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Generating Value through Forest Carbon

An Introduction for Forest Owners in the U.S.



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Introduction

Individuals seeking facts about the forestry carbon marketplace in the United States can easily be overwhelmed by the amount of information available. Landowners hoping to evaluate the potential of their forested properties to generate carbon credits are often faced with confusing and contradictory details, making it nearly impossible to assess income potential or assign appropriate risk. The objective of this guide is to provide answers to the most frequently asked questions about forestry carbon and help direct further investigation.

Forests, Climate, and Carbon Markets

Forests have the capacity to both store and emit carbon. Through the process of photosynthesis, trees absorb carbon dioxide from the atmosphere and store carbon in their stems, roots, branches, and leaves. Wood products that are harvested from forests also provide long-term storage of carbon. When managed in an unsustainable manner, or when existing forests are cleared and converted to non-forest land use (e.g. urban development, agriculture), carbon stocks in forests can suffer long-term declines and forests may become net emitters of carbon dioxide to the atmosphere.

Through sustainable management of existing forests, reducing rates of deforestation and establishing new forests, forest ecosystems have the capacity to absorb additional carbon dioxide from the atmosphere and help mitigate the potential impacts of climate change. Carbon markets can assign value to this forest benefit, which may provide a financial incentive for forest landowners to implement management practices that reduce emissions or sequester additional atmospheric carbon.

What is a Carbon Offset?

Generally, a carbon offset—also known as a carbon credit, offset credit, or an emissions reduction—represents a voluntary (i.e. not required by law) reduction in greenhouse gas

(GHG) emissions, or an increase in carbon sequestration, that is achieved to compensate for GHG emissions produced elsewhere. Offsets are typically measured in metric tons of carbon dioxide equivalent (mtCO₂e). A variety of industrial and land-use activities have the capacity to offset GHG emissions by avoiding, reducing, or sequestering carbon that would otherwise have been released to the atmosphere. In this guide, we focus on the opportunities for forests to generate offsets and participate in current carbon markets.

The U.S. Carbon Market

Compliance Markets

Compliance markets are driven by governmental regulation of GHG emissions. Specified sectors of the economy are required to reduce and/or offset emissions using market-based mechanisms. The United States has two notable examples of compliance markets. The first is the Regional Greenhouse Gas Initiative (RGGI). RGGI is comprised of 10 northeastern states that have agreed to reduce CO₂ emissions from electricity generation by 10% by 2018. Under RGGI rules, eligible forestry activities are limited to reforestation projects. California is creating the second-largest compliance carbon market in the world in accordance with Assembly Bill 32, The Global Warming Solutions Act. This law requires the state to reduce GHG emissions to 1990 levels by 2020, a 30% decrease from current levels. California's compliance program is set to begin in 2013. Unlike RGGI, forestry is positioned to play an important role in California's emissions trading program.

Voluntary Markets

Voluntary markets allow participants to buy and sell credits for non-compliance reasons. There are two general types of buyers in the voluntary offsets market. The first is the purely *voluntary buyer*. A voluntary buyer could be a business, a university, a household, or an individual seeking to directly mitigate his or her own GHG emissions through purchase of offsets. Other common motivations for these buyers include corporate citizenship, environmental branding, carbon footprint reduction, and philanthropy.

Pre-compliance buyers purchase offsets in hopes that they will be eligible for use in a future U.S. or regional cap-and-trade system. For these investors, the likelihood of acceptance of an offset credit in a future compliance market is a key investment driver. Pre-compliance buyers include emissions-dependent industries that are likely to be included in an emissions cap. Investment firms and asset management organizations are also an important component of pre-compliance demand.

For both pre-compliance and voluntary buyers, forestry offsets continue to play a modest but important role because of the many co-benefits that planting, managing, or protecting forests provide in addition to the carbon/climate benefit.

Compliance versus Voluntary Credits

In compliance markets, a regulator-approved set of standards governs the use of carbon offsets that provides a level of uniformity to these markets. The voluntary U.S. offset market, by comparison, is incredibly diverse in its treatment of eligibility requirements, offset quality and value.

While the U.S. offsets market has resulted in innovation and opportunity, its diverse nature has also generated a significant level of uncertainty. Without federal regulation, it is left to buyers and sellers to determine what constitutes a “quality” carbon offset. The definition of a carbon asset may vary considerably, depending upon the motivations of the parties involved. A buyer motivated by philanthropy may have very different expectations than a buyer who purchases an offset in anticipation of a federal cap-and-trade program. To increase transparency and buyer confidence in offset integrity, various organizations have developed carbon offset standards, to which buyers can assign value according to the standard used.

Due to the voluntary, largely unregulated nature of the U.S. offsets market, forest owners and farmers should recognize that this market is not monolithic. Carbon credits are not a uniform asset and valuation is highly dependent upon the underlying standard to which the offset conforms. It is likely that some forest-based offsets generated today will have little value in the future. This reality carries significant implications for a forest project that may be expected to produce a steady stream of credits for many years into the future.

Carbon Market Participants

Several entities play a role in delivering offsets to the market. Project developers oversee the planning, development and implementation of a particular offset activity. For private forest landowners, project developers may also provide start-up capital to cover costs associated with establishing a forest offset project. The responsibilities of the project developer often overlap with other roles. For example, project developers may also function as offset aggregators that buy and package bundles of offsets for marketing purposes and to achieve economies of scale. Verifiers function as third-party auditors who work to ensure that a project is eligible to generate offsets, and that those offsets are appropriately calculated. Brokers and exchange platforms provide liquidity to the market by bringing buyers and sellers together.

Voluntary Carbon Offset Registries

Unlike traditional commodities, carbon offset buyers cannot take delivery of a physical good. In essence, what is purchased is a promise that a particular offset activity has generated a valid carbon credit, and that this valid carbon credit is sold only once, to a single buyer. In order to make these transactions more transparent and legitimate, and to avoid double selling of credits, buyers and sellers often utilize an independent *offset registry* to document transactions and ownership of offsets.

In order to be transacted on a registry, each credit must meet a particular set of standards as determined by the registry administrators. Ideally, all credits in a registry should be of equivalent emissions value, giving buyers confidence in the product. Once registered, a serial number is issued for each credit that uniquely identifies it and may provide additional information on vintage, project type, geographic location, etc. Carbon offsets may be bought and sold many times. However, they may be used only once to offset an equivalent unit of GHG emissions. When this occurs, the credit is considered to be “retired” and can no longer be transacted. Registries document these retired offsets in order to prevent the same credit from being used more than once. Although a handful of carbon offset credit registries have emerged in the United States, buyers and sellers are under no obligation to use these platforms and transactions do occur outside of these accounting frameworks.

Carbon Offsets in Forestry

Role of Forestry Offsets in the U.S. Carbon Market

In 2010, forestry offset transactions captured a 45% share of the global voluntary carbon market, nearly double the number of transactions in 2009. Historically, demand for forestry offsets has outpaced available supply, but new policies and programs have expanded the opportunities for forestry. High-quality forestry offsets often generate higher prices than other offset types because of the multiple co-benefits that healthy forests provide (e.g., clean water, wildlife habitat, aesthetic values, stronger rural economies) in addition to carbon benefits.

General Types of Forestry Offset Projects

Forest offset projects can be generally classified into three types: **reforestation, improved forest management, and avoided conversion**. Specific definitions and eligibility requirements vary with the offset standard being used.

Reforestation projects involve the establishment of forests on lands that are currently in a non-forest use. Examples of reforestation-type activities include the planting of tree

seedlings, direct seeding, and removing existing barriers to natural regeneration. In 2010, 6% of credits transacted in the voluntary market originated from reforestation projects.

Improved forest management projects encompass deliberate, voluntary changes in forest management activities that result in long-term carbon storage increases on established forest sites. Examples of forest management practices that may achieve this include longer rotations, timber stand improvement, changes in harvesting practices, or managing for long-lived tree species. In 2010, 5% of credits transacted in the voluntary market originated from the improved forest management (IFM) projects.

Avoided conversion projects include the protection of forestland from conversion to non-forest uses (e.g. agriculture, grazing, urban development) through the application of conversation easements or other legal instruments. In 2010, 29% of all voluntary offsets transacted were from avoided conversion projects. Most of these projects are located outside of the United States.

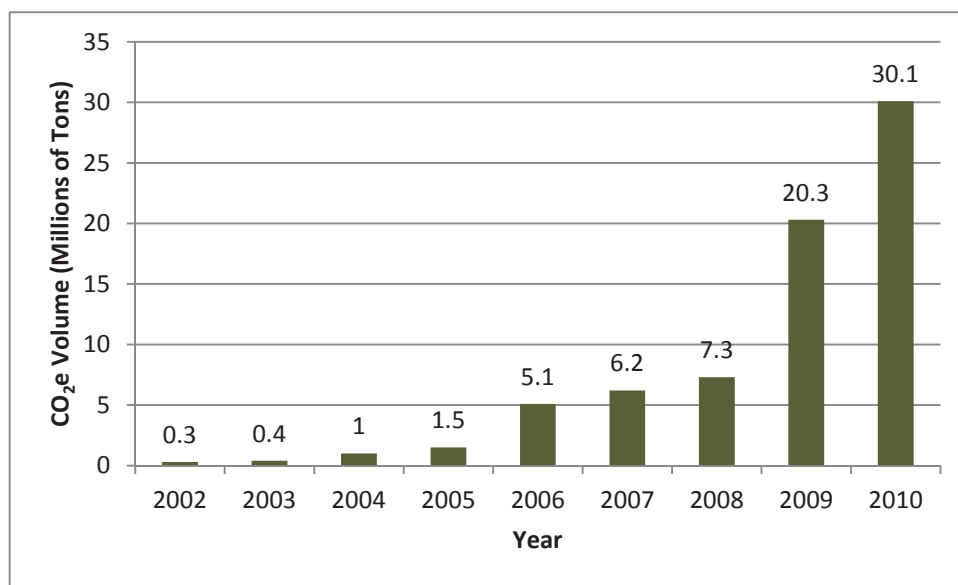


Figure 1. Global Forest carbon offset volumes transacted annually from 2002-2010. Adapted from data published by Ecosystem Marketplace, 2011.

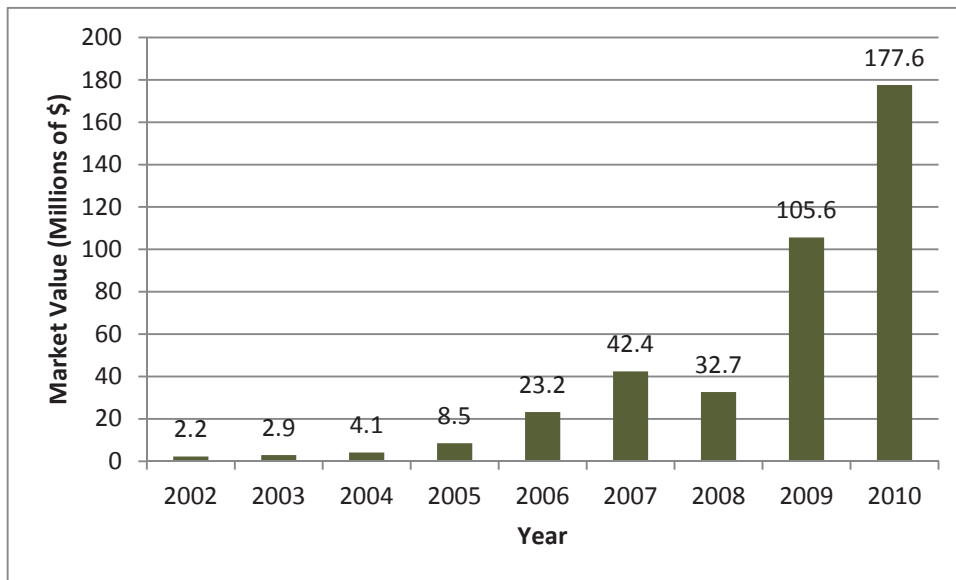


Figure 2. Global value of the forestry carbon market from 2002-2010.
Adapted from data published by Ecosystem Marketplace, 2011.

What Qualifies a Forestry Activity as an Offset Project?

Not all activities that sequester carbon or reduce emissions are eligible to produce offset credits. Although specific requirements may vary among different carbon offset standards and programs, there is general consensus among market participants and regulators that an emissions reduction must be *real, permanent, additional, verifiable, and owned unambiguously*.

- **Real:** Emissions reductions cannot be the result of incomplete or inaccurate accounting. Carbon offset projects should also take into account any unintended consequences that may result from emissions reduction activities, referred to as “leakage.”
- **Additional:** Emissions reductions must be above and beyond those that would have been achieved in the absence of a carbon credit market. “Business as Usual” emissions reductions—i.e. reductions that would have occurred without the financial incentives of a carbon market—are typically not eligible. Activities cannot be required by law. For forestry offset projects, additionality implies a change in forest management or land use activities that will increase or maintain sequestered carbon above a “business as usual” baseline. Once the forest project is initiated, actual carbon sequestration is compared to that expected in the baseline. Carbon sequestered above the baseline is considered credible as an offset.
- **Permanent:** Since GHG emissions are likely to remain in the atmosphere for many decades, carbon offsets must have a similar level of permanence. For forest projects, permanence is ensured by requiring long-term project monitoring (5-100 years) and contributing a percentage of offset credits to a buffer account that insures

against carbon stock reversals. The percentage of credits issued to the buffer account is dependent upon the project's risk level.

- **Verifiable:** Emissions reduction activities must be verified by a third party before being used to offset GHG emissions. Verification requirements vary across standards.
- **Owned Unambiguously:** Offset ownership must be clearly defined. No other parties should be able to reasonably claim ownership of the offsets. Fee simple ownership of the forested property is often preferred.

Steps for Developing an Offset Project

The process of developing and implementing a forest offset project is a complex process that may take a year or more to complete. In this section, we provide a general step-by-step explanation of the project process.

1. **Conduct a feasibility study.** Forest management records, inventory data, ownership details, landowner management objectives and other forest resource data are used to examine the potential of a particular forest to generate carbon credits under current and anticipated future market conditions. Forested properties may be evaluated using multiple standards and/or methodologies in order to determine which program would most likely maximize financial returns. In some cases, the feasibility study may determine that the forest property in question is not suitable as an offset project.
2. **Conduct a forest inventory.** Carbon accounting in a forestry project begins with current inventory data that meets specified measurement standards. Landowners with current inventories may or may not need additional data collection.
3. **Create or modify the forest management plan.** A long-term management plan is developed that incorporates carbon management as a primary objective. Many offset standards require that forest projects demonstrate a commitment to sustainable management by enrolling in a third-party forest certification system, such as the Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), or Tree Farm.
4. **Write the project design document.** The project design document (PDD) provides a comprehensive description of the plan. It details how the forest project will go about reducing or sequestering additional carbon, and provides reasons why the proposed activities should be eligible to generate carbon offsets. The PDD includes a plan for monitoring, verification, and quality assurance of carbon accounting over the life of the project, which may span several decades.
5. **Risk Assessment (part of PDD).** Carbon stocks sequestered in forests always carry some risk of reversal as a result of fire, weather events, or other catastrophic disturbance. Factors including forest species, management regime, harvesting/thinning schedules, geography, and site history impact the likelihood of

reversals. Standardized procedures are used to quantify project risk, which is expressed as a percentage. The lower the percentage, the less risk associated with a project. This percentage is used to calculate how many credits must be held in reserve to cover potential carbon losses, and is ultimately assigned by the project verifier.

- 6. Initial verification.** The proposed project is audited to ensure that it conforms to offset program standards. This may include a desk audit of required documentation, a site visit, and interviews with project participants and stakeholders.
- 7. Verify offsets.** Emissions reductions achieved by the project must be measured and verified by a third party prior to carbon credit issuance. Some forest projects may generate carbon offsets every year; others may only verify and register emissions reductions every 5 or 10 years. Based upon the risk assessment of the project, a certain percentage of issue credits will be withheld to cover potential carbon reversals.
- 8. Annual project monitoring.** Regardless of whether offsets are issued in a given year, the project owner will be required to provide regular updates on the status of the forest offset project. Annual desk audits of project documentation are usually required. On-site verifications are required every 5-6 years for the life of the project.

The project development process is highly variable and is dependent upon the project standard, type of project, stand history, forest data needs, and a host of other factors. Generally, 6 to 12 months are required from contract to the issuance of tons. Figure 1 outlines the general procedure for developing and managing a forest offset project.

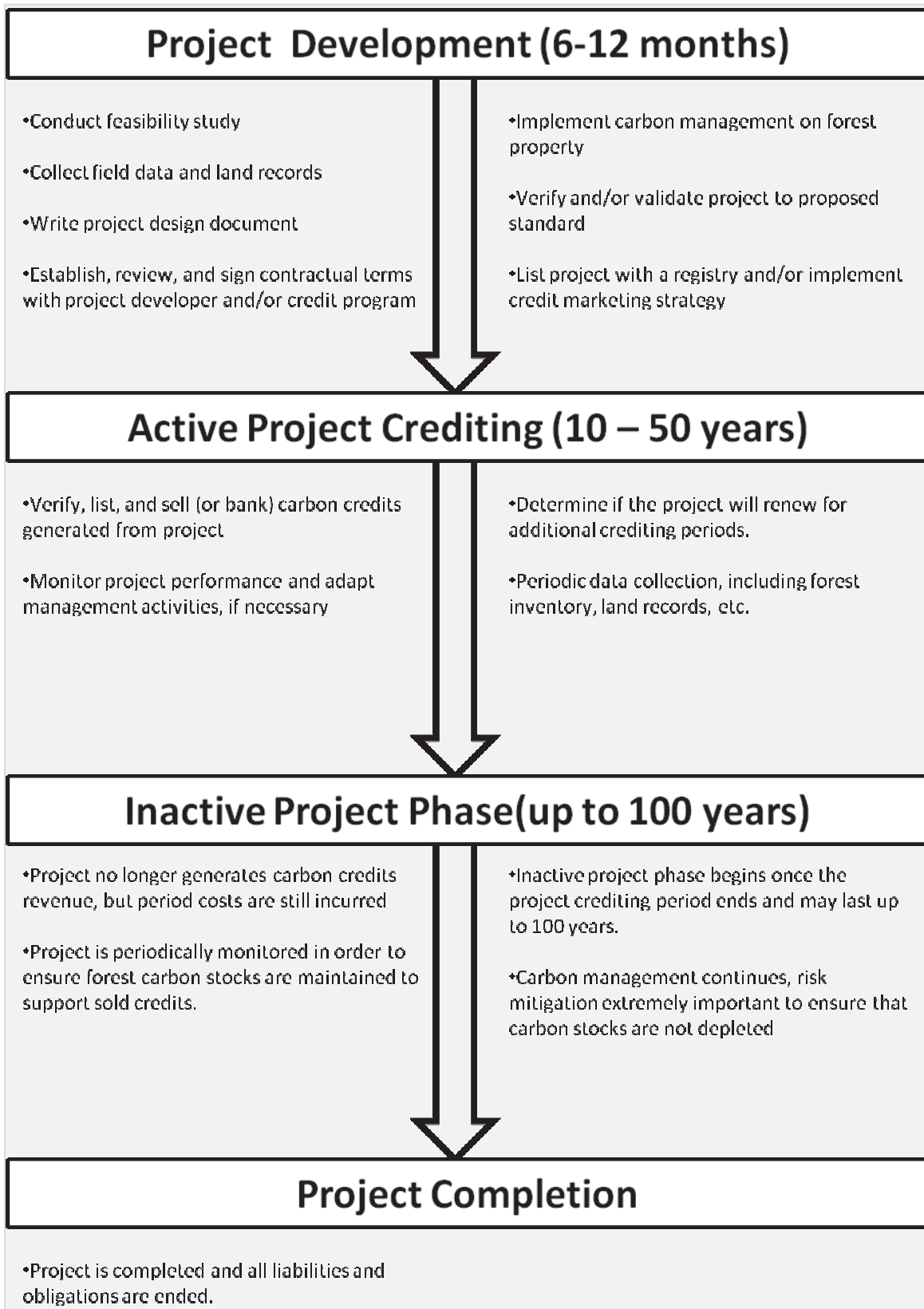


Figure 3. General procedure for the development and management of a forest offset project

Forest Offset Standards

Parties seeking to develop or purchase offset projects have a number of different standards to evaluate. These standards provide methodologies for calculating, monitoring, and certifying offset credits. Often, each standard provides a unique approach for a particular project type. Furthermore, some project types are not recognized across all leading standards. The leading standards organizations in the U.S. are the Climate Action Reserve (CAR), the American Carbon Registry (ACR), and the Verified Carbon Standard (VCS). Each of these standards offers a unique approach to forest-based offset projects.

Climate Action Reserve

The Climate Action Reserve (CAR or “the Reserve”) is a national pre-compliance/voluntary offsets program that sets standards and protocols for the development, quantification, and verification of carbon offset projects and operates a web-based carbon offset registry. CAR has established protocols for eight types of projects, including one protocol for traditional forestry and another specifically for urban forests. All relevant documentation is publically available online at www.climateactionreserve.org.

Forest projects developed to CAR standards are confirmed for eligibility¹ in California’s forthcoming regulatory cap-and-trade program, which is slated to commence in 2013² and will be the second largest compliance market for carbon credits in the world, behind the European emissions trading program. As a pre-compliance standard, CAR has emerged as the dominant forestry offset program in the United States.

As of September, 2011, 70 forest offset projects were listed on the Climate Action Reserve Registry. “Listed” projects are defined as projects that have signed contractual agreements to implement the project and that have submitted preliminary documentation to the Registry. Five of these projects are “registered,” which means that they have verified and registered offset credits with the CAR registry.

¹ Current CAR projects must have two additional verifications in order to be eligible for California’s regulatory market: (1) to have any registered CAR credits grandfathered in, and (2) to convert the entire project from a pre-compliance project to a compliance project that is approved by the regulatory authority, i.e., the CA Air Resources Board (ARB). These verifications will increase costs associated with a forestry project.

² Originally slated to begin in 2012. For more information on the delay, refer to: http://www.ecosystemmarketplace.com/pages/dynamic/article.page.php?page_id=8405§ion=news_articles&eod=1

CAR Project Types

The CAR Forest Project Protocol version 3.2 defines three eligible project types: reforestation, improved forest management, and avoided conversion. CAR's project registry accepts only projects that are verified to the Forest Project Protocol. Other offset development standards/methodologies are not eligible. Previous protocol versions include different project types; these projects are not considered in this document.

Reforestation projects involve establishing trees on lands that are non-stocked (less than 10% tree cover) or that have experienced catastrophic disturbance. Landowners are required to demonstrate that reforestation activity would be unlikely to happen without potential revenue from carbon credits. Public and private lands are eligible. Projects that are commercially viable in the short term (30 years) without carbon revenues are not eligible. Reforestation activities that follow harvest activities are not eligible.

Improved forest management projects are implemented on established forestlands and involve the implementation of management activities that will increase carbon stocks above an established baseline level. Public and private forestlands are eligible. Harvesting, thinning, and other silvicultural actions are permitted, provided that average carbon stocks are increased or maintained over the life of the project.

Avoided conversion projects prevent forests from being converted to non-forests via conservation easements. The forest owner must demonstrate that there is a significant threat of conversion. Instances in which timber production is the highest and best use would not be eligible. Offset credits are awarded based upon the amount of carbon emissions avoided by preventing the forest conversion and are issued over a 10-year period.

All forest projects must adhere to the following management requirements:

- No broadcast fertilization is allowed within project area.
- Forest certification under Tree Farm, Sustainable Forestry Initiative(SFI), or Forest Stewardship Council (FSC)
- Over the life of the project, landowners must maintain or make progress towards keeping no more than 40% of their forested acres younger than 20 years. For even-age stands, this equates to a 50-year rotation length.
- Projects that apply even-age management must limit clear-cut harvests to 40 acres in size. Adjacent stands cannot be harvested until the regenerated harvest site is five years old.
- Forest owners must maintain native species diversity.

Minimum Time Commitment

The forest landowner must commit to a minimum project term of 100 years following the issuance of any offset credits. This means that if credits are generated 20 years from today, the forest owner is responsible for maintaining the project until year 120.

Reversal Risk Mitigation

CAR requires all projects to deposit a percentage of earned offsets in a buffer account in order to cover reversal risk. Risk is evaluated using a standardized risk assessment tool.

Minimum Project Size

CAR does not designate a minimum forest project size.

CAR Offset Credit Values

In 2010, CAR credit values ranged from \$2 to \$20 per credit. Average value in 2010 was approximately \$7 per credit. Current values for CAR forestry credits are estimated at \$6.50 - \$7.50 per credit.

CAR Forest Project Example: Alligator River Avoided Conversion Project

The Alligator River Avoided Conversion Project is a 2,372-acre pine and mixed bottomland hardwood forest located in North Carolina. The entire property was placed under a permanent warranty easement deed through the Wetlands Reserve Program (WRP). Before the property was placed in the WRP program, the forest was slated to be converted to agricultural land. By placing the property under an easement that precludes development, this project has avoided carbon emissions associated with the planned clearing of the forest. This project does not include any harvesting activities.

In 2010, this project generated a total 80,847 verified carbon credits (34 credits per acre), which are currently registered with the Climate Action Reserve. The results of the risk analysis conducted for this project specified that 20.9% of the issued credits must be contributed to the buffer pool. Therefore, 16,898 credits were transferred to the buffer pool as insurance against carbon stock reversals. Over time, these withheld credits may be released back to the project. After accounting for withholdings, the project yielded 27 marketable credits per acre for the 2010 reporting year.

If the project continues to advance as planned, it will generate credits through 2019 (10 years). After this crediting period, the project owner will be responsible for monitoring the project through 2119 (100 years).

American Carbon Registry

The American Carbon Registry (ACR) is a non-profit voluntary offset program established by Winrock International³. The ACR's forest project standards are somewhat less restrictive than the Climate Action Reserve. ACR program remains a work-in-progress, but hopes are high that this program will expand forest carbon opportunities for private forest owners in the future. All documentation is available on ACR's website⁴.

Eligible Project Types

The ACR has developed a general standard that all projects must meet, but allows market interests to develop and propose methodologies for new project types. The ACR is responsible for determining whether proposed methodologies adhere to offset program's standard; approved methodologies are then available for use by all interested parties.

Currently, ACR has approved the following forest project methodologies:

- *Methodology for Afforestation and Reforestation of Degraded Land*
- *Methodology for Quantifying GHG removals and Emission Reductions through Increased Forest Carbon Sequestration on U.S. Timberlands*
- *ACR Methodology for REDD—Avoiding Planned Deforestation*
- *100-year Improved Forest Management Methodology for Quantifying GHG Removals and Emission Reductions through Increased Forest Carbon Sequestration on U.S. Timberlands*

Management Restrictions

ACR does not require prescriptive management. Forest certification is required under Tree Farm, Sustainable Forestry Initiative (SFI), and Forest Stewardship Council (FSC).

Minimum Time Commitment

Forest owners must commit to project management for 40 years.

³ www.winrock.org

⁴ www.americancarbonregistry.org

Reversal Risk Mitigation

Forest landowners have two options for mitigating reversal risk. Projects may contribute credits to a buffer account in accordance with assessed risk, or they may purchase insurance that guarantees the replacement of credits if a reversal were to occur. Projects with purchased insurance will not be required to withhold a portion of earned offsets.

Minimum Project Size

The Afforestation/reforestation of degraded land methodology does not include a minimum project size requirement. The improved forest management for industrial U.S. timberlands has a minimum project size of 1000 acres.

ACR Offset Credit Values

In 2010, ACR credit values ranged from \$1 to \$11 per credit; volume weighted average price was approximately \$1 per credit.

ACR Forest Project Example: GreenTrees Reforestation Project⁵

The GreenTrees reforestation project has planted bottomland hardwood species on 12 tracts of privately-owned former agricultural land in the Mississippi River Valley. The 1,806-acre project is located in Arkansas and Mississippi. Tree planting activities occurred in 2008 and 2009. A total of 1,119 carbon credits were issued to this project in 2009 (0.6 credits per acre).

Verified Carbon Standard

The Verified Carbon Standard (VCS) is an international organization that sets standards for offset projects and operates a registry. Similar to ACR, VCS has established methodologies for a variety of forest offset project types, but the primary focus is on international forest conservation projects. In 2010, across all offset projects, VCS was the leading third party standard used in the voluntary market, with 34% of transacted volumes. As of June 2011, no U.S. forestry offset projects have been listed on the VCS project database.

⁵ More project information is available at: <http://www.americancarbonregistry.org/carbon-registry/projects/greentrees-forest-carbon-project>

Eligible Project Types

The VCS program specifically identifies eligible forestry activities, which are grouped into three broad categories:

- *Afforestation, Reforestation, and Revegetation (ARR)*: This category includes all activities that involve the conversion of non-forested lands to forest use. Timber harvesting is permitted.
- *Improved Forest Management (IFM)*: This category includes activities that increase carbon sequestration or reduce carbon emission in forests managed for wood products. VCS outlines four eligible IFM activities:
- *Reducing Emissions from Deforestation and Degradation (REDD)*: This category includes activities that avoid conversion of forests to non-forest uses and/or reverse forest degradation caused by unsustainable management.

Seven methodologies have been approved for forest project development. Refer to www.v-c-s.org for a complete listing of approved methodologies.

Management Restrictions

VCS does not require prescriptive management. Forest certification is required under some methodologies.

Time Commitment

Forest owners must commit to project management for 30 years.

Minimum Project Size

No general minimum size for forest projects is specified.

VCS Offset Credit Values

In 2010, VCS credit values ranged from \$1 to \$25 per credit; volume weighted average price was \$4 per credit.

Table 1. A comparison of some requirements for forest carbon projects as specified by three carbon credit programs: The Climate Action Reserve, the American Carbon Registry, and the Verified Carbon Standard.

	Climate Action Reserve (CAR)	American Carbon Registry (ACR)	Verified Carbon Standard (VCS)
Minimum Time Commitment	100 years	40 years	30 years
Cancellation Penalties	Yes, 1.4 times issued credits	No	No
Baseline Establishment Method	Common Practice	Max Net Present Value	Variable
Forest Certification	Yes	Yes	Variable
Grade	Compliance	Voluntary	Voluntary
Management Restrictions	Yes	No	No
Buffer Account?	Yes	Yes	Yes
Insurance Option?	No	Yes	No
2010 Average Values (\$/credit)	\$7	\$1	\$4
Earliest Project Start Date	6 months prior to registration	Nov. 1 1997	Jan. 1 2002 (may be earlier until Oct. 2011)
# of U.S. Forestry Projects Listed (as of June 2011)	70	1	0

Chicago Climate Exchange

The Chicago Climate Exchange⁶ (CCX) was North America's first voluntary, legally binding GHG emissions trading platform. CCX was the first program to develop an effective aggregation scheme and became the first large-scale carbon market opportunity for forest landowners in the United States. CCX protocols for forest offset projects had high scalability, low cost, and a low commitment threshold, which allowed large numbers of landowners to generate and sell carbon credits. At its peak in May,

⁶<http://www.chicagoclimatex.com>

2008, offset credits reached a high of \$7.50 per tonne. Unfortunately, this market opportunity was short lived. By the time the CCX ceased carbon trading in December, 2010, average carbon credit prices had fallen to 10 cents per tonne.

Conclusions

Where is the “low hanging fruit” in the forestry carbon marketplace? What types of forested properties are best suited to take advantage of this emerging revenue opportunity? Who is in the weakest position to participate? As we have seen in our examination of current forest carbon programs, not all forests are eligible to participate. Table 2 provides an overview of some of the major questions that landowners should ask when considering forest offset projects. Long-term obligations and liabilities, high up-front costs, and significant opportunity costs will lead many forest owners to dismiss forestry carbon outright. Others will adopt a wait-and-see approach, in hopes of greater regulatory certainty and higher revenue potential in the future.

Table 2. Important considerations for landowners looking to develop forest carbon projects.

Forest Management Objectives	<ul style="list-style-type: none"> • Is carbon management compatible with my forest management goals and objectives? • How much additional carbon can my forest realistically sequester and maintain? • What are the implications of making carbon management my primary management objective? • Am I willing to commit to a forest management plan that may span several decades? • Will I be able to take advantage of future markets for traditional forest projects and new markets for forest outputs, or will carbon limit these opportunities? • Will I have to manage for different tree species? Will I need to make dramatic changes to my forest management (e.g., changing from even-aged management to uneven- or all-aged management)?
Start-up and Other Costs	<ul style="list-style-type: none"> • What are the per-acre costs for developing the project? • Is the project large enough to achieve adequate economies of scale given fixed costs and projected revenues? • Will I be required to pay these costs out-of-pocket, or will the project developer cover the up-front cost; i.e., whose money is at risk if the project doesn't perform? • What is the timing of ongoing and/or periodic costs?
Financial Returns	<ul style="list-style-type: none"> • What are current and projected carbon credit values? • What is the timing and scale of carbon revenues? • How long is the project projected to generate credits? • Have I properly accounted for risk in my assessment of this revenue opportunity? • How will carbon impact my other revenue streams—what are the opportunity costs?
Time Commitment	<ul style="list-style-type: none"> • How long will my forest project realistically generate carbon credits? • How long will I be obligated to maintain additional forest carbon stocks, after my forest is no longer actively generating offsets? • Are projected carbon returns commensurate with the time commitment, long-term management obligations, and opportunity costs? • How will this obligation impact the heirs to my forest project property? • What are the penalties associated with cancelling the project? Am I planning to sell this property? Do I want my heirs to have the opportunity to sell the property without penalty?

Risks	<ul style="list-style-type: none"> • How will I reduce the risks of fire, pests, disease, and weather events that may negatively impact carbon stocks through management? • What types of insurance instruments are available to cover my carbon offset obligations in case of a catastrophic carbon reversal? • How will the credits be marketed and sold? Will project carbon be sold in compliance or voluntary markets? • What is the track record for the project standard/protocol to be used? How many projects from my region have been successfully developed and marketed using this standard/protocol? • How long has the project developer been in the business? What is their track record? Will they still be in business in 5, 10 or 20 years? If not, will there be additional costs to manage and market the project? • Will future federal/state regulations support the standard my project is developed to? • How easy will it be to adapt or modify my project to fit into a new standard?
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Insufficient economies of scale are arguably the biggest barrier for private forest owners to overcome. Many of the up-front and ongoing costs associated with a forest offset project are relatively fixed, meaning that per-acre costs are significantly higher for owners of smaller properties. Typically, a forest offset project must be at least 1000 acres in size in order to be commercially viable, although other factors may increase or decrease the required size for a particular forest. This barrier may be overcome by aggregating several landowners in order to bring down per-acre fixed costs. However, landowners should recognize that any cooperative arrangement with other forest owners will require each participant to give up some forest management decision-making authority to a project developer in order to ensure that adequate carbon stocking is maintained.

Still, the forestry carbon market may provide some landowners with an opportunity to fulfill their long-term forest management goals for their properties. Carbon revenues may serve as the economic incentive needed to restore degraded lands, protect threatened forests, and modify harvest regimes and other activities that may sequester additional forest carbon. Specifically, the types of properties best-positioned to enter the forest carbon market are:

- Properties held under public or private easements, including working forest easements and land use protection easements.
- Properties enrolled in the Wetlands Reserve Program, as long as the property owner retains all carbon rights in the easement.
- Conservatively-managed forests that have long-term management horizons.
- Forested properties that are larger than 1000 acres.
- Properties that provide habitat for threatened species or have unique ecological/geological/hydrological features.
- Properties facing high risk of conversion to non-forest use due to urban development pressure.

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