CLIMATE SMART GROUP

Agricultural Sustainability Key Issue Discussion: Permanence

ONE OF FOUR KEY ISSUE DISCUSSION PAPERS

OWNER

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Introduction

To develop credible, quality offsets or insets, a set of key criteria including additionality, baseline establishment, monitoring and verification, ownership, leakage, and permanence should be applied. This paper specifically addresses permanence, which is a type of project risk most often associated with biological and geological sequestration of emissions. Within an offset or inset project context, permanence means either that greenhouse gas (GHG) removals are not reversible or that, if removals are reversed, there must be a mechanism in place to account for and replace the lost carbon. More specifically, to be credible, projects sequestering carbon must be designed to have the same atmospheric effect as those achieved by non-sequestration projects. In practice many programs/registries place a liability or permanence period under which the carbon must be monitored, and any reversals addressed. In most cases, this period is based on the UNFCCC, which sets the current standard of 100 years for sequestration projects to essentially have the same atmospheric effect as GHG reduction projects (IPCC 2007, WCI 2010).

The policy community recognizes two kinds of reversals of sequestered carbon: intentional or unintentional (Diamant, Weisberg, & Zakreski, 2011).

- **Unintentional Reversals** - Unintentional reversals are reversals that occur when the land owner or manager could not reasonably be expected to prevent release of sequestered carbon. Examples of unintentional reversals include fire, disease, pests, and other natural disturbances. Pasture projects present challenges because weather events like extended drought can make pastures more susceptible to overgrazing.
- **Intentional Reversals** – Intentional reversals are actions taken by a landowner or land manager that result in the release of carbon sequestered by the project. Intentional reversals occur when decisions are made to discontinue project activities before the minimum project term (e.g. tilling the soil in a tillage project, terminating a perennial cover crop in favor of annual cropping, etc., harvesting a woodlot).

Most programs and registries have rules in place to assure permanence, either at the program or protocol level, for intentional reversals, which is the focus of this paper. These rules are designed based on the estimated risk of a reversal occurring. Various methods such as buffer pools, discounting, replacement, pro-rating and insurance schemes are used to manage this risk as described in Table 1. Further, either the program manager establishes, or the project developer is required to establish, monitoring and reporting procedures to account for any reversals. Reversals are usually verified, and the replacement of lost tonnes occur through various mechanisms.

Table 1 Policy Approaches for Managing the Risk of Reversals

Policy Approach	Description	Examples of Programs Using the Approach
Buffer Pool	A fixed percentage of the offsets are set aside and placed in a reserve account. The percent allocated to the reserve is established based on a risk assessment of the project. In some cases, the risk reserve is held by the program authority in perpetuity; in others, a sliding buffer reserve factor is applied based on successful verifications and no reversals. At this point, some offsets are returned to the project developer.	Verified Carbon Standard (VCS), Gold Standard, California Air Resource Board (ARB), American Carbon Registry (ACR), WCI Offset Recommendations (2010)
Account and Replace	Following quantification and verification of the reversals, the lost tonnes are replaced by the project developer from another project within the program or marketplace.	Australia CFI/ERF; WCI Offset Recommendations (2010)
Assurance Factor/Discount	A fixed percentage of the offsets is discounted from the total emission removal claimed is permanently retired. The percentage is based on an estimated risk of reversal and is determined at the program level.	Alberta Offset System (AOS)
Temporary Credits/Leasing	Credits are considered to be temporary reductions or rental of carbon storage abilities. These credits must be replaced with 'permanent reductions' after a period of time	Clean Development Mechanism - afforestation/reforestation
Insurance	A private insurance carrier insures a project for any reversal events that may occur. Unlike conventional insurance schemes, the sequestered carbon is insured with other carbon credits, not financial capital.	American Carbon Registry
Year-tonne method	Credits are issued only when they are deemed permanent on a radiative forcing basis. Credits for a removal in a given year accumulate over time and approach the full reduction quantity at the end of the permanence timeframe.	Not implemented

Definition of a reversal for no till projects

No-Till practices may result in a greenhouse gas emission reduction through a reduction in soil tillage intensity. There are typically three tillage systems discussed in reduced tillage systems: full tillage, reduced tillage and no-till (also referred to as "zero-till"). The technical definition of these systems differs between programs and therefore, the difference in soil carbon sequestration between these systems varies between systems. If a project is adopting an existing program standard or developing a new standard, these definitions must be clearly defined to maintain transparency for all stakeholders.

A greenhouse gas emission reduction may occur via three pathways:

- Transition from Full Till to Reduced Till;
- Transition from Full Till to No Till; and
- Transition from Reduced Till to No till.

Conversely, an increase in greenhouse gas emission reductions may occur via the same three pathways in the opposite direction (i.e. transition from No Till to Reduced till, etc.). If a greenhouse gas emission reduction is registered for a land area and a subsequent change in tillage practices results in an increase in emission reductions, a *reversal* is deemed to have occurred.

Permanence Period

The sequestration protocols and programs examined in this paper clearly state the permanence or liability period for which projects must guarantee the sink will be maintained. Programs differ in the length of this period, ranging from 30 to 200 years (Table 2). Several programs have tried to take a more pragmatic approach to the liability period, since 100 years is not practical from a land owner/land manager perspective in agricultural cropping systems. These will be discussed in the next section.

Table 2 Example Sequestration Protocol Permanence Periods (Source: Adapted from Anderson & Luckert, 2014)

Sequestration Protocol	Liability/Permanence Period
Alberta Conservation Cropping	Conservative reserve discount factor covers future liabilities and is assessed periodically to ensure a 30-year permanence period.
Australia Carbon Farmer Initiative Conservation Afforestation	100 years, but this may be reduced to 25 years under some circumstances. In 100-year scenario, the carbon must be replaced if a reversal occurs.
British Columbia Forest	100 years
American Carbon Registry (ACR) Forest Carbon Project Standard	40 years
California Forest, ARB	100 years, plus an additional 100-year monitoring and reporting commitment
Clean Development Mechanism Afforestation/ Reforestation	100 years
Verified Carbon Standard REDD	100 years
Verified Carbon Standard- Soil	100 years

Examination of Policy Approaches Used by Programs/Registries and Standards

Permanence approaches have evolved over the last 15 years with most jurisdictions using a risk-based approach for dealing with sink reversals. A risk-based approach is not new to insuring against loss and is commonly used in insuring other products and processes (e.g. automobiles, houses, health, damage from fire, flood, hurricanes, etc.). Statistical estimates of risk, based on historical data or other means (reliable prediction tools), are used to devise actuarial tables and risk premiums. Similar techniques can and are already being applied to offset projects.

Reserve pools, buffer accounts, and insurance programs are discussed in this section. Some of these approaches address permanence by assuring it at the program level, while others embed the requirements at the protocol or project developer level. While none of these approaches are without challenges, from a project risk perspective, markets where the program manager has established the permanence mechanism (e.g. buffer reserve through risk-based discounts a reversal) are typically more manageable and reliable for project developers and the program manager.

Verified Carbon Standard (VCS)

Under the VCS, a pooled buffer account is a reserve of non-tradable credits that collectively serves as a shared insurance pool for all VCS Agriculture, Forestry and Other Land Use (AFLOU) projects. It is managed at the program level. If carbon stocks from one project are lost as a result of unforeseen events, then buffer credits may be cancelled from the buffer account to compensate for the loss. Over time, the buffer pool may be released back to the projects when it has been demonstrated that risks have been effectively mitigated. In the VCS, the pooled buffer account acts as a form of insurance for all AFOLU credits to ensure that issued credits remain permanent and that Verified Carbon Units (VCUs) from AFOLU projects are fungible with VCUs from all other project types. The pooled buffer account is subject to periodic reconciliation and revision based on a review of existing AFOLU verification reports and an assessment of project performance, as set out in the VCS Program Guide (Verified Carbon Standard, 2013). This 'sliding buffer' approach is unique to the VCS and represents a reasonable approach to assuring permanence.

Under the VCS approach, risks are assessed in three categories: internal risks, external risks and natural risks. Together, these categories are used to determine the risk rating of the project and subsequent buffer determination[1]. The potential, temporary and permanent losses in carbon stocks are assessed over a 100-year period and based on the conditions present and information available at the time of the risk analysis, unless otherwise specified. A project with an overall risk rating greater than 60 is deemed unacceptably high, which means the project fails to meet the minimum criteria of the VCS (Verified Carbon Standard, 2013). Each risk category also has minimum risk ratings.[2] The project risk rating is converted to a percentage which corresponds to the number of credits that must be deposited in the AFOLU pooled buffer account. For example, a project with an overall risk rating of 35% converts to a risk percentage of 35%. This percentage is multiplied by the net change in the project's carbon stocks from the verification report (i.e. the number of tonnes sequestered) as set out in the VCS document Registration and Issuance Process. The corresponding buffer credits are deposited in the ALOLU pooled buffer account.

[1] VCS and CCAR[1] have developed procedures/tools to guide risk assessments on biosequestration offset projects. Both procedures ultimately determine the size of the buffer reserve needed to provide assurance against loss of offsets for each project. The VCS tool is qualitative and fairly subjective. While CCAR applies a quantification method for risk assessment, many of the answers to questions are based on a subjective; high, medium, or low level of risk.

[2] When a project receives a risk rating of 35 in Internal Risk, 20 in External risk or 35 in Natural Risk the project is deemed to fail the entire risk analysis and is not eligible for crediting (Verified Carbon Standard, 2013).

Sliding Buffer Pool Reserve: At first VCU issuance, buffer credits are being deposited into the AFOLU pooled buffer account using the risk assessment. The report establishes the non-permanence risk rating (percentage) which is applied to the net change in the project's carbon stocks based on the verification report. The appropriate number of buffer credits are required to be deposited into the account. Buffer credits are not issued a serial number as they are not considered to be VCUs and are not subject to serialization fees. VCS utilizes a sliding scale for deductions. To maintain adequate withholding levels, buffer withholding requirements (i.e. percentages) and overall buffer reserve levels are periodically adjusted based on actual project performance across the VCS AFOLU portfolio.

Credits from the buffer pool may be released back over time to projects where risks have been successfully mitigated, which incentivizes better risk management. Buffer credits from the AFOLU pooled buffer account can be released upon presentation and acceptance of a verification report to the VCS registry. When buffer credits are released from the AFOLU pooled buffer account, they are issued as VCUs (and serialized as such) and placed on the designated project developer's VCS registry account upon payment of the VCU issuance levy (serialization fees). The total buffer to be withheld is based on the number of years (broken down into five-yearly increments) since the initial VCS verification, which is considered the date when the project first established its track record for justifying the buffer release. Buffer credits cannot be realized more frequently than once every five years; however, project developers may choose to have their projects verified more frequently.

Buffer credits associated with a given project can be drawn upon over time as an incentive for future verification and to recognize that as the project's longevity is demonstrated (through subsequent verifications), certain project risks can be reduced. For example, a project entity with a solid track record can provide historic performance data to verifiers to demonstrate a lower risk than a similar but less experienced project developer. If the project's risk rating decreases from one verification event to the next, then the new (lower) buffer withholding percentage is applied to all credits generated to date by the project. For example, if a project's first risk assessment took place at year five (i.e., five years after project start/implementation date) and determined that it should be subject to 30% buffer withholding, then the project would have 15% of this buffer released at its next verification at year ten or later (i.e., ≥5 years after the 1st VCS verification), provided its risk rating stayed the same. This would mean that now 25.5% of total carbon credits generated by the project (including the new credits issued during the current verification) would have to be withheld. And at year 15 (or later) from the project start, at the next verification event the project would have 15% of its remaining buffer released and so forth.

Table 3 illustrates how the buffer would be drawn down over time for a project starting with a 30% buffer. In such cases, the project's buffer is reduced to reflect the lower "risk-assessed" withholding requirement in addition to the "time-related" release (i.e., these two kinds of buffer reductions should be applied cumulatively). If a project's risk rating increases from one verification event to the next, then the total buffer reserve is not reduced. Table 4 (Verified Carbon Standard, 2011) below illustrates the reduction of buffer withholding over time for a project that has a constant 30% non-permanence risk rating and is verified every five years.

Table 3 VCS Release of Buffer Credits

Year Since First Verification	Non-Permanence Risk Rating (%)	Buffer Withholding Percentage (%)
0	30	30.00
5	30	25.50
10	30	21.68
15	30	18.42
20	30	15.66
25	30	13.31
30	30	11.31
35	30	9.62
40	30	8.17
45	30	6.95
50	30	5.91
55	30	5.02
60	30	4.27
65	30	3.63
70	30	3.08

When a project has negative net emission reduction or removal, buffer credits are cancelled from the AFOLU pooled buffer account. A negative verification report indicates a negative net change in GHG emissions and as a result no VCUs are issued under the project until the deficit is remedied. A project which fails to submit a verification report to the VCS registry within five years of its last verification report will have 50% of buffer credits associated with the project placed on hold. If no subsequent verification is received within a period of 15 years and the project is still eligible for crediting, then buffer credits equivalent to the total number of VCUs issued to the project are cancelled. The project developer may reclaim buffer credits when they submit a new verification report prior to the expiration of the crediting period.

Crediting Period	• Non-AFOLU projects and Sustainable Agriculture Land Management (ALM) projects focusing on reduction of N2O, CH4 and/or fossil fuel derived CO2 emissions have a maximum crediting period of ten years which may be renewed twice. • All other AFOLU projects involving sequestration have a minimum crediting period of 20 years and up to a maximum of 100. Crediting periods can be renewed up to 4 times up to a maximum of 100 years.
Tonnes Generated under Soil Sequestration Methodologies	• Adoption of Sustainable Agricultural Land Management, v1.0 (World Bank's BioCarbon Fund, 2011) - 21,565 tonnes • Soil Carbon Quantification Methodology, v1.0 (The Earth Partners LLC, 2012) – 0 tonnes

American Carbon Registry (ACR)

Under the ACR, project developers are required to assess both general and project-specific risk factors using an ACR-approved risk assessment tool. The tool develops a risk classification that is translated into a percentage or number of offsets that must be deposited in the ACR buffer pool to mitigate the risk of reversal (unless the developer elects another ACR-approved risk mitigation mechanism, if allowed by the applicable methodology). Projects who chose to manage risk with the ACR Buffer Pool contribute the number of offsets determined in the project specific risk assessment to a buffer account held by the ACR. This account will be used to replace any unforeseen losses. The ACR has the management and operational control over the offsets in the buffer pool. In the event of a reversal, the ACR retires the required tonnes from the buffer pool to compensate for the reversal.

The risk assessment, overall risk category, and proposed buffer contribution is included in the GHG Project Plan, which the ACR reviews and the validation/verification body evaluates if the assessment has been completed properly. If reversals do not occur, then the project's risk category and applicable buffer percentage remain unchanged for five years, after which the risk analysis must be revisited. If a reversal occurs, then the risk category and buffer contribution must be immediately reassessed and re-verified.

The ACR is generally more flexible than that of both CAR and VCS. Under the ACR forest carbon protocol individual landowners are not required to commit to a permanence requirement guaranteeing that any sequestered carbon sold is sequestered for 40 years. However, aggregators are required to guarantee that credits sold are permanent. In other words, the aggregator is responsible for replacing credits should a reversal occur. The ACR grants the aggregator the flexibility to design mechanisms to mitigate the risk of reversal using diversification, futures contracts and insurance; thereby, aggregators are given the opportunity to include projects in a program without having a 40 year commitment from each individual landowner (Benefits, Existing Methods and Key Challenges to Aggregating Greenhouse Gas Emissions Offsets, 2012).

The ACR buffer pool grants project proponent's flexibility as it allows them to contribute tonnes to the buffer pool that are not related to the project that requires risk mitigation. Project developers must simply mitigate reversal risk by contributing Emission Reduction Tonnes (ERTs) of any type or vintage to the ACR buffer pool. ACR standard adherence ensures all ERTs are fungible.

Sector standards including the ACR Forest Carbon Project Standard provide additional details on the operation of the ACR buffer pool. These details describe: (1) the retirement of offsets to mitigate reversals, (2) requirements for replenishing the buffer in the event of a reversal, (3) the return of buffer tonnes to the project developer over time in the event of no reversals, and (4) the possibility for buffer contributions to increase or decrease over time as a project undergoes periodic verification and re-assessment of risk.

Alternative risk management options available under the ACR allow the developer to provide insurance, bonds, letters of credit or other financial assurances to the ACR in an amount, form and substance that is satisfactory to ACR. Financial products must ensure that sufficient funds are available so that in the event a project suffers an unintentional or intentional reversal, the funds are adequate to purchase and retire a number of ERTs sufficient to offset such reversal.

Crediting Period	• Crediting Period for non-AFOLU projects are 10 years. AFOLU projects can have a longer crediting period as specified in the ACR standard or methodology.
Tonnes Generated	• 39,383 t Credits issued from grassland conversion (soil sequestration) (American Carbon Registry, 2013) • (Note 2 tonnes from Nitrous Oxide Reductions in Corn)[3] (American Carbon Registry, 2012)

California Climate Action Reserve

To date, 17 protocols have been approved for use including a "Grassland Project Protocol", which provides guidance on how to quantify, monitor, report, and verify GHG emission reductions associated with the avoided conversion of grassland to cropland. CAR has also developed a Forestry Protocol and a Rice Cultivation Protocol[4]. CAR sets out permanence requirements in a Program Manual. CAR recognizes that offset projects which remove CO_2 from the atmosphere and store it in a reservoir (e.g. in trees or other organic materials, or in geologic formations) are at risk of re-emitting stored CO_2 into the atmosphere, leading to a "reversal" of GHG reductions. CAR states a reversal has occurred when the total amount of CO_2 stored by a project becomes less than the total number of CRTs issued to the project. In the event of a reversal, the Reserve requires that reversals be compensated for in order to ensure both the integrity of CRTs and their effectiveness at offsetting GHG emissions. Specific rules and conditions for reversal compensation are detailed in individual protocols. The Reserve requires CRTs to be retired in proportion to any reversals to ensure the total number of issued CRTs does not exceed the total quantity of CO_2 stored by a project over a sufficiently long period of time.

Crediting Period	• The majority of non-sequestration projects registered with the Reserve are subject to a 10-year crediting period (may be renewed one time for a maximum of two 10-year crediting periods) • Sequestration projects have a crediting period up to 100 years.
Tonnes Generated	• No tonnes from avoided grassland conversion • Only Forestry tonnes: o Avoided Conversion: 1,300,461 (both ARB compliance and non-compliance) o Conservation Forestry is at 5,062,124

Temporary offset credits under the Clean Development Mechanism

The Kyoto Protocol highlighted concerns over the inclusion of potentially reversible carbon stored in trees as a result of disturbance and subsequently decided to view afforestation and reforestation activities as a temporary solution to climate change mitigation (World Bank Carbon Finance Unit, 2011). Under the CDM, temporary offset credits were seen as an opportunity for Annex B countries to gain time to develop technologies required to effectively address climate change mitigation while still complying with

[3] https://acr2.apx.com/myModule/rpt/myrpt.asp?r=112
[4] http://www.climateactionreserve.org/how/protocols/

reduction obligations. Under the Kyoto Protocol, developing countries could use temporary credits to achieve no more than one percent of their annual emission reduction targets (times five) during the first commitment period of the protocol.

Under the Clean Development Mechanisms of the Kyoto Protocol, forestry projects are deemed at risk of reversal and are issued temporary credits (tCERs) or long-term certified emission reductions (lCERs) whereas all other projects are issued Certified Emission Reductions (CERs). A tCER represents the amount of tonnes of CO2e sequestered every verification whereas a lCERs represents the carbon sequestered since the last verification (see Figure 1 Accounting of tCERs and lCERs).

A key difference between the two types of credits is their term of expiration. Temporary CERs are CERs issued for an afforestation or reforestation project activity under the CDM which expires at the end of the commitment period following the one during which it was issued whereas a long-term CER is a CER issued for an afforestation or reforestation project activity which expires at the end of its crediting period (Figure 2 Expiration of tCERs and lCERs).

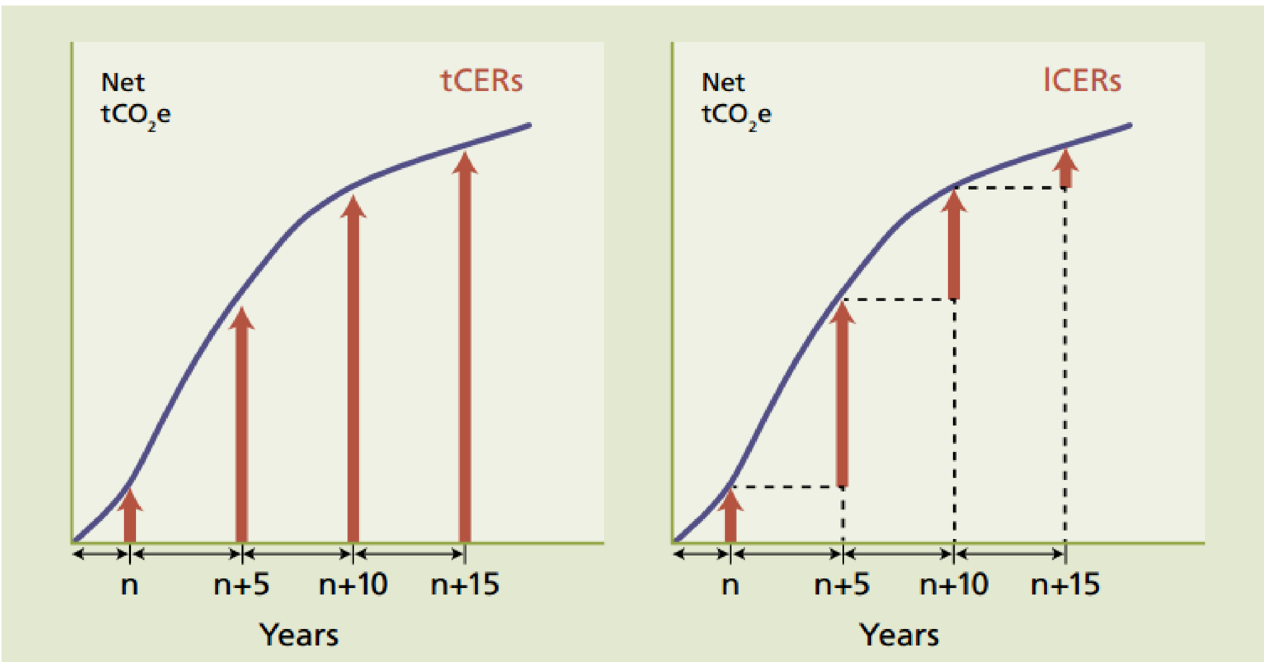


Figure 1 Accounting of tCERs and lCERs
Source: (Pedroni, 2005)

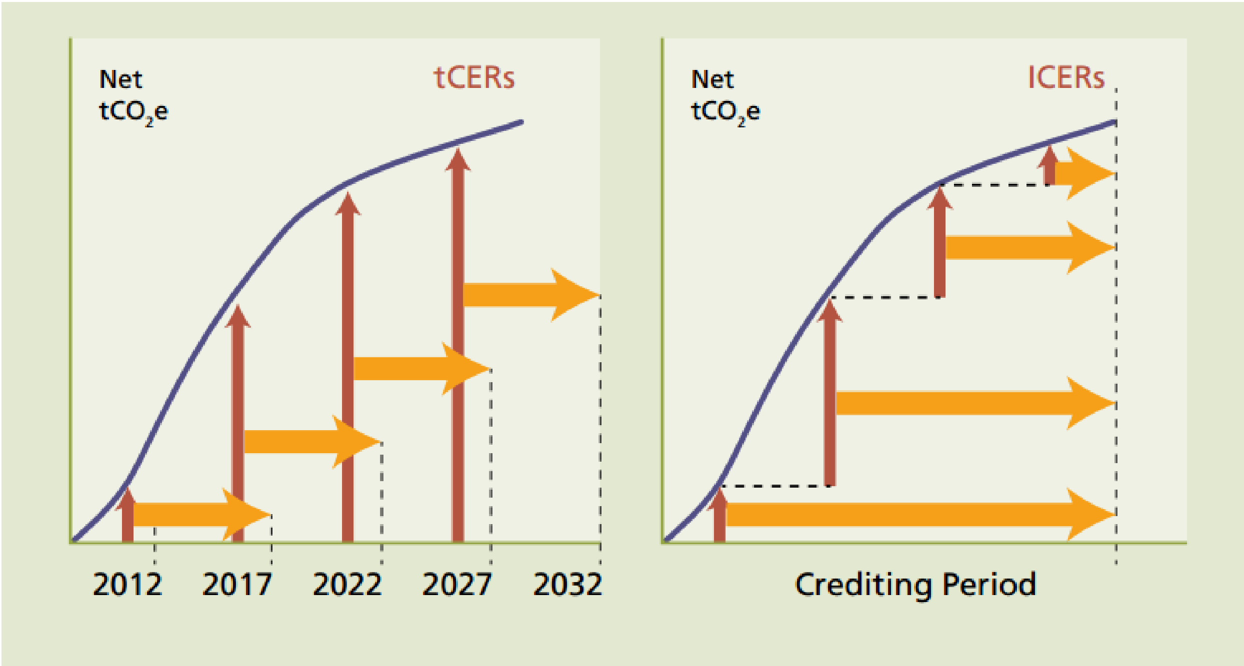


Figure 2 Expiration of tCERs and lCERs
Source: (Pedroni, 2005)

Before temporary credits expire, buyers are required to replace each unit with a permanent credit to ensure full compliance with their commitments including CERs, ERUs, RMUs or AAUs.
Temporary CERs were thought to have a better cash flow compared to lCERs because although both assets can be issued every five years after the first verification, the carbon stock generated by tCERs in one crediting period (i.e., the first vintage) can be reassessed once the tCERs have expired—and new credits issued in the next period. If this same first vintage is issued as lCERs, however, the credits would be committed from the certification date to the end of the project crediting period (World Bank Carbon Finance Unit, 2011). As a result, developers theoretically would receive less money from a stream of lCERs than tCERs.

In practice, however, the temporary nature of tCERs negatively impacted the economics of sequestration projects as it resulted in lower values of such credits in comparison to permanent Certified Emission Reductions from other sectors. As a result, very few tCERs have been generated, and therefore, very few forestry projects under the CDM have occurred since they were perceived in the EU ETS as difficult to manage and transfer (World Bank Carbon Finance Unit, 2011).

Crediting Period	The crediting period for CDM project activities is selected by the project participants, and in most cases may be either: • A 7-year crediting period, renewable twice; or • A single 10-year crediting period. The crediting period for a CDM Afforestation/Reforestation project activity is selected by the project participants, and may be either: • A 20-year crediting period, renewable twice; or • A single 30-year crediting period.
Tonnes Generated	• Afforestation and Reforestation projects are less than 0.8% of the total number of CERs issued.[5] • To date (July 1, 2016) only 3 afforestation projects have had CERs issued at a 69% success rate for a total of 751,000 tonnes. • 21 reforestation projects have CERs issued, for over 10,000,000 tonnes with a higher success rate, but since the EU ETS would not accept sequestration projects, it's likely that not many tonnes have been retired under the CDM.

Carbon Farming Initiative/Emissions Reduction Fund - Australia Soil Carbon Methodology6

The Australian Soil Carbon Methodology sets out the detailed rules for implementing and monitoring offsets projects that sequester carbon in agricultural soils using certain types of management actions on project land and default values of sequestration (Carbon Farming Initiative, 2015).

A soil carbon project is an eligible offset project only if a project management activity is carried out for the duration of the nominated permanence period. Initially, the Carbon Farming Initiative allowed carbon storage projects for a period of 100 years; however, project developers can now choose either a 100- or 25-year permanence period for new projects (the latter accommodating a more practical approach based on stakeholder concern regarding the inflexible nature of the methodology). Carbon must be maintained for the duration of the permanence period otherwise the credits issued for the project must be relinquished. This permanence period is translated into a discount in the number of credits that are issued. For example, projects with a 25-year permanence period will be subject to a 20 per cent discount on the number of credits that would be issued to the project under a 100-year permanence period. Existing carbon storage projects can convert from a 100 to a 25-year permanence period upon request within two years of the commencement of the Emissions Reduction Fund. If no request is made, then the project will remain a 100-year project. Once a permanence period is selected it will remain the permanence period for the project and cannot be varied.

If Australian Carbon Credit Units have already been issued for a project, project owners may choose to move to a 25-year permanence period; however, they must reflect the 20 percent discount and will have 90 days to give back credits. The project owner may also seek the Regulator's approval for an alternative repayment schedule.

[5] http://www.cdmpipeline.org/cers.htm
[6] https://www.environment.gov.au/climate-change/emissions-reduction-fund/methods/sequestration-carbon-modelled-abatement-estimates

Accountability for maintaining the permanence of a reduction resides with the project developer. Project developers can cancel carbon storage projects and remove the carbon stores at any time; however, they are required to return the same number of credits that were issued to the project. If credits have already been sold, then replacement credits can be purchased from other Emissions Reduction Fund projects.

The program managers of the Emission Reduction Fund view the 25-year permanence period as significantly reducing the amount of time before land managers can stop their project activities and impact carbon stores without financial penalty (compared to 100-year permanence). Following the 25-year period, owners have full flexibility, making it easier for mortgagees such as banks and lending institutions to consent to carbon storage projects. It should be noted that many carbon storage projects will continue at the end of the permanence period as they continue to benefit from improved agricultural productivity.

To account for unplanned reversals such as natural events like bushfires, existing CFI rules create a buffer by holding back five per cent in carbon storage projects. In other words, for every 100 tonnes of carbon stored by a project, only 95 Australian Carbon Credit Units are issued. In the event of an unplanned reversal, a project owner does not have to relinquish or pay back credits if carbon stores are lost because of natural events; however, if carbon stores are lost, proponents will no longer receive credits until carbon stores recover. The same rules apply for the Emission Reduction Fund.

For all types of projects, the project owner will be the person that is responsible for carrying out the project and has the legal right to do so. Under the CFI, proponents must obtain the consent of anyone with an interest in the land before a project can be registered. This will remain a requirement under the Emissions Reduction Fund, which applies to both aggregated and sequestration projects. To provide flexibility, consent can be obtained after a project has been to auction and secured a contract. Credits will only be issued once all the necessary consents have been obtained.

Crediting Period	• In general projects have a 7-year crediting period however sequestration projects have a 25-year crediting period.
Tonnes Generated	• As of July 1, 2016, Australia has implemented the SafeGuard Mechanism which places a regulatory backstop to the Emission Reductions Fund projects. Emitters will now be regulated. The methods for the Emission Reduction Fund are relatively new, and the generated offsets will be tracked on the ANREU, the Australian Registry. To date, no Australian Carbon Credit Units have been issued and registered on the registry.

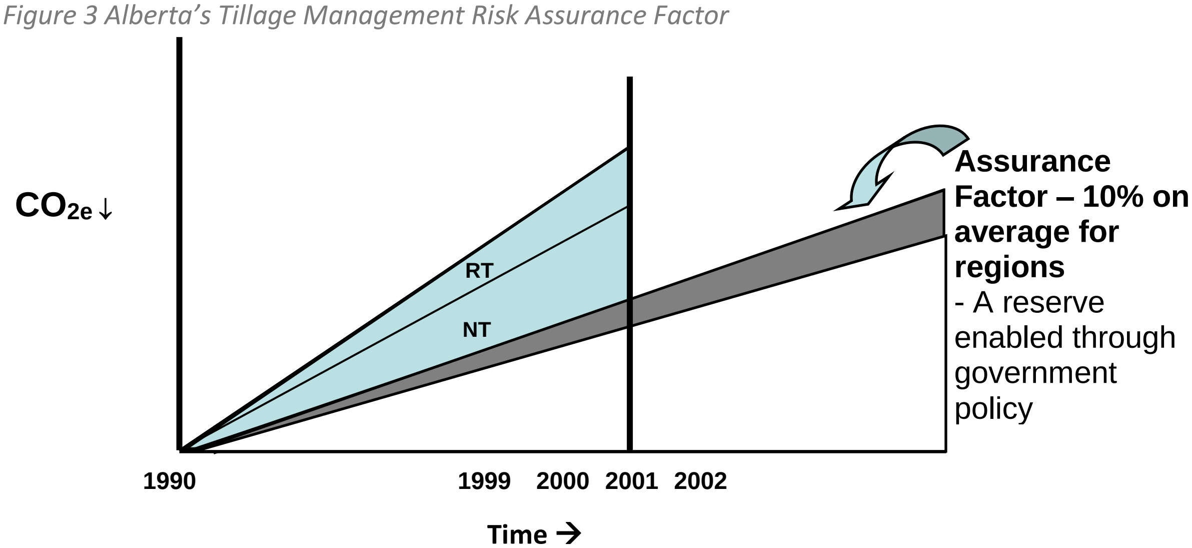
Alberta Offset System (AOS)

Alberta protocols involving sequestration projects apply an "Assurance Factor" to address the risk of reversals. The assurance factor is a scientifically-supported discount or 'risk premium' deducted from every tonne created in a project to account for any reversal. In effect, all tonnes created under a sequestration protocol are discounted to create a carbon reserve.

Through this approach, the Government is sharing in the risk through the enabling policy of an assurance factor. The size of the discount is derived from a risk probability assessment. For example, the Conservation Cropping Protocol uses an assurance factor based on a risk assessment (Government of Alberta, 2012). The CCP risk-assessment was conducted by polling agricultural extension specialists and examining records of industry tillage practices tracked by conservation agencies over the last few decades. This data was used to develop conservative estimates of the number of tillage reversal events for each of the accounting regions in the protocol for the last 20 years. These estimates were used to derive a reversal risk percentage, which are applied as a discount in the amount of carbon the project developer can claim (e.g., 10% discount on every verified result in 0.1t CO_2e collected by the government for each verified tonne created under the protocol). This pool of carbon is used to cover the risk of a reversal in the current and future years (similar to Australia's 25-year option).

To date, the number of Conservation Cropping tonnes registered in Alberta is approaching 13.5 Mt, and the reserve has retired approximately 1.35 million tonnes to the atmosphere to ensure against any reversals that occur in the future (see Figure 1 below). In the event of a reversal, project developers must disclose the reversal and do not receive credits for that year; however, they are not held liable for any reversals. In the case of Alberta's assurance factor, Agriculture Canada scientists estimate that the average reversal incidence is likely 3%, not 10% reversal incidence[7]. The government monitors the reversals to ensure reversals have not gone past the regional average, and to confirm that the carbon reserve is large enough to cover off future reversals.

Figure 3 Alberta's Tillage Management Risk Assurance Factor



Note: RT = Reduced Till; NT = No Till

[7] Dr. Brian McConkey, Agriculture and Agrifood Canada, pers comm.

Crediting Period	• Emission reduction projects have a credit period of 8 years plus a possible extension of 5 additional years. • Conservation Cropping Projects have been given two ten-year crediting periods (2002-2021), with reduced summer fallow being an additional project type for the final crediting period.
Tonnes Generated	• Conservation Cropping Tonnes[8]: 13,500,000 (vintage 2002-2015)

In summary, Alberta has found that this approach allows for more certainty in management and contracting. With this discounted approach to address liability, annual contracts can be used. Furthermore, the liability is not borne by the land owner/land lessee for an unmanageable period of time. Historical statistics used in concert with scientific data, modeled projections, and expert advice have the potential to produce more rigorous and less subjective measurements of risk albeit at a potentially higher cost. This is the justification for the program's preference for standardized procedures that are incorporated into the Protocols, rather than being developed at the Project application stage. These figures should be reviewed by the verifier and/or could also require a certain level of expert review including experts employed by the provincial or federal governments/agencies.

Applying a tonne-year approach to permanent crediting

The methods previously described reward credits in the year sequestration is achieved and require a buffer pool, reserve or discount that addresses credits that have been invalidated by a reversal. One of the key risks of these system is the non-continuance of the program, which would result in the ending of monitoring for reversals.

In a so-called "tonne-year" approach, credits are issued only when they are deemed permanent. Permanence is assumed by considering the cumulative radiative forcing of the emission removal over a pre-defined permanence period.[9] A permanent credit is calculated by applying an exponential function and accumulates over the residency period. This method is more compressively described in Murray and Kasibhatia Equating Permanence of Emission Reductions and Carbon Sequestration: Scientific and Economic Foundations for Policy Options (Murray and Kasibhatia 2013).

Using this approach and assuming a 100-year permanence period, a tonne of emissions removed from the atmosphere in the first year of a project receives on a small proportion of one tonne; however, additional credit is issued in the second year, third year, and so on. The total cumulative credit approaches one tonne by year 100. If a reversal occurs, no additional credit is issued or accumulated against the original tonne removed; however, no credit that was previously issued must be returned.

This method requires no buffer pool or reserve because credit is issued only as its calculated radiative forcing is achieved. This method effectively eliminates the risk associated with non-continuance of the program, and with estimating the of the magnitude of the risk required to establish the buffer pool to provide assurance under this mechanism.

[8] Including both Conservation Cropping and previous version called Tillage System Management Protocol.

[9] As previously discussed, 100 years is common permanence period used in GHG programs because the common GHG accounting standard refers to the Intergovernmental Panel on Climate Change use of a 100-year period for calculating global warming potential factors (IPCC 2007).

Policy Analysis and Recommendations

Principles for Developing a Reversals Policy

Establishing a set of guiding principles may prove invaluable in the process of developing a policy regarding reversals. ISO 14064-2 defines six principles for quantification and reporting greenhouse gas emission reductions or removals. These principles are also relevant for development of a reversals policy. Each of these six principles are defined in the context of a reversals policy below. Two additional principles, "practicality" and "fungibility" have been added to this list.

Transparency – The process for establishing and managing a permanence mechanism should be available to stakeholders. Sufficient information to track the total quantity in the reserve, cumulative discount or buffer pool should be available.

Accuracy – Methods for quantifying or monitoring reversals should adhere to the same requirements as those applied to quantify and report the initial emission reduction.

Conservativeness – quantification methodologies applied to quantifying or monitoring reversals should tend towards overstating reversals. When using the buffer pool, reserve or discount should be designed to ensure an abundance of credits so as to avoid a situation where reversals in a single year could exceed the quantity in the reserve[10]. If using the tonne-year approach, the permanence period[11] should be conservative.

Consistency – Methods applied to quantify emission reductions should be consistent with the methods applied to quantify reversals. These methods should be consistent over time, except if changes to these methods strengthens other principles. If methods are changed, a complete description of these changes should be available to stakeholders.

Completeness – Methods for quantifying and monitoring reversals should be designed to ensure all reversals are reported[12].

Relevance – Methods for quantifying and monitoring reversals should be designed appropriately for the needs of stakeholders.

Practicality – Administrative requirements for all stakeholders (Monsanto, their partners and growers) should be simple and not preclude farmers from participating.

Fungibility – Biosequestration insets are comparable and interchangeable within the GHG program with other insets.

[10] This situation is more likely in the first few years of a project when the quantity of credits in the reserve has not accumulated.

[11] The period over which a biological sequestration tonne is deemed to become permanent (e.g. IPCC uses 100 years).

[12] Use of remote sensing may significantly improve reversal tracking completeness over self-reporting methods that are currently common.

Risk to an Insetting Program

Reversals present two key risks to the integrity of an insetting program: (1) the risk that the reversals policy does not fully account for reversals; and (2) the risk of non-acceptance of the policy by program stakeholders. Non-acceptance of the policy could result from issues related to failure to uphold the principles defined in the previous section.

A mitigation strategy that includes the following two design elements can reduce the risk that the reversals policy does not fully account for actual reversals.

1. Design the reversals policy to overestimate reversals based on historical data (i.e. a conservative estimate). The GHG programs previously described in this paper acknowledge a high level of uncertainty in the reversal rate for many biological sequestration project types. These programs seem to have applied conservative estimates in the design of buffer pools and reserves. In some programs, the rate of credits that must be set aside may be adjusted periodically as the actual risk of reversals is better understood.

   Alternately implementing a tonne-year approach will effectively eliminate the risk associated with incorrectly estimating the risk of reversals.

2. Utilize a project monitoring method that moves from self-reporting to program level automated monitoring. The use of remote sensing (satellite imagery, for example) has the potential to significantly improve the complete reporting of all reversals.

Recommended Process for Developing a Permanence Policy

Considering the principles described above, the recommended process for developing a permanence approach for biosequestration projects within an insetting framework should include the following steps:

1. *Assess the risk of reversal.* This assessment includes identification of activities, either intentional or unintentional, that would result in a reversal. In order to design an appropriate permanence mechanism, it is necessary to design an appropriate risk management system; therefore, it is first necessary to understand the nature and extent of risk. Risk assessment can be based on historical evidence, expert opinion and/or predictive modeling. Where available, statistical analysis of historical data should be carried out to determine the level of risk for reversals from natural causes.

   Analysis of each of these potential reversal pathways should include an impact estimate considering the magnitude and likelihood of the reversal. Finally, if risk mitigation is practical, then an implementation strategy should be designed that prioritizes the reversal pathways with the highest impact.

2. *Establish the permanence approach.* Considering the program objectives, principles and risk of reversal, establish the permanence approach with the input of the Insetting Advisory Committee (risk assurance factor, reserve holdbacks/buffer pools, private insurance or tonne-year approach). The benefits and challenges associated with these methods is presented in the Appendix.

3. *Establish the permanence timeframe/period.* One hundred years is commonly applied in existing GHG programs; however, a different timeframe may be appropriate for an insetting program, particularly for biological/soil sequestration projects.

4. *Develop a monitoring and verification strategy.* This plan should include the policy and methods for determining if a reversal has occurred and the subsequent reporting or recording of reversal events. A prescriptive policy will enable efficient verification of reversals within the context of the larger program.

Conclusion

Permanence is a fundamental characteristic of GHG insets/offsets that sequester carbon in biological sinks. Release of stored carbon must be addressed within the GHG program to maintain environmental integrity and stakeholder acceptance of the program.

Existing GHG programs handle reversals using somewhat different approaches, including reserve pools, buffer accounts or insurance programs. These approaches generally require that all carbon removed and sequestered in biological sinks remains in place for a certain period of time. In the event of a reversal, the quantity of carbon released must be replaced in full in the programs currently in place.

A tonne-year approach may also be used to address permanence. This approach does not require any replacement of carbon releases because it credits only the cumulative radiative forcing associated with the original carbon removal. When a reversal occurs, no additional crediting for the original removal is granted. The tonne-year approach has not been implemented in any large-scale systems to date.

Developing a credible permanence policy for an insetting program should consider stakeholder needs and program objectives. A principle-based approach to developing this policy should consider the principles of transparency, accuracy, conservativeness, consistency, completeness, relevance, practicality and fungibility. An assessment of the estimated risk of reversal is also vital information for the development of a permanence policy. With all this information in mind, a permanence approach may be selected. The overall approach must include a permanence timeframe and should detail the monitoring and verification strategy that will ensure the approach is implemented as designed.

APPENDIX

	Benefits	Challenges
Discount or risk assurance factor	• Allows farmers greater aggregator choice over time, because it allows for more flexibility in management and contracting (i.e. allows for annual, even biannual, contracts to be used). [13] • Lower cost and easier administration • Project developer shares the risk of a reversal, so no major investment/action is required of an individual Project Developer to compensate for their loss • Transaction costs of monitoring are lower because the liability does not carry forward beyond the registration period • The reserve continually builds and is not returned – if the risk factor is accurate or better yet conservative…. the amount of carbon built in the reserve over time should cover off the need or a permanence period, i.e. the carbon is permanently held by the government. Typically set at the protocol level – no variation in factors	• All project developers receive fewer offsets as opposed to a few project developers bearing the large costs of a reversal (could be considered a pro or con depending on risk tolerance) • Lower incentive to avoid a reversal (than under a reserve or insurance) – although offset credits throughout the registration period will likely provide sufficient incentive to avoid a reversal; but a reversal means a loss in soil quality and or forest productivity and history has shown that companies are motivated to avoid this loss • Pressure will be on government to return a portion of the carbon as the reserve gets bigger and no reversals occur • Low incentive to report a reversal

=[13] Farmers don't always feel comfortable entering into future contracts.

	Benefits	Challenges
Buffer Reserve	• Higher incentive to avoid a reversal (than under an assurance factor). Because, if no reversal occurs, the Holdback is returned to the PD for sale. • A reasonable level of liability for buyers/sellers. • Depending on design, Project Developers could share the risk of a reversal, so no major investment/action is required of an individual PD to compensate for their loss • Can be set at the protocol level or by the project developer – may depend on scale of projects (known agricultural activities in a region, smaller units vs. broader scales of forest carbon management activities	• Risk of reversal can be on individual Project Developers or Aggregators, therefore greater risk of higher losses (as opposed to sharing the risk and taking a cut every year **unless** a reserve is pooled amongst Project Developers) • A Holdback could be a higher percentage than an assurance factor because the risk of a reversal is held by one Project Developer (**unless** a reserve is pooled amongst Project Developers) • Does not allow as much flexibility in contracting as an assurance factor • Project specific risk assessments may introduce inconsistencies;
Tonne-year Approach	• Eliminates risk that discount factor or reserve is insufficient to address reversals • The delayed revenue stream provides an incentive to maintain the practice to reap the larger reward of the accumulated permanent credits. • No verification or reserve pool reconciliation tracking is required if a reversal occurs	• Credit granted to farmers and Project Developers is only a small fraction of the total credit, which results in significantly less revenue • Requires tracking of every emission reduction claim within a project over an extended period of time

Works Cited

American Carbon Registry. (2012). *Methodology for Quantifying Nitrous Oxide (N2O) Emissions Reductions from Reduced Use of Nitrogen Fertilizer on Agricultural Crops .*

American Carbon Registry. (2013). *Methodology for Avoided Conversion of Grasslands and Shrublands to Crop Production V 1.0.*

(2012). *Benefits, Existing Methods and Key Challenges to Aggregating Greenhouse Gas Emissions Offsets.* Electric Power Research Institute.

Carbon Farming Initiative. (2015). *Sequestering Carbon in Soils in Grazing Systems .*

Diamant, A., Weisberg, P., & Zakreski, S. (2011). Aggregation of Greenhouse Gas Emissions Offsets: Benefits, Existing Methods, and Key Challenges. Palo Alto, CA: Electric Power Research Institute .

Government of Alberta. (2012). *Quantificiation Protocol for Conservation Cropping V1.0.*

Pedroni, L. (2005). Carbon Accounting for Sinks in the CDM after COP-9. *Climate Policy 5*, 407-418.

The American Carbon Registry® . (2010). *The American Carbon Registry® Forest Carbon Project Standard Version 2.1.*

The Earth Partners LLC. (2012). *Approved VCS Methodology VM0032 Soil Carbon Quantification Methdology.*

Verified Carbon Standard. (2011). *Registration and Insurance Process: VCS Version 3 Procedural Document.*

Verified Carbon Standard. (2013). *AFLOU Non-Permanence Risk Tool: VCS Version 3.2 Procedural Document.* Verified Carbon Standard.

World Bank Carbon Finance Unit. (2011). *BioCarbon Fund Experience: Insights from Afforestation and Reforestation Clean Development Mechanism Projects.* Washington, DC: World Bank.

World Bank's BioCarbon Fund. (2011). *VM0017 Adoption of Sustainable Agricultural Land Management, V1.0.*