Options for Managing CO_2 Reversals

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Introduction

A "carbon offset" is a reduction in greenhouse gas (GHG) emissions (or an increase in carbon sequestration) that is used to compensate for GHG emissions occurring at another source. The underlying premise of an offset is that the atmosphere is indifferent to where and how GHG reductions are achieved, so it is possible to trade one kind of reduction for another. For this to be true, however, carbon offset activities must have the same mitigating effect on climate change as would a reduction in the emissions they are offsetting.

The challenge for offsets involving carbon sequestration (e.g., storing carbon in trees or soils) is that sequestered carbon can be released back to the atmosphere. The re-release of stored carbon is referred to as a "reversal." When the carbon associated with an offset is reversed, its mitigation benefits are lost. Since CO_2 can remain in the atmosphere for many centuries,[1] a reversal that occurs within a relatively short timeframe (e.g., less than 100 years) will significantly undermine the effectiveness of an offset; the atmosphere would have been better off if CO_2 emissions had been directly reduced instead.

To address the risk of reversals, carbon offset protocols must contain mechanisms that either:

1. Guarantee the long-term storage of carbon associated with an offset;
2. Compensate with additional mitigation if a release of carbon occurs; or
3. Discount the amount of credit received based on the expected mitigation benefits relative to a direct reduction in CO_2 emissions.

These options are not mutually exclusive and different offset protocols may incorporate different mechanisms. Furthermore, mechanisms that work for one type of project (e.g., forestry) may not be feasible for other types of projects (e.g., soil carbon sequestration on cropland). The challenge in developing agriculture sector protocols for the Reserve will be to identify a mechanism, or combination of mechanisms, that provide sufficient guarantees of environmental integrity (i.e., upholding the parity between sequestered carbon and direct CO_2 emission reductions) while remaining practical.

[1] For example, see National Research Council, 2010. *Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia*. National Academies Press, Washington, D.C.

The Approach to Reversals in the Reserve's Forest Project Protocol

There are three basic questions that need to be answered in designing a policy to address offset reversals:

1. How long must carbon be stored before it can be said to fully offset CO_2 emissions?
2. How is a reversal defined?
3. How will reversals be addressed or compensated for?

The Climate Action Reserve's Forest Project Protocol (FPP) stipulates that carbon must be stored for 100 years before it can be considered a full CO_2 offset. This is based on the standard practice of evaluating climate change impacts of GHG emissions over a 100-year timeframe. For example, in international negotiations the global warming potentials (GWPs) used to compare the effects of different GHGs are derived from net impact of each GHG over a 100-year time horizon.[2] This horizon is based in part on economic and social decision-making analyses suggesting that 100 years is an appropriate time horizon to evaluate the comparative benefits of climate change mitigation actions.[3]

Accordingly, the FPP defines a reversal as occurring when the number of tonnes of CO_2 stored or reduced by a project becomes less than the total number of offset credits (called Climate Reserve Tonnes or CRTs) issued to the project within the past 100 years (see Table 1 for an example).

Table 1. Example of Reversal Accounting as Defined by the Reserve Forest Project Protocol

	Cumulative CO_2 Stored by Project	Net CO_2 Emitted to Atmosphere in Period	Total CRTs Issued to Date	CRTs Issued Over Past 100 Years	Magnitude of Defined Reversal
2000	0	0	0	0	0
2025	3,000	(-3,000)	3,000	3,000	0
2050	2,500	500	3,000	3,000	500
2075	5,000	(-2,500)	5,000	5,000	0
2100	6,500	(-1,500)	6,500	6,500	0
2125	8,000	(-2,500)	8,000	8,000	0
2150	4,000	4,000	8,000	5,000	1,000

In this example, a forest project sequesters 3,000 tonnes of CO_2 by its 25^{th} year (2025). Between 2025 and 2050, 500 tonnes are lost, equating to a reversal of 500 tonnes. Carbon continues to accumulate until 2125; between 2125 and 2150, however, half the cumulatively stored CO_2 (4,000 tonnes) is lost. In 2150 only 5,000 CRTs were issued within the previous 100 years, so the total reversal (as defined by the FPP) is only 1,000 tonnes (5,000 CRTs – 4,000 cumulatively stored tonnes of CO_2).

Under the FPP, the Reserve requires that reversals be directly compensated for by retiring a number of CRTs equivalent to the magnitude of the reversal. In the example in Table 1, for instance, 500 CRTs would have to be retired in 2050, and 1,000 CRTs would have to be retired

[2] United Nations Framework Convention on Climate Change, 1997. *Addendum to the Protocol*, Decision 2/CP.3, para. 3. Available at: http://unfccc.int/resource/docs/cop3/07a01.pdf

[3] For example, see Fearnside, P., 2002. "Why A 100-Year Time Horizon Should Be Used For Global Warming Mitigation Calculations" in *Mitigation and Adaptation Strategies for Global Change* 7: 19-30.

in 2150. By requiring compensation in this way, the Reserve guarantees that the total number of CRTs in circulation never exceeds the total quantity of CO_2 stored or reduced by a project over 100 years. The commitment to maintain forest carbon for 100 years or compensate for reversals is upheld with a contract between the Reserve and the project developer (called a "Project Implementation Agreement").

The FPP distinguishes between reversals that are "unavoidable" and those that are "avoidable." Unavoidable reversals are those due to wind, fire, disease or other events outside the control of the project developer. These types of reversals are compensated for using an insurance mechanism called a "buffer pool," administered and maintained by the Reserve. Project developers are required to contribute CRTs to this buffer pool over time, but in return face no liability if a fire on their property, for example, causes a reversal. Avoidable reversals are those due to intentional activities (e.g., harvesting) and must be compensated for directly by the project developer. Project developers may compensate by retiring CRTs previously issued to their project or by procuring CRTs from other forest projects and retiring those.

Project developers may choose to terminate a project at any time. If they do so, they are required to pay back (retire) a quantity of CRTs equal to the total number issued to the project over the previous 100 years.

Options for Agriculture Sector Protocols

The FPP's approach to addressing reversals was agreed upon through a multi-stakeholder consultation process specific to the forestry sector. This approach may or may not be appropriate for different types of carbon sequestration projects in the agriculture sector. In terms of fundamental principles, the Reserve is committed to its definition of how long carbon must be stored to fully offset CO_2 emissions (i.e., 100 years). Other dimensions of a reversal policy, however, such as how reversals are accounted for, how they are compensated for, and who bears liability, may be tailored to specific project types. A general list of possible alternatives is presented below, with some preliminary discussion of the potential merits and challenges of each approach.

Option 1: Use the Same Approach as the Forest Project Protocol

The approach described above for the FPP could be applied to projects that sequester carbon in the agriculture sector. This would be an effective method for ensuring environmental integrity. For a number of practical reasons, however, it would probably not be appropriate in an agricultural context. The main barriers are the short duration of management cycles in agriculture production systems, a need for flexibility to respond to unexpected circumstances that impact crop yields, and a high proportion of land tenure agreements where farmers rent the land on a short-term renewable basis. This last issue is a challenge because the Reserve's Project Implementation Agreement contract assigns liability to the landowner; but in the case of agriculture, the landowner may be completely removed from land management activities and the farmer – who controls management – may not work the same land for a 100-year period.

Certain elements of the FPP's approach could be incorporated in an approach for the agriculture sector, including the use of a buffer pool to insure against reversals and distinguishing between avoidable and unavoidable reversals.

Option 2: Assign Liability for Reversals to Credit Buyers

The Reserve's FPP assigns liability for reversals exclusively to landowners. The buyers of CRTs face no liability, and in fact are guaranteed that CRTs purchased from forest projects will maintain their worth because landowners must stand behind them and compensate for any reversals. An alternative approach would be to assign the liability for reversals to buyers. Under this kind of arrangement, buyers of CRTs would see their CRTs canceled if a reversal occurred. If any of the canceled CRTs were retired against an emissions obligation, they would need to be replaced.

Although this approach has been considered in some contexts, it has several significant drawbacks. Superficially, it would be attractive to landowners since they would not immediately bear the cost of any reversal risks. However, by imposing a liability on buyers, the value of a sequestration CRT would be substantially reduced. Sellers would therefore receive payments for CRTs significantly below the market price for other kinds of offsets. This approach could be combined with a buffer pool system to insure against unavoidable reversals, but in that case CRT buyers would be liable for any avoidable (intentional) reversals that occur within a 100-year timeframe. Because of this, buyers would have an incentive to negotiate contracts with landowners to transfer some or all of the liability. This could create significant transaction costs and impede the free exchange of CRTs (since liability contracts would need to be re-assigned with every sale of CRTs). Furthermore, the administrative challenges for buyers to track the performance of individual projects would discourage them from buying these kinds of offsets. From the Reserve's perspective, enforcement would be fraught with challenges surrounding tracking and enforcing buyer compliance, in particular when a single project provides credits to multiple buyers. If a partial reversal occurred, some mechanism would need to be devised to determine which CRTs and which vintages to cancel (possibly from multiple accounts).

Option 3: Use Only a Buffer Pool to Compensate for Reversals

One approach that is sometimes proposed to address reversals is to rely solely on an insurance buffer pool. Under this approach, projects are required to contribute credits to a buffer pool according to the expected risk of reversals over a certain time period (which, for environmental integrity purposes, should be the time required to fully offset CO_2 emissions, i.e., 100 years). Neither project developers nor credit buyers would face liability for any reversals that actually occur. Instead, reversals would be compensated for by retiring credits out of the buffer pool. The advantages of this approach are that project developers would not face any added cost (aside from required buffer pool contributions), and buyers would be able to buy fully valid and unencumbered credits (i.e., they would not have to replace credits in the case of a reversal).

One major challenge with this approach is that it can be difficult to estimate the risk and likely magnitude of reversals over a 100-year time horizon. This is especially true for agricultural systems (e.g., involving soil carbon), which have short management cycles and may be subject to significant variability depending on the management regime and possible natural perturbations. For some agricultural systems, the risk of reversal over a 100-year period may be so high – in the absence of any additional monitoring mechanisms and assignment of liability – that required buffer pool contributions would be highly prohibitive. Furthermore, it may be particularly challenging to estimate risks for and insure against intentional (avoidable) reversals.

Option 4: Partial Crediting for Temporary Carbon Storage

Given the costs and difficulties associated with assigning liability for reversals and estimating reversal risks over time, another approach is to simply assign partial credit for stored carbon over time based on the length of time it has been stored. Under the simplest arrangement, for example, one tonne of CO_2 stored for one year would receive $1/100^{th}$ of a credit. Full crediting would therefore be achieved only after the tonne had been stored for 100 years. There would be no penalty if a reversal occurred prior to 100 years – the landowner would forego future credit increments – but previously issued credits would be unaffected. A project that sequestered 1,000 tonnes for 50 years, therefore, would be issued a total of 500 credits, which would be unaffected if the project terminated at that point.

From a practical standpoint, partial crediting has many advantages. It does away with treating reversals as a liability. Credits are issued on an "as-you-go" basis according to the length of time CO_2 is stored, so there is no risk associated with reversals per se. The only penalty associated with a reversal would be the lost opportunity to continue to receive (partial) credits for the re-emitted carbon.

Methodologically, however, partial crediting presents a number of challenges. In theory, the "correct" amount of partial credit to give for temporary storage of CO_2 depends not simply on the time period for comparing mitigation effects but also on the incremental environmental damage associated with CO_2 emissions over time and the present value of the social and environmental costs of that damage.[4] Large uncertainties exist both in terms of estimating future damages from CO_2 emissions and in imputing a social cost to those damages in today's dollars. These uncertainties could be addressed by relying on conservative estimates, but doing so may result in a partial crediting rate that is prohibitively low (even granting 1/100th of a credit for each year of storage may be too severe depending on credit prices and the type of project).

Finally, the logic of partial crediting from a climate change mitigation perspective may be tenuous. In terms of atmospheric concentrations of CO_2, for example, it is hard to see how storing 10,000 tonnes of CO_2 for ten years (after which the CO_2 is emitted) would have an effect equivalent to permanently reducing 1,000 tonnes of CO_2 emissions.

Option 5: Carbon Rental Contracts

As noted previously, the Reserve's FPP assigns liability for reversals exclusively to landowners. This is advantageous for credit buyers, since it means CRTs are fully guaranteed. Buyers do not face any risk that the CRTs they purchase will be canceled or become invalid, and so are willing to pay the full market price for them. For project developers, however, this approach clearly imposes a significant burden, one that may be insupportable for most agriculture projects. Transferring liability exclusively to credit buyers, however, would create its own problems, as described above. One way to strike a balance would be to allow project developers and credit buyers to share liability in the form of carbon rental contracts.

Carbon rental contracts would be established by issuing CRTs with a predefined expiration date (e.g., within 10 years). When a CRT expires, it would be canceled out of the Reserve's system; if a buyer has retired the CRT against an emissions obligation, it would need to be replaced by retiring another CRT. Project developers would be liable for reversals only until the expiration date of the CRTs. At that point, project developers would bear no further commitment to store carbon, but could choose to renew their commitment to store carbon for another 10-year period. If the commitment is renewed, the project developer would be issued another set of expiring CRTs that could be rented on the market (to the previous buyer(s) or to others).

The chief advantage of carbon rental contracts is that they would impose a much more manageable liability on project developers, while maintaining environmental integrity by requiring the replacement of CRTs when they expire or when a reversal occurs. Rental contracts could also be combined with a buffer pool mechanism to insure project developers

[4] See, for example, Marshall, L., A. Kelly, and N. Sandwick (forthcoming). *The Time Value of Carbon and Carbon Storage: Clarifying the Terms and the Policy Implications of the Debate.* World Resources Institute, Washington, DC.

against unavoidable reversals during the term of a contract. The major challenge with rental contracts is that they would essentially create a new and distinct kind of market instrument for carbon credits. The “price” for expiring sequestration CRTs would be lower than the price for other kinds of offsets because it would be a rental price instead of a purchase price. It could take some time for market actors to fully appreciate and learn how to value this type of credit.