

An Overview of Carbon Markets for Florida Forest Landowners¹

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Introduction

Carbon markets pay landowners to capture or offset greenhouse gas (GHG) emissions by planting trees, preventing forest degradation, or improving forest management practices. In addition, a recent Environmental Protection Agency (EPA) ruling gives the state of Florida two years to submit plans to cut 38% of 2012 carbon dioxide emissions from the power sector by 2030 (from the 2014 EPA Clean Power Plan – Proposed State Goals). This means that land owners and policy makers can use carbon markets as a way to both comply and generate income. In North America, carbon markets can indeed offer a real income opportunity to landowners who participate in eligible programs that are either in place or being considered in 22 US states, two Canadian provinces, and six Mexican observant regions. Payments for sequestering carbon in forests can be an important supplemental income source in the southern US which includes one-third of the contiguous US forest carbon stocks (Turner et al. 1995) and supplies 16% of the world's wood (Prestemon and Abt 2002).

But, absent a comprehensive national forest carbon market program with clear and standardized guidelines, it is difficult to understand the carbon market and certification options available to Florida forest landowners and the possible risks of participating in such carbon markets. To address this need, we have compiled and reviewed available resources on the Internet, refereed and technical

publications, and personal communications with experts to provide an overview of forest carbon markets in the United States (US) as of 2014 and to compare key features of the four major *carbon offset* certification options. Using Florida as an example, we then discuss the potential for landowners to participate in carbon markets in the US South. Specifically, we discuss: (1) What a carbon market is and their brief history in the US; (2) What are differences in currently available forest carbon market certification programs; (3) How and where are carbon credits sold; and (4) What are the current market trends with an emphasis on Florida forests? A glossary of commonly used terms in carbon markets and additional resources for accounting standards is also provided at the end of the publication.

Carbon Markets and Their History

The opportunity for landowners to supplement their income using carbon markets typically requires: 1) enrollment in a certification program that reviews and monitors forest management activities such as reforestation, improved forest management, or the prevention of deforestation to capture and store carbon; 2) the use of an independent monitor that visits and inspects the property before any type of certification can be issued; 3) a multi-year contract that accounts for risks of natural disasters such as fires and hurricanes; 4) the issuance of carbon credits; and 5) the search for buyers of these carbon credits. Markets for these credits are currently being developed in

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the United States and elsewhere, and landowners can rely on professional brokers to match buyers and sellers.

Four main brokers, called *carbon offset certification programs*, or registries, operate in the United States. They are the California Air Resources Board (CARB), American Carbon Registry (ACR), Climate Action Reserve (CAR), and Voluntary Carbon Standard (VSC). At present, landowners from Georgia, Alabama, Mississippi, South Carolina, and Louisiana are participating in these programs, with more than 25 forest projects and thousands of acres enrolled. In Florida, however, only several landfills and biomass projects take advantage of these opportunities, despite the state's substantial forest resource (see ACR Projects, CAR Projects, and VCS Projects in the Additional Resources Section at the end of this publication).

Over 17 million acres, half of Florida's land area, is covered by forests that can provide revenue-generating opportunities through participation in *carbon sequestration* programs. A 2008 study by Mulkey et al. found that increasing management intensity on pine plantations and increasing afforestation of Florida range and pasture lands by 5% could potentially yield an estimated \$139.6 million in carbon-offset funds. In recent years, several public institutions and private entrepreneurs in Florida have expressed interest in participating in *carbon markets* or specific projects to reduce GHGs. For example, in 2007, the city of Miami entered into a contract with the now-defunct Chicago Climate Exchange (CCX) to further their goal of reducing 6% of GHG emissions by 2010. Miami allocated \$500,000 of their 2007–08 budget to the Office of Sustainability to staff a climate change taskforce and administer a CCX contract (Acosta, 2009). There have also been state-level initiatives targeting climate change. In 2010, Florida's governor signed legislation that created a Property Assessed Clean Energy program. This program allows local governments to levy non-ad valorem assessments (no value added for taxation purposes) to fund qualifying improvements in energy conservation and renewable energy. It also allows them to adopt ordinances or resolutions that provide upfront funds to cover the financial costs of environmental improvements (Friedman and Glinn, 2010). However, in spite of these efforts and the amount of forests in Florida, as of the writing of this publication, Florida has yet to register any current forest *carbon offset* projects using the existing ACR, CAR, CARB, and VCS certification platforms.

Cap-and-Trade Programs

Emissions trading or cap-and-trade (CAT) programs create carbon *compliance* markets that allow polluters to emit

more GHGs than they are allowed, while paying others to stop polluting or capture/offset GHGs elsewhere (for an extensive definition of CAT, please see Raymond and Shively 2008). This framework typically includes carbon "offsets" generated by forest projects (see Charnley et al. 2010). In 2010, North America was simultaneously the second biggest supplier and second biggest demander of *carbon offsets* (in the global voluntary carbon market), with domestic demand exceeding domestic supply by 0.7 million tons of *carbon dioxide equivalents* (CO₂e) a standard unit of measurement used to compare different GHGs based on their ability to trap heat in the atmosphere (Diaz et al. 2011). Although the United States does not have a national CAT program, a recent national survey found that 75% of US voters favor regulating CO₂ as a GHG pollutant and want the federal government to prioritize global warming as a policy issue (Zabanko 2012).

Policies Regulating GHG Emissions

Over the past 20 years, there have been several major efforts to institute federal policies that regulate GHG emissions in the United States, but none have been successful. In the early 1990s, based on a successful experience with a CAT system for sulfur dioxide and nitrogen oxides, US officials lobbied the international community for a market-based rather than tax-based approach to regulating GHGs (Adams 2009). Also in 1992, the United Nations ratified its Framework Convention on Climate Change, which became the negotiating framework of GHG reductions under the Kyoto Protocol (Charnley et al. 2010). This protocol required industrialized countries to reduce GHG emissions to an average of 5% below 1990 levels by 2012 (the requirements differed by country), with developed countries facing more obligations than their less-developed counterparts. The mid-2000s saw the first large-scale implementation of a CAT program for GHGs with the European Union's program to meet Kyoto Protocol obligations (Raymond and Shively 2008). Despite leading efforts for a CAT-type approach to CO₂ pollution, the United States did not overcome bipartisan disagreement on exempting developing countries from emissions reduction requirements under the Kyoto Protocol, and the US Senate failed to ratify the protocol as US law.

Future Federal Regulation of GHGs

Florida may soon consider forest *carbon offsets* to comply with a recent EPA ruling. On June 2nd of 2014, the EPA released a policy to reduce CO₂ emissions from the power sector by 30 percent nationwide below 2005 levels by 2030 (EPA Press Office 2014). This ruling followed the US Supreme Court's decision, *Massachusetts v. US*

Environmental Protection Agency (2007), which required the EPA to regulate GHGs as air pollution under existing federal laws (i.e., Clean Air Act). Key to this ruling is that each state is allowed the flexibility to use forest *carbon offsets* to meet their emissions goals. There is evidence suggesting that the use of forest *carbon offsets* may be implemented at a reasonable cost (Stavins 1999), and Stainback and Alavalapati (2002) have found that southern US private forest landowners might benefit from similar policies. Given the EPA ruling and the potential viability of forest *carbon offsets*, it could be of value to Florida policy makers to consider a forest *carbon offset* program to meet their 2030 carbon emissions goals.

Regional Cap and Trade Programs

While national-level efforts to regulate GHGs have failed, the recent EPA ruling to cut emissions by 2030 may present an opportunity to promote participation in regional CAT programs. Twenty-two states, not including Florida, are developing three major regional CAT programs: Western Climate Initiative (WCI), Regional Greenhouse Gas Initiative (RGGI), and the Midwestern Greenhouse Gas Accord (MGGA). However, the RGGI is the only active CAT program in the United States. It is currently facing the withdrawal of one of its 10 regional members – New Jersey (Fleisher and Sweet 2011). As of 2013, the WCI includes the US state of California as well as British Columbia, Manitoba, Ontario, and Quebec in Canada. Other US and Mexican states are encouraged to participate (See WCI Partner Climate Action Plans in Additional Resources Section).

Value of Carbon Offsets

Largely due to the economic downturn in 2008, *carbon offsets* have lost much of their value. The demand for RGGI carbon dioxide (CO₂) allowances has fallen dramatically, and in September 2013 they were sold at a clearing price of \$2.67 per ton (Brown, 2013). This CAT program in the Northeast regulates power plants and only allows for 3.3% of their allowances to come from CO₂ offsets. Forest projects are included in this system, but only within the 10 participating member states: Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and New Jersey. Still, prospects for *carbon offsets* are improving. In January 2013, California's Global Warming Solutions Act of 2006 (AB 32) came into effect. Its goals are to reduce California's GHG emissions to 1990 levels by the year 2020, similar to Kyoto Protocol goals (California AB 32 2013). The initiative aims to create an ambitious statewide CAT program on all

aggregate GHG emitters, and it plans to allow forest *carbon offsets*. The potential value of forest-based *carbon offsets* under this program is large. An estimated five million metric tons of CO₂ equivalents will be sequestered in California's forests by 2020 (California Legislative Analyst's Office 2013) and allowance markets are estimated to be worth \$7.7 billion (Peters-Stanley and Hamilton 2012). Importantly for Florida, the California program allows forest carbon projects anywhere in the United States except Alaska, Hawaii, and the US Territories to participate (AB 32 Protocols 2013). In November 2013, a forestry project in Maine was issued the first CARB offset credits. The Maine project is the first and only sale as of 2014 of registered forestry offsets for California's greenhouse gas cap and trade program (Finite Carbon 2013).

How to Participate and Requirements

Forest landowners currently have four major certification options to engage *carbon offset* markets: CARB, CAR, ACR, and VCS. These are voluntary, non-profit *carbon offset* certification programs that differ slightly in protocol requirements. The four programs allow *carbon offsets* to be generated by similar types of forest activities: afforestation/reforestation (AR), improved forest management (IFM), reducing emissions from deforestation and degradation (REDD), and urban forestry (under CAR and CARB). These programs issue independent third-party standards for carbon credits sold in domestic and foreign markets. In 2011, these certifiers led the development of 76% of all independent, third-party *carbon offset credits* transacted in voluntary markets (Peters-Stanley and Hamilton 2012).

Although no Florida forest projects have been registered under the ACR, VCS and CAR programs, there are six landfills certified to receive CO₂-equivalent credits for capturing methane under ACR, one "transport fleet efficient" truck stop that powers idle trucks with electricity to avoid using diesel under ACR (See ACR Projects in the Additional Resources Section), and one VCS project in Lee County, FL, receiving credits for incinerating municipal waste to generate electricity (See VCS Projects in the Additional Resources Section). The CAR currently has 4 registered landfill projects in Florida (See CAR Projects in the Additional Resources Section). In the US South, [Georgia](#), [Alabama](#), [Louisiana](#), [Mississippi](#), and [South Carolina](#) are currently participating in these programs with: 25 forest projects, 34 landfill sites, 4 "transport fleet efficient" truck stops, and three energy conversion projects. One of the most notable ACR forest projects is the GreenTrees Forest

Carbon Project. This project is privately managed and aims to “reforest one million acres in the Lower Mississippi Alluvial Valley, the nation’s largest watershed, covering approximately 25 million acres in Louisiana, Mississippi, Arkansas, Kentucky, Tennessee, Missouri and Illinois” (See the GreenTrees Forest Carbon Project in the Additional Resources Section).

Contract Duration and Type of Project

Carbon contracts through ACR, VCS, CAR, and CARB require long-term obligations that typically range from 40 to 100 years (i.e. ACR 40, VCS 20–100, CAR and CARB 100). Land ownership can be either private or public, and owners typically retain their original ownership status during their production period, except for CAR, which requires participants of REDD to reclassify their property as *conservation easements* or to transfer them to public ownership.

Carbon offset accounting standards provide quality control criteria, specific requirements for project eligibility, accounting protocols, and methods for quantifying and monitoring a project’s *carbon offsets* (Yonavjak et al. 2011). In addition to the ACR, VCS and CAR standards, other forest-carbon-accounting standards include CarbonFix, PlanVivo, and Gold Standard. Most programs allow for the use of the Clean Development Mechanism standards defined by the Kyoto Protocol to implement emission-reduction projects in developing countries, for the implementation of multiple activities, that is, a mix of AR, REDD, and IFM (Yonavjak et al. 2011). The registration processes and procedures based on carbon accounting standards vary within each project type, but all involve a project manager who submits a proposal to an offset certification program that screens applications and determines who is eligible to then be inspected by an independent third-party verifier who confirms the validity of the project. If approved, the project is registered and carbon credits are issued in accordance with project type and production capacity. The CARB platform used by the newly formed California CAT market only allows Avoidance Conversion, IFM, and Reforestation projects that have been registered and verified using the mechanism of ACR or CAR (Banberger, personal communication 2013).

Afforestation/Reforestation

Afforestation and Reforestation involve the restoration of forest-covered lands to “optimal stocking levels” (the optimal stocking level for a site is the number of trees per unit area that maximizes timber production) or other management objectives. There are time limits on when

the activity can occur, and reforestation permits typically exclude previously forested lands that were converted to another use within the last 10 years or areas substantially affected by natural disturbance events such as hurricanes or fire (ACR, VCS, CAR). Some programs have special additional requirements. ACR, for example, normally considers projects with start dates after 1997, and CAR does not allow lands previously registered as Forest Projects (unless the project was terminated due to unavoidable reversal, such as hurricanes or other natural disasters). The start date for AR projects is determined by the beginning of the planting season (ACR, VCS) or at the removal of growth obstacles (CAR). After the project is approved, it receives a *crediting period* (or “contract length”) of 40 to 100 years (40 ACR, 20–100 VCS, 100 CAR) and *carbon offsets* are acquired based on the project’s production characteristics. Only those projects that provide new, additional *carbon sequestration* are considered, and the production of *carbon offsets* is measured by comparing a “*baseline estimation*” of all GHG sinks (the starting *carbon sequestration* conditions of the forest project) with the subsequent sequestration rates implemented by the project. The programs offer slightly different ways to calculate baselines, but in essence, all take an inventory of current GHG *stocks and leakage* (sources that capture and release GHGs), which are then compared with the project’s improvements in sequestering or capturing carbon.

Improved Forest Management

Improved forest management (IFM) projects are generally locally approved forestry activities that increase *carbon sequestration* relative to a baseline “scenarios” and account for permissible timber harvests and their value (Yonavjak et al. 2011). Examples of these activities include: different logging practices, extending rotation periods, increasing forest productivity, thinning diseased or suppressed trees, managing competing brush and short-lived species, and managing for specific tree densities. IFM projects have a start date according to when the new management regime begins, and their crediting period ranges from 20–100 years (20 ACR, 20–100 VCS, 100 CAR). The VCS applies a 10-year exclusion to IFM projects (lands converted from forest within 10 years are excluded), and CAR requires lands that have not been previously registered as Forest Projects (unless project was terminated due to unavoidable reversal), and that have less than 10% tree canopy cover. The baseline estimates used to compare improvements of carbon stock require land managers to identify a credible alternative forest management scenario (ACR), or to provide 5–10 years of management records in order to show “normal historical practices” (VCS). The CAR requires additional assessments,

including a qualitative characterization of likely vegetation conditions and activities that would have occurred without the project (including laws, statutes, regulations or other legal mandates), and sample inventory plots that can be used to simulate forest stand growth over 100 years.

REDD (Avoided Conversion)

REDD is an approach to avoid planned, unplanned, and/or illegal deforestation of lands that are threatened by land-use change and urban development, industrial tree production, and/or changes in legislation. These REDD projects are credited for 10–100 years (10 ACR, 20–100 VCS, 100 CAR), and CAR does not allow projects to take place on previously registered Forest Projects unless the project was terminated due to unavoidable reversal. "Additionality," for all projects, requires that GHG reductions being used as offsets include only those that would have occurred in the presence of a project with market buyers willing to pay for them. For example, if a REDD project avoided deforestation in an area that was going to be developed into urban land uses, proof must be shown of investors' willingness to pay to develop this area. For REDD projects, additional *carbon sequestration* is measured by comparing existing carbon stocks with the expected stocks of the threatening activities (i.e., roads, buildings, timber harvest). The project's "baseline" is what would have happened on the land (e.g., urban development) absent the project. REDD projects can require additional assessments, and VCS demands a reassessment every 10 years, while CAR requires the same type of qualitative and forecasting methods as it does for IFM. CAR protocols differentiate between "project" and "regulatory" *additionality* (i.e., can be "additional" only if changes leading to increased *carbon sequestration* are not legally required). The starting dates for ACR and VCS are at the implementation of the project's actions, and CAR initiates after the recording of a *conservation easement*, or transfer to public ownership.

Urban Forestry

The CAR also provides opportunities for GHG-reduction urban forestry projects that involve planned tree planting and maintenance activities that permanently increase carbon stores and take into account GHG emissions associated with these planting and maintenance activities (CAR Urban Forest Project Protocol 2013). As of early 2014, this protocol is currently under revision, but in the existing protocol, urban forest GHG projects can be undertaken by municipalities, educational campuses, and utilities. The *tree site* is the unit of analysis (contains one tree at a time) and the tree occupying it can be replaced over the lifetime of the project. The 100-year projects can also report project

emissions reductions related to energy conservation and use of tree residue as a bioenergy feedstock as co-benefits. "Additionality" and "boundary" (sources containing and capturing GHGs) definitions (i.e. carbon stored in standing trees, carbon emissions from motor vehicles related to tree planting, care, and monitoring, etc.) as well as GHG-reduction calculation methods are also provided in the existing CAR urban forest project protocol. The CAR Urban Forest Project Protocol (2013) compliance offset protocols are based on those of the CAR (CARB Protocols, 2013).

Risk Management

Under all protocols, a project's boundaries (standard sources, sinks, and reservoirs) are defined within the property, but managers are responsible for "leakage", or unanticipated changes in GHG benefits outside of the project's bounds as a result of the project activities. That is, if the project causes emissions elsewhere, then managers are responsible for those leakages. A project might involve cattle grazing, for instance, or urban development, transportation, or tree farming, and in those cases, the activities would be considered leakage. This especially applies to REDD projects, which require regular monitoring of land that was originally meant for degradation or deforestation. Intentional or unintentional (i.e. natural disaster) leakages are handled by using a series of risk-management tools, such as: allowing participants to propose insurance products (ACR), carbon banking pools or "buffer pools" (ACR, VCS, CAR), and in some cases a buy-out option (ACR). Buffer pools are used by programs to spread the risk of leakage or "reversals" among all registered projects. They work like insurance premiums by allowing project managers to deposit a percentage of offsets into an account controlled and managed by the program. The pool of offsets is used to cover carbon losses from unexpected *reversals* (e.g., wildfires, hurricanes, etc.). The amount deposited and refunded varies with each program. ACR refunds 10% of offsets to producers every 5 years of *non-reversals*, for example, whereas VCS and CAR ask for a certain percentage of offset deposits depending on the project's risk level, which is considered lower in cases of easements or deed commitments. Each buffer or insurance is required for the entire duration of the commitment period.

Market Demand

There will be two CAT compliance markets operating in the United States in 2014, RGGI and California's CAT Program. Since Florida is not authorized to participate in RGGI, Florida's landowners attempting to sell their certified credits would have to make use of California's program or seek buyers from the voluntary carbon markets. California

only accepts CARB offset credits, which are issued after the programs have been registered with ACR and CAR. CARB reviews the verification reports from these two programs, and if the reports are acceptable, CARB issues CARB credits. These credits typically sell for one cent less than the California CAT Auction (Banberger, personal communication 2013). The May 2013 Auction reported an auction clearing price of \$14.00 per metric ton of *carbon dioxide equivalent* (MtCO₂e) (CARB Quarterly Auction 2013). The sale of carbon credits typically involves private contracts between an offset provider and a buyer (Charnley et al. 2010), and transactions occurring via a private exchange (e.g., Climex) or directly through a broker or online retail (Peters-Stanley and Hamilton 2012). Most transactions occur directly or are traded "over-the-counter" (Peters-Stanley and Hamilton 2012).

Since most voluntary carbon sales transactions occur via private brokers and individuals, prices and transacted volumes are often not publically available. However, a 2011 survey of 312 offset suppliers, seven exchanges, and all major registries (including ACR, VCS, and CAR) indicates that prices have a wide range (\$0.10 to \$100 per MtCO₂e) and a substantial price difference according to the standard used (Table 1). Higher prices for CAR projects are likely due to the pre-compliance approval of their protocols under the California CAT. Forest-based carbon projects were about 30% of total carbon market sales and also played a large role in the carbon credit production of ACR and VCS *carbon offsets*, but a relatively small share of CAR projects.

Summary

The future of carbon market demand in the United States will likely change with the recent EPA ruling aiming to reduce 30% of carbon emissions from the power sector by 2030. *Carbon offset* programs in the United States that are available to Florida forest landowners include the ACR, CAR, VCS, and CARB (via ACR and CAR), but each has key differences in program requirements that may attract or dissuade participation in certain or all programs (Yonavjak et al. 2011). For example, landowners interested in shorter time commitments might prefer a REDD or IFM under a VCS (20-year) or ACR (40-year) project over CAR or CARB, since these have 100-year time commitment requirements. Landowners with major concerns about property rights might avoid CAR, as well, because that program requires land to be transferred to an easement or to public property for the duration of some protocols (REDD). Owners with invasive species problems might avoid CAR because its requirements for the use of native species could mean additional costs to the landowner. Other landowners

concerned primarily with revenue and market stability might prefer the CARB (via CAR and ACR). This certification currently generates higher prices for *carbon offsets*, and given that California manages a mandatory CAT program, these credits are bolstered by compliance markets that are relatively more reliable and less volatile than voluntary markets.

It is also worth noting the tradeoffs inherent in each of the programs. For example, VCS is the more flexible platform in terms of time commitment. It can be traded in more countries and exchanges than ACR or CAR (Peters-Stanley and Hamilton 2012), but it yields the lowest prices. Landowners not interested in ACR, CAR, or VCS might want to consider over-the-counter transactions. These require finding a willing buyer and reaching an agreement on a protocol that meets the needs of the landowner and the *carbon offsets* buyer. Search costs and technical expertise requirements also present significant barriers for many buyers and sellers considering over-the-counter transactions. For other examples and a case study relevant to the southeastern United States on the feasibility of participating in these markets, see Yonavjak et al. (2011).

This publication examined the state of carbon markets and reviewed the major *carbon offset* certification programs operating in the United States. Carbon markets offer Florida landowners and interested parties the opportunity to take advantage of their forest resources to generate income, which provides incentive to prevent working forests from being converted to urban land uses, while also mitigating climate change. However, it is important to emphasize that the overview of these programs provided in this publication should not be used as a substitute for consultation with a consulting forester, professional verifier, and/or legal expert. Given that forest-based *carbon offset* projects are highly technical, have long-term commitment periods, and require constant verification, we strongly recommend consulting with the relevant experts to explore the financial and legal implications of entering into a contract to generate *carbon offsets*.

Glossary of Terms

The following is a list of frequently used terms from Soto et al. (2014).

Additionality – The requirement that new carbon offsets produce additional carbon sequestration that would not have happened without the carbon offset program.

Carbon dioxide equivalent— A standard unit of measurement for the global warming potential of greenhouse gases over a specified time period. Standardized to the effects of carbon dioxide, often symbolized as CO₂e.

Carbon offset – An increase in sequestered carbon (or reduction in greenhouse gas emissions) that offsets GHG emissions produced elsewhere.

Carbon sequestration – Process of trees, plants, and soils absorbing CO₂ and storing the carbon in biomass and organic matter. Sequestration is measured in terms of kg per year as opposed to stores or stocks (the amount of carbon stored in trees, plants and soils over their lifetime) that is measured in kilograms or tons.

Conservation easement – A legally binding agreement between a landowner and another party to restrict land use for an agreed period of time.

Contract commitments – In the context of carbon offsets, contract commitments are the length of time that the forest landowner is subject to the carbon offsets contract.

Cost-share agreements – Agreements, usually by state or federal entities, to help pay landowners' costs for projects that include developing and/or implementing changes in land management, building structures, and maintaining land in a certain condition.

Ecosystem services – Ecosystem processes from nature that directly and/or indirectly benefit humans and are typically undervalued by markets.

Greenhouse Gases – Atmospheric gases that trap heat, including CO₂, methane, nitrous oxide, and others.

Land rental payments – Direct payments to landowners for changing or maintaining environmentally friendly land management and/or production practices.

Reversals – Sequestered carbon that is emitted back to the atmosphere accidentally (e.g. wildfires, hurricanes, pest outbreaks, etc.) or intentionally (management practices, land use change).

Risk Pool – Similar to premiums paid for insurance, but with premiums paid in the form of a percentage of carbon offsets (e.g., 10%) paid to the pool.

Willingness to accept – In a carbon-offsets context, it is the minimum amount of money required to be paid to

landowners to leave them no worse off after signing the carbon-offsets contract than they would have been without the payment or the contract.

Additional Resources

Specific Programs and Registries:

- California Air Resources Board (CARB): <http://www.arb.ca.gov>
- Climate Action Reserve (CAR): <http://www.climateactionreserve.org/>
- American Carbon Registry (ACR): <http://americancarbonregistry.org/>
- Voluntary Carbon Standard (VCS): <http://www.v-c-s.org>

Other Links of Interest and Forest Project Developers:

- Ecosystem Market Place—Leveraging the Landscape: State of the voluntary carbon markets 2012: http://www.forest-trends.org/documents/files/doc_3242.pdf
- Green Trees Forest Carbon Project: <http://www.greentrees.com/>
- Point Carbon: <http://www.pointcarbon.com/>
- Finite Carbon: <http://www.finitecarbon.com>
- Blue Source: <http://www.ghgworks.com>
- Gold Standard: <http://www.cdmgoldstandard.org>
- Western Climate Initiative Climate Action Plan: <http://www.westernclimateinitiative.org/climate-action-plans>
- Barbara Banberger, staff member of the State of California ARB Cap-and-Trade Program. Contact information: Phone (916) 324-2303; e-mail bbamberg@arb.ca.gov

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Table 1. Contract duration and the 2011 *carbon offset* (over-the-counter) market shares by third party standard and associated transaction prices. CARB prices were not available in 2011. Adapted from Peters-Stanley and Hamilton (2012) and http://www.forest-trends.org/documents/files/doc_3242.pdf.

	Contract duration (years)	Market share	Forest share*	Price range (\$/MtCO ₂ e)	Average prices (\$/MtCO ₂ e)
Voluntary Carbon Standard	20–100	58%	28%	» 0.12–30.00	4.00
American Carbon Registry	40	6%	46%	» 0.10–10.00	6.00
Climate Action Reserve	100	12%	13%	» 0.35–15.35	7.00
California Air Resources Board	100	-	-	-	-
Others**		24%	39%	0.10–120.00	4.00–6.00***

*Forest market shares for independent and major co-benefits standards.
 **Includes Gold Standard, ISO-14064, Chicago Climate Exchange, Plan Vivo and others.
 *** Average for most international carbon accounting standards.