Agricultural and Forestry Carbon Sequestration Projects: Challenges for Credible Registration

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Background

In the decade since adoption of the United Nations Framework Convention on Climate Change (UNFCCC), there has been growing interest in the expansion of agricultural and forestry practices that can convert carbon dioxide gas into stable carbon compounds in wood and soil. These practices have been demonstrated to be effective in achieving a portion of the global commitment to reducing the buildup of atmospheric greenhouse gases (GHG's).

While improving agricultural and forestry practices to reduce emissions or sequester carbon has met with wide acceptance on the basis of their impact on environmental conservation and ecosystem sustainability, there have been a number of challenges to their long-term value as mitigation efforts to offset greenhouse gas emissions from industrial sources.

It is important, therefore, for projects seeking recognition for their emissions reduction or carbon-sequestering value to demonstrate that they have achieved real reductions in atmospheric GHG's, that those reductions can be maintained for an appropriate time period, and that project claims can be verified by an independent observer if necessary. These same challenges face all types of projects, but this review concentrates on those in agriculture and forestry.

As one means of encouraging a national effort to voluntarily reduce GHG emissions, President Bush has directed the development of an improved national GHG registry, built on the voluntary greenhouse gas reporting system in the Department of Energy that has been in operation since 1995, widely known as the 1605(b) program. Work to better incorporate agricultural and forestry projects in the national registry has been under way since that time, and the options and proposals from that effort will be available for public review and comment in the near future.

This paper assembles a framework of ideas and suggestions for incorporating agricultural and forestry projects in any future national or state registry, trading system, or regulatory framework. The contents were assembled from the author's experience and interviews with a wide group of experts in the field, ranging from people with experience in developing projects, those involved in national and international policy discussions, and those working to create market-based emission trading systems in GHG management. The author does not claim full knowledge of all the emerging systems. Most are evolving and changing, and some are reluctant to share information that is proprietary in nature. There has been, however, a great deal of effort to think about the challenges involved in agricultural and forestry projects, and work creatively to make these projects an integral part of any GHG registry that may emerge.

Framing the Questions and Issues

The basic questions in this inquiry were: A) What does a project need to demonstrate in order to meet a high standard of credibility for emission reductions or carbon

sequestration; and, B) How can the facts about projects be captured in a registry as a means of documenting the credibility of registered projects?

Hidden within these questions is a range of issues. For example:

- For all projects in the registry, covering a wide range of practices designed to increase sequestration, reduce emissions, or both, the "quality" of all claims should be reasonably uniform. A ton here should equal a ton there.
- For many of the issues raised in regard to projects (i.e. additionality, permanence or duration (for land-based projects), leakage), national or international policies to guide analysis are still being formulated. As a result, opinions vary as to what may ultimately be required to fully address these questions.
- A successful registry system must satisfy a range of user interests, which could include:
    - Project planners, developers, or accumulators – the "reporters" who will provide the data into the registry. They will need to be able to develop and enter the data without undue difficulty, and those who go to the work of developing excellent projects and reports will not wish to see other projects of lesser quality or value given equal credit.
    - The "managers," probably public agencies and policy makers, will want the registry program to be feasible to develop and manage, both in the short and long terms. They want to produce credible summary reports that help policy makers understand how effectively the system is working, as well as illustrating areas where improvement could be made. If the reported credits become part of meeting regulatory requirements, regulators will want the registry to establish adequate qualifications and credibility.
    - The "market," may be made up of members of the public who wish to access the registry for a variety of research and information needs and, in the event of a commercial market in emissions trading, as a source of information about credible projects that can produce tradable credits.
- Project calculations need to be transparent to reviewers, and the results need to be verifiable by outside observers. In the case of land-based projects, there are differences between soils, sites, and practices, but the ranges of variability are well known to scientists and practitioners. As a result, exaggerated baseline projections or claims of emission reduction or carbon sequestration that fall outside a reasonable range will draw technical criticism. Methods to review reports and identify, adjust, or justify such claims will be needed to maintain the credibility of any registry.

Options for Addressing Important Issues

In addition to the experience provided in the 1605(b) voluntary registry, there have been other efforts to define what should be done to create a credible carbon sequestration project, and what should be contained in an adequately accurate and transparent analysis and explanation of the project's effects. The following reviews some of the thoughts expressed by interviewed experts with experience in the various systems.

Additionality and Baselines

Additionality is the amount of net carbon sequestered when one calculates the amount resulting from the project activities as compared to the amount that would have occurred without the project activity. As noted earlier, there have been several ways proposed to arrive at this calculation, but as yet there are no fully-agreed or universal guidelines. Some of the ways that have been proposed (and, in most case, are in use somewhere) are:

- A "base year." Normally used for carbon sequestration projects, this would be a measure of the carbon stock at the time the project activity was begun. It serves as the reference point from which future measurements are compared to calculate the amount of carbon sequestered over a period of time.
- A "historic baseline." This would use the records covering a past time period to estimate the average annual rate of emissions or sequestration that occurred before the project was initiated. This could be done, for example, with records of fuel usage, regional records of deforestation, or forest growth records.
- A "business as usual" baseline. This involves the creation of a forward-looking model to predict what would occur in the absence of project action. To arrive at the estimate, one normally creates a "base case" or "reference case," which projects a most likely future for the project area. From that reference case, one constructs the carbon "baseline" that would have resulted. For example, in a land-based project, a piece of land might have remained in cultivation without the project. That could result in a flat baseline (i.e. one indicating no change in carbon on the site), a declining baseline (i.e. from continued soil erosion), or an increasing baseline (i.e. improved cultivation techniques). Which of these are chosen for the analysis depends on the arguments and assumptions the analyst brings to the construction of the reference case. The project may propose to plant trees on the land (afforestation). Using available scientific information about the growth rate of the species involved on the particular soils and sites of the project, the planner creates a "project case" that illustrates how the trees are projected to grow over future years. That growth (normally measured by foresters as the amount of merchantable wood produced) can be converted into carbon equivalents by readily-available conversion tables for the major species.

While this sounds straight-forward on the surface, there are any number of assumptions and methods that can be used to calculate both the reference and project cases. It can be readily seen that, to achieve the maximum carbon credit for the project, it is necessary to produce a minimum reference case and a maximum project case. This leads to fears that project developers will "game" the system and attempt to achieve credit for carbon that is either not present, or that would have been present with or without the project. This has led to several different approaches and suggestions, including:

- *Limit to easy situations*. Some programs have limited their consideration to projects where baseline calculation is relatively straight-forward, such as afforestation, reforestation, conversion of cropland to grass, or implementation of conservation tillage. On these, the baseline assumption can be that carbon stocks would have changed little or none without the project, and the carbon increases on the land can be readily modeled and actually measured. A more difficult case might be

forest management, where a project proposes to improve the management of a forest to enhance growth. The forest growth between two time periods is partly the result of natural change, and partly the result of the manager's actions. There is no scientifically credible way to separate these two effects, so if carbon credits are limited to those caused solely by management action, any claim can be suspect.

- *Use a base year approach.* The CCX approach for large forestry projects is to use a base year approach. An inventory of the reporting entities' forest carbon stocks establishes a starting point, and all change that occurs beyond that year is considered to be the result of management. While this includes natural growth factors, it also recognizes that forest management can (often with good ecological and economic justification) result in biomass declining for a period of time. Thus, management that supports an increase in the carbon stocks on a forest is, in fact, a reflection of management choice. (Early indications are that the new 1605(b) guidelines will also utilize this approach.)
- *Provide clear guidelines.* Some systems require that a project go beyond what is required by law or regulation in order to be additional. Therefore, in states that require reforestation in their state forest practice act, a reforestation project would be difficult to qualify.
- *Provide calculation methods and tools*. Projects submitted to the National Carbon Offset Coalition are required to provide calculations using standard tables developed by NCOC. For those who wish to use it, an Excel workbook is available to aid in calculating both soil and wood carbon for both reference and project cases. Use of the standard method by all project developers allows NCOC to readily check all calculations and assure itself that different projects have used consistent methods.

  The DOE also provides Excel software for both field forest and urban forest plantings to assist in calculating what is termed "net effect," for inclusion in the 1605(b) report. It is therefore assumed that the software calculates a reference case, but it is not clear what that case contains, since only the net figure is illustrated. The forest workbook relies on a small set of standard growth tables published in the reporting instructions, so may need to be expanded for the many additional situations likely to be encountered in the field.
- *Ask for narrative explanation.* In the 1605(b) program, reporters are asked to explain the method used to arrive at the reference case. The program distinguishes between a "basic" reference case, defined as an actual historical record of sequestration for a year or period of years, and a "modified" reference case, which is a projection of the sequestration that would have occurred in the absence of the project. Almost all of the existing project reports have used the modified case. The reporters are then asked to explain in a narrative how they arrived at the project calculations.
- *Use general tables and discount for uncertainty*. In the Chicago Climate Exchange (CCX), general growth tables published in the scientific literature have been adopted for use in calculating additionality for agriculture and small forestry projects, and the indicated amounts have then been discounted fairly severely to allow for the uncertainty between general estimates and specific projects. This produces a project calculation that is conservative at the outset, but which can be adjusted later if measurements indicate that different results are actually being achieved.

- *Adopt default values*. For conservation tillage projects, the CCX has consulted scientific experts to set regional default values. Projects are then credited with that value per acre each year that they maintain their tillage plan. Values are selected to be conservative, with the thought that a wide range of projects should produce an average value equal to or greater than the estimate. These values may or may not be sensitive to different soil and climatic conditions within the region. Usually, they are not, but reflect broad regional averages.
- *Adopt regional baselines*. Although no program has yet adopted regional baselines to our knowledge, this has been suggested as one way of approaching the problem of estimating the amount of forest growth that would have occurred in the absence of a forest management project. In this approach, the regional growth data produced by the Forest Service's Forest Inventory and Assessment program would be used as the baseline for the different types of forest in each forest region. Those data reflect the measured growth rates by forest type achieved by all owners, across all soils and sites in the region. A project that could, through periodic measurements or other credible means, demonstrate that its growth rates were above the regional baseline could, under this idea, claim that difference as a carbon credit produced by project action.
- *Model potential regional changes*. In some of the forest protection projects done for the UtiliTree program, computer models such as GEOMOD have been used to produce projections of future deforestation based on a geographic analysis of deforestation trends in the recent past, as reflected by remote imagery. These models, that can assign statistical weights to the various physical, cultural, and economic factors that are associated with past deforestation, build future projections based on how those same factors will drive deforestation pressure within the project area. That deforestation pressure, if unchecked by project action, reflects a credible reference case.

Leakage

Leakage is the term applied to off-site impacts caused by a project. While there have been many studies as to its possible impact on project calculations, there are very few established programs that include guidelines for including leakage estimates. There are several ways that it might be addressed, including:

- *Ignore it*. This may eventually be unacceptable, but several programs today offer little or no guidance, so it is likely that leakage has effectively been ignored.
- *Rename it*. There is no mention of leakage in the 1605(b) guidelines, for example, although the term "indirect emissions" and "unintended effects" are clearly designed to get project reporters to calculate effects that occur outside project boundaries. There appear to be no instructions on how this might be done consistently across reports.
- *Establish simple guidelines.* For the CCX at the present time, a project that indicates that the reporting entity is maintaining a sustainable forest (i.e. not destroying forest elsewhere while claiming credit for planting a new one) is adequate evidence of no leakage. For the Environmental Resources Trust, Inc. (ERT), protecting an existing forest from harvest means taking today's existing volume off the market, therefore necessitating harvest elsewhere. They argue that a forest

management or protection project that relies on eliminating harvest should count the standing stock as leakage, with only the future growth counted as additional.

- *Decision Tree.* Provide a "decision tree" that project developers can utilize to help them understand whether leakage is likely to exist in their project and, if so, whether it is significant. Several technical papers exist that could help suggest ways to do this.
- *Establish Standard Discounts.* Perhaps in connection with the decision tree, a registry could provide discount percentages (i.e. given these indications of leakage, discount the project calculations __% to arrive at the reported amount.)

Duration (permanence)

Because the carbon in agricultural and forestry projects is stored in woody vegetation and soils, there is always the possibility that it might be lost, either through intentional management actions or natural events such as wildfire. While recognizing that few, if any, things in nature are permanent, it has also been effectively argued that these projects buy important time. The need, therefore, is to properly calculate the value of carbon sequestered over differing time periods, as well as protect against premature losses. Several approaches have been used, or suggested, such as:

- *Seek Long Term Easements.* Some programs have been based on very long (80 to 100 year) or even perpetual conservation easements. These easements establish guidelines for the use of the land, and are designed to maintain the project's integrity over the term of the easement. There are obvious limitations to the ability of an easement to eliminate the loss of carbon in natural events or disasters, so while an easement might prevent the clearing of a forest for another land use, it wouldn't prevent the forest from burning in a wildfire. A forest thus lost should be counted as an annual emission in a registry to maintain an accurate accounting of carbon on the land. (If that were required, then the forest should gain annual credit as it re-grows.)
- *Record Annual Amounts.* In the 1605(b) program, reporters are encouraged to update the amounts sequestered, by project, on an annual basis. For afforestation and reforestation, annual amounts can be calculated in the associated Excel software as a "net amount" based on forest growth tables provided in the supporting materials. The software calculates the net amount as a uniform annual amount for years 1 through 20, so it appears that it must calculate a mean annual growth increment (MAI) for years 0-20. As discussed below, this would produce a significantly different result than a calculation of MAI for years 0-50. The CCX plans to credit conservation tillage projects on an annual basis, based on a default value established by the Exchange.
- *Establish fixed crediting periods.* Current guidelines for CDM (Clean Development Mechanism) projects under the Kyoto Protocol call for two approaches: A) a maximum of 7 years which may be renewed at most two times; or, B) a maximum of 10 years with no option of renewal. The NCOC has established project lengths based on the standard economic life of the forest species involved (i.e. 80 years for ponderosa pine.)
- *Short, renewable contracts.* NCOC is experimenting with approaches to flexible short-term renewable contracts. Thus, a landowner might establish a sequestration project with an anticipated duration of 50 years, but only register a 5-year contract

based upon the MAI (mean annual increase of carbon) for the first 5 years. At the end of the contract, the actual carbon is measured, adjustments made if needed, and the contract is re-negotiated for another period (i.e. from 5 to 15 years) at the new MAI (which, in a young growing forest, will be significantly higher). The short contracts are designed to protect all parties in the transaction from major differences between calculated and measured amounts, as well as allow responsiveness to future price levels if the projects are involved in market transactions.

- *Create Portfolios of Projects.* NCOC and CCX are both looking at the value of creating portfolios of various projects to increase diversity and reduce the risk of losing stored carbon. Both systems anticipate using actual measurements of forest carbon (probably on 5-year intervals) to "true up" project estimates. If some projects under-perform projections, others may over-perform, maintaining the integrity of the total amount reported in the portfolio.
- *Create a protection fund.* Where projects produce credits that are sold in a market transaction, their loss incurs a financial loss to the buyer who no longer can claim them. An insurance pool that contained un-claimed, but legitimate, carbon credits could provide replacements. Another option would be a program that could reimburse the loser financially through insurance. The NCOC has worked with insurance companies to create an insurance program patterned after existing crop insurance programs used in agriculture, but this has yet to be implemented. (Again, these issues apply to most types of projects, so they offer possible approaches that might be used well beyond the agriculture and forestry arena.)

Monitoring and Verification

To the extent that sequestered carbon or emission reduction attains a value (i.e. a "creditable" tonne), it becomes a commodity. Unlike other commodities, however, it does not move physically from the control of the supplier to the control of the buyer. Instead, what moves is a certificate or statement proclaiming the existence, stability, and legitimacy of the claim. To be fully credible, that claim must be subject to monitoring and verification. This has led to several approaches, including:

- *A Monitoring Plan.* All of the systems involving credit sale or trade require that a monitoring and verification plan be submitted as part of the project plan. While there appears to be no single approach at this time, there seems to be a trend toward a tiered approach. For example, NCOC guidelines require an annual report from the landowner, stating that the project is still intact and that the management plan remains in effect. That is supplemented by periodic monitoring, in most cases carried out by a local public agency such as a conservation district or county forester, or a consultant. That monitoring may take the form of a visual inspection or, in some cases, plot measurements to ascertain tree growth. In some plans, those measurements are planned at year 5, then periodically (2-5 years) thereafter. In the event of term contracts, there will be actual measurements at the end of the term to ascertain values. Soil sampling has generally been proposed at year 10 and at 10-year intervals to recognize its higher cost and the slower rate of change anticipated.
- *Verification.* Auditing of the program, including a sample of the field projects, is foreseen in all programs involving carbon credit sale or trading. It has not been a part of the voluntary 1605(b) program and, given the cost involved, seems unlikely to

become a requirement in a voluntary program. Forest certification is an increasingly common part of forest management, particularly for large owners. All of the forest products members of the CCX, for example, have achieved certification. NCOC recognizes that the third-party audits conducted for certification provide independent verification of landowner claims involving timber growth and system sustainability. If a registry provided a checkoff that indicated whether a forest project was certified, and a drop-down to indicate which certification system was involved, it would add a great deal of confidence in the reported claims. Such certification also assures that other environmental (as well as economic and social) issues have been addressed in the forest's management.

Transparency and Credibility

Project reports that feature fully transparent measurements and calculations will be more readily accepted than those where the calculation of reported amounts cannot be determined from the available material. Some of the following issues may be important to address:

- *Project plan.* All trading systems require a written project plan that contains explicit information about the "who, what, when, where, and how" aspects of the project. Those plans need to be on file and available for program auditing if that is required. It is unlikely, however, that all aspects and details of the plan need to be listed in a formal registry. The registry might, however, have a place to indicate where the project plan is on file and available for review. That should normally be in the reporter's control but if future systems allow credit trading, it likely will not be. For example, an emitter may purchase an NCOC portfolio through the CCX as a mitigation tool. Their report could show that project plans are available at NCOC.
- *Stocking rate.* In afforestation, different species are planted at different physical spacing, and there can be significant mortality during the planting year. Both NCOC and CCX require project developers to conduct survival surveys after the first year and, where the remaining live trees do not meet minimum stocking guidelines, in-fill planting must be done to bring the stand to acceptable stocking levels. Several experts indicated that, without some evidence of acceptable stocking based on site surveys, they would have a difficult time believing that a project was producing full carbon sequestration values. One suggestion is that instead of just counting trees planted by year (as is the current case in the 1605(b) program), the registry might also include a space for a stocking entry in the year that stocking is measured. That could be expressed as a percentage of full stocking to recognize differences between species.
- *Methods of calculation.* Transparency is enhanced when the methods of calculation are clearly apparent to reviewers. This could be as simple as a box on the reporting form where one could check of the method used (model, measurement, comparison, standard table, etc.) Where claimed sequestration rates are outside established ranges, planners should be required to submit detailed calculations. Where the results of proprietary models cannot be reproduced in open models, there should be some method of adjusting to more credible and transparent figures.
- *Pools measured.* Carbon can be sequestered into several "pools," including above- and below-ground biomass, soil carbon, forest floor, and understory growth.

For credible reporting, all pools measured should be indicated, and the method of establishing current (baseline) carbon stocks in each pool should be known. For unmeasured pools, there should be some technical assurance that there will not be significant reduction in carbon stocks as a result of the project activity. This detail is generally contained in the project plan; whether or not it is needed in registry data to assist in transparency should be considered.

- *GHG Gases reported*. While the measurement of carbon stocks offers are relatively effective way of measuring the transfer of CO_2 between the atmosphere and the land, a project could affect the emission of other GHG gases that are much more difficult, or impossible, to measure. This may require a project developer to consider how (and whether) those other emissions should be reported. It is anticipated that most registries will have rules that must be followed. The California Climate Action Registry, for example, allows a forest entity to report only carbon stocks and CO_2 emissions for the first years, but from the fourth year onward, they are required to report emissions of all five GHG's in the Kyoto Protocol. Calculation and reporting methodologies are yet to be developed.
- *Location*. Sequestration projects differ from many industrial emission reduction projects in that they are tied to a wide geographic area rather than a point location. A transparent registry will provide geographic location data for agricultural and forestry projects. Developers should provide the geographic coordinates of an adequate set of points to describe the project polygon or polygons. This reduces the risk of duplicate reporting, facilitates monitoring, and could eventually allow better understanding of cumulative impacts in regions where projects become a significant part of the landscape. (This does not need to be the location of an activity, such as conservation tillage, within an agricultural project. By showing the project boundaries, however, it reduces the chance that another project (i.e. a land conversion) could be reported within the same land area.)
- *Credit ownership*. It is generally thought that the right to report credits (or sell or trade them in an eventual market system) will often be separated from the ownership of the land or emission source upon which the credits are produced. NCOC, for example, requires a sale document from the landowner to establish NCOC's right to report or sell the credits, as do all the systems involving credit sale or trade. A transparent registry will have rules for annual reporting that only allow the owner of record for the year involved to report the credits. Associated with requirements for geo-locating each project, it may be useful to document the landowner of the land where the credits actually reside.

The conclusion from this review is that, although agricultural and forestry projects face issues in creating tradeable credits for emission reduction or inclusion in a registry, experience is being gained in a variety of places, and solutions are emerging. Official rules have yet to emerge, but the current experience is likely (hopefully) to inform rulemakers and contribute to development of practical, effective methods.