



Bonnefield

FARMLAND *for* FARMING

The Role Of Farmland In Mitigating Climate Change

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Introduction

The topic of climate change has never seemed more prevalent, with 2019 witnessing a continued trend of climate disasters. From wildfires in California, Brazil, and Australia, to droughts in Europe, and floods in the United States, these are only some of the negative impacts that climate change is having across the globe. Concern regarding climate change's contribution to an increasing frequency of extreme weather events is reaching a crescendo in public discourse. This is perhaps best exemplified by climate activist Greta v being named Time Person of the Year for 2019. Across multiple industries, geographies, and political affiliations, there exists a sense of urgency to develop solutions to this mounting global situation.

Against this backdrop, Bonnefield believes that the agricultural industry will play an important role in mitigating future carbon emissions. However, the sector's specific role is far from clear. Not only is the sector directly affected by climate change, it has also been viewed as a contributor to climate change. Less widely discussed are the ways in which agriculture serves as a powerful tool to combat climate change.

The following discussion serves to illustrate the complex nature of the climate while highlighting agriculture's role in mitigating the negative impacts of climate change.

Agriculture and Climate Change

Human contribution to climate change is well documented: processes such as fossil fuel combustion convert carbon, long stored in the earth, into greenhouse gases such as carbon dioxide ("CO₂") and methane. These gases accumulate in the atmosphere faster than can be sequestered, resulting in increasing atmospheric carbon and warming surface temperatures. These carbon molecules store energy and heat in the atmosphere, contributing to a warming trend over the past century which is projected to continue unless net emissions are drastically reduced.

While the mechanism is understood, policy makers and private interests continue to search for viable solutions to both mitigate further emissions, and increase rates of carbon sequestration. One area of focus is on the agricultural sector which has been identified as a major carbon emitter, and is a target for potential global policy changes in the effort to combat climate change. Proposals, such as the United States Democratic Congress' Green New Deal, highlight the political concern regarding agriculture's contributions to emissions. However, these policies say little regarding farmland's capacity to sequester carbon and mitigate future climate change.

Mounting evidence suggests that farmland, and sustainable farming techniques, may present a significant opportunity to mitigate a portion of global greenhouse gas emissions in the future¹.

With the adoption of modern and sustainable farming practices which encourage additional carbon storage through increasing soil organic matter ("SOM") over time, farmers can play a part in reducing total emissions. The effects that modernizing agriculture have had in enhancing soil carbon storage capacity suggest significant improvements are still to come – both an important undertaking and a deeply encouraging thought.

As evidenced by BlackRock's recent statements on sustainable investing, the investment industry has reached a tipping point in realizing that investors have a major role to play in promoting viable solutions to address climate change. Against this backdrop, a deeper understanding of sustainable farming techniques shows that farmland is immensely valuable, not only as a financial asset, but perhaps more importantly, due to the environmental and social value of agriculture.





The Current Greenhouse Gas Landscape

Temperatures throughout the world are increasing as greenhouse gases, such as carbon dioxide, linger in the atmosphere and trap heat around the earth's surface. The implications of global warming are experienced ubiquitously: melting glaciers, rising sea levels, increased desertification and heightened levels of weather volatility. Surface temperatures are already 1°C higher than levels in the 1950s and are set to increase another 2.5°C in the next 40 yearsⁱⁱ. In Canada, three of the last five years have been the warmest on record, and each of the last 20 years have been warmer than the 20th century averageⁱⁱⁱ.

As atmospheric CO₂ exceeded 415 parts per million ("ppm") in 2019 (an event which marks the highest levels in history), countries were urged by the Intergovernmental Panel on Climate Change to not

only lessen emissions but to reduce net atmospheric CO₂ concentrations. To date, much of the discussion has centered on means to slow greenhouse gas emissions. However, initiatives to sequester these emissions may also prove crucial in mitigating the worst effects of climate change.

As responsible investors consider how best to incorporate environmental, social and governance ("ESG") issues in their investment decisions, the concept of investing in carbon-offsetting assets has become a focal point. A growing field of evidence suggests that agriculture, and specifically the sustainable use of cropland, can serve as a meaningful tool to mitigate the effects of climate change.

How Sustainable Farming Can Sequester Carbon

Among the most accessible, practical, and effective methods to reduce atmospheric carbon is to store it in our soils and vegetation^v. Photosynthesis, the essential process in agriculture, is a key mechanism for achieving carbon sequestration. Plant life, from root to stem, is comprised of carbon that was previously in our atmosphere. In addition to plant biomass, our soil also represents a major repository of carbon and will be an important interface for increasing future sequestration of atmospheric carbon.

Carbon sequestration achieved through adopting sustainable farming practices is directly connected to building SOM on our farms. Organic compounds are critical to the health of the soil biome: they act as a glue that connects the soil particles and increases carbon content, allowing the soil to maintain beneficial moisture levels and resist erosion^{vi}. With ecologically sustainable farming practices such as reduced tillage and direct seeding, residues from crop roots, manure, and biomatter become part of the soil structure. Microbial activity breaks down these materials, releasing nutrients and carbon into the soil, which allows for organic matter to build.

Canada's Role in Sequestering Carbon and Mitigating Climate Change

Canada benefits from an abundance of fertile land, fresh water, and natural resources. However, these resources require responsible management and sustainable use in order to protect them for the long-term. Over the past several decades in Canada, there have been substantial changes in both farming practices and soil carbon sequestration, resulting in positive outcomes.

Regenerative farming methods, more efficient land use, and a change in crop composition, have helped to shift the average acre of Canadian farmland from a net emitter of carbon to a net collector. Soils have gone from emitting 1.2 million tonnes of carbon in 1991 to removing about 11.9 million tonnes from the atmosphere in 2011.





Changes in Farming Practices That Can Lead to Greater Carbon Sequestration

Past Canadian Farming Practice	Current Canadian Farm Practice
<ul style="list-style-type: none">• Regular tillage leading to mechanical soil disruption• Fields frequently left fallow during summer• Homogenous fertilizer application	<ul style="list-style-type: none">• Conservation tillage practices• Use of cover crops and green manure• Precision fertilizer applications• Rotational grazing programs for pastureland• Direct seeding• Restoration of degraded lands• Regular use of ‘good’ microorganisms in integrated pest management plans

Profitable and Sustainable Farming

Fortunately, there does not need to be a trade-off between sustainability and profitability in farming operations. Rather than being mutually exclusive, sustainable practices are critical to profitable farming. Productive soils and environmental health in the long-term increase the cash flow potential of the land, whereas extractive agricultural practices can erode soils and destroy value. Resilient soils with less erosive risk also have greater SOM levels.

Evidence shows that healthy SOM levels increase crop yields, increase water retention capacity, and reduce reliance on synthetic fertilizers^{xiii}. One U.S. survey of corn yields suggested that fields with greater SOM concentrations averaged over 10 percent higher yields – simply put, building soil organic matter pays^{xiv}. Bonnefield believes that the trend toward agricultural sustainability in Canada is beneficial for the land, the atmosphere, and the farmer’s bottom line.





Bonnefield's Role

Some Canadian farmers have benefited from a warming trend with longer growing seasons and the possibility of cultivating new crops. These changes can increase crop production and, subsequently, increase sequestration rates^{viii} assuming regular crop rotations, and increased crop residue left in the soil^x.

It is worth noting that permanent crops, such as fruit orchards, vineyards, and berry bushes, have been shown to store significantly more carbon per area than row crops^x. With an estimated 600,000 acres of permanent crops in Canada, the biomass of permanent crops, including orchards and vineyards, is estimated to sequester 5 million tonnes of carbon per year and release nearly 4 million tonnes of oxygen into the atmosphere^{xi}.

If sustainable practices continue, the Canadian Agri-Food Policy Institute suggests that Canadian cropland can maintain a sink of 17.8 million tonnes of carbon per year from 2016 to 2030^{xii}. While not a total solution, these are encouraging estimates that contribute towards a global effort to reduce net emissions.

Conclusion

According to the United Nations Environment Programme, net carbon emissions must be reduced by 55% annually to avoid the worst effects of climate change^{xv}. While there is no denying the enormity of this challenge, Bonnefield believes that Canadian farmland can positively contribute to the solution by acting as a carbon sink. Increasing evidence indicates that sustainable agricultural practices can reduce the effects of climate change

going forward and offer an accessible means to make an important difference in the future of our climate^{xvi}.

As investors and policymakers alike consider the implications of their environmental decisions, farmland should be viewed not only as an attractive financial asset, but also a positive contributor to managing the impacts of climate change.

i The Canadian Agri-Food Policy Institute, 2019.
ii Grantham, 2018.
iii Climate Atlas of Canada, 2019.
iv Earth System Research Laboratory, 2019.
v Mulligan et al. 2018.
vi Pucetaite et al. 2019.
vii Environment and Climate Change Canada, 2016
viii Intergovernmental Panel on Climate Change, 2018.

ix Statistics Canada, 2019
x Huffman et al. 2015.
xi Lakso, 2010
xii Smukler, 2019.
xiii Oldfield et al. 2019.
xiv Oldfield et al. 2019.
xv United Nations: Emissions Gap Report, 2017
xvi Smith et al. 2014.