to implement sustainable agriculture practices that increase soil carbon storage. In addition to government targets and initiatives, programs within industry associations are beginning to emerge. For example, the Dairy Farmers of Canada have released targets to be net zero by 2050 and are regulating best practices among farmers in Canada to support this transition (Dairy Farmers of Canada 2022a).

Beyond the farming industry, Canada is committed to protecting at least 30 per cent of the land, inland water, and coastal and marine areas by 2030 (see Focus Point). Various companies upstream and downstream of the farm and in adjacent industries to farming have a role in leading this transition by supporting regenerative agriculture to advance climate targets and reverse biodiversity loss. With these imminent targets, leaders in the industry are acting to get ahead of the regulatory demands and adopt ecological best practices to reduce the impact on local ecosystems and climate.

FOCUS POINT:

The Kunming-Montreal Global Biodiversity Framework

Many countries have introduced targets to reverse the climate and biodiversity crises. In 2015, Canada, the UK, and 193 other countries adopted the Paris Agreement with the long-term goal of keeping the average global temperature rise below 1.5°C and 2°C. In 2021, they joined more than 120 countries to achieve net-zero emissions by 2050. In 2022, the Kunming-Montréal Global Biodiversity Framework was adopted, through which governments committed to protecting 30 per cent of their lands and waters by 2030.

Agri-food companies' push toward regenerative agriculture

A concerted shift toward a new business model integrating regenerative farming among significant food companies globally has emerged. The shift has numerous reasons: changing public policy, worries about farming practices' long-term productivity, and consumers and shareholders pressures to adopt more sustainable practices initiatives (Jindřichovská, Kubíňková, and Mocanu 2020). Agri-food companies are getting more involved in the food chain to consider producers' practices and whether they align with company values, with the aim ensuring a quality product and transparency of ecological impacts in the value chain.

There is a business case for adopting sustainability. Research has found that a company's financial performance is positively impacted by sustainability initiatives such as corporate social responsibility (Flammer 2015).

In the agri-food sector, companies performing best in ESG (environmental, social, and governance) dimensions improve profitability (Cupertino, Vitale, and Riccaboni 2021). However, many factors may influence this relationship and lead to differing results on the profitability of sustainability (Alshehhi, Nobanee, and Khare 2018).

Agri-food companies are getting involved with producers up the supply chain, including farmers, which translates into targeted commitments toward regenerative agriculture. For example, Pepsico aims to apply regenerative agriculture practices to over seven million acres by 2030. Similarly, Danone has committed to cutting methane emissions from its fresh milk supply chain by 30 per cent by 2030, partly through applying regenerative agriculture practices. Unilever has committed to implementing regenerative agriculture and developing principles for perennials, dairy, and arable crops. Unilever also has a sustainable agriculture code, containing regenerative agriculture principles containing regenerative agriculture principles that commit to tracking and monitoring soil health, biodiversity, farm profitability, water, and resilience (Unilever PLC 2021). Finally, McCain has stated that it will implement regenerative agricultural practices at 100 per cent of its potato acres worldwide by 2030 (McCain Foods 2022a). To support this target, McCain launched the "Farms of the Future" program based on regenerative agriculture principles like reducing soil tillage, increasing livestock grazing, and improving crop diversity. McCain developed a tiered-level system for farmers to progress through as they meet regenerative agriculture performance criteria.

The Science Based Targets initiative (SBTi) defines best practice emissions reductions and net zero reduction in line with science (Science Based Targets 2023a). Unilever and Pepsico have set and committed to science-based targets whereas Danone has only set its target (Science Based Targets 2023b). Agropur Cooperative, Maple Leaf Foods, McCain, Open Farm, and Riverside Natural Foods have set science-based targets to reduce scope 1 and 2 emissions, which include GHG emissions associated with direct production and indirectly through purchased electricity. According to the SBTi, setting 1.5°C targets is more ambitious than well below 2°C. (Science Based Targets 2020) Agropur Cooperative and Maple Leaf Foods have set targets well below 2°C, while McCain, Open Farm and Riverside have set 1.5°C targets. Conversely, Nutrien has removed its commitment (Science Based Targets 2023b). A critique of these corporate targets is the lack of outcomes described at the farm, landscape, and global levels, advocating for the need for a systems perspective (Ewer et al. 2023). Setting distant goals with few details leaves firms open to criticism about how serious they are in their commitments to regenerative agriculture practices. Such ambiguity can also invite concerns about companies reducing the intensity of their activities but not reducing their overall impacts on an absolute basis, e.g., number of acres farmed, litres of water used or carbon emissions.

Despite the benefits of these corporate commitments, there are still barriers preventing the food industry from getting involved in the transition to regenerative agriculture. First, there is a condition of food consistency; to supply restaurants and partners downstream, farmers need to ensure consistent outputs. This could be disrupted in the short term due to the transition and adoption of regenerative practices. Additionally, practices such as cover cropping and intercropping may decrease yield in the short-term and introduce inconsistency in variety of a particular crop output. While this presents an opportunity for farmers to diversify their products, there are inherent risks. For example, reduced quantity can hinder farmers' ability to reach economies of scale in bringing their products to market, and a change in product quality may cause some suppliers to rethink their contracts.

Consumer interest in regenerative agriculture

The early phase of the COVID-19 pandemic gave consumers more time and space to understand the agri-food system, which helped fuel an interest in regenerative agriculture. Films like "The Littlest Big Farm" and "Kiss the Ground" bolstered interest (Blair 2021; Fawcett-Atkinson 2022). Breakdowns in cross-border food supply chains raised consumer awareness about their fragility, driving consumers to seek local or domestic food sources (Nguyen 2022).

Some consumers are willing to pay a premium for regeneratively raised or grown products due to sustainability and their health benefits (Saba 2021; Montgomery et al. 2022). Indeed, consumer concerns over pesticide usage are among the factors that have influenced this interest. In June 2023, Bruce Lanphear resigned as co-chair of an independent scientific committee advising Health Canada's

Pesticide Management Regulatory Agency (PMRA). Dr. Lanphear cited an "obsolete" methodology for assessing chemicals and frustration over information that was withheld from the committee (Thurton 2023).

Regeneration Canada has raised public awareness of regenerative agriculture through their events and offers an online map for consumers to source regenerative farmers (Saba 2021). Farmers practising regenerative agriculture receive a price premium when selling directly to consumers, but rarely when selling to wholesalers or retailers. In such a case, consumers seeking regeneratively grown or raised foods must rely on the packaging at grocery stores or ask farmers directly.

Our interviews illuminate farmers who doubt most consumers' willingness to pay for regenerative agriculture despite a growing interest in the practices. High inflation in Canada since 2021 has affected food prices, causing consumers to cut grocery spending (Ferreira 2023; Krashinsky Robertson 2023). Statistics Canada's Consumer Price Index (CPI) is declining steadily, registering at 3.8 per cent year-over-year in September 2023 (Statistics Canada 2023f). Grocery prices were a major driver, with a 5.8 per cent year-over-year increase in September 2023, where fresh fruit, fish, bakery products and edible fats and oils were the major contributors (Statistics Canada 2023f). In Québec, inflation is the top concern among consumers polled on food habits. Though many consumers continue to care about their foods' environmental footprint and animal welfare impact (De Marcellis-Warin et al. 2023), high food prices remain a deterrent to the premiums on ethically grown food, with Food Banks Canada reporting a 35 per cent increase in food bank usage from March 2019 to June 2022 (Food Banks Canada 2022). Thus, the economic factors of prudent consumer spending on groceries pose headwinds for a potential consumer market for regeneratively grown and raised products in Canada.

FOCUS POINT:

The relevance of regenerative agriculture when produce is not used for nourishing humans

Many foods like grains are exported and used as animal feedstocks or to produce fuels, e.g., ethanol. The domestic grain industry is an important contributor to animal feed production in Canada. The most recent figures estimate that 80 per cent of barley and 60 per cent of corn grown in Canada was used in feed manufacturing (Animal Nutrition Association of Canada 2021). In 2019, 39 percent of Ontario's grain production was used by feed manufacturers, an eight per cent increase since 2016 (Grain Farmers of Ontario 2020). The average annual global land use for dry pet food is 49 million hectares, twice the size of the United Kingdom (Alexander et al. 2020). Roughly half of global dry pet food comes from maize, grain, rice, soy, and their derivatives (Alexander et al. 2020).

Meanwhile, corn ethanol and soybean-derived diesel are feedstocks for low-carbon fuel production. Grain corn is estimated to account for about 33 per cent of Ontario's ethanol output (Miller 2021; Grain Farmers of Ontario 2022). Canada produced 1.6 million cubic metres of ethanol in 2021 , accounting for about 10 per cent of regular gasoline in Ontario (Statistics Canada 2022h). The Ontario government enacted the Cleaner Transportation Fuels regulation under the Environmental Protection Act in 2021 (Government of Ontario 2020). It requires gasoline or diesel producers, buyers, and importers to have 10 per cent content from biofuels (e.g., ethanol, biodiesel), and the requirement will increase gradually to 15 per cent in 2030 and beyond (Ministry of Environment, Conservation and Parks 2023). The lack of market price incentives for regenerative agriculture may make farmers reluctant to adopt these techniques, particularly for grains destined for animal consumption or fuel use.

Questions can be raised about the global environmental footprint of such agricultural usages, even in farmers who adopt regenerative practices. Additionally, using corn for ethanol has been criticized for displacing agricultural lands designated for food production (Reguly 2022). It was estimated that 2.8 million tonnes of agricultural residues could have been sustainably harvested in 2009 in Ontario without degrading the soil (Hewson 2010).

The relevance of ecosystem regeneration for the insurance industry

Globally, the crop insurance market was valued at approximately USD 34 billon in 2019, with a projected increase to USD 53 billion by 2027 (Aarti, Pramod, and Vineet 2020). In Canada, the overall value of insured provincial crops has reached nearly CAD 10 billion for the past two years (Aldrich 2023). Traditionally, farmers were required to mitigate their own risks by diversifying crop production. Crop insurance emerged as a response to risks and costs associated with disrupted production, for example, planting inhibition and reduced yield quality or quantity as a result of environmental conditions outside of farmers' control (e.g., drought, flood, freeze, fire, wind, insect infestations, wildfires, and disease) (Agriculture and Agri-Food Canada 2019).

With the increase in these extreme weather events, there is a growing interest in research on the risk management benefits of regenerative practices. This implicates the insurance industry through crop insurance and the protection of downstream infrastructure, including households and businesses.

For example, one case in the United States saw USD 4.2 billion in crop insurance claims paid out for prevented planting due to the prohibitive planting conditions of an exceptionally wet season (Schnepf 2019). For the same period, a national survey showed that 78 per cent of farmers who planted cover crops did not submit a prevent-planting claim (AGree 2021).

On the other end of extreme weather, Canada was threatened by an unusually hot and dry growing season in 2021, with 74 per cent of agricultural lands nationally classified as "Abnormally Dry to Exceptional Drought" (Chen and Fernandes 2021; Agriculture and Agri-Food Canada 2023c). Soil organic matter, including carbon, helps retain water in the soil, which protects it during drought. Fostering soil organic matter through regenerative practices on the landscape thus benefits farming.

Regenerative practices that increase the resiliency of the land are of interest to the insurance industry since they help reduce climate risk and payouts for extreme weather events.

Financier's growing interest in sustainable agriculture

Increasing risks for financiers due to the climate and biodiversity loss crises

It is estimated that CAD 31 billion is required in Canada's agriculture sector to achieve net zero by 2050 (Royal Bank of Canada 2021). Among Canada's top banks, there is no dedicated financial instrument for regenerative agriculture.[7] On average, agriculture accounted for 2.55 per cent of the top seven Canadian banks' loan portfolios in 2022.[8] Residential mortgages account for 46.59 per cent of their loan books. The latter might provide a negative incentive to support agriculture, given that subdivisions built on farmland would increase residential bank mortgages.

Certain Canadian banks report on regenerative agriculture practices in their net zero reporting. The For example, Royal Bank of Canada (RBC) has published about practices that can reduce agricultural carbon emissions. Bank of Montreal (BMO) reports on "production efficiency improvements" in its thematic funds' agricultural focus, and also reported its financed emissions in the agriculture sector as 6,991 ktCO2e (6.991 MtCO2e) for 2020 (BMO Financial Group 2023). The Bank of Nova Scotia reports its financed emissions in the agriculture sector as 3.9 MtCO2e in 2019, but with a large margin of error (Bank of Nova Scotia 2023). The Toronto-Dominion Bank (TD) reports its credit and carbon exposures to agriculture. In TD's case, Scope 1 and 2 financed emissions of its drawn loans in agriculture in 2020 were 9.3 MtCO2e, lower than its 9.6 MtCO2e commitment (Toronto-Dominion Bank 2023). All reported financed emissions were the sum of Scope 1 and 2.

Cooperative banks and credit unions have favoured local economic development, which in rural contexts supports the agricultural sector (Macpherson 2014). Ontario has over

7 We included Canada's top banks by assets: Royal Bank of Canada, Toronto-Dominion Bank, Canadian Imperial Bank of Commerce, The Bank of Nova Scotia, Bank of Montreal, Desjardins Group, and National Bank of Canada.

8 The seven banks were: Royal Bank of Canada, Bank of Montreal, Canadian Imperial Bank of Commerce, Toronto-Dominion Bank, The Bank of Nova Scotia, Desjardins Group and National Bank of Canada.

70 credit unions, with numerous in rural areas (Central 1 2023). FCC is a crown corporation exclusively focused on agriculture. FCC launched a specialized financial instrument for regenerative agriculture in 2022 (see Focus Point).

FOCUS POINT:

Farm Credit Canada and McCain Foods Partner on Financial Instrument

In November 2022, FCC and McCain Foods announced a financial instrument for potato farmers to transition to regenerative agriculture practices. Funds from the FCC's Sustainability Incentive Program and McCain will provide an annual incentive to farmers involved in such practices. Eligible farmers will received up to CAD 2,000 annually from McCain, and one-year free access to FCC agriculture software (McCain Foods 2022b). There is also a sliding scale financial payment from McCain depending on which level farmers are on the framework up to CAD 14,000 (McCain Foods 2022b). The more advanced farmers are on McCain's regenerative agriculture framework, the higher the payment.

The largest seven banks by assets report varying GHG exposure to agriculture. We are measuring this based on financed emissions, defined as disclosure of GHG emissions in listed equity and corporate bonds, business loans and unlisted equity, project finance, commercial real estate, mortgages, motor vehicle loans, and sovereign debt (Partnership for Carbon Accounting Financials 2023). Most Canadian banks identify agriculture as a significant physical risk: Scotiabank estimates that 30 per cent of its Scope 1 and 2 financed emissions are in agriculture (Bank of Nova Scotia 2023). Agriculture accounted for 32.9 per cent of TD Bank's 2020 financed emissions. BMO discloses that agriculture accounted for 15 per cent of its 2020 financed emissions. Four of the seven banks did not disclose the percentage or the quantity of financed emissions for the agriculture sector in their most recent net zero and climate reports.

The agricultural industry is increasingly risky for financial institutions due to the threats posed by droughts, floods, pests, disease, and high transaction costs (Ruete 2015). The natural hazards, volatility of prices, and challenges with landownership for collateral are risk factors present in agriculture that prevent lending (IFDA 2009). In the face of disruptive ecological crises like climate change and biodiversity loss, financiers are exposed to additional levels of risk, with increased frequency of droughts, floods, disease, and demand for land (Insurance Bureau of Canada 2022). The Canadian Climate Institute estimated that climate change will cost the Canadian economy CAD 25 billion dollars by 2025, representing half of Canadian annual GDP growth (Beugin and Sawyer 2022).

Although much of the risk associated with these grand-level crises is related to "black swan events" (Taleb 2010),[9] the gradual accumulation of extreme weather events and other related issues associated with climate change and biodiversity loss warrants attention and mitigation.

Financiers experience climate risk, risk associated with the volatility of returns, and increased default risk due to the impact of climate change. However, current risk management techniques must adequately capture climate risk's radical uncertainty (Christophers 2017). This leaves the finance and insurance industries particularly vulnerable to absorbing climate risk (Grimaldi et al. 2020). Thus, insurance actors and the finance industry should have a vested interested in supporting a shift to regenerative practices and strengthening ecosystem resilience.

Evaluation of the investors' initiatives and involvement in regenerative agriculture

According to Pitchbook, in July 2023, there were USD 2.58 billion invested in 116 companies (at various stages) involved in regenerative agriculture. In 2022, USD 385 million was raised for companies in regenerative agriculture, mostly from venture capital. Indigo Ag has become well-known for a plant microbiome agricultural service to increase crop yields. Investments in Indigo Ag account for nearly USD 1.7 billion between 2016 and 2022. Most are roughly 70 per cent of what has been raised under the regenerative agriculture category (Pitchbook 2023b). Tikehau Capital manages the Regenerative Agriculture Fund, whose focus includes biodiversity. The fund has a target size of USD 1.07 billion

9 A black swan event is a metaphor used to describe an event that is extremely rare such that it cannot be predicted, yet the consequences of the event have a high impact.

but has raised USD 320 million (Pitchbook 2023c). The fund's backers include AXA and Unilever.

There are signs that financiers recognize the importance of financing investments into regenerating local ecosystems as a critical agriculture practice, not just machinery, land, etc.. Financing needs in agriculture include the needs of farmers (e.g., farming inputs, production, and marketing), strengthening the connections between farmers and other actors in the value chain, infrastructure systems to support farming, and generating knowledge through research and development (Ruete 2015). Thus, financial actors need to consider investing in regenerative agriculture and supporting the biodiversity of natural ecosystems, not as a philanthropic addition but as smart and sustainable business practices to mitigate risk.

FOCUS POINT:

Is technology the solution?

Novel technological solutions are attractive and often are met with optimism that they will solve the complex issues facing society. However, the nature of systemic issues is such that there is often no single "silver bullet" solution, but rather a combination of smaller actions that progress the system in the right direction.

Although there may be no single technical solution to regenerative agriculture, technological advancements can support the adoption and monitoring of nature-based solutions (Eng, King, and Strong 2022). For example advancements in soil testing and monitoringhas helped take the guesswork out of farming; farmers can apply more targeted interventions to their crops and soil and reduce the economic and environmental costs of excess inputs. Technologies that track environmental DNA (eDNA) are becoming more accessible, allowing better monitoring and data on environmental performance (NatureMetrics 2023).

.Agtech and nature tech are growing areas of interest. Agriculture Technology (agtech) includes hardware and software that aims to improve agriculture operations' efficiency, sustainability, and resilience (Frederick 2023). This can include agriculture biotech, agrifinance and e-commerce, indoor farming, animal agriculture, and precision agriculture (Pitchbook 2023a). Despite a slowdown in Q1 2023, 2021 and 2022 saw significant Venture capital activity in the agtech sector. Agtech has attracted great investor interest. According to Pitchbook, there was a high of USD 13.8 billion in deal value and 1,234 deals in agtech in 2021.

Another type of technology that has gained traction in the agriculture industry is Nature Technology (nature tech). Nature Tech includes technologies that mimic Earth's ecosystem function to accelerate nature's regeneration and advance nature-based solutions (Eng, King, and Strong 2022). An example of nature tech includes biomimicry or nature-inspired innovations, which use nature as a point of departure for human-made technology interacting with ecosystems. One example is the innovation of perennial grain crops which can lead to reduced herbicide usage and erosion, minimized soil disturbance, and improved soil structure (The Land Institute 2023).

Beyond technological innovations, social innovations are also needed to mobilize solutions for regenerative agriculture. Technology can play a key role, but there is also immense power in low-tech solutions that convene actors across the system to impact change in regenerative agriculture.

High-tech is meeting low-tech with several start-ups. For example, the online platform Grain Discovery uses blockchain to provide better price discovery for farmers and traceability (Grain Discovery 2023). In another example, Pacific Ridge is an Alberta-based company that offers a platform for those in the plant-based value chain, e.g., farmers, suppliers, consumers etc. to share information about their foods' regenerative practices. It also sells technologies to help farmers with issues facing their plant-based foods. And Danish start-up Agreena is using remote sensing software to obtain data on regenerative practices. It targets agri-food companies and carbon market providers. Agreena mainly generates revenue through a subscription service.

Multi-stakeholders and rightsholders' initiatives

The role of institutional investors (e.g., asset managers and pension funds) in influencing oil and gas companies to adopt carbon-reducing practices has been well-publicized (McGrath 2023; Kenyon 2022). Institutional investors are well-positioned to engage with their investee agri-food and chemical companies to adopt regenerative practices. Investors are also interested in pushing for ecological and economic outcomes in the agri-food sector. Inaction exposes investors and companies to reputational risks from increased NGO and public scrutiny. For instance, Planet Tracker published a report in January 2023 criticizing the lack of practices for addressing methane emissions of the top institutional investors and banks invested in 15 leading meat and dairy companies.

Numerous relevant investment initiatives exist to influence agri-food and chemical companies. Climate Engagement Canada (CEC) is a collaborative engagement initiative organized by the Responsible Investment Association (RIA), Shareholder Association for Research and Education (SHARE), and Ceres. In June 2022, CEC announced its CEC Focus List of firms it would engage on climate risk governance, disclosure, and a low-carbon economy transition in Canada (Climate Engagement Canada 2022). Six firms are in the agri-food and chemical sectors, including on the CEC Focus List: Alimentation Couche-Tard Inc.; Saputo Inc.; Loblaw Companies Ltd.; Empire Company Ltd.; Metro Inc.; and Nutrien Ltd. They have yet to publish any documents with their progress on engaging with firms on a sector-by-sector basis. At an international level, the UK-based Farm Animal Investment Risk and Return (FAIRR) Initiative is a member-based network focused on ESG in intensive livestock production (FAIRR 2023).

The Finance for Biodiversity Pledge represents 126 financial institutions and EUR 18.8 trillion (CAD 27.44 trillion) in assets under management.[10] These investors ask global leaders to protect and restore biodiversity through finance and investments by engaging with companies and setting targets. The Kunming-Montreal global biodiversity framework in December 2022 motivates investors to prioritize biodiversity, including regenerative agriculture. Manulife is co-leading the World Business Council for Sustainable Development (WBCSD)'s Scaling Positive Agriculture project, prioritizing climate, nature, and farmers. Manulife claims that many of its farms use regenerative techniques. The insurer and asset manager cite an almond farm in California that it is invested in. The farm does not use synthetic fertilizers or pesticides, and employs cover crops and reduced tillage.

Aside from engagement, there are impact-oriented initiatives. For example, the AGRI3 Fund aims to mobilize USD 1 billion through financial institutions to encourage transactions that prevent deforestation. It is a partnership between Dutch financial institutions, the Dutch government, and the UN Environment Programme. The tools it is proposing include credit enhancement and technical assistance.

10 Exchange rate as of September 8, 2023, https://www.bankofcanada.ca/

Summary

Key take-aways:

- Federal government priorities and corporate targets in the food chain are drawing more attention and interest in regeneration.
- The Kunming-Montreal Global Biodiversity Framework may provide tailwinds for regenerative agriculture adoption.
- Consumers contribute to the demand for regenerative practices, yet the instruments for consumers to pay for regenerative practices are not always apparent in distribution models.
- The insurance and the financial industry benefit from regenerative practices as a risk management strategy to develop resilience of the landscape, especially in the face of climate risk.
- Investors are beginning to show interest in regenerative agriculture, positioning it as a potential industry for growth.

Barriers:

- Demand from end consumers for regenerative agriculture paired with an unwillingness to pay more. If the downstream industry only values the end food products, it is not incentivizing regenerative practices that support the natural system and production.
- The lack of a universal definition puts this term at risk of greenwashing when companies make commitments, especially if the supporting details for implementation are lacking.
- Interest in investment in regenerative agriculture, but lack of investment readiness in the industry.
- Various industries receive the benefits, but the end benefits are not always monetized in current business models.

Conditions for success:

- Investment opportunities with measurable impact must go beyond accusations of greenwashing in corporate commitments.
- Integrating regenerative practices downstream to the industry can create new markets for regenerative products.
- Support needed for investment opportunities and ag tech start-ups that support regeneration.

PHOTO: Sheeps feasting, **twohumans / Getty Images**

Beyond industrial agricultural practices, the need to address the problem of farmland's disappearance through planning: The case of Ontario

The influence of land use planning and zoning on farmland loss

Property zoning presents threats and opportunities for regenerative agriculture practices. Land use planning is the practice of designating what types of development can occur in urban and rural planning resources over time. A Zoning By-law (ZBL) is a regulatory document that implements the policy of the official plan, prescribing the use and provisions, e.g., building heights. A ZBL will also define terms like agriculture and rules that apply to land use classifications. These uses are defined in long-range documents like official municipal plans. For instance, residential-classified properties would promote housing construction. A property zoned "low-rise residential" could require building homes to be on full municipal services, and may accelerate infrastructure construction like paved roads and wastewater to support future single-detached and semi-detached homes or townhouses.

Agricultural zoning is often initiated to support local farming, reduce sprawl, and protect the environment (Deaton and Vyn 2010b). Agricultural zoning on properties can be changed through OPAs and Zoning By-law amendment applications by investors, land speculators, and real estate developers to allow residential construction. Once agricultural zoning is changed, it is virtually impossible that the zoning will revert. Greater consideration for biodiversity in municipal Zoning By-laws is needed. Although it was not agricultural land beforehand, the 7.5-acre Trillium Park in Ontario Place was opened in 2017 after being built on a parking lot (Benzie 2017; LANDinc. 2023). However, this is a rare example of a hard surface being converted to green usage.

How a property is designated and zoned affects land values and tax structures, influencing farmers' motivations for operating on a particular parcel of land. In the County of Wellington, farmland benefits from having the county's lowest tax rates. Industrial facilities have the highest property tax rates and are increasingly built on agricultural properties to provide distribution centres for e-commerce operations. This trend is not isolated to the County of Wellington and is seen in other southern Ontario suburban and rural municipalities. However, the low tax rates for farming are not set in stone. Chatham-Kent council backed off a proposal to increase farm property taxes in April 2023 after opposition from farmers (Shreve 2023). Industrial areas provide municipalities with predictable and long-term property tax revenues, create employment, and can be less expensive to service than residential areas (Amborski 2021).

Re-zoning agricultural properties to be residential can create a patchwork of farming operations. Interviewed farmers in Wellington County complained about drainage issues and homes being built up along farmers' property lines (Bazjat et al. 2021). According to rural planners, it requires much more effort to make adjacent agricultural and residential land parcels compatible. Interviewees also offered to modify zoning by-laws to allow more than one residential dwelling to be built on a parcel of farmland, envisioning a change that would facilitate housing to assist with land farming.

Ontario's Provincial Policy Statement (PPS) and OMAFRA's ***Guidelines on Permitted Uses in Ontario's Prime Agricultural Areas*** (2016) have classified on-farm diversified uses (OFDUs) to maintain farming activities with development opportunities (Ministry of Municipal Affairs and Housing 2020a; Geerts 2016; Duesling, Sousa, and Caldwell 2022). OFDUs allow farmers to operate another business from the same farming property. It is a tool to help ensure that farmland is not lost because of economic pressures and to support farmers financially. Oxford County adopted OFDUs as part of its official plan in 2022, according to a Planner – Policy Focus on the municipality. However, the provincial government has not yet approved this official plan.

Competing land uses: Balancing social, economic, and environmental concerns

There are strong development pressures on agricultural land in southern Ontario, where urban sprawl is highly evident despite some land being zoned for agriculture. Municipal councils are tempted to facilitate land conversions of properties in proximity to grow their tax bases. Concurrently, housing shortages have become an acute problem and an Ontario provincial government priority. Development pressures regarding agricultural zoning have intensified in the wake of food security concerns in cities where food supply shocks were felt during the early COVID-19 pandemic.

Different agricultural land management strategies exist (e.g., sparing vs. sharing). Agricultural land can be segmented to maximize food production, or agricultural land can be less efficient and exist alongside conservation (Tscharntke et al. 2012). An example of the former is British Columbia's Agricultural Land Reserve, where farming is encouraged, and non-agricultural uses are restricted (Provincial Agricultural Land Commission 2022). Agriculture may become a more attractive form of land use due to its closer access to urban markets. This would help to counteract decreasing farmland availability from encroaching urbanization (Akimowicz, Cummings, and Landman 2016). Wu, Fisher, and Pascual (2011) looked at farmland rental and found that net farm income rose with population density, with the rationale being that farms near urban centres switch to producing higher-value specialty crops to meet local and growing demand. We assume that this relationship would positively influence farmland values, particularly those that integrate regenerative agriculture practices. The latter could sustain crop production over a longer time horizon thanks to improved soil management techniques.

There are also severe housing shortages in southern Ontario, adding to farmland being converted to make way for low-rise residential development. To alleviate such development pressures, municipalities can prioritize intensifying existing urban areas.[11] A silver lining of the Ontario provincial government's Bill 23, More Homes Built Faster Act, is that it allows up to three units per parcel of urban residential land on municipal services, e.g., water, sewage, and energy, in Ontario municipalities, encouraging intensification in urban areas as opposed to rural ones (Ministry of Agriculture, Food and Rural Affairs 2022b, 23; 2022b). Intensification can mean infill developments, where high and medium-rise apartments are built in the parking lots of increasingly under-utilized shopping centres. Gentler forms of density, like low-rise apartments and multiplexes or the "missing middle," are being promoted in existing neighbourhoods to increase housing options for residents. Perhaps the biggest challenge of intensification in municipalities is human opposition to change. Residents' associations can obstruct housing proposals at the Ontario Land Tribunal or through their elected officials, slowing down the application permitting process and construction. Longstanding cultural norms of residential backyards and lot space between homes are being challenged through new housing proposals in existing neighbourhoods. However, trade-offs need to be made. Protecting agricultural and environmental conservation areas will necessitate changing how we build cities and where we build housing.

11 Intensification is when real estate development is prioritized in existing urban areas through taller buildings.

FOCUS POINT:

The rise of urban agriculture

In the past decade, there have been significant discussions as to whether the production of food should be limited to rural regions or also conducted within urban areas. This debate has been exacerbated by the COVID-19 pandemic, which triggered fears about the future of food security in urban areas. Many also believe that rural farms will not be able to keep up with the growing populations of the cities, hence several are looking for ways in which cities could also contribute to feeding their own urban populations (Stall-Paquet 2021). Further, with urban sprawl encroaching on agricultural lands, and competing land uses, innovations in urban farming have flourished to address challenges with food security in cities and farmland fragmentation.

Wu, Fisher, and Pascual (2011) looked at farmland rental and found that net farm income rose with population density. The implications of this study for urban farming suggest a heightened demand for farms near urban centres to feed urban populations. The scale of urban farming could be as small as a local garden in a backyard and rooftop, or as large as a former industrial site, but both could be used for feeding urban populations.

Vertical farming

Vertical Farming, as the name implies, refers to the practice of farming crops through vertically stacked layers, most often done through hydroponics. This unique form of agriculture could range from a single storage container to a skyscraper-like structure, and presents an effective means of growing food within the limited-space environment of many cities (Despommier 2009).

With this promising version of farming, many have built high expectations as to how much food production it could provide for cities. Some proponents are hopeful that this modern form of farming could replace its rural counterpart completely and allow cities to feed themselves through skyscraper-sized farms. Such farms possess a high level of water and nutrient efficiency while the controlled environment with fewer pests could mean little use for pesticides. However, high costs in energy and infrastructure may prove to be a major challenge to achieving this outcome. More specifically, since much of the energy used in cities comes from fossil fuels, it could be assumed that the carbon footprint for these farms would be higher than many would tolerate (Park 2023).

Greenhouses

The greenhouse industry is a major employer in southwestern Ontario, primarily composed of horticulture and cannabis (Independent Electricity System Operator 2019). The greenhouse industry accounted for 14.8 per cent of Ontario's agriculture jobs in 2021 (Job Bank 2023; Ontario Greenhouse Vegetable Growers 2022). Southwestern Ontario provides greenhouses with a central location to ship to major Canadian and U.S. markets. There are customer requests from the industry projected to grow to 1,300 megawatts (MW) by 2025, up from demand for 300 MW in 2019 (Independent Electricity System Operator 2019).

There are environmental concerns about the greenhouse industry. Municipalities in southwestern Ontario have seen rapid growth of the greenhouse industry on farmland with good soil, according to a Planner. Greenhouse operations can yield up to 15 times more produce per square metre than outdoor agriculture, underscoring the motivation for farmland conversions (Helmore 2023). Greenhouses are energy-intensive operations because of their lighting demands and natural gas for heating. Greenhouses also have significant water demands. There are energy and water-efficiency initiatives, but their adoption does not seem to be broad.

Urban greenhouses

Urban greenhouses, like all greenhouses, are confined glass buildings used to grow healthy plants. In an urban setting, these structures could be grown at essentially any scale and at any place that has access to enough sun. This is a good option for those who wish to produce food in an urban setting.

Urban greenhouses sizes could range from a single plant in a backyard to a skyscraper rooftop or even any vacant land (e.g., former industrial areas) (Immovili and Butturini 2018). The introduction of greenhouses onto urban farms is a valuable asset, especially where Class 1 soil is present, and could extend the growing season to produce more local food. An example of this could be seen through Calgary's Highfield Regenerative Farm, which has been able to provide fresh produce for a longer duration as well as better protect more sensitive crops from the greenhouse built in 2022 through a grant from Agriculture and Agri-Food Canada (Highfield Farm 2023). Therefore, urban greenhouses act as a valuable tool to those attempting to make their food production periods last longer as well as protect crops that are sensitive to temperature changes.

Community gardens

Community gardens are plots within neighborhoods that are maintained by their respective community for the purpose of growing food. Historically, these gardens have existed to serve multiple purposes. They have served those during times of economic hardship using it as a cheap and convenient source of food. Meanwhile, others have used these gardens to build a common area for the community and help beautify neighborhoods with greenery (Milburn and Vail 2010).

As Milburn and Vail (2010) discuss, community gardens offer many benefits within a neighbourhood, the most evident being inexpensive and accessible food (Milburn and Vail 2010). The benefits also extend to the environment, as food that is being grown in a local garden has a lower carbon footprint than food that is transported from rural farms into urban areas. Finally, as mentioned previously, these gardens provide a convenient opportunity for increased connection and socialization amongst community members (Levy-Ward 2023).

Green/Living walls

Green walls are vertical structures that are covered by vegetation of any kind. Often integrated with irrigation systems, green walls present a unique farming method, and can be used in a complementary way to other urban farming methods. This is because green walls often reduce energy costs, improve the ability to manage water in a given area, and increase urban biodiversity, among many other considerations (Loh 2008).

Rooftop gardens (Green roofs)

To combat the need for space in urban centres, a notable solution comes from building on top of the structures that occupy urban real estate (Figure 4). Rooftop gardens possess many of the same benefits as green walls, though rooftops are often easier to both irrigate and use as community gardens. These gardens can proffer protection against stormwater, boosting the resiliency of high-rise rooftops. However, this method is also not without its own unique challenges, with high winds posing a significant threat to these farms (Oberndorfer, Lundholm, and Bass 2007).

< *Figure 4: Carrot Green Roof: Toronto, Ontario, Canada.*
PHOTO: **Jean-François Obregón Murillo**

The fragmentation of farmland in Ontario

Between 2016 and 2021, Ontario lost 582,392 acres of farmland, which translates to 319 acres of farmland lost daily; conversions to urbanization, like low-density subdivisions, were among the causes of farmland loss (Statistics Canada 2022d). The economics of increased farmland values create a barrier to entry for would-be farmers (Statistics Canada 2022a). The high cost-to-revenue ratio, increased expenses, and decreases in farm incomes make it increasingly more challenging for farmers to earn a decent living. There has also been an increase in off-farm work. These challenges for small farmers make achieving economies of scale with their operations hard.

Drivers behind farmland fragmentation

Two competing forces participate in the fragmentation of farmland. Firstly, farmland is being bought up by larger corporations to achieve economies of scale, while smallholder farms struggle. Secondly, municipal planning typically facilitates subdivision of land. Once divided, it is complicated to bring farmland back into larger plots. This puts farmland further at risk for development and other land uses.

As explained at left, farmers are incentivized to grow their operations to achieve economies of scale, leading to more intensive farm practices on the land. Small and medium-sized farms are decreasing while large farms are increasing (Statistics Canada 2021 via Duesling, Sousa, and Caldwell 2022). Due to farmers' financial challenges, they are also incentivized to "sell out" their land to the highest bidder. This trend can be accelerated if the proposed Provincial Policy Statement (PPS) changes are approved, making it easier to build residences on farmland. Ontario's More Homes Built Faster Act passed in November 2022, requires municipalities to spend at least two-thirds of their Development Charge Reserve Funds on hard infrastructure like wastewater and roads. This change will lead to premature construction, accelerating pressure to build services (e.g., water, sewage, energy) in rural and agricultural areas, contributing to increased fragmentation. Other concerns with fragmentation include urban-rural conflicts, loss of potential revenue-producing farmland, and the loss of wildlife corridors.

According to rural planners, farmers are concerned about splitting their lots and housing construction on agriculturally zoned properties. Rural planners work hard to maintain farmland as whole as possible. However, there are no municipal-level penalties for rezoning rural or agricultural properties as urban. At the local scale, converting agricultural land to residential or commercial purposes causes a gradual fragmentation of farmland that can lead to tensions from non-farmers over smells, sounds, and road uses. Over time, fewer farming activities reduce the number of customers for extension services like veterinarians and equipment retailers – which are fundamental to successful agriculture. Fragmentation has consequences for conservation, disrupting migratory bird patterns and threatening wildlife corridors. Nevertheless, farmland can have portions of their property qualifying for Ontario's Managed Forest Tax Incentive Program, where landowners pay 25 per cent of the municipal property tax (Ministry of Natural Resources 2023). This program contributes to conservation efforts.

Ontario's response to farmland destruction: The case of the Greenbelt

The Ontario government can select a "nuclear" option for municipal land use planning and zoning by changing provincial policies, legislation, and invoking Ministerial Zoning Orders (MZOs). Municipalities have little to no agency on these matters, given that provincial laws can change their structures or functions without their consent (Borins 1997). The Ontario government had established a strict form of agricultural zoning called the "Greenbelt" to prevent farmland development for non-agricultural uses in the Greater Toronto and Hamilton Area (GTHA). The Greenbelt Act was established in 2005 and eliminated a municipality's ability to re-designate farmland for non-agricultural uses in "prime agricultural areas" and "specialty crop areas," including in the Niagara Peninsula.

The Greenbelt legislation's implementation lowered property values in "Protected Countryside" (PC) designated lands within 5 km of the Greater Toronto Area (GTA) by 24.3 per cent. There was no statistically significant decline between the five km to 40 km distance from the GTA (Deaton and Vyn 2010b). The empirical analysis suggests that zoning influences property values and varies spending on development pressure. The Greenbelt's implementation also had a negative and significant effect (~10 per cent) on the probability of farm exit (Li, Vyn, and McEwan 2016), meaning farms had a lower chance of quitting business than

those outside the Greenbelt. The Greenbelt accomplished one of its goals of safeguarding local agriculture. Protecting extensive farmland provides the local agriculture industry certainty, encouraging investment and long-term conservation. Nevertheless, the Greenbelt policy's effect varied by zone. Farms in the PC area experienced significantly negative impacts on investments. The study's finding goes against the Greenbelt's goal of enhancing long-term local agriculture investment.

Akimowicz, Cummings, and Landman (2016) analyzed the impact of the Greenbelt Plan on farmers' investment decision-making, capturing the nuance of the issues with this policy in the Greater Toronto and Hamilton Area. The Greenbelt was created to protect agricultural land. However, it has been imperfect in its implementation and criticized for insufficient consultation with farmers. For example, there were conflicts in peri-urban areas between farmers and non-farmers regarding road usage and odours.

The Greenbelt needed more measures to help it achieve its objective of protecting agriculture. These included the broken links within the food chain, the obscure multi-layer regulation system that emerged, the general mistrust of political initiatives, the perception of the equity value of land, and the GTA population's overall support of Ontario's Greenbelt (Akimowicz, Cummings, and Landman 2016). As urbanization increased, peri-urban farmers complained about declining slaughterhouses, large animal veterinarians, and equipment retailers. Such missing links increased farmers' transaction and transportation costs (Akimowicz, Cummings, and Landman 2016). Protecting the agricultural sector requires technical services and having other actors in the whole food chain present (e.g., slaughterhouses).

The Greenbelt's goal of protecting agriculture would have benefited from the legislation being implemented sooner. Akimowicz, Cummings, and Landman (2016) found that there may have already been a prior loss of agricultural infrastructure due to encroaching urbanization. Thus, the timing of land use policies to protect agriculture in near-urban areas is critical. Investors interested in protecting agricultural lands must identify areas with Greenbelt-like qualities and assess the state of extension services. Doing so would benefit regenerative agricultural and nature-based financial instruments.

PHOTO: Caledon New Housing – Aerial, **Carmenwalker**

FOCUS POINT:

The Greenbelt under threat and the implications for farming

The current provincial government has a developer-friendly reputation. It has loosened provincial planning rules and directed municipalities to facilitate greenfield real estate development. A blistering Auditor-General of Ontario report in August 2023 detailed suspicious interactions between provincial ministerial staff and developer lobbyists (Office of the Auditor General of Ontario 2023). The provincial government has also imposed provincial priorities on municipalities. It is worth noting that after the Auditor-General's report, Ontario's provincial government has been reviewing some of its sprawl-friendly policies.

The primary casualty of these policies is farmland and natural heritage areas (Gray 2023; Weber 2022). During its first term between 2018 and 2022, the Doug Ford government obligated municipalities to undertake municipal comprehensive review (MCRs), which saw increased designations of greenfield areas (e.g., agricultural, destined for real estate development). Since 2019, the Ford government has reportedly invoked over 100 MZOs, allowing sites to be immediately zoned for development, bypassing municipal authority and environmental considerations (Wang and Javed 2023). Previously, MZOs were issued about once per year (Wang and Javed 2023). The Minister of Municipal Affairs and Housing, Paul Calandra, who was sworn in in September 2023, has stated that he was reviewing the use of MZOs (Gray and Howlett 2023; cpac 2023). Minister Calandra will reportedly revoke a "handful" of the MZOs (Crawley 2023b).

In April 2023, Ontario's Bill 97, Helping Homeowners, Protecting Tenants Act, 2023, included an updated version of the PPS. The draft version of the PPS would eliminate requirements for housing density targets on greenfield development and allow municipalities to expand urban boundaries into farmland anytime (Gray 2023). The draft PPS document proposes that municipalities designate prime agricultural areas and encourage them to support a viable agri-food network. However, it is not required. A contentious proposal among farmers allowed three lot severances per farm parcel and up to two additional dwelling units per lot in prime agricultural areas (Ontario Farmland Trust 2023). A coalition of farm groups pushed back against the proposals, leading the provincial government to re-consider them and extend the deadline for public feedback (Crawley 2023a).

At the time of writing, Bill 97 had been passed, but the regulatory proposal for the PPS has not yet been decided on. However, one may envision the concern for agriculture in that protections are reduced to allow for more urban development. Environmental conservation protections could also be weakened in the PPS. Agricultural properties could see rises in land value from increased speculation that may incentivize farmers to exit their businesses. Farm fragmentation could also reduce the sector's viability in peri-urban areas.

The implications of land zoning for land value

Ontario farmland values rose sharply in 2021, with a 22.2 per cent annual change in percentage values. The most expensive farmland per acre was in southwestern Ontario, driven by high commodity prices and low-interest rates (Farm Credit Canada 2022). Higher demand for land in this region increases the land value relative to other regions within Ontario. Residential real estate developers were a primary factor driving the competition for land (Farm Credit Canada 2022).

Current zoning practices aim to protect agricultural land, ensure food security, prevent land fragmentation, and reduce the threat of real estate development out-competing farm operations on prime land. These measures are only sometimes effective in all cases, as developers and investors may gamble or lobby for future rezoning of land to reap benefits in land valuation. In this way, investors' incentives must be aligned with the goals of maintaining farmland and building regenerative practices on the land.

Changing zoning classification has major implications for land value. Ontario's Doug Ford government removed the Duffins Rouge Agriculture Preserve (DRAP) from the Greenbelt in December 2022 to make it available for housing (Environmental Registry of Ontario 2022). It also repealed the Duffins Rouge Agricultural Preserve Act, 2005, which enshrined the protection of the large swath of environmentally sensitive and agricultural lands adjacent to Rouge National Urban Park. After significant public outcry following the Auditor-General's report, the Ford government announced that it would be reversing the repeal as part of Bill 136, Greenbelt Statute Law Amendment Act, tabled in October 2023 (Calis 2023a; Hon. Paul Calandra 2023; Ontario Newsroom 2023). The DRAP removal was undergoing federal review by the Impact Assessment Agency of Canada, which would have blocked the province's action (Javed, Wang, and McIntosh 2023).

While it is a municipal decision to re-zone land, the loss of provincial protection increases the probability that the City of Pickering will zone the DRAP to allow housing construction. As of July 28, 2023, the DRAP's "Natural Area" zoning has not changed on the City of Pickering's open data portal. Nevertheless, Pickering municipal staff, the province, and landowners had been conducting the planning work assuming that the DRAP protections had been removed (Calis 2023a). The City of Pickering then requested reimbursements to the province over planning costs incurred from the reversal on the DRAP repeal (Calis 2023b).

Since the provincial changes, land values have risen significantly in the DRAP due to speculation about future housing construction. 14th Avenue Farms paid CAD 7.9 million for 106 acres in the agricultural preserve in 2020, or CAD 85,000 per acre (Javed, Wang, and McIntosh 2023). In June 2023, White Cherry Development paid CAD 29.5 million for 82 acres, or CAD 357,000 per acre (Javed, Wang, and McIntosh 2023). The value increased fourfold since 2020 before the land use classification was changed.

Table 1: Farmland Values in Ontario in 2022

	% change	Value $/acre*	Value range**
Northern	13.1%	$4,400	$2,500 - $7,000
Eastern	14.9%	$11,100	$5,700 - $18,900
Mid-Western	23.0%	$17,700	$10,900 - $25,300
Southwest	23.3%	$12,800	$7,900 - $23,700
Central West	10.3%	$25,600	$15,100 - $35,700
Southern	19.7%	$20,400	$13,500 - $29,800
Southeast	22.9%	$19,200	$11,600 - $31,100

*FCC reference value $/acre.

**The value range represents 90 per cent of the sales in each area and excludes the top and bottom five per cent.

Adapted from ***Farmland Values in Ontario in 2022***, Source: FCC 2022.

FOCUS POINT:

How the prospects of re-zoning increase land valuation – The example of Montrose Road, Niagara Region

The sale of a rural property in Niagara Region near a future hospital site demonstrates the speculation around the area's anticipated re-zoning and the potential financial windfall for future owners. The corner of Biggar Road and Montrose Road is the site of the South Niagara Hospital, a 1.3 million square foot facility expected to be completed by 2028. Planning for this hospital dates back to 2012. A screenshot was taken of a 9.2-acre property nearby that was for sale for CAD 5.4 million in June 2022 (Figure 5). A map has also been provided for context (Figure 6). The screenshot of the property for sale was taken before Niagara Region's Official Plan received provincial ministerial approval in November 2022. When we checked Realtor.ca on October 27, 2022, the site had been sold. The site is symbolic of the real estate speculation and re-classification of agricultural lands across southern Ontario in recent years.

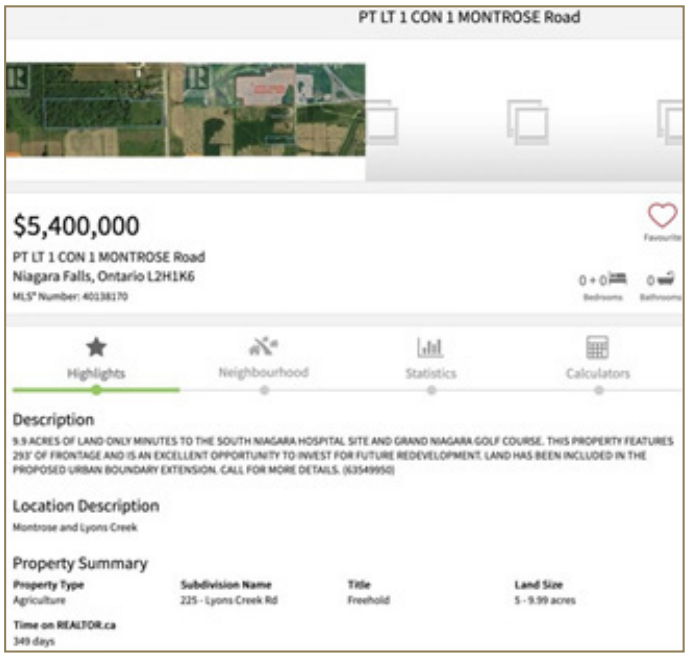


Figure 5: Screenshot of Niagara region property for sale in June, 2022

Source: Realtor.ca 2022

Niagara Region expanded its urban boundaries in the vicinity of the future hospital. Below are the urban boundaries (grey) that have grown as part of the NiagaraRegion Official Plan update in 2022. Figure 7 On October 23, 2023, Ontario's Minister of Municipal Affairs and Housing announced that Niagara Region would be among the municipalities whose urban boundary expansions would be reversed (Municipal Affairs and Housing 2023). At this time, it is unclear how much this will affect the urban boundaries in the vicinity of the future hospital. The province has stated that exceptions would be made in cases where construction has started or reversing the changes would contravene provincial legislation and regulation (Municipal Affairs and Housing 2023).The Agricultural land base is a classification in Niagara Region that includes specialty crop areas, prime agricultural areas, and rural lands as part of a mapped schedule in the municipality's official plan. Prime agricultural areas are mapped through A Place to Grow: Growth plan for the Greater Golden

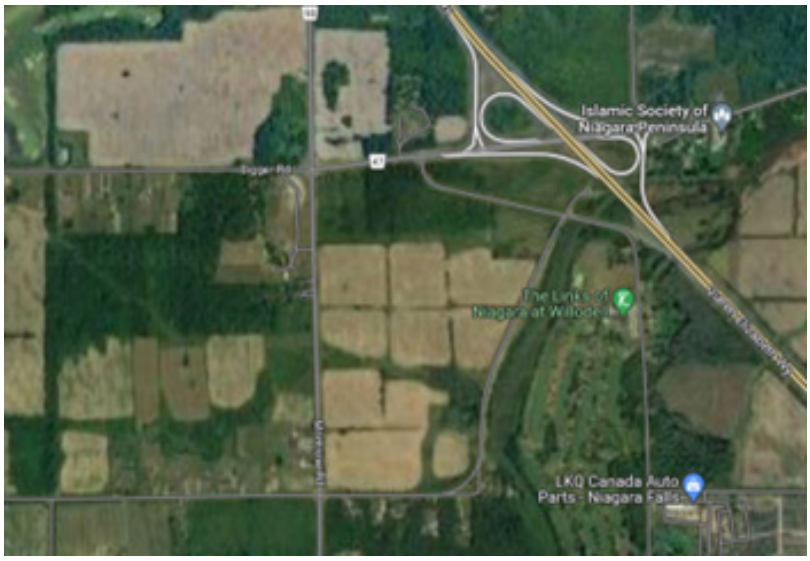


Figure 6: Satellite imagery of property and vicinity

Source: Google Maps 2023

Figure 7: 2022 Niagara Region Official Plan: urban expansion areas and future employment areas

Source: Niagara Region 2015

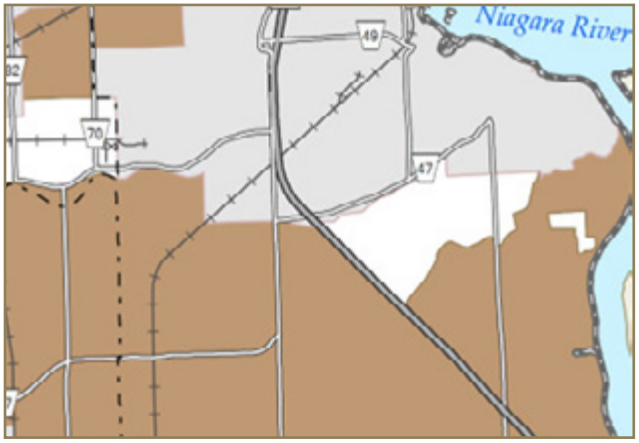


Figure 8: 2022 Niagara Region Official Plan: agricultural land base

Source: Niagara Region 2022

Source: Niagara Region 2015

Horseshoe Growth Plan, (Growth Plan), a policy that may be removed as part of the province's changes to planning legislation and regulation (Ministry of Municipal Affairs and Housing 2020b). At the time of writing, a decision on its removal had not been made (Environmental Registry of Ontario 2023).

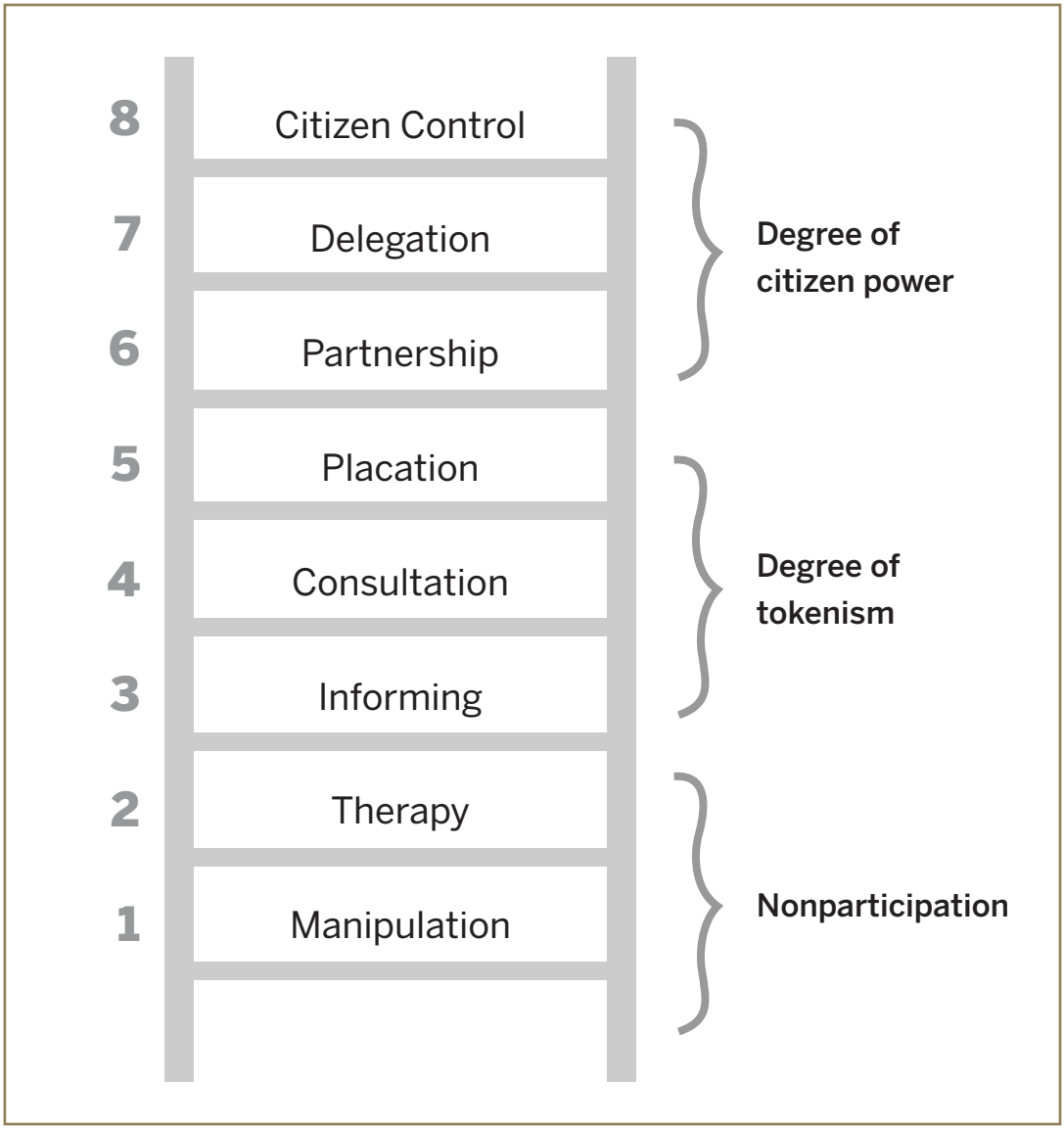
Niagara Region's agriculture sector generated CAD 1.41 billion in GDP impact in 2016 and its underpinning policies have received thoughtful consideration (Niagara Region 2018). Comparing Niagara Region's 2022 Official Plan to its 2014 version, we can see a growth in the urban boundary and future employment areas along the QEW highway (yellow on Figure 8 and white on Figure 9). It is unclear how this map will be affected by Minister Calandra, who announced on October 23, 2023 that Niagara Region was among the municipalities whose provincial changes to their most recent official plans would be reversed (Municipal Affairs and Housing 2023). It is worth noting that the site is surrounded by prime agricultural area, which is brown in Figure 9.

Changing our approaches to land planning

Land valuation depends on society's power relations, which influence which and whose values of nature are recognized (Pascual et al. 2022). This is relevant for property valuations in Ontario. There are reduced protections for agricultural lands in this region through the MCRs recently completed in compliance with provincial orders. Real estate interests may benefit from land use changes (e.g., rural to residential), making residential development possible on land previously used for farming. This reflects where farmers fall within the power relations in society.

The buying-up of farmland by institutional investors and real estate development interests threatens small- and medium-sized agriculture operators, as well as fauna and flora in southern Ontario. Legal and regulatory changes at the provincial land use level exacerbate this trend. The urban encroachment of farmland reflects a Canadian cultural value that prioritizes home ownership (Badelt 2023). This value is consistent with Generation Z, which preferred detached housing in a 2021 survey (Sotheby's International Realty Canada and Mustel Group 2021). This suggests that demand remains strong for a suburban form ***en vogue*** since the post-World War II era. Adherence to this cultural value has helped to justify supply-side housing policies by the provincial government in recent years. However, there needs to be more value being placed on nature or farmland preservation by provincial lawmakers through these policies. Changes to the Conservation Authorities Act have weakened agencies' roles in the development process, and removing sections of the Greenbelt puts peri-urban agricultural land at risk (Lintner 2020; Arjaliès, Bansal, and Gualandris 2022; Municipal Affairs and Housing 2022).

Figure 10: The Eight Rungs of the Ladder of Citizen Participation
Credit: Adapted from Arnstein 1969



Recent provincial housing policy changes are abandoning a shift toward intensification in urban areas encouraged by the Places to Grow legislation and regulations (Government of Ontario 2005). If we deconstruct how value is created, we could help re-orient societal values towards nature and farmland protection. Housing as a good could be analyzed through four value moments: 1) institution: how the chosen value(s) are set up as ideals to pursue; 2) production: the mechanisms for producing such value(s); 3) evaluation: the selection of objects, practices or beings to which value(s) can be attached, and 4) territorialization: the evaluation schemes used to assess the production of (future) value(s) (Friedland and Arjaliès 2020). Focussing on territorialization will be vital to shift values towards nature and farmland protection.

Participatory land use planning can help embed nature into decision-making. Sherry R. Arnstein's influential 1969 article ***A Ladder of Citizen Participation*** provides clues on what local planning governance structures can yield better results for nature, specifically partnership, delegated power, and citizen control (Figure 10). The partnership stage means having board or committees with planning decision-making power with equal representation from conservation groups. Under a partnership structure, a local elected municipal council still has final veto power (Arnstein 1969). Delegated power is where citizens, e.g., conservation groups, have dominant decision-making authority over a plan or program (Arnstein 1969). Citizen control is where a citizen-run entity or corporation exercises power and control over planning decision-making with no intermediaries between it and the source of funds (Arnstein 1969). In affected municipalities, increased advocacy for farmland protection may necessitate coalitions forming between citizens, industry associations, farmers, and municipal leaders.

Summary

Key take-aways:

- **Farmland, especially near cities, is threatened by competition over land use.**
- **Trends like urban sprawl and shortage of residential properties lead to policy and regulatory changes that further exacerbate these pressures for farmers. The Ontario provincial government's recent reversals on sprawl-friendly policies provide some hope for farmland.**
- **Land use, zoning and valuation structures have implications for the fragmentation of farmland and the barriers to entry for farmers to own land.**
- **Maintaining access to farmland is essential for farmers. Small- and medium-holder farmers and farmers seeking to enter the market are especially challenged.**

Barriers:

- **The low property tax rates for farmland incentivize municipalities to encourage other land uses, e.g., industrial, commercial, and residential.**
- **The increasing fragmentation of farmland due to competing land uses, including heightened demand for residential development, can erode conditions for farmers.**
- **Legislative and regulatory changes between 2019 and 2022 threaten to accelerate southern Ontario's farmland loss. However, recent legislative, policy, and regulatory reversals by the provincial government may lead to less farmland loss.**
- **Increasing farmland values in southern Ontario suggest speculation for real estate development.**

Key conditions for success:

- **Participatory land use planning structures, where citizens hold equal or majority power over housing decision making, can yield better results for farming and nature. Establishing local planning bodies with increased citizen representation (e.g., farmers, conservationists, and scientists) can aid in achieving such results.**
- **Beyond maintaining farmland access, incenting extension services (e.g., large-animal veterinarians and equipment retailers) in proximity to farmland is crucial.**

Financing the shift to regenerative agriculture

Producers are increasingly concerned about the rising costs of production inputs, climate change and its impacts as top strategic issues facing their agricultural production (Agriculture and Agri-Food Canada 2022a). These issues signify threats of increased costs to producers.

Agricultural producers often need help with finance due to the high costs and capital requirements for industrial agricultural production, the uncertainty of returns due to environmental effects, and the lag in revenues based on harvest cycles. Today, money goes to real estate or grey infrastructure, favouring short-term profits of a few actors over the sustainable development of the entire country (see the above section on the fragmentation of farmland in southwestern Ontario). It is essential to allocate more capital to transforming agricultural practices toward regeneration and value those practices financially and societally. Financiers are essential to this system shift.

Historical sources of agriculture funding

In addition to equity financing, often in the form of personal savings or grants, farmers regularly seek debt financing for the high capital required to operate.

Three types of credit are required for farming: 1) Long-term mortgage credit used for land acquisition; 2) Intermediate credit needed to meet the needs of farmers over the three to five years it takes to liquidate investments in livestock and equipment; 3) Short-term operating credit on terms of 60 to 90 days, which the banks often deemed as a high-risk business since farming operates on a longer time horizon of returns (Coleman and Grant 1998).

The Canadian government has typically intervened in financing agriculture through market regulations and supporting farmers' income. Governments used credit to strategically incentivize agricultural development, including more land, machinery, facilities, and chemicals (Coleman and Grant 1998).

Since 1944, Canada's Farm Improvement Loans Act — renamed the Canadian Agricultural Loans Act in 2009 — has provided a guaranteed loans policy to encourage intermediate credit for farmers (Agriculture and Agri-Food Canada 2021a). Provincial governments also played a supporting role in intermediate financing. The role of the government in supporting intermediate credit for farmers addressed a gap in private industry at the time for longer-term credit options at a competitive interest rate.

In 1959, the federal government passed the Farm Credit Act, which created FCC, offering loans with subsidized interest rates. In 1993, FCC was amended to move toward a mixed model in which interest rates were brought closer to the private sector, and the loans expanded to operations in agribusiness beyond production (Gilson 2021). This saw the government and private sector supporting long-term markets rather than the government playing an exclusive role. FCC still has a large responsibility in financing agriculture in Canada.

An additional challenge to the high capital requirements of farmers is that their income is often uncertain and highly dependent on environmental conditions. The time cycles of harvests mean that annual payment does not coincide with most expenses, due to the high capital expenditure required upfront. This creates cash flow concerns in farming. Futures markets in agriculture aim to provide a solution to these challenges. The futures market exists to hedge against the uncertainty of future revenues. For example, a farmer may sell futures contracts early in the year to eliminate the uncertainty of prices at harvest; a downstream agri-food company may purchase futures to ensure they have the future supply for their processing needs (Geman 2015; Prager et al. 2020).

The Government of Canada also offers an Advance Payment Program, through which cash advances are paid to producers based on the value of their projected produce sales on various commodities. As the farmers sell their produce, they contribute to paying back the loan. These payments for future production help to address the cash flow uncertainties farmers face, since the cycles of farming harvests often differ from loan payments and what is required to support ongoing business operations.

Financing needs to support a transition toward regenerative agriculture

Despite decades of improvement in supporting agriculture funding in Canada, more solutions need to be provided for the capital increase required to support agricultural development in the face of a growing population and projected labour shortages (RBC 2023). Additionally, growing concern over climate change warrants additional investment in the agriculture sector to mitigate and adapt (Huang and Wang 2014). The current financial flows into nature are approximately one-third of where they need to be by 2030 to meet these global climate, biodiversity, and land restoration targets. Notably, 86 per cent of current financial flows are public funds, and 14 per cent are private (UN Environment Programme 2023). To address the nature-funding gap, more private capital should be channelled toward nature (Rally Assets and Nature Conservancy of Canada 2020).

As resiliency of the land, access to water, healthy soil, and biodiversity are all essential to agricultural development; particular attention needs to be paid to supporting farmers' investments in nature and strengthening the productivity of natural ecosystems. Investing in natural ecosystems is as important to agriculture development as man-made infrastructure, machinery, and chemical inputs.

Traditionally, the view of financing agriculture has been decoupled from financing nature and supporting biodiversity. Primarily, nature is funded by the public sector and philanthropic donations from private individuals (Rally Assets and Nature Conservancy of Canada 2020). The debt financing of agriculture mainly comes from chartered banks, government agencies, credit unions, and advanced payment programs. However, as established in previous sections of this report, healthy ecosystems are foundational to farming and support its economic success. Thus, the financing of regenerating ecosystems should also be seen as foundational to agricultural production.

FOCUS POINT:

Nature-based solutions for agriculture

Nature-based solutions are actions to protect, sustainably manage, and restore natural ecosystems to solve societal challenges (Wood 2022). Nature-based solutions are often referred to in the context of solving societal-level challenges, such as climate change and biodiversity loss. However, they can also be implemented on a smaller scale to deal with micro-level challenges in a local setting. Examples include planting trees to deal with wind erosion on farms, restoring wetlands to deal with flooding, or managing biodiversity as a natural fertilizer and pest control.

All these solutions are nature-based and have the natural functions that nature provides. Nature-based solutions are about fostering and leveraging the functions of nature as a sophisticated operating system to solve a challenge, for example, by installing green infrastructure instead of grey infrastructure (Eng, King, and Strong 2022).

On a farm level, there are a variety of nature-based solutions to agricultural challenges, including water retention, soil erosion, crop fertilization, and pest control. The benefits of these nature-based solutions are that they have co-benefits that extend beyond the farm and aggregate to address ecological crises such as climate change and biodiversity loss. These macro challenges, such as increased extreme weather events, production volatility, and soil health, also impact the farm.

Agriculture adopts nature-based solutions when it leverages the power of natural ecosystems, including woodlands, grasslands, aquatic systems, and working lands (Wood 2022). Regenerative agriculture, which supports natural ecosystems, is an example of a nature-based solution.

However, one of the challenges is that investment in regenerating the natural ecosystems to leverage their natural functions is costly. The returns are uncertain, not easily monetized, and take time. Financing solutions for investments in nature and nature-based solutions are less distinctly supported than built grey infrastructure, for which the changes are immediately visible. Farmers, bearing high risk, thus gravitate towards tried-and-true solutions to their operational challenges.

What makes financing regeneration different from typical financing of agriculture?

Harm reduction vs. regeneration

A review of agriculture practices can fall into three categories regarding the relationships with the natural environment. The first is ***harmful*** practices, which support the efficiency of agricultural production; however, they negatively affect the natural environment. A second category of practices is ***harm reduction*** practices. These are often included in sustainable agriculture and focus on reducing harm imposed by industrial forms of agricultural production.

However, harm reduction in a system that relies on exploitation is still unsustainable in the long run. To achieve sustainability in agriculture systems that rely on exploiting goods and services from the environment, ***regenerative*** practices and harm reduction practices are needed.

Figure 11: Examples of practices which can be harmful, reduce harm, and are regenerative

Both harm reduction and regenerative practices are needed for sustainable agriculture systems. However, regenerative practices should be funded more, as they are normally underfunded. Reducing harm is quantifiable and visible in the short-term. There are cost savings in applying fertilizer that can be immediately realized by not using as much fertilizer and switching to cover crops. However, investments in the regeneration of biodiversity and land health are only visible once they impact structures already valued and tied to cash. For example, an increase in crop yields is realized by the farmers.

Another challenge with regeneration that contributes to its underfunding includes identifying a baseline. With harm reduction, the incremental improvement is clear compared to a baseline of harm. With regeneration, the point in time for the baseline becomes less clear. With landscapes always changing, the end goal of restoration can seem arbitrary. Additionally, in a multi-year effort, the question remains: To which year are you comparing? If regeneration is tracked annually, short-term interventions and low-hanging fruit may be incented, but not more challenging, longer-term interventions. Growth in regeneration efforts is only sometimes linear or visible.

FOCUS POINT:

The Canadian Sustainable Finance Taxonomy

Canada's Sustainable Finance Action Council published its Taxonomy Roadmap Report in September 2022. A taxonomy would provide a standardized approach for funding sustainable activities. The report strongly focuses on prioritizing climate mitigation and provides an outline of what could be eligible and ineligible green projects. Regenerative agriculture would be relevant to "Do no significant harm" (DNSH) projects, including afforestation and wetland restoration. Mitigating/preventative measures, e.g., wildfire prevention, would have to be implemented to ensure the permanence of carbon emissions for DNSH agricultural projects. We do not know if agriculture and nature-based solutions will be more visible in the taxonomy as short-form taxonomies are released for priority sectors. A complete taxonomy is expected by the end of 2025 (Sustainable Finance Action Council 2022).

Short-term vs. long-term

The temporal cycles of farming are different from the extreme long-term cycles of nature. Investors seek quarterly returns—farming harvest once a year, restricted by seasons. Nature operates on a multi-year process. Farmers are entrepreneurs with finite timelines to produce. As one farmer pointed out, there may only be 60 harvests in the working life of a farmer. More time is needed for experimentation and patience for effects of regeneration to be realized in natural cycles.

Thus, financing industrial agriculture that can match the short-term cycles of expected returns is different from financing regeneration which may realize returns based on the long-term temporal cycles of nature. It is hard to source short-term cashflows from nature that meet investors' temporal expectations and farming costs.

There is also an issue with the visibility of change on the land. Financing a project with visible outcomes in the short term is more attractive to investors than a multi-year effort with invisible outcomes. As one interviewee points out, it is easier to convince farmers to plant trees instead of prairie grass on fallow fields since, with trees, the difference in the landscape is visible in the short term. Investing in biodiversity below the ground is often only recognized once the impacts are visible above the ground. This takes time.

Unclear ownership and appropriation of positive externalities (yet risk borne by farmers)

With industrial agriculture production, it is clear what is being funded and that the farmer can sell the goods. With biodiversity, it is still being determined if and how the items that are being financed will translate into cash. Additionally, supporting biodiversity and regeneration of ecosystems provides a plethora of ecosystem goods and services which may aggregate benefits beyond the farm. Thus, there is hesitation in financing regeneration when "owning" the benefits are not guaranteed. With harm-reductive practices, it is clear who owns the costs as they may be realized, so a reduction of costs is justified. Farmers are bearing the risk with regenerative practices, yet the benefits of healthy ecosystems extend beyond the farm. The ownership of externalities needs to be clarified in a regenerative model, especially positive externalities.

Natural capital still needs to be priced into production models. Ecosystem health is not currently integrated into the market value of the land. Land value increases with agricultural efficiency – for example, soil type. However, soil health considerations are not priced into the valuation of the land. Thus, the positive externalities of regenerative efforts should be captured through agriculture production and land sale. Regeneration is not incentivized in the value of the land.

Largely seen as a government or philanthropic effort

The perception is that since the benefits of regenerative agriculture aggregate to society, it is not the responsibility of the farmer to bear the upfront costs and risks. The government does support programs such as windrows on farms. Non-profit organizations like Reforest London also support regenerating fallow fields into forests or grassland prairies (Reforest London 2023). However, the perception of regenerating farmland and supporting biodiversity as a philanthropic effort places production in tension with ecological efforts. The current state of financing the ecosystem restoration on farmlands is largely viewed as a separate function from farming and, sometimes, viewed as coming in direct opposition.

The federal government currently treats funding for agriculture and conservation differently. Although some of the traditional debt financings offer loan amounts to improve soil health. Improvement loans may target: "the conservation of soil, prevention of erosion and the planting of trees and shelter belts" (Government of Canada 2021). There are no additional considerations for ecosystem recovery compared to building grey infrastructures, particularly on the time horizons of returns or interest rates. Although, as we have shown, the natural ecosystems work with the agricultural ecosystem to support production, and governments do not invest the same way in the latter, as in machinery or man-made structures.

Investment in biodiversity to support the productivity of surrounding ecosystems is the government or society's responsibility. It is a philanthropic effort. However, a nature funding gap exists to support biodiversity and ecosystem health. More private capital and investment are needed, not just public funding. It is time to build in the cost of positive externalities into business models. This needs to adequately account for the benefits of ecosystem health to the agri-food system actors.

PHOTO: Silos on a farm on the Oak Ridges Moraine, north and east of Oshawa, in 2007, **Rick Harris**

Suggestions for improvements in the financial infrastructure for regenerative agriculture

Existing financial instruments: pros and cons

In the agriculture sector, nature-based finance can support and incentivize investment into nature for those in the agri-food industry. Specifically, agriculture can help overcome some of the challenges of investing in nature-based solutions by redistributing the risk and upfront costs that farmers face. Several current initiatives and recent innovations exist to advance the financing of regenerative agriculture. These can be viewed in Table 2 below.

Table 2: Financial Instruments for Regenerative Agriculture

Financial Instrument	Description	Pros	Cons	Examples
Accelerators	Accelerators support the growth of businesses at the minimum viable product. Such programs offer mentorship and access to investment in exchange for equity. Accelerator programs tend to run for a three-to-six-month period, helping start-ups to run on their own afterwards.	Start-ups can improve their chances of commercial success by accessing an accelerator's resources. Many accelerators exist and are funded by private, public, and philanthropic entities. Firms iterate quickly to determine a viable product.	Accelerators take equity stakes, which founders may be reluctant to do. Start-ups may not meet requirements for all accelerator programs.	**The Resilient Agriculture Accelerator Fund** The Sustainability Consortium and the National Fish and Wildlife Foundation partnered to create a fund that leverages private and public agriculture funding to scale resilient agriculture and amplify impact (The Sustainability Consortium 2023). **THRIVE Canada Accelerator** Supports early-stage agri-food tech start-ups which are innovating for a sustainable future in agriculture (SVG Ventures 2023).
Blended Finance, Concessional finance	Earth Security defines blended finance as an approach involving the use of public and philanthropic funds to change the risk/profile of projects to attract the private sector (Earth Security 2021). Concessionary capital may be used, which could mean the public or philanthropic sector accepting below-market or no returns (Nature Conservancy Canada and Rally Assets 2020). Regenerative agriculture projects can become more viable with concessionary and blended finance. For instance, larger agricultural properties could be bought, as having numerous parties can offset high farmland values.	The involvement of multiple parties increases the available pool of capital for projects. Blended finance can help fund projects faster than using traditional tools.	It can take time to find the right partners and align interests. Concessional finance means that a party is willing to take a loss or accept sub-market performance. The funding of nature-based solutions is not yet part of Canadian crown corporations' practices, despite their potential fit with their mandates. This is notably due to a lack of market infrastructure.	**Blended Climate Finance Program (BFCP) (Government of Canada and International Finance Corporation (IFC))** In March 2018, the Canadian government committed CAD 250 million towards this program intended to fund resilient infrastructure, climate-smart agriculture, and renewable energy in developing economies (International Finance Corporation 2020). The BFCP contributed USD 5 million towards the IFC's Sri Lanka Agri-Finance Program that enables farmers to better preserve crops, prevent spoilage, and mitigate against severe climate shocks. The IFC contributed USD 20.1 million. Proceeds were used by financial institutions to fund climate-smart agriculture and women-led agriculture and farmers.

Financial Instrument	Description	Pros	Cons	Examples
Carbon and Biodiversity Credits	Farmers can sell carbon and biodiversity credits based on their ability to restore carbon sequestration and biodiversity on their land. Investors and corporations purchase those credits to compensate for the negative environmental impacts.	Generates profits for farmers. Enables us to compensate for negative externalities.	Price of offsets is too low for most farmers to participate given the costs incurred by the monitoring of offsets. The offsetting needs to be very closed to the pollution/destruction of land for the compensation to be of equivalent nature.	**Canada's Greenhouse Gas (GHG) Offset Credit System** A GHG offset credit is issued for organizations or individuals removing or reducing GHGs from the atmosphere (Environment and Climate Change Canada 2022a). Each tradeable unit represents one tonne. This includes carbon or methane. A valid offset project is when its reduced or removed GHG emissions would not have occurred without it. E.g. protecting forests or grasslands from development. The Canadian government implemented regulations in May 2022 (Canada Gazette 2022). Offset protocols are being developed for agriculture (Environment and Climate Change Canada 2022b).
Conservation Easements	A conservation easement is an alternative to land acquisition when the purchase price is too high. Easements are arranged between the landowner and another party, e.g., municipality, conservation authority, government, etc. to allow for a long-term use, typically in perpetuity, for a portion of a property that is deemed to have public benefit. Easements are registered on the title, ensuring that the protection passes from owner-to-owner.	Conservation easements qualify for tax deductions if it meets the criteria of the federal Ecological Gifts Program (Ontario Land Trust Alliance, n.d.). Farming activities can continue while the easement exists. Participating landowners can ensure that agricultural uses and environmental features are not lost in the future.	It can be time-consuming and costly to apply for a farmland easement. There needs to be a comfort level between the landowner and the authority with whom it enters into agreement .	**Ontario Farmland Trus** Farmland Easement Agreements are promoted by the Ontario Farmland Trust to prevent farmland conversion to non-agricultural uses which has been promoted (Ontario Farmland Trust 2020).

Financial Instrument	Description	Pros	Cons	Examples
Community Supported Agriculture (CSA)	Consumers pay a fee to a farm and obtain a share of the year's harvest. Thus, consumers receive regular deliveries of farm produce throughout the season.	Farmers can reduce their risk and ensure having markets for their produce. Consumers can directly buy from farmers.	CSAs may not be as available online as subscription services by food retailers. Thus, it requires more effort from consumers to access. Consumers bear the risks.	**Organic Council of Ontario – Directory** This association has an online database with hundreds of organic certified actors, mostly producers, in the agri-food chain in Ontario. The majority of its producers are in southern Ontario. There are only three CSAs or farm shares listed (Organic Council of Ontario 2023). This directory is updated annually.
Cost Sharing Programs	Typically supported by Federal, Provincial/ Territorial, First Nations, Municipal governments, or non-for-profit organizations, it provides funding to farmers to costs incurred by adopting new farming practices (i.e., cost sharing).	Supports the upfront costs supported by farmers.	Eligible costs are often reduced to specific practices, at the expense of a holistic approach.	**The Canadian Agricultural Partnership, now the Sustainable Canadian Agricultural Partnership (Sustainable CAP)** (Agriculture and Agri-Food Canada (AAFC) 2023). The Sustainable CAP is a CAD 3.5 billion dollar agreement spanning from 2023 to 2028 between the federal, provincial, and territorial governments. Its primary goals are to strengthen the agrifood industry's resiliency, innovation, and competitiveness (Agriculture and Agri-Food Canada (AAFC) 2023). The agreement will focus on five key areas. Among them are climate change and environment as well as resiliency and public trust. These key areas are based on the Guelph Statement, which openly advocates for more sustainable methods of farming (Agriculture Canada 2021).

Financial Instrument	Description	Pros	Cons	Examples
Crop Insurance	Protects and ensures a farmer's financial security due to unforeseen circumstances relating to crops (e.g., droughts, crop failure, etc.) or a general loss of revenue from crops.	Protects farmers from circumstances that are not under their control and allows them to recover from crop-related setbacks quicker.	Encourages farmers to be less cautious towards the overuse of resources such as water, making the industry less resilient to climate change. Crop insurances are typically government-funded, which means taxpayers pay for the negative externalities, while profits are privately appropriated.	**Saskatchewan Crop Insurance Corporation (SCIC)** The SCIC is a Crown corporation under the Saskatchewan Ministry of Agriculture, to which many of its goals and themes derive directly from governmental policies (SCIC 2023a). The SCIC provides many important services such as crop insurance as well as compensating farmers for different scenarios, like drought and flooding relief. The organization also has insurance programs catering to those who decide to use more organic practices (SCIC 2023b).
Equipment Financing	A financial tool/loan that is used by farmers to purchase farming equipment	Often beneficial for equipment that is only used during certain portions of the year, especially for newer and younger farmers. Savings could be instead used to expand farm.	Is a specialized loan, so proceeds may only go to equipment and nothing else. Ownership may work better for the equipment that is used more often due to payments.	**AgDirect** AgDirect offers financing for new and used equipment such as loans, leases and refinancing options.
Green Lease	In commercial real estate, a green lease aligns the financial incentives of sustainability measures in lease documents between landlord and tenant. Thus, the landlord and the tenant benefit from investments in water, energy, and waste efficiency. A green lease, as a concept, is applicable to agriculture, where it is common for farmers to rent land. However, a contractual incentive may be lacking for the leaseholder to apply environmentally conscious practices, e.g., reduced or no external fertilizer to help soil health.	A green lease helps preserve soil health for current and future leaseholders. A green lease could attract farmers practising organic, biodynamic, ecological, or regenerative agriculture. Biodiversity conservation may be improved because of green lease stipulations.	There may be resistance to the concept as it is uncommon in agriculture. It may take longer than normal for the initial farmer to lease the land to negotiate the green lease contract. A degree of periodic monitoring of soil health may be necessary by the landlord to ensure the leaseholder's compliance with the terms.	**Bonnefield and Area One Farms** For more information, see the Focus Point on page 58.

Financial Instrument	Description	Pros	Cons	Examples
Grants	Supported by Federal or Provincial/Territorial, First Nations Governments, funding for agriculture is supported through a variety of programs.	No expectation of financial return from grant providers.	Outcomes are not ensured. Grant funding takes effort to secure, usually over fixed periods. Does not typically cover full financing needs.	**Canadian Agribusiness Funding Programs** Various Canadian agribusiness funding programs are available through governments (Mentor Works 2023).
Green Bonds	Bonds in which the proceeds are earmarked for green-related activities. It functions like an ordinary bond, but its labelling and purposes differ. High investor demand for this asset can allow for green bonds to be sold at a premium, reducing the cost of servicing debt (Rendell 2022). Companies will come up with a green bond framework that must be vetted and under which it can issue bonds for various purposes.	The premium attached to green bonds may continue to make them attractive in a high-interest rate environment. Green bonds can be used as a marketing tool to generate public attention over a sustainability-related investment.	It is advisable for firms and government to seek strong second and/or third-party opinions on green bond issuances to avoid greenwashing accusations.	**PepsiCo's Green Bond Framework** Under this framework, PepsiCo issued a USD 1.25 billion green bond in 2022. Uses can include farmer training, practices to reduce fertilizer use, and watershed enhancement (PepsiCo, Inc. 2022a). Pepsico's 2022 Green Bond Report states that its green bond funded activities that replenished 1.3 billion litres to high water-risk watersheds (PepsiCo, Inc. 2022b).
Impact Investing	A financial strategy that considers the environmental and social impact of investing rather than just its profitability.	Able to invest in technologies and initiatives that would make a positive impact on the world and communities.	Very few impact investing funds in Canada focus on regenerative agriculture.	**Verge Capital, Pillar Nonprofit Network (London, Ontario)** Verge Capital is a social finance program of the Pillar Nonprofit Network and a collaborative effort with partners like Libro Credit Union and Sisters of St. Joseph. Climate action is a significant part of their portfolio, including finding ways to create a carbon neutral economy and reducing GHG through investments (VERGE Capital 2023). Verge has shown a keen interest in regenerative agriculture through investment and education (5th World 2023).

Financial Instrument	Description	Pros	Cons	Examples
Pay-for-Success Models/ Impact Bonds	Financial instruments that seek specific outcomes which will trigger financial return on investment for investors.	An attractive option for private investors who value specific outcomes. Redistributes the risk of the outcomes not being achieved.	Difficulty in assigning financial value to the conservation outcomes means that low-hanging fruit with established economic links may be prioritized. Labour intensive to co-create, track, and analyze metrics, challenges to realizing co-benefits.	**The New York Outcomes Based Fund** A collaborative project that provides financial support and technical assistance for farmers to support regenerative agriculture practices. Targets the Great Lakes watershed with outcomes funded by Great Lakes Protection Fund (NY Outcomes Fund 2023). **The Deshkan Ziibi Conservation Impact Bond** An outcomes-based financial instrument in southwestern Ontario which takes a two-eyed seeing approach with the goal of reconciling people and ecosystems. Seeking a landscape approach with a holistic set of impact metrics with applicability for farmland.
Payment for Ecosystem Services	Farmers who transition their land and achieve environmental outcomes are paid per acre for the ecosystem services they generate. Environmental outcomes are aggregated and sold to beneficiaries.	Rethinking the role of a farmer as a producer of ecosystem services addressed identity piece.	Some of the funding upfront and some after does not always cover the cost of a transition. Incentive to maintain the practices once transition is complete is not clear.	**Alternative Land Use Services Canada (ALUS)** For more information, see the focus point on page 102. Soil and Water Outcomes Fund (Soil and Water Outcomes Fund 2022). Grown Climate Smart, DeLong Co (U.S.).
Sustainability-Linked Bonds	Loans with preferred financing terms based on sustainability outcomes.	An attractive option for private investors who value specific outcomes. Redistributes the risk of the outcomes not being achieved.	Difficulty in assigning financial value to the conservation outcomes means that low-hanging fruit with established economic links may be prioritized. Labour intensive to co-create, track, and analyze metrics, and challenges realizing co-benefits.	**Groupe BPCE** Group BPCE in Europe issued a sustainability-linked bond dedicated to refinancing assets linked to sustainable agriculture. Various sustainability-linked bonds have been issued in Canada by large banks. Regenerative agriculture is a potential growth area for sustainability-linked bonds. Some work is being done to develop new initiatives in this space (Innovaiton North 2023).

Financial Instrument	Description	Pros	Cons	Examples
Transition Loans	A loan that is used by farmers to reduce the environmental impact of their farms.	It makes it easier for farmers to reduce emissions and transition to more sustainable practices. Aligned with the Canadian taxonomy.	No universal standard, increasing the risk of greenwashing and limiting public trust.	**Cadent Gas (UK) Transition Bond Framework** This UK natural gas company has issued two transition bonds respectively worth EUR 500 million (2020) and EUR 625 million (2021) to fund its decarbonization initiatives. These activities include installing infrastructure to carry hydrogen and reduce methane leakage (Cadent Gas Ltd 2021a; 2021b). In Canada, eligible transition finance activities in the future could include CCS and methane capture in natural gas facilities (Sustainable Finance Action Council 2022).
Venture Capital	Venture capital (VC) firms invest in start-ups in exchange for equity and board positions. Start-ups coming out of accelerators may end up with VC investors .VC is the largest funding source for regenerative start-ups (Pitchbook 2023). However, deal size has decreased since 2020 (Pitchbook 2023).	VCs can share their networks and experience to accelerate start-up growth, providing them with credibility. Niche industry segments can quickly grow thanks to VC funding.	VCs may have high-growth expectations, which may not be suitable to all founders depending on their strategy. VC stakes can dilute founder's shares. VC membership on boards can also lead to founders being removed. VC funds rarely focus on regenerative agriculture practices.	**Ag Capital Canada Limited Partnership, Farm Credit Canada** A CAD 24-million equity fund aimed at discovering, developing, and nurturing Canadian agricultural businesses through capital investment and entrepreneurial expertise. The focus is on established businesses in need of growth capital and business management mentorship. FCC's commitment is CAD 12 million, which represents 50 per cent of the fund (FCC 2022).

Financial Instrument	Description	Pros	Cons	Examples
Weather Index-Based Insurance	An insurance product designed to payout if farmers do not meet their yield or production goals due to weather issues, e.g., insufficient rainfall (CGIAR 2013). It can enable farmers to invest in regenerative practices and encourage banks to provide them with credit. The index is based on weather stations' data.	An incentive to support farmers to adopt regenerative practices, e.g., cover crops, water retention. Low-income and small-scale farmers may benefit from this product.	Weather stations must be close to farmers to provide data. Drone availability may also be required depending on the insurer.	**Indian Farmers Fertilizer Cooperative and Tokio General Insurance (IFFCO-Tokio)** A joint venture was formed between both entities in 2000 to provide insurance to Indian farmers (Tokio Marine Holdings 2019). More than 200 farmers have signed up for index-based insurance in Bihar and Haryana states in India (CGIAR 2014). This was done under CGIAR's Climate Change, Agricultures and Food Security research program.

FOCUS POINT:

Transforming the agriculture production model through ecosystem services payments

ALUS' New Acre project pays farmers for the ecosystem services they produce and encourages them to think of an acre of land differently; it is not only about the products that can be grown on that space but also the ecosystem services that can be supported and the co-benefits that can be achieved (New Acre Project 2023). It allows farmers to re-think what they consider "productive land" and reconsider what it means to be productive on a farm.

The payment for ecosystem services model addresses many challenges farmers face when transitioning to regenerative practices, including the financial risks and community and in-kind support. ALUS connects farmers to a community serving a broader purpose. Payment for ecosystem services reimagines the role of the farmer as a producer because of the farming process. Rather, it considers the farming process's by-products as the farm's valued outputs. Instead of merely compensating farmers for their produce, they also pay farmers for the ecosystem services they support on their farms by cultivating healthy ecosystems.

Placing a value on these by-products shifts the farming model and allows for a broader view of the role of the farmer embedded in the ecosystem. It makes the labour-healthy ecosystems provided for farms and society visible in the short term. It also values it as part of the farming business model.

How can financial instruments address some challenges of transitioning to regenerative agriculture? What have we learned about conditions for success? What is needed of our financial infrastructure to support regenerative agriculture?

Barriers to overcome

Despite the growing interest of financiers in supporting the agri-food system, several barriers exist to scaling up finance for nature-based solutions and funding the transition toward regenerative agriculture. The UN Standing Committee on Finance Forum met to discuss finance for nature-based solutions and identified barriers. These barriers include (United Nations Framework Convention for Climate Change 2022):

- The current rate and scale of financing are different from investment needs.
- Integrating ecosystem goods and services into economic and financial services and the need for building capacity is difficult.
- The longer time horizon of nature-based solutions generates desired outcomes slower than non-nature-based solutions.
- Identifying collateral for nature-based finance is difficult.
- There is a need for verified data for assessing the risk of investments for nature-based solutions.
- The challenges of nature-related financial disclosure include developing a global framework.
- There is uncertainty of internationally recognized outcomes of nature-based solutions.

These barriers were conceptualized for nature-based finance generally, which is relevant for financing regenerative agriculture. In addition, in this report, we have identified supplementary considerations for regenerative agriculture that challenge the transition, including cultural resistance to a paradigm shift in farming practices, lack of standard definition for regenerative agriculture, concerns over access to farmland and ownership of farmland, and a diffused sense of responsibility for investments across jurisdictions.

Some of the current financial instrument models need help to navigate these barriers. Although these items remain challenging, innovative efforts to create financial instruments that target nature can overcome some of these challenges. Initiatives that target one or more of these barriers and meet the conditions for success outlined in this report have the potential to channel more private capital to investing in nature and supporting a regenerative agricultural transition.

This report has sought to provide a systems perspective on these challenges. Employing a systems perspective and engaging new actors would bring new ideas into the conversation, spurring creativity in developing innovative and high-impact financial infrastructure.

Financial infrastructure is one of many paths needed to transition to regenerative agriculture. However, it is one step forward in an ecology of solutions, both in public policy and private sector innovation, needed to advance a transition to a regenerative system in agriculture.

Although some may contest the financialization of nature, we advocate for financial instruments that value and financially reward the regeneration of ecosystems to incentivize investment in nature. This is consistent with previous calls that one must go beyond disincentives to incent practices consistent with achieving environmental goals, such as net zero targets (Keenor et al. 2021).

PHOTO: Farm field with barn and wind turbines, **Jean-François Obregón Murillo**

Checklist for financial instruments aiming to advance regenerative agriculture

This report calls for a shift in agriculture systems to advance regeneration. This goes beyond discussing on-farm practices. A transformation toward regenerative agriculture requires engagement and support from various actors across the system. As such, this report highlights some key takeaways and conditions for success in advancing regenerative agriculture.

A systems approach is required. To advance regenerative agriculture, we need to go beyond organizations and linear perspectives on agricultural production and value chain models to include implications across many actors in the system. This includes engaging perspectives from across the system, including otherwise invisible or silenced viewpoints.

Clarify the regenerative agriculture term. Regenerative agriculture has often been conflated with other movements toward sustainability in the agricultural system. Some farmers have recognized it as the next trending term rather than a paradigm shift in farming. As such, another condition for success is clarity on what "regenerative agriculture" means in certain contexts, including but not limited to production practices.

Recognize nature interconnectedness for a holistic approach. To advance regenerative agriculture, one needs to recognize the interconnectedness of nature and natural processes in ecosystems. Thus, more is needed to evaluate the benefits of carbon sequestration, soil health, biodiversity enhancement, or water quality improvements in isolation. Proponents of regenerative agriculture should take on a holistic approach that acknowledges that enhancing ecosystems' health involves all these components. Co-benefits should be considered when tracking outcomes and success to mitigate unintended consequences.

Place farmers first to redistribute the risks and benefits. Farmers often bear the risks of transitioning to a regenerative approach. To advance regenerative agriculture, the responsibility and risks must be shifted from the farmer and redistributed across the system. This helps address the challenges farmers face in bearing the upfront costs and risks of transformation.

Address social issues such as power dynamics and colonial legacies. The agriculture context maintains colonial legacies and systemic power structures that discriminate against certain communities. To transform the system and advance regenerative agriculture, these often-silenced communities need to be engaged, and power dynamics and social issues must be addressed. These groups offer knowledge that would aid the implementation of regenerative agriculture principles and benefit many ecosystem health aspects like long-term soil health.

Meet goals of industry, including economic, social, and environmental. A transition to regenerative agriculture should also consider the goals of industry actors. This goes beyond economic impacts to include social and environmental considerations – e.g., climate targets and corporate social responsibility.

Maintain access to farmlands for small- and medium-holder farmers. To advance regenerative agriculture, we also need to address concerns about protecting farmland access. Fragmentation of farmland, especially in areas of high competition for land use, is problematic as it reduces the farmland acreage available to farmers to grow their operations. Additionally, there are high barriers to entry with farmland consolidations and purchases by larger operators and institutional investors, which make entry and economies of scale for small- and medium-holder farmers difficult. The common thread to balance farmland fragmentation and aggregation is ensuring maintained farmland access, especially for small- and medium-holder farms.

From these main conditions for successful transition to a more regenerative system, we have developed a "checklist" that actors engaging in projects to advance regenerative agriculture should consider. This checklist captures the varying degrees to which each item can be implemented through a project in advancing regenerative agriculture:

Table 3: Regenerative Agriculture Financial Instrument Checklist

ACTION	Good	Better	Best
Engage systems actors	Organization only.	Engage upstream and downstream value chain.	Consider system, including silenced perspectives (non-humans, marginalized communities).
Clarify the definition of regenerative agriculture	Term is mentioned. No definition given.	Regenerative is defined in terms of the practices employed.	Regeneration is defined in terms of practices, and off the farm considerations for a paradigm shift.
Holistic approach to outcome tracking	Success is determined by a single metric.	A few metrics are being tracked in isolation.	Multiple metrics and co-benefits are tracked, and success is determined by holistic environmental, social, and economic factors.
Place farmer first, redistribute the risk and benefits	Offering financing to farmers. Risk borne by farmers.	Support specifically for adoption of ecosystem services. Cost-sharing.	Farmer/landowner compensated for adoption of regenerative practices. Ecosystem services are priced into business model.
Consider social implications of ecosystem regeneration (e.g., cultural importance of land, power dynamics, worker conditions, etc.)	Social aspects of agriculture are not considered.	Food security of communities is considered and addressed.	Involves BIPOC leadership. Supports land sovereignty and cultural knowledge transfer.
Meet goals of downstream actors	Meets single target. Focus on economic goals.	Consider social and environmental goals to the extent that they impact the organization.	Considers how the organization can better contribute to the system. Considers social and environmental impacts to the system.

ACTION	Good	Better	Best
Maintain access to farmland (Protections for agriculture and environmentally sensitive lands)	Financially supports access to farmland. Supports keeping farmland from development and rezoning.	Supports the enhancement of farmland to be healthier and more productive. Prioritizes prime locations under threat.	Supports development of farming support services. Considers health of farmland for future generations. Considers implications for ecosystem corridors, natural heritage and cultural usage of land, and co-benefit tracking across plots of land.

From the table above, one can see that the various options available for financing a transition to regenerative agriculture have pros and cons. Evaluating current structures against the checklist, we can see that there is potential alignment, but also opportunity for improvement.

PHOTO: Minesing Wetlands, **Claudiu Dobre**

PHOTO: Farm field with trees in Niagara, **Jean-François Obregón Murillo**

Summary

Key take-aways:

- Historically, the financing of agricultural infrastructure has been decoupled from financial support for nature.
- Several considerations of regenerative agriculture make it different than typical agriculture funding.
- Several barriers exist to financing nature-based solutions; these extend further to financing agriculture.
- Despite the challenges, there are a number of innovative instruments to finance regenerative agriculture.
- This report highlights several conditions for success for financial instruments to advance regenerative agriculture and overcome some of these barriers.

Barriers:

- The nature, time horizons, appropriation of benefits, and diffusion of responsibility of regenerative agriculture make it especially difficult to finance compared to the typical financing structures of agricultural production.
- The lack of a commonly agreed-upon definition for regenerative agriculture impedes financial instruments being developed by financial institutions. The Sustainable Finance Action Council aims to develop a taxonomy by the end of 2025. What role agriculture will have when short taxonomies are developed for priority sectors is unknown.
- The value of nature, e.g., ecosystem benefits, is not yet easily translated into financial value.

Conditions for success:

- Improvements to the financial infrastructure for regenerative agriculture that consider a systems perspective.
- High-impact projects that consider the "checklist" conditions for success.
- There is a need for greater private funding of nature-based solutions, estimated at 14 per cent. Most of the funding for nature-based solutions comes from public sources.

Conclusion: the need for gradual changes from financiers to farmers to support systems change

This report has provided a comprehensive overview of the role of agriculture in the Canadian economy, the challenges it faces, and the potential for regenerative agriculture to address these challenges. Regenerative agriculture, focusing on ecosystem health and sustainability, certainly promises to transform the agricultural sector.

The report highlights several important points:

1. **Challenges in conventional agriculture**: The report acknowledges that the conventional industrialized agricultural practices, while successful at increasing production, have led to ecosystem degradation and declining productivity over time. This sets the stage for a shift toward more sustainable practices like regenerative agriculture.
2. **Ecosystem regeneration and farming**: The report explains how regenerative agriculture enhances ecosystem health, particularly focusing on biodiversity, soil health, and water management. These interconnected elements contribute to improved crop pollination, healthier soil, water purification, erosion prevention, and resilience to extreme weather events.
3. **Barriers for farmers**: From the farmers' perspective, the report addresses the challenges they face in transitioning to regenerative practices. These include the high costs and time required for transition, land ownership challenges, and the uncertainty of neighbouring practices affecting their efforts.
4. **Just transition and equity**: The report emphasizes the importance of a just transition to regenerative agriculture. It discusses the necessity of honouring Indigenous practices, involving BIPOC communities, and ensuring equitable land and food production access. This aligns with broader social considerations in sustainable development.
5. **Government, industry, and consumer perspectives**: The report touches on the interests and roles of various stakeholders, including the government's focus on environmental targets, downstream food companies' sustainability efforts, and consumers' demand for sustainably produced goods.
6. **Financial aspects and infrastructure**: Financial perspectives are interwoven throughout the report, highlighting the need for financial incentives to aid farmers in transitioning, support from communities, and the role of financiers and insurers in mitigating risks. The report also suggests various financial instruments like crop insurance, payments for ecosystem services, green bonds, blended finance, and impact bonds that can support regenerative agriculture.
7. **Systems perspective**: The report takes a holistic view of the entire value chain, recognizing that transitioning to regenerative agriculture involves multiple actors and factors. It underscores the importance of defining regenerative agriculture, fostering a culture around it, building communities of practice, and considering various implications, such as land ownership and zoning.
8. **Economic and environmental considerations**: The report intertwines economic considerations with environmental ones, showing how regenerative practices can create value through carbon sequestration, risk reduction, food security, reduced costs, and increased land valuation.
9. **Need for improved financial infrastructure**: The report suggests improving financial infrastructure to support regenerative agriculture adequately. This involves considering financial challenges and social and environmental conditions contributing to success.

This report comprehensively analyzes the challenges and opportunities associated with transitioning to regenerative agriculture in Canada. It considers multiple perspectives and recognizes the complex interplay of factors that must be addressed for successful implementation.

We have outlined key implications and recommendations from the report. These recommendations provide a clear roadmap for advancing regenerative agriculture and addressing the challenges and opportunities highlighted in the report. A summary of the recommendations is found below:

1. **Clarity around regenerative agriculture**: Rather than striving to define set practices and a standard definition, embrace regenerative agriculture as a paradigm of farming which emphasizes the principle of enhancing ecosystems and valuing the role of nature in production. Multiple practices may advance regeneration in this view.
2. **Accounting for nature's value**: Develop methods to account for the value of nature in agricultural production. Translate the benefits of regenerative practices, such as cost reduction, sustained yields, and risk management, into financial value. Create instruments that attract investment toward nature-based solutions by quantifying biodiversity value.
3. **Inclusive financial infrastructure**: Collaborate with stakeholders and rightsholders across the value chain to develop an inclusive financial infrastructure. Overcome challenges like risk distribution and time horizons associated with regenerative agriculture. Encourage innovative thinking and hybrid approaches that address economic and non-economic barriers to support farmers effectively.
4. **Just transition and empowerment**: Considering marginalized perspectives ensures a just transition to regenerative agriculture. Recognize Indigenous farming methods, involve BIPOC communities, and address inherited colonial structures. Build a system that is equitable, respectful, and inclusive.
5. **Systems-level solutions for transformation**: Engage various actors in the agricultural system to bring about transformative change. Encourage small actions from multiple actors to contribute to the larger shift. Call for the involvement of both private and public sectors to bridge the nature-funding gap and enhance ecosystem resilience.

These recommendations collectively address the multi-faceted nature of transitioning to regenerative agriculture, encompassing ecological, economic, social, and systemic aspects. They emphasize collaboration, innovation, and the need to recognize and value nature's contribution to agricultural production. By following these recommendations, stakeholders and rightsholders can work toward building a more sustainable and resilient agricultural sector in Canada.

PHOTO: Forest in winter on the Oak Ridges Moraine at Whitby, Ontario, Canada, **Rick Harris**

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