Forest Carbon Trading and Marketing in the United States[1]

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1. Introduction

During the 1992 Earth Summit convened by the United Nations Conference on Environment and Development, a rudimentary framework for a global emission trading system was presented in a "side show" in a tent. Concern over climate change was limited to a few scientists and environmentalists and the idea was received with great skepticism. The concept of emissions trading was but a theoretical chapter in economics textbooks.

Fourteen years later, the situation is quite different. Market-based mechanisms such as emissions trading have become widely accepted as a cost-effective method for addressing climate change and other environmental issues. Dealing with environmental issues is quickly moving out of the confines of corporate environmental departments into the realm of corporate financial strategy.

The recent results from the emerging carbon markets are encouraging. In May 2006, the World Bank reported on the global market for trading carbon dioxide (CO_2) emissions stating that in 2005 the overall value of the global aggregated carbon market was 10 times that of 2004. The World Bank reported for the first time that markets are pricing carbon, creating the opportunity for the private sector to efficiently support investments to reduce greenhouse gas (GHG) emissions. Additionally, analysts are now describing CO_2 emissions as a financial market rather than the more traditional commodity market (Capoor and Amborsi, 2006).

The primary event that dramatically increased 2005 global carbon dioxide trading volume was the emergence of Phase I of the European Union Emissions Trading System[3] (EU ETS) that went into affect in January 2005 to address 25 European Union country Kyoto Protocol[4] GHG emission reduction targets. Under the program, regulated sectors in all 25 EU nations took on a binding commitment to reduce CO_2 emissions.

The underlying notional value[5] of the total EU ETS carbon market is now over US$58 billion. Putting this in context, the EU ETS is now 1.3 times bigger than the 2005 value of all corn,

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[3] http://unfccc.int/essential_background/feeling_the_heat/items/2913.php

[4] http://unfccc.int/essential_background/kyoto_protocol/items/2830.php

[5] Notional value is used throughout this paper and is the value of the underlying asset (emission allowances in metric tons of CO_2 equivalent) at the spot price. Notional values were calculated by the authors who believe that they represent a more accurate valuation of carbon markets.

soybean and wheat produced in the United States. It is clear that markets for trading GHG emissions are growing and here to stay.

Due to the inherent ecosystem services provided by forests' carbon sinks, forests have a role to play in climate change policy and the development of the global carbon markets. The role of forest and other carbon sinks associated with land use changes were first recognized by international treaties during the 1992 Earth Summit; the UN Framework Convention on Climate Change (UNFCCC) which recognized that activities in the Land Use Land Use Change and Forestry (LULUCF) sector can provide a relatively cost-effective way of offsetting emissions[6], and the UN Convention on Biological Diversity which recognizes the results that slowing the pace of rapid climate change would have in providing for the preservation of biological diversity.

Forest carbon projects offer a practical and credible low-cost option to mitigate CO_2 emissions. In their research report, The Conference Board recently reported that about 44 percent of surveyed companies in the United States are either involved in sequestration projects or considering them to offset GHG emissions (The Conference Board, 2006). Forestry based sinks provide an immediate opportunity to channel financial support for biological diversity that may lead to multiple social and economic benefits. Forest carbon projects also expand the range of international participation in the carbon market in places such as Africa where CO_2 reduction opportunities are very limited due to low levels of fossil fuel use.

Markets for forestry projects internationally are very modest. Currently, the ability of forestry to participate within international markets outside the United States is severely constrained by Kyoto Protocol rules that apply only to afforestation and reforestation projects. Due to the absence of a comprehensive United States GHG regulatory regime mandating emission reductions, e.g. cap-and-trade legislation, U.S. carbon markets have been voluntary. Demand for forestry offset credits (to be explained in the next section) for afforestation and reforestation, and managed forest projects has mainly been driven by voluntary markets developed by a wide variety of non-governmental organizations such as the Carbonfund[7], The Climate Trust[8], the National Carbon Offset Coalition[9], Powertree[10], and Pacific Forest Trust[11]. These organizations work with established registries and buyers to market forestry offset projects.

In this paper we present an overview of the state of carbon trading and voluntary markets for forestry offset projects, and our analysis of evolving forest carbon markets in the United States.

[6] http://unfccc.int/methods_and_science/lulucf/items/3060.php

[7] http://carbonfund.org/site/more/media/211

[8] http://www.climatetrust.org/

[9] http://www.ncoc.us/

[10] http://www.powertreecarboncompany.com/index.htm

[11] http://www.pacificforest.org/

2. Carbon Transactions – A Primer

GHG emission reduction transactions can be classified as either allowance-based or project-based (Capoor and Amborsi, 2006). Both allowance-based and project-based carbon transactions are measured and traded in standard units representing a quantity of CO_2 equivalent (metric tons of CO_2 equivalent = $MTCO_2$). The goal of any tradeable permit program is to allow market forces to efficiently allocate emission mitigation resources so that the overall emission reduction goal is achieved at the lowest cost. Emission trading programs allocate benefits to entities that reduce emissions at low cost by allowing them to make additional emission reductions, thereby gaining emission allowances that they can sell to those facing high emission reduction costs. Emission trading programs provide a profit incentive to devise lower cost emission reduction methods and technologies as well as environmentally sound land use changes that encourage long-term economic efficiency.

Allowance-based carbon transactions (also called emission allowances) are created by a regulatory or other cap-and-trade body and are initially allocated or auctioned to the user. Emission allowance transactions are based on the buyer's direct emissions. Buyers must reconcile their emissions account at the end of each compliance period through direct and verified measurements to ensure compliance with their allocated/auctioned emission allowances.

Project-based carbon transactions (also called emission reduction credits) are created using methodologies/rules approved by the organization issuing these transactions from a project that can credibly demonstrate reduction in GHG emissions compared to what would have happened without the project. Forestry offset projects are one category of projects that can provide emission reduction credits. Others include projects such as capturing landfill methane, conservation tillage practices, and alternative energy.

Emission reduction credits should be issued only after their reductions have been verified, which can then be used to offset direct emissions above an organization's allocated/auctioned emission allowances. The purchase or sale of contracts for emission reduction credits typically carry higher transaction costs and risk than emission allowances. The "quality" of projects for gaining emission reduction credits is directly related to the credibility of the organization issuing the credits, the methodologies/rules for establishing baselines and monitoring the project's performance, and the requirement for third-party verification. Once emission reduction credits are issued and used to offset direct emissions, they provide an identical environmental improvement in reducing GHG emissions as emission allowances.

3. Forestry and the Kyoto Protocol - The International Context

The world's attention has been focused on human-induced changes in the earth's climate since the signing of the United National Framework Convention on Climate Change (UNFCCC) at the 1992 Earth Summit. Since then, the Convention has been ratified by 189 countries, including the United States (U.S.). As provided in Article 2 of the Convention, the overall objective was to stabilize greenhouse gas emissions, "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system". It states that, "such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally

to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner".[12]

The UNFCCC required parties (countries) to meet periodically in "Conference of the Parties" (COP) meetings. To date there have been 11 COP meetings. From the December 1997 COP 3 session came the Kyoto Protocol which required the Annex I parties[13] (39 industrialized countries) to implement policies and measures for achieving legally binding assigned emission limitations and reduction commitments.

The global carbon market has emerged as a result of the Kyoto Protocol that set GHG emission limitations on its signatory countries, and established mechanisms for reducing overall GHG by at least 5 percent below 1990 levels by the end of 2012[14]. The Kyoto Protocol went into affect in February 2005 after being ratified by all industrialized countries except Australia and the United States.

The Intergovernmental Panel on Climate Change (IPCC) reported in its third assessment that 10-30% of human-induced global GHG emissions are due to Land Use, Land Use Change, and Forestry (LULUCF), (Intergovernmental Panel on Climate Change, 2001). The IPCC concluded that globally, changes in forest management could induce future carbon sequestration adequate to offset an additional 15-20% of CO_2 emissions. Within the U.S., LULUCF activities in 2004 resulted in a net carbon sequestration of 780.1 tons CO_2 equivalent. This represents an offset of approximately 13 percent of total U.S. CO_2 emissions, or 11 percent of total GHG emissions in 2004 (Environmental Protection Agency, 2006).

Of most interest regarding emission reduction credits for forestry, Article 3 of the UNFCCC introduced GHG emissions by sources and removals by sinks resulting from direct human-induced LULUCF activities, limited to afforestation, reforestation, and deforestation since 1990. In November 2001, COP 7[15], also known as the Marrakesh Accord, provided definitions for these forestry activities and introduced forest management, effectively linking all forestry practices to a change in land use.

COP 7 provided for a set of principles to govern LULUCF[16] from which the UNFCCC directed the development of Good Practices Guidance for Land Use, Land Use Change and Forestry. These guidelines provide for supplementary methods and good practices for estimating, measuring, monitoring and reporting on carbon stock changes and green house gas emissions from forestry activities under Article 3 paragraphs 3 and 4 of the Kyoto Protocol (Intergovernmental Panel on Climate Change, 2003).

[12] http://unfccc.int/essential_background/feeling_the_heat/items/2914.php

[13] http://unfccc.int/parties_and_observers/items/2704.php

[14] http://unfccc.int/essential_background/kyoto_protocol/items/1678.php

[15] http://unfccc.int/methods_and_science/lulucf/items/3063.php

[16] http://unfccc.int/resource/docs/cop7/13a01.pdf#page=54

Recognizing the important role that forest management plays in the continual sequestration of carbon dioxide, in May 2006, the UNFCCC began addressing carbon pools associated with the harvesting of wood products[17]. Further discussions of how harvested wood products can be counted should be forthcoming at COP 12 in November 2006.

It is important to note that to date the Kyoto Protocol authorizes only afforestation and reforestation activities, excluding soil carbon storage, sustainable forest management, and avoided deforestation. It appears that forestry emission reduction projects will continue to be restricted from participating in offsetting GHG emissions associated with Kyoto Protocol compliance targets through 2012 - the first commitment period, within member countries. This is reflected in the World Bank's 2006 Report with LULUCF projects accounting for only 1 percent of the 2005 traded volumes (Capoor and Amborsi, 2006).

4. The United States Context

The U.S., citing concerns that the Kyoto Protocol was not balanced, did not set realistic goals, and did not include developing countries, decided not to ratify the Protocol and withdrew after COP 6. Even though the Kyoto Protocol provisions have limited relevance to the development of U.S. domestic policy, the U.S continues to pursue unilateral GHG mitigation programs and policies. As a practical matter, and as a member of the UNFCCC, any U.S. GHG mitigation program and policies will be influenced by the international negotiations that surround the Kyoto Protocol; therefore it seems to be in the best interest of the U.S. to develop a national program that is consistent with Kyoto Protocol rules (Sampson and Grover, 2005).

In spite of the absence of a comprehensive U.S. GHG regulatory regime mandating emission reductions, e.g. cap-and-trade legislation, GHG emissions trading in the U.S. has been actively occurring since December 2003 through the Chicago Climate Exchange (CCX). The CCX runs the world's first and North America's only comprehensive GHG trading program requiring its members to take on a legally binding GHG reduction commitment. As of September 2006, CCX's 210+ membership have traded volumes of over 12 million $MTCO_2$. The CCX program is significant considering the underlying emissions baseline registered in CCX makes it the second largest active CO_2 emission trading program, second only to Germany.

At the federal level, several legislative initiatives have been made on climate policy. The Bingaman-Domenici White Paper presented in February 2006 entitled, "Design Elements of a Mandatory Market Based GHG Regulatory System", surveyed 130 entities on how to design a GHG market within the US[18]. Among the earliest climate change initiatives in the Senate was the McCain-Lieberman Climate Stewardship and Innovations Act. The bill calls for a federal cap-and-trade system for selected sectors that emit more than 10,000 $MTCO_2$ per year. The cap, set initially at 2000 levels was required to be met by 2010. Senator Feinstein's bill calls for capping emissions at 2006 levels until 2010 and then for a gradual reduction (7.5%) of emissions by 2020. Feinstein's bill allows for the use of afforestation credits from U.S. or

[17] http://unfccc.int/resource/docs/2006/sbsta/eng/l10.pdf

[18] http://energy.senate.gov/public/_files/JointStatementonClimateConference.pdf

international sources. Table 1 presents a summary of various congressional legislative bills currently being debated in the U.S. Senate (Point Carbon, 2006).

Table 1 Proposed GHG Legislation in the U.S.

Proponent	Type	Scope	Target Level	Price Cap	Offset
McCain and Lieberman	Cap and Trade	Electricity, transportation, industry and large commercial facilities	Stabilization at 2000 level by 2010	NA	Upto 15% including sequestration and international markets
Bingaman	Intensity target with trading mechanisms	Fuel Producers, importers and emitters of non-fuel GHGs	2.4% below BAU intensity	$7 per ton (+5% annually)	Domestic credits including sequestration. Upto 3% international credits
Feinstein	Cap and Trade	Large stationary sources, including utilities, oil and gas and transportation facilities	2006 levels in 2010, 92.75% of 2006 level in 2020	NA	25%, domestic and international including farming and afforestation
Waxman	Cap and Trade	Large emitters	Stabilization at 2000 levels, 2% annual reduction from 2010 to 2020	NA	Not defined
Kerry and Snowe[19]	Cap and Trade	Passenger vehicles, the U.S. to derive 20% of its electricity from renewable sources	Freeze GHG emissions in 2010. Then reduce annually to a goal of 65 percent below 2000 emissions levels by 2050	NA	Not defined

The lack of a comprehensive mandatory federal GHG reduction program in the U.S. has led to a flurry of climate change policy initiatives at the municipal, state, and regional levels. Rules for the nation's first regional mandatory cap-and-trade program to reduce CO_2 emissions were released August 2006. Under the Regional Greenhouse Gas Initiative (RGGI)[20], seven northeast states have adopted a pact beginning in 2009 to cap CO_2 emissions from power plants at current levels, with a goal of achieving a 10 percent reduction by 2019.

In September 2006, Governor Schwarzenegger of California signed a bill, the Global Warming Solutions Act[21], making California the first state to cap GHG in the U.S. The bill would develop regulations and market mechanisms with the goal of reducing California's GHG

[19] This bill is not included in the Point Carbon reference. http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_bills&docid=f:s4039is.txt.pdf

[20] http://www.rggi.org/modelrule.htm

[21] http://www.aroundthecapitol.com/billtrack/text.html?file=ab_32_bill_20060418_amended_sen.html

emissions by 25% by 2020. Under the bill, mandatory caps will begin in 2012 targeting significant emission sources in the state.

Through the CCX trading platform, numerous cities, municipalities, states and counties have committed to reducing GHG emissions by 6% by 2010. Cities include Chicago, IL, Portland, OR, Berkeley, CA, Oakland, CA, Aspen, CO, and Boulder, CO. The two states, New Mexico and Illinois, have committed to the CCX reduction commitment.

The mayors of 284 U.S. cites representing over 48 million citizens have signed the U.S. Mayor's Climate Protection Agreement[22] urging their state governments, and the federal government, to enact policies and programs to meet or beat the GHG emission reduction target suggested for the United States in the Kyoto Protocol.

A parallel development involves the emergence of multiple CO_2 emission "Registries". The four primary emission registries that provide for forestry offset emission reduction credits in the U.S. include, 1) the Chicago Climate Exchange[23], 2) the Department of Energy (DOE) National Voluntary Reporting of Greenhouse Gases Program under section 1605(b) of the Energy Policy Act of 1992[24], 3) the California Climate Action Registry (CCAR)[25], and 4) the RGGI. Of these, the CCX is the only exchange platform for trading forestry offset credits in the U.S.

The development of numerous registries has implications both to emission allowances as well as emission reduction credits created by forestry offset projects. In the absence of mandatory emission reduction requirements or knowing the price of carbon that may be obtained, the financial incentives to register direct emission reductions or sequestered carbon will remain illusive. Forestry offset projects have unique characteristics where the proliferation of registries will create additional transaction costs. Multiple registries will translate into different rules for participating, e.g. how to set carbon baselines, the eligibility of managed vs. afforestation/reforestation projects, monitoring methods, verification rules, and the pools of carbon that can be registered (i.e. above ground, below ground, harvested wood products), all of which will increase registration transaction costs for forest management organizations that manage forest lands in multiple regions of the U.S.

The registries that are currently active in the U.S.; the CCX, the DOE's 1605(b) program, and the CCAR are all in a development phase. The rules for qualifying, monitoring, and verifying forestry projects are quite different, opening the door for a much needed standardized national program that will most likely develop as federal cap-and-trade legislation evolves over the next five years. For now, due to the infancy of these registries in handling forestry offset projects, they play a minor role in their total emission reduction portfolios.

[22] http://www.seattle.gov/mayor/climate/default.htm

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

[24] http://www.pi.energy.gov/pdf/library/TechnicalGuidelines_March2006.pdf

[25] http://www.climateregistry.org/PROTOCOLS/FP/

An analysis of forest sequestration projects registered in 2003 in the DOE's 1605(b) program indicated that 446 projects were reported in the "carbon sequestration" category by 51 different entities and accounted for 2.1 million tons of net carbon emission reductions, of which 89 percent were from foreign projects. Almost all of these carbon sequestration projects involved forestry projects, the vast majority of which entailed preservation, conservation, and afforestation or similar tree-planting activities. While 39 of the projects reported are based on forest preservation, those projects accounted for 88 percent of the total carbon sequestration reported. All of these reductions were reported by five large forest preservation projects; as a result, just 10 percent of all reporting entities accounted for 92 percent of the total sequestration reported in 2003 (Richards, et al. 2006).

5. Global Carbon Markets

The global market for CO_2 emissions is emerging as one of the most rapidly developing commodity markets. In 2005, the global carbon market as a whole traded about US$12 billion in notional value. A significant portion of this trading volume was attributed to the EU ETS. Driven by Kyoto compliance commitments, emission allowances worth US$9.1 billion in notional value were traded in 2005 in the EU ETS, representing nearly four times that of previous years' volumes.

As of July 2006, approximately US$19 billion in notional value has been traded, representing over 700 million $MTCO_2$. The EU ETS is projected to reach over US$34 billion by the end of 2006. However, as currently designed, offsets earned from LULUCF projects are excluded from the EU ETS.

Other GHG trading schemes outside Kyoto worthy of mention include the New South Wales Greenhouse Gas Abatement Scheme (NSW) and CCX. The NSW program in 2005 traded 6.11 million $MTCO_2$ with a total notional value of US$57.2 million. The CCX program has also been witnessing significant growth in trading volume. In 2005, the CCX traded around 1.4 million $MTCO_2$ compared to over 8.2 million $MTCO_2$ as of September 2006. To date, over US$54 million in notional value have traded on the CCX exchange platform. Both the CCX and the NSW exchanges issue credits for sequestered forest carbon.

In October 2006[26], emission allowances were trading at US $4.05/$MTCO_2$ on the CCX exchange, US $20.80/$MTCO_2$ on the EU ETS exchange, and US $9.42/$MTCO_2$ on the NSW exchange.

6. Trading and Marketing U.S. Forest Carbon Offset Projects

a. Trading Forest Carbon Credits

Of the three markets described above, the only one available to organizations located in the U.S. for trading forestry offset credits is the CCX. Broader goals of the CCX exchange include

[26] http://ecosystemmarketplace.com/pages/marketwatch.segment_landing.carbon.php?component_class_name_csv=carbon_market,carbon_aggregate_market

building market institutions and infrastructure, developing human capital in environmental trading and establishing the viability of a multi-sector and multi-national system for GHG emissions trading. CCX members that cannot reduce their own emissions can purchase credits from those that make extra emission cuts or from verified offset projects. Eligible forest offset projects include forestation and forest enrichment, combined forestation and forest conservation projects, and urban tree planting[27]. Membership in the CCX includes five North American and four Brazilian integrated forest products companies operating both manufacturing facilities and managing forest lands[28]. The CCX has registered forest offset credits from Costa Rica, Brazil, and numerous states in U.S., and is currently considering registering forest offset projects in Belize and Bolivia. General eligibility requirements under the CCX forestry offset program include:

- Afforestation, reforestation and forest enrichment projects initiated on or after January 1, 1990 on unforested or degraded forest land.
- Forest conservation projects may be eligible to earn CCX CFI offsets if they are undertaken in conjunction with forestation on a contiguous site.
- Demonstration that entity-wide forest holdings are sustainably managed.
- Demonstration of long-term commitment to maintain carbon stocks in forestry.
- Use of approved methods to quantify carbon stocks.
- Independent third-party verification of carbon stocks (where required).

Since its first trade in December of 2003, the CCX has expanded its electronic exchange platform capacity to include the European Climate Exchange that accounted for 70% of the market share of exchange platform activity in the EU market in 2005, the Montreal Climate Exchange in Canada, and the New York Climate Exchange and Northeast Climate Exchange to develop carbon financial instruments relevant to the RGGI. Figure 1 provides an overview of the CCX market design.

[27] http://www.chicagoclimatex.com/news/publications/pdf/CCX_Forest_Offsets.pdf

[28] http://www.chicagoclimatex.com/about/members.html

Figure 1 - Overview of CCX Market Design

Chicago Climate Exchange Members

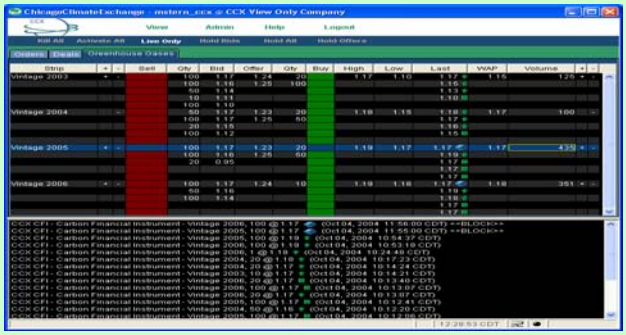
- Binding commitments to cut emissions or buy project-based offsets (e.g. Forestry) or allowances from Members with excess cuts;
- Standardized emission monitoring and reporting protocols, NASD to audit
- Renewable fuels treated as zero-carbon
- Annual true-up and audit
- Voluntary, self-governance and self-regulatory exchange

Chicago Climate Exchange Offset Providers

- Offset providers/Offset Aggregators:
  - Continuous no-till
  - Grass and tree plantings
  - Methane combustion
- Aggregators (e.g. Farm Bureaus) bundle, document and trade offsets produced by individual producers
- Verifiers (private contractors): conduct in-field verification (process is audited by NASD)
- Market-makers, voice brokers to provide market liquidity

CCX Registry - The CCX Registry is an electronic database that serves as the official holder of record and transfer mechanism for Carbon Financial Instruments owned by Registry Account Holders.

CCX Electronic Trading Platform



The Chicago Climate Exchange Trading Platform's fully electronic functionality does not require intervention or assistance from brokers.

b. Voluntary Markets for Forest Carbon Credits

Marketing of voluntary forestry offset credits to buyers has been conducted in a variety of transactions. The World Bank became the first multilateral organization to become a member of the CCX in 2006. In June, the World Bank Group announced that it offset 100 percent of its GHG emissions produced by its Washington, D.C. operations and business transportation tracked from its headquarters in fiscal year 2006. CCX Carbon Financial Instruments equivalent to 22,000 $MTCO_2$ of the World Bank Group's emissions were acquired and retired. These verified and registered credits originated from a reforestation project in Costa Rica owned by the Precious Woods Group, a sustainable forest management company based in Switzerland with operations in South and Central America.[29] The Costa Rican project represents the world's first ever registration and trade of carbon credits from a forestry offset project.

The Pacific Forest Trust worked with the van Eck Forest Foundation to register California's first forest carbon project with the CCAR, achieving emission reductions of more than 500,000 $MTCO_2$ from sustainable management on 2,100 acres of working forestlands. Carbon emissions reductions registered and certified by the CCAR can be sold to businesses and other entities seeking to offset their own emissions, thus generating a new source of sustainable forest revenue. The Conservation Fund, Nature Conservancy, and California Coastal Conservancy are working on a similar project for the 23,000 acre Garcia River Forest[30].

Another example of marketing voluntary forestry offset projects includes the National Carbon Offset Coalition (NCOC). The NCOC is a member of the Department of Energy's Big Sky Carbon Sequestration Partnership with a charter to propose and test strategies for a national carbon credit trading system for terrestrial offsets. The NCOC is comprised of seven Montana non-profit corporations. The NCOC program is designed to assist landowners in planning carbon sequestration activities and documenting the resulting Carbon Sequestration Units in a manner that adheres to international standards and protocols, and meets the needs of potential buyers. As a CCX aggregator, the NCOC brings agricultural and forestry offset projects into the CCX trading platform for its clients.

The Carbonfund purchases and retires verified reforestation project CO_2 emission reductions on behalf of its clients. The Carbonfund does not sell or trade project emission reductions.

Offset funding provided to The Climate Trust is used to select, contract, purchase and manage reforestation offset projects over the life of enforceable contracts. Offsets are transferred to and owned by the client as a corporate asset and can be used to meet GHG regulatory requirements or can be "banked" for use in meeting future requirements.

Twenty-five U.S. electric power companies, under the PowerTree Carbon Company, invested $3 million to establish six bottomland hardwood reforestation projects in Louisiana, Mississippi, and Arkansas with a goal of sequestering 1.6 million metric tons of CO_2 while providing important wildlife habitat and clean water co-benefits. These projects expect to

[29] http://www.preciouswoods.com/index.php?option=com_content&task=view&id=220&Itemid=2&lang=en

[30] http://www.pacificforest.org/news/pdf/vanEck-AP-Story-July-06.pdf

provide sequestered carbon at a cost of less than US$2/MTCO$_2$ that will be shared with these power companies. These projects are eligible to be registered with the DOE's 1605(b) program.

A comparison of the types of forestry projects that can participate in each of the primary U.S. registries is provided in Table 2.

Table 2 – Forest Project Types Within the U.S. Registries

DOE 1605(b) Registry (Voluntary)	California Climate Action Registry (Voluntary)	Chicago Climate Exchange (Voluntary)	RGGI Registry (Mandatory – active in 2009)
Managed forests, forest restoration, afforestation, reforestation, agroforestry, short-rotation woody biomass plantations, low-impact harvesting, protecting existing forests from conversion to other uses, and urban forestry.	Forest conservation, conservation-based management, and reforestation.	Afforestation and reforestation, forest conservation, managed forests, and urban forests.	Afforestation.

7. Forestry Project Accounting Issues for U.S. Registries

The Kyoto Protocol and subsequent COP meetings have identified forest project accounting issues that are handled differently by the four primary registries in the U.S. and which affect the eligibility and transaction costs of participating in these registries. These issues include baseline setting, additionality, leakage, and permanence.

a. Baseline Setting

Carbon baselines must be established as a means for determining the point from which the net change in carbon stocks are measured so that emission reduction credits can be issued. Typically, baseline carbon values are determined through standard forestry biometric methods that include direct and statistically designed and modeled measurement techniques.

b. Additionality

Since the environment must benefit from any forestry offset project where emission reduction credits are issued, the amount of carbon sequestered must be additional to what would have occurred without the project. For forestry projects, this can be subjective. An example of a forestry project that demonstrates additional carbon sequestered is an afforestation project. However, a sustainably managed forest project can sequester more carbon over the same long term planning horizon as an afforestation project. When harvesting occurs, the recognition of harvested wood products that have long-lived life cycles is a legitimate carbon pool associated with managed forests. Additional carbon can also be sequestered through a change in rotation length or in harvesting less volume than planned. In states that have strict forest practices

regulations such as California, projects that manage forestlands below regulated levels could also generate additional net changes in carbon stocks.

c. Leakage

Leakage is a term that addresses the impact that the project might have, i.e. an increase or decrease in sequestered carbon, outside the boundaries of the project, and can be difficult to measure for forestry projects. Large projects may shift activities in ways that were not intended, e.g. an afforestation project in one location may displace an afforestation project in another area. Market-based leakage can occur where a project may alter the supply and demand forces of forest product markets, e.g. where large forestry projects might reduce the supply of timber.

d. Permanence

Ensuring that a forestry project is permanent can be difficult since the amount of carbon sequestered might be "emitted" through natural disasters such as wildfire, insects, and hurricanes, or through management activities. When these events occur, some registries require that the reduction in sequestered carbon be included in the net change calculations so that credits previously issued can be paid back and no additional credits can be issued until the net change in carbon stocks is again positive.

Table 3 provides a summary of the ways that the primary U.S. registries address these issues.

Table 3 – Forestry Project Accounting Issues[31]

Issue	DOE 1605(b) Registry (Voluntary)	California Climate Action Registry (Voluntary)	Chicago Climate Exchange (Voluntary)	RGGI Registry (Mandatory – active in 2009)
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. Verification is encouraged.	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. Verification is required.	Base year measurements establish the baselines, and annual carbon stock changes are reported. Verification is required on medium and large projects.	Base year measurements establish the baselines, and carbon stock changes are reported not less than every five years. Verification is required.

[31] This table was adapted from R. Neil Sampson's 2005 paper, "Terrestrial Carbon Sequestration Activities, Voluntary GHG Registries, and Market Trading Programs", and updated to include the final DOE 1605(b) rules, and revised to include the newly published RGGI Model Rules.

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. Afforestation or reforestation projects must have occurred since January 1, 1990.	All offset projects are additional if projects are established on lands that have been non-forested for at least 10 years preceding the project.
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)	Project applications must be verified that sustainable forestry practices are planned. (Internal leakage)
Permanence	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. A perpetual conservation easement to ensure permanent forest use.	Credits are based on net change in sequestered carbon, 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 forests will be maintained is required. Demonstration of sustainable management practices and long term commitment to maintaining carbon stocks in forests.	Credits are based on net change in sequestered carbon and may be permanently retired after stage 1. Projects receive 90% of the net change to protect against loss of sequestered carbon. Permanent conservation easement and demonstration of sustainable management practices.

8. Conclusion and Synthesis

Market-based mechanisms are emerging as a more efficient means for addressing climate change. With market-based mechanisms come opportunities for increasing return on investments available to managed forests, and afforestation and reforestation projects. Voluntary and mandatory forest carbon markets are evolving in the United States for evaluating, registering, verifying, and trading carbon credits for offsetting GHG emissions from manufacturers and utilities. As markets for ecosystem services like sequestered carbon develop globally, managed forests, and afforestation and reforestation projects will play an increasingly important role for addressing climate change.

The Chicago Climate Exchange is the only exchange platform in North America and is currently trading emission reduction credits that can be gained through verified net increases in forest carbon stocks. Three other U.S. regional registries have emerged for registering carbon credits associated with managed forests, and afforestation and reforestation projects; the CCAR, the DOE's 1605b program, and RGGI. Each registry addresses, with different rules, the important issues of additionality, leakage, and permanence of forestry projects, and how managed forests and harvested wood products can participate. Buyers of forestry offsets have established their own purchasing criteria for the level of quality that they demand in these types of financial instruments.

Since the U.S. is not a party to Kyoto, there are no opportunities to export emission allowances or emission reduction credits out of the U.S. to other exchanges, such as the EU ETS exchange platform, where prices are currently about five times that of the CCX exchange platform. So, as organizations make investments in emission reduction credits such as forestry offset projects in the U.S., they may decide to protect those investments by registering project CO_2 in one of the four primary U.S. registries.

Barriers to trading and marketing forest offset projects include the transaction costs associated with these registries which are directly related to the different project eligibility rules. Of course, the expected price of carbon will also be a determining factor in the economic analyses required to justify an investment. Forestry markets in the U.S. have, until the emergence of the RGGI, been voluntary. As RGGI comes on line in 2009, mandatory emission reduction targets assigned to power plants in the Northeast will motivate buyers in the forestry offset market. This demand should, in the short term raise carbon prices for forestry offset credits.

The lack of federal cap-and-trade legislation, on one hand, has stimulated innovative approaches to establishing trading and marketing systems. The CCX exchange platform is the best example of this innovation. On the other hand, the absence of long-term regulatory carbon constraints has kept buyers unmotivated in carbon markets, slowing the development of the required capital needed to sustain these markets. A well-defined, transparent, and credible federal cap-and-trade compliance program for reducing GHG emissions in the U.S. will help create clear price signals that are needed to attract the level of capital required to sustain a U.S carbon market.

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