



## Terrestrial Carbon Sequestration Activities, Voluntary GHG Registries, and Market Trading Programs<sup>1</sup>

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### Introduction and Background

Since adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, there has been growing interest in the expansion of agricultural and forestry practices that convert carbon dioxide gas into stable carbon compounds in wood, wood products, and soil. As discussions of possible programmatic approaches to the reduction of atmospheric greenhouse gas (GHG) emissions have proceeded, there have been proposals for the creation of either voluntary or mandated programs that would encourage transferable emission reduction offsets or credits. While such voluntary programs are in the initial phases of design and operation within the United States, a great deal of work is being done to design the accounting systems and institutional frameworks needed to implement them.

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This paper briefly describes some of the issues that have been raised in the international, national, and local discussions surrounding the inclusion of sequestration activities in voluntary GHG reduction programs. For the most part, accounting protocols to address these issues have not become officially established, so this paper will indicate how some of the current programs and/or proposals would affect the planning and implementation of a project designed to create transferable GHG credits.

For the purposes of this discussion and in the tables that follow, the concept of “project” means carrying out specific activities on an identified tract of farm or forest land that will sequester carbon in soil, wood, or wood products. These sequestered carbon amounts could then be measured, converted into an equivalent carbon dioxide emission reduction, and those amounts reported or registered under the guidelines. It also is recognized that an aggregator organization could assemble a group of projects, and either report the offsets or transfer them to a reporting entity.

In addition to the accounting protocols, there will be other requirements for carbon sequestration projects to qualify for either a voluntary registry or a trading system. As these requirements grow more stringent, the cost of meeting them will escalate, so one question facing program planners is how to balance the need for rigor, transparency, and certainty with the need for participation. This is no easy task, and in the development period, there are few guidelines upon which to depend.

There has been some experience in the federal government. Section 1605(b) of the Energy Policy Act of 1992 (P.L. 102-486) required the Secretary of Energy, through the Energy Information Administration, to establish a voluntary reporting program and database on emissions of greenhouse gases, reductions of those gases, and carbon sequestration. In response to the Act, DOE established the GHG Registry, widely known as the 1605(b) program, and has been operating and updating it since 1995.

The initial 1605(b) program was designed to encourage participation rather than to ensure analytical rigor, but some indications can be drawn from its experience. In 2000, 222 reporting entities recorded 1882 projects. Of these, 494 were reported in the carbon sequestration category. Since some of the projects were reported by several cooperating sponsors, the actual number of projects for the year was 307. They accounted for about 2.5 million tons of net offsets, compared to 72.5 million tons for non-sequestration activities. In the carbon sequestration category, 5 large international forest preservation projects (1.6 percent of projects) reported 87.4 percent of the total sequestration category. While almost all of the projects in this category were forestry projects, the limited number of projects, coupled with the enormous variation in size (some 6 orders of magnitude) and approach limited the utility of the database in making valid comparisons.

On February 14, 2002, the President directed the Secretary of Energy to propose improvements to the 1605(b) registry to “enhance measurement accuracy, reliability and verifiability, working with and taking into account emerging domestic and international approaches.” On the same date, the President directed the Secretary of Agriculture, in consultation with EPA and DOE, to develop accounting rules and guidelines for crediting carbon sequestration projects. The new and expanded 1605(b) registry, consistent with the President’s requests, is nearing final form (US DOE 2005). In the meantime, several other efforts have influenced thinking on these issues.

The following sections discuss four such efforts, but it is important to recognize that that these systems do not proceed from identical goals and objectives. Thus, differences

will flow from different objectives, as well as different methods or requirements. The WRI/WBCSD provides guidelines for project planning and carbon accounting that its expert advisors feel are necessary to achieve international credibility. It does not suggest whether or not carbon stock changes estimated by these methods will meet market or registry requirements, but the goal is to establish a uniform set of methods that will meet with wide recognition as a standard. The 1605(b) and the California CCAR are voluntary registries, so they provide a set of criteria that reporters must follow in order for the carbon sequestration amounts to be “registered” as offsets against emissions. The Chicago Climate Exchange is a market exchange, so it establishes the kinds of activities, measures, and other criteria that qualify carbon stock changes for market trading.

## **The 1605(b) Voluntary Reporting Program**

The National Voluntary Reporting of Greenhouse Gases Program<sup>3</sup> offers an instrument for entities and individuals to report their GHG emissions and any reductions thereof as a result of voluntary action to avoid, abate or sequester green house gases. The registry has outlined general as well as sector specific guidelines for reporting GHG reductions through voluntary action that allows the reporting entity to demonstrate that they have achieved the reductions.

On February 14, 2002, President Bush directed the Secretary of Energy, in consultation with the Secretaries of Commerce and Agriculture, the Administrator of the Environmental Protection Agency (EPA), and other Departments and agencies, to propose improvements to the program to “enhance measurement accuracy, reliability and verifiability, working with and taking into account emerging domestic and international approaches.”

The President also directed the Secretary of Energy to recommend reforms “to ensure that businesses and individuals that register reductions are not penalized under a future climate policy, and to give transferable credits to companies that can show real emissions reductions.” In the Federal Register notice transmitting the final draft general guidelines<sup>4</sup>, it becomes apparent that seeking this future protection is easier to include in a political charge than to accomplish in practice, so whether this goal can be fully accomplished will have to await future decisions and developments.

The President also directed the Secretary of Agriculture, in consultation with EPA and DOE, to develop accounting rules and guidelines for crediting carbon sequestration projects in agriculture and forestry. Thus, the objective of the 1605(b) program is to provide a set of uniform national guidelines for GHG emission accounting and reporting, including both emission reductions and carbon sequestration.

The process of federal register publication, agency consultation, public meetings, and drafting new 1605(b) guidelines proceeded through 2004. A final draft for public review and comment was released March 23, 2005. Readers are encouraged to go directly to the DOE website for current information on the final status of the guidelines.

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<sup>3</sup> <http://www.eia.doe.gov/oiaf/1605/frmtvrgg.html>

<sup>4</sup> Federal Register 70, No. 56, March 24, 2005, page 15176.

The descriptions below are based on the March review draft. Reporters should be alert to possible changes when the final guidelines are issued.

It is vitally important to recognize that the 1605(b) guidelines focus almost entirely upon *entity emissions reduction reporting*. It appears, at this stage, that the most logical reporters will be corporations that choose to participate in the voluntary reporting program. While a single farm or small non-industrial forest property could report as an entity under the guidelines, it is difficult to see why one would choose to do so. The most likely reports containing agricultural or forestry accounting would be integrated corporations that own and operate land, or those that choose to report offsets as part of their emissions reductions. It is in this latter area where the greatest opportunity may lie for conventional (or small) farm and forest operations.

A major concern exists with guidelines requiring an aggregator to submit an entity statement for all the entities where the project lands exist. This could run into dozens, if not hundreds, of entity statements that would need to be collected, kept current, and reported. Such an administrative burden may overwhelm the value of aggregating project offsets if it remains intact.

In order to qualify for registration by the reporting entity, the methods used to measure the sequestered carbon in projects would have to meet a rating of 3.0 on a scale of 1 to 4 that is established in the guidelines. In practice, this means carbon stock measurement by statistically designed sampling programs or well-validated models. Several methods, and their associated ratings, are provided in the technical guidelines.

## **The California Climate Registry**

The California Climate Action Registry (CCAR)<sup>5</sup> is a non-profit voluntary registry for greenhouse gas (GHG) emissions, which allows members to document GHG emissions by using any year following 1990 as a base year. California law (SB812) requires the CCAR to create a protocol to encourage sink activities by creating an incentive for forest landowners to undertake forest conservation, conservation-based management, and reforestation projects. The forestry protocols were released in late 2004; the Registry encourages feedback on how to improve and update them.

Under the forestry sector protocol, any entity with at least 100 acres of trees is eligible to report their GHG emissions. The registry requires them to report net emissions from both biological (e.g., sequestration gains and harvest losses) and non-biological (e.g., emissions from forestry management and harvesting operations). Guidelines for reporting non-biological emissions are included in the registry's General Reporting Protocol and the guidelines for reporting biological emissions are detailed in the Forest Sector Protocol.

For the first three years of reporting a forest entity is required to record only entity-level carbon stocks and CO<sub>2</sub> emissions. From the fourth year onwards they are required to report any of the other five greenhouse gases mentioned in the Kyoto Protocol that are relevant to the forestry sector. The methodologies for reporting other greenhouse gases are yet to be developed by the California Registry.

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<sup>5</sup> <http://www.climateregistry.org>

The registry distinguishes between a forest entity and a forest project, where a project may be a smaller area within the geographic boundary of a forest entity. The registry requires that any entity reporting project level emissions or reductions also report entity-wide emissions, both biological and non-biological. Though the participants can choose to report both California and Nation-wide emissions, only California emissions are certifiable by the registry for the time being. The Registry requires third party certification of forest biological inventories by a State and Registry approved forest sector certifier for inventories within the state of California.

It also requires identification of geographic, organizational and operational boundaries for all forest entities. Geographically the emissions can be recorded in two ways, either as total carbon stocks and biological emissions within California or as total carbon stocks and biological emissions in U.S., separated into California and non-California inventories. Organizational boundaries refer to an entity's share of ownership or control of the sources (or potential sources) of biological emissions and forest carbon stocks that fall within an entity's chosen geographic boundaries. In case of multiple ownership sources, trees in case of forest entities, the organizational boundary of each owner is determined on the basis of their equity share and they are required to report emissions from both commercial and non-commercial biological sources.

## **The Chicago Climate Exchange**

The Chicago Climate Exchange (CCX) is a self-regulating exchange that administers a voluntary, legally-binding pilot greenhouse gas emission reduction and trading program for North America, with participation of offset providers from Brazil. It began active on-line trading of GHG emission allowances in 2003. CCX member include major corporations, trading firms, non-governmental organizations, and public institutions such as cities and universities.<sup>6</sup> Members with direct emissions commit to reduce GHG emissions by 1% per year over the years 2003 to 2006, thus achieving a total reduction of 4% below their baseline average emissions in 1998-2001. A member whose emissions exceed its commitment can reduce emissions directly, purchase emission allowances from other CCX members who are below their commitment target, or purchase offsets from third parties. Those that reduce emissions below the commitment level can either sell their excess allowances on the exchange or bank them for use in future years.

CCX has contracted with the National Association of Securities Dealers (NASD) to provide oversight and regulatory services. NASD will assist in the registration, market oversight, and compliance procedures for CCX members, as well as provide auditing services to verify claimed baselines, measurements, and offset project verifications. Offset project verification, done by CCX-approved verifiers, is required for all offset projects.

As the only rules-based and standardized GHG emissions trading system in North America, CCX provides its members an opportunity to participate in building the institutions and shaping the policies that may eventually guide a national or international GHG trading system. Trades are conducted through a web-based system designed to keep transaction costs to a minimum. Prices and volumes are posted daily on the CCX website. The units of trade are called Carbon Financial Instruments (CFI's) and each

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<sup>6</sup> <http://www.chicagoclimatex.com/>

represents 100 metric tons of carbon dioxide equivalent (100tCO<sub>2</sub>e). As of August 1, 2005, the price for 2005 and 2006 vintage credits was around \$2.00 per tCO<sub>2</sub>e, and trading volume for the month of July (2005 vintage credits) had been 47,200 CFI.

CCX allows members to create agriculture and forestry offsets through projects featuring afforestation, forest management, forest conservation (Brazil and Mexico only), conservation tillage, and conversion of agricultural land to grass. For the initial pilot period, eligible agricultural soil activities are limited to selected counties in the Midwest. One CCX Exchange Allowance is issued per 100 tCO<sub>2</sub>e of increase in carbon stocks. Each Allowance has the “vintage,” of the year in which the net increase of carbon occurs. Carbon stored in 2003 can be used to offset 2003 emissions, or “banked” to be credited against future emissions. Once used as an offset against emissions, it is permanently “retired,” cannot be used again, and must be maintained.

Forestry projects are designated as small (less than 2000 tCO<sub>2</sub>e per year), medium (2,000 – 12,500), or large (over 12,500 tCO<sub>2</sub>e per year), and accounting and documentation rules differ somewhat between the categories. Each project must set aside 20% of its earned offsets in a Forest Carbon Reserve Pool (FCRP). If the project fails to meet its target upon final accounting in 2006, FCRP offsets will be cancelled as required to make up the deficiency. If not needed, offsets in the FCRP will be returned to the owner at the end of 2006. A CCX Committee on Forestry establishes technical and reporting guidelines for adoption by the CCX Committee on Offsets and the CCX Board of Directors.

## **The WRI/WBCSD Protocols**

In 1998, the World Resources Institute (WRI) and the World Business Council on Sustainable Development (WBCSD) launched the Greenhouse Gas Protocol Initiative<sup>7</sup> to develop internationally accepted greenhouse gas accounting and reporting standards for business. In the first phase of the project, a GHG Protocol Corporate Accounting and Reporting Standard was developed and published in 2004.

In the second phase, efforts to complete a Project Quantification Standard are nearing completion. The following information was taken from the 2004 “Road Test Draft” of that standard (cite), so there may be changes in the final documents that are not reflected in this paper. The objectives of this Standard are to:

- Simplify GHG quantification while enhancing the credibility and quality of GHG reductions or removals through the use of standardized procedures and GHG accounting principles;
- Reduce uncertainty and transaction costs for project developers and others;
- Increase investor confidence in GHG reduction projects; and,
- Increase the consistency between different GHG projects and trading programs.

The GHG Protocol is designed to be policy- and program-neutral, and does not address questions about converting quantified project reductions into program-eligible units. It is being developed by a set of international experts, and is designed to be

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<sup>7</sup> <http://www.ghgprotocol.org>

applicable to a wide variety of international, national, and regional programs that use, or are considering, market-based mechanisms as part of their GHG reductions programs. The generic GHG Protocol is broader than agriculture and forestry, but a specific “Land-use, Land-use Change and Forestry” Protocol is also being developed to provide guidance for these types of projects.

There have been significant changes made in the Project Protocol since the “Road Test Draft” was released, according to conversations with WRI scientists. When those changes have been released, there will be a need to change the comments made in the following tables and discussion.

In the meantime, however, the Project Protocol serves as an important reference point for generic project planning guidance. If, in its final form, it is widely accepted both within the U.S. and internationally, project planning methods will almost certainly begin to coalesce around its guidance.

## **Basic Project Requirements**

The following requirements are established by registry or market trading systems as a means of maintaining some consistency in the types of projects, reports, and measurements that are included in the system. They include:

- Project eligibility – Definitions as to the type of projects allowed, the geographic location of acceptable projects, or the methods by which project boundaries must be established, measured and reported.
- Reporting requirements – The type, periodicity, and other requirements for reporting project activities to the administrator of the program.
- Measuring, Monitoring, and Verification (MMV) – Specific guidelines or rules for measuring carbon stock changes or other emissions and reductions, periodic monitoring to assure that reported changes are continuing to occur; and independent third-party verification of reported amounts.

Table 1 illustrates generally how the four different systems address these requirements under current guidelines. Since all the systems are in some phase of development, these factors could change, and the specific guidelines should be consulted if project developers wish to qualify a project under one or more of the systems.

**Table 1. Basic Project Requirements**

<b>Program/ Element or Issue</b>	<b>1605(b) Voluntary Registry</b>	<b>California Climate Action Registry</b>	<b>Chicago Climate Exchange</b>	<b>WRI/WBCSD Project Protocol</b>
Project Eligibility	These guidelines are primarily geared toward entity reporting, not projects. Project activities can be reported within an entity, or from outside sources as offsets.	Reporting entity must own 100+ acres of non-commercial or commercial trees. Eligible activities include forest conservation, conservation-based forest management, and reforestation. Project must be secured with conservation easement. Only California projects are eligible to register.	Members can utilize a limited set of sequestration projects (afforestation, conservation tillage, and forest conservation) in some regions as offsets to meet a portion of their emission reduction targets.	These protocols focus on the planning and documentation requirements of all types of projects, including terrestrial sequestration. Eligibility would be determined by the individual programs to which the projects apply.
GHG Gas Reporting	Guidelines cover only CO <sub>2</sub> , measured as changes in total carbon stock in forests, forest products, or ag soils. If other GHG's are more than 3% of total emissions, they should be reported, but no guidelines exist yet.	Projects must quantify emissions and sinks of biological and non-biological changes. Only CO <sub>2</sub> needs to be reported for 3 years; in the 4 <sup>th</sup> year, all Kyoto GHG's are to be reported.	Only CO <sub>2</sub> emissions and sinks are included in current trading regime for the pilot period.	The protocol does not address reporting requirements, assuming those will be established by registries or trading systems.
Measuring, Monitoring, Verification (MMV) Requirements	Annual reports are certified by entity official as true, which creates a legal obligation under U.S. law; Annual 3 <sup>rd</sup> party verification audits are recommended but not required. Extensive guidance on measuring stock changes in agricultural soils and forests is provided in technical guidelines. Methods include default values, look-up tables, models, and direct measurements. Methods are rated A to D, and reporter must use methods averaging B to register reduction amounts.	There is extensive guidance on measuring forest carbon changes. Approved 3 <sup>rd</sup> party certifiers must audit reported GHG data in years 1 and 5, and every 5 years thereafter. Reported data must be within 15% of certifier findings. Agricultural soils are not included at this time.	Large projects (>12,500 tCO <sub>2</sub> e per year) must use CCX-approved verifier to verify reported amounts. Projects measure above-ground tree carbon in forest projects. Small (< 2,000 tCO <sub>2</sub> e/yr) and medium projects can use either direct measures or CCX-approved default tables. Agricultural soil projects use CCX default tables. All projects subject to CCX audit and verification.	Guidance given for carbon pool measurement including above-ground biomass, below-ground biomass, dead biomass and soil carbon, where a pool is thought to be subject to change as result of the project. In forestry projects, measuring soil carbon may or may not be prudent. Methods recommended include direct sampling and appropriate models.

## How Key Project Accounting Issues are addressed

Emerging registries or market trading systems will generally have guidelines for addressing certain critical project accounting issues. These issues stem from the need to possibly adjust project carbon accounts to reflect factors that may undermine their GHG offset potential, often due to factors outside the project developer's control. While there are no formal or official rules for addressing these issues, there are some commonalities emerging among the systems that may eventually become accepted guidelines (Table 2). Of the four systems compared in this paper, not all require attention to all these issues, and those that do may differ in their guidance as to how to address one or more of them. In the current situation, where program guidelines are emerging and being tested, project developers must be alert to the particular requirements of the system for which their project is to be applied. The issues include:

- **Additionality and Baseline setting** – Some systems require that the emissions reduced or the carbon sequestered in a project be “additional” (see below) to the emissions or sequestration that would have occurred without the project. That “without project” (or business as usual) scenario is called the baseline scenario and, as will be seen below, there are several ways in which it can be defined and developed.
- **Leakage** – The impact that project activities may have outside the project boundaries. If protecting a forest here means losing one there, much or all of the net gain to the atmosphere could be lost and the project's net results will be diminished and, perhaps, totally lost. Most leakage is much more subtle, such as small market impacts on a huge market, and planners are challenged to develop good methods of identification and quantification. Some of the systems compared below have guidelines for estimating leakage; others do not.
- **Impermanence (duration)** – In biological sequestration projects such as forest growth or soil carbon enhancement, there is a risk that the sequestered carbon can again be emitted, either through management actions or through natural events such as fire, pests, floods, etc. Identifying, managing, or mitigating these risks enhances a project's environmental value, so most systems will have requirements to be met by projects.

**Table 2. Key Project Accounting Issues**

<b>Program/ Element or Issue</b>	<b>1605(b) Voluntary Registry</b>	<b>California Climate Action Registry</b>	<b>Chicago Climate Exchange</b>	<b>WRI/WBCSD Project Protocol</b>
Baseline Setting	Entities report annual change in emissions relative to a Base Value, calculated as the emissions in the year prior to reporting, or an average of up to 4 prior years.	Baselines on projects must reflect management over time (under California Forest Practices Act as a minimum) and corresponding quantification of carbon stocks. Baseline initiation can be year of entry in the Registry or, until 2008, any year after 1989. For forest conservation, county default baselines are available.	Base year measurements establish the base value, and annual carbon stock changes are reported.	Forward-looking baseline scenarios are recommended for each project. There can be several “candidate” baselines, and there is guidance on picking the most appropriate. Baselines can be either project specific or, where available, based on a performance standard for a representative cohort group.
Calculating Additionality	Additionality not specifically required. All stock changes after base year are considered (implied) additional	Additionality calculated by subtracting baseline carbon, estimated above, from project carbon.	All registered credits must be declared additional. All stock changes after base year are considered (implied) additional	Additionality calculated by subtracting baseline carbon, estimated above, from project carbon.
Calculating Leakage	Small emitters must certify that reported reductions weren’t from activities likely to cause increases elsewhere in the entity. (Internal leakage). No guidelines for calculation. No requirement for external leakage calculation.	Activity-shifting leakage within entity boundaries must be quantified. If forest products are reported, market leakage estimation is encouraged.	Project owner must attest that all forest land outside the project, but within their control, is managed sustainably. (Internal leakage).	Leakage may occur from secondary effects, upstream-downstream effects, or market effects. These are to be identified for both baseline and project scenarios, then compared to determine extent of leakage.
Impermanence (Duration)	Carbon stocks are to be fully accounted in periodic inventories, which has the effect of netting out gains and losses. Casualty losses do not need to be reported, but regrowth after casualty cannot be reported until the original stock is replaced.	Project area must be secured by a perpetual conservation easement. Sequestration is credited on the year it occurs, and must be maintained thereafter without additional credit. If entity stops reporting, reductions are no longer valid.	Credits are based on annual amount sequestered and once used, must be permanently retired. Projects place 20% of earned credits in a reserve pool to cover potential shortfall at the end of the reporting period. Conservation easement or other proof that forest will be maintained is required.	Project should develop a Carbon Reversibility Management Plan: <ul style="list-style-type: none"> <li>• Identify and assess reversible elements;</li> <li>• Describe actions to reduce or eliminate reversibility;</li> <li>• Methods to compensate;</li> <li>• Monitoring plan</li> </ul>

## Carbon Sequestration Activities

While there are many activities in agriculture and forestry that alter carbon fluxes in the affected ecosystem and offer a potential for creating documented carbon sequestration that might be eligible as an offset against GHG emissions, it is not always feasible to include every activity in a registry or market trading program. As of today, it appears that the three registry or market exchange programs would recognize different activities (Table 3.) That may, of course, change as the programs evolve over time.

The WRI/WBCSD protocol is not specific as to activity, since it is designed to be used with any project activity that results in carbon sequestration or emissions reduction. At this point, it may be most usefully viewed as a model of project planning and accounting guidance that can be compared to the requirements of the other three systems.

**Table 3. Activities Considered in Four Programs**

Program/ Activity	DOE 1605(b) Voluntary Registry	California Climate Action Registry	Chicago Climate Exchange	WRI/WBCSD Project Protocol
Conservation Tillage	X		X <sup>8</sup>	The protocol methods could be used with any project activity. Not all activities would produce carbon changes significant enough to warrant going through the project planning protocols.
Conversion to Grass	X		X <sup>9</sup>	
Livestock Emissions	X			
Crop Residue Burning	X			
Fertilizer Management	X			
Rice Cultivation	X			
Improved Grazing	X			
Cultivating Organic Soils	X			
Afforestation	X	X	X	
Mined Land Restoration	X	L	L	
Forest Restoration	X	L	L	
Agroforestry	X	L		
Forest Management	X	X	X	
Short-Rotation Biomass	X			
Forest Preservation	X	X	X <sup>10</sup>	
Wood Products	X			
Urban Forestry	X			

X = covered in current program documents

L = likely to qualify as an extension of Afforestation or Reforestation

<sup>8</sup> Eligible only in designated states, counties, and parishes in the Midwest and Mississippi Delta.

<sup>9</sup> Eligible only in designated states, counties, and parishes in the Midwest and Mississippi Delta.

<sup>10</sup> Eligible only in Brazil and Mexico.

## Discussion

The methods required to meet the project accounting criteria listed above will impact the feasibility of developing and reporting different agriculture and forestry activities and projects. Since today's programs remain voluntary in the United States, people will need to see them as being both technically and economically feasible or the participation could be too low to test the program's concepts and values. One of the major distinctions in the programs discussed above is the approach to setting baselines and determining additionality. This is a key issue that significantly affects the amount of sequestered carbon that will be recognized as "register-able" or "trade-able" in the programs. It also impacts the amount and cost of obtaining adequate data for an acceptable project plan.

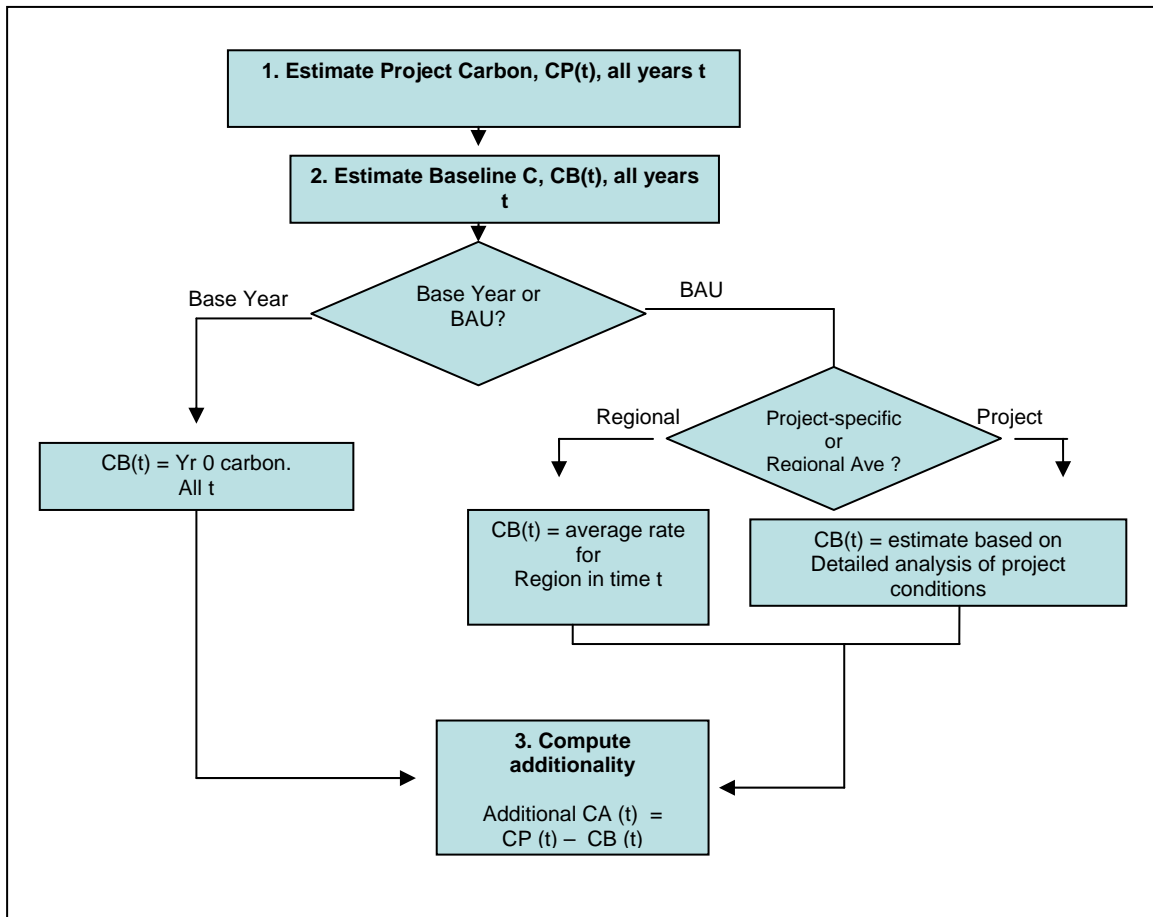
The simplest way, used in some situations, is to simply avoid the entire issue of baseline establishment and pay landowners for performing a particular practice. This system has been called "practice-based," and has a long history in the conservation and forestry incentive programs that have been administered by the Department of Agriculture since the 1930's (Richards et al. 2005). In Table 4, it is labeled "DV" or "default value" to indicate that producers are credited with a single carbon value per acre of practice applied. Establishing that default value may involve some sense of "business as usual," in that conservative estimates can be used to discount the anticipated carbon sequestration. For example, if research indicates that, on average, conservation tillage results in a soil carbon increase of 1 tCO<sub>2</sub>e per acre per year, a market such as CCX may establish a rate of 0.5tCO<sub>2</sub>e per year as the recognized allowance for implementing the practice. The reduced rate offers protection to the market in that, on average, it should recognize only increased sequestration. It also reduces transaction costs, since there is no need for periodic soil carbon monitoring to demonstrate the actual sequestration achieved.

Most of the emerging systems, however, are based on the actual measurement of sequestered carbon. These methods have been called "results-based," and while they are costlier to implement, they are recognized as necessary in some market-based transactions (Richards et al. 2005). In order to measure actual carbon sequestration over time, it is necessary to establish a starting point (time 0) from which the changes in carbon will be compared. For agricultural soils, that involves a statistically-valid sampling accompanied by a laboratory analysis (Lal et al. 2001). For forests, the sample findings are expanded to represent the entire forest area through well-established statistical protocols (US DOE 1605[b] guidelines).

Once the starting point is established, there are significantly different points of view about how to establish a credible baseline for determining additionality, and the distinctions are important in defining the project's potential for creating offsets. The simplest is to measure carbon stocks periodically (most suggest every 5 to 10 years), and subtract the initial stocks to calculate the amount of increase over time. This "base year" (labeled BY below) approach assumes that all measured carbon stock change is the result of management action.

Many systems have, however, proposed that the measured change needs to be discounted to recognize that some of the carbon would have been sequestered under any circumstance. This is particularly true in a forest situation, where the forest would have grown with or without management action. It is argued that, in order to be a legitimate

offset against allowed emissions, carbon sequestration should only count the amounts that are the direct result of project action. This “business as usual” (BAU) approach requires the creation of a “without project” scenario. There are essentially two ways of doing this that have been proposed to date (Figure 1). One method (labeled BAU) relies on project-specific estimates of potential future change. The other (labeled RA) uses regional average data to show how similar situations change over time. Both essentially establish a “business as usual” baseline that can be projected over the planned life of the project. If the project activity can be shown to sequester more carbon over the planned time frame, the amount in excess of the baseline is credited as carbon sequestration.



**Figure 1. Schematic drawing of ways to establish baseline values for calculating project additionality.**

The differences in these approaches affect not only the total emission offsets that are recognized in the accounting system (Figure 2), but also the difficulty in administering the programs and the perceived environmental integrity of each approach. They carry very different administrative and transaction costs, both to participating landowners, emitters, and regulatory or administrative bodies. Thus, there are trade-offs involved that create a fertile field for both research and experimentation in registries and markets.

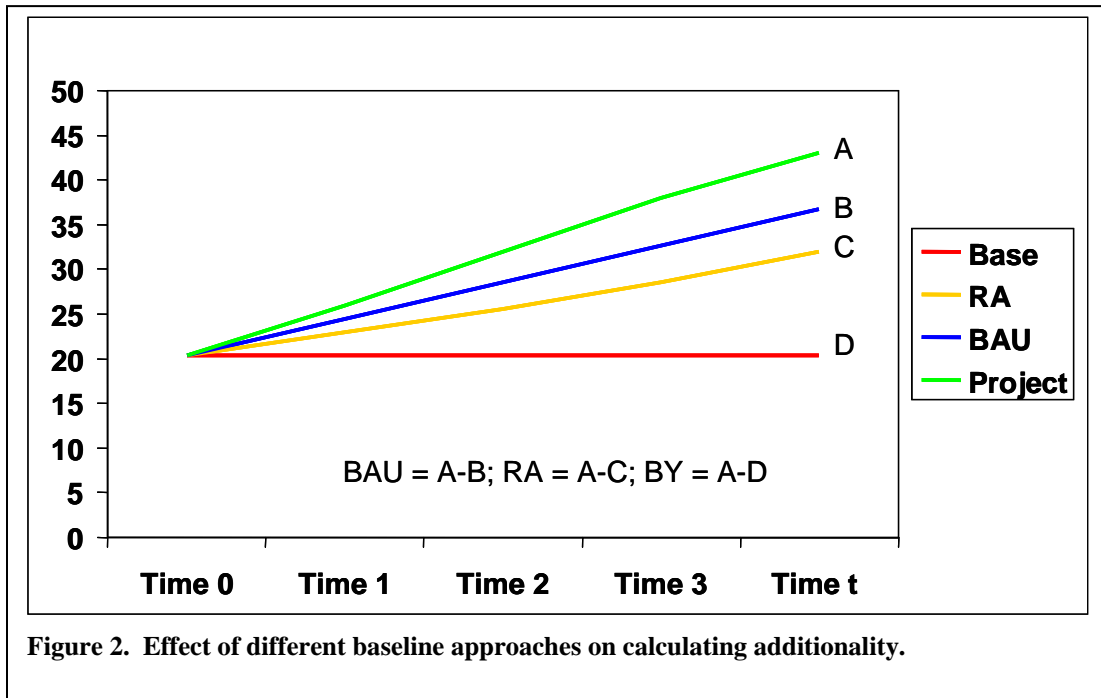



Figure 2 illustrates three possible impacts on additionality if one follows the scheme shown in Figure 1. It assumes that a project-level baseline assessment (BAU) would produce a future sequestration estimate higher than the regional average (RA). That, of course, will only be true part of the time. If the RA truly reflects a regional average, any particular project would be as likely to fall below the RA line as above it. It could also be true that the future prospects for a project are so similar to the chosen baseline projection that net sequestration would not be sufficient to make the action feasible.


Table 4 illustrates some of the different ways existing registry and market programs propose to handle the selected accounting calculations for different activities. There may also be some other tests for additionality and/or leakage required in calculating the final amounts that can be registered or traded. If a landowner is required by law, for example, to plant trees on certain lands, a “legal additionality” test would say that the resulting carbon stock change would not be counted as additional since it would have occurred anyway. In California, with its heavily regulated forest practices, a landowner can only count carbon amounts achieved in addition to those that would have resulted from following the prescriptions in the Forest Practices Act.


Similarly, some programs recommend or require an economics test to determine if the landowner would have been likely to do the practice anyway. One example might be to develop an analysis of economic return, or net present value. If the practice appears to be profitable compared to other options, the carbon stock change is not allowed on the assumption that a rational owner would have done it without credit for the carbon offsets. This test requires that one assume that landowners act on economic rationality – a premise that is open to challenge in many situations.

**Table 4. Comparison of Baseline, Additionality, and Leakage Features**

Program	WRI/WBCSD	1605(b)	CCAR	CCX
<b>Baseline Approaches</b>				
Afforestation/Reforestation	BAU	BY	BAU	BY
Forest Management	BAU	BY	BAU	BY
Forest Conservation	BAU	RA/BY	RA	RA
Conservation Tillage	BAU	RA	N/A	DV
Conversion to Grassland	BAU	RA	N/A	DV
Cropland Management	BAU	RA	N/A	N/A
<b>Additionality Tests</b>				
Legal Additionality	Required	Not Required	Suggested	Not Required
Economic Additionality	Required	Not Required	Suggested	Not Required
<b>Leakage Tests</b>				
Internal (Activity shifting)	Required	Required	Required	Required
External (Activity shifting)	Required	Not Required	Not Required	Not Required
External (Market effects)	Suggested	Not Required	Suggested	Not Required

 Required

 Suggested

 Not Required

Other important elements of feasibility will be the cost of meeting a registry or marketing program’s requirements, in terms of registering, certifying, or participating in some way, and the length of the obligation. Not all of the potential participants in agriculture and forestry will see these elements in the same way. Obviously, the wide availability of low cost carbon credits is favorable for buyers but not for sellers. If the price of registered carbon credits remains at very low levels, the cost and effort to meet registry requirements will become an important factor. Lengthy commitments or permanent obligations that reduce property values or ownership flexibility may ease problems for program administrators, but pose problems for buyers and/or sellers.

This general review of four programs has disclosed some significant differences. The WRI/WBCSD Project Protocol is not directly comparable with the registries and market trading systems. It reflects more attention to the issues of baseline setting, additionality, leakage, and impermanence than may be required in the current registries. The closest pattern is the California registry (CCAR), where the requirements appear to be very comparable to the WRI/WBCSD protocol. In reviewing the two at this intermediate stage, it appears that a California project planned and presented with the WRI/WBCSD protocol should meet the CCAR’s requirements for registry provided that the reporting entity met all the other requirements. On the other hand, a project in California that was documented adequately for registration under 1605(b) would not, for example, meet the CCAR requirements for baseline construction.

By contrast, it appears that a project planned with the WRI/WBCSD protocol or the CCAR guidelines, while it would qualify for registry by an entity under 1605(b), or be eligible as a trading unit on CCX if it met the other size and membership requirements, would be significantly over-planned. The work to go through the rather detailed process

of baseline setting, additionality, and leakage estimation would be immaterial under the current guidelines for either 1605(b) or CCX.

The WRI/WBCSD project protocol takes the strongest approach to leakage, and sets forth some process guidelines for evaluating it. In many agricultural and forestry projects, particularly those that take place on relatively small areas and landholdings, it is not clear that the data to do these calculations will be accessible to project developers. The creation of local or regional “default” leakage values has been proposed as one way of making these calculations feasible for small project developers.

DOE’s 1605(b) registry is more oriented to agricultural practices than either CCAR or CCX. It will, to the extent that it is implemented by entities, encourage the development of methodologies and experience in evaluating the GHG impact of a wide range of activities in crop and animal agriculture. Because of its orientation to entity reporting, and emissions reduction, much of the activity is likely to be in the industrial sectors (as it has been since the registry was initiated in 1994). Whether or not agricultural and forestry projects become important under the new 1605(b) guidelines will be strongly influenced by how much the reporting entities are encouraged to seek offsets as a component of their emission reduction efforts.

USDA, in its role as part of the 1605(b) process, has established some national protocols for measuring carbon fluxes in agriculture and forestry that should encourage practices to become more standardized and measurement and monitoring costs to be managed more effectively (U.S. DOE 2005). The current guidelines provide the basis for more common practice, but seem open to continual improvement as experience is gained and technology change occurs.

Both the two registries and the CCX trading floor provide essential, but different, pieces for an eventual national program in GHG reductions. Defining a legitimate terrestrial sequestration offset against emissions has been a conceptual and policy exercise that has proceeded for almost a decade. The two registries, while taking somewhat different approaches, provide an opportunity for testing these approaches while systems are still voluntary, and open to innovation and improvement. Future regulatory programs, if they emerge, should benefit greatly from the experience gained in these voluntary efforts. For emissions trading programs to function, there must be an efficient trading platform, and the CCX pilot program is establishing that experience. As State and National policymakers grapple with policy options in the future, all of this experience, and those that have participated in it, will inform that debate.

The WRI/WBCSD Project Protocol, when it comes out in final form, will be an important and influential guide to project planning. Whether it will become a “standard” in the U.S. will depend largely on how future policy decisions on GHG emissions shape the requirements for registry and market trading. The standard that emerges will be the result of competing pressures for credibility and feasibility in the methodologies. Whether this version of the Project Protocol has weighed that balance correctly, or will be pressed one way or the other in the process, is uncertain at this time. What appears likely, however, is that the Protocol will be at the center of many of those debates.

## References

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