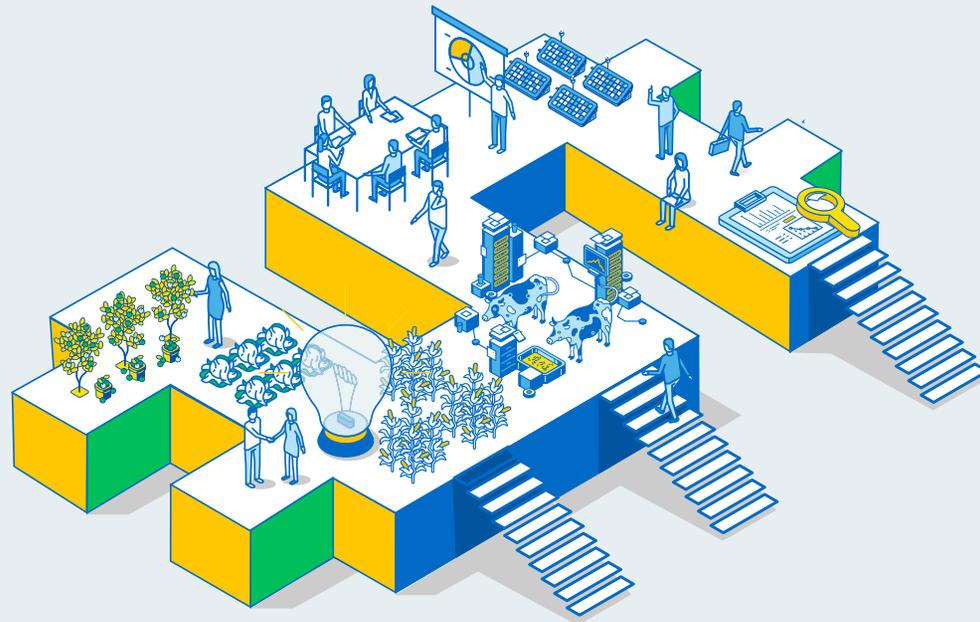




A collaboration with BCG Centre for Canada's
Future and Arrell Food Institute at the University
of Guelph.

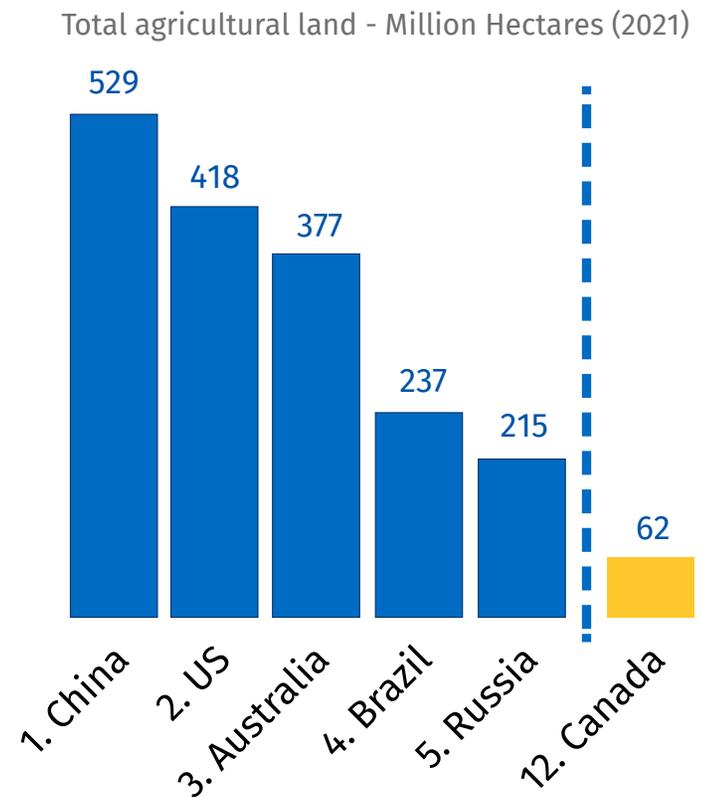


The Discovery

1

Canadian farmers manage one of the world's largest inventories of agricultural land.

Canada's vast area of cultivated agricultural land is the 12th largest globally.



*this includes Indigenous lands that are self-farmed or leased to third-party operators.

Source: OECD Data & Statistics Canada

2

This soil could be a powerful “carbon sink”.

Soil has the potential to store or “sequester” carbon, pulling it out of the atmosphere where it contributes to climate change. Canada’s agricultural land could sequester between 35MT and 38MT of annual GHG emissions—cutting about 25% of potential 2050 emissions, according to our estimates.

Potential annual emissions sequestered by 2050 (CO2e)



Mitigation potential in 2050 106 MT

3

By using sustainable practices, farmers can unlock this potential, earn money and protect water, land and air.

Through practices such as cover cropping, reduced tillage and nutrient management, farmers not only increase soil carbon, they also improve water and air quality and preserve biodiversity.



Enhance crop resilience while reducing pesticide & fertilizer use



Protect & enhance biodiversity in fauna, flora & microorganisms



Reduce water stress, increase soil water retention & drought resilience



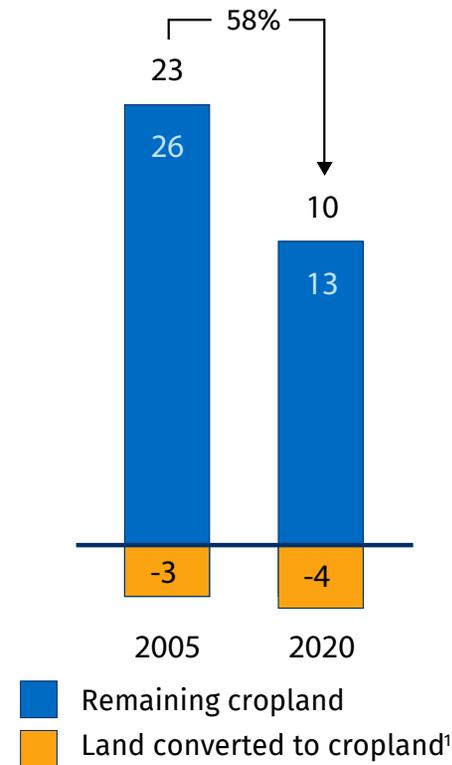
Increase soil preservation, improve air quality and reduce pollution

4

The challenge: soil sequestration on Canadian cropland has fallen by 58%.

Degradation from heavy tillage and practices like mono-cropping (where a single crop is grown year after year on the same land), have halved the amount of carbon stored annually in agricultural soil over the last two decades.

Annual emissions sequestered (MT CO₂e)

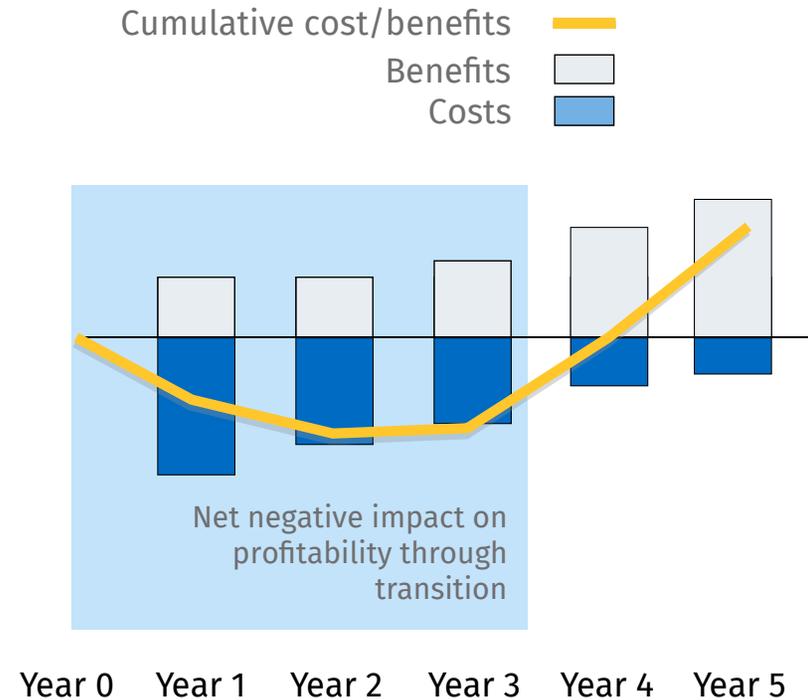


1. Annual emissions from all land converted to cropland in last 20 years
Source: National Inventory Report, IPCC common reporting format, BCG analysis

5

And major financial barriers are deterring farmers from adopting sustainable practices.

Sustainable farming eventually enhances yields. But upfront costs (including for new equipment) and the potential for initial yield loss can pose significant obstacles. This is particularly true for farmers operating on slim margins.



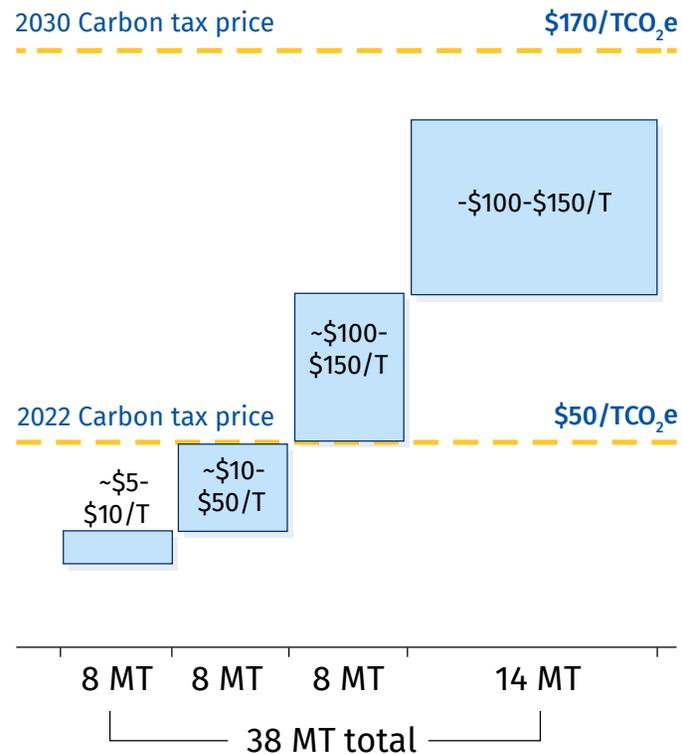
*illustrative
Source: BCG analysis

6

To accelerate adoption of sustainable farming, we'll need more money:

Financial incentives can boost farm income and assist producers with the costs associated with the transition. Storing 38MT of carbon in soil per year will require incentives of up to \$4 billion annually. To secure those funds, we'll need to find the right financial instruments and funding sources.

Price range of potential 2050 emissions sequestered by Ag (\$/TCO₂e)



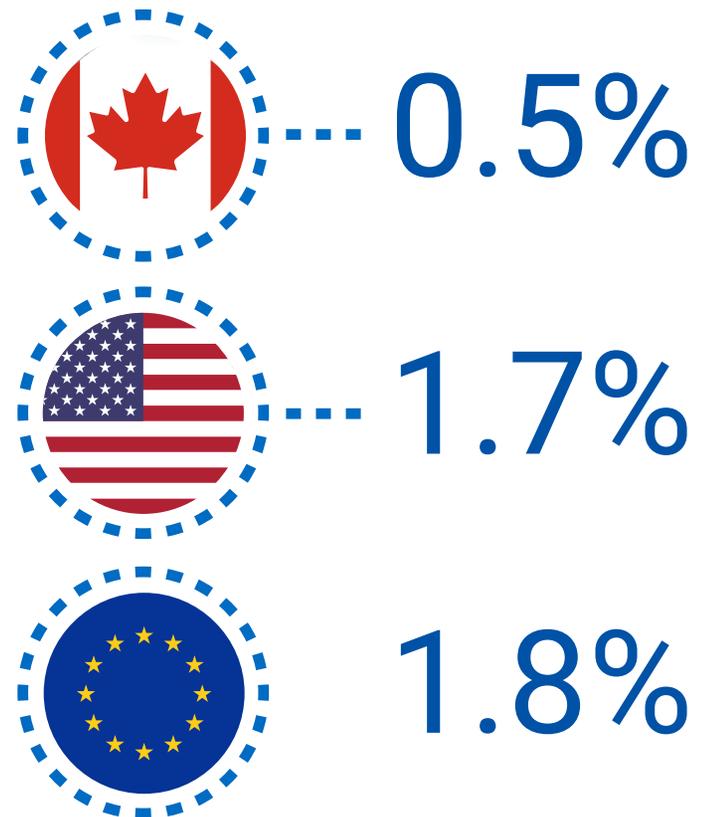
Source: Drever et al (2021), "Natural climate solutions for Canada", BCG analysis

7

Currently, insetting and government funding are the best mechanisms to inject this capital.

But Canada’s public funding for sustainable agriculture significantly lags that of other major economies. And uncertainties about systems to measure, report and verify soil carbon (MRVs) persist across all financial instruments. The market integrity of carbon offsets, which will also have a critical role to play as the economic system to support sustainable farming evolves, are particularly dependent on MRVs.

Climate funding as a % of farm receipts 2021



8

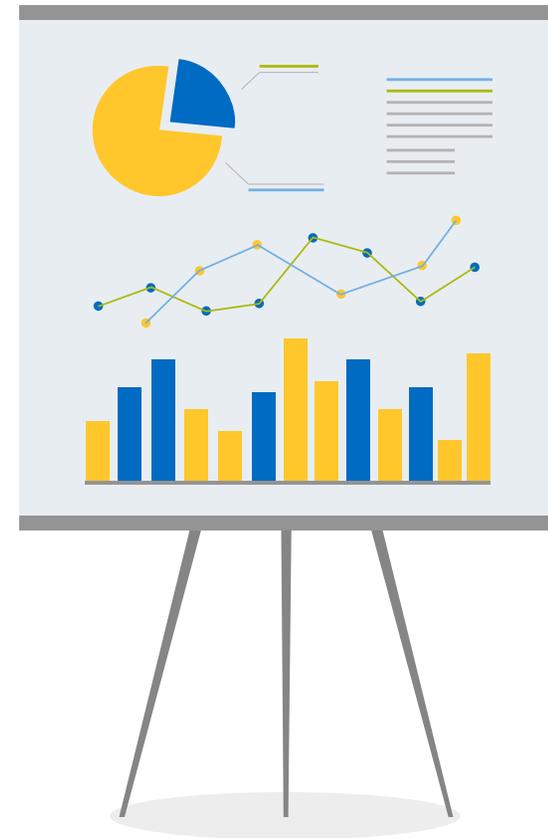
More reliable measurement, reporting and verification systems (MRVs) will provide the foundation for better inseting and offsetting.

Key MRV challenges

Further inputs needed - Most MRVs don't reward early adopters of sustainable agriculture practices.

Lack of standardization - No common protocol exists to award carbon credits or verify insets. This has led to mistrust.

Convincing investors - Investors question the trustworthiness of MRVs and quality of credits.



Betting on the farm:

Leveraging soil to fight climate change

For generations, Canadian farmers have been financially rewarded for the food they produce. The more bushels of wheat a farmer grows—and the greater price that commodity fetches on markets—the larger the return will be.

Yet by embracing sustainable practices, farmers also hold unparalleled power to cut emissions, and to improve air and water quality, soil health and biodiversity.

Tapping that power will require capital. While the current potential of sustainable agriculture is ro-

bust, the economics underpinning it are not. We'll need to price in sustainable practices while supplying the funding and financial instruments to de-risk and incentivize their use. And we'll need to rethink an economic system that wholly rewards agricultural *production* while placing little value on *preservation*.

These efforts—supported by national MRV protocols, and cross-industry partnerships—can be the foundation of a world-leading sustainable agriculture strategy.

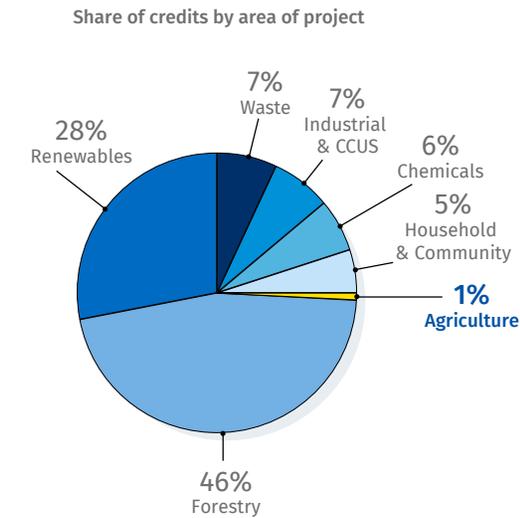
What are MRVs?

Measurement - A tool monitors reductions of emissions performed by farming activity.

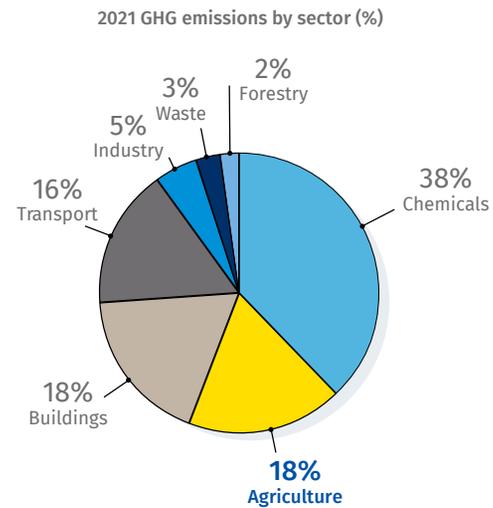
Reporting - The measurement is submitted to a third party verifier.

Verification - The third party verifier certifies emissions.

Agriculture could be a much larger source of emissions reduction and removal



Agriculture has generated only ~1% of carbon credits globally



Yet it accounts for ~18% of total global GHG emissions

Source: Elis (2021). BCG Analysis

What are insets and offsets?

Insets: Organizations directly avoid or reduce emissions within their own supply chains.

Offsets: Companies or individuals purchase tradeable credits, generated by renewable energy or other emissions reducing projects. This credit negates or offsets the same amount of carbon emissions created by the buyer.

Hitting pay dirt:

Three financial pathways to a more sustainable agriculture sector

In this paper, we examine three financial instruments that could boost carbon storage in soil and create other benefits: carbon offsets, carbon insets, and government funding. All of these tools are currently operating at varying scales. However, their potential to make an immediate impact on sustainable farming ranges.

Insetting is currently the most effective mechanism to incentivize farmers to adopt new practices. Though broad consumer demand for sustainable food has yet to develop, agri-food companies have

displayed a willingness to pay more for sustainable inputs as a way to reduce emissions in their own supply chains.

Government support will also be critical in the early days of this transition. Yet as it stands, Canadian government funding is lagging that of its global peers. This discrepancy could put Canadian farmers at a disadvantage as sustainable and reliant food systems become more important in the global marketplace. In all cases, reliable measurement, reporting and verification systems (MRVs) are key. Offsets are particularly reliant on MRV trials to build a foundation of market integrity and trust. Developing these systems will take time.

1

Carbon offsets

Short-term: Challenged | Long-term: Important

What are they?

Tradeable credits, each representing one ton of carbon emissions. Buying one negates or “offsets” a ton of emissions that a company or individual releases into the atmosphere.

Opportunity

If challenges are addressed, the agricultural credit market could grow to \$2B-\$4B by 2050 (were 38MT in emissions removed).

Challenge

The market has been held back by uncertainties about MRVs, which have impacted the quality of credits. Regulatory uncertainty, and fears of greenwashing are related problems.



How do carbon offsets work?

Projects

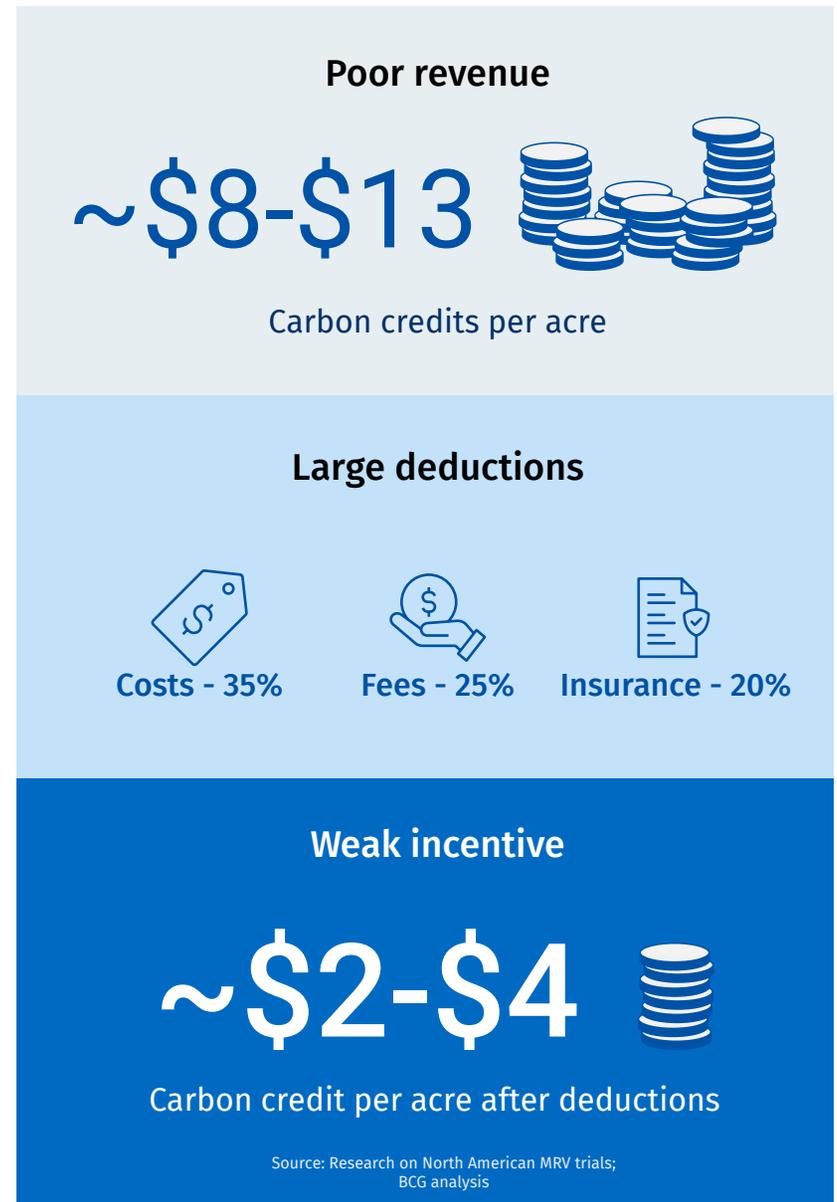
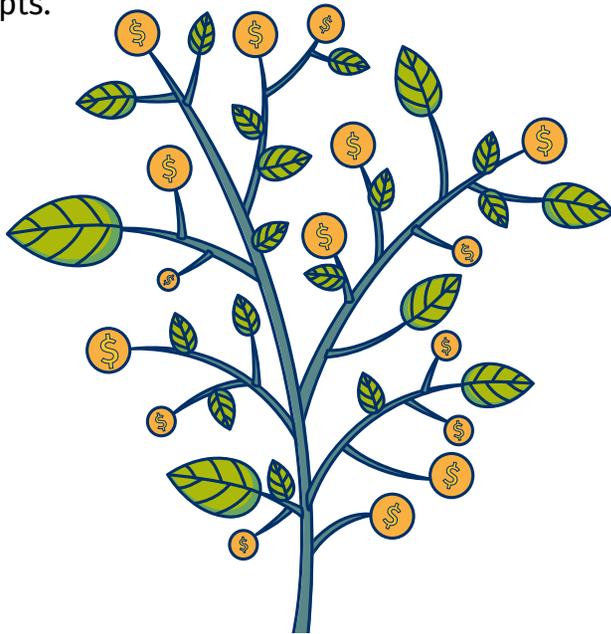
Projects reduce or remove GHG emissions (for example, through direct air capture, reforestation, sustainable ag practices). Once the projects are validated, credits are issued and then verified by a 3rd party auditor.

Offsetting

Organizations or individuals can purchase external credits to offset their emissions.

For farmers, the return on offsets doesn't add up

A farmer using sustainable practices receives roughly \$8 to \$13 in carbon credits per acre. But due to imperfect science and shaky measurement, a large portion of these credits may be withheld. That's before multiple project costs deduct as much as 60% (35% for costs, 25% for fees) and another 20% for insurance. In the end, the farmer's share is just \$2 to \$4 per acre, a sliver of total farm receipts.



The quality of carbon credits hinges on measurement

3 main types of MRVs

Soil sampling

Soil sampling takes a small volume of soil for lab analysis. Measurement for organic and inorganic carbon is conducted through heat or acid tests. While accurate, it is not scalable due to price and scalability barriers including repetitive and time-consuming lab tests and inconsistent data standards.

Scalability: Poor

Price: Poor

Accuracy: Very Good

Result Variance: Poor

Administrative Intensity: Poor

Process-based modeling

A process-based model is an algorithm that is interpreted on real-world data to predict future carbon soil activity accurately. While inexpensive, it has a larger margin of error and should be coupled with either soil sampling or remote sensing to be valuable.

Scalability: Good

Price: Excellent

Accuracy: Good

Result Variance: Average

Administrative Intensity: Good

Remote sensing

Though the use of ground-based sensors or satellite imaging, farms can be viewed geospatially to help producers monitor carbon sequestration. Highly scalable, but requires further global infrastructure development to become a universally adopted solution.

Scalability: Excellent

Price: Very Good

Accuracy: Very Good

Result Variance: Excellent

Administrative Intensity: Excellent

Framework to identify high quality MRVs

Though every MRV is different, the most effective deploy the following:

MRV Function	Bronze	Silver	Gold
Soil sampling	✓	✓	✓
Process-based models	✗	✓	✓
At least two 3 rd party certifiers to audit findings	✗	✓	✓
Remote sensing	✗	✓	✓
Assesses life cycle of inputs on farm or more than three best management practices	✗	✗	✓
Covers more than five field crops	✗	✗	✓

2

Insetting

Short-term: Ready | Long-term: Important

What is it?

Organizations directly avoid or reduce GHG emissions in their own supply chains.

Opportunity

Insetting programs enable companies to shrink their carbon footprints, demonstrate their sustainability commitments and future-proof their businesses against more stringent emissions regulations. The higher price they pay for sustainable goods can compensate farmers for costs and yield losses stemming from the transition to more sustainable practices.

Challenge

The need to coordinate with farmers and other stakeholders—and to measure and verify emissions reductions—can be time-consuming and difficult. The lack of standardization and reliable measurement can also make it difficult to confirm and share results. As a result, the need for a green premium may be unclear to consumers and need to be absorbed by the company.



How sustainably-grown foods can cut agri-food supply chain emissions

Farmers

A network of farmers within a supply chain are selected to farm sustainably by incorporating new practices or expanding them.

Companies

Companies pay farmers more for this food, which helps compensate them for the costs and risk associated with transitioning to sustainable farming. Companies may absorb the added cost of this or pass it on to consumers in the form of a higher price or “green premium”.

The process helps companies avoid or reduce Scope 3 emissions in their supply chains and better prepares for them for future regulations that may be more stringent. These supply chain initiatives can also be used for marketing purposes.

Consumers

Consumers have the option to purchase products that have been grown sustainably.

Most consumers won't buy for sustainability alone¹

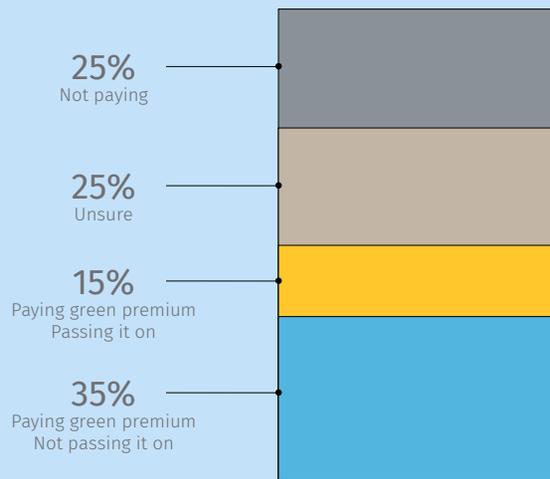
10% of consumers are **buying** just to “save the planet”.

10-30% of consumers are willing to buy when sustainability² is linked to other benefits such as health, safety and quality.

40-60% of consumers express concern for sustainability but are limited by **barriers³ like income, cost and convenience.**

1. Including shoppers often/very often purchasing sustainably and considering themselves as sustainable; 2. Including shoppers that sometimes buy sustainably; 3. Includes non-buyers that would be willing to pay a >5% premium at parity of other benefits.

But half of companies, including those in agri-food, are willing to pay more¹



Reasons given to pay green premium

- Meet sustainability commitments (e.g. insets)
- Gain advantage in faster growing markets
- Secure supply ahead of future scarcity
- Prepare for government regulation, (e.g. carbon price)
- Capture customers willing to pay for and/or willing to stop buying for sustainability

Source: BCG sustainability consumer survey (June 2022); BCG project experience and analysis; BCG-WEF Report (2023)

3

Government funding

Short-term: Ready | Long-term: Important

What is it?

Government funding to support farmers who are conserving, sustainably managing and restoring agricultural ecosystems. Programs include CAP and On-Farm Climate Action Fund.

Opportunity

\$0.6B-\$1.5B in additional agricultural climate initiative funding is needed in Canada to match U.S. and EU levels. Without competitive funding, Canadian farmers could be at a competitive disadvantage.

Challenge

Beyond the size of funding, there is an opportunity to improve access and delivery of support, to include broader sustainability initiatives and to improve data on program impact.



Canada's funding for sustainable agriculture lags peers



United States

Total farm receipts¹

\$545B



Ag support as a % of receipts

\$64B | 12%

Climate funding as a % of total farm receipts

~1.7%

Inflation Reduction Act (IRA) includes \$27 billion for agricultural conservation and stewardship through 2031



European Union

Total farm receipts¹

\$699B



Ag support as a % of receipts

\$122B | 18%

Climate funding as a % of total farm receipts

~1.8%

Common Agricultural Policy includes about \$224 billion through 2027 for 'climate-relevant initiatives'



Canada

Total farm receipts¹

\$83B



Ag support as a % of receipts

\$8B | 10%

Climate funding as a % of total farm receipts

~0.5%

The Sustainable Canadian Agricultural Partnership could commit \$500M in added funding, and \$800 million in On-Farm Climate Action Fund & Ag Clean Tech funding

For more information see appendix

Recommendations:

Harvesting change

Government

Create the world's leading sustainable agriculture strategy. Agriculture and Agri-Food Canada recently launched public consultations on the Sustainable Agriculture Strategy. This should provide decisive targets on emissions reductions across the spectrum of farming activities and clear direction on a framework for sustainable agriculture.

Develop a national soil strategy. Define how Canada and the provinces can best value, manage, and improve their soil for the next 15 years through clearly defined soil health targets and MRVs. Launch demonstration-scale programs through public-private initiatives that can determine how to lower the cost of MRVs and soil sampling. Assisting farmers with the upfront costs of soil sampling can offset the financial risks of transitioning to sustainable farming. And a national soil data sharing program, made easily accessible to farmers, can identify what practices work best in each province and region. This can be used by provincial Environment Farm Plan programming to develop local schemes to keep agricultural soil sustainable.

Increase direct public support. For our farmers to remain competitive with those in other major economies, Canada must lift the level of public support for sustainable agriculture. It must also deliver funding programs that make sustainable farming practices a priority and provide financial mechanisms to cost share the burden of transition with farmers. All of these benefits must be equally accessible regardless of farm size or commodity focus.

Make innovative changes to existing tax and financial tools. Tax and financial incentives can support the transition to sustainable agriculture. Practices like cover cropping can lower yields for over two years on certain types of farms. One way to cut that risk for farmers is to offer crop insurance discounts that make up for lost revenue. Financial mechanisms to accelerate depreciation on cost-prohibitive technologies can also accelerate the adoption of sustainable agriculture and MRV tools. Establishing a fund to purchase carbon credits can boost demand, making it more attractive for farmers to participate in markets.

Companies

Establish a council to create an MRV protocol. A committee of industry leaders across the agriculture supply chain should agree on a protocol to determine the best standardization route for MRVs. The council will provide the federal and provincial governments with a list of data required to improve the development of MRVs. The protocol will be aligned with international standards currently in development and will value the number of practices monitored, the measurement tools used to verify results, and the cost to farmers. This will ideally be recognized and followed by Canada's trading partners.

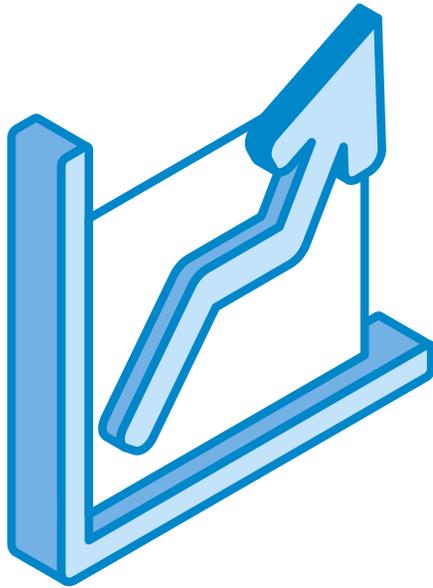
Improve transparency around emissions reduction efforts. Through insetting programs, companies are currently driving some of the most innovative soil carbon sequestration trials. The data they are collecting has immense scientific and societal value. Making this data available, without sacrificing intellectual property, can be invaluable to a national pursuit of sustainable farming.

Educate consumers. Industry needs to inform consumers about the importance of sustainably-grown food. As education and awareness grows, more consumers will ask for sustainably-made products. As a broader marketing strategy, agri-food processors should pay a premium for sustainably-grown food. This can not only enable processors to claim an inset, it can kickstart consumer demand. Currently, insetting is one of the most compelling and effective ways of accomplishing Scope 3 reductions.

Partner with NGOs to support farmers' transition. Program and funding delivery can be a significant bottleneck to the uptake of sustainable farming practices. NGOs can play a pivotal role in shaping policy and standards, deploying experts for technical assistance and promoting sector-wide collaboration. They can also shape and deliver comprehensive training programs, access to funding, opportunities for knowledge sharing, and advocacy efforts to raise awareness and drive change.

Investors

Finance gold standard MRVs. Emerging MRVs need to grow quickly, but they need to make economic sense for farmers. At the moment, the administrative hurdles and cost of MRVs limit their widespread use. In addition, MRVs need to work for any farm. Yet the majority of current MRVs only work for certain production systems. Ultimately, the most successful MRVs will balance administrative obligations, with cost, time, and accuracy of verification.



Farmers

Farmers must continue to lead. While 65% of farms reported adopting sustainable practices in the last agricultural census, more can be done with the right education, reskilling, and funding mechanisms. Producers need to blend the expertise they hold on their own land with new skills and local knowledge about which sustainable practices will reduce emissions and develop carbon sinks. A range of programs, like the Farmer Resilience Mentorship Program, can do much to help us transition to sustainable agriculture.

Push for better education. Farmers are ingrained in Canada's agricultural colleges and have a powerful voice in the curricula they follow. Sustainable agriculture practices should be taught in schools with an emphasis on both their environmental value and their economic value.

Glossary of sustainable farming practices

Cover crops

Crops, such as clover, can be grown in the off-season after cash crops to increase carbon storage & reduce soil erosion

Reduced Tillage

Reducing soil disturbance by limiting tilling in crop-lands, which improves carbon storage

Nutrient Management

Applying fertilizer from the right source, at the right rate, at the right time, and in the right place, using as little as required

Silvopasture

Integrate trees, forage, and livestock grazing in the same area to improve soil nutrients and livestock well-ness

Crop rotations

Planting different crops sequentially to improve soil health and nutrients, while combating pests and weeds

Manure Management

Manure can be turned into energy through anaerobic digestion or used as a natural fertilizer

Biochar

Converting crop residue (i.e., waste) to charcoal; when used as a fertilizer, it can increase carbon storage

Appendix: Where Canada sits in a global landscape

Canada

The Sustainable Canadian Agricultural Partnership includes \$3 billion over 5 years. About \$1 billion is through federal programs and activities, of which \$690M goes to innovative and sustainable growth including the AgriScience program to tackle pre-commercial and other research. About \$2 billion is dedicated to supporting sustainable agriculture, equipment purchases, training, and scientific research.

The \$200 million On-Farm Climate Action Fund was distributed through 12 organizations across Canada. These will dispense money to help farmers adopt sustainable practices. Provinces are also establishing or managing their own carbon trading systems where producers can sell agricultural carbon credits. Alberta and Quebec's offset systems are well established, while Nova Scotia and Saskatchewan are in the process of launching their own approaches.

United States

The Inflation Reduction Act (IRA) is the largest piece of federal legislation to ever address climate change, increasing the pool of funding for conservation efforts by US\$20 billion. It expands the Partnerships for Climate-Smart Commodities program which seeks to remove 50 million metric tons of carbon dioxide. It has allocated US\$3 billion to 141 projects on crop and livestock farms across all 50 states and Puerto Rico. And it involves collaboration among more than 100 universities, 20 tribes and tribal groups, and 60,000 farms, on over 25 million acres of working land. The project will remove the emissions amounting to the equivalent of 12 million gas-powered vehicles.

European Union

The Common Agricultural Policy (CAP) program was revamped in 2022. It includes €387 billion, a third of the EU's entire 2021-2027 budget, to assist in the transition to Net Zero farms and rural communities. Its goal is to cut greenhouse gases by 55% by 2030—in line with EU's Green Deal targets. In all, 40% of the CAP's financial plan is explicitly dedicated to climate relevant activities and a further 10% of the EU's budget outside the CAP is directed towards biodiversity efforts.

Australia

The Emissions Reduction Fund is Australia's flagship program for fighting climate change. It supports farmers, businesses, and rural communities in decreasing greenhouse gases by providing carbon credit units that can be sold on to public or private buyers. The scheme actively promotes soil carbon projects by sharing the upfront costs of soil sampling. The program expects Australian farmers to earn over AUD 400 million from the sale of credits from soil carbon sequestration by 2050. The federal government is also dedicating AUD 64 million in funding to promote the development of soil carbon measurement technologies and an additional AUD 54.4 million to encourage active soil testing and national data sharing.

Brazil

Brazil is offering farmers low-interest loans through the ABC Plan. Farmers are given credit and financing options to adopt sustainable farming practices like no-till, intercropping, crop rotation, and recovering degraded pastures. Launched in 2010, the program was recently revamped with the goal of storing 41MT annually of carbon dioxide over 177 million acres of farmland across the country. In its last financing round, over 62,000 contracts were signed. This made Brazil the second highest ranked nation in the world for no till farms (around 18% of Brazil's total agricultural land).

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