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Comparison of available and emerging protocols for monitoring carbon sequestration projects

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Background

No mandatory national program currently exists to mitigate climate change in the U.S. and, as a result, no standard protocols exist for measuring, monitoring, and reporting (MMR) land use change and forestry activities. Consequently, voluntary programs and mandatory sub-national programs are multiplying to allow users to register emission-offset activities, creating multiple often contradictory measurement, monitoring and reporting standards.

Four major registries that include monitoring protocols for the land use, land use change, and forestry sector[1] (LULUCF) are in operation or coming into operation in the US:

- The voluntary reporting system of the US Government is known as 1605(b) after Section 1605(b) of the Energy Policy Act of 1992. This system is designed for an entity rather than a particular project activity. The 1605(b) program is run by the US Department of Energy.
- To manage registration of emissions and removals in California, the State Government established a non-profit registry of greenhouse gas emissions known as the California Climate Action Registry (CCAR)[2].
- The Regional Greenhouse Gas Initiative (RGGI)[3] will register emissions and reductions in emissions from power plants. Entities may use offset projects to reach their emission reduction targets.
- The Chicago Climate Exchange (CCX)[4] was the world's first greenhouse gas emissions registry. It is a self-regulated, rules-based registry governed by members that commit to voluntary reduction targets. Members trade 'carbon financial instrument contracts' (CFIs) – one contract being equal to 100 metric tons of carbon dioxide.

Each of CCX, CCAR, RGGI and 1605(b) have protocols for measuring, monitoring and reporting of emissions and sequestration from the LULUCF sector.

Given the state of the various programs within the United States—voluntary and potentially regulatory—and the different monitoring and reporting protocols available, the question arises of the comparability and interchangeability of the GHG benefits generated. The aim of this report is to compare the forest protocols from the 1605(b) program (USDOE 2006), CCX (CCX 2006), RGGI's Model Rule (RGGI 2007) and CCAR's Forest Project Protocol (CCAR 2004),

Internationally, programs exist, the most important of which are the flexibility mechanisms of the Kyoto Protocol—the Clean Development Mechanism [CDM] in developing countries, and Joint Implementation [JI] in developed countries that have taken a commitment under the Protocol. Although significant debate exists among experts over these rapidly evolving programs, the CDM in particular, sets a standard for afforestation and reforestation activities against which other programs could be compared. The Voluntary Carbon Standard (VCS) for the LULUCF sector has recently been released[5]. The VCS framework has been developed to enable high-quality LULUCF projects from around the world to generate Voluntary Carbon Units (VCUs) that are credible, robust, permanent and fungible. To generate Voluntary Carbon

[1] Environmental Resources Trust –Winrock International (ERT-WI) operate a GHG registry, but as of this writing they do not have any protocols for the LULUCF sector.

[2] http://climateregistry.org

[3] http://www.rggi.org

[4] http://www.chicagoclimatex.com

[5] Voluntary Carbon Standard. 2008. Guidance for Agriculture, Forestry and Other Land Use Projects. VCS Association. Available at: www.v-c-s.org

Units (VCUs), a project activity must apply a VCS-approved methodology to estimate and monitor its net GHG emission reductions or removals. The VCS registry is not yet operational nor has it any approved monitoring methodologies at present, and it requires project proponents to develop a new methodology that will be verified by two external reviewers. It is anticipated that in a relatively short time after the VCS is published that methodologies will be approved and available for other project proponents to use.

A key requirement of any project developed as an "offset" is that is must be additional. Additionality is the requirement that projects demonstrate their activities would not occur in the absence of the project and carbon funding. Additionality in the CDM is demonstrated by meeting tests for project financial viability and/or showing the presence of barriers to implementation that will only be overcome through carbon financing. In other words, a project that is additional would not occur in the absence of GHG mitigation project finances. However, within the US, many refer to a different definition of additionality, which is the positive difference in carbon between the project and the baseline. This is not the right interpretation—the key for additionality, which only refers to "offsets", is that the project must demonstrate that it would only occur because of carbon financing, it is not applicable where an entity is reporting its stocks and changes in stocks under a cap-and-trade system. Here we refer additionality as either regulatory additionality (is the activity to be undertaken already required by local, state or federal law?) or financial additionality (is it likely that for financial motivations the activity would have been undertaken regardless of carbon financing?).

In this report we focus our comparison on the four major registries described above. We will conclude with a brief discussion of the CDM and the VCS.

Comparison of the four US protocols

Some of the important similarities and differences among the protocols are listed in Table 1. For CCX different protocols exist depending on whether the activity is on the member's own lands (under the cap and trade system – termed entity accounting protocol here) or are to be counted as "Exchange Offsets" (i.e., GHG mitigation occurring outside one's own lands or facilities – termed project protocol here).

Table 1. Key facets of the forestry protocols for the Chicago Climate Exchange, the California Climate Action Registry, the Regional Greenhouse Gas Initiative and the 1605(b).

	CCX	CCAR	RGGI	1605(b)
Admissable Activities	Unlimited for reporting on own lands. Limited to reforestation and conservation (in Brazil) on "offset" lands	-Forest-management -Afforestation & Reforestation -Conservation	- Afforestation	Unlimited, except for activities that require a baseline to show benefit, such as conservation of mature forest
Measurement Pools	Wood in the main stem of the tree up to the terminal bud for entity accounting For offset activities – aboveground tree biomass	*Required*: Live aboveground tree biomass; Live belowground tree biomass; Standing and down dead wood; *Optional*: All other pools are optional and can not be certified	*Required*: Live aboveground tree biomass; live belowground tree biomass; soil carbon; dead organic matter, coarse woody debris (optional if baseline measurement is at or near zero). *Optional*: Live aboveground non-tree biomass; Dead organic matter, forest floor	All pools included. Pools can be omitted as long as they don't lead to greater than *de minimis*[a] emissions

Measurement Requirements	Measurement required. Permanent plots allowed	Permanent plots required	Measurement required but permanent plots are practically excluded given the method to be used for estimating change in stock	Measurement not required for registration
Baseline	Cap and Trade Baseline for "offset" conservation activities	Required	Required	1 to 4 base years
Non-CO_2 gases	Non-CO_2 gases are not included	Optional	Not discussed in model rule	Required if are more than *de minimis*
Uncertainty Adjustments	No published detailed guidance is currently given	Based on the width of the confidence interval (CI), from 0 deduction for a CI within 5% of the mean, 10% deduction for CI equal to 10% of the mean, to a 100% deduction if the CI≥ 20% of the mean	requires that each pool separately, rather than for the combined pools, must achieve a precision of 10% of the mean with 95% confidence	Uses a grading system for monitoring activities—project as a whole must achieve a 'B' grade. On-the-ground measurements get an A-grade, modeling gets a B and look up tables get a C
Leakage[b]	All forest land inside and outside the project must be managed *sustainably,* but this does not preclude leakage	Assessment of activity shifting is required, but quantification only required if on-site. Assessment of market effects, upstream and downstream effects only encouraged.	Not discussed in model rule	Must certify activities do not lead to increased emissions elsewhere in entity, but no requirements for outside entity boundaries.
Permanence	Indefinite reporting required on own lands. Project activities require "legal protection status"	Legal Easement Required	Legal easement Required	No proof needed
Additionality	No requirement for financial additionality Not applicable for entity reporting	Requirement for regulatory additionality No requirement for financial additionality Not applicable for entity reporting	Requirement for regulatory additionality No requirement for financial additionality	No requirement for financial additionality
Third Party Certification	Required	Required	Required	Not Required

[a] de minimis is defined as greater than 3% of total sequestration or emissions
[b] leakage refers to unintended losses of net carbon benefit as a consequence of project activities

None of the protocols potentially issuing project offsets adequately accounts for additionality, or leakage—both policy and technical issues for project-based activities that have been widely debated, but for which programmatic solutions seldom have been implemented.

CCAR does not include non-CO_2 gases and effectively omits shrubs and herbaceous vegetation, forest floor biomass, soil organic carbon and wood products. If these pools can not be registered, there is no incentive to measure if the result is positive, nor is there a requirement if the result is an artificial inflation of the reported values (as is the case if the optional pool exists in the baseline and will be destroyed as part of the project).

1605(b) does not adequately include uncertainty. Steps are involved to ensure that, across the project, on average at least a model has been used, but this does not guarantee precision. The methods are open to interpretation and exploitation; with methods being specifically chosen to maximize reportable sequestration or avoided emissions. The 1605(b) protocols also do not include a baseline but instead employ base year values. This is adequate if the baseline is constant through time, but where the baseline is anticipated to change, then base years will not account for changes in carbon stocks.

CCX entity accounting, probably through an initial basis in the forest industry, only accounts for carbon in the stem of the tree. While this does allow for simple conversion from already existing inventories it more than halves the carbon gains that can be reported.

The RGGI protocol mandates the monitoring of soil carbon even when no change is expected. Soil carbon can be an expensive pool to monitor and it should be sufficient to mandate measurement only when a decrease in soil carbon stocks is a possibility. Non-tree vegetation is an optional pool, which means that projects with a baseline consisting of non-tree vegetation can derive an artificial credit by excluding this pool.

The RGGI protocol requires all selected pools to be measured to a high level of precision (95% confidence intervals equal to 10% of the mean or less). This creates a disincentive to measure optional pools and greatly increases the costs of required pools. International measurement protocols (cf Pearson et al. 2005[6]) typically require the total carbon stock or carbon stock change to have a high precision but this "total" precision can be derived from precision in the dominant live tree carbon pools. This approach allows lower levels of precision in the highly variable pools such as dead organic matter and soil carbon, which contribute relatively little to the total carbon stock change.

The RGGI protocol is the only one to limit the duration of projects. RGGI afforestation projects consist of up to three 20-year periods. This mirrors the system under the Clean Development Mechanism (CDM) of the Kyoto Protocol (see Pearson et al. 2006[7]). However, clearly sequestration does not stop at 60 years and unlike the CDM, RGGI requires a permanent easement that will prevent landowners from cutting down trees and choosing alternative land uses after 60 years. The CCAR, CCX and 1605(b) protocols can therefore potentially claim large additional sequestration beyond what is possible under RGGI by continuing to report on sequestration beyond 60 years.

The one difference between carbon offsets from the LULUCF sector and all other sectors is the issue of permanence or lack of. Carbon storage on the land has the potential to be reversed either caused by human actions or by natural disturbances. All protocols, except the 1605b, require legal easements or legal protection to address permanence—this addresses the reversal caused by humans but not by natural disturbances. Moreover, from a landowners perspective this could be a disincentive to commit to doing carbon projects even though the price might be attractive. The concept of putting lands into legal easements to address the permanence issue was a sticking point in the early negotiations for the CDM

[6] Pearson, T., Walker, S., Brown, S. 2005. Sourcebook for BioCarbon Fund Projects. Prepared for BioCarbon Fund of World Bank. Available at: http://www.winrock.org/Ecosystems/tools.asp

[7] Pearson, T., Walker, S., Brown, S. 2006. Guidebook for the Formulation of Afforestation and Reforestation Projects under the Clean Development Mechanism. Prepared for International Tropical Timber Organization. Available at: http://www.winrock.org/Ecosystems/tools.asp

afforestation/reforestation activities. This sticking point was eventually resolved with the use of temporary (short or long term) credits. Addressing the issue of permanence could be accomplished in several ways:

- Use of legal easements as is currently used by CCAR and RGGI
- Deductions going into a registry buffer based on a verifiers assessment of risk to permanence (as used by the VCS)
- "Insurance buffers" provided potentially by carbon sequestration activities on public lands (could be "bought" by a developer to insure their project)
- Temporary credits as used by the CDM

The point is, there are several approaches by which the potential for reversibility of the carbon in forests could be accounted for and that take into account the potential risks to a project's permanence. To encourage greater adoption of activities to enhance carbon storage on the land, flexibility in dealing with the non-permanence risk is important. It is likely that these different methods could have implications for the value of the carbon offset but one could assume that the market might be able to sort this out. Projects that did use legal easements and were located in an area of low natural disturbance risk would likely have a higher value (most likely demonstrated by the actual quantity of carbon offsets) versus one that used temporary crediting also in a low natural disturbance risk area or one that had a percentage of its credits deducted and placed in the registry's buffer based on a verifiers assessment of the risk.

Ideally, GHG mitigation registries and programs should provide incentives to improve the data and methods of GHG benefit estimation over time, so the system evolves and more GHG pools or fluxes are included more accurately and precisely. Table 2 provides an overview of selected incentives and disincentives of the four registries to the improvement of measurement and monitoring of project activities, and their cost implications. Significant disincentives exist in the current programs, and offer the potential for evolution of methods and reduced transaction costs if such barriers are addressed.

Table 2. Selected program incentives and disincentives to improve measurement and monitoring (MM) of project activities, and cost implications

	CCAR	1605(b)	RGGI	CCX
Incentives to Improve MM	Precision less than 5% of the mean with 90% confidence requires a C discount, thus incentive to improve precision. CCAR, CCX and 1605(b) have no time limit on C benefits.	Can include or exclude carbon pools based on cost and expected sequestration, but must measure all pools that could emit carbon dioxide over the analysis period	Must achieve a precision equal to 10% of the mean with 95 % confidence	Deduction for uncertainty required, but not yet defined.
Disincentives to Improve MM	Only required pools will be certified, so no incentive to include optional pools.	The rating system requires only an average of a B which can be achieved through models so there is no requirement for field measurements	All carbon pools must be separately measured to 95% confidence. Acts as a disincentive to include optional pools. Soil carbon must be measured to this high precision level even if no accumulation is expected. Permanent plots excluded. C benefits limited to 60 years	For projects, only tree stem biomass considered. No incentive to include other pools. For entity measurements only aboveground tree biomass considered.

Cost Implications	Allows pools to be combined to determine 95% confidence, dominated by high-C tree stems, which reduces costs of sampling low-C pools.	Lookup tables and online calculators (e.g., COLE, COMET-VCR) reduce sampling costs.	High confidence for low-C pools never cost effective.	Stem biomass only approach for entity reporting can be measured inexpensively but halves C benefits, raising cost.