

increased soil health and fertility. The following are other examples of policy and program-based solutions that have been implemented across Canada.

Environmental Farm Plans

Across Canada, all provinces and one territory offer Environmental Farm Plan (EFP) programs to enhance awareness and education of environmental conditions and Best Management Practices (BMPs) on the farm. Although EFPs are delivered differently across the country, there are often opportunities for farmers to apply for cost-shared funding programs to implement projects that improve on-farm environmental management practices. These practices will often result in enhancing EG&S. For example, Ontario's Canadian Agricultural Partnership Funding Program includes project funding to support the development of riparian buffer strips to prevent nutrient and soil loss into nearby waterways. The activities supported by this program include establishing permanent plant cover on field margins and purchasing and planting non-invasive trees, shrubs, wildflowers, and grasses to stabilize riparian areas. Through such cost-sharing programs, individual farmers can access financial support to implement projects that reduce environmental risk on the farm, as well as gain valuable learning tools.

There is additional potential for EFPs to stimulate economic activity in international markets as well as reduce insurance costs for farmers. With increased environmental concern, international markets are requiring more stringent environmental regulations for the production of their imports. Harmonization with internationally recognized standards, such as the International Organization for Standardization (ISO) sustainability standards would allow provincial EFPs to be recognized globally, thereby accessing novel markets. While EFPs are not currently ISO Certified, an ISO Certification of provincial EFPs could result in additional benefits such as insurance companies offering lower insurance rates for farmers.³⁵

Conservation Land Tax Incentive Program

The Ontario Ministry of Natural Resources and Forestry (MNR) administers the Conservation Land Tax Incentive Program (CLTIP) that encourages private land stewardship of provincially important natural heritage features.³⁶ Under this program, a portion of the land-owner's property may be eligible for 100% property tax exemption. Eligibility must be demonstrated through one of four features present on the property: provincially significant wetlands; provincially significant areas of natural and scientific interest; habitats of regulated endangered species; and designated 'natural area' within the Niagara Escarpment Plan. Regular farming practices may take place if the natural features are underground (such as an aquifer, geological formations, or habitat for endangered species) or in marginal land, while other features may constrain farming activities. When participating, landowners agree to protect the feature and allow MNR staff to inspect the site when necessary. Recent research shows that CLTIP participants were as likely to engage in conservation behaviours as landowners who are not in the program,³³ clearly demonstrating that participation in incentive programs is not strictly financially motivated.

STRATEGIES FOR ESTABLISHING ECOSYSTEM SERVICES

CASE STUDY 1: COVER CROPS FOR SOIL HEALTH

Soil erosion costs Canada \$3.1B per year.³² Cover crops are grown to support ecosystem health, rather than for harvestable products.³³

What are the benefits?

Cover crops are planted for enrichment and protection of soil. They provide:

- Reduced soil erosion over winter
- Reduced soil erosion from water runoff
- Additional income from cover crops
- Increased soil health & fertility

Numerous organizations in Ontario have championed the use of cover crops, including the Ontario Ministry of Agriculture, Food and Rural Affairs' [New Horizons program](#).³⁴ As a result, the number of farmers using cover crops has more than doubled in Ontario from 12% in 2011 to 25% in 2016.

Cover crops can be used for forage and biofuel, though they may no longer be considered cover crops.

CASE STUDY 2: AGROFORESTRY

Agroforestry outperforms conventional agricultural systems for marketable and non-marketable ecosystem services.

What is it?

Agroforestry is a land use management system in which trees or shrubs are grown around or among crops or pastureland.

How does it help?

This intentional combination of agriculture and forestry has varied benefits such as:

- Reduced pollution
- Reduced nutrient loss
- Reduced soil loss
- Increased carbon capture
- Increased wildlife habitat
- Economic gains

Bonus: Trees can provide supplementary income from fruit, nuts, or lumber.



ALUS is the longest running paid EG&S system in Canada

ALUS is a farmer-driven, fee-for-service approach that offers farmers annual payments for the provisioning and enhancement of Ecological Goods & Services. ALUS invests in farmers and ranchers who are producing clean air, clean water, wildlife habitat and other ecological goods & services in communities across Canada. It currently operates in 6 provinces.

Some examples of funded projects:

- Expanded riparian buffer zones that provide critical wildlife habitat and improve water quality.
- New, enhanced or restored wetlands that improve water quality and can protect communities against spring flooding and offset the impact of droughts.
- Pollinator hedgerows that provide habitat for native bees which in turn pollinate our agricultural crops.

Between 2008 and 2021, ALUS has enrolled over 32,100 project acres and distributed over \$12.3 million to over 1100 farmers and ranchers across Canada.

Ontario Managed Forest Tax Incentive Program

Through the Managed Forest Tax Incentive Program, land owners who get their property classified as 'managed forest' pay 25% of the municipal tax rate set for residential properties.³⁸ Ontario, for example, already implements a farm-land tax class, where agricultural land-owners pay a maximum of 25% of the municipal property tax for registered land. However, forest land that exists in agricultural landscapes falls under the full residential tax-class rate unless registered with the MNR as 'managed forest'. Farm properties with a minimum of 4 hectares of managed forest may be eligible. The program requires land owners to submit 5-year progress reports, and updated forest management plans every 10 years. Recent research indicates that the MFTIP program increases the likelihood that landowners will be successful in removing invasive species and planting native species.³⁷ Retaining managed forests in agricultural land also provides habitat for wildlife, sequesters carbon, and reduces soil, fertilizer, and pesticide runoff.

Market-Based Solutions

The following section provides an overview of market-based solutions that exist to compensate farmers for the provision of EG&S within the Canadian context.

ALUS Canada

ALUS (Alternative Land Use Services) Canada is a national charitable organization that funds projects to enhance EG&S provided by farmers and ranchers that benefit all Canadians. Projects include wetland restoration, reforestation, windbreak planting, installation of riparian buffers, management of drainage systems, and pollinator habitat creation, among others.³⁹ Most projects focus on marginally productive and/or environmentally sensitive agricultural lands. In addition to funding project costs, ALUS provides per-acre annual payments to farmers maintaining ALUS projects on their land. As a community-delivered program, each ALUS community establishes a Partnership Advisory Committee to direct funding in its area. Approximately half of each Partnership Advisory Committee is made up of farmers.

ALUS works as a mediator to deliver funding from a wide spectrum of sources. These include private donors such as the Weston Family Foundation, federal programs like the Great Lakes Protection Initiative, provincial programs like the Ontario Species at Risk Stewardship Fund, municipal governments, and corporate Canada through the New Acre Project.³⁹

Market-based requirements

In order to sell to certain markets, environmental considerations can be made a prerequisite to sale. The Potato Sustainability Initiative was created as a response to concerns by the food industry of pesticide use on potatoes

used for frozen products.⁴⁰ As a result, growers of processing potatoes (which, in Canada, are largely concentrated in Alberta and New Brunswick) are required to meet environmental management standards around pesticide use and impact to surrounding landscape in order to supply their goods to major businesses such as McDonald's.⁴⁰ Similar models could be applied by existing membership and standards organizations. The Dairy Farmers of Canada (DFC) have already begun this process through their ProAction initiative, which is mandatory for all milk producers in Canada.⁴¹ This program promotes environmental sustainability and is moving towards mandating that all participants develop an EFP. Taken a step further, DFC could require certain best management practices to be included in EFPs, thereby creating a high level environmental standard consistently across the sector. Similar models could be adopted for certifications that exist in wine-growing regions.⁴² Certification or enrollment in membership programs can provide benefits such as additional advertising, or increased sales prices.^{42,43} Wine growing regions also benefit greatly from tourism in part due to the aesthetics of "ideal" rural and agricultural landscapes.^{42,44} However, wine certifications, such as the Vintner's Quality Assurance (VQA) certification, rarely include environmental considerations.⁴² Integrating environmental considerations into existing certification structures can have impacts on regional and local scales, as well as align growers to the same sustainability standards.

Conservation Easements

Conservation easements (CE) offer a market-based solution for preserving ecologically significant land. CE's are defined as instruments by which a landowner grants the rights of their land to another party.⁴⁵ CE's are written agreements between a landowner and a qualified organization (generally an organization whose core activities include land conservation) identified on the land title. In Canada, eligible CE holders and governance vary from province-to-province. Once donated, it is protected permanently by the recipient organization.

The Ecological Gifts program is an example of a tax-break policy resulting from CE's. The program is administered through Environment Canada. Through this program, private land owners can donate their ecologically significant land by way of conservation easements. Landowners receive a charitable receipt for the fair market value of their donation among other financial benefits*.

Alberta Carbon Offset Program

The Alberta Ministry of Agriculture and Forestry facilitates a carbon offset program, where farmers can sell carbon credits after they adopt an agricultural practice that improves carbon sequestration.⁴⁶ Farmers are required to register with aggregation companies, which in turn, sell large bundles of farm offsets to large company purchasers. This gives farmers an opportunity to earn extra income, while reducing their carbon footprint.

* Other advantages include: no tax on capital gains for gifts, no limit on the total value eligible for deduction/credit in any one year and a ten-year period to apply the receipt to income.

EG&S: CHALLENGES IN CANADIAN AGRICULTURE

Gaining Value-Chain Support

The challenge for agriculture and EG&S is that producers benefit only from selling their agricultural commodities, while EG&S, such as pollinator services or wildlife habitat, are more difficult to quantify. The question is, what role could the government play in addressing this gap?

Currently, there is variation between individual provinces' and territories' Environmental Farm Plans. This variability, as well as differing priorities between provinces and in federal policy, contributes to confusion on how to most effectively implement BMPs as well as a lack of understanding of their long-term effectiveness. The [Canadian Agri-Food Sustainability Initiative \(CASI\)](#) is a national initiative to unify sustainability tools and practices while creating a transparent system of accountability for environmental farming practices. This creates assurances throughout the value-chain that sustainability standards are being maintained across the country. For example, producers use an online portal to report on topics such as wetlands and other marginal lands, nutrient management practices, and riparian buffer strip management. Providing transparency through the value-chain allows policy and decision makers to better understand the efficacy of BMPs and work towards developing projects and programs that use and enhance existing EG&S practices.

It is also important to ensure that, as a vital part of the value-chain, consumer perceptions around incentive programs for farmers are positive. Ultimately, an ideal EG&S program is implemented so that consumers recognize the direct beneficial ecological impacts that farming has on the landscape. Such considerations may affect purchasing decisions at the consumer level with effects seen throughout the value-chain.

Market Response Time for Ecological Goods and Services

A key challenge in valuing EG&S is the time lag between implementing a management practice and successfully measuring the resulting EG&S within a feasible time-frame, as it may take multiple seasons for EG&S to be realized. Additionally, the value of the EG&S may change over time. For example, in the Alberta carbon offset program aggregators can hold offsets, and re-sell when the market value goes up. Farmers, however, must register and sell their offsets in that given year — meaning farmers do not see the benefit of the increased value over time.⁴⁶ Activities like increasing the capacity for carbon capture have a lag time between implementation and measurable response, and this will also vary with farm size and commodity type. Research has shown that to implement conservation behaviours at the farm level, practices must be economically profitable and result in productivity gains (or, at the very least, do not result in decreased productivity).⁴⁷ Measurable productivity gains also depend on farm size. Additionally, there is a lag between research and application at the farm-level. Information dissemination is an opportunity to not only increase the prevalence of practices resulting in the provision of EG&S, but also to communicate the market value of EG&S in agriculture.

Taking low producing areas out of production would mean that these areas could return to a naturalized state, such as native grasslands or woodlots. Once restored these areas would start to provide more EG&S through habitat creation, increased carbon sequestration, and water purification.⁵¹

The lag time between implementation of measures to support the provision of EG&S in landscapes and a measurable response will differ depending on the desired outcome. For example, the response of native pollinators in newly established native grasslands will have a quicker measurable response than carbon sequestration. These are inherently different and need to be accounted for when assessing 'success'. The time scale shift depending on the EG&S will require patience to measure and report on. Importantly, the time it takes to see and measure EG&S can take longer than typical political cycles, meaning tools to allow time to measure outcomes must be incorporated into incentive programs and policy development.

Incentives for Ecological Goods & Services Are Not Always Needed

Incentives are not always needed to maintain lands and practices that provide EG&S. For example, EG&S associated with native grassland can provide services for humans such as food and other raw materials. Plants, animals, and microorganisms provide regulating services such as pollination, prevention of soil erosion and water purification, as well as cultural services, like recreation and a sense of place.^{48,49} In some cases the intrinsic value of nature or the added benefit of reducing management intensity is enough motivation to preserve the area, and the associated positive environmental externalities. Nature is not monetized but rather the intrinsic economic and cultural values are recognized. In some cases, monetary incentives for EG&S can cause a loss of intrinsic value. For example, if existing land features are incentivized, farmers may be less inclined to keep those features once the incentive is removed.⁵⁰ However, long-term monetary incentives for natural features can be unrealistic and thus intrinsic value should be promoted through education and awareness.

A study from the University of Guelph suggests that using precision agriculture tools can save farmers money by taking low producing areas out of production.⁵¹ Low producing areas requiring greater inputs and producing lower yields make certain parcels of land less profitable. Precision agriculture was used to map areas of high and low productivity over time, which was then linked with economic data on commodity yields compared to the costs of investing in alternative management for EG&S.⁵¹ Taking low profitability areas out of production would return areas to a semi-natural state, such as restored native grasslands or woodlots. Once restored, these areas provide more EG&S through created habitat, increased carbon sequestration, and water purification.⁵¹ By converting marginally productive agricultural land to natural areas that support EG&S, the land owner may derive higher profits from the land in the long term.

Agroforestry is an example of agriculture and EG&S working together. Agroforestry offers the cultivation of crops grown between rows of trees and is further discussed in [case study 2](#).^{20,26,52,53}

Other Means of Facilitating Adoption of EG&S Practices

When it comes to the adoption of environmental practice, monetary incentives are not always enough to change behaviour. Incentive programs across the world have seen low enrolment rates in environmental agriculture programs, with research suggesting a link between social factors and the likelihood of enrolling in such programs.^{54,55}

Research on landowners in southwestern Ontario found that the likelihood of enrolling in a voluntary land enhancement program was strongly motivated by access to information on how the decline in natural areas would directly affect landowners.⁵⁰ When learning about ecological on-farm practices, farmers across Manitoba and Ontario ranked learning from other farmers and neighbours (peer-to-peer) as the most important learning source, followed by independent learning from the internet and print publications. Learning from government programs was ranked much lower than these options by farmers.⁵⁶ Integrating farmers into research and policy has shown potential to engage farmers, change the intention and motivation of farmers towards sustainable practices, and bring together diverse learning communities.^{56,57} Therefore, there is an opportunity for innovative agricultural and environmental solutions through education, the support of peer-to-peer learning, and encouraging research and practitioner collaboration.

However, other economic factors may still impede action. For example, farmers with diversified incomes that do not rely entirely on farming are more likely to set aside land for conservation.⁵⁰ In some circumstances this could mean that assisting farmers to diversify their income (e.g., through tourism or hosting community events) might encourage them to adopt ecological practices. However, such an approach would likely be less feasible or viable for larger-scale farm operations, and could be construed by farmers as an attempt to try and stop them from farming. Overall, this could make suggestions to diversify income streams detrimental if they alienate farmers that might otherwise have engaged with initiatives to support the provision of EG&S. Quick fixes may not support long-term change, and any program or plan should consider benefits as part of a long-term strategy. Longer-term changes to societal beliefs and values sets will likely require substantial inputs of time and resources.⁵⁷

Land Tenure

Farmland in Canada can be owned, rented, or shared⁵⁸ and each have their own constraints when it comes to the provision of EG&S. While farmers are generally good stewards of the land, the notion of land tenure poses three main challenges for EG&S:⁵⁹

1. Lease agreements can limit the ability for renters to implement certain practices that result in EG&S.⁶⁰
2. Farmers who farm their own land are more likely to be good stewards because they are more likely to see return on their investment.⁶⁰ Unless renters are constrained by terms in their lease agreements, they do not have the same incentives to invest in the BMPs resulting in provision of EG&S as landowners do.



Hectares of farmland in Canada

Owned: 40,319,298 ha

Rented: 16,218,269 ha

Shared: 1,832,424 ha

3. Landowners who are leasing their land may not be incentivized to require practices supportive of EG&S from their tenants.⁶⁰

Of course, the implementation of practices supporting the production of EG&S depends on several other factors including the rental agreement and relationship between owners and renters. Overall, there is evidence to suggest that provision of EG&S may be reduced when land is rented rather than owned⁶⁰ and that values of ecosystem services are better predicted by who owns the land (i.e. private, public, or government ownership) than by assigned protected area status.⁵⁹ However, work is still needed to fully understand the links between values, land tenure systems, and provision of EG&S.

Long-term Goals and Strategies

The cultural, intrinsic, and aesthetic value of the environment plays an important role in agricultural EG&S, but monetizing this value is difficult. More research is needed to identify economic value of a variety of EG&Ss across Canada.⁵⁹ Current evidence suggests that motivation to preserve the intrinsic values of the environment correlates with wider participation and lasting commitments to implementing BMPs that result in the provision of EG&S.⁶¹ The main economic barriers are identifying what is important to society versus what is feasible to protect for the purpose of supporting EG&S, how can payments be provided, and can one strategy work across several spaces (i.e., provision of land in Wellington County versus Okanagan Valley). The literature suggests that place-based market structures are more achievable due to temporal and spatial scale.¹

Farmers and decision-makers often have different backgrounds, and so communication and collaboration may be more difficult because of differing understanding of local agricultural practices and norms. Directly involving farmers — the implementers of BMPs, EG&S strategies, and regulations — will help to improve uptake and adoption. This suggests that researchers need to adopt an integrated knowledge translation (IKT) model. IKT involves farmers and decision-makers from the onset and throughout the investigation, development, and recommendation processes. IKT has been shown to both enhance the relevance and utility of project outcomes and recommendations and to increase the likelihood of end-user adoption. IKT partnerships involve collaboration and information sharing to define research questions, enhance research design and data collection, strengthen interpretations and policy recommendations and establish plans to improve the integration and uptake of recommendations.

CREATING VALUE AT THE LANDSCAPE LEVEL FOR HABITAT CONSERVATION

About the program:

Since 2014, hay producers who register their fields with the Credit Valley Conservation Authority as Bird-Friendly Certified agree to delay cutting until July 15.

Grassland birds like the Bobolink and Eastern Meadowlark are threatened by habitat loss due to changes in land use and cover type. These birds prefer to breed and nest in native grasslands.

More animals grazing per acre results in decreased vegetation height. Hay crops are also cut earlier, which coincides with the nesting period for these birds.

The Results

41 Program participants	15 Farmers and 19 properties	388 Acres certified as bird-friendly
267 Bobolink sightings	41 Eastern Meadowlark sightings	22 Pairs of nesting grassland birds

CONCLUSIONS AND FUTURE WORK



Agriculture and Agri-Food Canada (AAFC) recommends that initiatives to support environmental services should be **locally-based, adapted to local conditions, and draw on local expertise** and access to local resources. The AAFC recommendation fits well with the objectives of this report.¹²

Ecological Goods and Services are products of healthy, functioning ecosystems. Implementation of practices resulting in the provision of EG&S help create sustainable and resilient agricultural landscapes. Many farmers already champion environmental stewardship practices, whether it be by improving soil health through cover cropping or conserving native bird populations in open pasture fields. Although some farmers are proactively supporting the provision of EG&S on their land, there should be recognition and support from policy advisors, academia and industry leaders to provide research and incentive-based programming, as well as adequate education for farmers on the large-scale, long-term and direct benefits of these practices.

Current market structures undervalue the economic contribution of EG&S and fail to recognize their intrinsic and cultural benefits. Measuring and assigning monetary values to EG&S by introducing relevant market structures is a way to increase their uptake and increase recognition of their importance. For example, environmental farm plans are used to help farmers stay informed about best management practices that not only increase their productivity but also preserve the environment. This could be a steppingstone for a monetized EG&S framework, and collaboration between industry, academics and policy leaders would be necessary to develop market structures that are supportive.

However, introducing an all-encompassing financial incentive system across Canada would not be appropriate for provision of EG&S. Climatic and crop conditions vary from coast to coast to coast. For example, the groundwater recharge capabilities of farmland in a near-urban area may provide significantly more value compared to the same function provided in a sparsely populated rural area. Landscape design for the provision of EG&S is complex, and requires ecologists to engage with other disciplines, stakeholders and policy makers.

Additionally, incentives can be provided through indirect means such as sustainability certification, which can positively influence value chains by providing greater oversight and guidance across different agricultural and environmental management systems. This solution also provides direct benefits to farmers through access to new international markets and indirect benefits like reduced insurance costs.

Additionally, we should strive to create innovative policy solutions that are not only based on the economic value of providing EG&S, but also facilitate collaboration between policymakers, farmers, and researchers. Collaborative projects between researchers and non-governmental organizations (NGOs) like ALUS could improve provision of EG&S in marginal agricultural lands. Policy should also integrate effective learning strategies that promote intrinsic valuations of EG&S to promote long-term adoption of sustainable practices. Further, food systems will benefit from transparency to consumers about the EG&S provided by agricultural landscapes. Academia, government, NGOs, and farmers should work together to make this a reality for the Canadian agricultural sector.

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