

Forest Carbon Markets for Vermont Landowners

Natural climate solutions

Forests are considered a natural solution to climate change because they remove carbon dioxide (CO₂) - a potent greenhouse gas (GHG) - from the atmosphere and store the carbon in wood and soil¹. Increasing the amount of carbon stored in forests and harvested wood products can reduce the amount of CO₂ in the atmosphere while providing the other critical ecosystem services that forests provide. New carbon offset markets allow landowners to sell the carbon taken up by their forest to another entity to compensate for emissions made elsewhere. Because of the interest in forest carbon offsets from landowners and emitters, new opportunities for selling forest carbon are rapidly developing. Forest carbon offset projects can include improved forest management practices, avoided deforestation, or tree planting. Programs are open to all forestland owners, including family forests, municipalities, tribes, non-profit groups, and public entities. **Selling forest carbon can provide an additional source of revenue to a landowner and the long-term commitment keeps forests intact, but carbon projects are complex and may not be suitable for all forest parcels.**

What is a carbon offset?

A **carbon offset** – also referred to as a **carbon credit** – is a reduction in greenhouse gas (GHG) emissions in one location that compensates for or "offsets" GHG emissions made elsewhere.

A carbon offset is also called an **emission reduction ton (ERT)** because a metric ton of CO₂ is the standard unit for carbon accounting. While CO₂ is the most abundant GHG, a carbon offset can apply to other GHGs as well – like methane (CH₄), nitrous oxide (N₂O), and ozone (O₃). Each GHG has a different global warming potential (GWP), which is based on how long the GHG stays in the atmosphere and how strongly it impacts atmospheric warming. For simplicity, all GHGs are compared to CO₂ and expressed in the same unit: metric tons of carbon dioxide equivalent (Mt CO₂e). Carbon dioxide has a GWP of 1, while methane has a GWP of 25². This means that 1 Mt of CH₄ is equivalent to 25 Mt of CO₂e or 25 ERTs.

What is the purpose of carbon offsets?

As businesses, municipalities, organizations, and individuals make efforts to reduce their GHG emissions, reductions can be difficult, costly, and take time. Carbon offsets are intended to help these entities reduce their emissions through the purchase of offsets while they work to reduce the sources of emissions.

In addition to the carbon taken in by forests, carbon offsets can be generated by reducing emissions or increasing sequestration from a variety of sources, like agricultural or industrial processes; for example, capturing methane emitted from a dairy farm or a coal-fired power plant. Regardless of the type of carbon offset, it must represent a direct and quantifiable reduction in emissions or an increase in sequestration.

¹ For background information on forest carbon, terminology, and differences between forest types see *What is Forest Carbon?* (Kosiba, 2021).

² Based on 100-year timeframe. Source: EPA <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>

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What are the benefits of forest carbon offset projects?

The key tenet of a forest carbon offset project is that the forest must store more carbon than it would without the carbon offset project. This additional carbon stored in the forest allows another entity to compensate for GHG emissions made elsewhere. In this way, selling carbon offsets allows for the private sector to provide financial support for forests. The revenue earned by a landowner from selling forest carbon could be used for other goals, like land conservation, trail maintenance, timber stand improvement, climate-adaptive management, invasive species control, or wildlife habitat improvements. Additionally, it is feasible that the landowner could use the generated carbon offsets to compensate for their emissions. For example, Middlebury College uses some of the offsets generated from the Bread Loaf Wilderness carbon project to compensate for campus emissions.

Enrolling forestland in a long-term carbon agreement can provide more benefits than just revenue. The long-term commitment of forest carbon project helps to keep the forest intact, which protects the other vital ecosystem services that forests provide, like water cycling, wildlife habitat, and flood resilience.

The Five Requirements of Carbon Offsets

Real	Reductions in emissions or increases in carbon sequestration must be tangible.
Additional	Reductions in emissions or increases in carbon sequestration must occur beyond a baseline scenario and not be the result of a prior legal commitment.
Verifiable	Reductions in emissions or increases in carbon sequestration must be quantifiable, monitorable, and verifiable by an accredited third-party through a standardized system.
Permanent	Reductions in emissions or increases in carbon sequestration must last in perpetuity (at least as long as the project contract).
Enforceable	Reductions in emissions or increases in carbon sequestration can be counted only once.

How do forest carbon offset projects work?

Carbon registries & markets

Because carbon offsets are purchased by another entity to compensate for emissions made elsewhere, all carbon offsets must be real, additional, verifiable, permanent, and enforceable. These criteria are achieved through the adherence to detailed protocols set by independent **carbon registries**. Registries monitor and supervise the listing, reporting, verification, and tracking of carbon offsets.

Each registry may have multiple protocols for use with different types of carbon offset projects. For example, the protocol for developing and quantifying the generated carbon offsets for a tree-planting project will differ from an improved forest management project. And under different registries, the protocols for developing the same

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type of carbon offset project may differ. The most common registries for forest carbon projects are American Carbon Registry (ACR), Climate Action Reserve (CAR), and Verra's Verified Carbon Standard (VCS). For forest carbon projects in the Northeast, ACR is more commonly used compared to the other registries, but there are some new programs for small forest parcels that use protocols developed under Verra's VCS. There are also other registries developed or in development for specific sectors, for example, City Forest Credits³ is designed for municipalities.

Carbon offset projects may be developed for either the **compliance (regulatory) market** or the **voluntary market**. The distinction between these two types of markets pertains only to the GHG emitter – the offset purchaser – and not the seller of carbon offsets. In compliance markets, there is a government mandate for emitters to reduce emissions, while in the voluntary market there is no mandate.

Compliance market

Under compliance markets, GHG emitters are required by law to reduce their emissions but are provided the option to purchase allowances from other regulated emitters or buy offsets from carbon sequestration or emissions-reduction projects. For example, California's Cap-and-Trade program allows emitters to buy a percentage of their required emissions reductions from carbon offset projects, but the amount that emitters can offset is decreased over time. This market is overseen by the California Air Resources Board (ARB). In the Northeast, the Regional Greenhouse Gas Initiative (RGGI) cooperative market establishes regional caps on emissions from the power sector. As more governments regulate GHG emissions, we may see an expansion of compliance markets. Currently, these markets are not well-suited for Vermont forestland owners because California's Cap-and-Trade program restricts the number of offsets purchased from projects located outside of the state of California and RGGI is not currently used for forest carbon projects.

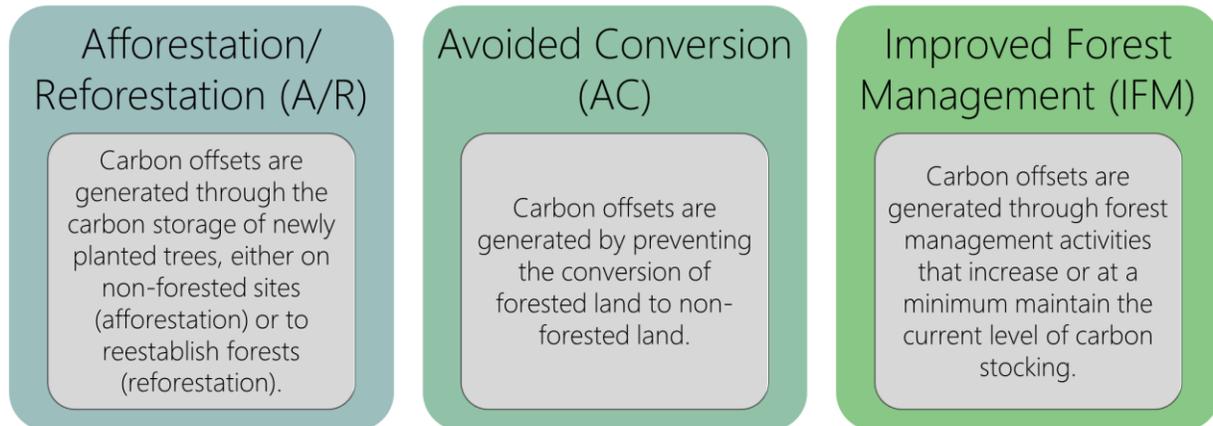
Voluntary market

Unlike the compliance market, participation in the voluntary carbon market is not required by law and any individual or entity seeking to mitigate emissions may purchase offsets on the voluntary market. For this reason, protocols developed under the voluntary market generally follow more flexible accounting and measurement guidelines than those on the compliance market. Less regulation can mean that carbon offset prices span a wider range than in the compliance market and more factors affect the price, including the type and location of the project, additional project benefits, marketing, and demand. The voluntary market also includes a larger variety of forest carbon protocols, including protocols that more easily allow for the aggregation of multiple forest parcels into a single carbon offset project.

³ <https://www.cityforestcredits.org/about-city-forest-credits/>

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Three Types of Forest Carbon Projects



Types of forest carbon offset projects

There are three different types of forest projects currently eligible to produce carbon offsets: **afforestation or reforestation (A/R)**, **avoided conversion (AC)**, and **improved forest management (IFM)**.

Unless the parcel has an imminent risk of deforestation or tree planting will be undertaken, most forestland owners in Vermont will be interested in the Improved Forest Management (IFM) category. IFM protocols allow for both active and passive forest management. There are a variety of forest management strategies that can be used to maintain or increase carbon stocks. Timber management under a carbon offset project may require lighter and less frequent harvests compared to forests where the primary objective is wood product yield.

Key attributes of forest carbon projects

For all types of forest carbon projects, carbon registries outline strict requirements for eligibility. Carbon projects must demonstrate that there is additional carbon capture that would not have occurred without the carbon project – this is called **additionality**. Additionality is the difference between the carbon storage of the forest if it was enrolled in a carbon offset project compared to the carbon storage if it was not enrolled in a carbon project. The latter is usually called the **baseline**. The baseline is defined according to the project type and registry's protocol; it can relate to common practice, business as usual, standardized emissions estimates, profit maximization, or minimum legal requirements. The project must have a long-term commitment, or **permanence**, to ensure that the stored carbon is not immediately released. And the project must demonstrate that it does not facilitate any new emissions elsewhere, or **leakage**. For example, there are penalties if the carbon project results in an increase in timber harvesting in another location. The number of carbon credits that a project produces is based on the additionality while accounting for permanence and leakage.

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Key Attributes of Forest Carbon Projects



The general process for developing a forest carbon project for the voluntary market

Forest carbon offset projects are open to private, industrial, tribal, and public landowners. To begin a forest carbon project, typically the landowner needs to contract with a private carbon project developer. The project developer will work with the landowner to oversee, develop, broker, and market the carbon project, for a fee, typically as a percent of sales proceeds. For a list of current forest carbon developers, refer to the table at the end of this document. Developers may enroll projects in one or more carbon registries but are independent from the registries.

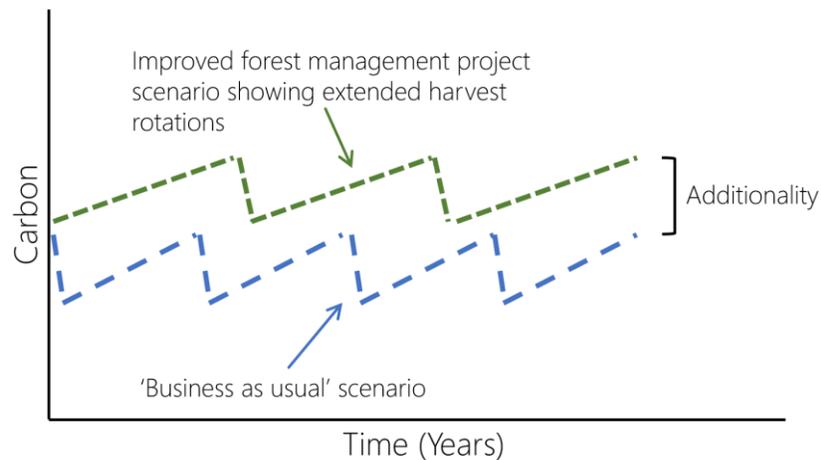
The developer will determine if the land is eligible for enrollment under a carbon registry protocol and financially feasible to proceed. Often this process is free, or has a nominal fee, and does not require a commitment. For the assessment, the developer will need information on the characteristics of the forest parcel, like forest type, size, and stocking. Forest parcels do not have to be contiguous to be enrolled but do require a single landowner unless project aggregation is pursued (see more details under *Forest carbon options for small forests* below). The landowner will need to provide the developer with information on any legal constraints on the parcel, like easements, planned management, and parcel operability that may limit harvesting. With satellite data, this assessment may be able to occur without collecting new data. Having a current active management plan can facilitate this process. If the project is eligible and financially feasible, the official project development stage begins.

The developer will conduct a sample inventory of living and dead trees to quantify carbon stocks. To compute the potential offsets generated from the project, the developer will use the inventory data to model average carbon stocks over time under the baseline scenario and the project's scenario. For improved forest management (IFM) projects under the American Carbon Registry (ACR), one of the commonly used protocols in the Northeast computes the baseline carbon stocks using the legally acceptable harvest that could occur, per the forest and landowner type, to maximize near term revenue. The project scenario must retain more carbon on-site compared to the baseline, but that can be achieved with a variety of silvicultural strategies, like extended rotations (harvest

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intervals), higher retention of trees, and/or lower removals. The difference between the carbon stocks in the project scenario and the baseline is the additionality and the basis for the number of offsets generated. IFM projects require a forest management plan that will describe the silvicultural prescriptions that will be implemented to achieve higher carbon stocks compared to the baseline.

Example of Additionality in an IFM Carbon Project



Projects must also include deductions for leakage. If the project will harvest fewer wood products compared to the baseline scenario, the project could result in increased timber harvesting somewhere else to meet wood market demands. Leakage is deducted from the number of offsets generated based on the amount of reduction in harvested wood products compared to the baseline. Projects must also compute the risk of unintentional reversal that could occur from a natural disturbance like an ice storm, insect outbreak, or fire. Projects must contribute a proportion of offsets generated to a buffer pool (like contingency funds) based on the project-specific risk of reversal. These calculations and assumptions must be reviewed and verified by an independent third-party organization, which is arranged by the project developer.

Once the project has been successfully verified, the registry gives each metric ton of emissions reduction a unique serial number and the offset can then be sold. Once purchased, the offset is retired. Forest carbon stocks must be periodically re-measured and verified.

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Example Forest Carbon Project Development



Note that this process can vary depending on the registry, project type, and protocol used; further, newly developed programs for smaller forest parcels that aim to reduce the cost of project development will differ.

Carbon offset project compatibility with other forestland programs

Forestlands enrolled in a forest carbon offset project can be actively managed for timber and other wood products along with additional goals like improved wildlife habitat or recreational opportunities. In general, forest carbon offset projects are compatible with other forest programs if they do not restrict timber harvests or mandate carbon storage.

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Use Value Appraisal program

Forests enrolled in Vermont's Use Value Appraisal (UVA) program (the current use tax equity program) are eligible for enrollment in a carbon offset market. A key criterion of the UVA program is that the parcel has an up-to-date and active forest management plan prepared by a VT licensed forester and approved by a Vermont Forests, Parks and Recreation County Forester. The pre-existence of a UVA management plan can help determine eligibility and expedite the carbon offset project development process. If the land continues to be actively managed under a carbon offset project, selling carbon will not invalidate the UVA program criteria. Keep in mind that if the UVA forest management plan needs adjustment because of enrollment in a carbon project, an amendment will need to be approved by VT FPR.

Conservation easements

Having a conservation easement on forestland, like through a local land trust or government organization, should not restrict eligibility in a carbon offset project. The exceptions would be if the easement specifically mandates that the landowner maximize forest carbon or restricts timber harvest. In these cases, future carbon capture is already accounted for to meet the legal agreement of the easement and the landowner cannot sell the forest carbon a second time. For some projects, having a conservation easement can lower the risk associated with the project, which can increase the number of offsets credited. The Forest Legacy Program is a federal program that provides funding to states to conserve private land with unique or important forest characteristics and environmental value. It is compatible with carbon markets, conservation easements, forest certification, and Vermont's UVA program, and the program requires a management plan.

Cost-share programs

The Environmental Quality Incentives Program (EQIP), administered by the Natural Resources Conservation Service (NRCS), can provide financial and technical assistance to landowners for forest management planning and silviculture, including forestland enrolled in a carbon offset program.

Third-party forest certification

Forest certification programs ensure that forestland owners use sustainable forest management practices. All three types of forest certifications – Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and American Tree Farm System (ATFS) – are compatible with carbon offset markets.

Forest carbon options for small forests

Currently, many challenges exist for owners of small forest parcels to sell forest carbon. Upfront project development costs can be large and therefore challenging when not spread over many acres of ownership, and the process is complex. Under current protocols and market prices for carbon offsets, projects need to encompass more than 2000 acres to be financially viable, although this is not a technical or legal requirement. As carbon markets evolve, the cost of development may decrease and the sale price of a carbon offset may increase such that the size threshold for financial feasibility declines.

Selling Forest Carbon is Compatible with Many Other Programs



VT Current Use



Forest Legacy



EQIP



SFI



FSC



American Tree Farm

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While current markets favor large forest parcels, the voluntary market is rapidly developing, and new options are becoming available. One option for smaller landowners is to aggregate smaller forest parcels into a single carbon offset project. Because there are more landowners involved in an aggregation project, it can introduce additional complexities and risks. While some carbon registries have guidelines for aggregating forest carbon projects, successful aggregated projects are not yet common. There is one example of project aggregation in Vermont: The Cold Hollow to Canada carbon Project, a forest carbon offset aggregation project of 10 landowners⁴. Aggregation projects are being developed under The Nature Conservancy's Family Forest Co-op program⁵.

As there is growing interest in enrolling land in a carbon offset project, coordinated efforts to provide financial and technical assistance to small forest owners will likely increase. For example, there are newly developed pathways for smaller private forests to enter carbon markets that seek to lower project development and inventory costs:

- [The Family Forest Carbon Program](#)⁵

A joint program between The Nature Conservancy and American Forest Foundation that reduces development costs by using national forest inventory data and a payment-for-practice incentive. The minimum parcel size is 50 acres. Currently, this program is being piloted in Pennsylvania and Western Massachusetts/Southern Vermont, but expansion to other areas is expected to occur soon.

- [Core Carbon](#)⁶

A new program by carbon developer Finite Carbon is designed for family forests as small as 10 acres. This program will be released in 2021.

In addition to these new programs for owners of small forest parcels, there is a recognized need for more standardization and transparency for carbon projects for natural and working lands, like forests and farms. Currently, there is a bipartisan bill in the US Congress, the Growing Climate Solutions Act⁷, that would establish a USDA certification for carbon experts, developers, and third-party verifiers and an online marketplace for buyers and sellers. The accompanying Rural Forest Markets Act⁸ would provide project funding.

How does a landowner enroll forestland in a carbon offset project?

A forester may be able to help a landowner navigate forest carbon offsets, but as this is a new and rapidly changing economic sector, talking to a carbon developer will be the best way to determine if the land is eligible to be enrolled in a carbon offset market. Because there are not many forest carbon projects in the Northeast, many foresters and managers do not yet have experience in project facilitation.

Landowners can use the table below to find a project developer that matches the amount of forestland and other criteria. Carbon project developers can help determine if your property is a good fit for a carbon program. Keep in mind that many of the programs for smaller forest owners are in development; you may need to wait until they are open for enrollment.

⁴ <https://vlt.org/forests-wildlife-nature/local-solution-global-impact-forest-carbon>

⁵ <https://www.nature.org/en-us/what-we-do/our-insights/perspectives/family-forests-powerhouse-in-climate-mitigation/>

⁶ <https://corecarbon.com/>

⁷ https://www.braun.senate.gov/sites/default/files/2020-06/Growing%20Climate%20Solutions%20Act%20One%20Pager_0.pdf

⁸ https://www.agriculture.senate.gov/imo/media/doc/Rural%20Forests%20Factsheet_Final.pdf

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List of Forest Carbon Project Developers and Programs⁹

Developer/Program	Website	Registry standard(s) ¹⁰	Commitment	Min. parcel size
American Forest Foundation & The Nature Conservancy – Family Forest Carbon Program ¹¹	https://www.familyforestcarbon.org/	VCS	20-year minimum	50-2400 acres
Blue Source	http://www.bluesource.com	ACR, VCS, CAR, ARB	40 or 100 years	>3000 acres
Finite Carbon	https://www.finitecarbon.com	ACR	40 years	>2000 acres
Finite Carbon – Core Carbon Program ⁴	https://corecarbon.com	ACR	40 years	>40 acres
Forest Carbon Works	https://forestcarbonworks.org	ARB	100 years	>40 acres
Forest Carbon Partners (New Forests)	https://newforests.com.au/forests-carbon-partners	ARB	100 years	Not provided
SilviaTerra – Natural Capital Exchange (NCAPX)	https://www.silviaterra.com/ncapx	RISE ¹²	1 year	>20 acres
Spatial Informatics Group (SIG)	https://sig-gis.com/carbon-offsets	ARB, CAR, VCS	40 or 100 years	Varies
Terra Carbon	http://www.terracarbon.com	ARB	100 years	Not provided
The Nature Conservancy – Family Forest Co-op	https://www.nature.org/en-us/what-we-do/our-insights/perspectives/family-forests-powerhouse-in-climate-mitigation	ACR	40 years	200-2400 acres
The Nature Conservancy & Blue Source – Working Woodlands	https://www.nature.org/en-us/about-us/where-we-work/united-states/working-woodlands	VCS	40 years	>2400 acres

Abbreviations: ACR, American Carbon Registry; ARB, California Air Resources Board (compliance market); CAR, Climate Action Reserve; RISE, Real, Immediate, Scalable, and Efficient; VCS, Verra’s Verified Carbon Standard.

Frequently asked questions about forest carbon projects

Is active forest management allowed under a forest carbon project?

Under the ‘Improved Forest Management’ type of forest carbon projects, parcels can be actively or passively managed. Landowners will need a professional management plan describing the silvicultural strategies and prescription schedule. Forest management can have additional carbon benefits if harvested wood products are used as a substitute for fossil fuels, concrete, or steel, and long-lived, durable wood products can result in carbon storage for the life of the product.

⁹ As of January 2021, list is subject to change. Inclusion does not signify an endorsement by VT FPR.

¹⁰ Refer to list of registry abbreviations presented below table.

¹¹ Currently in development.

¹² Note that this framework varies from the other standards and is in its first year of enrollment. Refer to <https://www.silviaterra.com/ncapx>

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What happens if there is a natural disturbance on the property?

Most carbon projects require that a certain number of carbon offsets be set aside in case there is a loss of forest carbon due to a natural disturbance, like insect defoliation, fire, wind event, or ice storm. The methodology to compute the risk of natural disturbance and the number of offsets to add to this buffer pool varies by the registry. A carbon developer can provide more information.

Does it matter what kind of wood products are produced from the harvest?

The expected lifecycle of the harvested wood products can add additional carbon storage, but this does require accounting. Many protocols simplify this accounting and assume a set life span for harvested wood.

Can a carbon offset contract be terminated early?

There can be a large penalty for leaving a carbon project and the landowner may be responsible for repaying the offsets generated. These details are described in a carbon project contract. Entering a carbon project does require a time commitment. Although there are new options that require shorter commitments, these programs are in development or are not yet widely vetted.

How much revenue can you earn from a forest carbon project?

The amount of revenue a landowner can make with a carbon offset project varies greatly. It depends on the market, tree stocking and condition, site factors, size of the parcel, and future timber harvests. Costs of project development, inventory, and verification can vary by project and the standard used. The new programs for smaller parcels (e.g., Family Forest Carbon Program) are designed to reduce development costs through a 'pay-for-practice' framework; however, these programs are in the testing phase. In the voluntary market, carbon offsets generated from an improved forest management project can sell for more than other projects because of the co-benefits included with keeping forests as forests (e.g., wildlife habitat, flood resilience). For projects that have occurred in New England, landowner revenue can range from \$5-\$25 per acre per year¹³.

How long does it take to develop a forest carbon offset project?

From contract signing to selling of credits takes about 12 to 24 months with most current standards, but this depends on many factors like project type, location, forest heterogeneity, and time of year. New programs for family forests may have different timelines because project development methods differ.

What is the minimum land requirement?

The amount of forestland needed for a forest carbon offset project varies by the standard used but is generally more than 2000 acres. Refer to the table 'List of Forest Carbon Offset Project Developers' above. There are programs for forest parcels as small as 10 acres, but these programs are in development.

Is forestland enrolled in current use eligible for a carbon offset project?

Land enrolled under Vermont's Use Value Appraisal (UVA), or current use, program is eligible for a carbon offset project, provided that the land meets the criteria outlined by the specific carbon registry. Keep in mind that forestland must be actively managed to be enrolled in the UVA program.

¹³ For more details on pricing see Forest Trends' Ecosystem Marketplace. Carbon Markets Hub and Keeton *et al.* Vermont Forest Carbon: A Market Opportunity for Forestland Owners. https://www.vlt.org/wp-content/uploads/2018/07/Vermont_Forest_Carbon.pdf

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