



# An Overview of Forest Carbon Credit Programs in Virginia

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Woodland owners increasingly hear about opportunities to earn income by participating in emerging forest carbon markets. This publication provides an overview of these markets and introduces the carbon credit programs operating in Virginia. This information is intended to help Virginia's woodland owners decide if taking part in a forest carbon credit program is a good fit for their management objectives.

## The Role of Forests in the Carbon Cycle

In Virginia, over 16 million acres (62%) are forested. Sixteen percent of that forested acreage is naturally regenerated or planted pine and 80% is mixed hardwoods/mixed hardwoods-pine. Fifty-nine percent of the forestland is owned by nonindustrial, private woodland owners (VDOF 2022). The trees in these forests absorb (sequester) carbon dioxide (CO<sub>2</sub>) from the atmosphere during photosynthesis. The carbon is then stored in the stems, roots, and soils until it is removed through forest harvesting: Part of it continues to be stored in forest products, and the remainder returns to the atmosphere via root and litter decay. As such, forests play a key role in reducing the levels of atmospheric CO<sub>2</sub>, the primary component of greenhouse gas emissions (IPCC 2023). Virginia's forests sequester approximately 40% of the commonwealth's carbon emissions every year under business-as-usual management practices (Domke et al. 2021). These forests could sequester even more carbon if management practices are altered (e.g., longer rotations, tree planting on bare land, improvement of young and mature forests), increasing their potential as a policy instrument toward global climate change mitigation.

## Carbon Markets

As interest in reducing greenhouse gas emissions to mitigate the effects of climate change increases, so does people's willingness to pay for forest-based actions that offset or reduce CO<sub>2</sub> emissions (Donofrio and Procton, 2023). Forest carbon markets provide an opportunity for these types of payments to be made. The commodity being exchanged is called a carbon credit. One carbon credit corresponds to 1 metric ton of CO<sub>2</sub>-equivalent (CO<sub>2e</sub>) either removed from or not emitted to the atmosphere. Forest carbon programs provide woodland owners with management options that increase carbon

sequestration and storage on their land, generating forest carbon credits that can be sold to buyers in carbon credit markets.

There are two types of carbon markets: compliance and voluntary (see fig. 1, Buyers box). The two markets are distinguished by their carbon credit buyers. In the compliance carbon market, the buyers are companies required by the government to limit the amount of CO<sub>2</sub> emissions from their facilities or activities. The California Cap-and-Trade Program and the Regional Greenhouse Gas Initiative are examples of compliance markets in the United States. The companies required to limit CO<sub>2</sub> emissions can either implement technologies to reduce their own emissions or pay others to either reduce their emissions or increase the amount of atmospheric carbon stored in trees and soils (carbon sequestration). The governments in participating states set the extent to which companies can use forest carbon credits for compliance.

In voluntary carbon markets, carbon credit buyers are usually companies (some of which represent individuals), governments, and other organizations that seek to offset their carbon emissions to meet their voluntary social and environmental goals. At the time of publication, companies like Microsoft and Google have goals of net zero carbon emission, meaning they intend to offset all of their carbon emissions. Voluntary carbon markets have expanded significantly in recent years. According to the World Bank (2022), international carbon credit markets grew by 48% in 2021, the highest annual increase

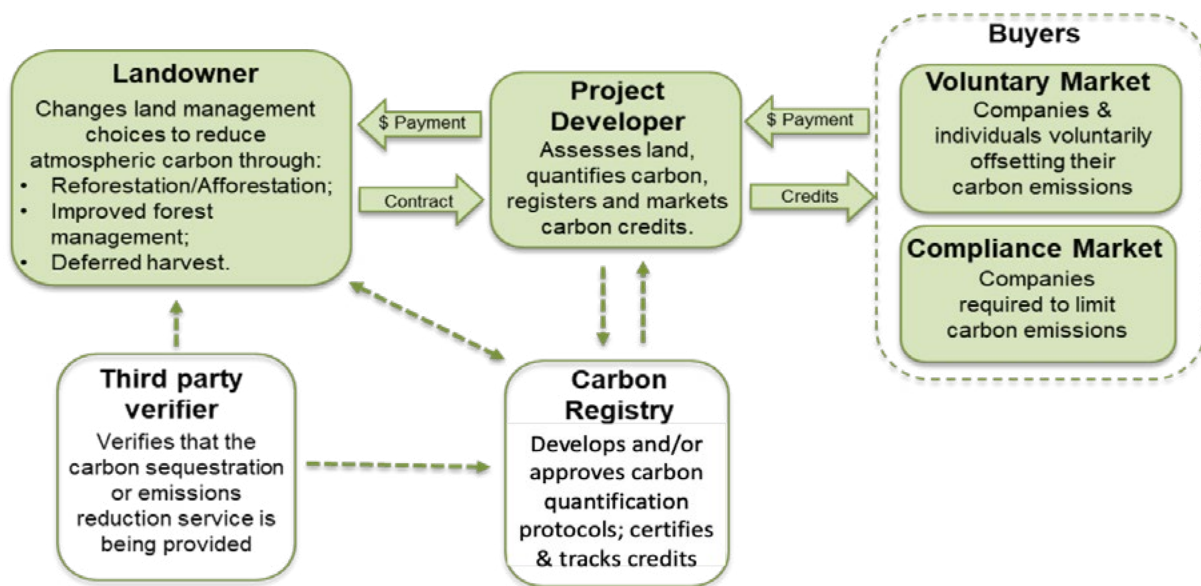
since 2012. Currently, most forest carbon credit market opportunities for Virginia woodland owners come from the voluntary carbon credit market.

## Creating and Selling Credits in the Carbon Market

Carbon credits are generated by forest carbon project developers in collaboration with woodland owners (fig. 1, Project Developer box). Project developers are either private companies or nonprofit organizations that organize activities to either increase the volume of carbon stored in a forest or decrease carbon emissions from their lands. Contracts between a project developer and woodland owner describe the obligations of each party and how the owner will be compensated.

Project developers and woodland owners can create forest carbon credits in three general ways: afforestation/reforestation (A/R), improved forest management (IFM), and harvest deferral (fig. 1, Landowner box). Afforestation occurs when trees are planted on historically unforested lands; reforestation occurs when trees are planted on previously forested lands. Improved forest management seeks to increase the carbon stored on existing forests through management practices that improve growth and regeneration success, reduce the number of harvests, and/or delay harvests (Kaarakka et al. 2021). IFM projects are the most common way to generate carbon credits in Virginia. Harvest deferral happens when a woodland owner increases carbon storage by delaying a timber harvest for some period.

**Figure 1: Forest Carbon Credit Generation, Verification and Market Process**



**Figure 1:** Diagram of the forest carbon credit generation, verification, and market process.

To convert on-the-ground forest management changes into carbon credits, project developers follow rules established by carbon registries (fig. 1, Carbon Registry box). Carbon registries are private or nonprofit organizations that define procedures for how carbon credits are quantified, verified, and tracked. Quantification is carried out by applying a standardized accounting method that translates management actions into changes in the amount of sequestered carbon. Verification procedures define whether the proposed actions are actually occurring. Carbon registries also list the credits they certify to potential buyers. Several registries operate in the United States, including Verified Carbon Standard Program (managed by Verra), Climate Action Reserve, ACR, and Gold Standard.

Carbon credits are only certified and generated after a third party (fig. 1, Third Party Verifier box) verifies and guarantees that the activities and carbon sequestration or emission reductions have occurred. This verification process typically requires verifiers to visit the forestlands under carbon contracts at the beginning of the project (when the woodland owner first enrolls in the program) and then periodically, according to the method that is being followed. This system assures buyers that the carbon credits being bought represent new, real, permanent, and transparent reductions in atmospheric CO<sub>2</sub> (IOSCO 2022). Oftentimes, the woodland owner also signs a contract with the registry, committing to increased carbon storage or emissions reductions.

## Forest Carbon Programs in Virginia

A number of forest carbon project developers are operating in Virginia. As opportunities to take part in forest carbon markets increase, woodland owners are faced with many questions.

- Should they take part in a forest carbon program?
- Is their land suitable for a forest carbon project?
- Which forest carbon project is right for them?
- Will participation in a forest carbon project affect their ability to use their land for other purposes?
- Will participation in a forest carbon project affect their ability to take part in other conservation programs?
- How much money will they get paid?
- How and when will they get paid?
- How long is the commitment?

## Table Explanation

To help woodland owners answer these questions, characteristics of current forest carbon credit programs in Virginia are summarized in table 1. Listed across the top of the table are the five forest carbon programs that are or will soon be available to Virginia woodland owners. The programs include:

1. Forest Carbon Works.
2. Family Forest Carbon Program (developed by the American Forest Foundation and The Nature Conservancy and overseen by the Family Forest Foundation LLC).
3. Anew.
4. LandYield (in partnership with Finite Carbon).
5. ACRE Investment’s GreenTrees Program (ACRE Investment Management LLC).

(Note: NCX is a company that used to be in the forest carbon project development business, and it was largely known for its one-year harvest deferral program. NCX has recently changed its line of business, and the program does not exist anymore [Pariza 2023].)

Each row of the table provides information on a program characteristic or attribute that is contained somewhere in the terms of contracts. These characteristics are organized into four categories: (1) general program description, (2) woodland owner eligibility requirements, (3) woodland owner obligations and costs of participation, and (4) revenue model. While forest carbon programs may represent an income-generating opportunity, they also require careful consideration of obligations and costs associated with participation.

### 1. General Program Description

Carbon credit program developers can differ based on the type of carbon credit-generating projects being offered. These include:

- **Project type:** A description of the types of activities allowed in order to increase carbon sequestration and storage. Activities fall into three categories: afforestation/reforestation, improved forest management, and/or harvest deferral.
- **Forest type:** The type of forest (age, species, location, etc.).
- **Carbon registry:** Project developers often partner with specific registries to create and market credits.

## 2. Woodland Owner Eligibility Requirements

Carbon program developers have different landowner eligibility requirements. These include:

- **Minimum acreage:** The minimum number of wooded acres a landowner needs to be eligible to take part in the program.
- **Ineligibility due to land use restrictions:** Carbon credit protocols aim to ensure that land management activities produce new or additional carbon uptake and storage. Properties under easements or other restrictions that limit or prohibit timber harvest may be ineligible to produce carbon credits because a carbon project would add little or no new carbon storage.
- **Forest management plan:** Some carbon credit programs require a written forest management plan. If required, programs may either pay for the plan or develop one themselves.
- **Other eligibility requirements:** Carbon credit programs have specifications about the type and condition of forestland and prior land use. Program developers can provide a complete list of requirements.

## 3. Woodland Owner Obligation and Costs

Landowner participation in a carbon credit program means that the landowner agrees to a set of management obligations intended to increase the amount of carbon sequestered on their land. Forest carbon programs have different terms and conditions that woodland owners must follow. These include:

- **Contract duration:** Most forest carbon programs require woodland owners to make long-term commitments.
- **Allowable harvest:** Carbon programs restrict or limit harvest in some way. These restrictions vary by program.
- **Woodland owner reporting:** Most programs require woodland owners to conduct some minimal reporting. This often requires notifying the program developer of changes in land conditions or land use.
- **Out-of-pocket expenses:** Most carbon programs do not require the woodland owner to incur out-of-pocket costs associated with determining eligibility, registration, plan development, planting trees, or monitoring and verification.

- **Verification:** Carbon credit registries and carbon credit buyers want assurance that carbon sequestration and storage is occurring. Carbon programs have different methods to verify the outcomes of their activities and may include periodic site visits.
- **Carbon credit and land sale:** Most but not all programs establish restrictions on land use that transfer with the property in the case of sale or inheritance. Exit clauses exist but typically require financial penalties.

## 4. Revenue Model

**Target market:** Carbon developers may sell credits to different types of buyers, including those in the voluntary or compliance markets. For forest carbon projects, most carbon credit exchanges occur in the voluntary market.

**Payment type:** Woodland owners can receive payments based on either a fixed per-acre amount or as a share of net revenue received from credit sales. Some program developers offer woodland owners a choice of payment type.

**Payment range:** Actual payment will vary based on market conditions and carbon credit generating potential.

**Price risk:** Risk associated with changes in carbon credit prices.

**Production risk:** Risk associated with unplanned loss of stored carbon due to events like fires, insect damage, or weather-related damage. In most cases, woodland owners face little direct production risk because the project developers pool risk with multiple projects and often include a carbon storage or emissions reduction buffer pool with each project.

**Timing of compensation:** Defines when payments are received, including annual and one-time upfront payments.

**Time from project initiation to payment:** Estimated amount of time between starting a project and receiving the first payment.

**Carbon credit ownership/control:** Identifies who legally owns the carbon credits produced from the project. This can be the woodland owner or the project developer. In most cases, the project developer owns and markets the carbon credits.

**Other revenue opportunities:** Most forest carbon projects allow woodland owners to generate revenue from other nontimber land uses. Listed activities are not an exhaustive list.



**Table 1:** Specifics of forest carbon programs operating in Virginia (as of January 2024).

Program characteristics	Forest Carbon Works (FCW)	Family Forest Carbon Program	Anew	LandYield (with Finite Carbon)	ACRE GreenTrees Program
<b>GENERAL PROGRAM DESCRIPTION</b>					
Project type	Improved forest management (IFM) through extension of rotation age (Verra VM0003 methodology). For existing forestland.	IFM. For existing forestland. Restrictions on forest harvesting. Harvest deferral to increase carbon storage.	IFM. For existing forestland. Sustainable forest management to maintain and increase carbon uptake and storage.	IFM. For existing forestland. Restrictions on harvesting (harvest deferral).	Afforestation/ reforestation. Credits created by planting trees on nonforested land.
Forest type	All	Mixed hardwoods	Managed and unmanaged forests	Commercial timberland (hardwoods & softwoods)	Mixed hardwoods
Carbon registry	Verra	Verra	Verra, ACR	ACR	ACR
<b>WOODLAND OWNER ELIGIBILITY REQUIREMENTS</b>					
Minimum acreage	40 acres	30 contiguous acres	3,000-4,000 acres	40-5,000 acres for lands under a single owner.	25 acres. Land does not have to be contiguous.
Ineligible if property has the following land use restrictions	Overly restrictive conservation easements that limit harvesting.	Timber harvest restrictions, regulatory conditions (presence of threatened & endangered species, wetlands, etc.). Tree plantations are ineligible. Degraded forests or forests with undesirable timber species/volume may not qualify.	Timber harvest restrictions, regulatory conditions (presence of threatened & endangered species, wetlands, etc.).	Timber harvest restrictions, regulatory conditions (presence of threatened & endangered species, wetlands, etc.).	Timber harvest restrictions, regulatory conditions (presence of threatened & endangered species, wetlands, etc.).
Other eligibility requirements	Privately owned lands. Must own timber rights. Participation in previous carbon programs may be allowed. Must enroll all owned forestland. Must disclose commercial harvests in the previous 10 years.	Minimum 2,000 board feet per acre of timber on parcel. Evidence of markets for timber. No participation in previous carbon programs. Enrolling all acreage is not necessary.	If commercial harvest will occur, land must be certified by the American Tree Farm System, Forest Stewardship Council, or Sustainable Forestry Initiative.	Tracts with accessible commercial timber. Must own full timber rights. Do not have to enroll all timberland to be eligible.	Ineligible if land was in a forested state within the past 10 years. Offers “3-year look back” on stands planted within 3 years of contract signing. No liens (i.e., mortgages).

<b>Program characteristics</b>	<b>Forest Carbon Works (FCW)</b>	<b>Family Forest Carbon Program</b>	<b>Anew</b>	<b>LandYield (with Finite Carbon)</b>	<b>ACRE GreenTrees Program</b>
Forest management plan	If commercial harvests occur during crediting period, land must be certified by the Forest Stewardship Council (at no cost to landowner). FCW may assist with forest management plan.	Yes. Either a free forest management plan template is provided by the program (to be used by the landowner's forester) or the program can help the landowner apply for funding for a third-party detailed plan.	Required if commercial harvesting will occur.	Required if commercial harvesting will occur on other land owned but not enrolled in the program.	Yes
<b>WOODLAND OWNER OBLIGATIONS AND COSTS</b>					
Contract duration	Minimum of 60 years broken between a 25-year payment period, followed by a 35-year monitoring period. The payment period may be extended in 5-year increments (allow for price and inventory adjustments) up to 50 years.	20 years	Two options: • 40-year monitoring commitment with ACR and 10-year contract with Anew for voluntary markets. • 100-year monitoring commitment for compliance markets.	40 years: • No harvest for the first 20 years; 40 years of monitoring. • Option for second forest deferral and additional payments after initial 20-year period.	40 years
Allowable harvest	10% of merchantable timber reserved for climate smart forestry practices. Harvests exceeding this amount may incur a harvest offset fee. Fewer restrictions during legacy period (after 25 years).	Limited harvest: 25% of basal area within designated harvest area, and QMD is not reduced by more than 10%. Qualified forester needed for pre- and post-harvest reporting.	Flexible; landowners may harvest no more than 100% of annual growth as allowed by forest carbon protocols.	Commercial harvest allowed after 20 years. Some noncommercial thinning and prescribed burning allowed in the first 20 years.	Thinning is allowed according to the forest management plan.
Woodland owner reporting	Annual online survey on the condition of the forest	Yes	Yes, per registry standards & protocols	Landowner must submit quarterly attestations	Yes
Out-of-pocket expenses*	None	None	None	None	The program covers seedling/ planting costs up to \$500 per acre

\*Programs that require landowners to assume upfront costs may not be legitimate programs.

<b>Program characteristics</b>	<b>Forest Carbon Works (FCW)</b>	<b>Family Forest Carbon Program</b>	<b>Anew</b>	<b>LandYield (with Finite Carbon)</b>	<b>ACRE GreenTrees Program</b>
Verification	All enrolled properties receive on-ground inventory and third-party verification.	Landowner documentation every 5 years. Regular verification of monitoring plots if selected.	Site visit every 5 years.	Remote verification with potential site visits.	Site visit every 1-3 years (remote verification under development).
Obligations transfer with land sale	Yes	Yes	Yes	Yes	Yes
<b>WOODLAND OWNER REVENUE MODEL</b>					
Target market	Voluntary	Voluntary	Voluntary and compliance	Voluntary	Primarily voluntary
Payment type	Two options: annual flat rate per acre payment or revenue share depending on acreage.	20% upfront plus payments per acre per year over 20 years.	Percentage of net revenue (amount varies with size and complexity of project).	Quarterly payments. Fixed price for the first 3 years; percentage share of credit prices in the remaining 17 years.	Two options: fixed per acre payments or percentage of carbon credit sales.
Payment range	Variable: starts at approximately \$10 per acre per year, higher for large acreage or highly productive lands. No payments after 25 years (during the monitoring period).	\$200-\$300 per acre total over 20 years.	Percentage of net revenues depending on the property & carbon credit market price.	It is estimated that landowners could earn \$30-\$40 per acre per year (December 2023).	Fixed payments: \$20-\$40 per acre for the first 15 years of the 40-year term. From year 16 on, payment on a carbon split system. Carbon split payments based on credit sales: 50% of net revenue at market price.
Price risk	Minimal within a contract period	None	Some	Yes, with revenue sharing	Yes, for credit price option. No risk with fixed payments.
Production risk	None	None	None	None	None
Timing of compensation	Annual payments start with the signing of contract.	20% of the total received upfront; annual payments over the following 20 years, with an increasing percentage over 5-year periods.	When credits are sold.	Quarterly payments for the first 20 years.	Annually for fixed payments. Every 1-2 years for carbon split, depending on volume of credits sold per year.

Program characteristics	Forest Carbon Works (FCW)	Family Forest Carbon Program	Anew	LandYield (with Finite Carbon)	ACRE GreenTrees Program
Time from project initiation to payment	Within 30 days	30-60 days	Approximately 2 years	1-3 months	Fixed payment contracts: within 1 year after planting. Percentage share contracts: 18-24 months after planting. 1-12 months can pass between contract signing and planting.
Carbon credit control/ownership	Developer	Developer	Developer	Developer	Developer
Other revenue opportunities	Hunting leases, recreational opportunities.	Hunting leases. Compatible with most cost-share programs.	Hunting leases and miscellaneous practices, such as nontimber forest products.	Hunting leases and miscellaneous practices, such as nontimber forest products.	Hunting leases, nutrient credits, CREP, preservation tax credits.

## Final Observations

The table is meant to provide a starting point for woodland owners who are considering taking part in a forest carbon program. The specific terms and conditions that appear in final contracts will depend on the individual characteristics of the land being enrolled and the carbon program requirements. Woodland owners should consult an attorney for a full understanding of the details and implications of their contracts. There may be tax implications for enrolling in a forest carbon program and receiving payments from carbon credits. An accountant can assess the potential tax implications so woodland owners can plan for tax season.

Finally, although carbon markets seem to represent a new income-generating opportunity for Virginia woodland owners, enrolling in a forest carbon program has the same inherent risks associated with any market and are mainly related to carbon prices in the voluntary markets. Following carbon market prices and other trends online and with natural resources management professionals is a good idea. The risks and the potential costs involved in entering the carbon credit market must be weighed against the expected benefits in a thorough and clear trade-off analysis that your forester, accountant, and attorney may be able to help with. The local Extension office and for-profit service providers can further assist you. Taking time to fully understand the requirements of a carbon program is important, as most of them require long-term commitments.

## Glossary

This is a list commonly used terms used often when referring to carbon programs.

**Accidental release** – When a natural disturbance (e.g., wildfire, hurricane, pests) causes a large number of unexpected tree deaths, which increases carbon emissions from the forest via conditions that are deemed “unavoidable.”

**ACR** – A private, nonprofit, voluntary greenhouse gas registry. [acrcarbon.org](http://acrcarbon.org).

**Additionality** – Carbon storage must be real and additional to the amount of carbon that would have been stored if a forest were not enrolled in a carbon program. To determine how much carbon storage is “additional” due to forest management, project managers must estimate how much carbon would have been stored and sequestered under a business-as-usual scenario (i.e., without the intervention). The projected emissions amount in the business-as-usual scenario constitutes the baseline carbon values. Additional net carbon sequestration is the difference between the real, measured emissions resulting from a change or changes in forest management versus the projected baseline value.

**Afforestation/reforestation (A/R)** – Afforestation creates forests on nonforested land. Reforestation restores tree cover to previously forested land (e.g., replanting trees after a timber harvest).



**Baseline** – Project managers must estimate how much carbon would have been stored and sequestered under a business-as-usual scenario (i.e., without the carbon project). The projected emissions amount in the business-as-usual scenario constitutes the baseline carbon values.

**Basal area** (of a stand of trees) – A measure of tree density, it is “the sum of the cross-sectional surface areas of each live tree, measured at DBH (diameter at breast height), and reported on a per unit area basis” (Bettinger et al. 2017, p 23-24).

**Board foot (BF)** – A unit of volume for timber equal to 144 cubic inches. Equivalent to the volume of a board that measures 12 inches by 12 inches by 1 inch.

**CO<sub>2</sub>e** – CO<sub>2</sub> stands for “carbon dioxide” and the letter “e” stands for “equivalent.” This is a measure of the global warming potential of 1 metric ton of carbon dioxide, usually used with other greenhouse gases such as methane, nitrous oxide, and fluorinated gases.

**Conservation easement** – A voluntary legal agreement between a landowner and a government agency or land trust that permanently limits ownership rights such as development and subdivision to protect conservation values and natural and cultural attributes. The landowner maintains ownership. The easement is recorded with the property’s deed. [landtrustalliance.org](http://landtrustalliance.org), [dof.virginia.gov](http://dof.virginia.gov), [vaunitedlandtrusts.org](http://vaunitedlandtrusts.org).

**Conservation Reserve Enhancement Program (CREP)** – A cost-share program that aims to improve Virginia’s water quality through installation of riparian buffers, fencing livestock out of waterways, and providing alternative watering systems for livestock.

**Endangered Species Act (ESA)** – Establishes protections for fish, wildlife, and plants that are listed as threatened or endangered; provides for adding species to and removing them from the list of threatened and endangered species and for preparing and implementing plans for their recovery; provides for interagency cooperation to avoid the taking of listed species and for issuing permits for otherwise prohibited activities; provides for cooperation with states, including authorization of financial assistance; and implements the provisions of the Convention on International Trade in Endangered Species of Wild Flora and Fauna. [fws.gov/law/endangered-species-act](http://fws.gov/law/endangered-species-act).

**Forest Stewardship Council (FSC)** – An international, nonprofit certification program that certifies sustainably managed forests. [fsc.org/en/about-us](http://fsc.org/en/about-us).

**Improved Forest Management (IFM)** – A type of forest carbon project that involves improving current forest management practices to increase carbon uptake and storage. Specific activities vary by forest carbon program. [fs.usda.gov/research/treesearch/62753](http://fs.usda.gov/research/treesearch/62753).

**Measurement, Reporting, and Verification (MRV)** – A multistep process that (1) measures the amount of greenhouse gas emissions reduced by a specific forest carbon program activity (e.g., improved forest management, delayed harvest, and/or afforestation/ reforestation) over a period of time, (2) reports these findings to an accredited third party that then, (3) verifies the reported amounts. This process must be completed before carbon credits can be issued. [openknowledge.worldbank.org/entities/publication/a1abead2-de91-5992-bb7a-73d8aaaf767f](http://openknowledge.worldbank.org/entities/publication/a1abead2-de91-5992-bb7a-73d8aaaf767f).

**Permanence** – For nature-based projects, total carbon gains must exceed carbon losses over the lifetime of the project, where the lifetime of the project can be up to 100 years beyond a project’s credit-generation period.

**Quadratic mean diameter (QMD)** – The diameter of the tree with average basal area (cross-sectional area) in a forest.

**Sustainable Forestry Initiative (SFI)** – North American nonprofit certification program that certifies sustainably managed forests. [forests.org](http://forests.org).

**Verra** – A private, nonprofit carbon registry that develops standards for climate action and sustainable development programs. [verra.org](http://verra.org).

## Relevant Websites

ACRE Investment Management LLC – [acre-investment.com](http://acre-investment.com)

Anew Climate LLC – [anewclimate.com](http://anewclimate.com)

California Air Resources Board. Compliance Offset Program — [ww2.arb.ca.gov/our-work/programs/compliance-offset-program](http://ww2.arb.ca.gov/our-work/programs/compliance-offset-program)

Family Forest Carbon Program – [familyforestcarbon.org](http://familyforestcarbon.org)

Forest Carbon Works – [forestcarbonworks.org](http://forestcarbonworks.org)

Forest Owner Carbon and Climate Education (FOCCE) – [sites.psu.edu/focce/resources](http://sites.psu.edu/focce/resources)

LandYield – [landyield.com](http://landyield.com)

Regional Greenhouse Gas Initiative — [www.rggi.org](http://www.rggi.org)

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Produced by Virginia Cooperative Extension, Virginia Tech, 3-24

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