Canada Grassland Project Protocol

Avoiding Greenhouse Gas Emissions Related to the Conversion of Grassland to Cropland in Canada

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Abbreviations and Acronyms

AGC	Avoided grassland conversion
AGD	Animal grazing days
CDM	Clean Development Mechanism
CH_4	Methane
CLI	Canada Land Inventory
CO_2	Carbon dioxide
CRT	Climate Reserve Tonne
GHG	Greenhouse gas
GPP	Grassland Project Protocol
GRP	Grassland Reserve Program
GWP	Global warming potential
IPCC	United Nations Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
kg	Kilogram
LCA	Land Conservation Agreement
LSRS	Land Suitability Rating System
N_2O	Nitrous oxide
PIA	Project Implementation Agreement
QLCA	Qualified Land Conservation Agreement
Reserve	Climate Action Reserve
RZ	Reporting Zone
SOM	Soil Organic Matter
SOC	Soil organic carbon
SSR	Source, sink, and reservoir
t	Metric ton (or tonne)
tCO_2e	Metric ton of carbon dioxide equivalent
TTA	Tonne-tonne accounting
TYA	Tonne-year accounting
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

The Climate Action Reserve (Reserve) Canada Grassland Project Protocol (CGPP) provides guidance to account for, report, and verify greenhouse gas (GHG) emission reductions associated with projects that avoid the loss of soil carbon due to conversion of grasslands to cropland, as well as other associated GHG emissions. This protocol is designed to ensure the complete, consistent, transparent, accurate, and conservative quantification and verification of GHG emission reductions associated with an avoided grassland conversion project.[1]

The Reserve is an offset registry serving the California cap-and-trade program and the voluntary carbon market. The Reserve encourages actions to reduce GHG emissions and works to ensure environmental benefit, integrity, and transparency in market-based solutions to address global climate change. It operates the largest accredited registry for the California compliance market and has played an integral role in the development and administration of the state's cap-and-trade program. For the voluntary market, the Reserve establishes high quality standards for carbon offset projects, oversees independent third-party verification bodies, and issues and tracks the transaction of carbon credits (Climate Reserve Tonnes or CRTs) generated from such projects in a transparent, publicly-accessible system.[2] The Climate Action Reserve is a private 501(c)(3) non-profit organization based in Los Angeles, California.

Project Owners and Cooperative Developers that initiate avoided grassland conversion (AGC) projects use this document to quantify and register GHG reductions with the Reserve. The protocol provides eligibility rules, methods to calculate reductions, performance-monitoring instructions, and procedures for reporting project information to the Reserve. Additionally, all project reports receive independent verification by ISO-accredited and Reserve-approved verification bodies. Guidance for verification bodies to verify reductions is provided in the Reserve Verification Program Manual and Section 8 of this protocol. There are several additional resources which accompany this protocol document. Additional details for all of these resources can be found at the Canada Grassland Project Protocol page on the Reserve's website: http://www.climateactionreserve.org/how/protocols/canada-grassland/.

Resource	Required or Optional	Description
GrassTool vC1.0 (MS Excel spreadsheet)	Optional	The Canada GrassTool is built upon the quantification section of this protocol, allowing for Project Owners to conduct project quantification without first developing their own tool. It is updated periodically to enhance usability or to correct errors.
Project Development Handbook (PDF)	Optional	This document provides additional context and description for the rules and requirements contained in this protocol. It is not considered to be official protocol language, and is not meant to be a standard of verification. It is informal guidance to help understand protocol requirements, and it is updated periodically.

[1] See the WRI/WBCSD GHG Protocol for Project Accounting (Part I, Chapter 4) for a description of GHG reduction project accounting principles.
[2] The online registry may be accessed from the Reserve homepage at: www.climateactionreserve.org.

2 The GHG Reduction Project

This section describes the GHG reduction project in terms of defining the project site, the related activities, the parties involved, and the possible project structures.

2.1 Background

Grasslands have the ability to both emit and sequester carbon dioxide (CO_2), the primary GHG responsible for human-caused climate change (1). Grasses and shrubs, through the process of photosynthesis, naturally absorb CO_2 from the atmosphere and store the gas as carbon in their biomass (i.e., plant tissues). As plants die and regrow, some of this carbon is also stored in the soils that support the grassland.

Grassland and Shrubland soils are significant reservoirs of organic carbon that will, if left uncultivated, continue to store this carbon belowground. When grasslands are disturbed, such as when the land is tilled for crop cultivation, a portion of the stored carbon oxidizes and decays, releasing CO_2 into the atmosphere. The quantity and rate of CO_2 that is emitted may vary, depending on the particular circumstances of the land and the disturbance. Grasslands function as reservoirs in the global carbon cycle. Depending on how grasslands are managed or impacted by natural and human events, they can be a net source of emissions, resulting in a decrease to the reservoir, or a net sink, resulting in an increase of CO_2 to the reservoir. In other words, grasslands may have a net negative or net positive impact on the climate, depending on their characteristics and management.

Through sustainable management and protection, grasslands can play a positive and significant role to help address global climate change. This protocol is designed to take advantage of grasslands' unique capacity to sequester, store, and emit CO_2 and to facilitate the positive role that grasslands can play to address climate change. The protocol focuses on the avoided conversion of grasslands to cropland. Because conversion is avoided, we can never measure the exact GHG impacts of conversion activities on the project area, and thus cannot know exactly how much carbon would have been released if a particular area of land were converted. To avoid the cost and uncertainty related to site-specific soil sampling and ecosystem modeling, the Reserve has adopted a standardized, modeling-based approach to estimating baseline emissions for AGC projects. This approach is discussed in more detail in Section 5, as well as Appendix B.

2.2 Project Definition

For the purpose of this protocol, the GHG reduction project is defined as the prevention of emissions of GHGs to the atmosphere through conserving grasslands, shrublands, rangelands, or pasture land belowground carbon stocks and avoiding crop cultivation activities on an eligible project area. Conversion is avoided through the recording of a qualifying Land Conservation Agreement, as described in Section 3.5. The project area must be grassland, shrubland, rangeland,pasture land as defined below, and it must be suitable for conversion to crop cultivation, as defined in Section 3.3.1.2. Land established under the Permanent Cover Program in Canada is eligible. The project area must have been in continuous grassland cover for at least 10 years prior to the project start date, without subsurface disturbance. The baseline scenario for all grassland projects is conversion to crop cultivation.

For the purposes of this protocol, grassland is defined as an area of land dominated by native or introduced grass species with little to no tree canopy. Other plant species may include woody shrubs, legumes, forbs, and other non-woody vegetation. Tree canopy may not exceed 10% of the land area on a per-acre basis. For the purposes of this protocol, grassland may include managed rangeland and/or pastureland (as defined in Section 9). Grasslands may contain limited areas of wetlands, subject to the limitations of Section 3.1.1.

Shrubland is defined as land covered predominantly by shrubs, e.g. woody plants that are smaller than trees and have several main stems arising at or near the ground. Rangeland is defined as an area of grassland which is managed principally through the use of livestock grazing. For the purpose of this protocol, rangeland must meet the definition of grassland. Pastureland is an area of grassland which is managed through livestock grazing as well as other cultivation treatments, such as human and/or mechanical labor, fertilization, irrigation, and/or seeding. To be considered pasture, it may not involve any level of tillage.

The entire project area must be protected through one or more Land Conservation Agreements (LCAs). Multiple LCAs are only allowed in a single project in cases where the grantor and grantee are common among all LCAs. Multiple projects may be managed together as a project cooperative, as described in Section 2.2.2. In addition, the project area must have been privately-owned prior to the project start date.

An AGC project may involve moderate levels of seeding, fertilizer application (i.e., manure, compost, etc.), haying, forage harvesting, livestock grazing and/or irrigation as part of the project activity. If grazing is employed in the project scenario, the livestock manure must not be managed in liquid form (i.e., containing less than 20% dry matter and subject to active management), and grazing activities must meet the criteria in Section 6.3.

Other recreational or economic activities incidental to the project activities may also occur on the project area (e.g., hunting, bird-watching, light haying), but only to the extent that the incidental activity does not threaten the integrity of the soil carbon stocks and is otherwise compatible with the maintenance of grassland under conservation. Supplemental management practices that increase carbon stocks in the project scenario are allowable, but the resultant emissions avoided or removed are not eligible for crediting unless quantified through a separate protocol. The Reserve maintains the right to determine whether an activity is “incidental” to the project or whether the presence of the activity would cause part or all of the project area to be considered an entirely different land use (i.e., not grassland). In those cases, the area used for such activities may not be considered to be part of the project area.

The project lifetime for an AGC project is up to 130 years. This includes the crediting period, which may be up to 30 years (Section 3.4) and the permanence period, which is up to 100 years following the crediting period (Section 3.5).

2.2.1 Defining the Project Area

An eligible project area consists of grassland that meets the criteria in Section 3 regarding the threat of conversion to cropland and the lack of legal barriers to such conversion. Only areas that are suitable for conversion to cropland, as defined in Section 3.3.1, are eligible to report under this protocol. The entire project area must be able to be protected by the recording of one or more Land Conservation Agreements (see Section 3.5.3). The area bound by the LCA(s) does not need to match the project area. However, the entire project area must be included within the area of a Land Conservation Agreement. A single project may include multiple legal parcels if all of these conditions can be met. The project does not need to contain every parcel listed on a deed, and project boundaries do not necessarily need to be coincident with parcel boundaries (i.e., the project area may contain a portion of a parcel without necessarily including the entire parcel).

The geographic boundaries defining the project area must be described in detail at the time a grassland project is listed on the Reserve (see Section 7.2 for details on project documentation). The boundaries must be defined using a georeferenced map, or maps, that displays legal property boundaries, public and private roads, major watercourses (fourth order or greater), project wetlands, topography, towns, and latitude and longitude. The maps should be of adequate resolution to clearly identify the required features. The shapes delineating the project area must contain only areas that meet the eligibility requirements of this protocol. If the project area contains more than one legal parcel, these delineations must also be included. This map is not publicly accessible.

A Geographical Information System file (GIS shapefile) must be submitted to the Reserve with the project documentation prior to the initial registration. If the project area is modified during a reporting period, the GIS file must be updated and resubmitted prior to the next registration. The shapefile may be submitted as a KML file. The acres reported for the project must be based on the acres calculated from the shapefile. The project area can be contiguous or separated into tracts, but must share common a Grassland Owner, Project Owner, LCA Grantee, and project start date. See Section 5.1 for guidance regarding the stratification of the project area.

After the project has been verified, sections of the project area may be removed (subject to the requirements of Section 5.4). The project area may also be expanded, so long as the new area(s) meets all requirements of this section. Any area added to a project following the initial verification will share the same project start date. Project expansions may not be allowed in such cases where the new area would change the eligibility determination of the original project. In such cases the new area may need to be submitted as a new project. New projects may always be added to a project cooperative (see Section 2.3.4).

2.2.2 Project Cooperatives

A “project cooperative” or “cooperative” is a collection of two or more individual grassland projects managed by a common entity (referred to as the “Cooperative Developer,” Section 2.3) that engage in joint monitoring, reporting, and verification (Sections 6.4, 7.6, and 8.1)[3].

2.3 Project Ownership Structures and Terminology

A grassland project can be implemented using various ownership structures. Figure 2.1 displays possible ownership structures for grassland projects, indicating the flow of information and which entities are required to hold Reserve accounts. These are simplified representations; actual project and cooperative structures may be more complex, but the relationships follow the same approach.

[3] The word “cooperative” is not used in its legal sense by this protocol. Unless otherwise specified, nowhere in this protocol, or its accompanying documents, shall the word “cooperative” be construed to represent a legal entity. “Cooperative,” as used by this protocol, is a programmatic term used by the Climate Action Reserve to reflect an administrative grouping of projects, managed by a common entity.

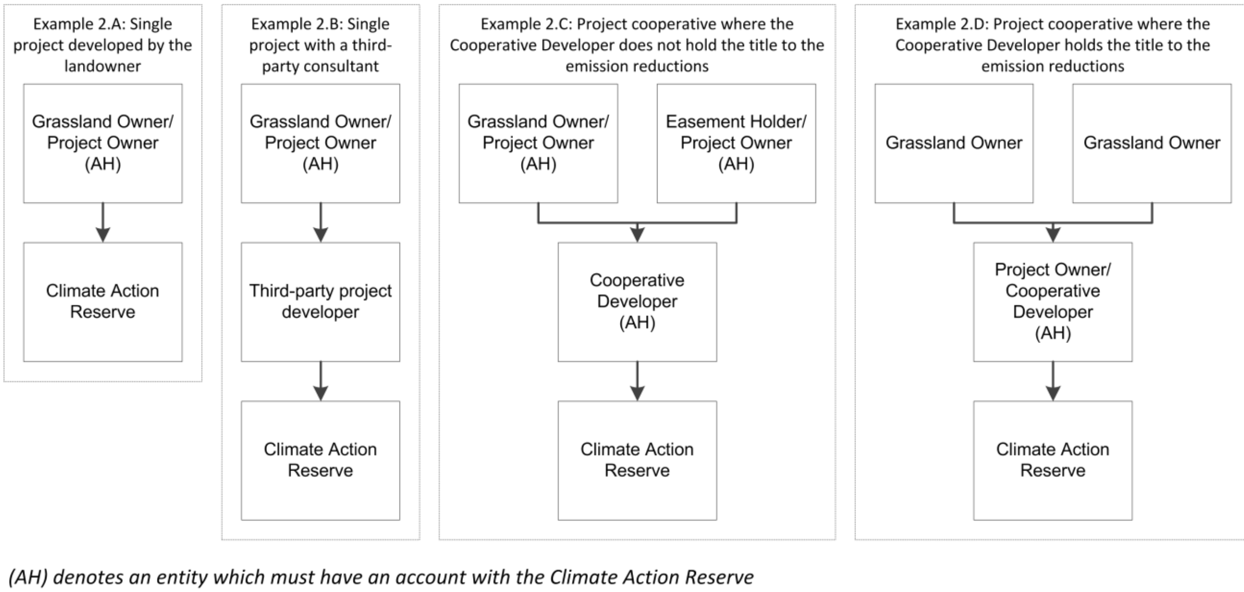

Figure 2.1. Grassland Project Ownership Structures and Terminology

Depending on the project structure, the existence and/or status of certain legal instruments must be verified in order to successfully register a project. The instruments required are described in general below. For every project, the Grassland Owner must demonstrate an understanding of the potential participation in a carbon offset program, either through implementing a project himself, or through clear conveyance of the GHG reduction rights associated with the land through a recorded legal instrument as described below. The sections outlined in Table 2.1 should be referred to for specific requirements for each respective legal instrument required. Additional discussion of these legal instruments can be found in Appendix D.

Table 2.1. Guide to Protocol Sections Related to Legal Instruments for Grassland Projects

Legal Instrument	Protocol Section(s)
GHG reduction rights contract	2.3.2
Indemnification agreement	2.3.2
Land Conservation Agreement	2.2, 3.2, 6
Qualified Land Conservation Agreement	3.5.3
Project Implementation Agreement	3.5.4
Reserve attestations (title, voluntary implementation, regulatory compliance)	2.3.2, 3.3.2, 3.6
Instruments associated with concurrently-joined conservation programs	3.3.2.1

2.3.1 Qualifications and Role of Grassland Owners

A Grassland Owner is an individual or a corporation or other legally constituted entity, city, county, state agency, or a combination thereof that has fee ownership and legal control of the land within the project area. A lessee is not a Grassland Owner. Deeded encumbrances that exist within the project area may prevent a fee owner from satisfying the definition of a Grassland Owner. The Grassland Owner is the entity that has the authority to execute and record (i.e., grant) a Land Conservation Agreement on the project area. Any unencumbered soil carbon is presumed to be controlled by the Grassland Owner. Notwithstanding this presumption, the Reserve maintains the right to determine whether an individual or entity meets the definition of Grassland Owner.

2.3.2 Qualifications and Role of Project Owners

A Project Owner is the entity that holds legal title to the emission reductions related to the grassland project, and is responsible for undertaking the grassland project and registering it with the Reserve. The Project Owner may be a Grassland Owner, a grantee of a Land Conservation Agreement on the property, or they may be a third-party entity who has a signed contract with the Grassland Owner conveying title to the emission reductions. Title to the emission reductions may be conveyed through the Land Conservation Agreement or in a separate contract, but in any case such rights must be legally established. Project Owners may not claim GHG reduction credits for periods of time when they weren't the legal owner of the rights to the GHG emission reductions associated with the project area. If a project area is expanded by adding land acquired after the Project Start Date, the Project Owner may only receive credits from the date when the title to the GHG emission reductions has been legally conveyed (see Section 7.4 for reporting period considerations in relation to grassland area acquisitions). If there are any Grassland Owners who are not party to the GHG reduction rights agreement, the Project Owner must also execute an indemnification stating that they will indemnify the Reserve in connection with any claims brought by other grassland owners or would-be grassland owners against the Reserve.[4] The Project Owner shall execute the Project Implementation Agreement (PIA) (see Section 3.5.4). The Project Owner is also responsible for the accuracy and completeness of all information submitted to the Reserve, and for ensuring compliance with this protocol, even if the Project Owner contracts with an outside entity to carry out these activities. The Project Owner must have a Reserve registry account[5] and must sign all required legal attestations (e.g., Attestation of Title, Attestation of Voluntary Implementation, and Attestation of Regulatory Compliance). Sample language related to ownership of emission reductions is included below, to be amended to fit each project's specific situation:

> *"TITLE TO CARBON OFFSET CREDITS. The [grantor/grantee- i.e., whichever party to the Land Conservation Agreement or agreement is the Project Owner] hereby retains, owns, and holds legal title to and all beneficial ownership rights to the following (the "Project Reductions"): (i) any removal, limitation, reduction, avoidance, sequestration or mitigation of any greenhouse gas associated with the Property including without limitation Climate Action Reserve Project No. [___] and (ii) any right, interest, credit, entitlement, benefit or allowance to emit (present or future) arising from or associated with any of the foregoing, including without limitation the exclusive right to be issued carbon offset credits or Climate Reserve Tonnes (CRTs) by a third party entity such as the Climate Action Reserve."*

In all cases, the Project Owner must attest to the Reserve that they have exclusive claim to the GHG reductions resulting from the project. Each time a project is verified, the Project Owner must attest that no other entities are reporting or claiming (e.g., for voluntary reporting or regulatory compliance purposes) the GHG reductions caused by the project.[6] The Reserve will not issue CRTs for GHG reductions that are reported or claimed by entities other than the Project Owner (e.g., grassland owners who are not the Project Owner). In the case of project

[4] A sample indemnification agreement is available at: http://www.climateactionreserve.org/how/protocols/grassland/.
[5] Information regarding Reserve accounts and the process for project submittal and registration is available here: http://www.climateactionreserve.org/how/projects/register/.
[6] This is done by signing the Reserve's Attestation of Title form, available at: http://www.climateactionreserve.org/how/program/documents/

cooperatives, each Project Owner must sign an attestation for each individual project. Attestations may be submitted by a third party, but must be signed by the Project Owner.

A Project Owner who will be managing the submittal, reporting, and verification of the grassland project through their own Reserve account will open a Project Developer account. A Project Owner whose project will be managed as part of a cooperative, and who will not be utilizing their Reserve account for any action beyond outgoing transfers of CRTs, will open a Project Owner account.

Project Owners are ultimately responsible for timely submittal of all required forms and complying with the terms of this protocol. Project Owners may designate a technical consultant or Cooperative Developer to manage the flow of documents and information to the Reserve. The scope of services provided by a technical consultant or Cooperative Developer should be determined by the Project Owner and the relevant management entity and reflected in the contracts between the Project Owner and the relevant management entity.

2.3.3 Qualifications and Role of Cooperative Developers

A “Cooperative Developer” is the entity that manages reporting and verification for a project cooperative, i.e., two or more individual grassland projects that report and verify jointly. A cooperative may consist of grassland projects involving multiple Project Owners. A Cooperative Developer must have an account on the Reserve.

A Cooperative Developer must open a Project Developer account on the Reserve and must remain in good standing throughout the duration of the cooperative(s) it manages. Failure to remain in good standing will result in all account activities of the participant projects in the cooperative(s) managed by that Cooperative Developer being suspended until issues are resolved to the satisfaction of the Reserve. In order for a Cooperative Developer to remain in good standing, Cooperative Developers must perform as follows:

- Complete cooperative contracts with Project Owners (see following section on Joining a Cooperative)
- Engage the services of a single verification body for all grassland projects enrolled in the cooperative in any given verification period
- Coordinate the submittal, monitoring, and reporting activities required by this protocol for all projects in the cooperative(s), observing all cooperative deadlines
- Coordinate a verification schedule that maintains appropriate verification status for the cooperative. Document the verification work and report to the Reserve on an annual basis how completed verifications demonstrate compliance (see Sections 6.4, 7.6, and 8.1)
- Maintain a Reserve account in good standing

As discussed in Section 2.3.2, Project Owners are ultimately responsible for timely submittal of all required forms and complying with the terms of this protocol.

2.3.4 Forming or Entering a Cooperative

Individual grassland projects may join a cooperative by being included in the cooperative’s Cooperative Submittal Form[7] (if joining a cooperative at initiation) or by being added through the

[7] All forms referenced in this section are available at: http://www.climateactionreserve.org/how/program/documents/.

submission of a New Grassland Project Enrollment Form (if joining once the cooperative is underway).

The Cooperative Developer will initiate the creation of the cooperative by submitting a Cooperative Submittal Form. The Cooperative Submittal Form includes the submittal information for all of the individual projects to be initially included in the cooperative. If the Cooperative Developer is not the Project Owner for one or more projects within the cooperative, the appropriate Project Owner account will be confirmed at the time of project submittal. All documentation related to the cooperative and its participant projects is submitted by the Cooperative Developer. After successful verification, CRTs are issued to the accounts of the Project Owners for each project.

Individual grassland projects that have already been submitted to the Reserve may choose to join an existing cooperative by submitting a Cooperative Transfer Form to the Reserve. The Cooperative Developer must also submit a New Project Enrollment Form, listing that project area, if the cooperative is already underway. Emission reductions occurring on individual projects or new projects entering a cooperative are reported as part of the cooperative during the reporting period in which the transfer occurred.[8] The project will begin reporting with the cooperative no earlier than the beginning of the cooperative's current verification period. If the project has already been registered, either as an individual project or as part of another cooperative, reporting under the new cooperative may not include any period of time that has already been reported and verified.

The crediting periods of the individual projects within a cooperative are derived from their individual project start dates, and are not affected by the crediting periods of other projects within the cooperative. All projects within a cooperative must follow the same version of this protocol. If a project that is subject to a more recent version of the protocol wishes to enter an existing cooperative, the rest of the projects in that cooperative must elect to upgrade to the newer version of the protocol.

2.3.5 Leaving a Cooperative

Individual grassland projects must meet the requirements in this section in order to leave or change cooperatives and continue reporting emission reductions to the Reserve. Reporting must be continuous.

Individual Project Owners may elect to leave a cooperative and participate as an individual grassland project for the duration of their crediting period, effective as of the day after the end date of the project's most recently registered reporting period. To leave a cooperative and become an individual grassland project, the Project Owner must submit a Project Submittal Form to the Reserve, noting that it is a "transfer project" and identifying the cooperative from which it is transferring. For projects which leave a cooperative to become an individual project, the deadline for submittal of the subsequent monitoring or verification report (whichever is sooner) is extended by 12 months beyond the deadline specified in Section 7.4. The Project Owner must submit either a monitoring report or verification report (whichever is due) by this new deadline in order to keep the project active in the Reserve. If the Project Owner has a Project Owner account in the Reserve at the time they leave the cooperative, they must contact the Reserve Administrator to set up a Project Developer account.

[8] The transfer is considered to have occurred once the Reserve has approved the Cooperative Transfer Form and the New Project Enrollment Form.

To leave one cooperative and enter another cooperative, the Project Owner must submit a Cooperative Transfer Form to the Reserve prior to enrolling in the new cooperative. Reporting under the destination cooperative shall continue according to the guidance in Section 7.6.1.

2.4 Environmental Best Management Practices

The Grassland Project Protocol is intended to generate GHG reductions through the avoided conversion of grassland to cultivated cropland. The protocol also seeks to limit potential environmental harms caused by project activities through the requirements for regulatory compliance specified in Section 3.6. Environmental enhancements in addition to GHG reductions are beyond the scope of this document. However, the Reserve does strongly encourage Project Owners and Grassland Owners to adopt practices that provide additional benefits to the grassland ecosystem beyond the GHG reductions. Project Owners and Grassland Owners are encouraged to review and implement the appropriate recommendations for grassland and rangeland management developed by the relevant local, provincial, and federal government agencies. It is furthermore recommended that best management practices relevant to the project area be included as terms of the Land Conservation Agreement and/or the GHG reduction rights contract.

While reporting guidance for non-climate benefits of grassland projects, as well as their potential alignment with the United Nations' Sustainable Development Goals (SDGs),[9] is beyond the scope of this protocol, project developers are encouraged to consider these benefits and report on them in the format they see fit.

[9] More information on the UN SDGs is available at: https://sustainabledevelopment.un.org/.

3 Eligibility Rules

Projects must fully satisfy the following eligibility rules in order to register with the Reserve. The criteria only apply to projects that meet the definition of a GHG reduction project (Section 2.2).

Eligibility Rule I:	Location	→	*Canada*
Eligibility Rule II:	Project Start Date	→	*No more than 12 months prior to project submission*
		→	*Project submittal, recordation of a Land Conservation Agreement, or eligible transfer of ownership*
Eligibility Rule III:	Additionality	→	*Meet performance standard*
		→	*Exceed legal requirements*
		→	*Satisfy credit and payment stacking requirements*
Eligibility Rule IV:	Project Crediting Period	→	*Emission reductions may only be reported during the crediting period, up to a maximum of 30 years*
Eligibility Rule V:	Permanence	→	*Maintain stored carbon according to the permanence requirements*
		→	*Employ a Qualified Land Conservation Agreement and Project Implementation Agreement*
Eligibility Rule VI:	Regulatory Compliance	→	*Compliance with all applicable laws*
Eligibility Rule VII:	Rangeland Health	→	*Periodic monitoring and adaptive management*

3.1 Location

Only projects located on private lands in Canada are eligible to register reductions with the Reserve under this protocol. All sources within the project boundary (Figure 4.1) must be located within Canada. Grassland projects in tribal areas must demonstrate that the land within the project area is owned by a tribe or private entities. Projects are not eligible on organic soils (histosols),[10] including areas identified as wetlands or peatlands.

In addition, the project area must be located on land whose particular combination(s) of Reporting Zone and soil texture would result in emissions of soil carbon in the baseline scenario. To be eligible, the grassland project must be able to generate emission reductions through project activities. This is determined by identifying the project strata following the guidance in Section 5.1. Only Reporting Zones listed in Table B.1 are eligible under this protocol.

[10] Wherever soil types or characteristics are referenced in this protocol, they shall be assumed to describe the upper 20 cm soil layer, unless otherwise specified.

3.1.1 Eligibility of Wetlands

Limited areas of wetland may be included within the project area. Wetlands which meet all three of the following criteria are considered eligible and are assumed to have been converted in the baseline scenario:

1. Wetlands must be intact, meaning they have not been previously drained or ploughed. Evidence of the intact status of the wetland must be demonstrated through the impact description for each wetland in the Canadian Wetland Inventory (CWI) Progress Map[11]. Alternatively, the intact status of the wetland area may be evidenced through the written statement of a wetland expert.
2. Only wetlands classified as 1-3 under the Stwart & Kantrud Classification System[12] are eligible.
3. Wetlands must be located on mineral soils. Wetlands located on organic soils are not eligible.

3.2 Project Start Date

The project start date is defined as the date on which the project area is committed to the long-term management and protection of grassland and therefore avoids conversion to cropland.

Commitment to long-term management and protection of grassland must be demonstrated by one of the following:

1. Submitting the project to the Reserve.[13] Note that the project must meet the tests for additionality as of the project start date. Thus, this option is not applicable if the project is submitted after the recordation of a QLCA covering the project area.
2. Recordation of a LCA on the project area. The project start date is the date the LCA was recorded. If a LCA is amended to meet the requirements of a Qualified LCA (Section 3.5.3), the recordation date of the unamended LCA may be used for purposes of determining the project start date. If the Project Owner intends to use the date of recordation of the amended LCA as the project start date, they must be able to show that, prior to amendment, the original LCA would not have violated any provisions of the legal requirement test (Section 3.3.2). If the project area is protected through multiple easements, the date of the earliest easement will be considered in determining the project start date under this option.
3. Transfer or sale of property ownership to a public or private entity. The project start date is the date of property transfer. Projects are still required to record a conservation easement, as described above, prior to the initial registration

To be eligible, the project must be submitted[14] to the Reserve no more than 12 months after the project start date, unless the project was submitted for listing prior to October 16, 2020. Prior to October 16, 2020, projects will be accepted with project start dates as early as October 16, 2017.

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[11] The Canadian Wetland Inventory (CWI) Progress Map is available online at: https://maps.ducks.ca/cwi/

[12] Stewart, Robert E., and Harold A. Kantrud. Classification of natural ponds and lakes in the glaciated prairie region. No. 92. US Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, 1971. Summary available at: http://www.wetlandpolicy.ca/stewart-kantrud-system.

[13] *Ibid*

[14] Projects are considered submitted when the Project Developer has fully completed and filed the appropriate Project Submittal Form, available at: http://www.climateactionreserve.org/how/program/documents/.

Projects that have previously been submitted to and accepted by another offset project registry (transfer projects) may be eligible with a historic start date. Start date requirements for those projects are described in the Reserve Program Manual.[15] Projects may always be submitted for listing by the Reserve prior to their start date.

3.3 Additionality

The Reserve strives to register only projects that yield surplus GHG reductions that are additional to what would have occurred in the absence of a carbon offset market.

Projects must satisfy the following criteria to be considered additional:

1. The performance standard test
2. The legal requirement test
3. Limits on payment and credit stacking

3.3.1 The Performance Standard Test

Projects pass the performance standard test by meeting a performance threshold, i.e,. a standard of performance applicable to all grassland projects, established by this protocol. The performance standard test is applied at the time a project applies for registration with the Reserve. The performance standard test for a grassland project has two parts:

1. Financial threshold
2. Suitability threshold

3.3.1.1 Financial Threshold

There is a financial barrier to project activities due to the economic incentives to convert grassland to cropland in specific regions for high quality soil. This protocol will use a threshold for financial additionality, referred to as the cropland premium.The cropland premium (CP) is determined as the percentage difference in the net present value of cropland over grassland for the project area. Depending on the resulting cropland premium value, the project must include a discount (DF_{conv}) of baseline emissions. Project eligibility is based on the cropland premium , based on the conditions below:

1. Projects with a cropland premium greater than 100% are eligible without any discount for uncertainty;
2. Projects with a cropland premium greater than 40% but less than 100% are eligible, but must apply a discount to their baseline emissions (see Section 5.2.4 for a description of DF_{conv});
3. Projects with a cropland premium less than 40% are not eligible.

Since Canada does not have a national dataset for land rental rates such as is available in the U.S., a default financial additionality screening is not possible. Thus, all projects must obtain a certified real estate appraisal to identify the financial pressure to convert. Appraisals submitted and favourably reviewed by an expert panel for ECOGift program participation which include a cropland appraisal shall be deemed sufficient the meet the requirements of this section.

[15] Please refer to the most current version of the Reserve Program Manual, available at: http://www.climateactionreserve.org/how/program/program-manual/.

The certified real estate appraisal must show:

1. *The project area is suitable for conversion to cropland*. The appraisal must clearly indicate how the physical characteristics of the project area are suitable for crop cultivation, including the particular crops expected to be grown.
2. The appraisal must conform with the following minimum standards[16]:
    a. Appraisal reports shall be prepared and signed by a third-party, Licensed or Certified Real Estate Appraiser in good standing.
    b. Appraisal reports shall include a description of the subject property and any market data relied upon, including the relationship between the location of the subject property and the market data. The appraisal must specify and quantify the areas of the project area that are suitable for crop production. (For example, an appraisal that identified corn production as an alternative land use must specify the approximate acres suitable for both the crops and any related roads, buildings, or other infrastructure.)
    c. Appraisal reports shall include a complete description of the subject property land, site characteristics and improvements. Valuations based on a property's cropland potential shall include:
        i. A description of what would be required for a conversion to cropland to proceed (e.g., legal entitlements, infrastructure).
        ii. Presentation of evidence that sufficient demand exists, or is likely to exist in the future, to provide market support for the conversion to cropland.
        iii. The appraisal must also provide:
            1. Evidence of soil suitability for the type of expected agricultural land use.
            2. Evidence of water availability for the type of expected agricultural land use.
            3. Evidence of no limitations to crop production due to slope or other physical characteristics of the land.
    d. Appraisal reports shall include a statement by the appraiser indicating to what extent land title conditions were investigated and considered in the analysis and value conclusion.
    e. Appraisal reports shall include a discussion of implied dedication, prescriptive rights or other unrecorded rights that may affect value, indicating the extent of investigation, knowledge, or observation of conditions that might indicate evidence of public use.
    f. Appraisal reports shall include a separate valuation for ongoing grassland management prepared and signed by a certified or registered professional qualified in the field of specialty interest. This valuation shall be reviewed and approved by a second qualified, certified or registered professional, considered by the appraiser, and appended to the appraisal report. The valuation must identify and incorporate all legal constraints that could affect the valuation of the ongoing grassland management.
3. *The cropland land use for the project area has a higher market value than maintaining the project area for sustainable grassland management, such that it meets the financial additionality threshold.* The appraisal for the property must provide an estimated fair market value for the rental rate (in CAD$ per acre per month) for the current grassland

[16] Adapted from Sections 5096.501 and 5096.517, Public Resources Code, State of California.

use condition of the project area (considering the land to be encumbered and thus unable to be converted to cropland) and an estimated fair market value of the rental rate for the anticipated use the project area as cropland. The appraisal must identify whether or not irrigation is considered in the valuation (or, alternatively, may provide estimations both with and without irrigation). The difference between the rental rate for cropland and the rental rate for grassland, divided by the rental rate for grassland, is the cropland premium for the project area. Eligibility is then determined according to the thresholds as outlined in the beginning of Section 3.3.1.1.

If a project which has been registered using the appraisal option later applies to expand the project area, they must first consult with Reserve staff to determine if a new appraisal is needed for the expanded project area.

3.3.1.2 Suitability Threshold

The project area must be suitable for conversion to cropland. Suitability is demonstrated by determining the specific suitability classification for the project soils, according to theLand Suitability Rating System (LSRS). For areas where LSRS classification data are not available, data may be referenced from Canada's Land Inventory (CLI) for the soil map units that are contained within or intersect the project area. Projects also have the option of conducting a site-specific LSRS assessment with an independent expert. Both ratings systems recognize seven classes of decreasing suitability as cropland, with ratings of class 1-4 being highly suitable for conversion to cropland (Table 3.1). The entire project area must be assessed using a single version of the Suitability Threshold. If the project area is expanded at a later date, the Suitability Threshold is applied to the new, expanded project area as a whole.

Table 3.1. Land Capability Class Descriptions for Agriculture
From Agriculture and Agri-Food Canada.

Class	CLI Description	LSRS Description (Limitation for the specified crop)
Class 1	Soils in this class have no significant limitations in use for crops.	None to slight
Class 2	Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices.	Slight
Class 3	Soils in this class have moderately severe limitations that restrict the range of crops or require special conservation practices.	Moderate
Class 4	Soils in this class have severe limitations that restrict the range of crops or require special conservation practices.	Severe
Class 5	Soils in this class gave very severe limitations that restrict their capability in producing perennial forage crops, and improvement practices are feasible.	Very severe
Class 6	Soils in this class are capable only of producing perennial forage crops, and improvement practices are not feasible.	Extremely severe
Class 7	Soils in this class have no capacity for arable culture or permanent pasture.	Unsuitable
Class 0	Organic Soils (not placed in capability classes).	N/A

The LSRS includes 13 subclasses, such as M for moisture limitation. A project may be able to overrule the moisture limitation if the project is irrigated. They must then provide evidence that the project area would have access (both legal and physical) to irrigation in the baseline scenario. This can be demonstrated by one or more of the following methods, subject to the verifier's professional judgment:

- Comprehensive assessment of the existence of available groundwater, and the legal and economic feasibility of the grassland owner to access it from within the project area
- Documentation of the current availability of water rights and/or permits for the project area on or around the project start date
- Documentation of installation of new irrigation on lands within the project region within the 24 months prior to the project start date
- Evidence of ongoing irrigation practice on other nearby parcels

Projects must be entirely located on Class 1-6 soils. In addition, this protocol requires a minimum percentage of the project area to be located on Class 1-4 soils. There are two options for determining the minimum fraction of the project area which must be Class 1-4: a default Reporting Zone-specific threshold or an assessment of the suitability of local cropland. Project Owners may select either of the two options below.

Option 1: Default Minimum Class 1-4 Soils By Reporting Zone

The Reserve has developed a table of default, Ecoregion-specific soil suitability thresholds. The specific default value for each Ecoregion is contained in Table 3.2, below. For any Ecoregion not listed, the default threshold is 100%.The percentage of cultivated land that is classified as Class 1-4 (rounded to the nearest whole number) represents the minimum required percentage of the project area for those land classes. For example, if the default value is 80%, the threshold for eligibility for that Ecoregion is 80% Class 1-4, allowing for up to 20% Class 5-6. Please see Appendix A for a description of how these thresholds were derived.

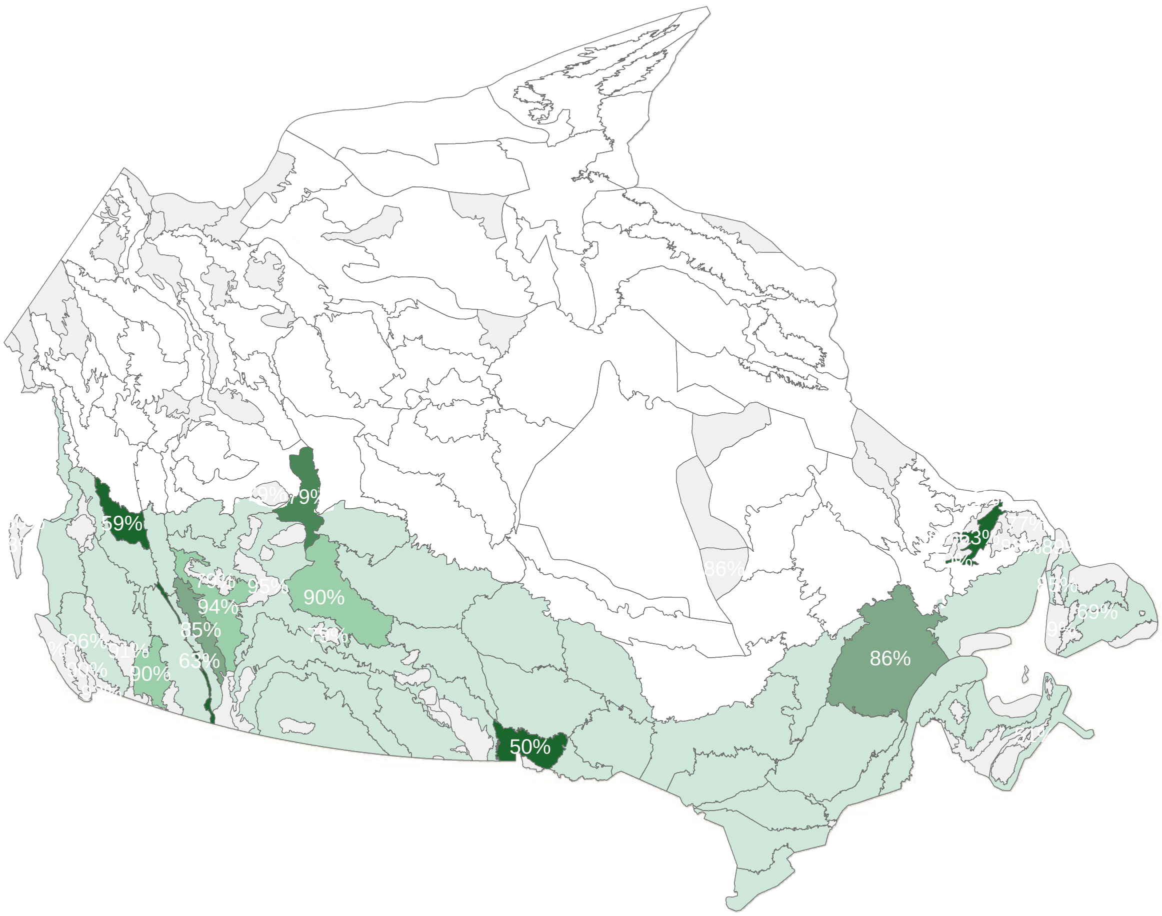

Figure 3.1. Percentage of CLI 1-4 Soils on Cultivated Lands per Ecoregion
Unlabeled regions have a threshold of 100%. Analysis performed June 2018.

If the project area includes more than one RZ, the appropriate threshold for Class 1-4 soils shall be an area-weighted average of the RZ-specific thresholds (e.g., if half of the project area is in a RZ with a threshold of 80%, and the other half is in a MLRA with a threshold of 70%, the overall threshold for the project area will be 75%).

Table 3.2. Default Thresholds for Percent of Project Area in Class 1-4 Land Suitability for Ecoregions where the Threshold is Less than 100%

Ecoregion	Minimum CLI1-4 Threshold	Ecoregion (cont'd)	Minimum CLI1-4 Threshold (cont'd)
91	77%	135	96%
92	79%	137	63%
93	59%	138	90%
96	78%	139	85%
97	79%	143	86%
98	50%	145	63%
99	81%	148	85%
101	80%	149	87%
117	63%	155	86%
118	86%	156	91%

Ecoregion	Minimum CLI1-4 Threshold	Ecoregion (cont'd)	Minimum CLI1-4 Threshold (cont'd)
120	94%	157	90%
121	77%	158	90%
122	90%	159	79%
123	88%	160	69%
126	95%	162	99%
128	79%	163	93%
130	89%	202	50%
132	90%	203	51%
134	85%		

Option 2: Local Cropland Assessment

In areas where the project developer believes that the option above does not accurately reflect the suitability of local cropland, a local assessment may be carried out. The assessment must include at least three actively-cultivated farms in the same ecoregion, and no more than 50 km from the project area, with the total acreage of all farms being no less than the total acreage of the project area, and must include the entire area under cultivation for each property, excluding areas that are not used for crop cultivation. For each property the project developer shall identify the suitability class of the soil map units, add up the acreage for each class across all properties in the assessment, and determine the percentage by area for Class 1-4 land. The fraction of cultivated land that is classified as Class 1-4 (rounded to the nearest whole number) represents the minimum required fraction of the project area for those land classes. The remaining fraction may contain Class 5-6 soils. Project developers are strongly encouraged to consult with Reserve staff when conducting an assessment under this option.

3.3.2 The Legal Requirement Test

All projects are subject to a legal requirement test to ensure that the GHG reductions achieved by a project would not otherwise have occurred due to federal, provincial, or local regulations, or other legally binding mandates. The legal requirement test for grassland projects involves three parts to ensure the project activity is allowed but not compelled:

1. There must be no federal, provincial, or local regulation for the project area to be maintained as grassland, either pre-existing or subsequent, or other pre-existing legally binding mandate, agreement, contract[17], deed restriction or deeded encumbrance[18] for the project area to be maintained as grassland (other than the QLCA that is enacted for the project); and,
2. There must be no zoning, permitting, ownership, or other legal obstacle to the conversion of the project area to cropland; and,

[17] An agreement that can be enforced specifically, that is, where a party to the agreement (who is not participating as a "Grassland Owner") can prevent the physical breaking of the grassland, is considered a binding legal requirement.

[18] Unless all parties with a potential claim to soil carbon ownership participate in the project as Grassland Owners, per Section 3.2, any pre-existing encumbrance or restriction or any other recorded agreement, must expressly and unequivocally assign soil carbon ownership and control to the participating Grassland Owner(s) and/or expressly permit the participating Grassland Owner(s) and Project Developer(s) to undertake a soil carbon offset project on the project area. Any subsequent legally binding agreement must be made subordinate to the PIA (if applicable) and project-related Land Conservation Agreement; the terms of a subsequent legally binding agreement must not be incompatible with an AGC project. See Sections 2.3.2 and 3.5.3 for more information on eligibility requirements regarding title recordings and encumbrances.

3. There must be no federal, provincial, or local regulation that would prohibit ongoing management of the project area as cropland.

Parts 1 and 2 are assessed as of the project start date. Part 3 is assessed on an ongoing basis following the project start date. Voluntary agreements that can be rescinded, such as rental contracts, are not considered legal requirements. Temporary or emergency restrictions or regulations shall be assessed with regard to the legal requirement test so long as they constitute a legally binding mandate, as described in this section. If a temporary legal restriction would violate parts 1 and/or 2 above, the project may delay implementation until such time that the project may pass the legal requirement test. If a temporary legal restriction violates part 3 above, the project is ineligible to receive CRTs for the period of time during which the regulation is effective.

Any agreement that serves to generate credits or payments for ecosystem services derived from the land is subject to the eligibility requirements in Section 3.3.3.

Deeded encumbrances, such as conservation easements, may effectively control soil carbon. Deeded encumbrances that are enacted prior to the project start date are considered legally binding mandates for the purposes of the legal requirement test.

To satisfy the legal requirement test, the Project Owner must submit a signed Attestation of Voluntary Implementation form[19] as part of the verification activities for the initial verification (see Section 8). In addition, the project's Monitoring Plan (Section 6) must include procedures that the Project Owner follows to ascertain and demonstrate that the project at all times passes the legal requirement test.

3.3.2.1 Requirements for Concurrent Legally Binding Agreements

A Grassland Owner may concurrently enter into a legally binding agreement related to ecosystem services or protection on the project area., subject to Section 3.3.2 for liability shielding agreements and/or Section 3.3.3 for ecosystem services or protection credit and payment stacking, under the following conditions. For liability shielding programs, an agreement is considered concurrently entered into if the legal agreement is approved no more than 6 months prior to the project start date. For credit and payment stacking programs, the agreement is considered concurrently entered into if the LCA required by the ecosystem program does not violate the legal requirement test of this protocol.

The Grassland Owner must ensure that the agreement, and/or the program under which the agreement is authorized, provides sufficiently clear language to demonstrate the legal additionality of the grassland project. Specifically, the agreement must not limit the ability or rights of the Grassland Owner to use the land covered by the agreement for the purposes of participating in a carbon offset market. The Reserve maintains the right to determine whether this issue is clear.

For agreements that require land to be put under perpetual Land Conservation Agreement, the LCA may also serve the requirements of a grassland project so long as the LCA conforms to the requirements of Section 3.2. For agreements that require at least one perpetual LCA but allow for multiple subsequent LCAs, each LCA should be evaluated individually. If any LCA does not conform to Section 3.2, the portion of the land covered by that LCA is ineligible as a project area.

[19] Attestation forms are available at http://www.climateactionreserve.org/how/program/documents/.

3.3.3 Ecosystem Services Credit and Payment Stacking

When multiple ecosystem services credits or payments are sought for a single activity on a single piece of land, with some temporal overlap between the different credits or payments, it is referred to as "credit stacking" or "payment stacking," respectively (4). Under this protocol, credit stacking is defined as receiving both offset credits and other types of mitigation credits for the same activity on spatially overlapping areas (i.e., in the same acre). Mitigation credits are any instruments issued for the purpose of offsetting the environmental impacts of another entity, such as emissions of GHGs, removal of wetlands or discharge of pollutants into waterways, to name a few. Payment stacking is defined as issuing mitigation credits for a best management or conservation practice that is also funded by the government or other parties via grants, subsidies, payment, etc., on the same land.

Any type of conservation or ecosystem service payment or credit received for activities on the project area must be disclosed by the Project Owner to the verification body and the Reserve on an ongoing basis. Each potential stacking scenario will be considered by the Reserve on a case by case basis. General guidance for this process is provided below:

- For credit or payment programs which are entered into prior to the project start date, it must be determined whether the program rules would violate the Legal Requirement Test.
- For credit or payment programs to be entered into after the project start date, it must be determined whether the commitment under the carbon project would violate any rules of the other credit or payment program.
- Credit or payment programs which are entered into concurrently with the carbon project are generally allowable, so long as the other program is not specifically incentivizing the protection of existing belowground carbon, and the requirements of this protocol do not violate the rules of the other program.
- Landscape-scale payments (i.e., payments to protect the project area) are generally more likely to render a project ineligible as compared to "enhancement" payments (e.g., payments for specific practices, such as planting wind breaks or

The above represents guiding principles, and any eligibility determinations are ultimately at the discretion of the Reserve.

3.4 Project Crediting Period

The baseline for any grassland project registered under this protocol is valid for up to 30 years. This means that a registered grassland project is eligible to receive CRTs for GHG reductions quantified using this protocol, and verified by Reserve-approved verification bodies, for a period of up to 30 years following the project's start date. In the case of project cooperatives, project crediting periods are tied to each individual grassland project within the cooperative and their respective start dates. Thus, unless all of the projects in the cooperative share the same start date, there is not a single crediting period applicable to the entire cooperative.

Projects may elect to end their crediting period at any time. Any CRTs that have been issued are subject to the permanence requirements described in Section 3.5. Any project that wishes to end its crediting period must notify the Reserve prior to the next monitoring or reporting deadline, as determined in Section 7.4. If a project chooses to end its crediting period, no future emission reductions may be reported. If a project would like to forgo credits for a period of time in order to delay verification, this is considered a Zero-Credit Reporting Period.[20]

3.5 Requirements for Permanence

To validly offset GHG emissions, the reversible emission reductions credited under this protocol must be permanent. An emission reduction is considered reversible if it is related to carbon which remains stored in a carbon pool, such as soil organic carbon. An example of a non-reversible emission reduction on a grassland project would be the avoided N_2O emissions related to baseline fertilizer use. This protocol allows for two options for ensuring permanence, each with its own approach to determining the quantity of credits to be issued.

Option 1: Tonne-Tonne Accounting (TTA)
Option 2: Tonne-Year Accounting (TYA)

If carbon is released before the end of the commitment period (the length of which depends on whether CRTs were issued based on TTA or TYA) after a CRT is issued, the release is termed a "reversal". A reversal occurs if stored carbon is actually released through a disturbance of the project area, or is deemed to be released through termination of the project or a portion of the project. Reversals may impact only a portion of the project area or the entire project area.

This protocol distinguishes between two categories of reversals, avoidable and unavoidable, and specifies separate remedies for each. Many biological and non-biological agents, both natural and human-induced, can cause reversals. Some of these agents cannot completely be controlled (and are therefore "unavoidable"), such as natural agents like fire, insects, and wind. This protocol also takes into consideration the extent to which a Project Owner has contributed towards the reversal through negligence, gross negligence or willful intent. Thus reversals caused by biological agents, where the Project Owner has not contributed to the reversal through negligence, gross negligence or willful intent, are considered unavoidable.

An avoidable reversal occurs if:

1. The Project Owner voluntarily terminates the project prior to the end of the commitment period. A Project Owner may voluntarily terminate the entire project, or a portion of the project area. If only a portion is terminated, then the reversal is considered to affect only the terminated area.
2. There is a breach of certain terms described within the Project Implementation Agreement (see Section 3.5.4, below). Such a breach results in the entire project being automatically terminated.
3. The Project Owner prematurely ceases ongoing monitoring and verification activities. Monitoring, reporting, and verification requirements are described in Sections 6, 7, and 8. Cessation of monitoring and verification results in the entire project being automatically terminated.
4. Any activity occurs on the project area that leads to a significant disruption of soil carbon. Examples include, but are not limited to, cropping activities (conversion to cropland), eminent domain, mining or drilling activities, or installation of wind turbines. In most cases, such disturbances would not constitute a reversal on the entire project area.

[20] See the Reserve Program Manual, available at: http://www.climateactionreserve.org/how/program/program-manual/.

5. A natural disturbance occurs to the soil carbon in the project area, and the Reserve determines that the disturbance is attributable to the Grassland Owner's or Project Owner's negligence, gross negligence, or intentional mismanagement of the project area as grassland.

Avoidable reversals must be communicated to the Reserve and compensated for by the Project Owner, as prescribed in Section 5.4.

To ensure that the permanence obligations are guaranteed for the duration of the minimum time commitment, projects are required to employ a Qualified Land Conservation Agreement (QLCA) (Section 3.5.3) and a Project Implementation Agreement (Section 3.5.4).

3.5.1 Tonne-Tonne Accounting (TTA)

Under this option, projects must commit to protection of the project area and the soil carbon within for a period of at least 100 years following the year of credit issuance. Both the QLCA and the PIA must be drafted to cover this entire period. If, at subsequent registration, either the QLCA or PIA do not provide at least 100 years of ongoing protection, they must be amended in order to continue employing the TTA option.

For the purposes of this option, an emission reduction is considered "permanent" if the quantity of carbon associated with that reduction is stored for at least 100 years following the issuance of a credit for that reduction. Once an emission reduction is considered permanent, it is no longer considered reversible. For example, if CRTs are issued to a grassland project in year 24 following its start date, soil carbon in the project area must be maintained through at least year 124. To meet this requirement, Project Owners must monitor and verify a grassland project for a minimum period of 100 years following the issuance of any CRT for GHG reductions achieved by the project, unless the project is terminated. Failure to maintain ongoing monitoring and verification may result in the automatic termination of the project. Note that this means that monitoring and verification for a project must continue even after the end of the project's crediting period. The period of time after the project crediting period has ended and before the minimum time commitment has been met is referred to as the "permanence period".

For the purposes of this protocol, both QLCAs and the PIA must be effective for 100 years following the issuance of CRTs.

3.5.2 Tonne-Year Accounting (TYA)

Tonne-Year Accounting is an approach which discounts the issuance of credits to reflect the effective radiative forcing benefits to the atmosphere from the length of time that the stored carbon is protected. Projects electing to employ the TYA option do not need to meet the 100 year commitment, but will be issued fewer credits, based on the length of the commitment. After their commitment period is ended, these projects will not be required to maintain ongoing monitoring for reversals.

All TYA projects must make a commitment to protection of the soil carbon (via a QLCA and PIA) for at least 20 years following the project start date.

Crediting for reversible emission reductions will be based on the remaining length of the permanence commitment compared to the vintage year of the credits. For example, if a project executes a QLCA and PIA, each with terms of 20 years, credits for reversible emission reductions will be issued on the following schedule:

Project Year	Percentage of current year emission reductions to be issued upon successful verification
1	20%
2	19%
3 - 20	18% - 1%
21	1%
22 - 30	1%

This schedule may be altered by the amendment of the existing QLCA and PIA, or drafting and recording of new versions of these documents. See Equation 5.6 for guidance on determining the appropriate issuance for a given project year based on the length of the commitment under the TYA option. Requirements for reversals are only applicable within the commitment period.

3.5.3 Qualified Land Conservation Agreement

A Land Conservation Agreement (LCA) is required for all grassland projects. The area bound by the LCA does not need to match the project area. However, the entire project area must be included in the area of the LCA. A Qualified Land Conservation Agreement (QLCA) is one whose terms prevent the conversion of the project area from grassland to another land use, such that avoidable reversals are sufficiently precluded as long as the LCA is enforced. For example, whereas a basic LCA may only restrict the subdivision and/or development of the project area, a QLCA would also restrict activities such as plowing and farming, which could release carbon stored in the soil. The QLCA may allow for other activities, such as road or building construction, on the land bound by the LCA. However, insofar as these activities would result in a land use other than grassland, the areas where they are allowed should be specified in the QLCA and subsequently excluded from the project area in order to avoid the occurrence of a reversal due to such activities. Additionally, the QLCA may make reference to the carbon project and simply specify that any non-grassland land use must occur outside of the specified project area. The language of the QLCA should be sufficiently clear to reasonably prevent cultivation on the entire project area.

There are additional provisions for project LCA that the Reserve strongly encourages, but does not require. For enhanced transparency and legal clarity, the LCA should explicitly 1) refer to, and incorporate by reference, the terms and conditions of the PIA and the GHG reduction rights agreement, thereby binding both the grantor and grantee – as well as their subsequent assignees – to the terms of the agreements for the full duration of the grassland project's minimum time commitment, as defined in Section 3.5 of this protocol; and 2) make all future encumbrances and deeds subject to the PIA.[21] It is also recommended that the QLCA incorporate and require environmental best management practices for rangeland management (Section 2.4).

3.5.4 Project Implementation Agreement

Permanence obligations must be guaranteed through a legal agreement that obligates the Project Owner to conduct monitoring activities on the project area for the term of the permanence commitment, and to compensate for avoidable reversals that occur during that period. This agreement is known as the Project Implementation Agreement.[22] Requirements for monitoring and reporting activities during the permanence period are detailed in Section 7.5.

[21] The approach to subordination of the PIA will impact the project's contribution to the risk buffer pool, as described in Section 5.4.3.
[22] The template PIA is available on the GPP webpage: http://www.climateactionreserve.org/how/protocols/grassland/.

The PIA is an agreement between the Reserve and a Project Owner setting forth: (i) the Project Owner's obligation (and the obligation of its successors and assigns) to comply with the Canada Grassland Project Protocol, and (ii) the rights and remedies of the Reserve in the event of any failure of the Project Owner to comply with its obligations. The PIA must be signed by the Project Owner before a project can be registered with the Reserve. The PIA is executed and submitted after the Reserve has reviewed the verification documents and is otherwise ready to register the project. It is not possible to terminate the PIA for only a portion of the project area; however an amended PIA may be executed that reflects a change to the project area as provided for by the exceptions to the minimum time commitment at the beginning of this section. For projects under Tonne-Tonne Accounting, the PIA is signed after project issuance and amended at each subsequent verification in order to extend the term of applicability until 100 years of permanence per CRT vintage is reached. Under Tonne-Year Accounting, Project Owners are only required to sign one PIA with a minimum time commitment of 20 years after the first reporting period's registration. In subsequent reporting periods, Project Owners are not bound to any permanence commitment and thus are not required to sign or amend the PIA. Subsequent PIA executions or amendments under TTA will be required in each reporting period when a new permanence commitment is made by the Project Owner.

The PIA does not restrict the transferability of the specific CRTs issued, but does hold the Project Owner to the compensation requirements of Section 5.4. By the terms of the PIA, the contract is satisfied upon the Project Owner's full performance of the requirements of this protocol (i.e., monitoring and verifying permanence for the period of time commitment following CRT issuance). The PIA is executed at the completion of the initial project verification, and then amended at the completion of each subsequent verification (prior to or at the time of CRT issuance). The PIA is not a public document.

3.6 Regulatory Compliance

As a final eligibility requirement, Project Owners must attest that project activities do not cause material violations of applicable laws (e.g., air, water quality, safety, etc.). To satisfy this requirement, Project Owners must submit a signed Attestation of Regulatory Compliance form[23] prior to the commencement of verification activities each time the project is verified. Project Owners are also required to disclose in writing to the verifier any and all instances of legal violations – material or otherwise – caused by the project activities. Where a temporary or emergency restriction or regulation is in force during the reporting period, it shall be included in the assessment of the project's regulatory compliance.

A violation should be considered to be "caused" by project activities if it can be reasonably argued that the violation would not have occurred in the absence of the project activities. If there is any question of causality, the Project Owner shall disclose the violation to the verifier.

If a verifier finds that project activities have caused a material violation, then CRTs will not be issued for GHG reductions that occurred during the period(s) when the violation occurred. Individual violations due to administrative or reporting issues, or due to "acts of nature," are not considered material and do not affect CRT crediting. However, recurrent administrative or reporting violations directly related to project activities may affect crediting, especially if related to negligence or intent on the part of the Project Owner or Grassland Owner. Verifiers must

[23] Attestation forms are available at http://www.climateactionreserve.org/how/program/documents/.

determine if recurrent violations rise to the level of materiality. If the verifier is unable to assess the materiality of the violation, then the verifier shall consult with the Reserve.

3.7 Ecosystem Health

Grassland project areas, regardless of location or management, are subject to forces that could degrade the grassland ecosystem and potentially cause the land to transition to a different landscape type, even in the absence of a single disturbance event. Such degradation or landscape transition not only has the potential to negatively impact the belowground carbon stocks (thus jeopardizing the integrity of the project quantification), but may also lead to eventual conversion of the project area to a land use other than grassland (e.g., dense shrubland, forest, bare soil, etc.). Project activities such as livestock grazing or recreation could also lead to impaired rangeland health, if not properly managed. Projects that are located adjacent to land that has already been converted to cropland or development may also be subject to a higher risk of rangeland health impairment due to encroachment of invasive species or increased grazing/foraging by wild animals whose habitat has been constrained by land conversion. The Reserve does not seek to prescribe specific land management activities. Rather, the intent of this section is to encourage thoughtful and proactive land management to maintain and/or improve rangeland health.

In order to protect against long term degradation of the project area, periodic assessments of ecosystem health must be conducted according to the guidance contained in Section 6.4. If a project area is expanded, the Project Monitoring Plan must be updated to incorporate management approaches for the new project area. Such assessments must be conducted at least once during the first two reporting periods, and at least once every six years thereafter. If the results of any assessment show degraded ecosystem health in a particular metric (e.g., soil stability, species diversity, etc.), the Project Owner must not only show a plan for management adaptation, but must also demonstrate improved ecosystem health at the subsequent assessment.

If projects that are required to improve ecosystem health fail to do so at the subsequent assessment, the Reserve will determine whether the degradation was avoidable or unavoidable. Avoidable degradation could lead to ineligibility for the current reporting period, resulting in no CRTs being issued for that period. If the continued degradation is determined to be unavoidable, the project may still receive CRTs for the reporting period, but must abide by the requirements of the previous paragraph to implement new management approaches to improve ecosystem health.

In cases where there is a rangeland health assessment showing grsignificant degradation for one or more metrics, the Reserve will consult with relevant experts to determine whether the degradation is sufficiently significant to warrant the determination that a reversal has occurred. In cases where is the Reserve determines that a reversal has occurred, the requirements of Section 5.4 regarding avoidable and unavoidable reversals shall apply.

4 The GHG Assessment Boundary

The GHG Assessment Boundary delineates the GHG sources, sinks, and reservoirs (SSRs) that must be assessed in order to determine the net change in emissions caused by an avoided conversion of grasslands project.[24] The GHG Assessment Boundary encompasses all of the GHG SSRs that may be significantly affected by project activities, including biological CO_2 emissions and soil carbon sinks and sources of N_2O.

Figure 4.1 illustrates all relevant GHG SSRs associated with grassland project activities and delineates the GHG Assessment Boundary.

Table 4.1 provides greater detail on each SSR and justification for the inclusion or exclusion of certain SSRs and gases from the GHG Assessment Boundary. The SSRs that are marked with "(R)" represent those for which baseline emissions are reversible, and thus subject to the requirements for permanence in Section 3.5.

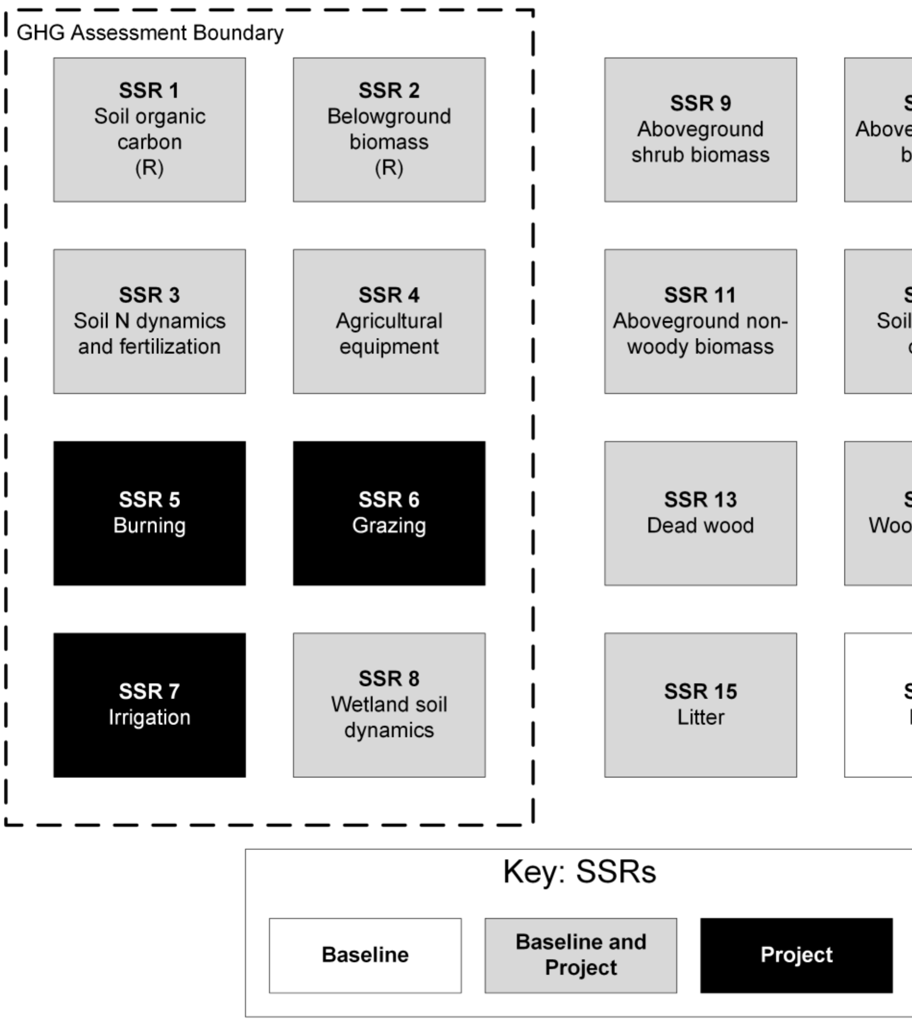

Figure 4.1. General Illustration of the GHG Assessment Boundary

[24] The definition and assessment of sources, sinks, and reservoirs is consistent with ISO 14064-2 guidance.

Table 4.1. Description of All Sources, Sinks, and Reservoirs

SSR	Source Description	Gas	Included (I), Optional (O), or Excluded (E)	Quantification Method	Justification/Explanation
1	Soil organic carbon	CO_2	I	Default emission factor	Emissions from the loss of soil organic carbon are a primary effect and major emission source in the baseline. Reversible.
2	Belowground biomass	CO_2	I	Default emission factor	Emissions from the loss of below-ground biomass are a primary effect and major emission source in the baseline. Reversible. The belowground biomass stock must be maintained in the project scenario.
3	Soil nitrogen dynamics and fertilization	N_2O	I	**Baseline:** Default emission factors **Project:** Calculated based on monitored data	Direct and indirect N_2O emissions from conversion activities, soil processes and fertilization can be significant in the baseline. Direct and indirect N_2O emissions from fertilization can be significant in the project scenario, if applicable.
4	Agricultural equipment from site preparation and ongoing operations	CO_2	I	**Baseline:** Excluded **Project:** Calculated based on monitored data	Fossil fuel emissions from equipment used for conversion site preparation and ongoing field operations (tillage, fertilization, etc.) may be significant in the baseline, but are conservatively excluded due to data availability. Fossil fuel and electricity emissions from equipment used for grassland management may be significant in the project scenario.
		CH_4	I	N/A	Fossil fuel and electricity emissions from equipment used for grassland management can be significant for the project.
		N_2O	E	N/A	Excluded, as this emission source is assumed to be very small.
5	Burning	CO_2	E	N/A	CO_2 emissions due to grass biomass burning are considered biogenic and thus are excluded from the project boundary.

SSR	Source Description	Gas	Included (I), Optional (O), or Excluded (E)	Quantification Method	Justification/Explanation
		CH_4	I	Calculated based on monitored data	When grass biomass is burned, a portion of the carbon is released as CH_4. Depending on the area burned, this could be a significant source of project emissions.
		N_2O	I	Calculated based on monitored data	When grass biomass is burned, a portion of the carbon is released as N_2O. Depending on the area burned, this could be a significant source of project emissions.
6	Grazing	CO_2	E	N/A	Excluded, as this is not a significant source of emissions. Additionally, any CO_2 emissions from grazing would be considered biogenic.
		CH_4	I	Calculated based on monitored data	Grazing livestock in the project scenario produces potentially significant quantities of CH_4 through the decomposition of manure, as well as enteric fermentation.
		N_2O	I	Calculated based on monitored data	Grazing livestock in the project scenario produces potentially significant quantities of N_2O through the decomposition of manure.
7	Fertilization	N_2O	I	Calculated based on monitored data	Direct and indirect nitrous oxide emissions from management activities, soil processes, and fertilization can be significant in the project.
7	Irrigation	CO_2	I	Calculated based on monitored data	Emissions from equipment used for grassland management may be significant in the project scenario.
		CH_4	E	N/A	No significant CH_4 emissions related to irrigation of the project area are expected.
		N_2O	I	Calculated based on monitored data	Indirect N_2O emissions from irrigation can be significant in the project scenario, where livestock grazing and/or fertilizer application occurs.

SSR	Source Description	Gas	Included (I), Optional (O), or Excluded (E)	Quantification Method	Justification/Explanation
8	Wetland soil dynamics	CO_2	I	**Baseline**: Default emission factor **Project**: Excluded	Protection of the soil carbon below wetlands is described by SSRs 1 and 2, above. The storage of additional carbon over time in the project scenario is conservatively excluded.
		CH_4	I	**Baseline**: Excluded **Project**: Calculated based on monitored data	CH_4 is produced during decomposition of organic material in wetlands. This source would not be present in the baseline, but is calculated in the project scenario.
		N_2O	E	N/A	Wetlands are not a significant source of N_2O emissions.
9	Aboveground shrub biomass	CO_2	E	N/A	Emissions from the loss of above-ground shrub biomass can be a significant emission source in the baseline for certain projects. Exclusion is conservative.
10	Aboveground tree biomass	CO_2	E	N/A	Trees may hold a significant amount of biomass, but the fate of that carbon after conversion is uncertain, depending upon the volume of wood, the species, and the accessibility of mills. This protocol conservatively excludes tree biomass from the baseline emissions calculations.
11	Aboveground non-woody biomass	CO_2	E	N/A	Excluded, as the permanent pool is assumed to be very small, despite seasonal fluxes. The exclusion is conservative.
12	Soil inorganic carbon	CO_2	E	N/A	Excluded, as this source is not included in the baseline modeling. The exclusion is conservative.
13	Dead wood	CO_2	E	N/A	Excluded, as this emission source is assumed to be very small. The exclusion is conservative.
14	Wood products	CO_2	E	N/A	Excluded, as this emission source is assumed to be very small. The exclusion is conservative.

SSR	Source Description	Gas	Included (I), Optional (O), or Excluded (E)	Quantification Method	Justification/Explanation
15	Litter	CO_2	E	N/A	Excluded, as this emission source is assumed to be very small. The exclusion is conservative.
16	Liming	CO_2	E	N/A	Excluded, as the direction and magnitude of this emission source is uncertain. Current IPCC emission factors treat liming as an emission source, whereas current USDA quantification methodologies treat it as a net sink (6) (7).

5 Quantifying GHG Emission Reductions

GHG emission reductions from an avoided grassland conversion project are quantified by comparing actual project emissions to the calculated baseline emissions. Baseline emissions are an estimate of the GHG emissions from sources within the GHG Assessment Boundary (see Section 4) that would have occurred in the absence of the project. In the case of grassland projects, the baseline emissions include the loss of belowground organic carbon through conversion to cropland, as well as the GHG emissions from crop production. Project emissions are actual GHG emissions that occur at sources within the GHG Assessment Boundary. Project emissions include GHG emissions from grassland maintenance and grazing, as well as any leakage of baseline conversion activities. Project emissions must be subtracted from the baseline emissions to quantify the project's total net GHG emission reductions (Equation 5.1).

Quantification of baseline emissions is done through the use of default emission factors developed through a probabilistic composite modeling approach. This approach greatly simplifies the quantification and monitoring of grassland projects, as compared to an approach based on site-specific sampling and modeling. Additional discussion of this approach can be found in Appendix B.

Timelines for quantifying and reporting GHG emission reductions are detailed in Section 7.4. Project Owners may choose to quantify and verify GHG emission reductions on a more frequent basis if they desire. The length of time over which GHG emission reductions are periodically quantified is called the "reporting period." The length of time over which GHG emission reductions are verified is called the "verification period." Under this protocol, a verification period may cover multiple reporting periods (see Section 7.4).

As of this writing, the Reserve relies on values for global warming potential (GWP) of non-CO_2 GHGs published in the IPCC Fourth Assessment Report: Climate Change 2007.[25] The values relevant for this protocol are provided in Table 5.1, below. These values are to be used for all grassland projects unless and until the Reserve issues written guidance to the contrary.

Table 5.1. 100-year Global Warming Potential for Non-CO_2 GHGs

Non-CO_2 GHG	100-Year GWP (CO_2e)
Methane (CH_4)	25
Nitrous Oxide (N_2O)	298

For cooperatives, the quantification of emission reductions is carried out separately for each individual project. The cooperative structure does not change the quantification methodology contained within this section. To report the total results for the cooperative, the Cooperative Developer shall sum the results of Equation 5.1 for each project in the cooperative. However, it should be noted that CRTs are serialized and issued to individual projects, rather than the cooperative.

[25] Available here: https://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml.

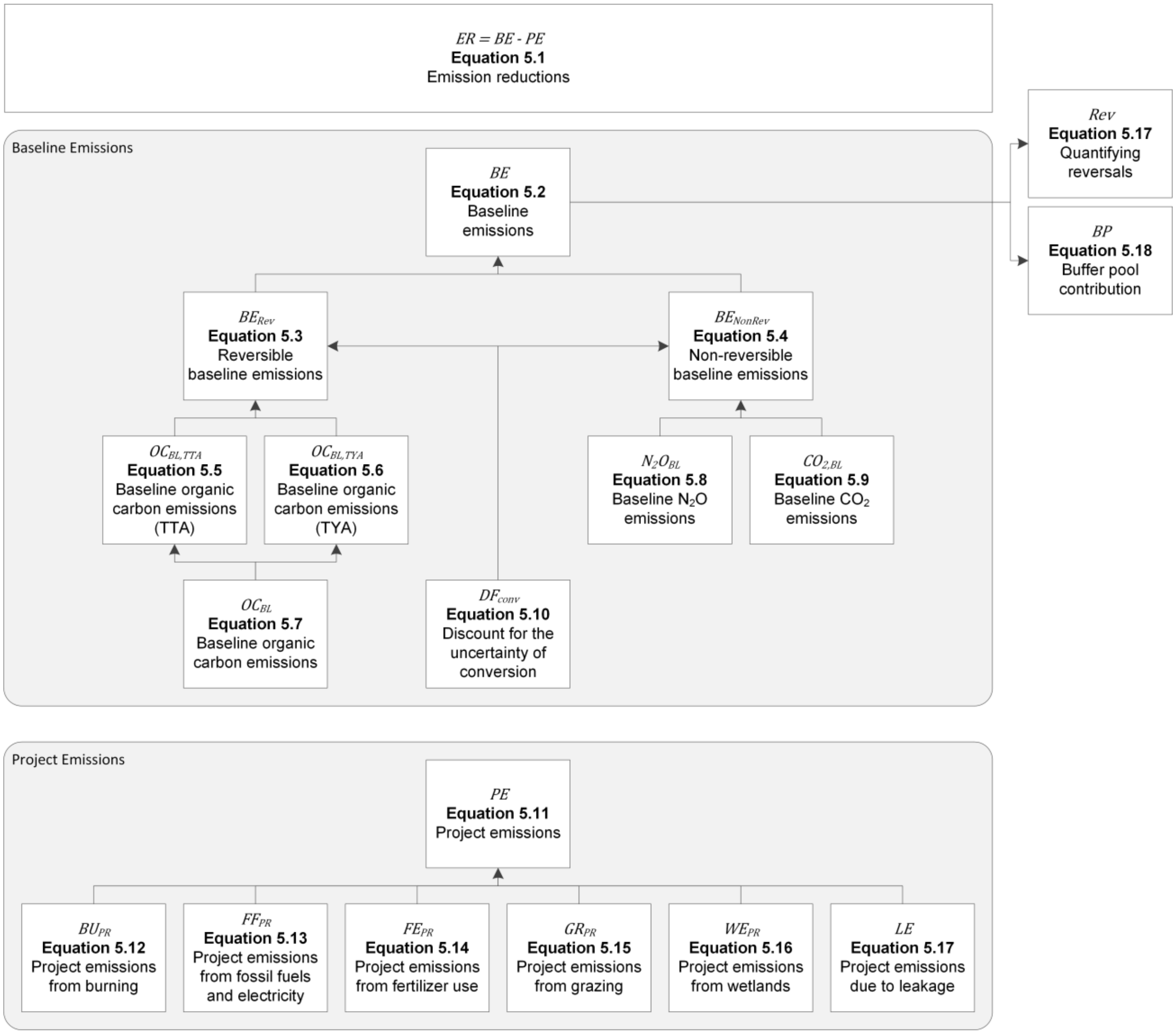

Figure 5.1. Organization of Quantification for Grassland Projects

Equation 5.1. GHG Emission Reductions

$$ER = BE - PE$$

Where,			Units
ER	=	Total emission reductions for the reporting period	tCO_2e
BE	=	Total baseline emissions for the reporting period, from all SSRs in the GHG Assessment Boundary (as calculated in Section 5.1)	tCO_2e
PE	=	Total project emissions for the reporting period, from all SSRs in the GHG Assessment Boundary (as calculated in Section 5.3)	tCO_2e

Note that the total emission reductions (*ER*) may not be equal to the number of credits issued to the Project Owner for the reporting period. If there is a buffer pool contribution (*BP*), that will be deducted from *ER*.

5.1 Stratification

For the purposes of this protocol, Canada. has been stratified in order to enable the development of baseline and project emissions estimates that correspond to local soil conditions, climatic conditions, and agricultural practices. A stratum represents a unique combination of these variables. All baseline and project modeling has been performed at the stratum level when possible, enabling the resulting emissions estimates to represent relatively fine distinctions in the primary drivers of variation in emissions. This protocol establishes emissions estimates for 27 total strata across Canada. By stratifying the country in this manner, the emissions estimates used in this protocol provide greater local accuracy and representation than would emission estimates generated at a national scale or with fewer variables.

It is likely that the project area will cover more than one stratum. In these instances, the project itself shall be divided up on an acreage basis into all appropriate strata. Instructions for identifying and calculating acreage in each stratum are provided in Section 5.1.3. All calculations shall be performed at the stratum level and summed to the project level where indicated.

The following variables are used to stratify Canada, and shall be used to determine the appropriate stratum for a project or project area:

- Reporting zone (roughly equivalent to Ecozone)
- Soil texture

Each project shall be evaluated on the basis of each of these variables to determine its appropriate stratum, or strata, should its area contain multiple strata. The following sections provide guidance on determining the appropriate stratum for any parcel or portion of the project area.

5.1.1 Reporting Zone

The first level of stratification used in this protocol delineates land based on its geography and associated climate, due to these factors' important influence over carbon pools and sources in both natural and managed ecosystems. Regional climate and geographic conditions are determined through the use of Reporting Zones as defined in Canada's National Emissions Inventory methodology. These designations are used for a variety of policy and planning decisions, as they represent information about land suitability for farming and other purposes. As such, they constitute a land area that has similar physical and climatic characteristics. In total, there are 18 Reporting Zones in Canada. Of these, only nine have grasslands that are eligible for this protocol (Figure 5.2):

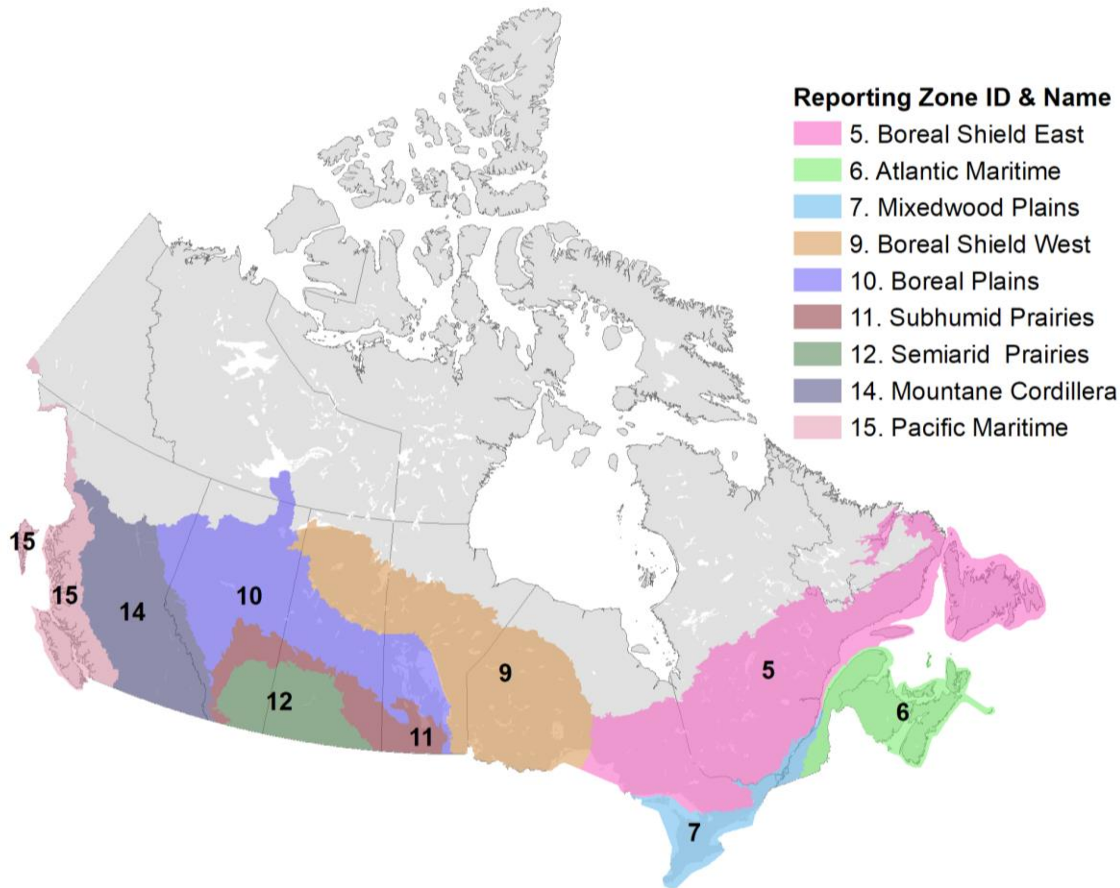

Figure 5.2. Eligible Reporting Zones

5.1.2 Soil Texture

Soil texture has a significant impact on land productivity and carbon dynamics through influences on soil fertility and water balance and on soil organic matter stabilization processes (8). Accordingly, the second level of stratification requires differentiating by soil texture. While successively finer delineations of soil type and texture would yield greater precision, this protocol limits the stratification of soils into three major classes of surface soil texture as defined FAO Soil Texture classification[26] which is used in Canada's National Emissions Inventory method. These are:

- Coarse
- Medium
- Fine

Table 5.2 explains how these three categories can be mapped to the various soil surface textures as they are listed in the soil database.

[26] Agriculture and Agri-Food Canada: http://sis.agr.gc.ca/cansis/nsdb/lpdb/index.html.

Table 5.2. Soil Texture Categorization

Texture Class Code	Texture Class	Grassland Protocol Texture Group
VCS	Very coarse sand	Coarse
CS	Coarse sand	
S	Sand	
FS	Fine sand	
VFS	Very fine sand	
LCS	Loamy coarse sand	
LS	Loamy sand	
LFS	Loamy fine sand	
LVS	Loamy very fine sand	
CSL	Coarse sandy loam	
SL	Sandy loam	
FL	Fine sandy loam	
VL	Very fine sandy loam	Medium
L	Loam	
SIL	Silt loam	
SI	Silt	
SCL	Sandy clay loam	
FCL	Fine sandy clay loam	
VCL	Very fine sandy clay loam	
CL	Clay loam	
SICL	Silty clay loam	
SC	Sandy clay	Fine
SIC	Silty clay	
C	Clay	
HC	Heavy clay	

5.1.3 Stratum Identification and Measurement

In total, this protocol stratifies Canada into 27 strata based on the two variables previously discussed (9 reporting zones with three soil textures) (see Appendix B for further details). Box 5.1 describes the method for naming each individual stratum. These names are then used in the Table B.1, provided for each stratum.

Box 5.1. Stratum Naming Convention

Name format: **X_Y**

Where,		Range of Values
X =	Numbered designation of the MLRA in which the stratum is found	1 – 9
Y =	Soil texture classification	coarse, medium, or fine

EXAMPLES:

Stratum	MLRA	Soil Texture
5_Medium	5- Boreal Shield East	Medium
14_Coarse	14 – Mountane Cordille	Coarse

Most quantification in this protocol is conducted at the stratum level. Equations require inputs in the form of total area (in acres) within each stratum and use of stratum-specific emission factors for various carbon pools and emissions sources. Project developers must prepare a georeferenced map file that contains the entire project area, excluding any portion of the project parcels not legally permitted to be converted due to buffer restrictions or other requirements. The project map should also exclude any ineligible areas, such as structures, roads, waterbodies, or forested areas.

Data must be used to identify the acres of the stratum for each soil texture class. It is recommended that project developers utilize the Canadian National Soil Database (http://sis.agr.gc.ca/cansis/nsdb/index.html) to map soil textures, as well as the land suitability category (see section on Additionality). At a minimum, project developers must be able to identify the acreage of each soil texture group based on the dominant condition of each map unit within the project area.

5.1.4 Emission Factors by Reporting Zone and Soil Texture

Using data from Canada's National Emissions Inventory, standardized emission factors were developed for reporting zones and soil textures across Canada. Appendix A fully explains the approach taken and associated assumptions. The table below presents these emission factors, using the average over 2006-2015 and using the lower confidence interval for conservativeness. The emission factors can be found in Table B.1.

5.2 Quantifying Baseline Emissions

Total baseline emissions for the reporting period are estimated by calculating and summing the emissions from all relevant baseline SSRs that are included in the GHG Assessment Boundary (as indicated in Table 4.1).

The baseline emission equations rely on emission factors that model the emissions of a full year. If this quantification methodology is being applied to a reporting period of less than one full year, Project Owners must refer to Box 5.2 in order to correctly pro-rate the annual baseline emission factors. Baseline emission factors for soil organic carbon, nitrous oxide, and fossil fuel emissions are organized in ten year groups. Those ten years are counted as calendar years from the year of the project start date, inclusive. The emission factor group to be used for a given reporting period is based on the beginning date of that reporting period, and applies throughout the reporting period. For example, if the project start date is May 9, 2019, the "Year 1-10" emission factor group shall be used for all reporting periods that begin during the years 2019-2028. For reporting periods beginning during 2029-2038, the "Year 11-20" emission factor group shall be applied.

Equation 5.2. Baseline Emissions

$$BE = BE_{Rev} + BE_{NonRev}$$

Where,			Units
BE	=	Total baseline emissions during the reporting period, rounded down to the nearest whole number	tCO_2e
BE_{Rev}	=	Baseline emissions from SSRs considered to be reversible Equation 5.3	tCO_2e
BE_{NonRev}	=	Baseline emissions from SSRs not considered to be reversible Equation 5.4	tCO_2e

Equation 5.3. Baseline Emissions from SSRs Considered to be Reversible

$$\boldsymbol{BE_{Rev}} = \left[\left\{either\ OC_{BL,TTA}, or\ OC_{BL,TYA}\right\} \times (\mathbf{1} - \boldsymbol{DF_{\sigma}})\right] \times (\mathbf{1} - \boldsymbol{DF_{conv}}) \times \boldsymbol{Pro}$$

Where,			Units
BE_{Rev}	=	Baseline emissions from SSRs considered to be reversible	tCO_2e
$OC_{BL,TTA}$	=	Baseline emissions due to loss of organic carbon in soil and biomass, accounted on a tonne-tonne basis (Equation 5.7)	tCO_2e
$OC_{BL,TYA}$	=	Baseline emissions due to loss of organic carbon in soil and biomass, accounted on a tonne-year basis (Equation 5.6)	tCO_2e
DF_{conv}	=	Discount factor for the uncertainty of baseline conversion (Equation 5.10)	%
DF_{σ}	=	Discount factor for the uncertainty of modeling future management practices and climatic conditions (Table 5.3)	%
Pro	=	Pro-rating factor for reporting periods of less than one year (see Box 5.2)	%

Equation 5.4. Baseline Emissions from SSRs Not Considered to be Reversible

$$\boldsymbol{BE_{NonRev}} = \left[\left(\boldsymbol{N_2O_{BL}} + \boldsymbol{CO_{2,BL}}\right) \times (\mathbf{1} - \boldsymbol{DF_{\sigma}})\right] \times (\mathbf{1} - \boldsymbol{DF_{conv}}) \times \boldsymbol{Pro}$$

Where,			Units
BE_{NonRev}	=	Baseline emissions from SSRs not considered to be reversible	tCO_2e
N_2O_{BL}	=	Baseline soil direct and indirect emissions of nitrous oxide from N additions (Equation 5.8)	tCO_2e
$CO_{2,BL}$	=	Baseline emissions of carbon dioxide from fertilizer use Equation 5.9	tCO_2e
DF_{conv}	=	Discount factor for the uncertainty of baseline conversion (Equation 5.10)	%
DF_{σ}	=	Discount factor for the uncertainty of modeling future management practices and climatic conditions (Table 5.3)	%
Pro	=	Pro-rating factor for reporting periods of less than one year (see Box 5.2)	%

Box 5.2. Pro-Rating for Reporting Periods of Less than One Year

Projects may report GHG reductions more frequently than on an annual basis. If a project reports on a sub-annual basis, then annual emission factors and quantities used in this section must be prorated. The following equation shall be used to determine the pro-rating factor for a sub-annual reporting period:

$$\boldsymbol{Pro = \frac{rd}{365}}$$

Where,

			Units
Pro	=	Pro-rating factor	%
rd	=	Number of reporting days in the sub-annual reporting period (i.e., days for which the project is claiming credit for emission reductions)	Days
365	=	Number of days in a calendar year (use 366 for leap years)	Days

5.2.1 Baseline Organic Carbon Emissions

The baseline assumption for grassland projects is that the project area would be converted to cropland absent the project activities. When grassland is converted to cropland, carbon emissions occur through the loss of stored soil organic carbon over time. There is an immediate loss of soil carbon when the soil is tilled (9), followed by potentially decades of loss until a new equilibrium is reached. Determining the exact nature of the converted land use (crop rotation, tillage practices, fertilization, ongoing management) is complex, uncertain, and subjective. This quantification approach has adopted a Canada's NIR methodology to produce a standardized, regionally stratified approach to determining organic carbon emissions from the baseline scenario for grassland projects. Refer to Appendix B for the development of the emission factors used in this quantification and the companion tables for the baseline emission factors.

In the case of projects that have made a full permanence commitment and are following the Tonne-Tonne Accounting (TTA) approach for crediting, the project will receive full value of the calculated annual baseline organic carbon emissions, as shown in Equation 5.5.

Equation 5.5. Baseline Organic Carbon Emissions, Accounted on a Tonne-Tonne Basis (TTA)

$$OC_{BL,TTA} = OC_{BL}$$

Where,

			Units
$OC_{BL,TTA}$	=	Baseline quantity of organic carbon emissions from soil and belowground biomass, accounted on a tonne-tonne basis	tCO_2e
OC_{BL}	=	Baseline quantity of organic carbon emissions from soil and belowground biomass	tCO_2e

In the case of Tonne-Year Accounting (TYA), Baseline Organic Carbon Emissions from Soil and Belowground Biomass Loss are quantified according to the length of time the CO_2e emissions are avoided and/or contractually secured. Specifically, for each additional tonne of CO_2e that is stored and verified, Baseline Organic Carbon Emissions are accounted proportionally to the value of the atmospheric impact of maintaining each tonne on the ground for the amount of time in which it is secured. This is achieved by multiplying the number of tonnes of avoided CO_2e emissions in a given Reporting Period by the radiative forcing coefficient for the period of time the CO_2e is secured or maintained.[27] The commitment to secure CO_2e must be established through a PIA with the Reserve (see Section 3.5.4). Equation 5.6 below, shows the formula for determining the baseline organic carbon emissions from soil and belowground biomass loss proportional to the value of the atmospheric impact of maintaining each tonne on the ground.

Equation 5.6. Baseline Organic Carbon Emissions, Accounted on a Tonne-Year Basis (TYA)

$$OC_{BL\,TYA} = \sum(OC_{BL,p,n} \times \left(\mathrm{YR}_{p,n} + \mathrm{CL}\right) \times 1\% - POC_{BL\,TYA_{p,n}})$$

Where,			Units
$OC_{BL\,TYA}$	=	Baseline quantity of organic carbon emissions from soil and belowground biomass under tonne-year accounting	tCO_2e
$OC_{BLp,n}$	=	Baseline quantity of organic carbon emissions from soil and belowground biomass in Reporting Period p, for each Reporting period in which additional carbon was preserved	tCO_2e
$YR_{p,n}$	=	Length of time since the initiation of the Reporting Period in which the additional carbon was sequestered, for each Reporting Period in which additional carbon was preserved	Years
CL	=	Length of contractual agreement into future from current Reporting Period that secures all preserved carbon	Years
1%	=	Annual radiative forcing coefficient	%
$POC_{BL\,TYA\,p,n}$	=	Previous baseline quantity of organic carbon emissions from soil and belowground biomass under tonne-year accounting, for each past Reporting Period in which credits were issued	tCO_2e

[27] Radiative forcing coefficients differ slightly based on the amount of time the carbon is maintained out of the atmosphere, but for the purposes of simplification, this protocol applies a radiative forcing coefficient of 1% for each year.

Box 5.3. Example of Tonne-Year Accounting

If baseline organic carbon emissions from soil and below ground biomass were 100 tonnes of CO_2e in the first reporting period, and the Grassland Owner submits the Project Report at the end of a one-year first reporting period, and secures the 100 tonnes of CO_2e by contract against reversals for 20 years, then 21 tCO_2e baseline organic carbon emission will be accounted. This is based on the 20 years for which the tonnes are secured through contract and the 1 year for which the tonnes have been maintained through the first reporting period:

$$\boldsymbol{OC_{BL\,TYA}} = \sum(\mathbf{100} \times (\mathbf{1} + \mathbf{20}) \times \mathbf{1}\% - \mathbf{0})$$

Alternatively, if the first reporting period was 2 years, then 22 tCO_2e would be accounted following verification.

$$\boldsymbol{OC_{BL\,TYA}} = \sum(\mathbf{100} \times (\mathbf{2} + \mathbf{20}) \times \mathbf{1}\% - \mathbf{0})$$

In this second example, the project would have 78 baseline carbon emissions that have not yet been accounted for out of the initial 100 tonnes of CO_2e that were verified. If, in the next year, the contract is extended by another year (so that the contract still has a term of 20 years total), using the simplified 1% radiative forcing coefficient, another 1 tCO_2e would be converted into a CRT in addition to the prior credits because the project has demonstrated another year toward the 100-year permanence requirement. Contracts may be extended in this way until the end of the contractual commitment reaches a date that is 100 years after the carbon was first sequestered. At that point, credits will have been issued for the 100 tonnes CO_2e sequestered in the first reporting period.

Equation 5.7. Baseline Organic Carbon Emissions from Soil and Belowground Biomass Loss

$$\boldsymbol{OC_{BL,}} = \sum_{\mathbf{1}-\boldsymbol{n}} (\boldsymbol{BEF_{OC,s}} \times \boldsymbol{Area_s} \div \mathbf{1000})$$

Where, Units

$OC_{BL,}$	=	Baseline quantity of organic carbon emissions from soil and belowground biomass	tCO_2e
n	=	Total number of strata	
S	=	Individual stratum	
$BEF_{OC,s}$	=	Annual baseline emission factor for soil organic carbon in stratum *s* (refer to Table B.1, selecting the appropriate stratum and time category)	kg CO_2/ac/yr
$Area_s$	=	Area of project in stratum *s*	acres
1000	=	Conversion factor	kg/t

5.2.2 Baseline N_2O Emissions

The use of fertilizer for crop cultivation results in emissions of nitrogen in the form of N_2O, which is a potent GHG.[28] Using emission factors developed with the composite modeling approach described in Appendix B, baseline emissions of N_2O are estimated for each stratum.

[28] For additional details regarding the pathways of N_2O emissions due to fertilizer use, refer to the Reserve's Nitrogen Management Project Protocol, available online: http://www.climateactionreserve.org/how/protocols/nitrogen-management/.

Equation 5.8. Baseline N_2O Emissions

$$N_2O_{BL} = \sum_{s}^{S} \left(BEF_{N_2O,s} \times Area_s \times GWP_{N_2O} \div 1000 \right)$$

Where,

			Units
N_2O_{BL}	=	Baseline emissions of N_2O	tCO_2e
$BEF_{N2O,s}$	=	Annual baseline emission factor for N_2O emissions in stratum *s* (refer to Table B.1, selecting the appropriate stratum and time category)	kg N_2O/ac/yr
$Area_s$	=	Area of the project in stratum *s*	acres
GWP_{N2O}	=	100-year global warming potential of N_2O (refer to Table 5.1).	CO_2e/N_2O
1000	=	Conversion factor	kg/t

5.2.3 Baseline CO_2 Emissions from Fertilizer Use

The use of fertilizer for crop cultivation results in emissions of carbon dioxide (CO_2). CO_2 emissions are estimated from the decomposition of limestone and dolomite (to increase pH in regions with acidic soils), as well as decomposition of carbon containing fertilizers (e.g., urea).

Equation 5.9. Baseline CO_2 Emissions from Fertilizer Use

$$CO_{2,BL} = \sum_{s}^{S} \left(BEF_{C_{fert},s} \times \frac{1}{1000} \times Area_s \right)$$

Where,

			Units
$CO_{2,BL}$	=	Baseline emissions from fertilizer use	tCO_2e
$BEF_{Cfert,s}$	=	Annual baseline rate of CO_2 emissions related to fertilizer use for stratum *s* (refer to Table B.1, selecting the appropriate stratum)	kg CO_2/ac/yr
1000	=	Conversion factor	kg/t
$Area_s$	=	The area of the project in stratum *s*	acres

5.2.4 Discount Factors

There are two discount factors that are applicable to the quantification of baseline emissions, DF_{conv} and DF_{σ}. DF_{conv} represents the uncertainty of using a standardized financial additionality threshold to represent the likelihood of the baseline conversion scenario. As the cropland premium decreases, uncertainty around the likelihood of baseline conversion increases. Equation 5.10 explains how to determine the value of this discount based on the value of the cropland premium for the project area (as determined according to the guidance in Section 3.3.1.1). In Equation 5.3, this discount is applied to the entire estimate of baseline emissions.

Equation 5.10. Discount Factor for the Uncertainty of Baseline Conversion

$$CP = \frac{(Cropland\ value - Pasture\ value)}{Pasture\ value} \times 100\%$$

Where,			Units
CP	=	Cropland premium for the project area	%
Cropland value	=	Real estate value of the land under cropland use	Dollars
Pasture value	=	Real estate value of the land under grassland use	Dollars

For CP < 40%: $DF_{conv} = 1$

For CP 40% - 100%: $DF_{conv} = 0.5 - \frac{CP - 0.4}{1.2}$

For CP > 100%: $DF_{conv} = 0$

Where,			Units
DF_{conv}	=	Discount factor for the uncertainty of baseline conversion	%

DF_{σ} is meant to embody the uncertainty contained within the modeling of the baseline emission factors. The baseline emissions quantified in this protocol are discounted to account for increasing uncertainty about input assumptions and model outputs into the future. Uncertainty arises due to anticipated but unknown shifts in practices in, among other things, tillage, cropping, and nitrogen management, and the interaction of agricultural systems with a changing climate. Model inputs and outputs are expected to accurately reflect baseline conditions in early years, but have greater uncertainty in future years. Accordingly, the quantification of baseline emissions is discounted , with the discount increasing through time in accordance with increasing uncertainty. The value of DF_{σ} for a given year is found below in Table 5.3.

Table 5.3. DF_{σ} Values by Year

Year	DF_{σ}
2019-2023	1%
2024-2028	2%
2029-2033	3%
2034-2038	4%
2039-2043	5%
2044-2048	6%
2049-2053	7%
2054-2058	8%

If the modeling exercise is updated in the future, it is likely that this discount schedule would reset back to 1% for new projects that would use the updated emission factors. The discount factor is assigned based on the year of the beginning date of the reporting period (i.e., a reporting period which begins on May 9, 2019 would apply the discount listed for 2019 for an entire 12-month reporting period, even though a portion of the period is in the calendar year 2020).

5.2.5 Fossil Fuel Emissions

The conversion of grassland to cropland, as well as the ongoing cropland management activities, involves the use of fossil fuels for vehicles and equipment. This usage results in direct emissions of CO_2. Under this baseline scenario, emissions from fossil fuels will be significantly larger than the project scenario due to the need for more fossil fuel use of field management practices (e.g. tilling, seeding, application of fertilizer/herbicides/pesticides, harvesting, etc). Therefore, fossil fuel emissions quantification is conservatively omitted from the baseline scenario.

5.3 Quantifying Project Emissions

Project emissions are actual GHG emissions that occur within the GHG Assessment Boundary as a result of the project activity. Project emissions must be quantified every reporting period on an *ex post* basis. In certain cases where these emissions are determined to be *de minimis*,[29] this protocol specifically allows for the Project Owner to use an alternative estimation methodology. Unless otherwise specified, project emission equations cover the entire reporting period, regardless of whether it covers a full year.

Equation 5.11. Project Emissions

$$PE = BU_{PR} + FF_{PR} + FE_{PR} + GR_{PR} + WE_{PR} + LE$$

Where,			Units
PE	=	Project emissions, rounded to the nearest whole number	tCO_2e
BU_{PR}	=	Emissions from burning in the project scenario (Equation 5.12)	tCO_2e
FF_{PR}	=	Emissions from fossil fuel and electricity use in the project scenario (Equation 5.13)	tCO_2e
FE_{PR}	=	Emissions from fertilizer use in the project scenario (Equation 5.14)	tCO_2e
GR_{PR}	=	Emissions from livestock grazing in the project scenario (Equation 5.15)	tCO_2e
WE_{PR}	=	Emissions from wetland soils (Equation 5.16)	tCO_2e
LE	=	Leakage emissions (Equation 5.17)	tCO_2e

5.3.1 Project Emissions from Burning

Although some geographies commonly burn grasslands, whether prescribed or accidental, it is not common to burn grassland in Canada. Any burning that occurs should be treated as project emissions, as the combustion of aboveground biomass results in emissions of CO_2, CH_4, and N_2O. The CO_2 emissions from grass burning are considered biogenic and are excluded from this quantification. The project emissions of CH_4 and N_2O must be estimated using Equation 5.12.

In order to estimate GHG emissions from grass burning, it is necessary to estimate the mass of aboveground dry matter (*DM*) that was present in the area which burned. Project developers are able to choose their preferred method for estimating the value of *DM*. In all cases, project developers are requested to consult with the Reserve prior to submitting any of these estimation methodologies for verification. The following methods could be employed for the estimation of the value of *DM*:

[29] For the purposes of this protocol, emissions are *de minimis* if they are less than the relevant materiality threshold when applied to the overall calculation of emission reductions. The materiality threshold for projects is defined in the Verification Program Manual, available online at: http://www.climateactionreserve.org/how/verification/verification-program-manual/.

- Recent, on-site inventory of the plant community, following a statistically-valid sampling design, and employing biomass quantification from peer-reviewed literature sources to determine the mass of aboveground dry matter for the area burned.
- Recent data from remote sensing systems employing a statistically-valid sampling design, and a biomass quantification approach approved by the Reserve. Remote sensing systems may also be employed to determine the area burned.
- Official government resources for estimating forage quantity with reasonable assumptions about animal category and percent forage grazed.
- If no reasonable estimation can be made, a default amount of 1,659 kg/acre may be applied[30]

Equation 5.12. Project Emissions from Burning

$$BU_{PR} = \sum_{S}\left[\left(Area_{burn,s} \times DM_s \times \frac{2.3}{1000000} \times GWP_{CH_4}\right) + \left(Area_{burn,s} \times DM_s \times \frac{0.21}{1000000} \times GWP_{N_2O}\right)\right]$$

Where,			Units
BU_{PR}	=	Emissions from burning in the project scenario	tCO_2e
S	=	Total number of strata	
s	=	Individual stratum	
$Area_{burn,s}$	=	Area of stratum *s* that was burned	acres
DM_s	=	Amount of aboveground dry matter in stratum *s*	kg/acre
2.3	=	Emission factor for methane from biomass burning (6)	g/kg dry matter
0.21	=	Emission factor for nitrous oxide from biomass burning (6)	g/kg dry matter
GWP_{CH4}	=	100-year global warming potential for methane (Table 5.1).	tCO_2e/tCH_4
GWP_{N2O}	=	100-year global warming potential for nitrous oxide (Table 5.1)	tCO_2e/tN_2O
1000000	=	Conversion factor	g/t

5.3.2 Project Emissions from Fossil Fuel and Electricity Use

In the case that the project activities include the use of mobile or stationary equipment or vehicles that consume fossil fuels or electricity, these project emissions are estimated using Equation 5.13. Quantities of each energy source should be documented for the reporting period However, if the project can demonstrate that the total value of FF_{PR} is reasonably expected to be *de minimis* (i.e., less than the relevant materiality threshold[31]), fuel and electricity consumption may be estimated through a conservative method proposed by the Project Owner and deemed acceptable by the verifier.

[30] Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines for National Greenhouse Gas Inventories, available at: https://www.ipcc.ch/report/2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/.
[31] Materiality thresholds for Reserve projects are specified in the Reserve Verification Program Manual, available at: http://www.climateactionreserve.org/how/verification/verification-program-manual/.

Equation 5.13. Project Emissions from Fossil Fuels and Electricity

$$FF_{PR} = FC + EU$$

Where,

			Units
FF_{PR}	=	Emissions from fossil fuel combustion and electricity use in the project	tCO_2e
FC	=	Emissions from fuel combustion in the project	tCO_2e
EU	=	Emissions from electricity use in the project	tCO_2e

$$FC = \frac{\sum(Vol_f \ x \ EF_{f,CO_2}) + \sum(Vol_f \ x \ EF_{f,CH_4} \ x \ GWP_{CH_4}) + \sum(Vol_f \ x \ EF_{f,N_2O} \ x \ GWP_{N_2O})}{1000}$$

Where,

Vol_f	=	Volume of fuel f consumed by the project during the reporting period	1000 L
$EF_{f,CO2}$	=	CO_2 emission factor for combustion of fuel f (Table 5.4)	kg CO_2/1000L
$EF_{f,CH4}$	=	CH_4 emission factor for combustion of fuel f (Table 5.4)	kg CH_4/1000L
GWP_{CH4}	=	Global warming potential for CH_4 (Table 5.1)	kg CO_2e/kg CH_4
$EF_{f,N2O}$	=	N_2O emission factor for combustion of fuel f (Table 5.4)	kg N_2O/1000L
GWP_{N2O}	=	Global warming potential for N_2O (Table 5.1)	

$$EU = \frac{\sum(E \ x \ EF_{E,CO_2}) + \sum(E \ x \ EF_{E,CH_4} \ x \ GWP_{CH_4}) + \sum(E \ x \ EF_{E,N_2O} \ x \ GWP_{N_2O})}{1000}$$

Where,

EU	=	Emissions from electricity use in the project	tCO_2e
E	=	Quantity of electricity consumed by the project during the reporting period	MWh
$EF_{E,CO2}$	=	Provincial CO_2 emission factor for electricity (Table 5.4)	kg CO_2/MWh
$EF_{E,CH4}$	=	Provincial CH_4 emission factor for electricity (Table 5.4)	kg CH_4/MWh
$EF_{E,N2O}$	=	= N_2O emission factor for electricity (Table 5.4)	kg N_2O/MWh

Table 5.4. Emission Factors for Fossil Fuels and Electricity[32]

Fuel	Province	Unit	$EF_{E,CO2}$ kg CO_2/unit	$EF_{E,CH4}$ kg CH_4/unit	$EF_{E,N2O}$ kg N_2O/unit
Diesel Fuel	All	1000 L	3427	0.18	0.10
Gasoline	All	1000 L	2879	0.54	0.25
Electricity	NL	MWh	40.0	0.0006	0.0010
Electricity	PE	MWh	14.0	0.0005	0.0002
Electricity	NS	MWh	720.0	0.0322	0.0107
Electricity	NB	MWh	330.0	0.0213	0.0043
Electricity	QC	MWh	1.4	0.0000	0.0001
Electricity	ON	MWh	20.0	0.0000	0.0012
Electricity	MB	MWh	2.1	0.0001	0.0001
Electricity	SK	MWh	699.2	0.0538	0.0215
Electricity	AB	MWh	800.0	0.0427	0.0107
Electricity	BC	MWh	9.4	0.0031	0.0007

5.3.3 Project Emissions from Fertilizer Use

Certain grasslands may see ecosystem improvements or possibly even enhanced carbon sequestration (not credited under this protocol) following the addition of soil amendments (10). In the case that the project activities include the application of fertilizer (such as compost or manure from off site), the project emissions of N_2O are estimated using Equation 5.14. This equation quantifies the total direct and indirect emissions of N_2O related to the application of fertilizers through the use of project-specific activity data and default emission factors. Organic amendments include only those brought from outside the project area, such as stockpiled manure from a livestock operation, and thus do not include manure deposited by the livestock while grazing (the emissions from manure from grazing animals is calculated under Project Emission from Grazing, Section 5.3.4). To be conservative, the potential increase in SOC from addition of organic amendments is conservatively excluded due to its uncertainty, as well as the added burden of measurement and quantification. Additional information regarding the default emission factors used in the next two equations can be found in Appendix C.

[32] National Inventory Report 1990–2017: Greenhouse Gas Sources and Sinks in Canada, 2019, Pt 2 and Pt 3

Equation 5.14. Project Emissions from Fertilizer Use

$$FE_{PR} = \left(\sum_{C} QF_{PR,c} \times NC_c\right) \times \left(PEF_{Fert,c} + 0.00225\right) \times \frac{44}{28} \times GWP_{N_2O} \div 1000$$

Where,

			Units
FE_{PR}	=	Direct and indirect nitrous oxide emissions from fertilizer use in the project scenario	tCO_2e
C	=	Total number of types of fertilizer applied, other than manure from grazing livestock	
$QF_{PR,c}$	=	Quantity of fertilizer type *c* applied	kg
NC_c	=	Nitrogen content of fertilizer type *c*	kg N/kg
$PEF_{Fert,c}$	=	Project emission factor representing the direct emissions of N_2O from fertilizer, the fraction of N which is volatilized, and the indirect emission factor for N volatilization and deposition. Equal to 0.011 for synthetic/chemical sources and 0.012 for organic sources.	
0.00225	=	Default factor combining both the fraction and emission factor for N_2O emissions due to leaching	
44/28	=	Molar mass ratio of N_2O to N	kg N_2O/kg N_2O-N
GWP_{N2O}	=	100-year global warming potential for N_2O (Table 5.1)	tCO_2e/tN_2O
1000	=	Conversion factor	kg/t

5.3.4 Project Emissions from Grazing

It is likely that grasslands projects include livestock grazing on the project area in the project scenario, leading to enteric methane and manure (methane and nitrous oxide) emissions that would not exist in the baseline scenario. These emissions are quantified using Equation 5.15 and the guidance in Box 5.3. For the purposes of this equation, the “grazing season” is defined as the period of time between the first and last grazing days of the reporting period.

Equation 5.15. Project Emissions from Livestock Grazing

$$GR_{PR} = N_2O_{MN} + CH_{4,MN} + CH_{4,ENT}$$

Where,			Units
GR_{PR}	=	Project emissions from grazing activities in the project area	tCO_2e
N_2O_{MN}	=	N_2O emissions from manure deposited by grazing animals	tCO_2e
$CH_{4,MN}$	=	CH_4 emissions from manure deposited by grazing animals	tCO_2e
$CH_{4,ENT}$	=	CH_4 emissions from enteric fermentation in grazing animals	tCO_2e

$$N_2O_{MN} = \sum_L \left(AGD_l \times Nex_l \times \left(PEF_{N_2O,d} + PEF_{N_2O,vol} + PEF_{N_2O,leach}\right) \times GWP_{N_2O} \div 10^6\right)$$

Where,			Units
L	=	Total number of livestock categories in the project scenario	
AGD_l	=	Animal grazing days for livestock category *l* (see Box 5.3)	animal days
Nex_l	=	Nitrogen excreted by grazing animals in livestock category *l*	kg N/head/day
$PEF_{N2O,d}$	=	Default provincial emission factor representing the direct N_2O emissions from manure deposited by grazing animals during the reporting period (Table 5.6)	g N_2O/kg N
$PEF_{N2O,vol}$	=	Default provincial emission factor representing the volatilized N_2O emissions from manure (Table 5.6)	g N_2O/kg N
$PEF_{N2O,leach}$	=	Default provincial emission factor representing the leached N_2O emissions from manure (Table 5.6)	g N_2O/kg/N
GWP_{N2O}	=	100-year global warming potential for N_2O (Table 5.1)	CO_2e/N_2O
10^6	=	Conversion factor	g/t

$$CH_{4,MN} = \sum_L \left(AGD_l \times PEF_{mn,l} \times GWP_{CH_4} \div 1000\right)$$

Where,			Units
$PEF_{mn,l}$	=	Default CH_4 emission factor for manure excreted by grazing animals of category *l* during the reporting period (Table 5.5)	g CH_4/head/day
GWP_{CH4}	=	100-year global warming potential for CH_4 (Table 5.1)	CO_2e/CH_4

$$CH_{4,ENT} = \sum_L \left(AGD_l \times PEF_{ENT,l}\right) \times GWP_{CH_4} \div 10^6$$

Where,			Units
$PEF_{ENT,l}$	=	Project emission factor for enteric methane emissions from livestock category *l*	g CH_4/head/day

Table 5.5. N Excretion, Enteric Fermentation CH_4 Emissions, and Manure CH_4 Emissions (Adapted from: National Inventory Report 1990–2017: Greenhouse Gas Sources and Sinks in Canada, 2019, Pt 2)[33]

Animal Category	N Excretion kg N/head/day	Enteric Fermentation g CH_4/head/day	Manure Emissions g CH_4/head/day
Dairy Cow	0.332	378.4	104.1
Dairy Heifer (replacement)	0.208	210.1	46.6

[33] National Inventory Report 1990–2017: Greenhouse Gas Sources and Sinks in Canada, 2019, Pt 2

Animal Category	N Excretion kg N/head/day	Enteric Fermentation g CH_4/head/day	Manure Emissions g CH_4/head/day
Dairy Calves	0.071	120.0	7.9
Bull	0.312	356.4	13.7
Beef Cow	0.205	331.0	12.3
Beef Heifer (replacement)	0.156	250.1	8.8
Heifer for Slaughter	0.178	146.8	5.8
Steers	0.181	132.6	5.5
Beef Calves	0.071	120.0	7.9
Sheep	0.011	21.9	0.9
Lamb	0.011	21.9	0.6
Llamas and Alpacas	0.047	21.9	0.9
Goat	0.029	13.7	0.9
Horse	0.135	49.3	7.1
Bison	0.185	150.7	5.8
Deer and Elk	0.037	54.8	0.6
Mules and Asses	0.073	27.4	2.1

Table 5.6. Factors for Emissions of N_2O from Manure from Grazing Animals[34]

Province	Direct Emissions g N_2O/kg N	Emissions from Volatization g N_2O/kg N	Emissions from Leaching g N_2O/kg N
AB	0.68	3.1	1.8
BC	0.68	2.8	1.8
MB	0.68	3	2.1
NB	8.8	2	3.5
NL	9.6	1.3	3.5
NS	8.8	2	3.5
ON	9.6	2.3	3.1
PE	7.5	1.9	3.5
QC	9.4	1.7	3.4
SK	0.68	3.1	1.5

[34] *Ibid*

Box 5.4. Determining Animal Grazing Days (AGD_l)

Equation 5.15 requires the use of parameter AGD_l, which represents the total number of days that were grazed by a single category of animals. This is the sum of the number of days each animal category was grazed during the relevant time period. A simplified example is below:

Animal Category	Population	Grazing Days	Animal Grazing Days
Bulls	100	240	24,000
Beef Cows	200	240	48,000
Beef Heifer (replacement)	40	240	9,600

Note: the numbers in this table are fictional used only for illustrative purposes

If the population of each category is not stable over the grazing period, a reasonable approach shall be applied to estimate AGD_l for each category over the relevant time period.

5.3.5 Project Emissions From Wetland Soils

Eligible wetlands that are preserved through the grassland project will continue to emit CH_4 to the atmosphere during the length of the crediting period. While the carbon sequestration of wetlands may, over the project lifetime, outweigh the CH_4 emissions, to be conservative this protocol requires that this source be counted in the total project emissions. This conservative approach is based around an emission factor appropriate for wetlands of classes 3-4[35] while eligible wetlands under this protocol are classes 1-3. The approximate, maximum extent of the wetland area during the year must be used for quantifying wetland emissions. The extent of the wetland must be identified in the project map referenced in Section 2.2.1 and updated annually.

Equation 5.16. Project Emissions from Wetland Soil Dynamics

$$\boldsymbol{WE_{PR} = Area_{wet} \times 80.13 \times GWP_{CH4} \div 1000}$$

Where,

			Units
WE_{PR}	=	Emissions from Wetland Soils	tCO_2e/yr
$Area_{wet}$	=	Wetland extent	acres
80.13	=	Wetland Emission Factor	kg CH_4/acre/yr
GWP_{CH4}	=	100-year global warming potential for CH_4 (Table 5.1)	CO_2e/CH_4
1000	=	Conversion factor	kg/t

5.3.6 Project Emissions Due To Leakage

Avoided grassland conversion projects would result in leakage if the project activities result in the conversion of other grassland outside of the project area. This would cause the “avoided” baseline emissions to simply shift and occur elsewhere, thus never actually being avoided. The extent to which this occurs depends on the economics of crop production. The project emissions due to leakage represent the probability that the avoided baseline emissions will occur outside of the project area due to the project activities. Calculating a precise value for this probability is both complex and uncertain. As this protocol relies on default baseline assumptions which are

[35] Zhu, Qiuan, et al. "Estimating global natural wetland methane emissions using process modelling: spatio-temporal patterns and contributions to atmospheric methane fluctuations." Global ecology and biogeography 24.8 (2015): 959-972.

composites of multiple baseline scenarios, it is not possible to determine a precise leakage value for each specific project.

Based on evaluations of land conversion programs run by the federal government, approximately 15% of the contracts were liquidated and converted back to annual crops. This analysis was performed by Hillard et al. (2009)[36] and a summary can be found in Appendix D. Based on this historical trend, it's proposed the leakage factor would be set at 20%, which is on par with estimates from the United States.

Several studies have examined the U.S. Federal Conservation Reserve Program (CRP) to assess "slippage" (leakage) caused by conservation of arable land. One study determined the slippage effect of CRP enrollment to be 20% (i.e., for every 100 acres that are conserved, 20 acres are converted elsewhere) (12). A later study found no slippage effect from CRP enrollment (13). A third study determined that there is a range from 17.5% to 20.6%, depending upon the number of acres enrolled (higher enrollment led to higher slippage), as well as the elasticity of supply of nitrogen fertilizer (inelastic fertilizer supply led to higher slippage) (14). Lastly, another study, attempting to address the disagreement between the first two, used satellite imagery to attempt to estimate the magnitude of this effect, and came up with estimates that ranged from 3% to 11% (15). This is all to say that estimates of leakage from CRP enrollment, a reasonable proxy for avoided grassland conversion, range from 0% to 20%, with evidence to support various values in the middle of that range. Thus, the Reserve has taken a conservative approach in its US Grassland Project Protocol, assuming a 20% leakage effect from grassland projects. Thus, this protocol has taken a conservative approach, assuming a 20% leakage effect from grassland projects in Canada.

Equation 5.17. Project Emissions from Leakage

$$\boldsymbol{LE = 0.2 \times BE}$$

Where,			Units
LE	=	Leakage emissions during the reporting period	tCO_2e
0.2	=	Leakage discount factor	
BE	=	Baseline emissions during the reporting period	tCO_2e

The default leakage estimate will be reconsidered and potentially revised at a later date pending the publication of updated scientific analysis of grassland conservation and its effects on cropland conversions.

5.4 Ensuring Permanence of GHG Emission Reductions

If a project has previously registered CRTs with the use of a permanence commitment (either via TTA or via TYA with a reduced commitment which has not yet expired) and a reversal occurs during a reporting period (see Section 3.5), the reversal must be compensated for by retiring CRTs. Projects which are not currently under a permanence commitment for previously-registered CRTs are not subject to reversal risk. Specific requirements depend on whether the reversal was avoidable or unavoidable, as described below. Reversal compensation

[36] Hilliard, C. Kenny, C. and Fomradas, K. 2009. Permanent Forage Cover Programs 1989-1992. An evaluation of Medium-term environmental outcomes and program participation. Agriculture and Agri-Food Canada, Agri-Environment Services Branch. 34 pp.11 pp.

requirements do not apply to emission reductions unrelated to carbon stored in the project area soils (e.g., CH_4 and N_2O).

Identification of a reversal is a binary decision based on area; either an area is subject to a total reversal or not. For example, if the Grassland Owner decides to plow and cultivate a 10-acre portion of the project area, that entire 10-acre portion shall be considered to have experienced a complete and avoidable reversal. If an area is subject to a reversal, then the quantity of soil carbon reversed is considered to be equal to total number of CRTs issued for reversible emission reductions on that specific portion of the project area, minus the atmospheric benefit which has already accrued in relation to the amount of time which has passed since the emission reductions occurred. For the purposes of this protocol, reversible emission reductions are those related to the avoided loss of organic carbon in soil and belowground biomass (Equation 5.5 or Equation 5.6). The quantity of CRTs that must be retired is determined using Equation 5.18. Note that, while this calculation is contained in a single equation, there are mutliple layers of summation occurring. The quantity of CRTs related to the reversal will be separately calculated for each prior reporting period, for each individual stratum, prior to summing.

Equation 5.18. Quantifying Reversals

$$\boldsymbol{Rev} = \sum_{\boldsymbol{S,RP}} \left[\boldsymbol{BE_{Rev,s,rp}} \times \frac{\boldsymbol{Area_{rev,s}}}{\boldsymbol{Area_s}} \times \left[\mathbf{1} - \left(\boldsymbol{Y_{s,rp}} \times \mathbf{0.01} \right) \right] \right]$$

Where,			Units
Rev	=	Quantity of emissions due to the reversal, summed for all affected strata, and for all previously-verified reporting periods	tCO_2e
RP	=	Total number of reporting periods for which CRTs have already been issued to the project	years
rp	=	Individual project reporting periods	
$BE_{Rev,s,rp}$	=	Baseline emissions from SSRs considered to be reversible in affected stratum *s* during reporting period *rp*	tCO_2e
$Area_{rev,s}$	=	Area of stratum *s* affected by the reversal	acres
$Area_s$	=	Total project area in stratum *s*	acres
$Y_{s,rp}$	=	Total number of years that have elapsed since the first day of the reporting period *rp*, for which CRTs were previously issued for stratum *s*	years
0.01	=	Simplified annual atmospheric impact of avoided GHG emissions in a given year	tCO_2e/tCO_2e

The quantity *Rev* must be determined for each vintage of carbon affected by a reversal. As indicated above, carbon is considered reversed in the opposite order to which the baseline carbon emissions were quantified and verified.

5.4.1 Avoidable Reversals

Requirements for avoidable reversals are as follows:

1. If an avoidable reversal is identified during annual monitoring, the Project Owner must give written notice to the Reserve within thirty days of identifying the reversal. Additionally, if the Reserve determines that an avoidable reversal has occurred, it shall deliver written notice to the Project Owner.

2. Within thirty days of receiving the avoidable reversal notice from the Reserve, the Project Owner must provide a written description and explanation of the reversal to the Reserve, including a map of the specific area that is affected.
3. Within four months of receiving the avoidable reversal notice, the Project Owner must transfer to the Reserve a quantity of CRTs from its Reserve account equal to the size of the reversal as calculated in Equation 5.18.
    a. The surrendered CRTs must be those that were issued to the grassland project, or that were issued to other grassland projects registered with the Reserve.[37] If there is not a sufficient quantity of grassland CRTs available for compensation, as determined by the Reserve, CRTs issued to a forest project registered with the Reserve are acceptable.
    b. The surrendered CRTs shall be retired by the Reserve and designated in the Reserve software as compensating for an avoidable reversal.

5.4.2 Compensating for Unavoidable Reversals

Requirements for unavoidable reversals are as follows:

1. If the Project Owner determines there has been an unavoidable reversal, it must notify the Reserve in writing of the unavoidable reversal within 30 days of identifying the reversal.
2. The Project Owner must explain the nature of the unavoidable reversal, including a map of the specific area affected, and provide an estimate of the size of the reversal using Equation 5.18.

If the Reserve determines that there has been an unavoidable reversal, it shall retire a quantity of CRTs from the Reserve Grassland Buffer Pool equal to the size of the reversal in metric tons of CO_2.

5.4.3 Contributing to the Grassland Buffer Pool

For each reporting period, the Project Owner must transfer a quantity of credits (determined by Equation 5.19) to the Reserve Grassland Buffer Pool at the time of credit issuance relative to the commitment period for the carbon secured in the reporting period. Credits that enter the buffer pool are never returned to the project directly (except as specified for credits related to $Risk_{SV}$), but instead are held in trust for the benefit of all registered grassland projects, to be used as compensation for unavoidable reversals, as described in Section 5.4.2. Equation 5.19 shall be used to calculate the buffer pool contribution for the project during the reporting period.

The risk of an unavoidable reversal to a grassland project is extremely low. Fires would not typically release the carbon that is stored underground. Catastrophic floods would typically only occur in areas that have already been screened out by the eligibility criteria. Volcanic activity is exceedingly rare in Canada, and does not occur in the areas where grassland projects typically occur. Due to the fact that the risk of unavoidable reversals is not significantly differentiated by location or land management, the Reserve has decided to adopt a default buffer pool contribution for all projects that is intended to insure against all types of unavoidable reversals.

In addition to the default contribution, projects may be obligated to make additional contributions to the buffer pool in certain situations. Where the Project Owner has elected to employ a Contract PIA, an additional contribution is required to reflect risks from financial failure; the

[37] Grassland CRTs used to compensate for reversals may come from US or Canada-based projects.

value of $Risk_{FF}$ in Equation 5.19 shall be 0.1. Where the Grassland Owner has elected to employ a Recorded PIA, and has elected to allow the PIA to be subordinated to subsequent deed restrictions (such as a mortgage), an additional contribution is required to reflect risks from financial failure. If the property owner has employed Recorded PIA Subordination Clause Type 1, the value of this risk is 0. If the property owner has employed Recorded PIA Subordination Clause Type 2, the value of this risk is 0.1.[38]

Site visits during verification are not mandatory for grassland projects. However, there is risk associated with a project that has never been visited for the purposes of a third-party verification. The Reserve believes that this risk is low enough that the site visit during verification has been made optional. However, an additional buffer pool contribution must be made to account for the increased risk (designated as "$Risk_{SV}$" in Equation 5.19). For each project that has never had a site visit during verification, the value of $Risk_{SV}$ shall be 0.05 until such time that a site visit verification occurs.[39] At that time, the CRTs contributed to the buffer pool due to this requirement shall be returned to the project in the form of either a reduced buffer pool contribution in future reporting periods or a lump sum refund of CRTs from the buffer pool, subject to agreement between the Project Owner and the Reserve. The amount of CRTs to be returned shall be determined by calculating what the buffer pool contributions would have been had the value of $Risk_{SV}$ been 0 for the previous reporting periods. If a site visit occurs during the initial verification, the value of $Risk_{SV}$ shall be 0 for the entire crediting period. This applies equally to individual projects as well as projects participating in a cooperative. For example, if a cooperative contains 10 projects and site visits occur on only 2 of them during the initial verification, the remaining 8 projects are subject to the increased buffer pool contribution, until such time that a site visit is carried out for those projects. If a project is expanded after a site visit has occurred, the value of $Risk_{SV}$ shall return to 0.05 for subsequent verifications until such time that either:

a) The project owner can demonstrate to the satisfaction of the subsequent verification body that the previous site visit was sufficiently thorough to be applied to the new project area, in whole; or,
b) Another site visit occurs at the new portion(s) of the expanded project area.

[38] The Project Implementation Agreements are available at: http://www.climateactionreserve.org/how/protocols/grassland/. Details on the buffer pool contribution related to subordination of the Recorded PIA are found in Exhibit E.
[39] The reporting period during which the site visit occurs shall be the first reporting period not subject to the additional buffer pool contribution.

Equation 5.19. Buffer Pool Contribution to Insure Against Reversals

$$BP = Risk_{rev} \times BE_{Rev}$$

Where,			Units
BP	=	Project contribution to the buffer pool. Equal to 0 where there is no permanence commitment beyond the current reporting period.	tCO_2e
$Risk_{rev}$	=	Risk of reversals, as determined below	%
BE_{Rev}	=	Baseline emissions from SSRs considered to be reversible (Equation 5.3)	tCO_2e

$$Risk_{rev} = 1 - [(1 - 0.02) \times (1 - Risk_{FF}) \times (1 - Risk_{SV})]$$

Where,			Units
0.02	=	Default risk of unavoidable reversals, applicable to all projects[40]	fraction
$Risk_{FF}$	=	Additional risk related to financial failure, the value is either 0 or 0.1, as described above.	fraction
$Risk_{SV}$	=	Risk of misstatement by projects which have not had a site visit by a third-party verifier. The value is either 0 or 0.1	fraction

As there are only three risk categories that contribute to $Risk_{rev}$, one of which is mandatory, there are six possible project scenarios, leading to four possible values for this parameter. The potential project scenarios and the resulting value of $Risk_{rev}$ are listed in Table 5.7.

Table 5.7. Possible Values of $Risk_{rev}$

Default Risk	PIA	$Risk_{FF}$	Site Visit	$Risk_{SV}$	$Risk_{rev}$
0.02	Contract PIA	0.1	Yes	0	**0.118**
0.02	Contract PIA	0.1	No	0.05	**0.162**
0.02	Recorded PIA, Type 1 Subordination Clause	0	Yes	0	**0.020**
0.02	Recorded PIA, Type 1 Subordination Clause	0	No	0.05	**0.069**
0.02	Recorded PIA, Type 2 Subordination Clause	0.1	Yes	0	**0.118**
0.02	Recorded PIA, Type 2 Subordination Clause	0.1	No	0.05	**0.162**

[40] Based on discussion between and among Reserve staff and external stakeholders regarding the risks of unavoidable reversals to grassland projects. Such risks were determined to be low, but also not zero.

6 Project Monitoring

The Reserve requires a Monitoring Plan to be established for all monitoring and reporting activities associated with the project. The Monitoring Plan serves as the basis for verifiers to confirm that the monitoring and reporting requirements in this section and Section 7 have been and continue to be met, and that consistent, rigorous monitoring and record keeping is ongoing at the project site. The Monitoring Plan must cover all aspects of monitoring and reporting contained in this protocol and must specify how data for all relevant parameters in Table 6.2 are collected and recorded.

At a minimum, the Monitoring Plan shall include a description of ownership of both the property and the emission reductions; the methods and frequency of data acquisition; a record keeping plan (see Section 7.3 for minimum record keeping requirements), and the role of individuals performing each specific monitoring activity. The Monitoring Plan should include QA/QC provisions to ensure that data acquisition and recordkeeping are carried out consistently and with precision.

Finally, the Monitoring Plan must include procedures that the Project Owner follows to ascertain and demonstrate that the project at all times passes the legal requirement test and meets regulatory compliance (Section 3.3.2 and 3.6, respectively).

Project Owners are responsible for monitoring the performance of the project.

6.1 Monitoring Land Use

The project area must be in continuous grassland cover for at least 10 years prior to the start date, as well as during each reporting period.

6.1.1 Documenting Historical Land Use

Initial carbon pools at project commencement are significantly influenced by previous land uses. Additionally, soil quality at project initiation influences nutrient inputs and farming practices in the baseline scenario. Per Section 3.1, all lands enrolled under this protocol must have been in a documented grassland or pastureland state for at least 10 years prior to project commencement. This requirement is necessary to ensure the validity of the baseline soil carbon emission factors.

The Project Owner must document that the project site meets the definition of grassland as of the project start date. This may be done through a site visit by the verifier, or through various other sources of evidence. Project Owners can use a wide variety of types of evidence, subject to review by the verifier. While the evidence is not required to be dated for each historical year, evidence must be provided that is relevant to every year that the land is asserted to have been grassland. It is easier for a verifier to confirm that the project area was in grasslands when the Project Owner provides evidence that is as specific and objective as possible. The list below contains examples of evidence that may be employed to document land use of the project area for a given period of time. For every year for which land use is being asserted, at least two different forms of evidence must be provided.

For example, if a Project Owner provides satellite data indicating grassland as the land cover on the project area for a given year, at least one additional form of documentation (such as a contract or an affidavit) is required for corroboration. Evidence cannot be corroborated by other evidence of the same type (e.g., satellite evidence cannot be corroborated by other satellite evidence). All land use evidence shall be subject to review and approval by the verifier.

Examples of evidence for current and historical land use:

- Site visit by the verifier (applies only to the relevant reporting period)
- Time-referenced photos of the project area taken during the relevant year(s) (applies to the areas that can reasonably be assessed with these photos)
- Time-referenced aerial photos taken during the relevant year(s)
- Rangeland health assessments by a 3rd party
- Satellite data products
- Contract(s) covering the relevant year(s) whose terms would require that the project area be grassland, but that would not cause the project to fail the legal requirement test (e.g., grazing leases or haying contracts)
- Tax records that indicate the land use during the relevant year(s)
- Notarized affidavit(s) from unrelated and unaffiliated parties attesting to the land use in the relevant year(s)
- Notarized affidavit from the Grassland Owner(s) attesting to the land use in the relevant year(s)
- Other official records submitted to or generated by a government agency that would indicate the land use or management during the relevant year(s)

This list is not meant to be comprehensive. The Project Owner may employ alternative approaches to monitoring land use on the project area, subject to review by the verifier. The evidence provided to satisfy this requirement must be sufficient to provide reasonable assurance as to the nature of the land use during the relevant time period. If a data viewing application, such as Google Earth, is used to access land use evidence, the Project Owner must determine and cite the primary source of the remote sensing data being used to support the assertion. The burden of proof lies with the project developer, not the verifier.

6.1.2 Documenting Current Land Use

To maintain eligibility on an ongoing basis, grassland projects must demonstrate that the project area has not been converted into another land use during the reporting period. If the project verification includes a physical site visit, that satisfies the requirements of this section. Otherwise, Project Owners shall refer to the guidance in Section 6.1.1 for guidance on documenting land use in the project area.

6.2 Monitoring Project Emission Sources

For fossil fuels and electricity emissions (Equation 5.13), if the Project Owner can demonstrate that the total value of $CO_{2,PR}$ is reasonably expected to be *de minimis* (i.e., less than the relevant materiality threshold), fuel and electricity quantities may be estimated through a conservative method proposed by the Project Owner and deemed acceptable by the verifier.

Otherwise, for each reporting period, the Project Owner must provide documentation for the following parameters used for the quantification of project emissions:

- Total acres burned and cause(s) of fire(s)
- Animal grazing days by livestock category
- Mass of fertilizer applied (other than manure from grazing), by type
- Nitrogen content of fertilizer applied, by type

- Purpose, type, and quantity of fossil fuels used (e.g., tractor, diesel, 100 liters)
- Purpose, source, and quantity of electricity (e.g., electric fence, MROW grid, 100 kWh)
- Extent of any eligible wetland area

For projects that employ additions of organic fertilizer (beyond the manure from on-site grazing of livestock), it is encouraged that a nutrient management plan be developed and implemented. Nutrient management plans should consider the principles contained in nutrient management guidance developed for use in the relevant province. Table 6.1 lists specific regulations which may apply in each province. Where a project also incorporates irrigation and/or grazing, such activities should be taken into account in developing any nutrient management plan for the project.

Table 6.1. Potentially Applicable Nutrient Management Acts, Regulations, and Guidelines by Province

Province/Territory	Potentially Applicable Regulations (at time of publication)
British Columbia	Agricultural Waste Control Regulation Organic Matter Recycling Regulation Environmental Farm Plan Environmental Management Act
Alberta	Agricultural Operation Practices Act Manure Spreading Regulations Nutrient Management Planning Guide
Saskatchewan	The Agricultural Operations Act The Agricultural Operations Regulations
Manitoba	The Pesticides and Fertilizers Control Act Water Protection Act Environmental Act Manure Regulation Nutrient Management Regulation Livestock Manure and Mortalities Management Regulation and Manure Management Plan
Ontario	Nutrient Management Act and Nutrient Management Plan
Quebec	Agricultural Operations Regulation Agri-Environmenntal Fertilisation Plan
New Brunswick	Livestock Operations Act Nutrient Management Plan

6.3 Monitoring Grazing

Livestock grazing is allowed in the project scenario, although livestock must not be managed in a confined area. While low to moderate levels of grazing intensity may have a beneficial effect on the grassland ecosystem and net soil carbon storage (16), overgrazing can be detrimental to both the storage of soil carbon (17) and the health of the grassland ecosystem (18). Project grazing must be limited to moderate levels of intensity, balancing stocking rates with forage production and accounting for site characteristics, including climate variability (especially periods of drought), range condition, slope, distance from water, and the needs of the particular animals (19) (20). Note that high stocking density alone is not necessarily indicative of overgrazing, so long as the time on the land is balanced with the stocking rate. The purpose of this section is to avoid sustained overgrazing. This is ensured through a combination of mechanisms.

Grazing must be monitored and/or limited for two specific purposes:

1. Quantification of project emissions; and,
2. Prevention of overgrazing to protect ecosystem health.

6.3.1 Monitoring Grazing for Quantification of Project Emissions

Projects must document the type of livestock being grazed and the total animal grazing days for each type (see Box 5.3). The livestock shall be categorized according to the categories in Table 5.5. These data are used for the parameter AGD_l in Equation 5.15. The frequency of monitoring and the form of the documentation is not prescribed by this protocol. The verifier shall use professional judgment to confirm with reasonable assurance that the quantification of project emissions from grazing is conservative.

Examples of documentation that may suffice to demonstrate the quantitative grazing monitoring requirements may include (this list is not comprehensive nor is it intended to define sufficiency of documentation):

- Grazing logs (kept daily, weekly, or monthly) that specify the animal categories, populations, and grazing locations
- Animal purchase and sale records, assuming all animals are grazed on the project area
- Grazing management plan, assuming maximum allowable grazing activity

6.3.2 Prevention of Overgrazing

Grassland projects must employ a mechanism to detect and prevent overgrazing on project lands, which is tailorerd to the specific conditions of their project and its ecosystem. It is up to each project developer to determine the appropriate means to safeguard the project against overgrazing. The project developer must obtain Reserve approval for the particular means they will use to ensure project land is not overgrazed. Such approval must be obtained prior to listing of the project, and any changes to the mechanism must be approved by the Reserve prior to the completion of verification activities in a given reporting period.

Potential mechanisms for the prevention of overgrazing on a grassland project (this list is not comprehensive nor is it intended to define sufficiency):

1. The presence of terms within the LCA which would be violated in the event of significant overgrazing of the project area, and which are regularly monitored and able to be enforced by the holder of the LCA. This could take the form of explicit quantitative or qualitative limits on grazing activity, or implicit limits, such as through terms requiring the maintenance of specific conservation values; or,
2. The development and adherence to a prescribed grazing management plan, developed to a recognized government or industry standard for long-term grazing management[41] and with the assistance of an appropriately trained expert. The management plan should specifically identify the protection of existing soil carbon pools as a management goal. Adherence to the plan should be reviewed and confirmed by a relevant expert at least once every six years following its initial implementation. In years without a government or professional review of adherence to the prescribed grazing management plan, the verifier shall take additional steps to assess the risk of nonconformance. This plan shall

[41] One suggested reference for this requirement is the Beef Cattle Research Council's Grazing Management planning materials, available at https://www.beefresearch.ca/research-topic.cfm/grazing-management-48. Additional materials are available at https://www.beefresearch.ca/research/forage-grasslands.cfm.

be updated to reflect any significant changes to the grazing management practices. It may be possible for the project to receive funding to implement a prescribed grazing management plan. A pre-existing grazing management plan does not violate the legal requirement test.

3. Use of the mechanism employed under Section 6.4 for monitoring ecosystem health during the relevant reporting period.

The mechanism in question should include requirements for monitoring and enforcement, as well identify the entity or entities that are responsible for such enforcement. The entity empowered to enforce this mechanism must be an entity (or entities) other than the Reserve or project verifier, and can be a third-party not directly a party to the offset project (e.g., the easement holder, in certain cases). Project developers shall include in their monitoring plan full details of the administrative mechanism they are employing to safeguard against over-grazing.

Project developers shall include in their monitoring report a description of grazing activity for the reporting period and whether this conforms to the mechanism in place to guard against overgrazing. As relevant, written confirmation from the entity or entities providing oversight with respect to this mechanism should be provided to the verifier. The verifier shall use professional judgment to confirm with reasonable assurance that effective monitoring of grazing has been maintained in accordance with this mechanism to prevent overgrazing and that no overgrazing has been detected using this mechanism.

CRTs will not be issued for any reporting period during which it is determined that there has been a violation of the mechanism to prevent overgrazing. In addition, the Reserve may conduct additional review to confirm that a reversal has not occurred due to overgrazing.

6.4 Monitoring Ecosystem Health

As described in Section 3.7, grassland projects are subject to forces, both natural and cultural, active and passive, that could impair the long-term health and functioning of the rangeland system. Thus, it is required that projects undergo a periodic assessment of ecosystem health. The exact form and procedure for this assessment is not prescribed by this protocol, but the approach to be employed by a project must be reviewed and approved by the Reserve prior to verification. An ecosystem health assessment must be submitted for review during one of the first two project verifications. Subsequent assessments may occur as frequently as desired by the Project Owner, with a minimum frequency of once every six years.[42] These assessments are only required during the crediting period, and are not required during the permanence period, although it is strongly recommended that the practice be continued on a voluntary basis.

The goal of the ecosystem health assessment is to identify management activities that could imperil the stability of the belowground organic carbon on the project area without necessarily causing a single disturbance event that would be readily identified. In other words, the assessments are a long-term view of land management, meant to identify degradation that occurs over a long period of time. Project developers should propose an approach to monitoring ecosystem health that expressly satisfies this goal.

[42] The result of this schedule is that if a project elects to follow the most relaxed verification schedule (once every six years), there will be at least one rangeland health assessment during every verification period.

Potential options for complying with this requirement include (this list is not comprehensive nor is it intended to define sufficiency):

1. Use of the Rangeland Health Assessment Protocol developed by Alberta Environment and Parks (AEP)[43]; or,
2. Use of an alternative assessment protocol which employs a robust sampling design which avoids or reduces bias in the selection of sample plots, assesses widely recognized metrics for ecosystem health, is/was developed with input from relevant experts, and is applied consistently over time; or,
3. Use of advanced remote sensing techniques, coupled with a clear, scientific evidence to support their use for this purpose. Such remote sensing must be of a sufficiently high resolution to detect ecosystem degradation at a scale which would be obvious from direct observation.

6.5 Monitoring Project Cooperatives

There can be gains in efficiency through centralized monitoring for project cooperatives. A Cooperative Developer may organize their monitoring plan such that information from individual projects is collected and processed together. However, all information and documentation must be organized in such a manner that the verifier can assess that the requirements of this protocol have been met for each individual project. For example, it is acceptable to submit a single spreadsheet of grazing data for the cooperative, but the grazing data for each individual project must still be clearly defined within that spreadsheet.

6.6 Monitoring Parameters

Prescribed monitoring parameters necessary to calculate baseline and project emissions are provided in Table 6.2.

Table 6.2. Grassland Project Monitoring Parameters

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
General Project Parameters						
	Project Definition	Must confirm project land use has not changed		R, O	Each reporting period	Information used to asses that the project area remains as grassland.
	Eligibility	Must satisfy all requirements of the Eligibility section		N/A	Each reporting period	Information used to assess satisfaction of the requirements of Section 3.

[43] The assessment protocol is available online at: https://open.alberta.ca/publications/9780778582090.

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
	Regulations	Project Owner attestation of compliance with regulatory requirements relating to the project	All applicable regulations	N/A	Each reporting period	Information used to: 1) Demonstrate ability to meet the legal requirement test – where regulation would prevent conversion of project area. 2) Demonstrate compliance with associated environmental rules, e.g., criteria pollutant limits.
Equation 5.7, Equation 5.8	S	Total number of strata relevant to the project area	strata	R	Once[44]	Information used to determine acres assigned to each relevant stratum.
Equation 5.1	ER	Emission reductions	tCO_2e	C	Per reporting period	Emission reductions are quantified once per reporting period per project. May be summed for reporting of a project cooperative.
Equation 5.7, Equation 5.8 Equation 5.9	$Area_s$	Area of project in stratum *s*	acres	M	Once	The area of each stratum is measured using GIS.
Baseline Emission Calculation Parameters						
Equation 5.1, Equation 5.3, Equation 5.17	BE	Baseline emissions	tCO_2e	C	Per reporting period	Calculated based on default factors.
Equation 5.2 Equation 5.3	BE_{Rev}	Baseline emissions from SSRs considered to be reversible	tCO_2e	C	Per reporting period	Calculated based on default factors.

[44] This parameter would only change if a portion of the project area was subsequently removed from the project and excluded from future quantification.

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
Equation 5.2 Equation 5.4	BE_{NonRev}	Baseline Emissions from SSRs Not Considered to be Reversible	tCO_2e	C	Per reporting period	Calculated for each stratum using default emission factors.
Equation 5.2 Equation 5.5	$OC_{BL,TTA}$	Baseline emissions due to loss of organic carbon in soil and biomass, accounted on a tonne-tonne basis	tCO_2e	C	Per reporting period	Calculated for each stratum using default emission factors.
Equation 5.3 Equation 5.6	$OC_{BL,TYA}$	Baseline emissions due to loss of organic carbon in soil and biomass, accounted on a tonne-year basis	tCO_2e	C	Per reporting period	Calculated for each stratum using default emission factors.
Equation 5.3, Equation 5.18	DF_{σ}	Discount factor for the uncertainty of modeling future management practices and climatic conditions	%	R	Per reporting period	The value of this uncertainty is related to the amount of time that has passed since the baseline modeling was completed.
Equation 5.3, Equation 5.10, Equation 5.18	DF_{conv}	Discount factor for the uncertainty of conversion	%	R	Once	The value of this uncertainty is based on the performance standard test.
Equation 5.3	Pro	Pro-rating factor	%	C	Per reporting period	For reporting periods which do not cover an entire year
Equation 5.3, Equation 5.8	N_2O_{BL}	Baseline emissions of nitrous oxide	tCO_2e	C	Per reporting period	Calculated for each stratum using default emission factors.
Equation 5.3, Equation 5.9	$CO_{2,BL}$	Baseline emissions of carbon dioxide	tCO_2e	C	Per reporting period	Calculated for each stratum using default consumption rates.
Equation 5.3, Equation 5.7, Equation 5.19	OC_{BL}	Baseline emissions due to loss of organic carbon from soil and belowground biomass	tCO_2e	C	Per reporting period	Calculated for each stratum using default emission factors.

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
Equation 5.6	$OC_{BLp,n}$	Baseline Organic Carbon Emissions, Accounted on a Tonne-Year Basis (TYA)	tCO_2e	C	Per reporting period	Calculated each reporting period
Equation 5.6	$YR_{p,n}$	Length of time since the initiation of the Reporting Period in which the additional carbon was sequestered,	Years	C	Per reporting period	Ror each Reporting Period in which additional carbon was preserved
Equation 5.6	CL	Length of contractual agreement into future from current Reporting Period that secures all preserved carbon	Years	C	Per reporting period	Ror each Reporting Period in which additional carbon was preserved
Equation 5.6	$POC_{BL\ TYA\ p,n}$	Previous baseline quantity of organic carbon emissions from soil and belowground biomass under tonne-year accounting	tCO_2e	C	Per Reporting Period	For each past Reporting Period in which credits were issued
Equation 5.7	n	Number of strata	-	C	Once, updated if project area changes	Information used to calculate total project baseline emissions
Equation 5.2	Rd	Number of reporting days in the reporting year	days	C	Per reporting period	For reporting periods that do not cover an entire year
Equation 5.7	CP	Cropland premium for the project site	%	C	Once	The appraisal must meet standard requirements
Equation 5.7	$BEF_{OC,s,}$	Annual baseline emission factor for organic carbon	kg CO_2e/ac/yr	R	Per reporting period	Default factor based on stratum.
Equation 5.8	$BEF_{N2O,s}$	Annual baseline emission factor for N_2O emissions in stratum *s*	kg N_2O/ac/yr	R	Per reporting period	Default factor based on stratum.

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
Equation 5.9	$BEF_{Cfert,s}$	Annual baseline rate of CO_2 emissions related to fertilizer use for stratum *s*	gal/ha/yr	R	Per Reporting period	Default factor based on stratum.
Equation 5.9	BRC_{CO2}	Annual baseline rate of consumption of diesel fuel due to cultivation activities	gal/ac/yr	R	Per reporting period	Default consumption rate based on stratum.
Equation 5.9	EF_{FF}	Emission factor for diesel fuel	kg CO_2/gal	R	Per reporting period	Default value for all projects.
Project Emission Calculation Parameters						
Equation 5.11	PE	Project emissions	tCO_2e	C	Per reporting period	Actual emissions in the project area during the reporting period.
Equation 5.11, Equation 5.12	BU_{PR}	Emissions from burning in the project scenario	tCO_2e	C	Per reporting period	Calculated only in the case of a fire during the reporting period.
Equation 5.11, Equation 5.13	FF_{PR}	Emissions from fossil fuels and electricity in the project scenario	tCO_2e	C	Per reporting period	Calculated only if fossil fuels or electricity are used for the project during the reporting period.
Equation 5.11, Equation 5.14	FE_{PR}	Emissions from fertilizer use in the project scenario	tCO_2e	C	Per reporting period	Calculated only if fertilizer is applied on the project area during the reporting period.
Equation 5.11, Equation 5.15	GR_{PR}	Emissions from livestock grazing in the project scenario	tCO_2e	C	Per reporting period	Calculated only if livestock grazing occurs on the project area during the reporting period.
Equation 5.11 Equation 5.16	WE_{PR}	Emissions from wetland soils	tCO_2e	C	Per reporting period	Calculated only if the project contains eligible wetland areas
Equation 5.11, Equation 5.17	LE	Emissions from leakage in the project scenario	tCO_2e	C	Per reporting period	Based on a default factor for leakage.
Equation 5.12	$Area_{burn,s}$	Area of stratum *s* that was burned	acres	O	Per fire event	Estimated through either remote sensing or on-site measurement.

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
Equation 5.12	DM_s	Amount of aboveground dry matter in stratum *s*	kg/ac	R	Per reporting period	Default factor based on stratum.
Equation 5.9	FC	Emissions from fuel combustion in the project	tCO_2e	C	Per reporting period	Estimated using project data and emission factors from Table 5.4
Equation 5.13	EU	Emissions from electricity use in the project	tCO_2e	C	Per reporting period	Estimated using project data and emission factors from Table 5.4
Equation 5.13	Vol_f	Volume of fuel f consumed by the project during the reporting period	1000 L	O	Per Reporting Period	Includes fossil fuels consumed for any activities on the project area.
Equation 5.9	$EF_{f,CO2}$	CO_2 emission factor for combustion of fuel type f	1000 L	R	Per reporting period	Default factor obtained from Canada's National Inventory Report. To be referenced from Table 5.4
Equation 5.9	$EF_{f,CH4}$	CH_4 emission factor for combustion of fuel type f	1000 L	R	Per reporting period	Default factor obtained from Canada's National Inventory Report. To be referenced from Table 5.4
Equation 5.9	$EF_{f,N2O}$	N_2O emission factor for combustion of fuel type f	1000 L	R	Per reporting period	Default factor obtained from Canada's National Inventory Report. To be referenced from Table 5.4
Equation 5.13	E	Quantity of electricity consumed during the reporting period	MWh	O	Per reporting period	Includes any electricity consumed on the project area.
Equation 5.13	$EF_{E,CO2}$	Provincial CO_2 emission factor for electricity	kg CO_2/MWh	R	Per reporting period	Default factor obtained from Canada's National Inventory Report. To be referenced from Table 5.4

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
Equation 5.13	$EF_{E,CH4}$	Provincial CH_4 emission factor for electricity	kg CH_4/MWh	R	Per reporting period	Default factor obtained from Canada's National Inventory Report. To be referenced from Table 5.4
Equation 5.13	$EF_{E,N2O}$	N_2O emission factor for electricity	kg N_2O/MWh	R	Per reporting period	Default factor obtained from Canada's National Inventory Report. To be referenced from Table 5.4
Equation 5.14	C	Types of fertilizer applied, other than manure from grazing livestock	Categories	O	Per reporting period	Does not include manure from grazing livestock; Must be documented if fertilizer is applied on the project area during the reporting period.
Equation 5.14	QF_{PR}	Quantity of fertilizer type *c* applied	kg	O	Per reporting period	Must be documented if fertilizer is applied on the project area during the reporting period.
Equation 5.14	NC_c	Nitrogen content of fertilizer type *c*	kg N/kg fertilizer	O	Per reporting period	Must be documented if fertilizer is applied on the project area during the reporting period.
Equation 5.14	$PEF_{Fert,c}$	N2O emission factor for fertilizer		R	Per reporting period	Default factors are presented for both synthetic and organic sources of fertilizer
Equation 5.15	N_2O_{MN}	N_2O emissions from livestock grazing	tCO_2e	C	Per reporting period	Based on AGD for each livestock category using default emission factors.
Equation 5.15	$CH_{4,MN}$	CH_4 emissions from manure	tCO_2e	C	Per reporting period	Based on AGD for each livestock category using default emission factors.
Equation 5.15	$CH_{4,ENT}$	CH_4 emissions from enteric fermentation	tCO_2e	C	Per reporting period	Based on AGD for each livestock category using default emission factors.

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
Equation 5.15	L	Total number of livestock categories	Categories	O	Per reporting period	Documented for every reporting period where livestock are grazed on the project area.
Equation 5.15	AGD_l	Animal grazing days for livestock category *l*	Animal days	O	Per reporting period	Documented for every reporting period where livestock are grazed on the project area.
Equation 5.15	Nex_l	Nitrogen excreted by animals in livestock category *l*	kg N/animal grazing day	R	Per reporting period	Default factors based on livestock category and project location
Equation 5.15	$PEF_{N2O,d}$	Default provincial emission factor representing the direct N_2O emissions from manure deposited by grazing animals during the reporting period	g N_2O/kg N	R	Per reporting period	Default factors based on the project province
Equation 5.15	$PEF_{N2O,vol}$	Default provincial emission factor representing the volatilized N_2O emissions from manure	g N_2O/kg N	R	Per reporting period	Default factors based on the project province
Equation 5.15	$PEF_{N2O,leach}$	Default provincial emission factor representing the leached N_2O emissions from manure	g N_2O/kg N	R	Per reporting period	Default factors based on the project province
Equation 5.15	$PEF_{mn,l}$	Default CH_4 emission factor for manure excreted by grazing animals of category *l* during the reporting period	g CH_4/head/day	R	Per reporting period	Default factors based on livestock category and project location
Equation 5.15	$PEF_{ENT,l}$	Project emission factor for enteric methane emissions from livestock category *l*	g CH_4/head	R	Per reporting period	Default factors based on livestock category and project state.

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
Equation 5.18	Rev	Quantity of emissions due to a reversal	tCO_2e	C	Per reversal event	Any event, avoidable or unavoidable, which causes a loss of belowground organic carbon results in a reversal of CRTs which have been issued. Reversals must be quantified and compensated for.
Equation 5.18	RP	Total number of reporting periods for which CRTs have already been issued to the project	Years	C	Per reversal event	Number of reporting periods previous to the reporting period when the reversal event happened
Equation 5.18	rp	Individual project reporting periods	-	C	Per reversal event	Each reporting period previous to the reporting period when the reversal event happened
Equation 5.18	$BE_{Rev,s,rp}$	Baseline emissions from SSRs considered to be reversible in affected stratum *s* during reporting period *rp*	tCO_2e	C	Per reversal event	Calculated for each reporting period previous to the reporting period when the reversal event happened
Equation 5.18	$Area_{rev,s}$	Area of stratum *s* affected by the reversal	acres	M	Per reversal event	Estimated through either remote sensing or on-site measurement.
Equation 5.18	$Y_{s,rp}$	Total number of years that have elapsed since the first day of the reporting period *rp*, for which CRTs were previously issued for stratum *s*	years	O	Per reversal event	The magnitude of a reversal is related to the affected area and the number of CRTs which have already been issued in each previous reporting period
Equation 5.19	BP	Buffer pool contribution	tCO_2e	C	Per reporting period	Based on risk rating for the project.
Equation 5.19	$Risk_{rev}$	Risk of unavoidable reversals	%	C	Per reporting period	Includes a default risk plus additional project-specific risks.

Eq. #	Parameter	Description	Data Unit	Calculated (C) Measured (M) Reference (R) Operating Records (O)	Measurement Frequency	Comment
Equation 5.19	$Risk_{FF}$	Risk related to financial failure	%	R	Once, unless the PIA is updated to change the subordination clause	The value is determined based on the specific subordination clause that is included in the PIA. Details can be found in Exhibit E of the PIA.
Equation 5.19	$Risk_{SV}$	Risk related to site visit schedule	%	R	Per reporting period	The value is determined based on whether the project or cooperative adheres to the recommended minimum site visit schedule.
Multiple	GWP_{CH4}	Global warming potential for CH_4	unitless	R	Per reporting period	Alberta Carbon Offset Emission Factors Handbook
Multiple	GWP_{N2O}	Global warming potential for N_2O	unitless	R	Per reporting period	Alberta Carbon Offset Emission Factors Handbook

7 Reporting Parameters

This section provides requirements and guidance on reporting rules and procedures. A priority of the Reserve is to facilitate consistent and transparent information disclosure across projects.

7.1 Time Periods for Reporting

Table 7.1 summarizes the various time periods that are relevant to AGC projects. Project Owners should recognize that recurring periods (such as reporting periods or verification periods) must always be contiguous, such that there are no gaps between recurring periods. CRTs can only be issued upon approval of a verification report by the Reserve.

Table 7.1. Guide to Relevant Time Periods for Grassland Projects

Description	Time Period	Protocol Section
Project lifetime	Up to 130 years	2.2
LCA term	Perpetual	2.2
Pre-project land use history	No less than 10 years prior to project start date	2.2
Crediting period	No more than 30 years following project start date	3.4
Reporting period (first)	No more than 24 months	7.4
Reporting period (subsequent)	No more than 12 months	7.4
Verification period (first)	First reporting period	7.4
Verification period (subsequent)	No more than 6 reporting periods	7.4
Permanence period	100 years following crediting period	3.5
Monitoring period (LCA enforcement)	No more than 6 years	7.5.1
Monitoring period (outside of LCA enforcement)	No more than 3 years	7.5.2
Verification period (outside of LCA enforcement)	No more than 15 years	7.5.2

7.2 Project Documentation

Project Owners must provide the following documentation to the Reserve in order to register a grassland project:

- Project Submittal form (or Cooperative Submittal form)*
- Property ownership documentation*
- Project Land Conservation Agreement
- Project Implementation Agreement
- Project area map (this map is public; it is only required to show the outer extent of the project area and is not required to be in a georeferenced format)*
- Signed Attestation of Title form
- Signed Attestation of Voluntary Implementation form
- Signed Attestation of Regulatory Compliance form
- Verification Report
- Verification Statement

** Denotes items that are required at the time of project submittal.*

Project Owners must provide the following documentation for each verification period during the crediting period in order for the Reserve to issue CRTs for quantified GHG reductions:

- Verification Report
- Verification Statement
- Signed Attestation of Title form
- Signed Attestation of Voluntary Implementation form
- Signed Attestation of Regulatory Compliance form
- Signed Project Implementation Agreement (for the initial verification) or signed, amended Project Implementation Agreement (for subsequent verifications)
- Georeferenced project boundary map (this map is private; it must delineate the actual polygons of the eligible project area, and must be a shapefile or KML format)

Documentation requirements for the Permanence Period are explained in Section 7.5.

At a minimum, the above project documentation (except as noted) is available to the public via the Reserve's online registry. Further disclosure and other documentation may be made available on a voluntary basis through the Reserve. Project submittal forms can be found at http://www.climateactionreserve.org/how/program/documents/.

7.3 Record Keeping

For purposes of independent verification and historical documentation, Project Owners are required to keep all information outlined in this protocol for a period of 10 years after the information is generated or 7 years after the last verification. This information is not publicly available, but may be requested by the verifier or the Reserve.

System information the Project Owner shall retain includes:

- Detailed, georeferenced project maps (created per guidance in Section 2.2.1)
- Ongoing monitoring reports or documentation related to the Land Conservation Agreement
- All data inputs for the calculation of the project emission reductions, including all required sampled data
- Documentation of the continued conservation of the grassland cover in the project area (see Section 6.1)
- Copies of all permits, Notices of Violations, and any relevant administrative or legal consent orders dating back at least 3 years prior to the project start date
- Executed Attestation of Title, Attestation of Regulatory Compliance, and Attestation of Voluntary Implementation forms
- Onsite fossil fuel use records, if applicable
- Onsite grid electricity use records, if applicable
- Grazing management plan, if applicable
- Nutrient management plan, if applicable
- Grazing management records
- Fertilizer use records, if applicable
- Documentation of fires, if applicable
- Results of annual CO_2e reduction calculations
- Initial and annual verification records and results
- Documentation of any reversals and parameters needed to quantify reversals

7.4 Reporting Period and Verification Cycle

The reporting period is the length of time over which GHG emission reductions from project activities are quantified. Project Owners must report GHG reductions resulting from project activities during each reporting period. A reporting period may not exceed 12 months in length, except for the initial reporting period, which may cover up to 24 months. The Reserve accepts verified emission reduction reports on a sub-annual basis, should the Project Owner choose to have a sub-annual reporting period and verification schedule (e.g., monthly, quarterly, or semi-annually). However, it is recommended that projects follow a calendar year reporting schedule to simplify the application of the quantification and monitoring requirements. Reporting periods must be contiguous; there must be no gaps in reporting during the crediting period of a project once the first reporting period has commenced. If a project area is expanded after the initial verification, the earliest date when the Project Owner can claim title to the emission reductions shall mark the beginning of a new reporting period.

The verification period is the length of time over which GHG emission reductions from project activities are verified. The initial verification period for a grassland project is limited to one reporting period. Subsequent verification periods may cover up to six reporting periods. It is required that a project verification occur at least every six years during a project's crediting period. CRTs will not be issued for reporting periods that have not been verified. Project Owners may choose to verify more frequently than every six reporting periods. For any reporting period that ends prior to the end of the verification period (i.e., years 1-5 of a 6 year verification period), an interim monitoring report must be submitted to the Reserve no later than 90 days following the end of the relevant reporting period. The interim monitoring report shall contain a summary of ownership (describing the entities and relationships detailed in Section 2.3), evidence of land use (as described in Section 5.1.3), and basic documentation of land management activities and project emissions during the relevant reporting period.[45] See Section 7.5 for guidance on reporting and verification activities after the crediting period is concluded.

To meet the verification deadline, the Project Owner must have the required verification documentation (see Section 7.2) submitted within 12 months of the end of the verification period. The end date of any verification period must correspond to the end date of a reporting period. No more than six reporting periods (a maximum of 72 months) can be verified at once during the project's crediting period.

7.5 Reporting and Verification of Permanence

When the crediting period for a grassland project ends, the project enters the permanence period. Per Section 3.5, the project area must be monitored to ensure against reversals for a period of 100 years following the last issuance of CRTs related to carbon pools at the project site (i.e., soil organic carbon). During the permanence period, no emission reductions are claimed and no new credits are issued. Projects may elect to begin the permanence period prior to the end of their maximum allowable crediting period by notifying the Reserve in writing prior to their next reporting deadline. This monitoring can take different forms depending on the terms of the LCA which binds the project area. In any case, monitoring must continue through the permanence period to confirm that no reversals have occurred, and the results of this monitoring must be reported to the Reserve periodically. There are two categories of monitoring scenarios: projects may either be monitored as part of their LCA monitoring activities, or they may be monitored specifically for the carbon project. In both cases, the required periodic monitoring reports shall, at a minimum, contain the following:

[45] A template monitoring report is available at: http://www.climateactionreserve.org/how/program/documents/.

- Evidence to support the conclusion that no reversals have occurred on the project area since the previous reported time period
- Information related to ongoing activities on the site, including grazing
- Updated information related to ownership of the property, the LCA, and the rights to the soil carbon

In certain cases (see Section 7.5.1) these reports are not required to be verified, but in all cases they must be reviewed and approved by the Reserve in order for the terms of the PIA to be satisfied. Project emissions are not quantified during the permanence period. If a reversal is identified, it must be reported to the Reserve and the guidance in Section 5.4 regarding compensation for reversals shall apply.

7.5.1 Monitoring Through Land Conservation Agreement Activities

If a project area is subject to the terms of a Qualified Land Conservation Agreement (Section 3.5.3) which includes provisions for ongoing monitoring and specific mechanisms for enforcement, such monitoring activities may be considered sufficient for the purposes of this protocol. The Project Owner must submit a monitoring report at least every six years (i.e., this report is due no later than 72 months after the end date of the previous verification or monitoring period, whichever is relevant). The Reserve maintains the right to determine whether the terms of a LCA are sufficient to meet the requirements of this section. A LCA may be amended at any time to meet these requirements, subject to approval by the Reserve. If the monitoring is not carried out according to the terms of the LCA or the monitoring reports are not received by the Reserve, the Project Owner may be in breach of the PIA.

7.5.2 Monitoring for Carbon Separately

If the LCA does not contain monitoring and enforcement terms that satisfy Section 7.5.1, the Project Owner must continue monitoring and reporting activities through other means. Projects must prepare and submit a monitoring report to the Reserve at least every 3 years (i.e., this report is due no later than 36 months after the end date of the previous verification or monitoring period, whichever is relevant). These monitoring reports shall be verified at least every fifteen years, although verification may be more frequent. The verification deadlines described in Section 7.4 shall apply.

7.6 Joint Reporting of Project Cooperatives

Project cooperatives carry out a certain amount of joint effort for reporting. While the quantification section shall be applied to each project independently, the results may be collected and reported together to the Reserve by the Cooperative Developer. Reports and documentation may be combined for efficiency, but it must be possible to trace the evidence for the emission reductions from each individual project.

In the management of a cooperative, certain documents are required to be submitted for each individual project, while certain other documents may be submitted once for the entire cooperative. Table 7.2 details which documents belong to which category. The Cooperative Developer shall submit all documentation through their Reserve account. Once the verification report is registered, CRTs shall be issued to the Project Owner account associated with each project in the cooperative.

Table 7.2. Document Management for Project Cooperatives

May Apply to the Cooperative	Must be Submitted for Each Individual Project[46]
▪ Cooperative Submittal form ▪ Verification Report ▪ Verification Statement	▪ Property ownership documentation ▪ Attestation of Title form ▪ Attestation of Voluntary Implementation form ▪ Attestation of Regulatory Compliance form ▪ Project maps

7.6.1 Cooperative Verification Cycle

The verification period for the entire cooperative must end on the same date, unless a project reaches the end of its crediting period during the verification period. In that case, it is acceptable for that project to end reporting prior to the end of the cooperative's verification period. However, during a project's first verification as a member of a cooperative, it may begin reporting at a date that is different from other projects in the cooperative. It is likely that each project in a cooperative has a different start date, and thus during the initial verification for a cooperative each project begins reporting on a different date. The initial verification period shall cover a single reporting period, and the initial reporting period may be up to 24 months in length. Although the individual projects begin their reporting periods on different dates, they shall all end on the same date, such that subsequent verifications of the cooperative will cover the same length of time for every project. When a project joins a cooperative that has already undergone verification, that project's next reporting period must not begin prior to the end of the cooperative's previous verification period, but it may begin at a date that is later than the beginning of the cooperative's next reporting period. Table 7.3 describes various cooperative scenarios and the resultant outcomes for their respective verification cycles.

If an individual project within a cooperative is unable to meet the requirements of this protocol for one or more reporting periods, that project may report zero credits for that time period and continue to be verified as part of the cooperative. For reporting periods where a project claims zero credits, the verifier shall confirm that project emissions were not greater than baseline emissions, and that no reversals occurred. Additional guidance regarding Zero-Credit Reporting Periods can be found in the Reserve Program Manual.[47]

Table 7.3. Example Cooperative Verification Scenarios

Example Scenario	Resulting Verification Cycle
1. Cooperative X contains two projects: Project A has a start date of 1/1/15 and Project B has a start date of 7/22/15.	The initial verification period for the cooperative would cover 1/1/15 – 12/31/16. Project A would report for the entire period, while Project B would report only for 7/22/15 – 12/31/16.
2. Project C wishes to join Cooperative X. Project C has a start date of 5/9/17.	The next reporting period for the cooperative is 1/1/17 – 12/31/17. The first reporting period for Project C would be 5/9/17 – 12/31/17.

[46] These documents for individual projects may be electronically combined into a single PDF (e.g., one digital file may contain the individual Attestation of Title forms for every project in the cooperative).
[47] Available at: http://www.climateactionreserve.org/how/program/program-manual/.

Example Scenario	Resulting Verification Cycle
3. Project D wishes to join Cooperative X. Project D has a start date of 1/1/16 and has not yet gone through verification.	There are two options: *Option i*: The project may undergo verification as a standalone project for the period 1/1/16 – 12/31/16, then subsequently join the cooperative for future reporting. *Option ii*: The project may join the cooperative immediately, taking a Zero-Credit Reporting Period for 1/1/16 – 12/31/16, and begin reporting on 1/1/17 with the cooperative's next verification period.
4. Project E wishes to transfer into Cooperative X from another, different cooperative, which has already undergone verification. The last verification period for Project E ended on 6/30/16.	There are two options: *Option i*: The project may undergo verification as a standalone project for the period 7/1/16 – 12/31/16, then subsequently join the cooperative for future reporting. *Option ii*: The project may join the cooperative immediately, taking a Zero-Credit Reporting Period for 7/1/16 – 12/31/16, and begin reporting on 1/1/17 with the cooperative's next verification period.

8 Verification Guidance

This section provides verification bodies with guidance on verifying GHG emission reductions associated with the project activity. This verification guidance supplements the Reserve's Verification Program Manual and describes verification activities specifically related to grassland projects.

Verification bodies trained to verify grassland projects must be familiar with the following documents:

- Climate Action Reserve Program Manual
- Climate Action Reserve Verification Program Manual
- Climate Action Reserve Grassland Project Protocol

The Reserve's Program Manual, Verification Program Manual, and project protocols are designed to be compatible with each other and are available on the Reserve's website at http://www.climateactionreserve.org.

Only ANSI-accredited verification bodies trained by the Reserve for this project type are eligible to verify grassland project reports. Verification bodies approved under other project protocol types are not permitted to verify grassland projects.[48]

8.1 Joint Verification of Project Cooperatives

Projects that participate in a project cooperative are verified together for every verification period. The Cooperative Developer has their own account on the Reserve through which they submit all documentation related to the cooperative. One set of verification documentation shall be submitted for the entire cooperative, but the project-specific attestations must be executed by the Project Owner for each project.

If the verifier cannot reach a positive verification opinion for one or more projects within a cooperative, the verification may still be completed, and emission reductions registered for the projects for which the verifier can reach a positive opinion. However, the verification of the cooperative as a whole cannot be approved by the Reserve unless an opinion is rendered on every project within the cooperative.

8.2 Standard of Verification

The Reserve's standard of verification for grassland projects is the Canada Grassland Project Protocol (this document), the Reserve Program Manual, and the Verification Program Manual. To verify a grassland project report, verification bodies apply the guidance in the Verification Program Manual and this section of the protocol to the standards described in Sections 2 through 7 of this protocol. Sections 2 through 7 provide eligibility rules, methods to calculate emission reductions, performance monitoring instructions and requirements, and procedures for reporting project information to the Reserve.

[48] Information about verification body accreditation and Reserve project verification training can be found on the Reserve website at http://www.climateactionreserve.org/how/verification/.

8.3 Monitoring Plan

The Monitoring Plan serves as the basis for verification bodies to confirm that the monitoring and reporting requirements in Section 6 and Section 7 have been met, and that consistent, rigorous monitoring and record keeping are ongoing at the project site. Verification bodies shall confirm that the Monitoring Plan covers all aspects of monitoring and reporting contained in this protocol and specifies how data for all relevant parameters in Table 6.2 are collected and recorded.

8.4 Verifying Project Eligibility

Verification bodies must affirm a grassland project's eligibility according to the rules described in this protocol. The table below outlines the eligibility criteria for grassland projects. This table does not present all criteria for determining eligibility comprehensively; verification bodies must also look to Section 3 and the verification items list in Table 8.2.

Table 8.1. Summary of Eligibility Criteria for a Grassland Project

Eligibility Rule	Eligibility Criteria	Frequency of Rule Application
Start Date	Projects must be submitted for listing no more than 12 months after the project start date, unless the project was submitted for listing prior to October 16, 2020	Once during first verification
Start Date	Recordation of a Land Conservation Agreement, submittal of the project to the Reserve, or execution of a notarized contract	Once during first verification
Location	Canada	Once during first verification
Location	Project strata must have a positive baseline emission factor for soil organic carbon during the reporting period	Every verification
Performance Standard	Project area must pass the financial threshold at the time of project submittal	Once during first verification
Performance Standard	Project area must pass the suitability threshold	Once during first verification
Legal Requirement Test	Signed Attestation of Voluntary Implementation form and monitoring procedures for ascertaining and demonstrating that the project passes the legal requirement test	Every verification
Credit and Payment Stacking	Projects must meet credit and payment stacking requirements and disclose all credits or payments received in relation to the project area	Every verification
Regulatory Compliance Test	Signed Attestation of Regulatory Compliance form and disclosure of all non-compliance events to verifier; project must be in material compliance with all applicable laws	Every verification
Project Implementation Agreement (tonne-tonne accounting)	The Project Owner must execute a PIA with the Reserve prior to the initial registration, and sign an amended PIA prior to each subsequent registration	Every verification

8.5 Core Verification Activities

The Grassland Project Protocol provides explicit requirements and guidance for quantifying the GHG reductions associated with the avoided conversion of grasslands to croplands. The Verification Program Manual describes the core verification activities that shall be performed by verification bodies for all project verifications. They are summarized below in the context of a grassland project, but verification bodies must also follow the general guidance in the Verification Program Manual.

Verification is a risk assessment and data sampling effort designed to ensure that the risk of reporting error is assessed and addressed through appropriate sampling, testing, and review. The three core verification activities are:

1. Identifying emission sources, sinks, and reservoirs (SSRs)
2. Reviewing GHG management systems and estimation methodologies
3. Verifying emission reduction estimates

Identifying emission sources, sinks, and reservoirs
The verification body reviews for completeness the sources, sinks, and reservoirs identified for a project, based on the guidance in Section 4.

Reviewing GHG management systems and estimation methodologies
The verification body reviews and assesses the appropriateness of the methodologies and management systems that the grassland Project Owner uses to gather data and calculate baseline and project emissions, based on the guidance in Sections 5 and 6.

Verifying emission reduction estimates
The verification body further investigates areas that have the greatest potential for material misstatements and then confirms whether or not material misstatements have occurred. This may involve site visits to the project area (or areas if verifying a project cooperative) to ensure the activities on the ground correspond to and are consistent with data provided to the verification body. In addition, the verification body recalculates a representative sample of the performance or emissions data for comparison with data reported by the Project Owner in order to double-check the calculations of GHG emission reductions.

8.5.1 Site Visits

Site visits during verification are strongly recommended, but are not mandatory for grassland projects. However, there is risk associated with a project that has never been visited for the purposes of a third-party verification. This risk is related to the lack of direct, physical inspection of the project area and personal, face-to-face interaction with the project participants, which are valuable components of typical offset project verification activities. The Reserve believes that this risk is low enough in the case of grassland projects that the site visit during verification has been made optional. However, an additional buffer pool contribution must be made to account for the increased risk for those projects which forego a site visit verification. Section 5.4.3 details how this contribution is determined. Although the site visit is optional, it may be carried out at the discretion of the Project Owner or the verifier. If the project area is expanded, a new site visit will be required for the totality of the project to be excempt from the $Risk_{SV}$ buffer pool contribution, unless the the project owner demonstrates to the satisfaction of the verification body that the previous site visit was sufficiently thorough to be applied to the new project area.

When a site visit is carried out for the verification of a grassland project, the site visit may occur during the verification period or after its conclusion. During this visit the verifier confirms the eligibility of the existing land use, assess the accuracy of the project maps, assess the sources of project emissions, and assess the management and recordkeeping related to the project.

8.5.2 Desk Review Verification

For verifications that do not include a site visit, the verification body must follow the same standards and procedures, but is not required to physically visit the project site. Desk review verifications must achieve the same standard of reasonable assurance.

8.6 Grassland Verification Items

The following tables provide lists of items that a verification body needs to address while verifying a grassland project. The tables include references to the section in the protocol where requirements are further specified. The table also identifies items for which a verification body is expected to apply professional judgment during the verification process. Verification bodies are expected to use their professional judgment to confirm that protocol requirements have been met in instances where the protocol does not provide (sufficiently) prescriptive guidance. For more information on the Reserve's verification process and professional judgment, please see the Verification Program Manual.

Note: These tables shall not be viewed as a comprehensive list or plan for verification activities, but rather guidance on areas specific to grassland projects that must be addressed during verification.

8.6.1 Project Eligibility and CRT Issuance

Table 8.2 lists the criteria for reasonable assurance with respect to eligibility and CRT issuance for grassland projects. These requirements determine if a project is eligible to register with the Reserve and/or have CRTs issued for the reporting period. If any requirement is not met, either the project may be determined ineligible or the GHG reductions from the reporting period (or subset of the reporting period) may be ineligible for issuance of CRTs, as specified in Sections 2, 3, and 6.

Table 8.2. Eligibility Verification Items

Protocol Section	Eligibility Qualification Item	Apply Professional Judgment?
2.2	Verify that the project meets the definition of a grassland project	No
2.2.1	Verify that the project area, and subsequent modifications, have been correctly delineated on a map (or maps) that meets the requirements of the protocol	No
2.3	Verify ownership of the GHG reductions by reviewing Attestation of Title and accompanying documentation	No
2.3	Verify the project and/or cooperative structure is appropriate	No
3.2	Verify project start date	No
3.2	Verify accuracy of project start date based on documentation	Yes
3.2	Verify that the project has documented and implemented a Monitoring Plan	No

Protocol Section	Eligibility Qualification Item	Apply Professional Judgment?
3.3, 3.4	Verify that the entire reporting period is within the crediting period for the project	No
3.3.1	Verify that the project meets the performance standard test	No
3.3.2	Confirm execution of the Attestation of Voluntary Implementation form to demonstrate eligibility under the legal requirement test	No
3.3.2	Verify that the project Monitoring Plan contains a mechanism for ascertaining and demonstrating that the project passes the legal requirement test at all times	No
3.3.3	Confirm that disclosure has been made of any other credits or payments received in relation to the project area, and that these conform to the requirements of the protocol	No
3.5.3	Confirm that the Project Owner has executed a PIA with the Reserve	No
3.6	Verify that the project activities comply with applicable laws by reviewing any instances of non-compliance provided by the Project Owner and performing a risk-based assessment to confirm the statements made by the Project Owner in the Attestation of Regulatory Compliance form	Yes
6	Verify that monitoring meets the requirements of the protocol. If it does not, verify that a variance has been approved for monitoring variations	No

8.6.2 Quantification

Table 8.3 lists the items that verification bodies shall include in their risk assessment and recalculation of the project's GHG emission reductions. These quantification items inform any determination as to whether there are material and/or immaterial misstatements in the project's GHG emission reduction calculations. If there are material misstatements, the calculations must be revised before CRTs are issued.

Table 8.3. Quantification Verification Items

Protocol Section	Quantification Item	Apply Professional Judgment?
4	Verify that all SSRs in the GHG Assessment Boundary are accounted for (unless optional)	No
5	Verify that the emission factors are all correctly selected for the relevant parameters, both for baseline emissions and project emissions	No
5.1	Verify that the stratification procedures were carried out properly	Yes
5.1.4	Verify that the baseline emissions are properly aggregated (and pro-rated, if applicable)	No
5.2.1	Verify that the project employed the appropriate discount factors	No
5.3	Verify that the project emissions were calculated according to the protocol with the appropriate data	No
5.3.1	Verify that the Project Owner correctly monitored and quantified fires	No
5.3.2	Verify that the Project Owner correctly monitored, quantified, and aggregated fossil fuel use	Yes

Protocol Section	Quantification Item	Apply Professional Judgment?
5.2.3	Verify that the Project Owner correctly monitored and quantified fertilizer use	No
5.3.4	Verify that the Project Owner correctly monitored and quantified grazing activities	No
5.4	Verify that no reversals have occurred and that the correct contribution was calculated for the buffer pool	No

8.6.3 Risk Assessment

Verification bodies shall review the following items in Table 8.4 to guide and prioritize their assessment of data used in determining eligibility and quantifying GHG emission reductions.

Table 8.4. Risk Assessment Verification Items

Protocol Section	Item that Informs Risk Assessment	Apply Professional Judgment?
6	Verify that the project Monitoring Plan is sufficiently rigorous to support the requirements of the protocol and proper operation of the project	Yes
6	Verify that appropriate monitoring practices are in place to meet the requirements of the protocol	No
6	Verify that the individual or team responsible for managing and reporting project activities are qualified to perform this function	Yes
6	Verify that appropriate training was provided to personnel assigned to greenhouse gas reporting duties	Yes
6	Verify that all contractors are qualified for managing and reporting greenhouse gas emissions if relied upon by the Project Owner. Verify that there is internal oversight to assure the quality of the contractor's work	Yes
7.3	Verify that all required records have been retained by the Project Owner	No

8.6.4 Completing Verification

The Verification Program Manual provides detailed information and instructions for verification bodies to finalize the verification process. It describes completing a Verification Report, preparing a Verification Statement, submitting the necessary documents to the Reserve, and notifying the Reserve of the project's verified status.

9 Glossary of Terms

Accredited verifier	A verification firm approved by the Climate Action Reserve to provide verification services for Project Owners.
Additionality	Project activities that are above and beyond "business as usual" operation, exceed the baseline characterization, and are not mandated by regulation.
Anthropogenic emissions	GHG emissions resultant from human activity that are considered to be an unnatural component of the Carbon Cycle (i.e., fossil fuel destruction, de-forestation, etc.).
Baseline	The baseline is the estimated emissions from conversion to cropland and the likely management practices that would occur on the project area in the baseline scenario.
Baseline scenario	The baseline scenario in this protocol is the counterfactual scenario where the suitable grassland was converted to cropland, as would occur in the absence of the proposed project (business-as-usual).
Biogenic CO_2 emissions	CO_2 emissions resulting from the destruction and/or aerobic decomposition of organic matter. Biogenic emissions are considered to be a natural part of the Carbon Cycle, as opposed to anthropogenic emissions.
Carbon rights	Legal ownership of carbon stored in pools located within the project area. Carbon rights may be separate from GHG reduction rights (defined below).
Carbon dioxide (CO_2)	The most common of the six primary greenhouse gases, consisting of a single carbon atom and two oxygen atoms.
CLI Classes	The Canada Land Inventory (CLI) classifies agricultural soils into 8 classes (1-7, and O) that categorize the agricultural capability of the land. For further descriptions and maps see here: http://sis.agr.gc.ca/cansis/nsdb/cli/classdesc.html
CO_2 equivalent (CO_2e)	The quantity of a given GHG multiplied by its total global warming potential. This is the standard unit for comparing the degree of warming which can be caused by different GHGs.
Cooperative Developer	The entity responsible for management of a project cooperative. The Cooperative Developer may or may not be one of the Project Owners participating in the project cooperative.
Crediting period	The period of time over which CRTs may be quantified and registered under this protocol. For a grassland project, the crediting period may be a maximum of 50 years.
Cropland	Land whose management is primarily conducted through "cultural" treatments, such as human and/or mechanical labor, fertilization, irrigation, tillage, seeding, and/or planting. While cropland may include seasonal livestock grazing, at least a portion of the year it is specifically given over to cultivation of a crop which is intended to be harvested for off-site consumption.

Direct emissions	GHG emissions from sources that are owned or controlled by the reporting entity.
Emission factor (EF)	A unique value for determining an amount of a GHG emitted for a given quantity of activity data (e.g., metric tons of carbon dioxide emitted per barrel of fossil fuel burned).
Forest land	Land with at least 10 percent cover (or equivalent stocking) by live Trees of any size, including land that formerly had such Tree cover and that will be naturally or artificially regenerated. This includes transition zones, such as areas between Forest and non-Forest Lands that have at least 10% cover.
Fossil fuel	A fuel, such as coal, oil, and natural gas, produced by the decomposition of ancient (fossilized) plants and animals.
Grassland	An area of land dominated by native or introduced grass species with little to no tree canopy. Other plant species may include legumes, forbs, and other non-woody vegetation. Tree canopy may not exceed 10% of the land area on a per-acre basis. For the purpose of this protocol, grassland may include managed rangeland and/or pastureland, as well as limited presence of woody shrubs.
Grazing season	The period bounded by the first and last days of livestock grazing during the reporting period.
Greenhouse gas (GHG)	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), or perfluorocarbons (PFCs).
GHG reduction rights	Legal ownership of the GHG emission reductions resulting from avoided grassland conversion project activities on the project area during the reporting period. GHG reduction rights may be separate from carbon rights (defined above).
Grassland Owner	An individual or entity which has a right of ownership over a portion or all of the project area, or an ownership right whose exercise could reasonably be expected to impact soil carbon storage on a portion or all of the project area.
Grazing season	The period of time bounded by the first and last days of livestock grazing during the reporting period.
GHG reservoir	A physical unit or component of the biosphere, geosphere, or hydrosphere with the capability to store or accumulate a GHG that has been removed from the atmosphere by a GHG sink or a GHG captured from a GHG source.
GHG sink	A physical unit or process that removes GHG from the atmosphere.
GHG source	A physical unit or process that releases GHG into the atmosphere.
Global Warming Potential (GWP)	The ratio of radiative forcing (degree of warming to the atmosphere) that would result from the emission of one unit of a given GHG compared to one unit of CO_2.
Indirect emissions	Reductions in GHG emissions that occur at a location other than where the reduction activity is implemented, and/or at sources not owned or controlled by project participants.

Land Conservation Agreement (LCA)	An easement, covenant, deed restriction, or other legal agreement (based on the legal terminology in the applicable Province) that may be employed to maintain the project land cover. The LCA must transfer rights to a conservation organization such that the LCA holder may monitor and enforce the terms of the LCA, preventing conversion of the project area. The LCA does not necessarily contain language pertaining to ownership of carbon or greenhouse gas emissions.
Land Suitability Rating System	The Land Suitability Rating System (LSRS) categorizes agricultural land by their suitability for spring-seeded small grains in Canada. It considers more factors than the CLI ratings, but uses the same rating system with additional subclasses.
Metric ton (t, tonne)	A common international measurement for the quantity of GHG emissions, equivalent to about 2204.623 pounds or 1.102 short tons.
Methane (CH_4)	A potent GHG, consisting of a single carbon atom and four hydrogen atoms.
MMBtu	One million British thermal units.
Mobile combustion	Emissions from the transportation of employees, materials, products, and waste resulting from the combustion of fuels in company owned or controlled mobile combustion sources (e.g., cars, trucks, tractors, dozers, etc.).
Non-reversible emission reductions	An emission reduction is not considered reversible if it represents the destruction or avoided emission of a GHG which does not rely on storage within a carbon pool. For example, the avoided emissions of N_2O due to cultivation activities are considered non-reversible.
Pastureland	An area of grassland which is managed through livestock grazing as well as other “cultural” treatments, such as human and/or mechanical labor, fertilization, irrigation, and/or seeding. For the purpose of this protocol, pastureland may not involve any level of tillage.
Permanence period	The period of time following the crediting period during which the Project Owner must continue monitoring, reporting, and verification activities under this protocol. The permanence period for a grassland project is 100 years following the last issuance of CRTs related to reversible emission reductions.
Project area	The area defined by the physical boundaries of the project activities. The project area only contains land which meets the eligibility requirements of this protocol.
Project baseline	A “business as usual” GHG emission assessment against which GHG emission reductions from a specific GHG reduction activity are measured.
Project Implementation Agreement	A legal agreement that obligates the project developer to conduct monitoring activities on the project area to the conclusion of the permanence period, and to compensate for avoidable reversals that occur during that time.
Project Owner	An entity that has title to the emission reduction credits issued under this protocol and undertakes a GHG project, as identified in Section 2.2 of this protocol. The Project Owner may also be the Cooperative Developer and/or a Grassland Owner.

Project scenario	This describes the project activities that occur in the proposed project. It may include multiple grasslands.
Rangeland	An area of grassland which is managed principally through the use of livestock grazing. For the purpose of this protocol, rangeland must meet the definition of grassland.
Reporting period	The length of time over which GHG emission reductions from project activities are quantified. Under this protocol, the reporting period can be no more than 12 months.
Reversible emission reductions	An emission reduction is considered reversible if it represents an avoided emission or enhanced sequestration of carbon which must be stored in a carbon pool. For example, the avoided emissions of soil organic carbon due to cultivation activities are considered reversible, and the carbon must be permanently maintained through conservation of the project area.
Shrub	A woody perennial plant, generally more than 1.5 feet and less than 16.5 feet in height at maturity and without a definite crown (24). Shrubs will usually have multiple stems no more than 3 inches in diameter (23).
Shrubland	Land covered predominantly by shrubs, e.g. woody plants that are smaller than trees and have several main stems arising at or near the ground.
Soil Organic Matter	Organic constituents in the soil such as tissues from dead plants and animals, products produced as these decompose and the soil microbial biomass. Also known as SOM.
Soil Organic Carbon	Carbon (C) occurring in the soil in SOM. Also known as SOC.
Tree	A woody perennial plant, typically large and with a well-defined stem or stems carrying a more or less definite crown with the capacity to attain a minimum diameter at breast height of 5 inches and a minimum height of 15 feet with no branches within three feet from the ground at maturity (24).
Verification	The process used to ensure that a given participant's GHG emissions or emission reductions have met the minimum quality standard and complied with the Reserve's procedures and protocols for calculating and reporting GHG emissions and emission reductions.
Verification body	A Reserve-approved firm that is able to render a verification opinion and provide verification services for operators subject to reporting under this protocol.
Verification period	The length of time over which GHG emission reductions from project activities are verified. Under this protocol, the verification period can cover up to six reporting periods during the crediting period, and up to ten reporting periods during the permanence period.

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Appendix A Development of the Performance Standard

The Reserve assesses the additionality of projects through application of a performance standard test and a legal requirement test. The purpose of a performance standard is to establish a standard of performance applicable to all grassland projects that serves as a proxy for a significant threat of conversion of the project area to crop cultivation. If this standard is met or exceeded by the Project Owner, the project satisfies the criterion of "additionality."[49]

A.1 Components of the Performance Standard Test

The Canada Grassland Project Protocol performance standard test has two components:

1. Financial threshold
2. Suitability threshold

The intent of this two-part test is to create a standardized proxy for the complex decision-making process that leads to land use change. A project-specific approach would allow for the evaluation of all barriers to the project activity at the project site, but it would be fraught with subjectivity and uncertainty due to the counterfactual nature of the baseline scenario. Moreover, project-specific determinations of additionality tend to be very expensive and labor-intensive, thus rendering relatively low-volume projects, such as grassland projects, to be infeasible. While each individual component of the performance standard test would not, on its own, be a rigorous test of the additionality of the project, the Reserve believes that, taken as a whole with the other requirements for eligibility (e.g., location, legal surplus), the performance standard test does achieve such an outcome.

A.1.1 Financial Threshold

The first component of the performance standard test is a financial threshold. The concept is that the monetary incentive provided by offsets is needed to counteract the existing financial incentive to convert grassland to cropland. The incentive to convert to cropland is thus viewed as a barrier to the project. As a proxy for this financial incentive, the Reserve uses the concept of the "cropland premium." The cropland premium represents the increased value (either as a percentage or in absolute dollars per acre) of land that is converted from pasture to crop production.

This approach is also utilized by the Reserve's Grassland Project Protocol[50] and Forest Project Protocol.[51] Additional background and context may be found in those protocols. In forestry, the value premium for the converted land use must exceed 40% for eligibility and must exceed 80% to avoid the application of a discount, which is calculated on a sliding scale between the two thresholds.[52] The discount represents the uncertainty of the baseline conversion and recognizes that the threshold for the decision to convert will vary between landowners. Grassland projects follow the same approach, with the thresholds set at 40% and 100%.

[49] See the Climate Action Reserve's Program Manual for further discussion of the Reserve's general approach to determining additionality: http://www.climateactionreserve.org/how/program/program-manual/.
[50] Climate Action Reserve, Grassland Project Protocol Version 2.0 (January 20, 2017), Section 3.3.1.
[51] Climate Action Reserve, Forest Project Protocol Version 3.3 (November 15, 2012). Section 3.1.2.3.
[52] Climate Action Reserve, Forest Project Protocol Version 3.3 (November 15, 2012). Equation 6.14.

A.1.1.1 Setting the Threshold

There are several options for how to consider the cropland premium as a proxy for the financial incentive to convert the project area. There were also several other decisions that ultimately influenced the threshold, such as the most appropriate geographic level of analysis (county, ecoregion, province, region) and the particular metric for the cropland premium (absolute $/acre or percent difference).

Following the approach used in the Forest Project Protocol, the Reserve elected to continue to apply the financial threshold as a percent difference, rather than a dollar value, which limits the impact of other variables that affect land value. This approach is also used in the Grassland Project Protocol and the Avoided Conversion of Grasslands and Shrublands (ACoGS) methodology adopted by the American Carbon Registry, although that methodology does not rely on a standardized assessment of land value.

The Forest Project Protocol sets a threshold of 40% premium for eligibility, and 80% premium for undiscounted eligibility. The Grassland Project Protocol and ACR ACoGS methodology set a threshold of 40% premium for eligibility and 100% premium for undiscounted eligibility. The Reserve has elected to adopt the thresholds described in the Grassland Project Protocol. Cropland premiums between these two values are subject to a discount on a sliding scale, following the guidance in Equation 5.10.

A.1.2 Suitability Threshold

Projects should only be considered additional if the project area is actually suitable for conversion to crop cultivation. Otherwise, the baseline scenario is invalid, and the project area is not actually under threat of conversion to cropland. This is the premise behind the second component of the performance standard test: the suitability threshold. There are numerous parameters (slope, drainage, rockiness, etc.) that contribute to the overall suitability of a parcel for crop cultivation. Multiple systems have been employed in Canada over time to assess soil suitability for cultivation. Prominent systems used include the Storie Index, adopted in 1938, the Canada Land Inventory (CLI) (20), adopted in 1969, and the Land Suitability Rating System (LSRS) (21), which began implementation in 1995. This protocol leverages the LSRS where possible, and the CLI in places where the LSRS has not yet been applied. Due to the much broader spatial coverage, the default suitability thresholds for each ecoregion were developed using the CLI dataset. Below is a comparison of the three ratings systems in terms of the scope of their assessment (this table was developed through personal communications with Agriculture and Agri-Foods Canada).

Table A.1. Comparison of Factors Considered in the Development of Canadian Soil Suitability Indices

Component	Storie Index (1938)	Canada Land Inventory (1969)	Land Suitability Rating System (1995)
General	▪ 8 classes ▪ Productivity ▪ 4 factors ▪ Factors not indexed ▪ Broad ratings ▪ Subjective	▪ 7 classes, plus organic soils ▪ Capability factors ▪ Factors not indexed ▪ Limitation (specified)	▪ 7 classes, plus organic soils ▪ Suitability ▪ 17 factors ▪ Factors indexed ▪ Limitation (specified)

Component	Storie Index (1938)	Canada Land Inventory (1969)	Land Suitability Rating System (1995)
Climate	▪ Not considered	▪ Frost-free period ▪ Annual precipitation	▪ Growing season ▪ Moisture index (precipitation minus potential evapotranspiration) ▪ Energy index (effective growing degree days) ▪ Modifiers
Soils	▪ Soil profile development ▪ Texture ▪ Slope ▪ X factor (dynamic factors such as drainage, alkalinity, fertility, acidity, erosion, microrelief)	▪ Structure ▪ Salinity ▪ Texture ▪ Drainage ▪ Depth ▪ Erosion ▪ Fertility ▪ No organic rating ▪ Subjective	▪ Structure ▪ Salinity, sodicity ▪ Texture ▪ Drainage ▪ Depth ▪ Organic matter ▪ Soil reaction ▪ Organic rating ▪ Specific
Landscape	▪ Not considered	▪ Topography ▪ Stoniness ▪ Inundation	▪ Slope steepness (gradient) ▪ Slope length ▪ Stoniness ▪ Inundation ▪ Pattern

There are seven CLI classes, not including organic soils:

1. Land in this class has no significant limitations for production of the specified crops.
2. Land in this class has slight limitations that may restrict the growth of the specified crops or require modified management practices.
3. Land in this class has moderate limitations that restrict the growth of the specified crops or require special management practices.
4. Land in this class has severe limitations that restrict the growth of the specified crops or require special management practices or both. This class is marginal for sustained production of the specified crops.
5. Land in this class has very severe limitations for sustained production of the specified crops. Annual cultivation using common cropping practices is not recommended.
6. Land in this class has extremely severe limitations for sustained production of the specified crops. Annual cultivation is not recommended even on an occasional basis.
7. Land in this class is not suitable for the production of the specified crops

The CLI also employs subclasses for Climate (C), Soil, and Landscape, indicating specific limitations within these broad categories for the optimal growing of the specified crops.

Crop cultivation is generally not recommended for land classified above Class 3. However, we have received stakeholder feedback that would push this threshold in both directions, some saying that no land above Class 3 should be cultivated, and others saying that they have seen Class 5 and 6 land being actively converted. Recent research has supported this conclusion (3) in the United States. The Reserve has chosen to rely on the general recommendation that classes above 4 are not suitable for cultivation, while recognizing that land characteristics tend to be more heterogeneous than legal boundaries by allowing for small components of the project area to be Class 5 or 6 in certain areas.

To determine the appropriate minimum threshold for Class 1-4 soils as a percentage of the total project area, the Reserve assessed the CLI for existing cropland The cultivated lands data used in the assessment come from the Annual Crop Inventory (22). The ACI is built from optical and radar based satellite images and provides national coverage back to 2011.

The analysis combined the CLI and ACI for each year from 2012-2016, creating composite pixels which identify both the CLI Class and the ACI land cover. ACI land cover values were categorized as either cultivated or uncultivated. Within each ecoregion it was then possible to count the number of pixels (and thus calculate the area) of cultivated land in each CLI Class for each ecoregion. The total cultivated land in each CLI Class was divided by the total cultivated land for that ecogregion, yielding a fraction. The fractions of Class 1-4 lands for the cultivated lands of each ecoregion were then summed, yielding the final threshold. Specific thresholds were not calculated for ecoregions with less than 100,000 ha of cultivated land. To be conservative, any ecoregion for which there is not a calculated suitability threshold will, by default, employ a threshold of 100% (meaning the entire project area must be Class 1-4).

The resulting values by ecoregion are published in the accompanying Canada Grassland Paramaters spreadsheet.

A.1.3 Complete Performance Standard Test

While neither of the individual components of this performance standard test (or the eligibility section as a whole) would represent a comprehensive test for additionality on their own, when considered together, along with the eligibility limitations arising from the baseline stratification and modeling, they function to provide a holistic assessment of the threat of conversion of grassland to cropland in different areas of the country.

Appendix B Development of Standardized Parameters and Emission Factors

Note: this work was performed by Darrell Cerkowniak and Brian McConkey with Agriculture and Agri-Food Canada, and contracted as part of this project.

B.1 Soil Organic Carbon Emissions from Conversion

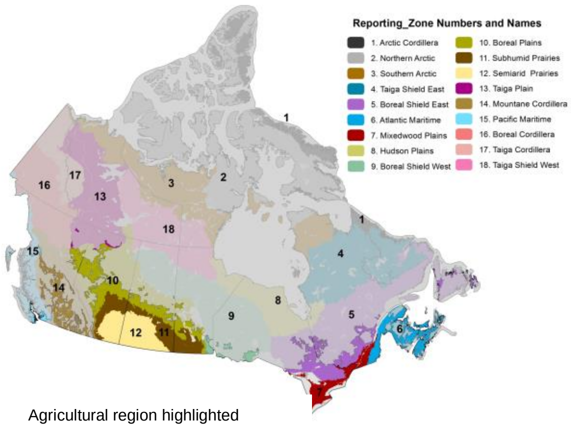
The carbon (C) change data generated for this project are based on the factors used in Canada's Greenhouse Gas (GHG) Inventory for reporting agricultural carbon stock changes from changes in land management practices under the Land use, Land-use Change and Forestry sector (LULUCF). A Carbon factor represents the rate of change in soil C per unit area for a land management change (LMC) as a function of time since the LMC. Carbon factors were generated using output from CENTURY Soil Organic Matter Model runs. Annual differences in soil carbon output between management change scenarios and base runs were charted and statistically fit to exponential curves such that carbon change could be expressed as:

Equation B.1

$$\Delta C_{LMC}(t) = \Delta C_{LMCmax} * (1 - \exp(-k * t))$$

where:
ΔCLMCmax = the maximum ΔC (Mg ha-1) assumed to be produced by the LMC
k = the rate constant (yr-1)
t = years since LMC

All agricultural soils were modelled, and results used to generate average Delta CLMCmax and rate constants aligned to Canada's GHG reporting framework (Reporting zones) and general soil texture classes (coarse medium and fine) (Figure B.1). Reporting Zones, with two notable exceptions, are identical to Ecozones of the Canadian Ecological Stratification Framework. The Prairie Ecozone was split into the Semiarid Prairie and Subhumid Prairie Reporting Zones and the Boreal Shield Ecozone was split into the Boreal Shield East and Boreal Shield West Reporting zones.



TEXTURE	TEXTURE DESCRIPTION	GENERIC CLASS
CS	Coarse sand	coarse
S	Sand	coarse
FS	Fine sand	coarse
VFS	Very fine sand	coarse
LCS	Loamy coarse sand	coarse
LS	Loamy sand	coarse
LFS	Loamy fine sand	coarse
LVS	Loamy very fine sand	coarse
CSL	Coarse sandy loam	coarse
SL	Sandy loam	coarse
FL	Fine sandy loam	coarse
VL	Very fine sandy loam	medium
L	Loam	medium
SIL	Silt loam	medium
SI	Silt	medium
SCL	Sandy clay loam	medium
FCL	Fine sandy clay loam	medium
VCL	Very fine sandy clay loam	medium
CL	Clay loam	medium
SICL	Silty clay loam	medium
SC	Sandy clay	fine
SIC	Silty Clay	fine
C	Clay	fine
HC	Heavy clay	fine

Figure B.1. Reporting Zones and Soil Textural Groups

The carbon factors used in the inventory are time dependant and the value of the C factor depends upon how many years have passed since the land use/management change occurred. Carbon change is calculated annually using an annual factor rate based on the equation:

$$F_{LMC}(t) = \Delta C_{LMCmax} * [\exp^{(-k * (t-1))} - \exp^{(-k * t)}]$$

where:
$F_{LMC}(t)$ - The C factor value due to the LMC at time, t
ΔC_{LMCmax} – The máximum SOC change assumed to be produced by the LMC.
k - the rate constant (yr^{-1})
t – year after LMC

On mineral soils, the GHG inventory currently applies the factor approach for changes in the following activities:

1) Change in mixture of crop types
    a) increase in perennial crops
    b) increase in annual crops
2) Change in tillage practices
3) Change in area of summerfallow
4) Forest land conversions to cropland
5) Grassland conversions to cropland

Only inventory factor parameters for the conversion of perennial to annual crops (P to A) and changes in tillage practices were used in the generation of soil carbon emission avoidance factors for grassland conversions.

Factors parameters for grassland conversion to cropland (GL to CL) were not used due to regional limits on where grassland conversion factors are applied. For GHG inventory purposes, grassland was defined as natural land used for grazing domestic livestock located in regions where the vegetation would not naturally convert to forest or woody shrubs if abandoned (Figure B.2). Under this definition, the extent of agricultural grassland was limited to the natural short-and mixed-grass prairie in southern Saskatchewan and Alberta and the dry, interior mountain valleys of British Columbia. For rangeland conversions outside of the grassland region, the perennial to annual (P to A) conversion factors were used. In order to maintain a consistent approach across the country and to avoid possible inconsistencies through the application of GL to CL factors in the grassland zone and P to A factors outside of this zone, P to A factors were used in all regions of the country.

Factors parameters for changes in the area of summerfallow were not used due to the diminishing use of fallow as a management practice on cropland. Summerfallow was used as a means of conserving water to increase water available in the following year when a crop is grown. The adoption of conservation tillage has increased both water conservation and water use efficiency thereby reducing the need for summerfallow as a water conservation practice. Only 2% of the cropland was in fallow in 2016, down considerably from 1971 when 28% of the cropland (primarily in western Canada) was under fallow. Given the limited extent in the usage of summerfallow, it is unlikely that summerfallow would be used to a significant degree as a management strategy on cropland after grassland conversion and therefore contribute to emissions avoidance potential in the future. Canada's cropland currently has a net sink of 8.5 Mt CO_2 eq from reductions the use of fallow management.

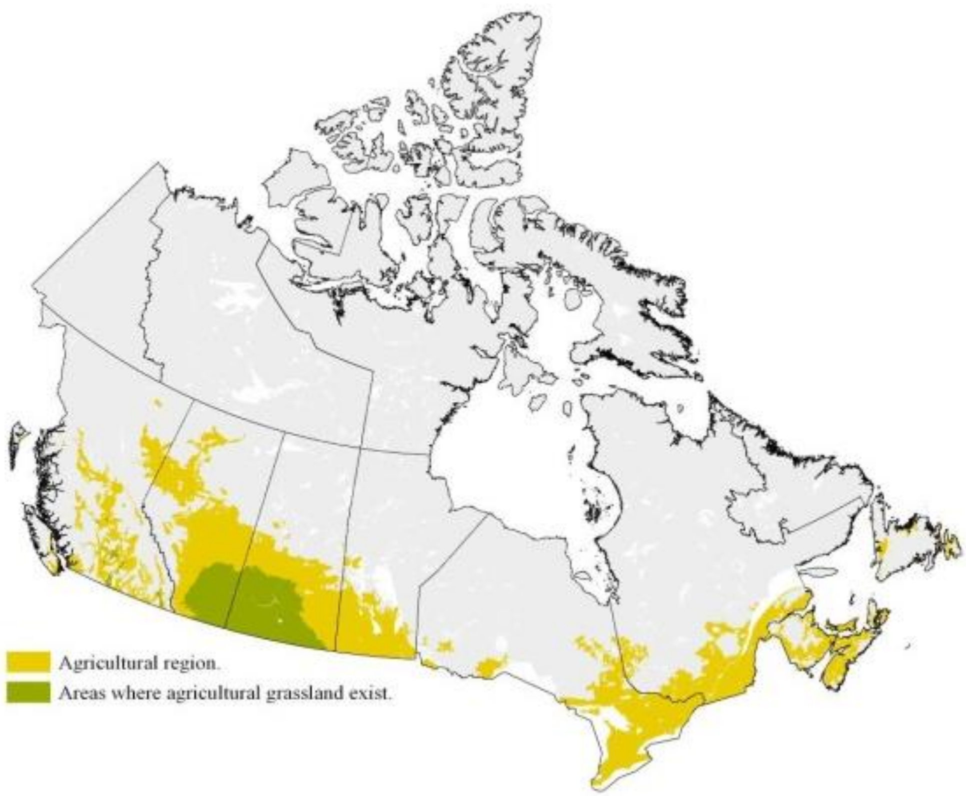


Figure B.2. Generation of Grassland Conversion Avoidance Factors

Perennial to annual factor (P to A) parameters were used as the basis for the calculation of grassland emissions avoidance factors. To account for tillage, the delta C max for P to A conversions was adjusted using the Delta C_{LMCmax} for tillage conversions (IT to NT and IT to RT) based on the proportion of land in reduced till and no till within the reporting zone (Equation B.3). In most regions, this in effect offset (lowered) the Delta C_{LMCmax} used for the P to A conversions given that inventory factors for conversions to reduced till and no till result in carbon gains. The revised delta C max parameters for P to A conversions were then run using Equation B.2 to generate changes in soil carbon stocks (kg/ha). An example of the output from this process is shown in Figure B.3. Annual Output was averaged over 10-year increments over a 30 year period to generate the final values.

$$\Delta C_{LMCmax} = (\Delta C_{LMCmax}PA * P_{it}) + ([\Delta C_{LMCmax}PA + \Delta C_{LMCmax}ITNT] * P_{nt}) + ([\Delta C_{LMCmax}PA + \Delta C_{LMCmax}ITRT] * P_{rt})$$

where:
$\Delta C_{LMCmaxl}$ - Maximum SOC change produced by the land use change.
$\Delta C_{LMCmax}PA$ - Maximum SOC change for the conversión of perennial to annual cropland .
$\Delta C_{LMCmax}ITNT$ - Maximum SOC change for the conversión of Intensive till to No till.
$\Delta C_{LMCmax}ITRT$ – Maximum SOC change for the conversión of intensive till to reduced till.
P_{nt} – Proportion of cropland under no-till.
P_{rt} – Proportion of cropland under reduced till.
P_{it} – Proportion of cropland under intensive till.

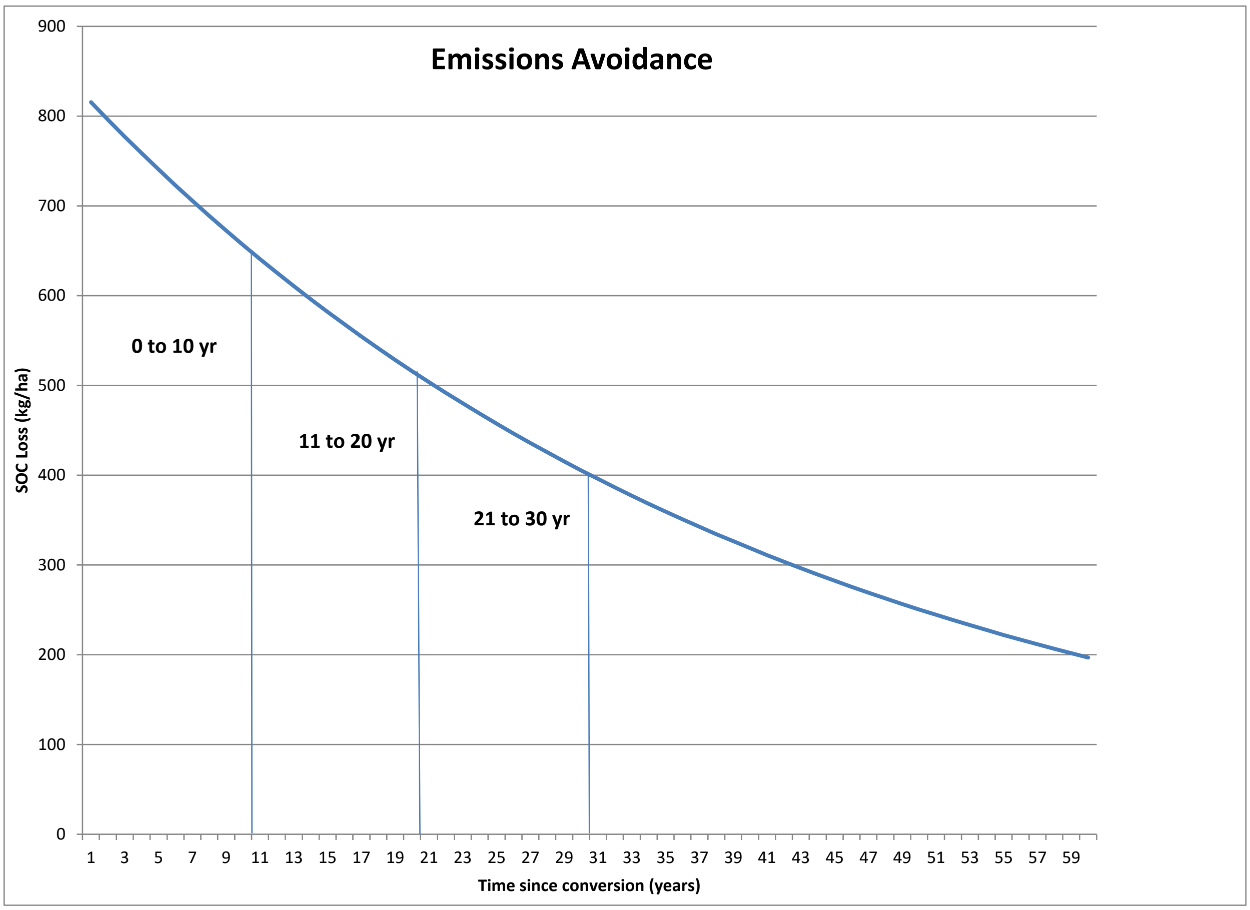


Figure B.3. Example of Output from Emissions Avoidance Run (Mixedwood Plains – Medium Texture)

B.2 Nitrous Oxide Emissions

Soil nitrous oxide (N_2O) emissions were estimated using an Intergovernmental Panel on Climate Change (IPCC) Tier II, or country-specific, approach. This is an established methodology, which is currently used for reporting Canada's annual national inventory of agricultural N_2O emissions to the United Nations Framework Convention on Climate Change. In this approach, direct soil N_2O emission factors are calculated based on moisture conditions during the growing season and are further modified by soil characteristics (soil texture), agricultural management practices (tillage intensity, irrigation) and landscape position. Nitrogen (N) pools from synthetic fertilizers, crop residues and mineralized soil carbon are calculated based on publicly available databases of crop areas, recommended N fertilizer application rates, N fertilizer sales statistics, crop production statistics, and land management practices. A variety of coefficients (e.g. harvest indices, carbon to N ratios) taken from the peer reviewed scientific literature, or from internationally accepted methodological documents are also employed.

Indirect N_2O emissions from leaching and runoff, as well as volatilization and re-deposition are estimated by taking the product of N loss from previously calculated pools and IPCC Tier I emission factors.

B.3 Carbon Dioxide Emissions

Carbon dioxide (CO_2) emissions are estimated from the decomposition of limestone and dolomite (to increase pH in regions with acidic soils), as well as decomposition of carbon containing fertilizers (e.g. urea). Emissions were estimated by taking the product of agricultural limestone and dolomite consumption, as well as carbon containing fertilizers, and accepted emission factors. Limestone and dolomite consumption estimates were acquired from Environment and Climate Change Canada. Due to high year-to-year variability in consumption estimates, a 10-year provincial-scale running average of consumption was used to estimate annual emissions. Consumption of carbon containing fertilizers was acquired from provincial fertilizer consumption statistics.

B.4 Crop Specific Estimates

Estimates of emissions were calculated per hectare for 28 unique crop types, for 3487 spatial polygons, and subdivided by generic soil texture groupings (coarse, medium, fine). A weighted average of total emissions per hectare at the Reporting Zone spatial scale was calculated, considering only the annual crops (24 crop types). Estimates were calculated annually for the years 2006-2015. To be conservative, the final emission factor was calculated as the lower bound of the 95% confidence interval for this entire 10-year period. The results were converted from units per hectare to units per acre.

B.5 Results

The results of the baseline modeling calculations for N_2O, carbon from fertilization, and soil organic carbon (SOC) are shown in

Table B.1. Baseline Emission Factors per Acre per Year

Reporting Zone	RZ_ID	Soil Texture	Stratum ID	$BEF_{N2O,s}$ Year 1-10 (kg N_2O/ac/yr)	$BEF_{N2O,s}$ Year 11-20 (kg N_2O/ac/yr)	$BEF_{N2O,s}$ Year 21-30 (kg N_2O/ac/yr)	$BEF_{Cfert,s}$ (kg CO_2/ac/yr)	$BEF_{OC,s}$ 1-10 yr (kg CO_2/ac/yr)	$BEF_{OC,s}$ 11-20 yr (kg CO_2/ac/yr)	$BEF_{OC,s}$ 21-30 yr (kg CO_2/ac/yr)
Atlantic Maritime	6	Coarse	6_Coarse	10	9	9	375	7275	5643	4378
Boreal Plains	10	Coarse	10_Coarse	5	5	5	116	3806	2831	2105
Boreal Shield East	5	Coarse	5_Coarse	8	7	7	234	6612	4903	3636
Boreal Shield West	9	Coarse	9_Coarse	7	7	6	115	4770	3361	2369
Mixedwood Plains	7	Coarse	7_Coarse	9	8	8	153	6277	4655	3452
Mountane Cordillera	14	Coarse	14_Coarse	3	3	3	46	3365	2763	2269
Pacific Maritime	15	Coarse	15_Coarse	6	5	5	34	3987	3373	2855
Semiarid prairies	12	Coarse	12_Coarse	3	2	2	77	3106	2220	1586
Subhumid prairies	11	Coarse	11_Coarse	5	4	4	105	3011	2235	1659
Atlantic Maritime	6	Medium	6_Medium	12	12	11	375	7199	5953	4923
Boreal Plains	10	Medium	10_Medium	6	6	5	116	4880	3932	3168
Boreal Shield East	5	Medium	5_Medium	11	10	9	234	8240	6646	5360
Boreal Shield West	9	Medium	9_Medium	7	7	7	115	5187	4028	3127
Mixedwood Plains	7	Medium	7_Medium	12	11	10	153	6644	5221	4103
Mountane Cordillera	14	Medium	14_Medium	4	3	3	46	4987	4190	3521
Pacific Maritime	15	Medium	15_Medium	7	7	6	34	5867	5188	4588
Semiarid prairies	12	Medium	12_Medium	3	3	2	77	4677	3503	2624
Subhumid prairies	11	Medium	11_Medium	5	5	4	105	4471	3486	2717
Atlantic Maritime	6	Fine	6_Fine	16	15	14	375	9022	7226	5787
Boreal Plains	10	Fine	10_Fine	6	6	5	116	5475	4577	3827
Boreal Shield East	5	Fine	5_Fine	12	11	11	234	7412	6285	5329
Boreal Shield West	9	Fine	9_Fine	8	7	7	115	5964	4796	3856
Mixedwood Plains	7	Fine	7_Fine	15	14	13	153	8036	6481	5227
Mountane Cordillera	14	Fine	14_Fine	4	3	3	46	4236	3802	3413
Pacific Maritime	15	Fine	15_Fine	6	6	6	34	4669	4170	3724
Semiarid prairies	12	Fine	12_Fine	3	3	3	77	5846	4701	3780
Subhumid prairies	11	Fine	11_Fine	5	5	5	105	4210	3492	2897

B.6 Uncertainty

Although some level of uncertainty is inherent in any modeling exercise, there are several important uncertainties unique to the establishment of baseline conditions and modeling performed over a 30 year horizon. Several sources of uncertainty are particularly noteworthy:

- Tillage Practice
- Fertilizer Use
- Climate Change

During the workgroup consultation process for the development of the US Grassland Protocol, the concept of including shifts in tillage practice and fertilizer use within the modeling environment was evaluated. However, because of data and modeling limitations, uncertainty around inputs, and the assumptions required to conduct modeling that included these shifts, it was deemed more appropriate to account for the uncertainty outside of the modeling exercise rather than compromise the model's inherent strengths and data sources. Both tillage and nitrogen management practice will further interact with climate change and weather events, with the result being unknown net impacts to field-level GHG emissions. The emission factors in this Canadian version of the protocol were also developed through a method which was unable to be adjusted to account for such changes in input variables over time. Thus, to be conservative, the quantification methodology includes a discount factor intended to address the uncertainty associated with these and other factors. The specific uncertainty related to these emission factors has not been quantified. Consistent with the U.S. Grassland Project Protocol, the Reserve has set the discount as 1% to start, increasing an additional 1% every 5 years. Thus, the discount increases as the time of quantification moves farther from the time the modeling was completed. If the Reserve is able to update this modeling exercise at a later date, then the discount for uncertainty will be reset for the new emission factors.

B.7 Justification for a Standardized Baseline

This section provides a brief overview of the benefits associated with use of a highly standardized approach to baseline determination and quantification of baseline emissions.

B.7.1 Transaction Costs and Verifiability

One of the primary goals to standardization is to cut down to the extent practicable on project costs and verification complexity. If the project proponent is required to assert the baseline cropping system and management practice, this would necessitate considerable costs both in project development and verification. Existing protocols rely on resources such as appraisals, government surveys, and universities in establishing baseline cropping systems. While government surveys provide some insight into dominant crops in a region, they are not generally differentiated by relevant soil characteristics, and do not reveal detailed crop rotation information nor do they link across variables (e.g., crop rotations and tillage practices). Further, while appraisals are useful in establishing that land may have a higher value as "cropland" versus grassland, it is unclear that these appraisals would consider specific cropping systems, inputs and management practices. Instead, these appraisals may assess only the publicly available rent information on cropland in the region, itself a composite of multiple practices.

In short, relying on project proponent assertions would require considerable project proponent resources to identify and document the likely cropping system, provided it can reliably be done at all. Additionally, the asserted crop system would need to be verified by the verification body, adding additional costs and uncertainty. Alternatively, the standardized approach does not require the project proponent to assert a baseline cropping system or management practice at all, or the verifier to assure this data. The baseline scenario and emissions estimates are defined exclusively based on geographic, historic, and physical characteristics of the project parcels, most of which are publicly available in national geospatial databases.

B.7.2 Customizability and Opportunity for Gaming

One potential shortcoming of a standardized approach to baseline determination and baseline emissions modeling is that it limits the opportunity for projects to be customized. Greater project proponent input provides greater opportunity to reflect specific knowledge or greater detail. For example, there may be characteristics of the land (e.g., slope) or local market (e.g., proximity to processing) that cannot be captured in the standardized methodology that nonetheless can reasonably be expected to influence cropping or practice.

However, this shortcoming of standardization is also a potential benefit in the ability it provides to avoid gaming. For example, if emission rates for two cropping systems are different, then gaming could occur if project proponents take steps to establish the system with higher emissions as their baseline. Given the complexity of verification and the potential methodological flexibility due to varying levels of data availability that may need to be afforded project proponents in establishing the baseline practice, it is possible that this gaming could occur without detection. Use of standardized composite baselines essentially eliminates this gaming risk by basing stratification and the determination of baseline emissions purely on geographic, historic, and physical characteristics of project parcels, most of which are publicly available in national geospatial databases.

B.7.3 Future Uncertainty

While the uncertainty of knowing what may occur on grassland directly following conversion is obviously significant, the uncertainty about what may occur 10 years or 20 years hence is even greater. Given a maximum crediting period of 30 years, it is therefore extremely important that the baseline determination and associated baseline emissions are not overly influenced by short-term considerations.

Means of evaluating the highest value cropping systems are highly dependent on short-term projections about commodity and crop prices, which are subject to change in the future. As such, even if one knew with certainty that a parcel would be converted to a given crop rotation and management practice tomorrow, there is no reasonable way to know that it would persist in that manner for 10 or 20 years. As such, it is more reasonable to treat each parcel as essentially a composite of a multitude of crop systems in the area reflecting longer term practices and trends.

Appendix C Default Parameters and Emission Factors

Most of the emission factors needed in this protocol can be found in tables and equations contained within the body of the document.

C.1 Development of Project Emission Factors for N_2O

To simplify the quantification of N_2O emissions from fertilizer and manure, the Reserve is relying on default values from the IPCC (6). Because of this, the full equation necessary for accounting for emissions from nitrogen volatilization and leaching can be collapsed and simplified by combining multiple constants into a single constant.

Equation 5.14 uses a value of either 0.011 or 0.012 to represent direct emissions and emissions from the volatilization of fertilizer. This value is derived thusly:

$$\boldsymbol{A} = \boldsymbol{B} + (\boldsymbol{C} \times \boldsymbol{D})$$

Where,
A = Emission factor for direct and volatilized emissions of N_2O from fertilizer (0.012)
B = Emission factor for direction emissions of N_2O from fertilizer (0.01)
C = Fraction of fertilizer lost to volatilization (0.1 for synthetic/chemical sources and 0.2 for organic sources)
D = Emission factor for N_2O due to volatilization and deposition (0.01)

Equation 5.14 uses a value of 0.00225 to represent emissions from the leaching of fertilizer. This value is derived thusly:

$$\boldsymbol{Leach} = \boldsymbol{E} \times \boldsymbol{F}$$

Where,
Leach = Default factor for the fraction and emission factor for N_2O emissions due to leaching (0.00225)
E = Fraction of fertilizer lost to leaching (0.3)
F = Emission factor for N_2O due to leaching (0.0075)

Appendix D Legal Instruments

Registration of a grassland project under this protocol requires the use of a number of specific legal instruments. This appendix provides additional guidance on the intent and usage of these instruments, as well as any requirements for their use with a grassland project. Table D.1 lists the relevant legal instruments and their relatedprotocol sections.

Table D.1. Legal Instruments Relevant to Grassland Projects

Legal Instrument	When Required	Protocol Section(s)
GHG reduction rights contract	Required when ownership of GHG emission reduction rights are not determined in the LCA	2.3.2
Indemnification agreement	Required when there are multiple Grassland Owners who are not party to the legal instruments related to the project	2.3.2
Land Conservation Agreement	Required	2.2, 3.2, 6
Qualified Land Conservation Agreement	Required	3.5.3
Project Implementation Agreement	Required for all projects, except where permanence commitment is complete and the project elects to employ TYA	3.5.4
Reserve attestations (title, voluntary implementation, regulatory compliance)	Required for all projects	2.3.2, 3.3.2, 3.6
Instruments associated with concurrently-joined conservation programs	Required only if the project area is enrolled in other conservation payment/credit programs	3.3.2.1

D.1 GHG Reduction Rights Contract

Purpose: This contract is required in order to clearly establish ownership over the GHG emission reductions associated with the grassland project. In order to meet the definition of a Project Owner, an entity must be able to demonstrate ownership of the GHG emission reductions associated with the project. Unless existing contracts specify otherwise, it is assumed that the Grassland Owner holds the rights to any GHG emission reductions that would be issued under this protocol. However, the recording of a Land Conservation Agreement may create the expectation, on the part of the LCA holder, that they hold ownership rights that include the GHG emission reductions. In addition, either the Grassland Owner or the LCA holder may wish to transfer these rights to a third-party Project Owner. The grantee of the GHG Reduction Rights contract will be the Project Owner of record (the Account Holder) with the Reserve, and will be the entity to which the CRTs are issued upon successful registration of a reporting period. The Project Owner is also the entity who will execute the Project Implementation Agreement.

Parties involved: Grassland Owner, Project Owner, LCA holder.

Timing: Ownership of the GHG emission reductions associated with the project activities must be documented during project verification.

Notes:

- May be a standalone document, or it may be incorporated into another legal document, such as the project's LCA. A standard, short form version is included as Exhibit B to the PIA.
- Must clarify the ownership of the GHG emission reductions at the time of their creation, rather than just the sale of those credits.
- Must clearly define ownership of rights for GHG reductions related to the project activities.
- Must be signed by the Grassland Owner, the LCA holder, and the Project Owner.
- Must include clauses that specify steps to be taken if ownership changes for either the land, the GHG reduction rights, or the LCA.
- Recommended inclusions:
  - Description of the project area
  - Description of the offset project and the offset project registry
  - Reference to the GPP as the method of quantifying GHG emission reductions
  - Specific reference to sources of GHG emissions which are covered by GHG assessment boundary for the GPP
  - Discussion of responsibilities in the event of a reversal (see Section 5.4)
  - Any potential exclusions (i.e., GHG or other benefits not covered by this contract)

D.2 Indemnification Agreement

Purpose: Where there may be multiple entities who could meet the definition of Grassland Owner, the Reserve must be indemnified against future GHG reduction claims by those entities which are not acting as Grassland Owner for the purposes of the protocol, and are not party to the GHG reduction rights contract.

Parties involved: Grassland Owner, Project Owner, Climate Action Reserve.

Timing: This agreement must be executed following the initial verification, prior to registration by the Reserve.

Notes: Must indemnify the Reserve in connection with any claims brought by other grassland owners or would-be grassland owners against the Reserve.[53]

D.3 Cooperative Contract

Purpose: For projects participating in a cooperative, this is a contract between the Project Owner and the Cooperative Developer. In general, this contract lays out the terms of the Project Owner's participation in the cooperative. However, its relevance for this protocol is its usefulness as a clear signal from the Project Owner of their intent to initiate a GHG offset project. This is particularly useful for determining the project start date, in order to ensure the additionality of the project.

Parties involved: Project Owner, Cooperative Developer.

Timing: If being used to denote the project start date, then the notarization date of this contract will be chosen by the Cooperative Developer as a date which will result in more efficient management of the cooperative. This date can be no earlier than the earliest recorded LCA on any project in the cooperative.

[53] A sample indemnification agreement is available at: http://www.climateactionreserve.org/how/protocols/grassland/.

Notes:

- This contract is only required for projects which wish to use it to denote the project start date. In those cases, this contract must be notarized

D.4 Qualified Land Conservation Agreement (QLCA)

Purpose: The Land Conservation Agreement is the principle mechanism by which the project area is protected against land use change during the project period, and in perpetuity. The QLCA is a label applied to a LCA whose terms either explicitly prevent reversals of CRTs by referencing the Grassland Project Protocol, or implicitly prevent reversals of CRTs by including land use limitations which are sufficient to prevent land use that would disturb soil carbon in the project area.

Parties involved: Grassland Owner, LCA holder, Project Owner (optional).

Timing: In most cases, the execution of the QLCA will denote the project start date. In all cases the QLCA must be executed prior to completion of the initial verification.

Notes:

- It is recommended that the QLCA also include clear discussion of both the carbon rights and the GHG emission reduction rights, as defined in Section 9 (see section above regarding the GHG emission reduction rights contract).
- It is required that the QLCA include enforceable provisions for the ongoing monitoring of compliance with the terms of the LCA.
- It is recommended that access rights be granted to the Project Owner and the Reserve for the purposes of monitoring and enforcing the provisions of the Protocol.
- If the project is at all likely to include livestock grazing, it is recommended that the QLCA include prescriptive guidance for grazing management which explicitly limits grazing intensity.
- It is recommended that the QLCA make reference to and incorporate the PIA.

D.5 Project Implementation Agreement (PIA)

Purpose: The PIA is a contract between the Reserve and the Project Owner which binds the Project Owner to the terms of the protocol, including the avoidance of and compensation for reversals, and the monitoring of the project during the permanence period. If the Grassland Owner is the Project Owner, they may elect to have the PIA recorded on the deed to the property, thus binding the landholder to the protocol and reducing the risk of uncompensated reversals.

Parties involved: Project Owner, Climate Action Reserve.

Timing: The PIA is executed during the initial verification of the project, prior to registration and CRT issuance. The terms of the PIA are applicable for 100 years following the issuance of CRTs. The PIA is updated at each subsequent registration in order to extend its term to cover the new CRT issuance, as well as to potentially reflect any changes in Project Ownership.

Notes:

- The Recorded PIA includes a clause specifying whether the PIA may be subordinated to any subsequent deed restrictions. The Project Owner will choose whether to use the Type I (not able to be subordinated) or the Type II (able to be subordinated) clause. Use of the Type II clause results in a value of 0.1 for the risk of financial failure in the calculation of the project's contribution to the risk buffer pool. Use of the Type I clause results in a value of 0 for this parameter.
- The Contract PIA, where the project area itself is not bound by the contract, always results in a value of 0.1 for the risk of financial failure in the calculation of the project's contribution to the risk buffer pool.

D.6 Reserve Attestations

Required attestations:

- Attestation of Title
- Attestation of Voluntary Implementation
- Attestation of Regulatory Compliance

Purpose: These attestations are legal documents whereby the Project Owner legally attests to the truth of the statements and facts necessary to support the conclusions of a positive verification report. The Attestation of Title confirms that the Project Owner is the legal owner of the rights to the GHG emission reductions represented by the CRTs which will be issued into their account. The Attestation of Voluntary Implementation confirms that the project passes the legal requirement test. The Attestation of Regulatory Compliance confirms that the project met the eligibility requirements of Section 3.6 during the reporting period(s).

Parties involved: Project Owner.

Timing: These attestations are completed during verification and apply to a specific period of time for which CRTs are to be issued. The Attestation of Title and Attestation of Regulatory Compliance are completed at every verification. The Attestation of Voluntary Implementation is only completed during the initial verification.

D.7 Other Instruments Associated with Concurrently-Joined Conservation Programs

Purpose: If a project area is enrolled in any other credit or payment program, the contracts or legal instruments associated with that program is relevant to the verification of the offset project. These contracts or instruments must be disclosed to the verifier during the verification process. The verifier shall assess each payment or crediting program against the guidance of Section #, conferring with the Reserve for guidance where appropriate.

Parties involved: Grassland Owner, others as relevant.

Timing: At every verification.

Appendix E Performance Assessments from PFRA Permanent Cover Programs 1989-1992

The following summarizes two Evaluation Reports of the Permanent Cover Programs (PCP) prepared by Clint Hilliard et al (2009):

Study Goals:

- 15 years post-incentive payments - what land is still in forage, as required by the contracts?

PCP Programs:

- CLI 5 or 6 - $20/hectare seeding payment contract for 10 or 21 years - one time; caveat against title to guarantee contract - fully prescribed in one month initially
- For 21 year contracts, amounts were greater per hectare
- No trends are given, but the reports implied that there was maximum participation for the eligible hectares
- Note - the 21 year agreements will reach maturity between 2010 and 2015 for the original PCP contracts of 1989 (PCP-1) and 1992 (PCP-2) (GreenCover came later)
- Total cost -$65M
- Results in Saskatchewan - 95% of lands remain under forage today. 19% hay production. The remainder was either grazed or hayed and grazed.
- Extrapolating to the Prairies - of total area converted under the PCP programs, 85% remains under cover. 15% reverted to annual cropland. All liquidated contracts were assumed to be returned to annual production.

Summary: Only about 20% of eligible hectares are likely to convert to hay production only, and a likely discount factor with 15% reversion rate.

Additional Information on GreenCover Program

Land Conversion (approximately 48% of expenditures)
The Land Conversion component offers farmers and ranchers financial assistance to offset a portion of the costs of converting environmentally sensitive annual crop land to perennial cover and provides a one-time incentive to enter into a Contribution and Land-Use Agreement to establish and maintain perennial cover on approved lands for a 10-year period. This component is delivered by PFRA, part of the Environment Team.

- Land Conversion: change in the level of conversion, measured by number of seeded hectares, by agricultural producers of environmentally sensitive cropland to perennial cover, and number of hectares protected.

Contribution agreements with recipients address performance reporting requirements for PFRA-delivered Program components. The Client Service Centre collects performance reports from the recipients. Contribution agreements with provincial and third-party delivery agents include clauses specifying performance reporting requirements. Performance reporting requirements are based on a recipient's annual Work Plan, quarterly progress reports/updates and an annual Performance Management Report.

An annual Work Plan from the recipient is required to identify the activities to be undertaken in the upcoming year and objectives, outcomes and results to be achieved.

Eligible Activities

- Converting environmentally sensitive land to perennial cover.

Eligible Costs

- $20 per hectare for seeding or planting tame forage or trees and signing a Contribution and Land-Use Agreement, or $75 per hectare for seeding native species and signing a Contribution and Land-Use Agreement; and
- $25 per hectare after you establish the perennial cover, and after Greencover Canada advisors/planners inspect it and issue a Certificate of Stand Establishment.