ADDRESSING PERMANENCE AND REVERSAL RISK IN AGRICULTURE, LAND USE CHANGE AND FOREST CARBON PROJECTS[1]

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[1] This paper draws heavily, including excerpted passages, from one of the author's published papers on permanence issues (Murray et al, 2007)

Storage of CO_2 in biological terrestrial carbon stocks is subject to re-emission into the atmosphere. In the case of carbon sequestration projects in agriculture, land use change and forestry (AgLUCF), the potential for re-emission stems from natural risks such as fires and floods as well, anthropogenic risks stemming from the ease with which a farmer can simply switch back to conventional emitting practices, and contractual risk from the fact that projects will generally have a finite life and compensation terms. This aspect of biological carbon sequestration (or "sinks") is referred to as the potential reversal or impermanence of greenhouse gas (GHG) mitigation benefits.

If the sequestered carbon is returned to the atmosphere as CO_2, the original benefits of the project have been reversed. Clearly, such a project does not have the same climate protection benefits as another AgLUCF project that keeps the carbon permanently sequestered in biomass or the soil layer, or a project in another sector that permanently reduces GHG emissions through a change in technology. Therefore, some mechanism will be necessary to account for the possibility that the sequestered carbon will be reversed.

Ensuring that GHG releases are debited and GHG removals (sequestration) are credited is critical to the integrity of the accounting system. Therefore, intentional or accidental releases to the atmosphere of terrestrially stored carbon should, in principle, enter the system as debits. However, there are a number of factors involved with AgLUCF projects that may make such comprehensive treatment difficult:

- Natural disturbance and other *force majeure* effects are unpredictable and for the most part the damage done is not under the control of the project
- Catastrophic loss of carbon could cause catastrophic financial losses for an investor
- Project contracts generally have finite lives

The first two factors relate to the difficulty of dealing with the risks of release when the project is underway. The unpredictability of project risk complicates project planning and decisions on actions that might be taken to reduce risks. By and large, the prospect that the investor might suffer catastrophic loss of the asset carbon credits, plus the normal accompanying economic asset, such as timber, makes the investment more risky and therefore reduces its attractiveness, all else equal. If the risks are large enough, investors may seek ways to cover these potential losses if they proceed with the investment. Specific instruments for covering these risks (insurance policies, pooling projects with similar or dissimilar characteristics and holding credit reserves) are discussed further below. The other critical issue is that the project will typically involve a contract that expires after some period of time. The question then arises – how do you account for risks of release at the end of the project period? Options for addressing this concern are also addressed below.

EXAMPLES OF CARBON REVERSAL IN AGRICULTURE AND FORESTS

Table 1 provides examples of carbon reversal in the four main types of AgLUCF carbon project activity: soil carbon management, grassland conversion, afforestation/reforestation and forest management. It is helpful to view unintentional reversal separately from intentional reversal as the risks are driven by fundamentally different factors and the solutions for dealing with each risk type may be different. Unintentional reversals are those due to fire, floods and other acts of nature. While landowners can take some actions to reduce the probability and extent of damage associated with these risks, the incidence and severity itself is largely out of their control. On the other hand, reversals can stem from intentional actions taken by the landowner, such as the decision to revert from conservation tillage back to conventional tillage or to harvest timber from a stand that has accumulated carbon since its time of establishment.

Table 1. Agricultural, Land Use and Forestry Carbon Activities: Examples of Reversal

Activity	Examples	Unintentional reversal	Intentional reversal
Agricultural soil carbon management	Reducing or eliminating conventional tillage practices to retain higher carbon content in soil	Flooding, fire	Reversion to conventional tillage practice
Grassland conversion	Convert cropland to pasture or other grassland to retain higher soil content and permanent above-ground biomass cover	Flooding, fire	Reversion to crops
Afforestation/ Reforestation	Planting trees on current cropland to increase carbon content of biomass and soils	Fire, pests, disease, storm damage	Harvesting
Forest management	Increasing stocking, lengthening harvest rotations and engaging in reduced impact logging to increase the carbon density of forests over time	Fire, pests, disease, storm damage	Reversion of conventional forest management, rotation lengths, harvesting practices

Although all of the reversibility risks inherent in AgLUCF endeavors cannot be eliminated, steps can be taken to lower them through proper project design. WRI-WBCSD (2003) has proposed that a "Carbon Reversibility Management Plan" be developed for any project intended to store carbon in biological, or geological, systems. In order to promote transparency and increase confidence in a project, the plan would include information on components that might be reversible, an assessment of any reversibility on the project's ability to achieve expected GHG reductions, and documentation of measures to monitor and offset reversibility that occurs. To accomplish these tasks, their plan includes four components:

1. *Identify and assess the reversible elements of the project's GHG reduction.*
2. *Describe actions undertaken to reduce or eliminate the reversibility of GHG reductions.*
3. *Establish mechanisms to compensate for any residual risk of carbon reversal.*
4. *Develop a plan to monitor carbon reversal.*

This paper addresses Item 3, mechanisms to account and compensate for reversals.

ALTERNATIVE WAYS TO ACCOUNT FOR AND RESOLVE CARBON REVERSAL

Even assuming a particular AgLUCF project has been designed in a way to reduce carbon reversal risks, residual risks associated with the project will be unavoidable. Methods used to address remaining reversibility risks will depend on the carbon-accounting rules adopted by the regulatory program. We can broadly classify these accounting rules into three approaches: (1) "Pay as you Go", (2) temporary crediting and (3) mandatory risk buffer. Table 2 summarizes these three accounting approaches and evaluates them along several different criteria, including: environmental rigor—the extent to which the system ensures that the atmosphere is "made whole again" after reversal occurs; feasibility of implementation; and transaction costs.

"Pay as you Go": This method generates credits as carbon is stored and debits as carbon is released into the atmosphere. The standard approach is to take carbon stock measurements at regular time intervals and impute the net credit (debit) quantities as the change in stock between periods. This system is consistent with national GHG accounting practices as currently used by Annex 1 countries under the UN Framework Convention on Climate Change. The critical element of this approach is that any carbon reversals are directly worked into the accounting and either reduce the number of credits generated or cause a debit that must be repaid either by acquiring replacement credits on the market, by a third party insurer, or by accumulating new credits onsite until the negative balance is cleared.

This type of approach is in some ways pure because it tracks carbon accumulation and reversals at the time they occur and assigns credits and debits accordingly. This most closely matches the timing of the atmospheric benefits and costs, which is desirable, yet it leaves the generator of the credits liable for the performance of that credit, which raises the risk of the project. Moreover, projects will generally have a finite contract life, a situation that might not square up with a perpetual accounting approach or raise issues associated with post-project liability for the stored carbon. Thus practicality generally leads to alternative methods for addressing reversals.

Table 2. Alternative Accounting Rules for Carbon Reversal

	"Pay as you Go"	Temporary Crediting	Mandatory Risk Buffering
Description	Balances debits and credits as they occur over time. Can be based on "stock change" or average storage during time period.	Balances debits and credits for finite periods with provisions for future reversal.	Sets aside credits in a risk buffer pool that can be used as a source of insurance payments against reversals within the system.
Environmental Rigor	Rigorous and consistent, as long as system is monitored into perpetuity.	Rigorous. Temporary credit must be replaced when it expires.	Credits may not equal debits for any particular project, but systemwide integrity should be met as long as pool is solvent.
Feasibility of Implementation	Enhances investment attractiveness by allowing credits to be received as soon as generated. Creates dilemma at project termination with either perpetual monitoring required post-project or potential future reversals are ignored.	Also enables up front payments. Can handle resolution of liability at end of project.	Relatively easy to impose reserve requirements at initiation of project; managing risk pool can be difficult if reversal risks have been incorrectly assessed.
Transaction costs	Measurement, monitoring, and verification (MMV), possibly into perpetuity.	MMV each period + contract renewal costs. No more costs after project ends.	MMV each period + costs of managing buffer reserve.

Temporary Crediting: Temporary crediting places a finite life on the credit generated by the project. Under this approach, reversal risk is checked by automatically treating the credit as if it expires and must be replaced in the future. The Clean Development Mechanism (CDM) of the Kyoto Protocol follows this approach, requiring that temporary Certified Emission Reductions (tCERs) be granted for sequestration projects (currently afforestation and reforestation only). Each tCER expires after the first commitment period of the Kyoto Protocol (2008-2012) and would need to be replaced at that time with presumed regular (or "permanent") reductions from other sources. Long reductions (or lCERs), also issued for Kyoto forestry projects, have a somewhat more flexible time horizon than tCERs but still expire at the end of the project's life, must be replaced, and thus are temporary.

In general, the value of a temporary credit is less than the value of a permanent one, because of the need to replace it at the end of the compliance period. Several studies show that temporary credits can be expected to trade at a perhaps sizable discount to permanent credits (Kim et al, 2008; Keeler et al, 2005), depending on the expected future price at which the temporary credits need to be replaced and the discount rate of money. The trading of temporary credits in the Kyoto regime has borne this out, with temporary credits trading at a significant discount, up to two-thirds off of a permanent credit, and the number of forestry projects undertaken has been quite low.

Mandatory Risk Buffer: Another way to approach reversal risks is to require that a given percentage of credits be set aside in a buffer pool at the time of issue and held to cover reversals. This could be imposed on individual projects as a due diligence measure or could translate to requiring individual projects to privately insure against reversal. But more typically, this is proposed as part of a large risk pool buffering operation. Such a system essentially mandates an insurance premium on all credits generated by AgLUCF projects–the premium is the number of credits that must be set aside in the buffer rather than traded at market value. The insurance pool itself may be managed by the program central authority (e.g., the government in a regulatory program) and used to cover reversals within the system.

In contrast to the temporary crediting approach, the credits that circulate in the market (those remaining after the set aside occurs) can be treated as fully fungible with other allowances or credits in the system, rather than branded as temporary and discounted. In contrast to the comprehensive "pay as you go" approach, under the mandatory risk buffering approach the replacement of reversals is no longer the liability of the individual project developer, seller or buyer; rather it is paid out of a pool of credits set aside in the aggregate buffer reserve. Note that this has efficiency advantages through risk pooling, but could create classic insurance problems of adverse selection (the more risky projects opt in) and moral hazard (principals no longer take sufficient risk prevention actions). These problems need to be monitored and addressed by the party managing the risk pool so as not to risk the solvency of the program. A particularly nettlesome issue is dealing with intentional reversals, e.g., reversion of conventional practices or harvesting of timber. In most insurance situations, when the insured takes intentional action to create the risk, the actions would not be covered by insurance policy. However, some voluntary programs may argue for inclusion of intentional reversals into the risk pool in recognition that without such coverage, few parties might opt in to a voluntary program in the first place. This issue needs more discussion and debate.

A mandatory risk buffer is the recommended approach for addressing reversals under the Chicago Climate Exchange (CCX) and under the Voluntary Carbon Standard's protocol for Agriculture, Forestry, and Land Use (AFOLU) projects (VCS 2008). With VCS, the size of the buffer reserve requirement is dependent on an initial assessment of project reversal risk performed by an individual verifier and could be adjusted downward over time once project performance has been demonstrated. A mandatory risk buffering approach was also proposed for agriculture and forest carbon offset projects as part of the Lieberman-Warner America Climate Security Act of 2008. Although it did not pass, the vestiges of these provisions may well work their way into future legislation.

SUMMARY

Carbon stored in terrestrial ecosystems, especially above-ground carbon, is particularly vulnerable to reversal, or the re-emission of CO_2 to the atmosphere through natural causes or anthropogenic activity. As such, concerns of impermanence have surrounded the issue of biological carbon sequestration from AgLUCF activity as a greenhouse gas mitigation strategy. Some parties have argued that impermanence risks make these strategies an unacceptable substitute for emissions reduction. Others argue that, with proper planning and accounting for reversal, AgLUCF can play a role in a multi-sector, comprehensive climate change mitigation strategy. Toward that end, it is important to recognize that, while bilogically sequestered carbon is at risk of reversal, it is not a foregone conclusion that reversal will occur. Moreover, if it does occur, even temporary storage may have value as part of a dynamic long-term mitigation strategy. However, because these risks are real, they must be identified, planned for, managed and used to adjust greenhouse gas accounting.

From a biophysical standpoint, reversal risks can be identified, measured and monitored. From a planning standpoint, these risks can be managed through prudent action, though they cannot be completely eliminated. Ultimately, though, the economic value of AgLUCF projects for GHG mitigation may be determined by institutional factors such as the existence of a viable market for generated carbon credits, and specific rules put in place to govern reversal risk. Caution in setting the rules for temporary storage may well be in order, but if the terms of the redemption are fairly restrictive (e.g., very short redemption periods, no opportunity to re-contract stored carbon in subsequent periods), this will erode the value of temporary storage and reduce the incentive for AgLUCF sequestration projects. Those who set the rules of these exchanges will need to consider tradeoffs between caution and flexibility. In essence, it could boil down to a choice between two types of potential errors: (1) rejecting transactions that could add value in the name of precaution, and (2) accepting transaction that could add little value in the name of flexibility (Trexler et al 2006).

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