OXFORD ECONOMICS

THE CASE FOR INVESTING IN CANADA'S NATURAL CLIMATE SOLUTIONS

A REPORT FOR NATURE UNITED

Canada's Nature Advantage

OCTOBER 2025

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To discuss the report further please contact:

Jake Kuyer: jkuyer@oxfordeconomics.com

Pete Collings: petecollings@oxfordeconomics.com

Oxford Economics

4 Millbank, London SW1P 3JA, UK

Tel: +44 203 910 8061

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EXECUTIVE SUMMARY

Given the enormous scale of Canada's landscape, there is great potential for Natural Climate Solutions (NCS) to have a substantial impact, both in contributing to Canada's net zero pathway and in providing additional benefits to the economy and society. However, there is another side to the ledger—the benefits achieved must be considered alongside the cost of delivering them. A core issue is that much of the potential benefit of NCS adoption is a "social" benefit, meaning it occurs outside market transactions and accrues to society in general, whereas much of the cost must be paid by landowners or land managers with responsibility for the land required to deliver the NCS. This represents a failure of markets to provide net benefits to society.

This study explores how private sector investment can be leveraged alongside government support by identifying which benefits would need to enter the private sector ledger, through marketisation or other financial mechanisms, to make NCS economically attractive for implementation.

APPROACH

This project applied a Cost Benefit Analysis (CBA) framework combined with ecosystem services valuation to better understand the value of NCS. Seven NCS pathways were assessed comprising 11 initiatives across three Canadian regions: agricultural practices in the Prairies and Southern Ontario, and forestry practices in British Columbia.

Costs were largely adopted from Drever et al. (2021) and include both implementation expenses and the opportunity cost of foregone economic value from alternative uses. Benefits were categorised to understand their potential for marketisation: financial benefits (already marketised); marketable non-financial benefits (with potential for policy-enabled marketisation); non-market economic benefits (valued by society but generally not traded); and non-valued benefits.

The study employs switching value analysis to identify which specific benefits would need to be marketised for the private sector Benefit Cost Ratio (BCR) to be greater than 1, the point at which investment becomes economically justified. The analysis was conducted over a 10-year period from 2025 to 2035, applying a 3% discount rate in line with Treasury Board of Canada Secretariat guidance. The results are further contextualised with a review of examples of mechanisms to marketise ecosystem service benefits from around the world.

RESULTS

The research and analysis were conducted as 11 CBAs. Overall, BCRs ranged from below 1 to several multiples of 1 by the end of the study period with all assessed benefits included. Regenerative cropping practices demonstrated strong returns. Several of these pathways reached a BCR greater than 1 on financial benefits alone, such as cover crops on the value of fodder and reduced tillage on crop yield increases, demonstrating that the private sector should have a strong case for investing in these NCS.

Trees in agricultural lands showed exceptional performance. Silvopasture achieved the highest BCR based largely on recreation and tourism value, while riparian tree planting achieved a BCR greater than 1 when water regulation benefits were included.

Avoided conversion pathways achieved BCRs greater than 1 in Southern Ontario, demonstrating strong value propositions when key ecosystem services like water regulation, erosion control, and pollination were quantified.

Conservation-focused pathways faced a steeper challenge to achieve a BCR greater than 1. Grassland and old forest conservation have relatively high costs from lost agricultural and forestry output, and they outweigh the assessed benefits. Fire risk management approached but did not reach a BCR greater than 1 on financial benefits from avoided damages alone.

SUPPORTING MARKETS TO LEVERAGE THE PRIVATE SECTOR

Different stakeholders, including the private sector and the Government of Canada, can have a role in supporting markets and instituting solutions targeted at leveraging private sector investment. Successful approaches from around the world demonstrate several potential mechanisms:

Establish markets through Payment for Ecosystem Services schemes, biodiversity offset markets with clear standards, integration of nature benefits into carbon markets via stacking mechanisms, and green infrastructure markets for services like water regulation.

Enhance regulatory environments via biodiversity net gain requirements, binding nature restoration targets, and favourable tax treatment for conservation practices.

Provide targeted financial support through seed funding for innovative projects, green bonds, match funding to spread risk, and specialised nature-focused financing facilities.

Address information gaps by funding pilot projects, establishing measurement standards and protocols, and requiring ecosystem service data from grant recipients.

The benefits for marketisation identified in the study align with existing and emerging market mechanisms and would substantially support leveraging the private sector.

KEY FINDINGS

Nature provides substantial economic value that markets do not currently capture. From a society-wide perspective, many of the NCS provide substantial net benefit. The combined Net Present Value (NPV) across the pathways exceeds several billion dollars. However, because many ecosystem service benefits exist outside market transactions, private landowners and land managers cannot capture sufficient value to justify investment costs. This misalignment of costs and benefits, rather than overall value, is the primary barrier to private sector investment.

When businesses can capture value, investment is justified. Several NCS achieve BCRs greater than 1 based on financial benefits alone, with others having a strong case with the marketisation of other benefits. This provides a private sector case for investment in NCS where market mechanisms function effectively.

Four benefits are critical for unlocking private investment. Marketising regulation of water timing and flows, erosion regulation, soil nutrient regulation, and pollination would enhance the business case for multiple NCS pathways. These benefits appear repeatedly across different pathways as either individually or collectively sufficient to achieve BCRs greater than 1.

Different NCS types require different policy approaches. NCS involving changes in land management while maintaining productive use present stronger economic cases than those requiring land use change or avoided conversion. This categorical difference suggests that policy mechanisms should be tailored accordingly, with market-based approaches more suitable for the former and direct subsidisation or carbon markets more appropriate for the latter.

Smart policy design can mobilise substantial private capital with reduced fiscal burden. By enabling mechanisms for the private sector to capture even a portion of the assessed benefits, governments can leverage substantial private sector investment toward climate change mitigation goals.

Marketising benefits can achieve GHG emissions abatement free of cost or at a discounted price. Where BCRs greater than 1 are achieved, the NCS could be favourable for private sector investment should those required to make the investments either receive or be compensated for the benefits produced. The GHG emissions abatement achieved by the NCS could be realised effectively without additional cost. For other NCS where the BCRs do not reach 1 based on the marketised benefits alone, additional subsidisation or the development of carbon markets may still make the private sector case for investment. However, marketising the benefits would still enable GHG emissions abatement at a discounted price.

CONCLUSION

Natural climate solutions could be a significant contributor to Canada's decarbonisation aims but are currently underutilised. Part of the problem is in funding and a mismatch between costs and benefits. While costs are generally borne by landowners and land managers, the benefits accrue to broader society. A mechanism to marketise some of those benefits will help make the case for investment in Canada's NCS.

Examples from around the world demonstrate that solutions to market failures around the provision of these ecosystem service benefits exist. Implementing them would help leverage private sector investment, while direct subsidisation and the creation of carbon markets would further enhance the case for NCS.

Supporting these solutions would enable Canada to achieve its climate ambitions, but realising the potential of Canada's NCS will require coordinated action. There is a role for the government in setting policy frameworks and supporting market development. Local stakeholders—including provincial and municipal governments, businesses, Indigenous groups, civil society, and private citizens—are equally essential to implementing NCS and realising their full range of benefits.

1. INTRODUCTION

1.1 CANADA, NET ZERO, AND NATURAL CLIMATE SOLUTIONS

Canada must seek to balance a range of connected endowments and challenges to flourish. The economy must continue to develop dynamically to ensure the creation of wealth, but also to do so in a way that does not impede other sources of people's well-being nor cause undue harm to the environment, which ultimately supports economic activity and human value. It must also strive to strike this balance alongside the changing global climate and taking action to mitigate its effects through GHG emissions abatement and building resilient infrastructure and systems.

The government of Canada has agreed to achieving net zero carbon emissions by 2050. There are many ways to achieve these reductions, including curbing high emitting economic activity, increasing renewable energy production, adopting technological solutions, and working with natural processes. Each of these options must be considered in the context of their financial, political, and technical feasibility. One promising approach to help achieve these targets is through Natural Climate Solutions (NCS)—actions to protect, manage, or restore nature and help mitigate climate change. NCS leverage nature to achieve emissions reductions, often at a lower cost than other options while providing additional co-benefits.

Given the enormous scale of Canada's landscape, there is great potential for NCS to have a substantial impact, both in contributing to Canada's net zero pathway and in providing additional benefits to the economy and society. However, there is another side to the ledger: the benefits achieved must be considered alongside the cost of delivering them. These costs must be shared by governments, private sector companies, and local communities, and accurately reflected in decision-making frameworks. To be a viable solution, the cost-sharing must be done in a way that ultimately leads to benefits for all, and the public sector has a role in aligning costs and benefits.

1.2 THE ECONOMIC CONTEXT

This study explores the costs and benefits of NCS and considers how private sector investment can be leveraged alongside government support. In other words, how can NCS be formulated in a way that would encourage the private sector to invest in and adopt these practices so that the costs and benefits are shared between the public and private sectors, alongside other stakeholders.

A core issue is that much of the potential benefit of NCS adoption is a "social" benefit, meaning it occurs outside market transactions and accrues to society in general, whereas much of the cost must be paid by those with ownership of, or economic responsibility for the land required to deliver the NCS. If the benefits from NCS, including GHG emissions abatement and avoided damage from climate change, outweigh the costs associated with implementing the NCS, then there are overall net gains to be made from doing so. Where these net gains are not being realised, there is an opportunity for a creative solution that makes all parties better off.

This situation, whereby net benefits are currently not being realised by markets, can be described as a "market failure" in economics. A market failure happens when markets either fail to form or operate inefficiently so the market does not provide a solution that is best for broader society. In this case, there are often barriers to market formation or efficient functioning, which can be addressed by market participants or third parties.

1.3 THE ROLE OF GOVERNMENT AND THE THIRD SECTOR

A government or third sector stakeholder can help to encourage private sector investment in NCS by several means, including directly, such as via subsidies and tax credits, and indirectly, such as by supporting the development of markets that deliver them. From an economics perspective, one of the roles of government is to support the development and maintenance of markets by removing barriers where markets do not exist or operate inefficiently. Non-governmental organisations (NGOs) and other stakeholder groups may also act in this capacity, or support governments to do so.

There are different mechanisms by which a government or other stakeholders may intervene in market formation, and these are largely dependent on the type of market failure. Some examples are summarised in Table 1.

TABLE 1: Market failures and actions

Market failure	Description of barrier to exchange	Example in the context of NCS	Potential action to support market
Externalities	Positive or negative effects are not borne by those involved in an economic exchange, and so not properly accounted for.	Farmers adopting cover crops and reduced tillage sequester carbon and reduce emissions, but receive no compensation for climate benefits.	Identify and measure externalities, internalise them through taxes, subsidies, or regulation; or encourage voluntary compensation mechanisms.
Public goods	Provision of value that is non-excludable and open to all, meaning there is not a clear mechanism for compensating the producer.	Peatland restoration provides global climate benefits through avoided emissions, but restoration costs fall on local landowners.	Provide the good through public funding, grants, or pooled provision arrangements.
Information asymmetry	One or both parties lack full information, causing uncertainty and friction in the exchange process, making bargaining and price setting difficult.	Uncertainty about actual carbon sequestration rates from different agroforestry practices makes it difficult to price carbon credits accurately.	Increase transparency and information availability by funding research, creating standards, promoting labelling, or publishing proof of concept pilot projects.
Market fragmentation or missing markets	There is no formal market or mechanism to facilitate exchange, so buyers and sellers cannot easily trade the good or service, even if it has value.	No established marketplace for farmers to sell soil carbon credits from regenerative agriculture practices to corporate buyers.	Create exchanges, registries, brokerages, platforms to facilitate direct transaction or group-based buying and selling to connect buyers and sellers.

Temporal and scale issues	Markets often undervalue long-term benefits or costs, overly discounting future outcomes, and may prioritise concentrated local costs or benefits over more diffuse or global ones.	Forest carbon projects provide climate benefits over 50+ years, but upfront restoration costs and uncertain long-term carbon prices deter investment.	Use contracts, insurance mechanisms, and policies that account for long-term and large-scale impacts, supported by strong institutions.
Tragedy of the commons	Open access and a lack of property rights may lead to overexploitation.	Degraded grasslands on communal grazing lands could sequester significant carbon through improved management, but no individual has an incentive to invest.	Assign property rights, collective management, community-based governance, lobby on behalf of stakeholders.
Market power	A single or smaller number of agents dominate a market setting prices which may not accurately reflect the open market value.	Concentrated ownership of forestland limits competition in forest carbon offset supply, potentially suppressing prices for NCS projects.	Promote competition, regulate monopolies, ensure transparency in pricing.

1.4 WHAT ARE NATURAL CLIMATE SOLUTIONS?

Natural Climate Solutions (NCS)[1,2] are a subset of Nature Based Solutions (NBS) that focus on protecting, managing, or restoring nature and natural processes to achieve GHG emissions abatement, GHG emissions sequestration, or mitigation against the effects of climate change. More broadly, NCS aim to leverage nature and natural processes to achieve a range of objectives as an alternative approach to sole reliance on the application of manufactured capital. NCS have some additional features that make them attractive, such as the provision of co-benefits (value-added in addition to the primary purpose) and leveraging nature's ability to maintain itself, reducing the need for substantial ongoing maintenance costs.

As such, NCS can be conceptualised as a form of capital expenditure and capital formation (often referred to as "natural capital" in contrast to manufactured capital or more intangible forms of capital such as intellectual capital or human capital). An investment in natural capital, such as via NCS, can increase or maintain its capacity to return a sustained flow, or revenue, of valuable benefits over time. These benefits are sometimes referred to as "ecosystem services" (simply understood as the goods and services provided by ecosystems) and these can accrue to local communities, private businesses, and broader society.

[1] For further NCS see: Griscom, B.W. et al. (2017). Natural Climate Solutions. Proceedings of the National Academy of Sciences, 114(44), 11645–11650. Available at https://doi.org/10.1073/pnas.1710465114
[2] For further on NCS see: Twigg, M. et al. (2024). Unlocking the Economic Power of Natural Climate Solutions. Smart Prosperity Institute.

Implemented effectively and at large scale, NCS have the potential to achieve substantial GHG emissions abatement much more efficiently than many other activities. However, their cost-effectiveness will depend on many factors and thus careful assessment should be conducted to determine their suitability given a range of factors, as discussed further in this report.

1.5 NCS IN THE CANADIAN CONTEXT

Canada is vast, with individual provinces and regions within Canada larger than many countries. This creates both opportunities for implementing large-scale land management initiatives, and challenges such as due to access, remoteness, and cross-regional coordination. This study focuses on three regions and sectors of interest:

- Southern Prairies agriculture—the southern portion of the provinces of Alberta, Saskatchewan, and Manitoba, and the vast "prairies" ecoregion as used for agricultural production and associated land management practices.
- Southern Ontario agriculture—the southern portion of the province of Ontario, specifically the southern and eastern stretch bordering the Great Lakes and south of Algonquin Park. While home to over a third of Canada's population and associated economic activity, the focus is on the productive agricultural lands in the region.
- British Columbia forestry—the large primarily forested regions of non-coastal British Columbia and specifically the area where forestry is practised.

While there are numerous NCS implementable in different regions and geographies and for different purposes, this study is focused on seven interventions comprised of 11 total initiatives as presented in Table 2.

Table 2 NCS descriptions

Label	Description	Initiatives
NCS1	Regenerative cropping practices (Prairies)	a. Cover crops b. Reduced tillage
NCS2	Improved pasture practices (Prairies)	a. Grassland conservation
NCS3	Avoided conversion of remnant natural habitats in agricultural lands (Southern Ontario)	a. Avoided conversion of freshwater mineral wetlands b. Avoided forest conversion
NCS4	Trees in agricultural lands (Southern Ontario)	a. Silvopasture b. Riparian Tree Planting
NCS5	Regenerative cropping practices (Southern Ontario)	a. Cover crops b. Reduced tillage
NCS6	Forest management (British Columbia)	a. Old forest conservation
NCS7	Forest management (British Columbia)	a. Fire risk management

1.6 STRUCTURE OF THE REPORT

The remainder of the report is structured as follows:

- **Chapter 2 Approach**—outlines the approach taken to assess these NCS.
- **Chapter 3 Results**—covers the key results from the analysis, providing a summary table for each NCS.
- **Chapter 4 Discussion**—interprets the results and their implications including supporting markets to leverage the private sector
- **Chapter 5 Conclusion**—summarises the study and points the direction for next steps.
- **Appendix 1 Methodology**—provides further detail on the methodology including a table of assumptions.

2. APPROACH

2.1 COST BENEFIT ANALYSIS

For such substantial undertakings to occur, the costs and benefits of implementing them should be well understood. A well-established approach that is appropriate for this study is Cost Benefit Analysis (CBA), which at its most basic level weighs the costs and benefits of an intervention to determine whether they will provide a net benefit and value for the resources invested. While simple enough as a framework, implementation can be much more nuanced and complex, especially in the case that costs and benefits are not necessarily well defined.

There are slightly different formulations of CBA, but they generally follow a set of similar methodological steps:

1. Define the scope and boundary of the assessment
2. Identify the material costs and benefits
3. Quantify and assign a value to the costs and benefits
4. Profile costs and benefits over time and discount to present value
5. Compare costs and benefits with a Benefit Cost Ratio and Net Present Value
6. Conduct sensitivity analysis and interpret results

One of the challenges in applying this framework to the assessment of NCS is that while the costs can readily be measured in monetary terms, the benefits (ecosystem services) are most often not exchanged in markets and therefore do not have associated prices. On the cost side, there are two components: the actual monetary expenses of implementing the intervention; and the opportunity cost, or foregone benefit, of the most likely alternative use of the land. The opportunity cost is also readily expressed in monetary terms, as it comprises the market value of the economic activity that can be conducted on the land (e.g., agriculture or forestry). The benefits must then be estimated in monetary terms, either with market prices (e.g., agricultural produce, timber) or with the application of a process called "transfer values", which applies results from existing studies to estimate values in a comparable context.

2.2 ECOSYSTEM SERVICE VALUATION AND TRANSFER VALUES

Ecosystem services are generally placed into three categories: Provisioning services; Regulating services; and Cultural services. Provisioning services include the production of goods, such as timber, fish, and agricultural produce, which are traded in markets and therefore have associated prices. However, other provisioning services, such as foraged foods and medicinal ingredients, generally are not. Likewise regulating services, such as regulation of water cycles, soil nutrients, and air filtration, and cultural services, such as amenity and recreational values, most often are not traded on markets and therefore not priced.

This means that other methods must be employed to estimate their value in monetary terms. There are various means to do this including modelling hypothetical markets, survey-based methods to elicit people's preferences relative to other known values, and statistical methods where appropriate data on things like usage are available. Discussing these approaches to valuation is not the purpose of this report, but rather to note that there are ways to quantify the value of ecosystem services that are robust and applied in practice.

Many ecosystem service valuation studies have been conducted going back decades, but in particular over the past 10 years as the practice has become increasingly widely recognised as being both credible and a useful instrument for policy and other decision-making contexts. These studies are dispersed by geographic region, ecosystem type, and the specific ecosystem service provided, and vary greatly in terms of the context, specification, and approach to the analysis. Therefore, while a lot of evidence on the value of ecosystem services has been produced, it is rarely directly applicable to the case in question.

To rectify this challenge, an approach called "transfer value" can be adopted. This technique seeks to identify relevant studies and then adapt the values for the specific use case. This might make use of an individual study with similar characteristics, or a meta-analysis of a range of relevant values from various studies. These values can then be adjusted by factors such as ecosystem type, population density, GDP per capita, and other relevant variables to derive an estimated monetary value of the ecosystem service provision applicable to the use case.

2.3 SWITCHING VALUES AND IDENTIFYING THE 'KEY BENEFITS'

With estimates on the costs and benefits of the NCS over time, the CBA framework can be used for different purposes. One tool of analysis is the "switching value", which is the point at which an input variable achieves a given output variable. For example, in CBA this might be applied to explore the value a benefit needs to be to achieve a Benefit Cost Ratio (BCR) of 1. This is the point at which benefits outweigh costs, and the intervention becomes justifiable on the terms of the assessed costs and benefits.

There are three situations where a switching value may be of interest. First, a switching value may be used as a sensitivity test, exploring the degree to which an assumption may influence the overall result. Second, where costs and benefits are profiled over time, a switching value might occur at a point in time at which the benefits start to outweigh the costs. Third, and somewhat unique to the specific aim of this study, we can use a switching value to better understand which specific benefits need to be monetised for the benefits of the NCS to outweigh the costs of implementing it.

Recall the overarching question this study seeks to answer: how might the private sector be encouraged to invest in implementing NCS, and what can the government do to support it. As the costs side of the equation is largely born by the landowner or manager, generally a private sector business, and the benefits are largely received by local communities and broader society, there is a mismatch in terms of the BCR. While from an overall society-wide perspective the BCR is greater than 1, the actual costs and realised benefits from the private sector perspective are often less than 1. Otherwise, there would already be a business case for implementing the NCS.

We can then reframe the question for the switching analysis to consider which benefits must be monetised for a private sector BCR to hit 1. In other words, which benefits would need to enter the private sector ledger, such as through marketisation or some other financial mechanism, for the private sector BCR to be greater than 1 and thereby encourage investment in implementing the NCS. Identifying this benefit, or set of benefits, allows us to understand the key benefits for marketisation to make the NCS attractive for the private sector. This in turn points the direction for government policy and action to support the development of markets to leverage the private sector to deliver on Canada's ambitions.

2.4 KEY PARAMETERS OF THE CBA

A detailed description of the full methodology can be found in the Appendix. However, there are some key parameters of CBA that will aid interpretation of the results:

- Scope and boundary—the scope is the selected NCS across the three regions of Canada and a focus on benefits in addition to carbon emissions reductions. The study period is 10 years but runs from 2025 to 2035 to account for some benefits being staggered a year after the cost of the intervention is incurred reflecting the lag in benefits realisation. The physical boundary of the assessment is the total area of opportunity for which the NCS is feasible within the region.
- Costs and benefits—the costs are largely adopted from those identified and quantified in Drever et al. (2021)[3] and included both expenses from the intervention and the opportunity cost of foregone benefits from alternate uses. The benefits are ecosystem services selected based on materiality in reference to external material, including Serecon[4]. To aid in the analysis of potential for marketisation, the benefits are further categorised as:
    - Financial benefits: monetary gains that are directly measurable and accrue to the private sector including individual households and businesses, or in some cases governments. These are already marketised and are effectively private benefits.
    - Marketable non-financial benefits: Non-monetary benefits that may not have a current market value but could be monetised with policy or regulatory changes. These are public goods with the potential for private benefits through marketisation.
    - Non-market economic benefits: Economic benefits that are not traded but still valued by individuals or society and can be quantified. These are public goods with some limited potential for private benefits through marketisation.
    - Non-valued benefits: Benefits that are valuable but not quantified. These are closer to pure public goods that are generally not suitable for private benefits.
- Quantification and valuation—costs are converted to a per hectare basis, and benefits are assessed on a per hectare basis, and both are applied across the assessed area of opportunity. Valuation is conducted either with transfer values or direct evidence on value.
- Profile over time—costs are generally applied linearly across the study period, while benefits can shift over time due to the cumulative area of opportunity addressed and potential declining marginal values.
- Benefit Cost Ratio and Net Present Value—a discount rate of 3% is applied in line with the Treasury Board of Canada Secretariat's social discount rate for CBA. Benefits and costs are compared with BCR in each study area as well as cumulatively across the study period and the overall Net Present Value (NPV) is calculated.

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[3] C. Ronnie Drever et al. (2021), Natural climate solutions for Canada.Sci. Adv.7,eabd6034.DOI:10.1126/sciadv.abd6034
[4] Serecon. Cultivating Change: Opportunities and Barriers for Natural Climate Solutions in the Canadian Prairies.

- Sensitivity and interpretation—the analysis includes identifying the benefits with the greatest values and assessing the effective discount on the price of carbon achieved by the other benefits to contextualise the BCR results.

2.5 CAVEATS ON THE APPROACH

The approach developed for this study and described in this report provides a strong framework for better understanding and addressing the complex challenges raised by the ambitious undertaking of implementing large scale NCS in Canada. However, by its nature the methodologies employed require making numerous assumptions and decisions, many of which are open to interpretation and further refinement. Therefore, the results and findings herein should act as a foundation on which to build, and not as a conclusive end point. Constructive criticism that leads to refinements in the approach are not only accepted but actively encouraged.

To these ends, transparency is critical as is ensuring the analysis is modular and readily updateable, especially where better evidence becomes available. Further detail is provided in Appendix 1, but it is useful to provide some general caveats upfront:

- The focus is on putting together a realistic understanding of the NCS at a macro scale. However, decisions about land management typically occur at a local or firm-level scale, so while the results presented in this study provide a solid basis, further work at a more micro scale would be beneficial to better support implementation.
- Often, input variables are adopted from external sources which result in a range of values. An attempt was made to select the most robust value, while adopting conservative assumptions, as described in Appendix 1. Further scenarios could explore a range of output values, such as a more optimistic case.
- Expectedly some variables have a greater impact on the results than others. As the denominator to the BCR, changes to the overall cost estimate generally have a larger effect on the BCR ratio than changes to most individual benefits, which are aggregated in the numerator.
- The scale and specific geography matter, both for the assessment, but even more so for real world implementation. While generalisations are made in the analysis, these need to be considered more closely in practice. In some cases, the BCR from smaller scale and more spatially explicit application of an NCS may vary significantly from the large scale, generalised case.
- Costs and benefits are generally profiled linearly over time according to simplifying assumptions, these profiles could be refined with better understanding of the practicalities of implementation and realisation of the actual benefits.
- While an effort has been made to include and quantify the most material benefits, some benefits are either not feasible to quantify or would be difficult to marketise in any practical manner. It is also possible some valuable benefits have been omitted. As such the assessed value of benefits may not capture the full range of value of the NCS.

3. RESULTS

The research and analysis were conducted as 11 CBAs across three regions. Each CBA is constructed to produce a range of metrics and this chapter presents a selection of the results from the CBAs.

In most cases a BCR greater than 1 is achieved or nearly achieved within the study period, but there are some outliers. Furthermore, different benefits are required to reach the switching value of a BCR greater than 1 for different NCS. There are also some similarities and commonalities across NCS.

While the results for each NCS should be interpreted as its own case rather than in direct comparison to the others, some general findings emerge and these are discussed further in the next chapter. This chapter presents the headline values and some key findings for each NCS.

3.1 HOW TO READ THE RESULTS FOR EACH NCS

Below, each NCS is described and headline results are presented in a table with a second table providing further detail profiling the area of opportunity, present value of the costs and benefits, and the BCR over the study period.

The headline results table includes the total present value of the costs and benefits over the study period (2025 to 2035), which are the aggregated yearly values discounted to present day values. It also presents the NPV, which is the present value of the benefits minus the present value of the costs, and the overall BCR for the NCS (present value benefits divided by present value costs). Notably, these values are for the total of all priced benefits within the CBA model, meaning that it reflects the total benefits to society, applied over the maximum area of opportunity. In effect this means it is the best case for private sector returns should all of the assessed benefits be monetised. Finally, the cost of GHG emissions abatement of the NCS is presented which is adapted from Drever et al. (2021).

The detailed study period table presents, for each year of the study period, the following:

- Area of opportunity—this is the area, in millions of hectares, in which the costs and benefits are assessed on for each year. These can differ from each other as the area which is invested in addressing each year (generally assumed to be equally spread across the study period), is not necessarily the same area from which benefits are received (which can be delayed and are often cumulative).
- Present values—these are the discounted values, presented in millions C$ in 2025 prices, of the various benefits and costs for each year of the study period. The benefits are presented both individually and aggregated.
- Benefit Cost Ratio—this is the benefits divided by the costs for each year of the study period. A value greater than 1 implies that the assessed benefits outweigh the costs. A value below 1 is equivalent to the fraction of costs that the assessed benefits achieve, while a value above 1 is equivalent to the multiple of the costs that the benefits achieve.

Following the tables, the results are interpreted highlighting what benefits are required to incentivise private sector investment and whether additional payment would be necessary to achieve GHG emissions abatement.

3.2 NCS1 REGENERATIVE CROPPING PRACTICES (PRAIRIES)—COVER CROPS

Table 3 presents headline values for the regenerative cropping practices in the prairies, cover crops pathway. The NCS achieves an overall net benefit over the study period, with benefits outweighing costs by nearly five times. Table 4 presents a breakdown of the results over the study period.

Table 3 NCS1 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	2,610
Present value of costs (2025 to 2035) (2025 C$, million)	558
Net Present Value (2025 to 2035) (2025 C$, million)	2,050
Benefit Cost Ratio by 2035	4.7
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	6.2
Average cost of GHG emissions abatement (2025 C$/tCO$_2$e) from Drever et al. 2021	90

Table 4 NCS1 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.0	0.3	0.5	0.8	1.0	1.3	1.6	1.8	2.1	2.3	2.6
Area of opportunity: costs (Hectares, million)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0
Present values*											
Present value: Benefits (2025 C$, million)	0	64	183	351	564	818	1,110	1,440	1,800	2,190	2,610
Of which:											
1. Financial benefits	**0**	**26**	**77**	**151**	**247**	**363**	**499**	**652**	**822**	**1,010**	**1,210**
Fodder	0	26.2	77.0	151	247	363	499	652	822	1,010	1,210
2. Marketable non-financial benefits	**0.0**	**24.1**	**67.3**	**127**	**202**	**291**	**391**	**503**	**626**	**758**	**899**
Erosion regulation	0	19.8	54.7	103	162	231	309	396	491	593	701
Pollination	0	4.3	12.6	24.7	40.4	59.5	81.6	107	135	165	198
3. Non-market economic benefits	**0.0**	**14.0**	**38.8**	**72.8**	**115**	**164**	**220**	**282**	**350**	**423**	**501**
Soil nutrient regulation	0	13.9	38.4	72.0	114	162	217	278	344	416	492
Air quality regulation	0	0.1	0.4	0.9	1.5	2.3	3.2	4.4	5.6	7.0	8.6
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued
Reduction in nitrate leaching	-	-	-	-	-	-	-	-	-	-	-
Present value: Costs (2025 C$, million)	63.5	125	185	243	299	354	407	459	509	558	*558***
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	0.0	0.5	1.0	1.4	1.9	2.3	2.7	3.1	3.5	3.9	4.7

Note: Assumed lag period of one year before benefits begin for this NCS.
Note: Figures may not sum due to rounding.
*Rounded to three significant figures.
*** Carried over from 2034 for calculation of BCR.*

Based on realising the estimated value of fodder, this NCS achieves a BCR greater than 1 on financial benefits alone, with benefits outweighing costs by 2028. This means that the private sector, including producers, should have a strong case for investing in this NCS. The case for the private sector investment in this NCS could be further enhanced by incorporating a mechanism for marketising the erosion regulation and soil nutrient regulation benefits. The large area of opportunity also means there is potential for large scale implementation, but in practice further analysis may be needed to ensure the benefits are achievable and of sufficient financial value across the entire area of opportunity. As a BCR greater than 1 is achieved on financial benefits alone, if the landowner or land manager that produces the benefit were to receive financial compensation, the GHG emissions abatement from the NCS could be achieved without additional payment.

3.3 NCS1 REGENERATIVE CROPPING PRACTICES (PRAIRIES)—REDUCED TILLAGE

Table 5 presents headline values for regenerative cropping practices in the prairies—the reduced tillage pathway. The NCS achieves an overall net benefit over the study period, with benefits outweighing costs by nearly three times. Table 6 presents a breakdown of the results over the study period.

Table 5 NCS1 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	4,480
Present value of costs (2025 to 2035) (2025 C$, million)	1,550
Net Present Value (2025 to 2035) (2025 C$, million)	2,920
Benefit Cost Ratio by 2035 (2025 C$)	2.9
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	13.4
Average cost of GHG emissions abatement (2025 C$/t$CO_2$e) from Drever et al. 2021	116

Table 6 NCS1 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.0	0.7	1.4	2.0	2.7	3.4	4.1	4.8	5.4	6.1	6.8
Area of opportunity: costs (Hectares, million)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0
Present values*											
Present value: Benefits (2025 C$, million)	0	126	347	649	1,030	1,470	1,970	2,530	3,130	3,790	4,480
Of which:											
1. Financial benefits	**0.0**	**41.3**	**114**	**213**	**337**	**482**	**647**	**829**	**1,030**	**1,240**	**1,470**
Crops	0.0	41.3	114	213	337	482	647	829	1,030	1,240	1,470
2. Marketable non-financial benefits	**0.0**	**45.6**	**126**	**236**	**372**	**532**	**715**	**918**	**1,140**	**1,370**	**1,620**
Erosion regulation	0.0	45.2	125	234	369	527	708	909	1,130	1,360	1,610
Water purification	0.0	0.4	1.2	2.2	3.5	5.0	6.7	8.7	10.6	12.7	14.9
3. Non-market economic benefits	**0.0**	**38.8**	**107**	**200**	**317**	**455**	**610**	**781**	**967**	**1,170**	**1,380**
Soil nutrient regulation	0.0	38.4	105	197	312	448	599	767	949	1,150	1,360
Air quality regulation	0.0	0.4	1.3	2.8	4.8	7.2	10.2	13.7	17.7	22.0	27.0
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued
Energy (biomass)	-	-	-	-	-	-	-	-	-	-	-
Lower drought risk	-	-	-	-	-	-	-	-	-	-	-
Present value: Costs (2025 C$, million)	176	348	514	676	833	985	1,130	1,280	1,420	1,550	*1,550***
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	0.0	0.4	0.7	1.0	1.2	1.5	1.7	2.0	2.2	2.4	2.9

Note: Assumed lag period of one year before benefits begin for this NCS.
Note: Figures may not sum to totals due to rounding.
*Rounded to three significant figures.
*** Carried over from 2034 for calculation of BCR.*

This NCS nearly achieves a BCR greater than 1 based on realising the estimated financial value for crop production alone by 2035. The case for the private sector investment in this NCS could be further enhanced by incorporating a mechanism for marketising the erosion regulation and soil nutrient regulation benefits. Doing so would bring achieving a BCR greater than 1 forward to 2029. The large area of opportunity also means there is potential for large scale implementation, but in practice further analysis may be needed to ensure the benefits are achievable and of sufficient financial value across the entire area of opportunity. Since a BCR greater than 1 is achieved with the marketisation of benefits, if the landowner or land manager were to receive financial compensation for the benefits produced, the GHG emissions abatement from the NCS could be achieved without additional payment.

3.4 NCS2 IMPROVED PASTURE PRACTICES (PRAIRIES)—GRASSLAND CONSERVATION

Table 7 presents headline values for improved pasture practices in the prairies—the grassland conservation pathway. The NCS achieves an overall net loss over the study period, with benefits reaching just over a 20th of costs. Table 8 presents a breakdown of the results over the study period.

Table 7 NCS2 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	54
Present value of costs (2025 to 2035) (2025 C$, million)	835
Net Present Value (2025 to 2035) (2025 C$, million)	-781
Benefit Cost Ratio by 2035 (2025 C$)	0.06
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	3.9
Average cost of GHG emissions abatement (2025 C$/t$CO_2$e) from Drever et al. 2021	213

Table 8 NCS2 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	
Area of opportunity: costs (Hectares, million)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Present values*											
Present value: Benefits (2025 C$, million)**	1.4	3.9	7.5	11.9	17.1	23.2	29.9	37.2	45.2	53.7	
Of which:											
1. Financial benefits	**1.3**	**3.5**	**6.5**	**10.3**	**14.7**	**19.8**	**25.3**	**31.4**	**37.9**	**44.8**	
Fodder	1.3	3.5	6.5	10.3	14.7	19.8	25.3	31.4	37.9	44.8	
2. Marketable non-financial benefits	**0.0**	**0.1**	**0.2**	**0.4**	**0.5**	**0.8**	**1.0**	**1.3**	**1.6**	**2.0**	
Water purification	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.5	
Erosion regulation	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.0	1.2	1.5	
3. Non-market economic benefits	**0.1**	**0.3**	**0.7**	**1.2**	**1.9**	**2.6**	**3.5**	**4.6**	**5.7**	**6.9**	
Soil nutrient regulation	0.1	0.3	0.7	1.2	1.8	2.5	3.4	4.4	5.5	6.7	
Air quality regulation	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	
Intrinsic value	-	-	-	-	-	-	-	-	-	-	
Present value: Costs (2025 C$, million)	95	187	277	364	448	530	610	687	762	835	
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	0.01	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	

Note: Figures may not sum to totals due to rounding.

* Rounded to three significant figures.

** As a conservation NCS, benefits were assumed to begin in 2025, and assessed across a 10-year time period to 2034.

There are relatively high costs associated with this NCS and they outweigh the assessed benefits. A contributing factor on the cost side is the financial cost of foregone agricultural sector output. It is possible that at more specific or local scales, benefits may be greater and costs lower. Direct subsidisation, such as the purchase of carbon credits, may be required to make this NCS more economically viable for the private sector. This NCS could achieve GHG emissions abatement alongside additional benefits; however, this may require additional payment in excess of the price of carbon. The results indicate that there are more cost-efficient ways to achieve carbon emissions reductions, but there might also be additional benefits to this NCS not included in this assessment or other justifications for implementing it.

3.5 NCS3 AVOIDED CONVERSION OF REMNANT NATURAL HABITATS IN AGRICULTURAL LANDS (SOUTHERN ONTARIO)—AVOIDED CONVERSION OF FRESHWATER MINERAL WETLANDS

Table 9 presents headline values for avoided conversion of remnant natural habitats in agricultural lands in southern Ontario—the avoided conversion of freshwater mineral wetlands pathway. The NCS achieves an overall net benefit over the study period, with benefits outweighing costs by nearly seven times. Table 10 presents a breakdown of the results over the study period.

Table 9 NCS3 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	45
Present value of costs (2025 to 2035) (2025 C$, million)	6.7
Net Present Value (2025 to 2035) (2025 C$, million)	38.3
Benefit Cost Ratio by 2035 (2025 C$)	6.7
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	0.2
Average cost of GHG emissions abatement (2025 C$/t$CO_2$e) from Drever et al. 2021	37

Table 10 NCS3 study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.000	0.001	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.003	
Area of opportunity: costs (Hectares, million)	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	
Present values*											
Present value: Benefits (2025 C$, million)**	1.9	4.7	8.2	12.3	16.9	21.9	27.2	33.0	38.9	45.0	
Of which:											
1. Financial benefits	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
-	-	-	-	-	-	-	-	-	-	-	
2. Marketable non-financial benefits	**0.2**	**0.4**	**0.7**	**1.0**	**1.4**	**1.8**	**2.3**	**2.8**	**3.3**	**3.8**	
Water purification	0.2	0.4	0.7	1.0	1.4	1.8	2.3	2.8	3.3	3.8	
3. Non-market economic benefits	**1.7**	**4.3**	**7.5**	**11.3**	**15.5**	**20.0**	**24.9**	**30.2**	**35.6**	**41.2**	
Soil nutrient regulation	0.2	0.4	0.7	1.1	1.5	1.9	2.4	2.9	3.4	3.9	
Regulation of water timing and flows	1.6	3.9	6.8	10.2	14.0	18.1	22.6	27.4	32.3	37.3	
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	
Intrinsic value	-	-	-	-	-	-	-	-	-	-	
Fodder	-	-	-	-	-	-	-	-	-	-	
Present value: Costs (2025 C$, million)	0.8	1.5	2.2	2.9	3.6	4.3	4.9	5.5	6.1	6.7	
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	2.4	3.1	3.7	4.2	4.7	5.1	5.5	6.0	6.3	6.7	

*Rounded to three significant figures.
Note: Figures may not sum to totals due to rounding.
** As a conservation NCS, benefits were assumed to begin in 2025, and assessed across a 10-year time period to 2034.

With the marketisation of benefits, particularly the regulation of water timing and flows, this NCS achieves a BCR greater than 1 from the first year of implementation. However, this result does require bringing currently non-market benefits onto the private sector's balance sheet. Aside from the substantial benefit of the regulation of water timing and flows, a combination of marketising both water purification and soil nutrient regulation would also lead to benefits outweighing costs. The area of opportunity for implementing this NCS is relatively small, and further analysis may be needed on the specific context at site locations. Since a BCR greater than 1 is achieved with the marketisation of benefits, if the landowner or land manager were to receive this financial compensation, the GHG emissions abatement from the NCS could be achieved without additional payment.

3.6 NCS3 AVOIDED CONVERSION OF REMNANT NATURAL HABITATS IN AGRICULTURAL LANDS (SOUTHERN ONTARIO)—AVOIDED FOREST CONVERSION

Table 11 presents headline values for avoided conversion of natural habitats in agricultural lands in southern Ontario—the avoided forest conversion pathway. The NCS achieves an overall net benefit over the study period, with benefits outweighing costs by nearly five times. Table 12 presents a breakdown of the results over the study period.

Table 11 NCS3 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	999
Present value of costs (2025 to 2035) (2025 C$, million)	203
Net Present Value (2025 to 2035) (2025 C$, million)	796
Benefit Cost Ratio by 2035 (2025 C$)	4.9
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	1.1
Average cost of GHG emissions abatement (2025 C$/t$CO_2$e) from Drever et al. 2021	180

Table 12 NCS3 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.04	
Area of opportunity: costs (Hectares, million)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	
Present values*											
Present value: Benefits (2025 C$, million)**	32	85	156	242	342	454	576	709	850	999	
Of which:											
1. Financial benefits	**2.6**	**7.5**	**14.7**	**24.0**	**35.4**	**48.6**	**63.5**	**80.1**	**98.2**	**118**	
Recreation and tourism	2.6	7.5	14.7	24.0	35.4	48.6	63.5	80.1	98.2	118	
2. Marketable non-financial benefits	**14.1**	**37.4**	**68.1**	**105**	**148**	**196**	**248**	**303**	**363**	**425**	
Erosion regulation	7.0	18.5	33.6	52.0	73.1	96.6	122	150	179	210	
Water purification	0.9	2.4	4.3	6.7	9.4	12.5	15.8	19.4	23.1	27.1	
Pollination	6.2	16.5	30.1	46.5	65.4	86.4	109	134	160	188	
3. Non-market economic benefits	**15.1**	**40.1**	**73.0**	**113**	**159**	**210**	**265**	**325**	**389**	**456**	
Air quality regulation	1.4	3.6	6.5	10.1	14.2	18.8	23.8	29.2	34.9	40.9	
Soil nutrient regulation	0.3	0.8	1.5	2.3	3.3	4.3	5.5	6.7	8.1	9.4	
Regulation of water timing and flows	13.5	35.6	64.9	100	141	186	236	289	346	406	
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	
Wild foods	-	-	-	-	-	-	-	-	-	-	
Wood fuel	-	-	-	-	-	-	-	-	-	-	
Biochemicals/medicine	-	-	-	-	-	-	-	-	-	-	
Intrinsic value	-	-	-	-	-	-	-	-	-	-	
Present value: Costs (2025 C$, million)	23	45	67	88	109	129	148	167	185	203	
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	1.4	1.9	2.3	2.7	3.1	3.5	3.9	4.3	4.6	4.9	

*Rounded to three significant figures.

Note: Figures may not sum to totals due to rounding.
** As a conservation NCS, benefits were assumed to begin in 2025, and assessed across a 10-year time period to 2034.

This NCS is assessed as achieving a relatively large estimated financial value for tourism and recreation which alone reaches over half the costs by the end of the study period. By bringing additional currently non-market benefits onto the private sector's balance sheet a BCR greater than 1 can be achieved from the first year. In particular, in addition to realising the financial benefits via recreation and tourism, marketising any of erosion regulation, pollination, or regulation of water timing and flows benefits would make the case for investment in this NCS as the private sector benefits would outweigh the costs. Alternatively, in the absence of the recreation and tourism benefit, marketising any two of these three benefits would also justify private sector investment. The area of opportunity for implementing this NCS is relatively small, and further analysis may be needed on the specific context at site locations. Since a BCR greater than 1 is achieved with the marketisation of benefits, if the landowner or land manager were to receive financial compensation for the benefits produced, the GHG emissions abatement from the NCS could be achieved without additional payment.

3.7 NCS4 TREES IN AGRICULTURAL LANDS (SOUTHERN ONTARIO)—SILVOPASTURE

Table 13 presents headline values for trees in agricultural lands in southern Ontario—the silvopasture pathway. The NCS achieves an overall net benefit over the study period, with benefits outweighing costs by over 30 times. Table 14 presents a breakdown of the results over the study period.

Table 13 NCS4 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	371
Present value of costs (2025 to 2035) (2025 C$, million)	12.1
Net Present Value (2025 to 2035) (2025 C$, million)	358
Benefit Cost Ratio by 2035 (2025 C$)	30.5
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	0.5
Average cost of GHG emissions abatement (2025 C$/t$CO_2$e) derived from Drever et al. 2021[5]	23

Table 14 NCS4 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.00	0.003	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03
Area of opportunity: costs (Hectares, million)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.000
Present values*											
Present value: Benefits (2025 C$, million)	0	12	31	57	89	126	167	213	262	315	371
Of which:											
1. Financial benefits	**0.0**	**1.5**	**4.3**	**8.5**	**13.8**	**20.4**	**28.0**	**36.6**	**46.1**	**56.6**	**67.8**
Recreation and tourism	0.0	1.5	4.3	8.5	13.8	20.4	28.0	36.6	46.1	56.6	67.8
2. Marketable non-financial benefits	**0.0**	**4.9**	**13.0**	**23.6**	**36.5**	**51.4**	**67.9**	**86.0**	**105**	**126**	**148**
Erosion regulation	0.0	2.4	6.4	11.7	18.0	25.4	33.5	42.5	52.1	62.2	72.9
Pollination	0.0	2.2	5.7	10.5	16.2	22.7	30.0	38.0	46.6	55.7	65.3
Water purification	0.0	0.3	0.8	1.5	2.3	3.3	4.3	5.5	6.7	8.0	9.4
3. Non-market economic benefits	**0.0**	**5.2**	**13.6**	**24.8**	**38.4**	**53.9**	**71.3**	**90.3**	**111**	**132**	**155**
Regulation of water timing and flows	0.0	4.7	12.4	22.6	34.9	49.0	64.8	82.0	101.0	120.0	141.0
Air quality regulation	0.0	0.5	1.3	2.3	3.5	4.9	6.5	8.3	10.1	12.1	14.2
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued
Wood fuel	-	-	-	-	-	-	-	-	-	-	-
Wild foods	-	-	-	-	-	-	-	-	-	-	-
Energy (biomass)	-	-	-	-	-	-	-	-	-	-	-
Present value: Costs (2025 C$, million)	1	3	4	5	7	8	9	10	11	12	*12***
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	0.0	4.2	7.7	10.8	13.6	16.3	18.9	21.3	23.7	26.0	30.5

Note: Assumed lag period of one year before benefits begin for this NCS.
Note: Figures may not sum to totals due to rounding.

[5] The cost estimates for this NCS were sourced from the supplementary materials in Drever et al. 2021

*Rounded to three significant figures.
*** Carried over from 2034 for calculation of BCR.*

Based on realising the estimated value to tourism and recreation, this NCS achieves a BCR greater than 1 on financial benefits alone, with benefits outweighing costs by 2028. This means that the private sector should have a strong case for investing in this NCS. The case for the private sector investment in this NCS could be further enhanced by incorporating a mechanism for marketising the erosion regulation, pollination, and regulation of water timing and flows benefits. The area of opportunity for implementing this NCS is relatively small, and further analysis may be needed on the specific context at site locations in particular around tourism and recreation benefits and costs. As a BCR greater than 1 is achieved on financial benefits alone, if the landowner or land manager that produces the benefit were to receive financial compensation, the GHG emissions abatement from the NCS could be achieved without additional payment.

3.8 NCS4 TREES IN AGRICULTURAL LANDS (SOUTHERN ONTARIO)—RIPARIAN TREE PLANTING

Table 15 presents headline values for trees in agricultural lands in southern Ontario, riparian tree planting. The NCS achieves an overall net benefit over the study period, with benefits outweighing costs by just over two times. Table 16 presents a breakdown of the results over the study period.

Table 15 NCS4 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	908
Present value of costs (2025 to 2035) (2025 C$, million)	426
Net Present Value (2025 to 2035) (2025 C$, million)	482
Benefit Cost Ratio by 2035 (2025 C$)	2.1
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	1.7
Average cost of GHG emissions abatement (2025 C$/t$CO_2$e) from Drever et al. 2021	254

Table 16 NCS4 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
Area of opportunity: costs (Hectares, million)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Present values*											
Present value: Benefits (2025 C$, million)	0	28	75	138	216	306	408	520	641	771	908
Of which:											
1. Financial benefits	**0.0**	**4.4**	**13.1**	**25.6**	**41.9**	**61.6**	**84.6**	**111**	**140**	**171**	**205**
Recreation and tourism	0.0	4.4	13.1	25.6	41.9	61.6	84.6	111	140	171	205
2. Marketable non-financial benefits	**0.0**	**11.4**	**30.1**	**54.9**	**84.8**	**119**	**158**	**199**	**245**	**292**	**343**
Erosion regulation	0.0	5.6	14.9	27.1	41.9	58.9	77.8	98.6	121	144	169
Pollination	0.0	5.0	13.3	24.3	37.5	52.7	69.7	88.2	108	129	152
Water purification	0.0	0.7	1.9	3.5	5.4	7.6	10.0	12.7	15.6	18.6	21.8
3. Non-market economic benefits	**0.0**	**12.0**	**31.6**	**57.6**	**89.1**	**125**	**166**	**210**	**257**	**307**	**360**
Regulation of water timing and flows	0.0	10.9	28.7	52.4	80.9	114	150	190	233	279	327
Air quality regulation	0.0	1.1	2.9	5.3	8.2	11.5	15.2	19.2	23.5	28.1	32.9
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued
Wood fuel	-	-	-	-	-	-	-	-	-	-	-
Wild foods	-	-	-	-	-	-	-	-	-	-	-
Energy (biomass)	-	-	-	-	-	-	-	-	-	-	-
Present value: Costs (2025 C$, million)	49	96	141	186	229	270	311	351	389	426	*426***
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	0.0	0.3	0.5	0.7	0.9	1.1	1.3	1.5	1.6	1.8	2.1

Note: Assumed lag period of one year before benefits begin for this NCS.
Note: Figures may not sum to totals due to rounding.
*Rounded to three significant figures.
*** Carried over from 2034 for calculation of BCR.*

This NCS is assessed as achieving a relatively large estimated financial value for tourism and recreation which alone reaches nearly half the costs by the end of the study period. By bringing additional currently non-market benefits onto the private sector's balance sheet a BCR greater than 1 can be achieved as early as 2030. This would require marketising the regulation of water timing and flows and at least one of either erosion regulation or pollination benefits so that private sector benefits would outweigh the costs. The area of opportunity for implementing this NCS is relatively small, and further analysis may be needed on the specific context at site locations. Since a BCR greater than 1 is achieved with the marketisation of benefits, if the landowner or land manager were to receive financial compensation for the benefits produced, the GHG emissions abatement from the NCS could be achieved without additional payment.

3.9 NCS5 REGENERATIVE CROPPING PRACTICES (SOUTHERN ONTARIO)—COVER CROPS

Table 17 presents headline values for regenerative cropping practices, southern Ontario—the cover crops pathway. The NCS achieves an overall net benefit over the study period, with benefits outweighing costs by nearly three times. Table 18 presents a breakdown of the results over the study period.

Table 17 NCS5 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	1,930
Present value of costs (2025 to 2035) (2025 C$, million)	665
Net Present Value (2025 to 2035) (2025 C$, million)	1,266
Benefit Cost Ratio by 2035 (2025 C$)	2.9
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	7.3
Average cost of GHG emissions abatement (2025 C$/t$CO_2$e) from Drever et al. 2021	90

Table 18 NCS5 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.0	0.3	0.6	0.9	1.2	1.5	1.8	2.2	2.5	2.8	3.1
Area of opportunity: costs (Hectares, million)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0
Present values*											
Present value: Benefits (2025 C$, million)	0.0	47.6	135	259	416	604	821	1,060	1,330	1,620	1,930
Of which:											
1. Financial benefits	**0.0**	**14.7**	**43.2**	**84.7**	**138**	**204**	**280**	**366**	**461**	**565**	**678**
Fodder	0.0	14.7	43.2	84.7	138	204	280	366	461	565	678
2. Marketable non-financial benefits	**0.0**	**22.0**	**61.7**	**117**	**187**	**271**	**366**	**473**	**590**	**716**	**851**
Erosion regulation	0.0	15.0	41.3	77.5	122	175	234	300	372	450	532
Pollination	0.0	6.9	20.4	39.9	65.2	96.0	132	172	217	266	320
3. Non-market economic benefits	**0.0**	**10.9**	**30.3**	**57.2**	**90.5**	**130**	**175**	**225**	**279**	**338**	**401**
Soil nutrient regulation	0.0	10.4	28.7	53.8	84.7	121	163	208	257	310	368
Air quality regulation	0.0	0.5	1.6	3.4	5.8	8.9	12.6	17.0	21.9	27.3	33.4
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued
Reduction in nitrate leaching	-	-	-	-	-	-	-	-	-	-	-
Present value: Costs (2025 C$, million)	76	149	220	290	357	422	486	547	607	665	*665***
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	0.0	0.3	0.6	0.9	1.2	1.4	1.7	1.9	2.2	2.4	2.9

Note: Assumed lag period of one year before benefits begin for this NCS.
Note: Figures may not sum to totals due to rounding.
*Rounded to three significant figures.
*** Carried over from 2034 for calculation of BCR.*

This NCS achieves a BCR greater than 1 based on realising the estimated financial value for fodder alone by 2035. The case for the private sector investment in this NCS could be further enhanced by incorporating a mechanism for marketising the erosion regulation, pollination, or soil nutrient regulation benefits. Bringing these benefits onto the private sector balance sheet would bring achieving a BCR greater than 1 going forward, potentially as early as 2029. The large area of opportunity also means there is potential for large scale implementation, but in practice further analysis may be needed to ensure the benefits are achievable and of sufficient financial value across the entire area of opportunity. As a BCR greater than 1 is achieved on financial benefits alone, if the landowner or land manager that produces the benefit were to receive financial compensation, the GHG emissions abatement from the NCS could be achieved without additional payment.

3.10 NCS5 REGENERATIVE CROPPING PRACTICES (SOUTHERN ONTARIO)—REDUCED TILLAGE

Table 19 presents headline values for regenerative cropping practices in southern Ontario—the reduced tillage pathway. The NCS achieves an overall net benefit over the study period, with benefits outweighing costs by nearly three times. Table 20 presents a breakdown of the results over the study period.

Table 19 NCS5 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	1,470
Present value of costs (2025 to 2035) (2025 C$, million)	581
Net Present Value (2025 to 2035) (2025 C$, million)	884
Benefit Cost Ratio by 2035 (2025 C$)	2.5
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	5.0
Average cost of GHG emissions abatement (2025 C$/$tCO_2e$) from Drever et al. 2021	116

Table 20 NCS5 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.0	0.3	0.5	0.8	1.0	1.3	1.5	1.8	2.0	2.3	2.5
Area of opportunity: costs (Hectares, million)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0
Present values*											
Present value: Benefits (2025 C$, million)	0.0	40.9	113	212	336	481	645	828	1,030	1,240	1,470
Of which:											
1. Financial benefits	**0.0**	**17.8**	**49.1**	**92.1**	**145**	**208**	**279**	**358**	**444**	**536**	**634**
Crops	0.0	17.8	49.1	92.1	145	208	279	358	444	536	634
2. Marketable non-financial benefits	**0.0**	**13.9**	**38.4**	**72.0**	**114**	**163**	**218**	**279**	**346**	**417**	**492**
Erosion regulation	0.0	12.7	35.1	65.8	104	149	199	256	317	382	451
Water purification	0.0	1.1	3.3	6.2	9.8	14.2	18.6	23.6	29.1	35.2	41.7
3. Non-market economic benefits	**0.0**	**9.2**	**25.5**	**48.0**	**76.4**	**110**	**148**	**190**	**236**	**286**	**339**
Soil nutrient regulation	0.0	8.8	24.2	45.3	71.7	103	138	176	219	264	313
Air quality regulation	0.0	0.4	1.3	2.7	4.7	7.2	10.2	13.6	17.4	21.9	26.6
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued
Energy (biomass)	-	-	-	-	-	-	-	-	-	-	-
Lower drought risk	-	-	-	-	-	-	-	-	-	-	-
Present value: Costs (2025 C$, million)	66	130	193	253	312	369	424	478	530	581	*581***
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	0.0	0.3	0.6	0.8	1.1	1.3	1.5	1.7	1.9	2.1	2.5

Note: Assumed lag period of one year before benefits begin for this NCS.
Note: Figures may not sum to totals due to rounding.
*Rounded to three significant figures.
*** Carried over from 2034 for calculation of BCR.*

This NCS achieves a BCR greater than 1 based on realising the estimated financial value for crop production alone by 2035. The case for the private sector investment in this NCS could be further enhanced by incorporating a mechanism for marketising the erosion regulation and soil nutrient regulation benefits. Doing so would bring achieving a BCR greater than one forward, potentially as early as 2029. The large area of opportunity also means there is potential for large scale implementation, but in practice further analysis may be needed to ensure the benefits are achievable and of sufficient financial value across the entire area of opportunity. As a BCR greater than 1 is achieved on financial benefits alone, if the landowner or land manager that produces the benefit were to receive financial compensation, the GHG emissions abatement from the NCS could be achieved without additional payment.

3.11 NCS6 FOREST MANAGEMENT (BRITISH COLUMBIA)—OLD FOREST CONSERVATION

Table 21 presents headline values for forest management in British Columbia—the old forest conservation pathway. The NCS achieves an overall net loss over the study period, with benefits reaching one-fifth of costs. Table 22 presents a breakdown of the results over the study period.

Table 21 NCS6 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	149
Present value of costs (2025 to 2035) (2025 C$, million)	715
Net Present Value (2025 to 2035) (2025 C$, million)	-566
Benefit Cost Ratio by 2035 (2025 C$)	0.2
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021	7.0
Average cost of GHG emissions abatement (2025 C$/t$CO_2$e) from Drever et al. 2021	103

Table 22 NCS6 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	
Area of opportunity: costs (Hectares, million)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
Present values*											
Present value: Benefits (2025 C$, million)***	5	13	24	37	52	69	87	106	127	149	
Of which:											
1. Financial benefits	**3.7**	**9.7**	**17.6**	**27.2**	**38.3**	**50.6**	**64.1**	**78.5**	**93.9**	**110**	
Timber products	0.3	0.9	1.6	2.5	3.5	4.6	5.8	7.1	8.5	10.0	
Recreation and tourism**	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	
Green premium	3.3	8.8	16.0	24.7	34.8	46.0	58.2	71.4	85.3	100.0	
2. Marketable non-financial benefits	**1.1**	**2.8**	**5.1**	**7.9**	**11.1**	**14.7**	**18.5**	**22.7**	**27.2**	**31.8**	
Water purification	0.1	0.4	0.7	1.0	1.4	1.9	2.4	2.9	3.5	4.1	
Pollination	0.3	0.9	1.6	2.5	3.5	4.6	5.9	7.2	8.6	10.1	
Erosion regulation	0.6	1.6	2.8	4.4	6.2	8.2	10.3	12.6	15.1	17.7	
3. Non-market economic benefits	**0.2**	**0.6**	**1.1**	**1.8**	**2.5**	**3.3**	**4.1**	**5.1**	**6.0**	**7.1**	
Soil nutrient regulation	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	
Air quality regulation	0.2	0.6	1.1	1.6	2.3	3.0	3.8	4.7	5.6	6.6	
4. Non-valued benefits	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	Non - valued	
Intrinsic value	-	-	-	-	-	-	-	-	-	-	
Wild foods	-	-	-	-	-	-	-	-	-	-	
Biochemicals/medicine	-	-	-	-	-	-	-	-	-	-	
Wood fuel	-	-	-	-	-	-	-	-	-	-	
Present value: Costs (2025 C$, million)	81	160	237	312	384	454	522	588	653	715	
Benefit Cost Ratio											
Benefit Cost Ratio (2025, C$)	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	

*Rounded to three significant figures.
** Non-valued due to lack of reliable data.
Note: Figures may not sum to totals due to rounding.

*** As a conservation NCS, benefits were assumed to begin in 2025, and assessed across a 10-year time period to 2034.

There are relatively high costs associated with this NCS and they outweigh the assessed benefits. A contributing factor on the cost side is the financial cost of foregone forestry sector output. Direct subsidisation or the development of a carbon market would make this NCS more economically viable for the private sector. Notably, several benefits are non-valued. In particular, a financial benefit from tourism and recreation is feasible at locations in proximity to population centres or accessible by tourists. It is therefore likely that at smaller scales and specific locations benefits may be greater and outweigh costs. There might also be additional benefits or other justifications for implementing this NCS. A BCR greater than 1 is not achieved even with the marketisation of benefits; however, if the landowner or land manager were to receive financial compensation for these benefits, the GHG emissions abatement from the NCS could be achieved at a discount to the price of carbon. A payment of around 50% of the Government of Canada price of carbon by 2031could make this NCS economically viable for the private sector.

3.12 NCS7 FOREST MANAGEMENT (BRITISH COLUMBIA)—FIRE RISK MANAGEMENT

Table 23 presents headline values for forest management in British Columbia—the fire risk management pathway. The NCS achieves an overall net loss over the study period, with benefits reaching over half of costs. Table 24 presents a breakdown of the results over the study period.

Table 23 NCS7 Headline results

Headline results	
Present value of benefits (2025 to 2035) (2025 C$, million)	311
Present value of costs (2025 to 2035) (2025 C$, million)	422
Net Present Value (2025 to 2035) (2025 C$, million)	-111
Benefit Cost Ratio by 2035 (2025 C$)	0.7
GHG emissions abatement potential (MtCO2e) derived from Drever et al. 2021[6]	-
Average cost of GHG emissions abatement (2025 C$/t$CO_2$e) from Drever et al. 2021[7]	-

Table 24 NCS7 Study period breakdown

Metric	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Area of opportunity											
Area of opportunity: benefits (Hectares, million)	0.00	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.07	0.07	0.08
Area of opportunity: costs (Hectares, million)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Present values*											
Present value: Benefits (2025 C$, million)	0	7	20	39	64	94	129	168	212	260	311
Of which:											
1. Financial benefits	**0.0**	**6.4**	**18.7**	**36.6**	**59.8**	**88.0**	**121**	**158**	**199**	**244**	**293**
Timber products	0.0	1.3	3.7	7.2	11.8	17.3	23.8	31.1	39.2	48.1	57.7
Recreation and tourism	0.0	0.5	1.3	2.6	4.3	6.3	8.7	11.4	14.3	17.6	21.1
Other damages	0.0	4.6	13.7	26.8	43.8	64.4	88.4	116.0	146.0	179.0	214.0
2. Marketable non-financial benefits	**0.0**	**0.4**	**1.2**	**2.2**	**3.4**	**4.8**	**6.4**	**8.2**	**10.1**	**12.1**	**14.3**
Water purification	0.0	0.1	0.2	0.3	0.5	0.7	0.9	1.1	1.4	1.7	2.0
Pollination	0.0	0.1	0.3	0.6	0.9	1.3	1.7	2.2	2.7	3.2	3.8
Erosion regulation	0.0	0.3	0.7	1.3	2.0	2.9	3.8	4.9	6.0	7.2	8.5
3. Non-market economic benefits	**0.0**	**0.1**	**0.3**	**0.5**	**0.8**	**1.2**	**1.5**	**2.0**	**2.4**	**2.9**	**3.4**
Soil nutrient regulation	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Air quality regulation	0.0	0.1	0.3	0.5	0.8	1.1	1.4	1.8	2.2	2.7	3.2
4. Non-valued benefits	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued	Non-valued
Wild foods	-	-	-	-	-	-	-	-	-	-	-
Wood fuel	-	-	-	-	-	-	-	-	-	-	-
Biochemicals/medicine	-	-	-	-	-	-	-	-	-	-	-
Intrinsic value	-	-	-	-	-	-	-	-	-	-	-
Present value: Costs (2025 C$, million)	48	95	140	184	227	268	308	347	385	422	*422***
Benefit Cost Ratios											
Benefit Cost Ratio (2025, C$)	0.0	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7

[6] Drever et al. 2021 did not estimate the GHG emissions abatement potential for this NCS

[7] Drever et al. 2021 did not estimate the average cost of GHG emissions abatement for this NCS

*Rounded to three significant figures.
*** Carried over from 2034 for calculation of BCR.*
Note: Figures may not sum to totals due to rounding.

There are relatively high costs associated with this NCS and the assessed benefits do not outweigh them over the study period. However, they do come close, even on financial benefits alone. A contributing factor on the cost side is the financial cost associated with the intervention which requires substantial physical works. Direct subsidisation or the development of a carbon market may make this NCS more economically viable for the private sector. There is a high degree of uncertainty around the frequency, scale, and location of forest fires and once the carbon emissions associated with Fire Risk Management burning is netted off from the potential carbon emissions avoided from fire suppression, it is difficult to reliably estimate the total carbon emissions benefit. However, given the relatively high value of non-carbon financial benefits, with compensation for their production and the inclusion of an additional payment for the GHG emissions abatement, this NCS could be economically viable for private sector investment and achieve GHG emissions abatement at a discount to the price of carbon.

4. DISCUSSION

The results from the CBAs demonstrate the value of implementing NCS and the substantial benefits they provide. The GHG emissions abatement they achieve is in addition to this value, and for many NCS it can be realised without additional payment beyond the financial and marketised benefits produced. However, as previously indicated, these overarching results must be interpreted with an understanding of the inherent caveats and limitations of the assessment. The results are indicative of the types of benefits possible, and their potential scale should they be realised. Ensuring that they are realised is critical to success. The results presented in this report are dependent on a range of modelling assumptions and real-world factors; more important is the concept that they represent, which is an indication of the large value that NCS can deliver.

That land use change and land management practices have impact beyond their direct economic implications should be obvious to anyone involved in these decisions. Linking them to a broader framework, as attempted by the methodology employed by this study, allows for systematically considering them in the decision-making process. Whether applying a formal CBA structure or not, most decisions do in effect come down to weighing up costs and benefits. What the framework applied in this study attempts to do is broaden the benefits under consideration.

From this broader perspective, many of the NCS provide a substantial net benefit from a society-wide perspective, which means there is value creation on the table from implementing them. The framework also demonstrates that if it were possible to bring at least some of the benefits into the private sector balance sheet by finding some mechanism to bring them into the market, it may be enough to switch the private sector BCR to attract investment in NCS.

4.1 FINDINGS

While care must be taken when directly comparing the CBA results for one NCS with another, some broad conclusions can be drawn from looking at them as a group. Firstly, despite some uncertainty at the margins, the NPV and BCR results do point to some being more favourable than others. The two NCS which are some ways off from a BCR greater than 1—grassland in the Prairies and old forest conservation in British Columbia—are both primarily focused on conservation. The result is largely due to the foregone market value of alternate land uses, such as forestry or agricultural.

In contrast, NCS which involve a change in land management while maintaining at least some market-oriented use of the land subsequently have a smaller gap to account for and are more likely to reach a private sector BCR above 1. Arguably, there is a categorical difference between NCS, which require land-use change or avoided land-use change, versus those which involve a change in land management practices, and these should be treated differently in how they are assessed, interpreted, and promoted.

Another important finding across the NCS results as a group are a few benefits which produce a lot of value. Table 25 presents, where necessary, the benefits that would be required to switch to a BCR greater than 1. Note that these benefits are in addition to the financial benefits being realised and received by the private sector landowner or land manager that invests in delivering the NCS.

Table 25 NCS Key benefits

NCS	Key benefits for marketisation
NCS1 Regenerative cropping practices (Prairies)—Cover crops	Not required as financial benefits are greater than costs.
NCS1 Regenerative cropping practices (Prairies)—Reduced tillage	Erosion regulation OR soil nutrient regulation required to achieve BCR greater than 1
NCS2 Improved pasture practices (Prairies)—Grassland conservation	Does not reach a BCR greater than 1, direct subsidisation or carbon markets required
NCS3 Avoided conversion of remnant natural habitats in agricultural lands (Southern Ontario)—Avoided conversion of freshwater mineral wetlands	Regulation of water timing and flows OR water purification AND soil nutrient regulation required to achieve BCR greater than 1
NCS3 Avoided conversion of remnant natural habitats in agricultural lands (Southern Ontario)—Avoided forest conversion	Erosion regulation OR pollination OR regulation of water timing and flows required to achieve BCR greater than 1
NCS4 Trees in agricultural lands (Southern Ontario)—Silvopasture	Not required as financial benefits are greater than costs.
NCS4 Trees in agricultural lands (Southern Ontario)—Riparian tree planting	Regulation of water flows and timings AND erosion regulation OR pollination required to achieve BCR greater than 1
NCS5 Regenerative cropping practices (Southern Ontario)—Cover crops	Not required as financial benefits are greater than costs.
NCS5 Regenerative cropping practices (Southern Ontario)—Reduced tillage	Not required as financial benefits are greater than costs.
NCS6 Forest management (British Columbia)— Old forest conservation	Does not reach a BCR greater than 1, direct subsidisation or carbon markets required
NCS7 Forest management (British Columbia)— Fire risk management	Does not reach a BCR greater than 1, direct subsidisation or carbon markets required

Across the NCS the benefits which would most help build the case for private sector investment if marketised are:

- Regulation of water timing and flows
- Erosion regulation
- Soil nutrient regulation
- Pollination

These all play a large role in achieving BCR above 1 across several NCS or in substantially enhancing the case for private sector investment. A mechanism to bring these benefits into markets, so that the private sector could secure revenue from them, would improve the attractiveness of several NCS at once.

Where a BCR greater than 1 is achieved with financial benefits alone, there still might require some sort of profit-sharing mechanism so that the producers of value are able to receive at least a portion of the financial benefit to compensate for the cost of their investment. For example, in Southern Ontario there is a substantial potential financial benefit from increased value to recreation and tourism from NCS which make the landscape more attractive, but this value does not necessarily accrue to the private sector firm or landowner investing in the NCS. Therefore, some sort of mechanism to distribute a portion of this financial value would be required.

The analysis also makes clear that scale and geography matter significantly in both assessing costs and benefits, and in implementation. The local context of NCS plays a major role in determining the actual costs and benefits achievable. While the framework and results from this study provide a useful baseline, actual implementation sites may have costs and benefits that vary widely from those presented here, and from each other. Some NCS that do not achieve a BCR above 1 at a region-level may succeed at a more local level, and vice versa.

Another important aspect of scale and geography is the sheer size of some NCS. This may distort the findings. Ecosystem services assessments of the impact of interventions are generally conducted on smaller scales, sometimes substantially so, such as a site-level assessment of a few hectares or a landscape-level assessment of a few thousand hectares. Extrapolating to the Canadian landscape requires stretching the transferability of values. Efficiencies may reduce expenses (e.g., equipment that, once purchased, can be used repeatedly), while benefits may diminish with scale (e.g., tourism and recreation value decreases for improvements farther from population centres). Creating a general case for any given NCS at this scale inevitably glosses over much local nuance.

Finally, it is important to remember that the primary purpose of NCS is climate change mitigation. This study focuses on co-benefits that make NCS more attractive for private-sector investment, but there is also a potential direct revenue source from GHG reductions, such as through carbon credit purchases. In cases where co-benefits alone do not achieve a BCR above 1, direct subsidisation or incorporating the market price for carbon credits, even the social cost of carbon, will likely tip the balance in favour of investment. Furthermore, if co-benefits are incorporated into markets, the subsidy required to make the NCS financially viable will likely be less than the full cost of directly purchasing those GHG emissions savings at the full price of carbon, offering an effective discounted means to support climate change mitigation aims.

4.2 SUPPORTING MARKETS TO LEVERAGE THE PRIVATE SECTOR

This study explored a range of benefits associated with the selected NCS pathways. While some of the benefits provided by the NCS pathways are already on the private sector's balance sheet, others are public goods that provide positive externalities and are not adequately priced in or provided by the market. This is a market failure that needs to be addressed to enable market solutions to provide an efficient level of NCS in Canada. Different stakeholders, including the Canadian Government, can have a role in addressing these market failures and instituting solutions targeted at leveraging private sector investment into implementing NCS. This section explores evidence of potential solutions to market failures drawing on relevant examples from around the world. The development of these solutions can create mechanisms to marketise benefits and incentivise the private sector to invest in NCS.

4.2.1 Produce evidence to address information asymmetry

When information is not available or is available to only one-party transactions between buyers and sellers can be impeded. There are many examples of supporting the generation of evidence on ecosystem service benefits to help solve information asymmetry. This includes government provided funding to pilot projects and evaluation studies, e.g., Natural England Upland Ecosystem Service Pilots[8]; issuing guidance on ecosystems service metrics and protocols and adopting standards on data collection and presentation, e.g., the British Standards Institute (BSI)[9]; and requiring recipients of government grants to provide ecosystem and biodiversity data, e.g., the EU's Common Agricultural Policy[10]. The latter requires farmers who receive subsidies to declare land use and management practices, which are then verified with a range of data sources, including satellite imagery. However, these requirements should take consideration of the specific recipient and context to ensure they are not overly onerous.

4.2.2 Enhance regulatory and policy environment

The regulatory environment can be used to support NCS and help with inadequate incentivisation. One approach is the implementation of biodiversity net gain regulations, such as requiring developers and land managers to ensure that habitats for wildlife are left in a better state than they were before development. For example, the UK's Biodiversity Net Gain (BNG) scheme[11] requires developers to deliver a biodiversity net gain of 10% (i.e., ensuring that a development will result in more or better-quality natural habitat than there was before development). Another approach is setting binding targets for nature restoration, for example, the EU Regulation on Nature Restoration[12] sets quantified and time-bound restoration target for habitats, requiring member states to ensure the continued provisions of ecosystem services to European citizens.

Likewise, creating a favourable tax environment to provide financial incentive to attract investors, such as property tax rebates for putting in place conservation practices on private lands, can also stimulate desired activity. British Columbia's conservation tax incentive programme, Natural Area Protection Tax Exemption Program (NAPTEP)[13], allows 65% exemption on property tax to landowners for lands protected permanently by conservation easements. As the programme focuses on lands critical for wildlife and sensitive ecosystems, it contributes to regional conservation efforts.

Competition law regimes, which sometimes run counter to collaborative environmental initiatives, can be structured to allow for financial market players to act in coordination on NCS. For example, the

[8] Natural England. Evaluation of the Upland Ecosystem Service Pilots - NECR254. Available at https://publications.naturalengland.org.uk/publication/4915928315985920

[9] UK Government (2024). Calculate biodiversity value with the statutory biodiversity metric. Available at https://www.gov.uk/guidance/biodiversity-metric-calculate-the-biodiversity-net-gain-of-a-project-or-development

[10] European Commission. CAP and the environment. Available at https://agriculture.ec.europa.eu/cap-my-country/sustainability/environmental-sustainability/cap-and-environment_en

[11] UK Government (2024). Understanding biodiversity net gain. Available at https://www.gov.uk/guidance/understanding-biodiversity-net-gain

[12] European Commission (2024). Nature Restoration Law enters into force. Available at https://environment.ec.europa.eu/news/nature-restoration-law-enters-force-2024-08-15_en

[13] Islands Trust Conservancy. Natural Area Protection Tax Exemption Program (NAPTEP). Available at https://islandstrust.bc.ca/programs/natural-area-protection-tax-exemption-program

Australian Competition and Consumer Commission has released a guide on sustainability collaborations[14] under competition law and recently released a draft decision[15] proposing to authorise collaborations on sustainable finance initiatives.

4.2.1 Target financial support

Targeted government and financial support can help resolve issues around risk mitigation, timing of returns, and ownership. For example, the European Investment Bank's Natural Capital Financing Facility[16] is a nature-focused government fund to provide targeted financial support for projects which enhance environmental assets. Other specific funding types could include: seed funding to initiate start-up projects which help to build business cases for projects high risk and novel aspects, e.g., the UK-based fund for nature-based solutions[17]; financial instruments and debt issuance such as green bonds, for example Canada's Green Bond Program[18]; match funding to attract money from different stakeholders and spread risk, e.g., in Canada match funding is available through the Nature Smart Climate Solutions Fund[19]; in the UK funding is available through the Infrastructure Bank[20].

4.2.2 Establish markets to reduce barriers

Payment for ecosystem services

Payment for Ecosystem Services (PES) programmes provide a financial incentive from a public or private entity to reward landowners or land managers for positive environmental practices. These are often set up as direct payment schemes between parties. For example, the Malewa-Naivasha Subbasin Watershed Project[21] in Kenya represents a PES project in watershed management where payments may serve as a vehicle for change in the region. The programme offers small-scale farmers new economic opportunities, provided that they embrace sustainable agricultural practices and thus contribute to less silt load in the rivers that feed Lake Naivasha, which in turn increases its storage

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[14] Australian Competition and Consumer Commission (2024). Sustainability collaborations and Australian competition law. Available at https://www.accc.gov.au/business/competition-and-exemptions/cooperation-among-businesses

[15] Australian Competition and Consumer Commission (2025). ACCC releases draft decision proposing to authorise collaborations on sustainable finance initiatives. Available at https://www.accc.gov.au/media-release/accc-releases-draft-decision-proposing-to-authorise-collaborations-on-sustainable-finance-initiatives

[16] European Investment Bank. Natural Capital Financing Facility: Terms of Eligibility. Available at https://www.eib.org/files/documents/ncff_terms_eligibility_en.pdf

[17] Morecroft, M. (2022). New Grant Scheme Opens: Nature-based Solutions for Climate Change at the Landscape Scale. Natural England. Available at https://naturalengland.blog.gov.uk/2022/07/14/new-grant-scheme-opens-nature-based-solutions-for-climate-change-at-the-landscape-scale/

[18] Government of Canada (2023). Canada's Green Bond Program. Department of Finance Canada. Available at https://www.canada.ca/en/department-finance/programs/financial-sector-policy/securities/debt-program/canadas-green-bond-program.html

[19] Environment and Climate Change Canada. Nature Smart Climate Solutions Fund. Available at https://www.canada.ca/en/environment-climate-change/services/environmental-funding/programs/nature-smart-climate-solutions-fund.html

[20] National Wealth Fund (2025). UK Infrastructure Bank backs Greensphere Capital's innovative British climate and nature fund. Available at https://www.nationalwealthfund.org.uk/news/uk-infrastructure-bank-backs-greensphere-capitals-innovative-british-climate-and-nature-fund

[21] FAO (2011). Payments for Ecosystem Services and Food Security. Food and Agriculture Organization of the United Nations. Available at https://www.fao.org/4/i2100e/i2100e00.htm

capacity and reduces eutrophication. There are many different structures PES schemes can take with over 150 examples from around the world compiled in a study by the United Nations Economic Commission for Europe (UNECE)[22].

Biodiversity markets

High transaction costs exist in the absence of efficient markets, and linking up buyers and sellers can become a barrier. Supporting the creation of markets can help resolve this issue, such as the creation of biodiversity offset markets. There are various approaches to creating a biodiversity offset market, one approach is providing funding and other support for the development of standards for implementation in biodiversity markets. For example, the Department for Environment, Food, and Rural Affairs (Defra) in the UK has supported[23] the British Institute Standard in the development of Principles and frameworks[24] for nature investing.

Another approach is designing and operating the scheme itself, like in the Biodiversity Offsets Scheme[25] in New South Wales, Australia. A 2023 review[26] of the latter found that it was not sufficiently providing for the conservation of biodiversity in the state, making numerous recommendations to overhaul the scheme. Subsequently the New South Wales Government announced plans[27] to reform the scheme, making recommendations around: nature positive strategy; nature positive spatial tools; nature positive development; species and ecosystem recovery; data-informed decision-making; and leveraging private investment.

In Canada, early work on biodiversity offset markets is outlined in "Biodiversity Offsets: A Canadian Primer[28]" which establishes key concepts and design considerations, while "Biodiversity Offsets: Policy Options for Government"[29] describes the experiences of governments that have put biodiversity offsetting in place giving general findings on policy to inform future development such as:

- the role of government as regulator, administrator, monitor and enforcer;
- the importance of oversight of markets and associated costs; strong rules of exchange;

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[22] UNECE/FAO (2018). Forests and Water: Valuation and Payments for Forest Ecosystem Services. United Nations Economic Commission for Europe. Available at https://unece.org/forests/publications/value-forests-payments-ecosystem-services-green-economy

[23] Ambler, C. (2024). Setting the standard for biodiversity markets in the UK. Defra Environment Blog. Available at https://defraenvironment.blog.gov.uk/2024/11/06/setting-the-standard-for-biodiversity-markets-in-the-uk/

[24] BSI (2024). BSI Flex 701 v2.0 Nature Markets – Overarching Principles and Framework. British Standards Institution. Available at https://www.bsigroup.com/en-GB/insights-and-media/insights/brochures/bsi-flex-701-nature-markets-overarching-principles-and-framework/

[25] NSW Government. How the Biodiversity Offsets Scheme works. NSW Department of Climate Change, Energy, the Environment and Water. Available at https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity-offsets-scheme/about/how-scheme-works

[26] Henry, K. et al. (2023). Independent Review of the Biodiversity Conservation Act 2016. NSW Parliament. Available at https://www.parliament.nsw.gov.au/tp/files/186428/Independent Review of the Biodiversity Conservation Act 2016-Final.pdf

[27] NSW Government (2024). NSW Plan for Nature. Department of Climate Change, Energy, the Environment and Water. Available at https://www.nsw.gov.au/departments-and-agencies/cabinet-office/resources/nsw-plan-for-nature

[28] Poulton, D. (2014). Biodiversity Offsets: A Primer for Canada. Sustainable Prosperity and the Institute of the Environment. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2797391

[29] Crowe, M. & ten Kate, K. (2014). Biodiversity Offsets: Policy Options for Government. Forest Trends. Available at https://www.forest-trends.org/publications/biodiversity-offsets-policy-options-for-government/

- integration with broader land use planning regimes; and,
- explicitness around scope, metrics, and goals.

Integrating biodiversity and nature in carbon markets

The creation of carbon markets is an example of a market solution to the provision of what was a non-market good, carbon emissions. These markets could be expanded to incorporate other related non-market goods such as biodiversity and nature. This would require developing methodologies for an expanded set of nature-based carbon credits in federal carbon credit markets. The Canadian government has identified and prioritised four project types[30] for federal offset protocol development: two of these pertain to nature-based carbon credits (improved forest management and enhanced soil organic carbon). Protocols for nature-based carbon credits could be expanded to include other project types. For example, Verra, best known as a certifier of voluntary carbon offsets, has published[31] methodologies for various nature-based carbon credits, such as the standard for Improved Agricultural Land Management. Furthermore, Scottish Forestry manages The Woodland Carbon Code[32], the UK's voluntary carbon standard for woodland creation projects, includes a mechanism for considering priority co-benefits in carbon unit pricing.

A related approach is the "stacking" of biodiversity credits along with carbon credits. For example, Eco-Markets Australia has introduced the Cassowary Credit scheme that allows landowners to earn biodiversity credits for restoring rainforest wetlands. These credits can be "stacked" with Australian Carbon Credit Units (ACCUs), which are issued by the government-regulated carbon market as outlined in the Cassowary Credits Stacking guide[33].

Establishing green infrastructure markets

There are multiple programmes in the US building storm water credit markets, which allow developers to meet a portion of their stormwater retention requirements by purchasing credits generated from green infrastructure projects (examples include Washington DC[34], Michigan[35], and Cook County, Illinois[36]). These types of arrangements could also be applied to deliver other types of land management practices where their outcomes, such as water flow management, are aligned.

[30] Government of Canada (2021). Greenhouse Gas Offset Credit System Regulations. Canada Gazette Part 1, Volume 155, Number 10. Available at https://gazette.gc.ca/rp-pr/p1/2021/2021-03-06/html/reg1-eng.html

[31] Verra. Approval of First VCUs Under Verra's Improved Agricultural Land Management Methodology (VM0042). Available at https://verra.org/approval-of-first-vcus-under-verras-improved-agricultural-land-management-methodology-vm0042/

[32] UK Government. The Woodland Carbon Code scheme for buyers and landowners. Available at https://www.gov.uk/guidance/the-woodland-carbon-code-scheme-for-buyers-and-landowners

[33] Eco-Markets Australia. Stacking Biodiversity and Carbon Credit Projects - Cassowary Credits. Available at https://eco-markets.org.au/cassowary-credits-stacking/

[34] DC Department of Energy & Environment. Stormwater Retention Credit Trading. Available at https://doee.dc.gov/src

[35] City of Grand Rapids. Stormwater Credit Trading Program. Available at https://www.grandrapidsmi.gov/Government/Departments/Development-Center/Stormwater-Credit-Trading-Program

[36] StormStore. Stormwater Credit Trading Marketplace. Available at https://www.stormstore.org/

4.2.3 Potential mechanisms for key benefits

The mechanisms presented above can be applied to the specific benefits identified in the CBA to help marketise them and make the case for private sector investment in a given NCS. Four key benefits were identified across the NCS: regulation of water timing and flows; erosion regulation; soil nutrient regulation, and pollination. Table 26 aligns these benefits to the mechanisms discussed above. This is not meant to be an exhaustive list but rather to give direction to potential next steps.

Table 26 Potential solutions for key benefits

Key benefit	Potential mechanisms	Examples
Regulation of water timing and flows	PES schemes Regulatory approaches Green infrastructure markets Financial support	FAO/UNECE PES case studies EU Nature Restoration Law (watershed targets) Stormwater Retention Credit trading (Washington DC) Grand Rapids stormwater credit program EU NCFF Canada Nature Smart Climate Solutions Fund
Erosion regulation	PES schemes Financial support Carbon markets (stacking) Biodiversity markets	World Bank Albania Natural Resources Project[37] Woodland Carbon Code (erosion co-benefit)
Soil nutrient regulation	PES schemes Regulatory approaches Carbon markets (stacking) Biodiversity markets	FAO/UNECE PES case studies EU CAP agri-environmental data requirements Verra VM0042 (soil health indicators)
Pollination	Regulatory approaches Biodiversity markets Financial support Carbon markets (stacking)	UK Biodiversity Net Gain (habitat requirements) UK Pollinator Action Plan[38] Cassowary Credits (biodiversity stacking)

[37] World Bank (2017). Albania: Restoring Growth and Improving Prosperity. Natural Resources Development Project reduced erosion by 220,000 tons during 2000-2008. Available at https://www.worldbank.org/en/results/2017/04/17/albania-restoring-growth-and-improving-prosperity
[38] UK Government (2022). Pollinator Action Plan 2021 to 2024. Available at https://www.gov.uk/government/publications/pollinator-action-plan-2021-to-2024

5. CONCLUSION

Natural Climate Solutions could be a significant contributor to Canada's decarbonisation aims but are currently underutilised. Part of the problem is in funding and a mismatch between costs and benefits. While costs are generally borne by landowners and managers, the benefits accrue to broader society. A mechanism to marketise some of those benefits will help make the case for investment in Canada's NCS.

This project applied a Cost Benefit Analysis framework to better understand the value of natural climate solutions, investigating the co-benefits to carbon emissions reductions delivered by NCS with an ecosystem services valuation approach. The framework allowed for the identification of specific benefits which were sufficient for the overall benefit of the NCS to outweigh the costs. Should these benefits be marketised, the case could be made for private sector investment.

Across the 11 NCS assessed, representing the British Columbia forestry sector, and the central Canadian Prairies and Southern Ontario agricultural sectors, the results varied. Several NCS were justifiable on financial benefits alone, such as regenerative cropping practices and silvopasture. A couple of others had costs that exceeded the quantified benefits, such as grassland and old forest conservation. The rest were able to make a strong case for private sector investment with the marketisation of specific benefits. Across these NCS, the key benefits were regulations of water timing and flows, erosion regulation, soil nutrient regulation, and pollination.

Solutions to market failures around the provision of these benefits would go a long way to leveraging the private sector. Direct subsidisation and the creation of carbon markets would further enhance the case. There are examples from around the world of diverse and innovative initiatives doing just that. Supporting these solutions would enable Canada to achieve its climate ambitions.

The analysis conducted for this study can be built on to outline action plans for individual NCS, presenting the value gap to attract private sector investment, specifying the benefits required to narrow this gap, and identifying and designing appropriate mechanisms for marketising these benefits. Proceeding towards actual implementation would necessitate taking further consideration of the specific context, location, stakeholders, and other practical aspects of the NCS to ensure feasibility.

Realising the potential of Canada's NCS will require coordinated action. There is a role for the government in setting policy frameworks and supporting market development. Local stakeholders—including provincial and municipal governments, businesses, Indigenous groups, civil society, and private citizens—are equally essential to implementing NCS and realising their full range of benefits.

APPENDIX 1—METHODOLOGY

This appendix describes the methodology employed by this study. The study assessed the seven Natural Climate Solutions (NCS) pathways and 11 initiatives. The NCS assessed within the study are outlined in Fig. 1.

Fig. 1. NCS pathways

Sector	Hotspot	NCS	NCS pathway	Initiative
Agriculture	Prairies	1	Regenerative cropping practices	Cover crops, reduced tillage
		2	Improved pasture practices	Grasslands conservation
	Southern Ontario	3	Avoided conversion of remnant natural habitats in agricultural lands	Avoided forest conversion, avoided conversion of freshwater mineral wetlands
		4	Trees in agricultural lands	Silvopasture, riparian tree planting
		5	Regenerative cropping practices	Cover crops, reduced tillage
Forestry	British Columbia	6	Old forest conservation	Old forest conservation
		7	Fire risk management	Fire risk management

The study adopted a Cost Benefit Analysis (CBA) approach to estimate the potential costs and benefits associated with each NCS initiative. In essence, the approach involved identifying, quantifying, and then weighing against one another the costs and benefits of each initiative. An ecosystem services approach was adopted to assess the value of the co-benefits provided by the NCS. The remainder of this section details these aspects of the study, as well as caveats to the approach and assumptions made in the analysis.

Note that accompanying workbooks containing the actual CBA for each NCS provide additional transparency and, furthermore, are constructed in a way to allow for further updates and refinements post publication of this report.

6.1 COST BENEFIT ANALYSIS

The costs and benefits of each NCS were estimated between 2025 and 2035. Whilst that captures an 11-year time period, this time series was chosen to account for any lag in potential benefits following the implementation of a subset of the NCS initiatives. Further information on this assumption is noted in 6.1.3.

The CBA follows six mains steps:

1. Define the scope and boundary of the assessment
2. Identify material costs and benefits
3. Quantify material costs and benefits

4. Profile costs and benefits over time and discount to present value
5. Calculate benefit-to-cost ratios over time
6. Conduct sensitivity analysis and interpret results

6.1.1 Define the scope and boundary of the assessment

Oxford Economics worked with Nature United to define the seven NCS pathways, and resulting initiatives to be included within the assessment, as shown above in Fig. 1. This study seeks to answer how the private sector could be encouraged to invest in implementing NCS, and what the government could do to support this. Therefore, the analysis sought to understand which "co-benefits" must be included for a private sector Benefit Cost ratio (BCR) to hit 1—the financial break-even point—or the point at which the costs and benefits of the NCS are equal. In other words, which benefits would need to enter the private sector ledger, such as through marketisation or some other financial mechanism, for the private sector BCR to be greater than 1 and thereby encourage investment in implementing the NCS.

6.1.2 Identify and quantify material costs and benefits

Identifying material costs

The costs of the NCS relate to both the implementation costs and the opportunity costs associated with the NCS. Implementation costs are the direct costs of actioning the NCS. For example, this could include the cost of purchasing seeds for planting cover crops. There are also opportunity costs associated with several NCS. Opportunity costs are the foregone benefits of using the land for an alternative purpose instead of the NCS. For instance, the opportunity costs associated with preserving forests in an area used for forestry are the revenue that could otherwise be gained from harvesting trees for timber.

Quantifying material costs

For this study, we used the estimated costs for six of the NCS pathways from Drever et al. (2021).[39][40] Oxford Economics was provided access to supplementary data produced in that paper, containing a low and high estimate of the total cost of abatement for each NCS between 2021 and 2030 for Canada as a whole. For NCS 6—old forest conservation in British Columbia—the low and high aggregate total costs were calculated using supplementary data provided in Drever et al. (2021) on the marginal abatement cost (MAC) curve for this pathway. In short, these data split the total mitigation potential for the NCS by the amount of mitigation which can be achieved under different C$/Mg CO_2e categories. For the purposes of this study, we assumed that:

- Annual mitigation is proportional to the area of opportunity conserved.
- Area of opportunity conserved is split linearly across the study period—for example, 10% is conserved each year.

[39] C. Ronnie Drever et al. (2021), Natural climate solutions for Canada.Sci. Adv.7,eabd6034.DOI:10.1126/sciadv.abd6034
[40] For further detail on which costs are captured for each NCS, please refer to the Drever et al. (2021) supplementary materials.

- As a corollary, 4.1MtCO_2e in 2030 corresponds to the mitigation across the full area of opportunity. The mitigation increases annually to this point, proportional to the growth in the area of opportunity (10% per year).

These aggregate cost figures were discounted to and presented in 2018 prices. To be applicable to this study, we undiscounted the totals using the 3% discount rate specified in Drever et al. (2021). This is because the total costs were discounted further along the CBA process, and the analysis was conducted in 2025 prices. As only the aggregate total cost across the 10-year period were available, for the "un-discounting", we made the assumption that the aggregate costs were evenly distributed between 2021 and 2030.

These undiscounted costs were then translated into cost per hectare values by dividing the total cost of abatement for each NCS in Canada across the 10-year time period by the total area of opportunity in Canada for each NCS. The average of the low and high estimate was taken to arrive at an estimate of the cost per hectare for the NCS, on an undiscounted basis in 2018 prices. Finally, the per hectare value was converted into 2025 prices using GDP deflators for Canada.[41]

For Silvopasture, under NCS 4—Trees in Agriculture in Southern Ontario—the cost per hectare was taken as C$323 per hectare (2018 prices) from the supplementary materials in Drever et al. (2021, p.19), as recommended by Nature United. This value was also converted into 2025 prices.

NCS7—Fire Risk Management (FRM)—was not included within Drever et al. (2021). Therefore, the estimated cost per hectare of implementing a FRM strategy in British Columbia was assumed to be equal to the Government of British Columbia's total spending on Crown Land Wildfire Risk Reduction (CLWRR) activities in 2024 divided by the total CLWRR treatments completed in 2024 to date in hectares.[42] This calculation arrived at an estimated C$5,735 per hectare. As the published data referred to 2024, the monetary spending figure was assumed to be in 2024 prices. This figure was then sense-checked against the provincial government's total spending and treated land since 2019.[42]

To estimate the total monetary cost of each NCS, we multiplied the per hectare cost by the area of opportunity in each period. This study assumes that, for costs, the NCS are implemented in a way as to evenly spread costs across the 10-year period (e.g., 10% of the area of opportunity is addressed per year). Finally, the costs were then discounted and cumulated across the time period to arrive at a present value on the cost side.

Identifying material benefits

The overarching aim of a NCS is to manage GHG emissions, either through sequestration or avoided emissions, in turn, contributing to global climate change mitigation. However, this study aims to identify the "co-benefits" to this primary aim to build a case for their implementation. Therefore, the benefits of global climate regulation were not considered within the core CBA, but are included as part of the sensitivity analysis, to understand if the estimated monetary benefits associated with global climate regulation would support implementation of a NCS where the assessed co-benefits alone are

[41] Oxford Economics. Global Economic Model, Databanks. Accessed May 2025.
[42] Government of British Columbia. Wildfire Season Summary. Available at https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary

not estimated to outweigh the costs. The sensitivity analysis can be found in the supporting workbooks.

The study utilised an ecosystem services approach to identify the potential benefits associated with each NCS. Ecosystem services refer to the provisioning, regulating, and cultural services that are provided by ecosystems to local communities, private businesses, and broader society. The relevant ecosystem services across each NCS were identified using the World Resources Institute (WRI), which indicates the ecosystem services provided by different land cover class.[43] The land cover class(es) selected for each NCS are described in Fig. 2.

This list was then refined using desk-based research and drawing on expertise from Nature United and Serecon to refine the list of benefits to be more representative of the specific NCS.[44] The study also drew on the co-benefits identified in Drever et al. (2021) for six of the seven NCS pathways to bring in, and align with the WRI framework, any additional ecosystem services that were not identified in the initial scoping.

Fig. 2. Land cover class(es) for ecosystem services benefit identification

NCS	NCS pathway	Initiative	Biome
1	Regenerative cropping practices	Cover crops	Non-irrigated arable land
		Reduced tillage	
2	Improved pasture practices	Grasslands conservation	Grassland
3	Avoided conversion of remnant natural habitats in agricultural lands	Avoided forest conversion	Coniferous forests
		Avoided conversion of freshwater mineral wetlands	Inland marshes
4	Trees in agricultural lands	Silvopasture	Agro-forestry areas / Agriculture and natural vegetation
		Riparian tree planting	
5	Regenerative cropping practices	Cover crops	Non-irrigated arable land
		Reduced tillage	
6	Old forest conservation	Old forest conservation	Coniferous forests
7	Fire risk management	Fire risk management	Coniferous forests

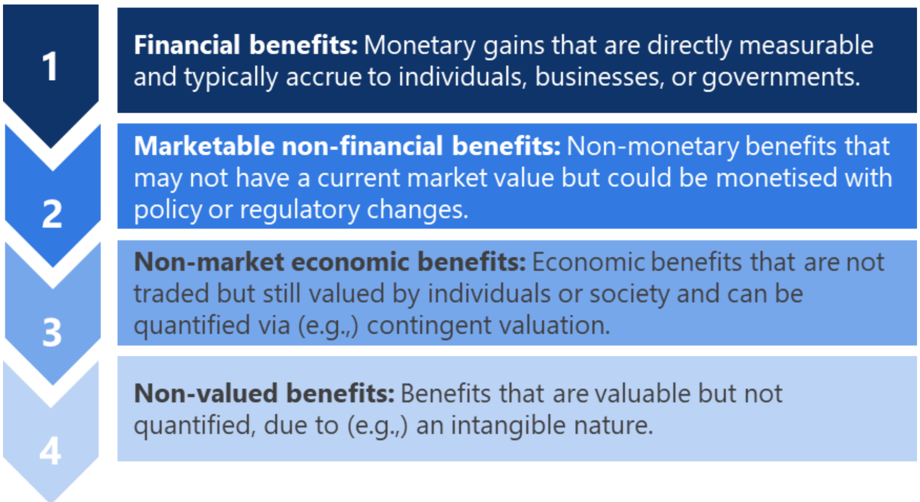
The benefits for NCS7—Fire risk management—were refined further based on desk research. The main financial benefits of avoiding wildfires stem from the avoided financial costs associated with fire-related damages. Other non-financial damages were also considered, including the impact on human health from wildfire smoke, but were not included due to a lack of data to quantify the benefit. The selection of avoided financial damages was guided by a study by Natural Resources Canada published in 2025 that investigates financial damages for a range of past Canadian wildfires.[45] The avoided damages included in this study were losses to the tourism sector's revenue, the financial value of lost

[43] World Resources Institute (2013). Weaving Ecosystems Services into Impact Assessment [technical appendix]. Available at https://files.wri.org/d8/s3fs-public/weaving_ecosystem_services_into_impact_assessment_technical_appendix.pdf
[44] Serecon. Cultivating Change: Opportunities and Barriers for Natural Climate Solutions in the Canadian Prairies.
[45] Natural Resources Canada (2025). Estimated Direct and Indirect Costs of Extreme Wildfires in Western Canada. Available at https://publications.gc.ca/collections/collection_2025/rncan-nrcan/Fo143-2-463-eng.pdf

timber resources, and other damages such as property loss and revenue losses from other business sectors across the wider economy.

The identified benefits were then classified into financial, non-financial, non-market, and non-valued benefits, as highlighted in Fig. 3. The "core" financial and marketable benefits were quantified first, followed by additional benefits such as non-market economic benefits. Non-market economic benefits provide economic benefits to society, but do not necessarily have an associated market mechanism to match producers and consumers. The more market-orientated benefits were quantified first in the CBA to allow for sensitivity testing to identify where the Benefit to Cost Ratio switches to 1.

Fig. 3. Benefit categories for different ecosystem services



Quantifying material benefits

Since the relevant ecosystem services were classified using the widely used WRI framework, they could be readily matched with external research to apply monetary valuations to the benefits.

For most ecosystem services, the study utilised the Ecosystem Services Valuation Database (ESVD) Value Transfer Tool (VTT) as an estimate of the per hectare value of the ecosystem service under the different NCS.[46] The ESVD VTT uses "value functions" which draw on meta analyses of data within the ESVD to estimate the value of ecosystem services using different characteristics of a study site such as elevation, population density, and area.[46]

For this study's purposes, values were collected for the exchange value rather than for consumer surplus, to better reflect potential market values. For benefits which used solely the ESVD VTT to quantify the ecosystem service benefit, either the marginal change, or total flow value was collected depending on the type of NCS. Marginal change values were collected for NCS which are implementing a land management change, as this inferred that the NCS would support a marginal improvement on an already existing ecosystem service benefit. Conversely, for NCS which preserve

[46] Luke Brander et al, Ecosystem Services Valuation Database (ESVD). Value Transfer Tool. Foundation for Sustainable Development and Brander Environmental Economics, 2004. Accessed June 2025. Available at https://www.esvd.net/vtt/calculations

existing land cover—meaning avoided land use change—the total flow value was taken as otherwise the ecosystem benefit would be lost due to land conversion.

To quantify benefits within the Canadian context, we used the transfer value method to estimate the monetary value of each ecosystem service within the relevant geography. This was done using the ESVD VTT and involved collecting data on relevant characteristics, such as elevation and population density, relating to the specific NCS hotspots. Further details on the metrics collected are specified in Fig. 6. Geographic data formats (e.g., shapefiles) were not available for many of the NCS so an alternative approach was adopted, as without these data it is difficult to identify the precise location of the NCS. Instead, we utilised available pictures of maps and the geospatial files for those available within the supplementary material of Drever et al. (2021) to assume the closest "ecozone" in Canada for each NCS. We then used characteristics based on this ecozone as the inputs for the ESVD VTT. Further information on the characteristics of data used for the VTT are detailed section 6.2.2 and Fig. 6.

The resulting per hectare values from the tool were specified in international dollars in 2020 prices. For the study's purposes these were converted into Canadian dollars in 2025 prices. We compared the default value from the tool with the values from the tool once our characteristics for each NCS were inputted. The default value was taken instead of the value provided based on the input variables where a more conservative value was warranted, such as for NCS3 for the regulation of water timing and flows value for wetland conservation.

To estimate the total monetary benefits of each ecosystem service, the per hectare values were then multiplied by the annual area of opportunity for the benefits. The analysis assumes that benefits occur on a cumulative basis. In other words, the benefits that occur on 10% of land implemented in the first year will also accrue in year two of the study period, whereby 20% of the land has been implemented, and so on. These total benefits are modelled as occurring linearly over the period, reaching full benefit value by year 10.

Benefits which were quantified not using the ESVD VTT, or involved an additional calculation on the value from the ESVD VTT include:

- For cover crops under NCS1 and NCS5, the per hectare monetary value for fodder and pollination were provided by Nature United and Serecon.[47]
- For reduced tillage, the benefit was estimated as the increased margin earned implementing reduced tillage. The margin was estimated using a figure calculated by Serecon from VandenBygaart and Liang (2023)[48], and applying this to the total flow exchange value of crop provisioning from the ESVD VTT.
- For NCS3 and NCS4, the potential benefit from additional tourism was estimated based on an external estimate of the value of agritourism in Southern Ontario.[49] Qualitative literature

[47] Serecon. Cultivating Change: Opportunities and Barriers for Natural Climate Solutions in the Canadian Prairies.
[48] Calculation provided by Serecon based on: VandenBygaart, A.J., and Liang, B.C. (2023). Crop yields under no-till in Canada: implications for soil organic carbon change, Canadian Journal of Soil Science, 104 (1): 22-27. DOI: https://doi.org/10.1139/cjss-2023-0061.
[49] Farmonaut (n.d.). Revolutionizing Ontario's Agritourism: New App Connects Families with Local Farm Experiences. Available at: https://farmonaut.com/canada/ontario-agritourism-app-5-ways-it-connects-families

illustrates that some NCS initiatives can improve recreation and tourism in agricultural landscapes.[50][51] For this analysis, it is assumed that the NCS would provide an annual 1% uplift in tourism value to reflect improvements in the aesthetics and visual amenity of the rural landscape for recreational and tourism users. This value was scaled to the share of the area of opportunity for each initiative of the total area of Southern Ontario, as a more conservative estimate of the per hectare value of tourism for each NCS.

- The green premium associated with timber under NCS 6, old forest conservation, which was assumed to be 10% of the market value of timber products.[52] The valuation of timber products was assumed as the ecosystem service value of wood provision from the ESVD VTT.
- All financial benefits, or avoided costs, from avoiding wildfire damages in NCS7—fire risk management—were calculated by using either estimates from Natural Resources Canada of the damages caused by the 2017 wildfires in British Colombia[53] or based on an average across bad fire years (notably, 2017, 2018, 2021, 2023, and 2024) between 2014 and 2024 using data from the British Colombian government on wildfire costs[54].
- The value of global climate regulation via carbon sink was valued using Canadian government guidance on the price of carbon.[55] This is dependent on federal Canadian carbon pricing becoming tradeable. The modelling assumed that the annual C$15 increase continues to 2030, as this is the latest value available from the Canadian government, and is then constant out to 2035. The resulting value was measured in Canadian dollars (2025 prices) per tCO_2e. Due to lack of clear guidance with the source to the contrary, we assume that these values were in 2025 prices within the analysis. To arrive at an aggregate estimate of the monetary benefit, the study multiplies the per tCO_2e value for each pathway by the tCO_2e per hectare of mitigation potential estimate for each NCS. The total mitigation potential of each NCS, apart from NCS 7, was provided by Drever et al. (2021).[56] Note that for the reasons previously discussed, this value is not included in the core BCR or Net Present Value (NPV).

For NCS7—Fire risk management—the mitigation potential was estimated using geospatial data on the area of wildfires in British Colombia provided by the Canadian Wildfire Information System[57] and data on the emissions from wildfire in British Colombia from the province's Provincial Inventory of

[50] Gabriel Pent & John Fike (2021). Enhanced Ecosystem Services Provided by Silvopasture. Available at: https://www.researchgate.net/profile/Yves-Laumonier/publication/355492533_Selected_Soil_Properties_Among_Agroforestry_Natural_Forest_Traditional_Agriculture_and_Palm_Oil_Land_Uses_in_Central_Kalimantan/links/63bb7adac3c99660ebdce9de/Selected-Soil-Properties-Among-Agroforestry-Natural-Forest-Traditional-Agriculture-and-Palm-Oil-Land-Uses-in-Central-Kalimantan.pdf#page=148.

[51] Fleur Maseyk et al. (2017). Change in ecosystem service provision within a lowland dairy landscape under different riparian margin scenarios. Available at: https://www.tandfonline.com/doi/full/10.1080/21513732.2017.1411974.

[52] Francisco X. Aguilar, Richard P. Vlosky. (2007) Consumer willingness to pay price premiums for environmentally certified wood products in the U.S., Forest Policy and Economics, Volume 9, Issue 8, https://doi.org/10.1016/j.forpol.2006.12.001.

[53] Natural Resources Canada (2025). Estimated Direct and Indirect Costs of Extreme Wildfires in Western Canada. Available at https://publications.gc.ca/collections/collection_2025/rncan-nrcan/Fo143-2-463-eng.pdf

[54] British Colombia government (2025). Wildfire Averages. Available at: Wildfire Averages - Province of British Columbia

[55] Government of Canada (2021). Update to the Pan-Canadian Approach to Carbon Pollution Pricing 2023-2030. https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/carbon-pollution-pricing-federal-benchmark-information/federal-benchmark-2023-2030.html

[56] C. Ronnie Drever et al. (2021), Natural climate solutions for Canada.Sci. Adv.7,eabd6034.DOI:10.1126/sciadv.abd6034

[57] Canadian Wildfire Information System. Available at: https://cwfis.cfs.nrcan.gc.ca/datamart

Greenhouse Gas Emissions[58]. Based on these data, a per hectare value of emissions from wildfire was estimated. The emissions from prescribed burning were not netted off from the per hectare emissions from wildfire due to a lack of data. Therefore, the mitigation potential is likely overestimated, but does not feature in the calculations of the core CBA.

The switching value is the point at which the Benefit Cost Ratio becomes greater than 1. To facilitate understanding of which benefits are required to reach the switching point, the study quantified the benefits according to the hierarchy in Fig. 3: financial benefits, then marketable non-financial, and then non-market economic benefits. Non-valued benefits were not quantified, but are included in the CBA as material potential benefits. In some cases, where monetary values were not available for a relevant ecosystem service, the benefit was included as non-valued (e.g., biomass).

6.1.3 Calculate the benefit cost ratio over time

Once the annual monetary costs and benefits were calculated, the total present value of the costs and benefits were calculated as the sum of the discounted costs and benefits across a 10-year time period for each NCS.

Time period

The costs and benefits were profiled over time between 2025 and 2035. Whilst 2025 to 2035 is an 11-year time period, in practice, the modelling of costs and benefits were each limited to 10 years, but the overall 11-year period accounts for potential lags in benefit realisation. For NCS that involve a land management change, we assumed that there is a lag period of one year between when the first period of costs occur and when benefits begin to be realised. For NCS which involve preserving, or not converting land use, we assumed that benefits occur within the first period. On the cost side, the study assumed that costs begin in the first year, and stop by 2034 for all pathways. This approach was also applied to NCS7—Fire risk management. however, in practice, as FRM is more likely to be an ongoing management practice, the costs of FRM may not typically end after the 10-year time period.

Discounting over time

Applying a discount rate is standard practice in CBA. The social discount rate considers the value of future costs and benefits at a given present period, accounting for greater time preferences for current rather than future consumption, or receipt of benefits.[59] The reference year was 2025, or in other words, costs and benefits were discounted from 2025. The study used a 3% annual discount rate in line with Drever et al. (2021), which is also the Treasury Board of Canada Secretariat's social discount rate for CBA.[60] The discounted costs and benefits were then summed to arrive at the total present value of benefits and costs for each NCS.

[59] Government of Canada from the Treasury Board of Canada Secretariat. Policy on Cost-Benefit Analysis. Available at https://www.canada.ca/en/government/system/laws/developing-improving-federal-regulations/requirements-developing-managing-reviewing-regulations/guidelines-tools/policy-cost-benefit-analysis.html

[60] Treasury Board of Canada Secretariat. (2022). Canada's Cost-Benefit Analysis Guide for Regulatory Proposals. Available at BT58-5-2022-eng.pdf.

Net Present Value and Benefit Cost Ratio

Finally, the total present costs and benefits were compared using a BCR and NPV. The BCR compares the unit of benefit received for each unit of cost for the NCS, or in other words, what is the dollar value of benefits received for every dollar invested. The study calculated the BCR at various points to identify the switching point where the benefits exceed the costs for each NCS. Additionally, the sensitivity analysis assessed the benefits of global climate mitigation applying the Government of Canada published price of carbon and the effective discount achieved via the NCS.

The BCR can be interpreted as:

- A BCR of 1 implies that the benefits and costs of the NCS are equal.
- A BCR greater than 1 implies that the benefits of the NCS are greater than the costs of the NCS.
- A BCR less than 1 implies that the costs of the NCS are greater than the benefits of the NCS.

Likewise, the NPV is equal to the difference between the present value of the benefit and the present value of the costs of the NCS. A positive NPV indicates that the estimated benefits exceed the estimate costs, and vice versa. This implies that the implementation of the NCS could create value for the private sector if identified benefits could be brought into the private sector balance sheet.

As previously stated, the cost estimates for the NCS from Drever et al. (2021) are treated as inclusive of opportunity costs, meaning the lost benefits of alternative uses of the land. This effectively means that the counterfactual situation, or base case with which to compare results, is implicitly netted off in the approach. Were opportunity costs not part of the cost estimates, a counterfactual case would need to be modelled to compare against, as is often done in CBA.

6.2 ECOSYSTEM SERVICE VALUATION

This section provides further detail on the area of opportunity, input and output variables from the transfer value, and scaling factors, or the estimated economically relevant area of opportunity, for each ecosystem service benefit, applied in the study.

6.2.1 Area of opportunity

The area of opportunity refers to area of land where the NCS could be implemented. The study used the area of opportunities specified in Drever et al. (2021) as the starting point. These areas were either adjusted, or overwritten, through consultation with Nature United and Serecon. The study assumes that the area of opportunity addressed was equally spread over the 10-year period. The area of opportunity and respective source are detailed for each NCS in Fig. 4.

Fig. 4. Area of opportunity for each NCS

Hotspot	NCS pathway	Initiative	Total area of opportunity across the 10-year period (hectares)*	Source

Prairies	Regenerative cropping practices	Cover crops	2,581,900	Estimate provided by Serecon based on Statistics Canada, 2021 Census of Agriculture.[61]
		Reduced tillage	6,789,400	
	Improved pasture practices	Grasslands conservation	98,300 (Based on 9,830 ha/per year)	Estimated provided by Nature United. Taken from the CAPI (Canadian Agri-Food Policy Institute) Agriculture Mapping tool, based on the Semi-decadal Land Use Series.
Southern Ontario	Avoided conversion of remnant natural habitats in agricultural lands	Avoided forest conversion	43,700 (Based on 4,370 ha/per year)	Estimated provided by Nature United. Taken from the CAPI (Canadian Agri-Food Policy Institute) Agriculture Mapping tool, based on the Semi-decadal Land Use Series.
		Avoided conversion of freshwater mineral wetlands	3,100 (Based on 310 ha/per year)	
	Trees in agricultural lands	Silvopasture	33,600	Drever et al. (2021). Area of opportunity adjusted from Ontario to Mixedwood Plains only using the share of pasture/forage relative to total land cover from the 2023 Annual Crop Inventory.
		Riparian tree planting	101,700	Drever et al. (2021). Shapefile via Harvard database intersected with a shapefile for the Mixedwood Plains ecozone in Ontario only from StatCan using geospatial analysis.
	Regenerative cropping practices	Cover crops	3,076,900	Estimate provided by Serecon based on Statistics Canada, 2021 Census of Agriculture.
		Reduced tillage	2,543,300	
British Columbia	Old forest conservation	Old forest conservation	270,900	British Columbia estimate from Drever et al. (2021) scaled down to the Montane Cordillera ecozone using the proportion of Montane Cordillera vs Pacific Maritime Area disturbed by harvest from White et al. (2017).[62]
	Fire risk management	Fire risk management	82,200	Natural Resources Canada. CWFIS Datamart - National Burn Area Composite.[63] These data were used to calculate the burn area in the BC area of Montane Cordillera. It is assumed that 10% of the total area is prescribed to be burned every year until all of the area has been prescribed burned and the process restarts.

*Rounded to the nearest 100 hectares.

6.2.2 Transfer value inputs

Fig. 6 outlines the metrics used as inputs into the ESVD VTT to estimate the value of ecosystem services based on characteristics of the Canadian ecozones, or provinces. The study used available images of maps and the GIS files for available NCS to assume the closest "ecozone" in Canada for each NCS, so that the spatial metrics were consistent across the NCS. Data were then collected at the ecozone, provincial, or national level if otherwise unavailable. Fig. 5 details the relevant ecozones identified for each NCS.

Fig. 5. NCS and relevant ecozone

NCS pathway	NCS pathway	Hotspot	Relevant ecozone
1	Regenerative cropping practices	Prairies	Prairies
2	Improved pasture practices		

[61] Serecon. Cultivating Change: Opportunities and Barriers for Natural Climate Solutions in the Canadian Prairies.
[62] Joanne White et al. (2017), A nationwide annual characterization of 25 years of forest disturbance and recovery for Canada using Landsat time series, Remote Sensing of Environment. DOI:https://doi.org/10.1016/j.rse.2017.03.035
[63] Available at https://cwfis.cfs.nrcan.gc.ca/downloads/nbac/NBAC_1972to2024_20250506_shp.zip

3	Avoided conversion of remnant natural habitats in agricultural lands	Southern Ontario	Mixedwood Plains
4	Trees in agricultural lands		
5	Regenerative cropping practices		
6	Old forest conservation	British Columbia	Montane Cordillera
7	Fire risk management		

The ESVD VTT specifies minimum and maximum input values based on its available primary valuation studies, therefore, for population density. If the input value for the ecozone fell outside of this range, the provincial level estimate was used, and otherwise the national level.[64]

It is important to note that these characteristic inputs, when measured at the ecozone level, cover a vast area, and so, characteristics at the local level may vary, thus impacting the per hectare valuation of the ecosystem service. Therefore, more localised studies could build upon this initial method where applicable.

Fig. 6. Value transfer metrics used as inputs into the ESVD VTT tool

Variable required in the ESVD VTT	Unit specified in ESVD VTT	Summary of method
Area	Hectares	Annual area of opportunity for benefits for each NCS.[65]
Elevation	Metres above sea level	Average elevation, metres taken from StatCan for ecozone.[66]
Ecosystem Productivity Index	NPP/maxNPP	Default used from ESVD VTT.
Night time light	nanoWatts/cm2/sr	Default used from ESVD VTT.
Population density	Persons per km^2 within a 10km buffer of the ecosystem	Population density data, Number per km^2, 2021, taken from StatCan for ecozone.[67] If ecozone population density is above the maximum in the ESVD tool, then the provincial, or national population density was used instead.[68] 68
Income per capita	International dollars per capita; 2020 price level	Median, total income per capita, 2023, (constant 2023 prices) taken from StatCan. Converted into 2020 prices US dollars using Oxford Economics' CAD to USD exchange rate in 2023 and US GDP deflator between 2023 and 2020.[69][70]
Percentage of protected area	%	% of protected area in selected ecozone taken from StatCan.[71]

[64] ESVD Value Transfer Tool. Guidance document for the ESVD Value Transfer Tool. Available at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.esvd.info/_files/ugd/53b4f9_86bcb5c7988e4070a8a51d6cdc2843c2.pdf.

[65] Please see Fig 4.

[66] Agriculture and Agri-Food Canada. Elevation by Ecozone. Released 2017. Modified 2024. Accessed May 2025. Available at https://open.canada.ca/data/en/dataset/b3baf8ca-e9cb-4356-9e90-49f52a076a95

[67] Statistics Canada. Population and dwelling counts: Canada, provinces and territories. Population density per square kilometre, 2021 Released 2022. Accessed July 2025. Available at https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/hlt-fst/pd-pl/index-eng.cfm

[68] The VTT specifies minimum and maximum input values based on its available primary valuation studies. Please see ESVD Value Transfer Tool. Guidance document for the ESVD Value Transfer Tool. Available at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.esvd.info/_files/ugd/53b4f9_86bcb5c7988e4070a8a51d6cdc2843c2.pdf

[69] Statistics Canada. Table 11-10-0091-01 Average and median market, total and after-tax income of individuals by selected demographic characteristics, 2023. "Median income, Total income" for British Columbia, Ontario, and Prairie Provinces. Released 2025. Accessed May 2025.

[70] Oxford Economics. Global Economic Model, Databanks. Accessed May 2025.

[71] Government of Canada. Proportion of area conserved, by ecozone, Canada, 2023. Accessed May 2025. Available at https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/conserved-areas.html

Road density	m/km^2 (10 km buffer)	Road density calculated for each ecozone using geospatial software.[72]
Land cover % grassland	10km buffer	"Grassland and shrubland area, Square kilometres" as a share of "Total land cover, Square kilometres" for Mixedwood Plains ecozone calculated from StatCan 2020 data.[73]
Land cover % forest	50 km buffer	"Treed (including treed wetlands), Square kilometres" as a share of "Total land cover, Square kilometres" for Montane Cordillera ecozone calculated from 2020 StatCan data.[73]
Biodiversity Intactness	How much of an area's original biodiversity is still present and functioning compared to its natural state. Index (between 0 and 1)	BII collected for Canada of 0.908, but outside of range when inputted into the ESVD tool, so default used from ESVD VTT.[6874]
Land cover % water	30 km buffer	"Inland water bodies area, Square kilometres" as a share of "Total land cover, Square kilometres" for Mixedwood Plains ecozone calculated from 2020 StatCan data.[75]

6.2.3 Scaling factors

The costs and benefits of the NCS were considered across the respective areas of opportunity for each initiative, as identified in or adapted from Drever et al. (2021), or provided by Nature United from an external source. Ecosystem services were priced per hectare, e.g., C$400/ha. However, this figure could not be directly applied to the areas of opportunity, because not all benefits are economically relevant, for private actors, across the whole area. For example, the benefits of pollination from old forest conservation are only economically relevant when they are near an agent which can economically benefit from them, such as a farm or a garden/park. The area was therefore scaled by the share that is likely to be near an agent which could benefit from the ecosystem services.

The scaling factors were applied at two stages of the analysis.

- Scaling factors were applied to the annual area of opportunity for each NCS by ecosystem service as the input for the ESVD VTT. This was to estimate a more realistic total area of opportunity for the ecosystem system service and the respective value estimate from the ESVD VTT based on that area.
- The scaling factors were also applied to the total annual area of opportunity before being multiplied by the per hectare value of each ecosystem service. This was to approximate where the value of the benefit could actually be realised, so as to not overstate the estimated monetary benefit of each ecosystem service. Fig. 7 includes a visual example of the scaling factor used for the benefit of pollination.

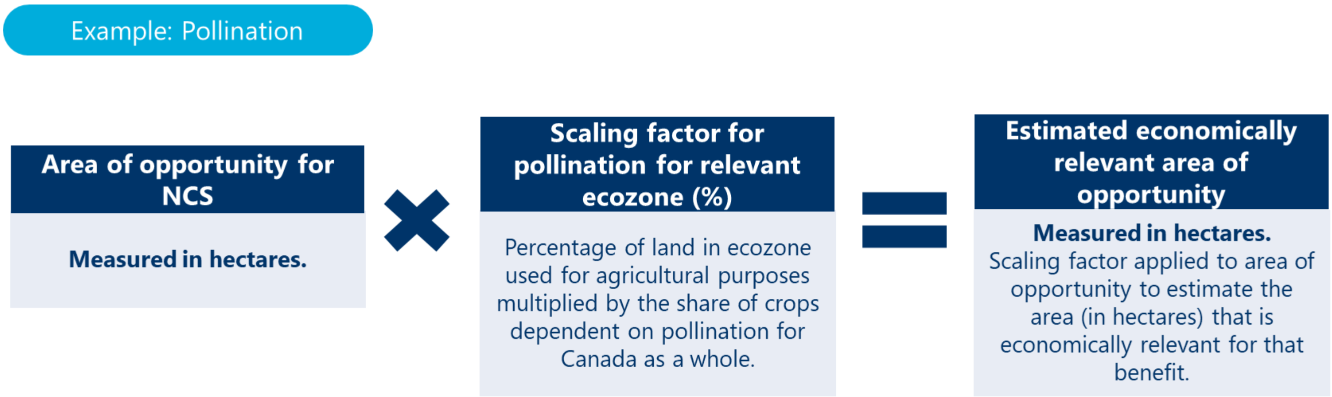
[72] Calculated for each ecozone using Statistics Canada. Road network files, 2021 census file. Available at https://www12.statcan.gc.ca/census-recensement/2021/geo/sip-pis/rnf-frr/index-eng.cfm

[73] Statistics Canada. Table 38-10-0177-01 Land cover by class, Canada, ecoprovince and ecozone, 2020. Released March 2025. Accessed May 2025. Available at https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810017701

[74] Helen Phillips et al. (2021). The Biodiversity Intactness Index - country, region and global-level summaries for the year 1970 to 2050 under various scenarios [Data set]. Natural History Museum. https://doi.org/10.5519/he1eqmg1

[75] Statistics Canada. Table 38-10-0177-01 Land cover by class, Canada, ecoprovince and ecozone, 2020. Released March 2025. Accessed May 2025. Available at https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810017701

Fig. 7. Visual example of the scaling factor calculation



Source: Oxford Economics

In line with the approach adopted for transfer values, without detailed geographical data for all NCS pathways, the study adopted the assumption of scaling factors based on available ecozone or national level data. Scaling factors were estimated for each "hotspot", as the prevalence of different ecosystem services is likely to differ across different geographies. Fig. 8 details the method used to estimate the scaling factor for each ecosystem service benefit included in the analysis.

Fig. 8. Scaling factors and calculation method, by geography

Ecosystem service benefit	Method	Scaling factor: British Columbia NCS	Scaling factor: Prairies NCS	Scaling factor: Southern Ontario NCS
Pollination	For NCS1 and NCS5, the scaling factor is already built into the price estimation provided by Serecon.[76] For all other pathways, where applicable: Share of land used for agricultural purposes by ecozone multiplied by the share of crops dependent on pollination for Canada as a whole.[77][78]	0.3%	26.2%	12.5%
Regulation of water timing and flows	Share of ecozone which falls into flood hazard zone class 5 or 6 calculated from the Flood Susceptibility Class dataset by GEO.ca[79][80]	1.1%	5.3%	16.0%
Fodder	Provided by Serecon.[81]	NA	NCS 1 (Cover crops): 46%	NCS 5 (Cover crops): 21%

[76] Serecon. Cultivating Change: Opportunities and Barriers for Natural Climate Solutions in the Canadian Prairies.
[77]OE calculated from Statistics Canada. Table 38-10-0177-01 Land cover by class, Canada, ecoprovince and ecozone. Available at https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810017701.
[78] Gabriela Duarte, Richard Schuster, and Matthew Mitchell, Unveiling the benefits and gaps of wild pollinators on nutrition and income. Environmental Research Letters, 19(4), p.044019, 2004
[79] GEO.ca. Flood Susceptibility Class. Available at https://app.geo.ca/en-ca/map-browser/record/df106e11-4cee-425d-bd38-7e51ac674128.
[80] Government of Canada. A National Ecological Framework for Canada. GIS data. Available at https://sis.agr.gc.ca/cansis/nsdb/ecostrat/gis_data.html.
[81] Serecon. Cultivating Change: Opportunities and Barriers for Natural Climate Solutions in the Canadian Prairies.

			NCS 2: 100%	
Recreation and tourism	Value in British Columbia for Fire Risk management values from external literature. Value of agroforestry tourism in Southern Ontario taken from external source.[82] 1% uplift scaled to share of area of opportunity of Southern Ontario's area assumed. Old forest conservation in British Columbia not valued due to lack of non-willingness to pay data.	No scaling factor needed. Estimated separately	Excluded from analysis	No scaling factor needed. Estimated separately.
Energy (biomass)	Non-valued benefit due to lack of economic data for agriculture pathways.	NA	Non valued benefit where applicable	Non valued benefit where applicable
Crops	Reduced tillage only. Crop yield gain of 7.14% calculated by Serecon from VandenBygaart and Liang (2023) applied to total flow value as a proxy for the total flow from reduced tillage. Also applied to reduced tillage in Southern Ontario.[83]	NA	7.14%	7.14%

Ecosystem service benefit	Method	Scaling factor: British Columbia NCS	Scaling factor: Prairies NCS	Scaling factor: Southern Ontario NCS
Timber products	Old forest conservation only: Approx. 1% of BC's timber harvesting land base is logged each year.[84] Fire Risk Management timber valued separately from external literature.	1.0%	Excluded from analysis	NA
Air quality regulation	Share of land area that is urbanised from StatCan for relevant ecozone.[85]	0.9%	3.1%	9.5%
Water purification	Share of land area covered by freshwater sources from StatCan for relevant ecozone.[85]	3.1%	3.8%	34.6%
Erosion regulation	Share of land area that is urbanised or used for agricultural purposes from StatCan for relevant ecozone.[85]	1.6%	62.6%	37.9%
Soil nutrient regulation	Share of land are used for agricultural purposes from StatCan for relevant ecozone.[85]	0.7%	59.5%	28.4%
Livestock	NA. benefit excluded due to low relevance for pathways.	NA	NA	NA
Wild foods	Non-valued benefit due to subsistence.	Non valued benefit	Non valued benefit	Non valued benefit
Wood fuel	Non-valued benefit due to subsistence.	Non valued benefit	Non valued benefit	Non valued benefit
Biochemicals/medicine	Non-valued benefit due to subsistence.	Non valued benefit	Non valued benefit	Non valued benefit

[82] Farmonaut (n.d.). Revolutionizing Ontario's Agritourism: New App Connects Families with Local Farm Experiences. Available at: https://farmonaut.com/canada/ontario-agritourism-app-5-ways-it-connects-families.

[83] Calculated by Serecon using VandenBygaart, A.J., and Liang, B.C. Crop yields under no-till in Canada: implications for soil organic carbon change, Canadian Journal of Soil Science, 104 (1): 22-27. DOI: https://doi.org/10.1139/cjss-2023-0061.

[84] Government of British Columbia. Old growth definitions and values Available at https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/old-growth-forests/old-growth-values

[85] OE calculated from Statistics Canada. Table 38-10-0177-01 Land cover by class, Canada, ecoprovince and ecozone. Available at: https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3810017701.

Global climate regulation via carbon sink	No scaling factor. Applies to whole area.	100.0%	100.0%	100.0%

Note: Figures rounded to 1dp apart from Crops which is rounded to 2dp.

6.3 CAVEATS, ASSUMPTIONS, AND LIMITATIONS

Undertaking CBA at a non-specific or non-localised scale typically requires a large range of assumptions and generalisations that might otherwise be addressed with data. Likewise valuing non-market goods such as ecosystem services is often complex and not straightforward. The analysis therefore required the adoption of numerous assumptions, and the results should be understood as caveated with awareness of subsequent limitations of the approach. We welcome future research to build upon the framework approach developed here and initial findings. Focus could be on updating the CBA analysis with refinement on the assumptions applied. Notably some assumptions have greater influence on the results and interpretation. To aid transparency in the approach employed by this study, key assumptions that inform the analysis are listed below, with further detail available in the supporting workbooks. The full list of assumptions adopted for the analysis are outlined in Fig. 9. This section categorises key assumptions according to three categories: (1) assumptions relating to data sources used, (2) methodological assumptions, and (3) modelling assumptions.

6.3.1 Potential areas for refinement

Data sources

- Costs: The costs for this study for six of the seven NCS pathways were adopted from Drever et al. (2021). The costs are a significant driver of a BCR, and updated prices should be considered as data become available. For NCS 7, Fire Risk Management, the data on the implementation cost of an FRM strategy were limited, and therefore, the cost provides an estimate based on provincial level expenditure. Refining cost estimates was not the purpose of this study, but there are areas that could be further investigated. For example, the costs for avoided grassland conversion, under NCS 2, could be an overestimation in part because the cost of preservation estimated as the land costs itself may overstate the true cost of the NCS, and as native grasslands may achieve carbon sequestration objectives whilst being grazed for cattle. Additionally, the cost of NCS could be varied over time or as further scenario analysis, such as the cost of cover crops depending on alternative estimates of seeding costs.
- Area of opportunity: The results also depended on the area of opportunity for each pathway. For most pathways, the areas were taken from or adapted from Drever et al. (2021). For the pathways where the area of opportunity was not taken from Drever et al. (2021), Nature United and Serecon provided estimates on the area of opportunity for these pathways. These impacted both the costs and benefits because the respective per hectare values are scaled up to the total.
- ESVD VTT: The valuation for most ecosystem service benefits were pulled from the ESVD VTT. The tool offers a valuable meta-analysis of available primary studies; however, it is important to note that the respective values will also be influenced by the availability of data, time period, and other factors from the primary studies included in the ESVD VTT for the given ecosystem service. The values, and therefore this study, are also subject to all assumptions

and limitations of the ESVD VTT tool itself, and all constituent studies within it. Further detail can be found through the ESVD VTT methodology.[86]

- External sources: Often input variables are adopted from external sources which result in a range of values. An attempt was made to select the most robust value, while adopting conservative assumptions. Further scenarios could explore a range of output values, such as a more optimistic case that could be strived for.

Methodological

- Scaling factors: As the scaling factors determine the economic relevance of each ecosystem service, they significantly drive the results. These factors impact both the inputs for the ESVD VTT and the final quantified benefits. Estimating the scaling factors based on the relevant ecozone for each hotspot provides a proxy estimate, however without geographic data to directly identify the economic and geographic characteristics of the region in question, it may not fully accurately represent the area of interest. More comprehensive localised geographic data could be used to more accurately estimate scaling factors for the region in question.
- Input variables for transfer values: The transfer values utilised for the study were also a significant driver of results, because they form the inputs into the ESVD VTT. Whilst collecting characteristics on the relevant ecozone for each hotspot provides a proxy estimate, the transfer values may not fully accurately represent the area of interest without detailed geographic data to directly identify the economic and geographic characteristics of the geography in question.
- Other price valuations (namely tourism in Southern Ontario and Fire Risk Management): Benefits not valued with the ESVD required bespoke approaches based on available external references which in some cases were limited and had to be modified. Further detail is available in the workbooks of the specific NCS.
- Fire Risk Management: The area of opportunity for prescribed burning is assumed to be 10% of the average annual burn area between 2014 and 2023 derived from geospatial wildfire data from the Canadian Wildfire Information System. It is assumed that of the whole wildfire area, 10% is treated each year until the total area has been treated, at which point the first 10% to be treated would be treated again. This point would occur after 10 years. It is assumed that treatment is 100% effective in preventing wildfires in the treated area which notably is a strong assumption but could be revised. Based on this conceptualisation, the benefits are realised on the cumulative area treated in each given year and the costs remain constant as 10% of the land is treated annually.
- Local level estimates: The focus is on putting together a realistic understanding of the NCS at a macro scale. However, land management occurs at a local scale, so while the results presented in this study provide a solid basis, further work at a more micro scale would be beneficial to better support implementation.

Modelling assumptions

[86] ESVD Value Transfer Tool. Guidance document for the ESVD Value Transfer Tool. Available at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.esvd.info/_files/ugd/53b4f9_86bcb5c7988e4070a8a51d6cdc2843c2.pdf.

- Time profile: Simplifying assumptions have been used to profile costs and benefits over time, these profiles could be refined with better understanding of the practicalities of implementation and realisation of the actual benefits. For example, in NCS7—Fire Risk Management—prescribed burning would need to be implemented on an ongoing basis to maintain the benefits of the NCS because burnt vegetation regrows after a certain period of time which reintroduces the risk of wildfires.
- Land use change vs land management practice: There is a categorical difference between NCS which require land use change or avoided land use change, versus those which require a change in land management practices. Arguably these should be treated differently in how they are assessed, interpreted, and promoted.
- Scale and geography in question: The scale and specific geography matter, both for the assessment, but even more so for real world implementation. While generalisations are made in the analysis, these need to be considered more closely in practice. In some cases, the BCR from smaller scale and more spatially explicit application of an NCS may vary significantly from the large scale, generalised case.
- Benefit identification: Some ecosystem services identified via the WRI framework for the respective land cover class were excluded from the analysis: livestock excluded due to low economic relevance; local climate regulation was excluded because it was not available in the ESVD VTT for all study biomes; and global climate regulation was already captured in the sensitivity analysis.

Fig. 9. List of assumptions adopted during the study

Assumption	Modelling impact/details
Assumptions relating to: General assumptions	
Aggregation of initiatives: The NPV cost and benefits for different initiatives under the same pathway were not aggregated due to risks of double counting.	Initiatives considered in isolation.
Benefit ranking: Benefits were "ranked" within each benefit tier based on their economic relevance.	This did not materially affect the modelling.
Ecozones: The analysis used "representative" ecozones to identify values for transfer value approach for benefit quantification.	This impacted the variables used to determine benefits using the transfer value approach. Nature United team approved the individual ecozones we have mapped to for each of the NCS.
Mitigation potential of FRM: Based on wildfire burn area in BC and reported emissions, we calculate annual average emissions from 2014–2022 to get a tCO_2e/ha value that is applied to calculate mitigation potential.	Benefits quantification for NCS 7 sensitivity analysis.
Discount rate: Costs and benefits were discounted at a rate of 3%.	Materially impacts CBA. Aligned with discount rate used in Drever et al. (2021).
Assumptions relating to: Costs	
Costs: Costs will be constant over time based on Drever et al. (2021) information.	We applied the overall cost evenly across the 10 years. No additional information provided by Nature United to imply time-varying costs.
Costs: Costs are calculated based on the mid-point of the total cost points (low and high estimates) for each NCS where taken from Drever et al. (2021)	Costs will reflect a mid-point estimation of total costs. This assumption is required to estimate aggregate cost for each NCS from data from Drever et al. (2021). We then combine this with the Area of Opportunity to estimate the average cost per hectare of the NCS.
Cost of fire risk management implementation: Calculated from 2024 BC government Crown Land Wildfire Risk reduction	Costs of FRM pathway

in 2024: Amount spent CAD / Land treated (hectares) = C$5,735.[87]	Supported by 2019 average from same source and average across WRR data sheet published on BC gov website (although limited information published with this source so not used in estimate).[88]
Cost per hectare: For Silvopasture, under NCS 4—Trees in Agriculture in Southern Ontario—the cost per hectare was taken as C$323 per hectare from the supplementary materials in Drever et al. (2021, p.19), as recommended by Nature United.	Cost per hectare value for NCS 4.
Assumptions relating to: Area of opportunity	
Area of opportunity: For Riparian tree planting this was taken as the intersection of Mixedwood Plains ecozone and the shapefile from the Harvard dataverse for Drever et al. (2021).	Area of opportunity for NCS 4. As agreed with Nature United.
Area of opportunity: For grassland this was estimated by Nature United from the CAPI tool based on the Semi-decadal Land Use Series.	Area of opportunity for NCS 2. Provided by Nature United.
Area of opportunity: For NCS 6, the value was scaled down from British Columbia in Drever et al. 2021 to Montane Cordillera ecozone using proportion of the Montane Cordillera and Pacific Maritime as a share of total British Columbia area disturbed by harvest from Table 2 White et al. (2017).[89]	Area of opportunity for NCS 6. Provided by Nature United.
Area of opportunity: Information from CAPI tool provided by Nature United used to model the area of opportunity for avoided conversion of forests and wetlands in Southern Ontario.	Area of opportunity for NCS 3. Provided by Nature United.
Area of opportunity: Area of opportunity accumulates annually on a linear basis for all NCS where further information is not available. This means that the NCS applies to 10% of the area of opportunity in year 1, 20% in year 2…. 100% in year 10.	Affects the annual 'quantity' element of analysis. All years will have equal quantity. This assumption is based on our understanding of the Drever modelling (e.g., Improved Forest Management has annual Area estimates, and they are approximately linear). The assumption is required for modelling simplicity.
Area of opportunity—Cover crops: The area of opportunity was taken as the midpoint of 2.2-2.9M hectares as provided by Serecon for the acreage potential for the cover crops business case in the Southern Prairies. Calculated as 2.6M hectares.	Area of opportunity for cover crops in Prairies. Provided by Serecon.
Area of opportunity—Reduced tillage: Area of opportunity equal to the data provided by Serecon of 6.8 million hectares for the total area of opportunity for reduced tillage in the Prairies.	Area of opportunity for reduced tillage in Prairies. Provided by Serecon.
Area of opportunity—Cover crops and reduced tillage in Southern Ontario: Area of opportunity taken from the figures provided by Serecon for Cover Crops (unscaled value) and reduced tillage.	Area of opportunity for cover crops and reduced tillage in Southern Ontario. Provided by Serecon.
Area of opportunity for Fire Risk Management: The area of opportunity was estimated as the average annual burn area in the part of Montane Cordillera that is in BC. Of that, 10% is prescribed burnt annually until 100% has been prescribed burned and the prescribing burning circles back around. The area that has been prescribed burnt does not burn in a wildfire.	Area of opportunity for NCS 7.
Assumptions relating to: Benefits	
Benefits: Benefits, where pulled from the ESVD VTT, will have varying prices over time due to changing annual area of opportunity. Prices will be quantified in constant prices.	We applied constant prices over the assessment period in 2025 prices.

[87] Government of British Columbia. Wildfire Season Summary. Available at https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary

[88] https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/prevention/fire-fuel-management/fuels-management/cost_summary_benchmarks_data_capture.xlsx.

[89] Joanne White et al. (2017), A nationwide annual characterization of 25 years of forest disturbance and recovery for Canada using Landsat time series, Remote Sensing of Environment. DOI:https://doi.org/10.1016/j.rse.2017.03.035

Wood fuel: Benefits of wood fuel not quantified.	Benefit identification. Due to likely subsistence use.
Biomass (energy) benefits under agricultural pathways: Biomass (energy) benefits for reduced tillage were marked as a non-valued benefit. Not due to lack of economic relevance, but due to lack of data to quantify such benefits.	Benefit: biomass (energy)
NCS 4 - benefit crops: Silvopasture or riparian tree planting would not increase crop yields.	Benefit: crops scoped out of NCS4
Value of recreation & tourism in Southern Ontario: The analysis assumed that an initiative would add 1% to the value of agritourism, which was C$1.5 million scaled to the area of opportunity for the initiative to estimate a per hectare value of tourism/recreation.	Benefit: recreation and tourism There is general evidence that maintained agrarian landscapes offer amenity that is valued by tourist and recreational users.[90][91] However, an appropriate specific value was not found. As this benefit is likely to be material, a zero value was thought to not present a meaningful representation, and so a non-zero value of 1% was chosen to demonstrate the potential value. This value of 1% was scaled by the share of the NCS initiative's area of opportunity of the whole area of Southern Ontario to distinguish between the initiatives. This should be revised as appropriate evidence becomes available.
Benefit of FRM: Based on estimated damages of the 2017 wildfires in BC and historic wildfire cost data from the BC government.	Benefits of FRM: Avoided tourism revenue loss, avoided timber loss, avoided other costs We include as a benefit avoided "other damages" in addition to avoided timber loss and avoided loss from tourism in line with damages identified by Natural Resources Canada for the 2017 fires. Avoided health costs from smoke pollution are not quantified but will qualitatively be mentioned. Recreation and tourism as well as timber loss is also quantified based on the paper from Natural Resources Canada based on the 2017 fires which are especially bad fires, but the 2023 and 2024 fires burnt a larger area, so 2017 is still representative. The benefits of avoided "other damages" is based on the average cost of wildfires as identified by the BC government across bad fire years. Benefits are also calculated based on the assumption that there is a bad fire year on average every two years (as it has been in the past 20 years). The scaling factors for those benefits were 1 because the benefit is directly the timber harvest/tourism income lost—so no need to scale by how much timber is harvested in the whole region.
Energy (biomass): Biomass excluded from Inland Wetlands due to lack of Peatland extent in Southern Ontario.	Benefits identification for NCS3.
Recreation: Excluded from Inland Wetlands due to lack of Peatland extent in Southern Ontario and resulting lack of evidence within Southern Ontario.	Benefits identification for NCS3.
Recreation and tourism: Included as a non-valued benefit for old growth in British Columbia due to lack of data on non-WTP valuations.	Benefits quantification for NCS6.
Timber: Price was taken from the ESVD VTT for British Columbia pathways. However, Timber was excluded as a benefit for South Ontario.	Benefits captured in CBA. Not identified as a benefit within the Prairies pathways, however scoped out for Southern Ontario due to South of Managed Forest in Ontario mainly private land and less public forest, which are less suitable for timber production.[92]
Recreation: This benefit was excluded from the Prairies NCS pathways due to limited economic relevance, and not quantified for British Columbia pathways due to a lack of data	Benefits captured in CBA.

[90] Fleur Maseyk et al. (2017). Change in ecosystem service provision within a lowland dairy landscape under different riparian margin scenarios. Available at: https://www.tandfonline.com/doi/full/10.1080/21513732.2017.1411974

[91] Gabriel Pent and John Fike (2021). Enhanced Ecosystem Services Provided by Silvopastures. Available at: https://www.researchgate.net/profile/Yves-Laumonier/publication/355492533_Selected_Soil_Properties_Among_Agroforestry_Natural_Forest_Traditional_Agriculture_and_Palm_Oil_Land_Uses_in_Central_Kalimantan/links/63bb7adac3c99660ebdce9de/Selected-Soil-Properties-Among-Agroforestry-Natural-Forest-Traditional-Agriculture-and-Palm-Oil-Land-Uses-in-Central-Kalimantan.pdf#page=148

[92] https://www.ontario.ca/page/state-ontarios-natural-resources-forest-2021#harvest.

not relating to Willingness to Pay, however, data were available for Southern Ontario.	
Wild foods and biochemicals/medicines: Benefits were not quantified for wild foods and biochemicals/medicines.	Benefit identification. Due to likely subsistence use.
Water regulation flow and timing included as a non-valued benefit for reduced tillage: Benefit of lower drought risk identified by Nature United. Water regulation and flow looks to refer more toward flooding.	Benefits quantification for NCS1 and NCS5.
Assumptions relating to: Scaling factors, value transfer, or benefit quantification	
Scaling: Scale quantity for benefits (i.e., Area of Opportunity) by various factors based on the applicability of benefits to NCS area.	Reduce the total benefits accruing to the NCS. Please see Fig 8.
Yield increase from reduced tillage in the Prairies: 7.14% figure for the reduced tillage yield gain provided by Serecon was used as a proxy for the price uplift applied to crop prices in the reduced tillage pathway.	Price of benefits for crops under reduced tillage pathway. Provided by Serecon.
Scaling factor for fodder: Provided by Serecon.[93]	Benefit: fodder scaling factor adjusted It is reasonable to value the benefit of fodder without considering the portion of all the regions grassland actively being grazed. In general, all conserved grasslands can support the benefit of fodder. A reasonable stocking rate for native grasslands is 1.5 animal units per month per hectare with a 5-6 average grazing season (e.g., a single cow requires about four hectares of native grassland per grazing year). At 100,000 hectares per year with 100% scaling, roughly 250,000 head of cattle would be supported on the landscape, which feels reasonable given that Alberta (roughly 5 million), Saskatchewan (roughly 2 million) and Manitoba (roughly 1 million) currently support about 8 million heads of cattle.
Pollination scaling factor: For NCS1 and NCS5, the scaling factor was factored into the per hectare value provided by Serecon.[94] For all other pathways, where applicable, the scaling factor was estimated as the estimated share of land used for agricultural purposes multiplied by the share of crops dependent on pollination (Canada) proxy.	Scaling factor of benefits.
Scaling factor for water regulation flow and timing: This was estimated as the estimated share of each ecozone that fell into flood hazard zone class 5 or 6 calculated from the Flood Susceptibility Class dataset by GEO.ca	Scaling factor of benefits.
ESVD VTT: The grassland biome was used as a proxy for the price of "nutrient retention" and "air filtration" as these benefits were not featured in the ESVD tool for agriculture.	Benefit quantification for agricultural pathways.
ESVD value for fodder: Grazed biomass	Benefit: fodder valued as 'grazed biomass' in ESVD tool
Water regulation timing and flow: The price of this ecosystem service for NCS3 conservation of inland wetlands was set to the default total flow value as transfer value produced an abnormally very high difference.	Benefit quantification for NCS3.
Population density input for the ESVD transfer value tool: Where the ecozone level population density input exceeded the maximum input supported in the ESVD VTT then the provincial level estimate was used. Likewise, where above the provincial value then we will use Canadian average was used.	Impacts inputs for transfer values and ESVD price pull. ESVD VTT contains a minimum and maximum bound on value transfer inputs based on availability of primary valuation studies.[95]

[93] Serecon. Cultivating Change: Opportunities and Barriers for Natural Climate Solutions in the Canadian Prairies.
[94] Serecon. Cultivating Change: Opportunities and Barriers for Natural Climate Solutions in the Canadian Prairies.
[95] ESVD Value Transfer Tool. Guidance document for the ESVD Value Transfer Tool. Available at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.esvd.info/_files/ugd/53b4f9_86bcb5c7988e4070a8a51d6cdc2843c2.pdf

Income per capita input for the ESVD transfer value tool: ESVD tool states income per capita, however unclear if referring to income or GDP per capita. We have used median income per capita given this is more likely to capture the income of our study areas relative to GDP per capita.	Impacts inputs for transfer values and ESVD price pull. ESVD VTT specifies income per capita, however guidance document refers to GDP per capita.[96]
Biodiversity intactness index input for the ESVD transfer value tool: We used the default value for the BII, as the Canadian figure of 0.908 from Phillips et al. (2021)[97] fell outside of the range within the ESVD VTT.	Impacts inputs for transfer values and ESVD price pull.
ESVD VTT: The analysis used the ESVD prices based on the scaled area of opportunity (area is a transfer value variable). These prices were then applied to the scaled area to arrive at the total benefit for the ecosystem service.	Materially impacts CBA. Creates consistency between price and quantity in our ecosystems services valuation.
Reduced tillage: ESVD prices for crops within reduced tillage were based on the unscaled area of opportunity. The scaling factor, or estimated marginal increase in crop yield from the implementation of reduced tillage was then applied to the ESVD prices.	Materially impacts CBA. These scaling factors are based on yield increases, or a proxy for a value increase, not area that would receive economic benefit.

[96] ESVD Value Transfer Tool. Guidance document for the ESVD Value Transfer Tool. Available at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.esvd.info/_files/ugd/53b4f9_86bcb5c7988e4070a8a51d6cdc2843c2.pdf

[97] Helen Phillips et al. (2021). The Biodiversity Intactness Index - country, region and global-level summaries for the year 1970 to 2050 under various scenarios [Data set]. Natural History Museum. https://doi.org/10.5519/he1eqmg1

OXFORD ECONOMICS

Global headquarters
Oxford Economics Ltd
60 St Aldates
Oxford, OX1 1ST
UK
Tel: +44 (0)1865 268900

London
4 Millbank
London, SW1P 3JA
UK
Tel: +44 (0)203 910 8000

Frankfurt
Marienstr. 15
60329 Frankfurt am Main
Germany
Tel: +49 69 96 758 658

New York
5 Hanover Square, 8th Floor
New York, NY 10004
USA
Tel: +1 (646) 786 1879

Singapore
6 Battery Road
#38-05
Singapore 049909
Tel: +65 6850 0110

Europe, Middle East and Africa

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Asia Pacific

Singapore
Hong Kong
Tokyo
Sydney

Email:
mailbox@oxfordeconomics.com

Website:
www.oxfordeconomics.com

Further contact details:
www.oxfordeconomics.com/about-us/worldwide-offices