A Landowner's Guide to Forest Carbon Offsets, Credits, and Incentives

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Why we created this guide

In addition to providing clean air and water, habitat for innumerable fish and wildlife, a natural resource base for rural community and economic development, as well as places we like to visit or call home, the unique ability of our forests and woodlands to sequester carbon is increasingly being recognized – and valued – to reduce the growing effects of climate change.

Ecotrust created this guide to offer a quick introduction to the rapidly-evolving world of forest carbon markets and incentive programs in the United States. Like many forest owners, we share the ethic of responsible stewardship and conserving the legacy of the land for the benefit of generations to come. New programs designed to reward forest carbon sequestration are becoming increasingly useful options for helping landowners to achieve that vision.

We've organized this guide to answer several fundamental questions:

- What are carbon markets? How are forests involved?
- What basic principles guide forest carbon crediting?
- What types of forest management practices can be used to sequester more carbon?
- What are the major forest carbon rules, standards, or regulations, and what important eligibility requirements or other criteria are there?
- What are the major financial and other practical considerations involved?
- What steps are involved in creating or joining a forest carbon project?
- What other resources are available for forest carbon planning or project support?

What are carbon markets?

A carbon market is an economic system created to enable transactions that place monetary costs on activities that increase greenhouse gas (GHG) pollution and reward the added value of activities that reduce or sequester those emissions.

The economic *demand* in carbon markets comes from companies and individuals who produce carbon emissions and either have a regulatory obligation or voluntary commitment to reducing that impact.

There are two main types of carbon markets, defined primarily by where *demand* comes from:

- In ***regulatory*** markets (also known as *compliance* markets), GHG pollution is controlled through government regulations, such as a cap-and-trade program or a carbon tax. To comply with regulatory obligations, polluters pay a tax or purchase permits to emit GHGs. These programs may allow polluters to substitute carbon offsets acquired through a market to cover some of their obligations.
- In ***voluntary*** markets, companies or individuals seek carbon credits for purely voluntary reasons, not for regulatory compliance. *Voluntary* carbon purchases are often used to demonstrate "corporate social responsibility," to market "green" or "carbon-neutral" products and programs, or to offset an individual's or event's carbon footprint, such as an airplane trip. These transactions often, but don't necessarily, involve the use of credits to directly *offset* the buyer's emissions.

How are forests involved?

In the United States, forests are typically eligible to produce carbon credits from three different types of projects:

- *Afforestation/reforestation* projects involve planting trees in areas that were previously not forested or not recovering following a major natural disturbance. Despite the fact that tree planting is very common, high costs make this the rarest type of carbon project.
- *Avoided Deforestation* or *Avoided Conversion* projects in the USA involve permanent conservation of forestland demonstrated to be under imminent threat of development or loss of forest cover.
- *Improved Forest Management (IFM)* projects involve management and/or conservation of existing forestlands to sequester more carbon than would occur under 'business-as-usual' forestry practices.

As the most common type of forest carbon project in the USA, this guide focuses primarily on the relevant issues and opportunities for landowners regarding *Improved Forest Management* (IFM) projects.

Forests managed to sequester more carbon than would be stored using 'business-as-usual' forestry practices can be certified to generate carbon credits. Certification is generally conducted by a third-party auditor who applies eligibility and accounting rules from an independent carbon standard with detailed forest project protocols. Once certified, a forest carbon project may be issued carbon credits that can then be transacted.

Regulatory (or *compliance*) markets generally require using a specific carbon standard and project protocol. For example, in California's cap-and-trade program, forestry projects must be certified according to the California Air Resources Board's regulations and the "Compliance Offset Protocol for U.S. Forest Projects."

In contrast, *voluntary* markets may allow landowners to choose one among several accepted carbon standard and protocols, primarily based on the needs or interests of the carbon buyer.

The other major forest carbon standards currently available in the United States include: the American Carbon Registry, the Climate Action Reserve, and the Verified Carbon Standard.

What are the basic principles behind forest carbon crediting?

Before we dive into the carbon credit philosophy and theory, let's start with the most basic question: ***what is carbon measured in?***

The standard units traded in carbon markets are usually metric tons of carbon dioxide-equivalent, written as tCO_2e. To get from trees to tCO_2e... tree biomass is ~50% carbon, and CO_2 is ~27% carbon (and 73% oxygen). Doing the math, you'd need 2 tons of tree biomass to get 1 ton of carbon, which would be equivalent to 3.67 tCO_2e.

Now that we know *what* is actually being traded, we can dive into the accounting principles that govern how many carbon credits a landowner might generate.

While more detailed eligibility and accounting rules vary between carbon standards and protocols, there are several fundamental elements or principles that they all share:

- *Additionality* refers to the "extra" carbon sequestered or GHG emissions avoided relative to a reference scenario (called a *baseline*). Carbon sequestration that would occur under typical forest practices or by following minimum forest practices regulations is not eligible for crediting.

  For example, in Washington, Oregon, and California, forest carbon projects would not earn credits for carbon stored in trees replanted following a clearcut,

since reforestation is required in all three states. However, if those trees are grown for an extended rotation (i.e., longer than typical commercial forestry rotations) before their next harvest, that *additional* carbon storage could be credited.

All forest carbon protocols require the definition of a specific time, known as a project's *start date*, when practices that sequester *additional* carbon were implemented.

All carbon standards also require disclosure of any legally-binding constraints on forest management (such as conservation easements, Habitat Conservation Plans for Threated & Endangered Species, State Forest Practices regulations, etc.). These restrictions are also generally required to be factored into a project's *baseline*.

- A ***baseline*** is a hypothetical reference scenario to which a forest carbon project is compared. In most protocols for IFM projects, the *baseline* reflects common practices in a region or 'business-as-usual' forest management systems. This typically reflects forest management focused on maximizing revenues from timber production. All carbon sequestered by a project above its *baseline* is considered *additional*.

- ***Leakage*** refers to any increases in GHG emissions outside a forest carbon project that can be directly or indirectly attributed to the project. For example, if a forest carbon project reduces timber production (relative to the *baseline*), some of that timber is likely to be supplied to the marketplace by more harvesting and carbon emissions elsewhere.

  Landowners are also prohibited from simply shifting harvest activities out of a forest carbon project area to other parcels they own or manage.

Forest carbon projects whose credits are used to offset others' greenhouse gas emissions must ensure the emissions reductions they receive credits for are effectively permanent.

- Because carbon offsets (especially in *regulatory* markets) may permit the buyer to release a comparable amount of GHGs now, emissions reductions credited and sold by forest carbon projects must be effectively ***permanent***.

  In reality, the biological cycling of carbon between the atmosphere, plants, and soil is never static. Upon their deaths, carbon stored in trees is gradually released to the atmosphere and converted into soil as the trees decompose. Disturbances such as wildfire, pest or pathogen outbreaks, and timber harvest can also rapidly release forest carbon back to the atmosphere (although carbon stored in long-lived wood products may still be credited).

  Annual disturbance monitoring (in some cases for decades following receipt of carbon credits) is a common strategy for ensuring *permanence*.

- To mitigate the risk of forest carbon losses (also known as ***reversals***) and ensure that forest carbon credits are effectively *permanent*, most carbon standards require the use of an insurance mechanism called a "buffer pool" to hold a portion of a project's carbon credits (often 10-15%) that can be drawn from in case any *reversals* do occur.

  More recently, insurance policies offered by outside companies have begun to emerge for carbon project *reversals*, but these are not yet universally available or accepted by all carbon standards and protocols.

What types of forest management practices sequester more carbon?

Forest carbon is stored in several pools above- and below-ground as well as off-site, including live trees, dead trees, downed logs and woody debris, the forest floor (or "duff" layer), in soils, and in wood products.

Common management strategies used to increase the amount of carbon stored by a forest include:

- Extending harvest rotations
- Retaining more green trees and snags in harvest areas
- Using thinning or partial harvest strategies instead of clearcutting
- Adopting wider buffers around streams and/or drinking water source areas

- Where appropriate considering fire risks and accessibility, retaining harvest residues or "slash" onsite (e.g., stopping or reducing slash burning)
- Limiting or stopping harvest activities in areas with steep or unstable slopes
- Creating "reserves" or "wild" areas with little or no commercial timber harvesting

All US forest carbon standards allow for active forest management, including timber production, within IFM projects.

Carbon sequestration should generally not be pursued as an isolated management objective, but rather as a complement or co-benefit paired with other goals, such as conserving soils and reducing erosion, protecting water quality, providing improved habitat for fish and wildlife, increasing forest health and resilience to wildfire or pests and pathogens, or the sustainable production of timber and other forest products.

For a more detailed review of the science behind practices that sequester forest carbon, check out:

- *Engaging Western Landowners in Climate Change Mitigation: A Guide to Carbon-Oriented Forest... Management and Carbon Market Opportunities. www.fs.fed.us/pnw/pubs/pnw_gtr801.pdf*

What are the major forest carbon rules, standards, or regulations?

In the United States, there are four major carbon standards which have one or more protocols available to certify forest carbon projects.

The first forest carbon protocol most commonly mentioned in carbon market discussions is the "Compliance Offset Protocol for U.S. Forest Projects" that was approved by the California Air Resources Board (ARB) and used in California's *regulatory* cap-and-trade program. *http://www.arb.ca.gov/cc/capandtrade/protocols/usforest/usforestprojects_2015.htm*

A couple common misconceptions related to forest carbon sequestration and carbon crediting

- You may have heard (or even been told by a professional forester) that we could store more carbon in forests by clearcutting older forests and adopting shorter and more intensive harvest rotations.

  Although it is generally true that most trees grow fastest at younger ages (e.g., 10-20 years old) and are sequestering carbon at relatively faster rates than older trees, it is important to recognize that trees continue sequestering and storing carbon throughout their lives, even in old-growth forests, and that forest carbon is not only stored in standing live trees.

  When trees are harvested and processed to create long-lived wood products, about half of the carbon that was stored in the tree will be released to the atmosphere.

  Protecting and conserving older forests avoids emitting huge amounts of carbon stored in standing live and dead trees as well as downed logs and woody debris and soils that would occur if these areas were harvested and converted to plantations on short even-aged rotations.

  Reducing harvests in older forests is one of the primary ways to prevent the emission of additional carbon to the atmosphere, and is a good option for carbon crediting.

- You may also have heard that using wood products instead of more carbon-intensive materials like concrete and steel can also reduce carbon emissions. *This is true.*

  However, there is currently no system to benchmark or measure these emission reductions, and if one does get developed, individual forestland owners will not likely be able to claim responsibility or credit for them.

The ARB protocol is currently the only one in the US that can be used to generate forest carbon offsets for sale into a *compliance* carbon market. No other forest carbon standards or protocols are accepted within California's cap-and-trade program.

In the *voluntary* carbon market, there are three main standards that offer protocols for certifying forest carbon projects in the US:

- American Carbon Registry (ACR)
  www.americancarbonregistry.org
- Climate Action Reserve (CAR, or The Reserve)
  www.climateactionreserve.org
- Verified Carbon Standard (VCS)
  www.v-c-s.org

What important eligibility or other project requirements are there?

Forest Management Plan certification

In general, all forest carbon standards will require a landowner to have a written Forest Management Plan. These Plans need to be followed and updated throughout the life of a forest carbon project, with regular certification by an independent third party or government agency to demonstrate any harvesting done is sustainable. The Forest Management Plan certification programs commonly used to meet these requirements include:

- American Tree Farm System (ATFS)
  www.treefarmsystem.org
- Forest Stewardship Council (FSC)
  us.fsc.org
- Sustainable Forestry Initiative (SFI)
  www.sfiprogram.org

Each of these certification programs has different requirements and policies regarding the types of management practices allowed and procedures for obtaining certification. Landowners would need to maintain certification of their Forest Management Plan as well meeting any additional requirements specified in whichever forest carbon credit protocol is used.

Eligible project start dates

Landowners will also need to identify a specific *start date* that reflects when activities to sequester additional forest carbon first began. This will often correspond to the completion of a new Forest Management Plan, acquisition of a property, or a commitment to long-term annual monitoring and certification for sustainable forest management and carbon storage.

Each standard has different eligibility criteria for start dates:

- Both ARB and CAR require a project's start date to be within one year of the date the project's proposal is submitted to the standard.
- ACR requires a project's start date to be on or after November 1, 1997.
- VCS requires projects to complete validation (the first-step of third-party carbon certification) within five years of its start date.

Length of carbon project commitments

Another important carbon standard requirement involves the length of time a landowner is required to continue forest carbon certification and monitoring activities. Again, each carbon standard takes a different approach.

The term *crediting period* is used differently between standards to either describe the length of time for which a project's *baseline* scenario is valid, OR the minimum length of a time a project is expected to continue verification for issuing carbon credits.

- ARB uses 25-year *crediting periods* to describe the minimum length of time a project commits to continue carbon certification. Crediting periods can be renewed, and a project's *baseline* will be updated based on the version of the forest project protocol.
- CAR does not set a minimum length for *crediting periods*, and allows a project to continue using the same *baseline* for up to 100 years.

- *Both ARB and CAR require 100 years of annual monitoring, forest carbon inventory, and reporting to third-party auditors from the date a project's last carbon credit is issued.*

- ACR uses 20-year *crediting periods* to describe the length of time an IFM project's *baseline* remains valid. *Crediting periods* can be renewed indefinitely, but a project's *baseline* scenario must be reevaluated at each renewal to account for any changes in legally-binding constraints on forest management.
  - *ACR forest carbon projects commit to continue certification for at least 40 years, however, this requirement lies with the carbon project manager, who may opt to use shorter-length contracts to enroll landowners.*
  - *ACR does not require ongoing monitoring or inventories after a project ends its last crediting period, although incentives exist to reward ongoing voluntary monitoring with ground or satellite images if it is completed at least every 5 years.*

- VCS uses 20-year *crediting periods* to describe the length of time an IFM project's *baseline* remains valid. *Crediting periods* can be renewed for up to 100 years, but a project's *baseline* must be reevaluated at each renewal.
  - *VCS requires a project to propose a 'commitment period' that spans at least one full harvest rotation (in the case of even-aged forest management) or the minimum interval between planned re-entries (in the case of uneven-aged management).*

The costs and practical implications of ongoing forest carbon inventory and monitoring for 100 years after a project's last carbon credit is issued (during which time no additional carbon revenue would be coming in) makes certification using standards such as ARB and CAR financially infeasible for most smaller and non-industrial private forestland owners.

Other forest carbon certification rules

Each carbon standard and the protocols used to certify forest carbon projects has a variety of other criteria regarding allowed management practices and eligibility rules. For example, CAR and ARB do not allow broadcast nitrogen fertilization and require maintenance of tree species diversity, among other rules.

All protocols also have some specific guidelines for how to conduct an acceptable forest carbon inventory, which can be a major cost and source of certification problems if not followed closely.

Landowners and any supporting forestry consultants should carefully review any relevant forest carbon standards and protocols and resolve any questions that come up before making any commitments to join or begin a project.

What major financial and practical considerations are involved?

Important differences in demand between compliance and voluntary markets

Earlier on, we mentioned that the California ARB's Compliance Offset Protocol for U.S. Forest Projects is often the first one mentioned in discussions about forest carbon markets in the US. This is because California's cap-and-trade program, by virtue of having a large group of regulated polluters and predictable regulations, is expected to offer stable (or at least ongoing) demand for carbon offsets into the future.

In contrast, in *voluntary* carbon markets, demand is based only on a buyer's voluntary interest. The uncertainty of securing enough demand for all the credits from a forest project that will last for several decades represents a major financial risk that should not be taken lightly.

Thus, in *compliance* markets, it is comparatively safe to assume buyers for credits can be reliably found, as long as the cap-and-trade program remains in effect and is managed properly. In

voluntary markets, however, one of a project's most important tasks is finding willing buyers to purchase all of the project's credits.

Legal differences for landowner contracts between compliance and voluntary markets

In the California *compliance* market, landowners enter into a legally-binding agreement with a State regulatory agency (the California Air Resources Board) and become subject to all regulatory requirements and enforcement mechanisms of the State's cap-and-trade program. California State Courts serve as the exclusive jurisdiction for resolving any disputes.

In the *voluntary* market, landowners developing their own project would enter a contract with the relevant carbon standard, while landowners participating in a project managed by a carbon project developer or aggregator may only have to enter contracts with that project developer, and not necessarily have to make direct contractual arrangements with the standards organization.

What kind of carbon prices should you expect?

The qualities of demand driven by regulation versus demand driven by voluntary actions can exert an important influence over carbon pricing.

In a *compliance* market, all purchases are driven based on a polluter's need to satisfy a regulatory liability, which would reflect the amount of emissions they produce and relative scarcity permits to pollute within the trading program. Demand is thus a direct function of how "tight" the "cap" of a cap-and-trade program is, how many tons of GHGs are emitted by regulated entities in a given year, and how many offset credits are available and can be used. In California, regulated polluters are allowed to use offset credits for up to 8% of their emissions liability, and all other emissions must be covered with "allowances" (emissions permits) acquired at public auctions or by trading in the marketplace.

The prices that have been reported for forest carbon offsets in the California marketplace are typically in the range of $8-12 per ton. Most market observers expect these prices to rise over time as more sectors of California's economy are regulated, and as the cap is increasingly "tightened" over time to keep California on track for its state-level emission reduction goals.

Some market surveys, such as the annual *State of the Forest Carbon Markets* and *State of the Voluntary Carbon Markets* reports produced by the non-profit initiative Ecosystem Marketplace (*www.ecosystemmarketplace.com*) can be useful to learn more about major trends and how the carbon markets around the world evolve from year to year. These reports will also provide results from surveys showing different prices (on average) received for credits sold using different carbon standards.

While these price reports can offer a rough benchmark, landowners should not place too much weight on them when entering or negotiating a new voluntary carbon deal.

Although publicly-available voluntary carbon market and price reports can offer a rough benchmark on carbon pricing, they are often based on *volume-weighted averages*, which are biased by larger carbon deals (that generally transact at lower prices), or include prices quoted or delivered by brokers or middle-men.

These prices are often not representative examples of most carbon projects that transact smaller volumes of credits directly to their buyers, and should be interpreted cautiously.

In general, there is still not a very long track record for the sale of credits from forest carbon projects developed in the US under any standard, and transactions are still relatively few and far-between. There is still no clear "favorite" among

US carbon buyers in terms of forest carbon standards, and competition among these standards remains strong and important.

Further, annual price surveys often only report *volume-weighted averages* for prices, which help to estimate the overall value or size of the entire market, but which are biased towards prices in the highest-volume deals (which are often transacted at lower prices) that are often not representative of sales made by most forest carbon projects.

From the last *State of the Forest Carbon Markets* report by Ecosystem Marketplace, covering global carbon sales during 2014 (from all project types, not just IFM or just US-based projects), *compliance* credits under the ARB standard ranged $8-$11 and averaged $8.90. In the *voluntary* market, credits averaged $7.20 under the ACR standard, and $9 under the CAR standard, both of which primarily reflect projects in the US. The VCS standard saw a global average of $4.30 per credit, based largely on high-volume low-price tropical forest projects.

In voluntary carbon markets, prices can vary widely from project to project, as they are primarily driven by each individual buyer's interest in the project they are purchasing credits from. This presents risk as well as opportunity.

While you can never be certain of the price a voluntary carbon buyer is willing to pay until you've begun negotiations, voluntary buyers often seek out and offer price premiums to more "charismatic" projects that can help communicate the image of a buyer's corporate social responsibility or other green marketing claims.

What are the costs of project development?

The carbon prices reported above do not take account for the costs of joining an existing project or developing a new one. The complexity of developing a new carbon project often takes around 2 years to go from the initial landowner consultation through to the first issuance of credits when the process is managed by professional carbon project developer.

The costs for standalone carbon projects that involve only one property are often so high that it typically requires several thousand acres of productive forestland to pencil out. Some of the major costs include:

- a consulting forester may cost $1,000-$5,000 to develop a new Forest Management Plan
- carbon inventory often costs $10-$15 per acre, and must be updated every 5-7 years
- a professional carbon project team conducting baseline modeling and preparing project documentation for third-party verification can easily go into the $50,000-$100,000 range
- contracts with third-party carbon verifiers typically cost $15,000-$25,000 and involve a month or two of additional work by the carbon project team
- carbon standards also charge their own fees to register projects and to issue and transfer credits
- once a project is up and running, annual disturbance and harvest monitoring reports must be prepared
- periodic third-party verification re-occurs at least every 5-7 years (many standards permit a less expensive "desk audit" if carbon credit issuance is desired in intervening years)

The high costs of project development for individual or standalone forest carbon projects are a major barrier for smaller landowners, and has led to increased efforts to develop grouped certification programs (often referred to as *aggregation* projects) that spread the costs among many landowners participating in a single project.

How are these costs usually handled?

Most projects are developed under contract with a professional forest carbon project developer.

Although the arrangements with all of the major companies that offer these services differ, they will often offer landowners free consultations and agree to cover the upfront costs of project development in exchange for some portion of the project's carbon credits and/or a share of future revenues. In some arrangements, a landowner may not receive payments from the sale of carbon credits under the project developer's upfront costs have been fully recovered.

When do carbon credits get sold?

Carbon credit sales can be contracted by a project developer or landowner at any stage of a forest carbon project's development. There are a variety of structures that can be used for carbon sales, ranging from pre-payment to pay-on-delivery as well as a variety of more complicated options. The earlier a project is in development, the riskier it is to a buyer, and any money that changes hands prior to the completion of third-party verification and carbon credit issuance will generally be for a discounted price.

What steps are involved in creating or joining a forest carbon project?

The main steps a landowner will take to join or start their own carbon project include:

Initial consultation and feasibility assessment

A forest carbon project developer will meet with a landowner to describe the process and expectations for carbon crediting, and discuss a landowner's management goals and needs to make sure carbon certification is appropriate.

At this point in time, the project developer may be able to provide a ballpark estimate of the landowner's carbon credit potential using simple models or "rules of thumb" and a basic awareness of the type of forests on the property and a landowner's management strategy.

If carbon certification looks promising, the landowner will generally need to enter into a contract with the project developer before additional services will be provided and major costs incurred by the project developer.

If a landowner does not already have a written Forest Management Plan, or needs to update an existing Plan to incorporate carbon sequestration or other goals, a carbon project developer may assist or arrange for those services, including independent certification of the Plan.

Forest carbon inventory

All projects require detailed field sampling of various forest carbon pools, including both standing live and dead trees. Some carbon protocols also require surveys of downed logs and coarse woody debris. Sampling of soils and forest floor litter or "duff" is usually not required.

While many land managers complete timber inventories as part of their overall management practices, the additional measurements required for carbon inventories with high levels of confidence can add 25–50% to the overall cost of a comparable timber cruise.

Carbon modeling

A landowner's forest carbon inventory will be used in a growth-and-yield model to simulate the *baseline* scenario against which the landowner's actual carbon storage will be compared into the future. Growth-and-yield modeling of the landowner's intended management actions is also often required for project documentation, and can give an estimate of the amount of carbon the landowner may expect to sequester and take credit for into the future.

Project document development

Each project must develop documents that describe the project and ensure its activities are eligible under the chosen carbon protocol and other standard guidelines.

A *Project Design Document* submitted to a carbon standard will generally include:

- a description of the project area, characterizing the forest and other natural resources in it, as well as its ownership and land-use history
- a demonstration of the project's eligibility and its proposed duration
- calculations of carbon storage simulated in *baseline* and "with-project" scenarios
- completion of a risk-assessment identifying how much of the project's credits may be held in a "buffer pool" to compensate for any potential future *reversals*
- a description of the plan for annual monitoring and reporting of any harvests or natural disturbances

A *Project Design Document* is usually submitted to initiate third-party verification.

Third-party carbon verification

During the final stages of preparing a *Project Design Document*, the project developer will contract with a third-party verifier to complete an audit of the project under the relevant carbon standard and forest carbon project protocol.

This verification will generally include a site visit and field audit to confirm inventory accuracy. All other project documents and calculations are typically reviewed in detail off-site.

A preliminary report including requests for clarification or areas of non-conformance with the carbon standard or protocol may be issued by the verifier. Once these issues have been resolved, the verifier will issue a final opinion that is submitted to the carbon standard.

Carbon credit issuance and transactions

Once verification has been completed, the project must pay any remaining registration or issuance fees charged by the carbon standard to be issued registered carbon credits. All of the carbon standards described in this guide have registries that track carbon credits issued and transacted to other accounts using unique serial numbers.

Ongoing monitoring, inventory, and verification

Each year, a project must collect annual reporting for harvesting or significant natural disturbances that have occurred.

Any time a project seeks the issuance of more carbon credits, third-party verification must be completed. Most standards allow for field audits every 5 years with less expensive desk audits in intervening years. Projects do not need to seek issuance of credits every year, and may choose to reduce verification expenses by seeking carbon credit issuances less frequently.

Throughout a project's life, the volume of carbon credits issued will be based on the continuation and updating the forest carbon inventory (as opposed to the 'with project' growth-and-yield scenario modeled at the outset).

The forest inventory must be completely redone every 5-7 years, depending on the standard used. In some cases, growth-and-yield models may be used to estimate carbon storage in intervening years for credit issuance, but these values will be trued-up with the field inventory over time.

Readers seeking a more detailed guide for forest carbon project development covering other project types, projects outside the United States, or for more strategic business planning advice are encouraged to check out:

Building Forest Carbon Projects:
A Step-by-Step Overview and Guide
www.forest-trends.org/publications/building_forest_carbon_projects

Terminating or leaving a project early

If a landowner voluntarily decides to terminate a project, or violates a carbon program's rules, they will often be liable either to the carbon project developer or to the carbon standard (if the landowner is the project developer) to pay back any credits that were issued to them. In *compliance* markets, this may trigger enforcement actions and penalties or fines by the regulatory agency managing the carbon program.

Causes for early project termination may include unplanned harvests that result in a net loss of carbon storage that has already been credited to the project, the sale or transfer of a property to a new owner who will not continue the carbon project, failure to maintain a certified Forest Management Plan or complete annual monitoring and harvest reporting, or failure to comply with other state, federal, or local laws and regulations. A project's buffer pool or insurance policy cannot generally be used to cover these liabilities.

Carbon contracts between landowners and project developers will often be designed to recognize that "life happens" and property sales or unplanned harvests cannot always be anticipated. If a landowner can foresee major expenses they cannot currently afford, such as sending children through college, long-term medical costs, or other legal or financial challenges, they should make sure to seek legal advice and consult with the carbon project developer to make sure participating in a carbon project would not create unmanageable burdens or limitations.

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What other resources are available for forest carbon planning?

Most private forestland owners should be able to find local financial and educational support for management planning and implementing conservation practices.

Several cost-share and incentive programs are often available through a State Department of Forestry or Natural Resources or a local office of the USDA Natural Resources Conservation Service. University Cooperative Extension programs, local Soil & Water Conservation Districts, and state and local membership organizations for forest and woodland owners are also a great place to start.

These types of programs will often help a landowner find funding and assistance for management planning, implementing conservation practices like tree planting, different types of thinning, controlling invasive weeds, riparian restoration, and more.

Once you've developed an understanding of the resources available as well as the landscape context and ecosystem functions your land can provide, carbon measurement and management may come naturally along for the ride.

For landowners in Oregon and Washington, Ecotrust has created a free online web application called ***Forest Planner*** that will allow you to easily find and map your property, define your forest types, and then create custom management scenarios where you can mix-and-match different types of management across your property.

It's kind of like a choose-your-own-adventure tool that will give you basic estimates of carbon storage, fire and pest hazards, timber stocking and yields, management costs and revenues, and many other values.

Take it for a spin at *www.forestplanner.ecotrust.org*.