Case Profile Series on
Land Trusts as Climate Change Solution Providers

Cold Hollow Carbon:
A Vermont Forest Carbon Cooperative for Climate Change Mitigation

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INTERNATIONAL LAND CONSERVATION NETWORK

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CASE OVERVIEW FOR EDUCATORS

Topic: Aggregating Forest Carbon to Generate Offset Credits

Subtopics: Carbon Sequestration, Carbon Markets, Family Forests, Cold Hollow to Canada

Timeframe: 2012 to 2021

Primary Learning Goals: (1) Better understand the role of forest carbon aggregation in enabling small family forest owners to participate in carbon markets and enhance carbon sequestration in their forestlands to mitigate climate change. (2) Move through project development analysis that considers, in sequence, situation, challenge, proposed solutions, implementation, and results.

Secondary Learning Goals: (1) Develop insights into how civic sector leadership, together with the support of key players from the public, private, civic and academic sector actors, leveraged existing partnerships to develop a process that makes forest carbon sequestration economically viable for family forest owners. (2) Gain basic appreciation of the complexity of forest carbon project development.

Primary Audiences: (1) Land Conservation practitioners, (2) Forest carbon project developers, (3) Public decision-makers and regulators, (4) Companies and businesses, (5) Staff, directors and supporters of NGOs, community organizations, (6) climate change analysts and advocates, and (7) interested members of the general public.

Prerequisite knowledge: General knowledge regarding climate change, carbon markets, and the conservation of land and biodiversity.

Summary: This case focuses on the development of a pioneering forest carbon aggregation project by Cold Hollow to Canada at the state and regional level, with implications for national and international forest carbon offset credit policy and practice. The project helps individual landowners of small forest parcels in Vermont overcome barriers to entering carbon markets by bringing them together in an aggregated project in which they maintain and increase carbon stocking levels across their forested parcels to generate carbon offset credits. The case assists forest carbon project developers, corporate and individual consumers, legislators and regulators, and other interested parties better understand the importance of aggregation in allowing family forest owners to contribute to climate change mitigation goals through participation in carbon markets. The development of the project itself, and the multi-sector partnerships required to make project successful, has taken almost a decade. The project, which has had positive initial response, may be adapted to or inform forest carbon projects in many locations around the globe, from Africa to the Asia-Pacific.

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Vermont’s Belvidere Mountain in Fall
(Photo courtesy of Jenny Goyne, Cold Hollow to Canada)

Executive Summary

This case profile details the genesis of the first aggregated forest carbon offset project in the United States, known as Cold Hollow Carbon. Developed by a multi-consortium partnership led by the Vermont Land Trust (VLT), and implemented through its subsidiary, Vermont Forest Carbon Company, this project has successfully aggregated 10 landowners over 12 parcels, totaling roughly 8,600 acres within the Cold Hollow mountains of Vermont, to generate carbon credits as one entity for sale in the voluntary carbon market. This proof-of-concept project has demonstrated that aggregated carbon arrangements can, in an economic and efficient manner, connect forestland owners to carbon offset markets in areas where smaller, private forestland holdings predominate. It has also demonstrated that land trusts and their special purpose subsidiaries can be appropriate homes for aggregated carbon offset projects.

The multi-sectoral, multi-consortium partnership responsible for organizing and realizing the Cold Hollow Carbon project includes a highly diverse group of organizations, including: the Vermont Land Trust (VLT), the University of Vermont (UVM), the Spatial Informatics Group (SIG, a private company providing analytical services), the Cold Hollow to Canada Regional Conservation Partnership (CHC RCP), and The Nature Conservancy (TNC). In addition to helping connect potential buyers to the carbon credits, TNC also provided guidance and supported early stages of the project through a Natural Climate Solutions Accelerator Grant funded by the Doris Duke Foundation. Two organizations deeply rooted in sustainable natural resource use and economic development, the High Meadows Fund and the Vermont Housing and Conservation Board, also provided funding and project guidance. Financial guidance for the project was offered by the Lyme Timber Company and Finite Carbon. And the principal buyers of the carbon credits supplied by the project are Gratitude Railroad, an impact investment group, and Amazon.com.

Carbon dioxide emitted into the atmosphere is, of course, a major contributor to climate change. Scientific research has shown that even relatively mature forests have the potential to sequester and store large quantities of carbon (that is, remove carbon from the atmosphere and store it in woody biomass and forest soils). Furthermore, the carbon storage potential of such forests can be enhanced through the implementation of certain forest management practices.

Landowners with natural capital assets such as forests can monetize this potential by managing their forests to improve carbon storage, and then selling carbon credits (also known as carbon offsets) into compliance markets or voluntary carbon markets. Such credits can then be bought by regulated entities that must *comply* with current environmental regulations to reduce their carbon footprint (that is, the net amount of carbon which they emit after offsets), or by individuals, non-profit organizations and companies that want to *voluntarily* reduce their carbon footprint for a variety of reasons, including: meeting corporate sustainability goals and shareholder expectations; enhancing the public reputation of their company or product; fulfilling their civic duty; and to show their ability to comply with potential future regulations.

The number of credits that a forest landowner (or an aggregated group of forest landowners) is able to sell is determined in part by the size of the available forest parcel(s), the forest type(s), and existing and projected stocking levels associated with certain management practices, all of which impact "baseline" carbon storage against which carbon credits are generated. The number of credits is calculated by experienced forestry experts who use field-based measurements and other sources to estimate the amount of carbon that can be sequestered by a specific forest landholding in excess of the established baseline.[1] For both the compliance and voluntary markets, carbon credits are generated following established protocols and listed in registries; the Vermont Forest Carbon Company has used the American Carbon Registry (ACR).

One of the impediments to participation in these markets that owners of relatively small forest lots face is the high upfront "soft" costs (a term generally analogous with "transaction costs"). These include costs associated with field inventory, the estimation of forest carbon sequestration potential, development of an appropriate financial structure, third-party verification, registry fees and other necessary work. Cumulatively, such soft costs can range from about $250,000 to $1,000,000 or more per project – a prohibitive set of expenses that may keep most owners of relatively small forest parcels out of the market (i.e., generally, excluding most lots smaller than 5,000 acres, and nearly all lots smaller than 1,500 acres).[2]

What the Cold Hollow Carbon project demonstrates is that, by aggregating small- to medium-sized, privately-owned forest parcels of about 200 acres or more into one package, that can be assessed and readied for market, soft costs can effectively be spread over a larger number of forest acres. Spreading the costs in that manner reduces the soft costs per acre. The owners of relatively smaller forest parcels can, in an aggregated project, bring their carbon credits to market. In combination with more volatile timber markets, and ancillary income from the sale of non-timber forest products such as maple syrup, such owners are better able to generate enough profit and positive cash flow, as well as multiple co-benefits, to make keeping forests as forests financially feasible.

One of the co-benefits of such aggregated projects is that they can incentivize private owners to protect their land as forests over extended periods of time, precluding the conversion of forests to other land uses. For example, the sale of credits into the Cold Hollow Carbon cooperative agreement requires participating landowners to commit to carbon stocking targets in their forests for 40 years. Over the term of that agreement, participating forest owners are not able to convert their forests to uses other than those specified in their agreement with the Vermont Forest Carbon Company.

In aggregation, the incremental protection of many such relatively small forest lots can generate additional systemic benefits across a large swath of Vermont, and even the entire Northern Forest, that stretches from the Gaspe Peninsula in Quebec and New Brunswick, Canada to western New York state. The expected benefits of the Cold Hollow Carbon project (officially known as the Forest Carbon Cooperative at Cold Hollow to Canada, which is administered by the Vermont Forest Carbon Company, a subsidiary of the Vermont Land Trust) include the following:

- Increased carbon sequestration by the acres of forest enrolled in such efforts;
- Income for landowners over 20 years to pay for enhanced forest management practices;
- Healthier forests, cleaner water, and reduced damage from future floods;
- A greater diversity of plants and animals, and healthier wildlife habitat;
- Continued timber harvests and maple sugaring;
- Potential reduction of summer heat island effects in the nearby towns and cities; and
- Long-term protection of the Northern Forest, and the more general environmental and economic values it provides.

Through similar cooperative entities, such benefits could potentially be extended across Vermont, the entire Northern Forest region, and beyond:[3]

It is important to note that, as the project developed, key ideas, professional skills, funding, energy and enthusiasm were contributed by individuals and organizations working in the civic (non-profit and philanthropic), private, public and academic sectors. In addition, in geographic terms, the project crosses multiple property boundary lines, town lines and county lines within Vermont. In these ways, this is a large-landscape project that is based on multi-sectoral, multi-jurisdictional, multi-institutional and multi-parcel collaboration. Several (but certainly not all) of the key players, across sectors, are described here.

- *Diverse Landowners Engagement*: Most fundamentally, the demonstration project includes 12 parcels across ten landownerships and encompasses more than 8,600 acres of forestland in the Cold Hollow mountains. Each of the landowners has agreed to a forest management protocol crafted to meet the 40-year requirements of the voluntary carbon credit market (a period shorter than the 100-year term more typically required in compliance markets). In addition to ongoing revenues from permitted timber, syrup and other forestry operations, each of these landowners will receive income from the sale of carbon credits of $282 per acre on average. Forestland owner agreements were signed in Spring 2020, and while credits will not be formalized for release until Winter 2021, verification has been completed and the project has commitments for credit purchase from multiple buyers that are described below.

- *Academic Sector Engagement*: Bill Keeton, Professor of Forest Ecology and Forestry and Director of the Carbon Dynamics Laboratory at the University of Vermont's Rubenstein School of Environment and Natural Resources helped to conceive the project as early as 2012. It was over months of conversation with Nick Richardson, who was in 2012 the VLT's Vice President for Enterprise and Finance, that Keeton succeeded in getting the VLT to take a serious interest in the potential for using carbon credits to protect Vermont forestland. Keeton joined the Board of Directors of the Vermont Land Trust in 2015. Keeton has continued to lead feasibility studies and help to see the project through to realization in 2020. In doing so, he remains true to a goal he has long held as a researcher: "to enhance carbon storage as a way to help fight climate change and at the same time generate income for forest landowners from ecologically friendly forestry practices."[4]

- The Cold Hollow to Canada Regional Conservation Partnership is one of many Regional Conservation Partnerships in New England affiliated with the Regional Conservation Partnership Network (RCP Network) now managed by Bill Labich of the Highstead Foundation. Part of the genesis of the idea of Regional Conservation Partnerships, and of the RCP Network, was the seminal *Wildlands and Woodlands* [5] vision paper authored in 2005 by: David Foster of the Harvard Forest, Harvard University; David Kittredge of the University of Massachusetts Amherst; and a group of seven additional collaborators, including Anthony D'Amato, currently Director of UVM Research Forests and a colleague of Keeton's on the UVM Rubenstein School faculty.

- *Civic (Operating Non-Profit and Philanthropic) Sector Engagement*: Nick Richardson, the President of the Vermont Land Trust since 2018, has been hard at work developing the Cold Hollow Carbon project since he first began discussing it with Keeton in 2012. VLT is at the center of this project, and its subsidiary, Vermont Forest Carbon Company, has the fiduciary responsibility for overseeing the project over its 40+ year lifetime. Richardson is confident that this project will have beneficial long-term impacts: "…future Vermonters will look back with gratitude for our effort, as they live surrounded by a healthy forest. It's what inspires us all to keep trying new things and finding new ways to work toward this goal."[6]

- Charlie Hancock and Nancy Patch founded the Cold Hollow to Canada Regional Conservation Partnership (CHC RCP) with the aspiration that it could build community capacity and consensus towards the protection and stewardship of the region's healthy and intact forests, the growth of a strong and sustainable local economy, and the establishment of core wildlife habitat and corridors.[7] The volunteer group was established as a registered non-profit in 2013, and has, as was envisioned, become an important community resource, with the Cold Hollow Carbon project an important pillar of its agenda. The CHC RCP partnered with the VLT in conducting feasibility research on the proposed carbon co-operative, and CHC RCP members own most of the land on which the Cold Hollow Carbon project is based.

- The High Meadows Fund primarily serves as a grantmaking organization, promoting "vibrant communities and a healthy natural environment while encouraging long term economic vitality in Vermont."[8] Over the course of several years, High Meadows made a series of grants to the CHC RCP to advance its Woodlots program, a precursor to the Cold Hollow Carbon project that encourages geographically clustered woodlot owners to work together to sustainably manage their land. Many of the landowners that eventually enrolled in the Cold Hollow Carbon project had previously known one another and the CHC RCP through the Woodlots sessions. High Meadows also helped to finance the Cold Hollow Carbon feasibility study.

- The Nature Conservancy participated in the CHC project at several stages. Locally, TNC Vermont Chapter staffer Phil Huffman has been a longtime proponent of the Staying Connected Initiative, a precursor of the CHC RCP. In addition, TNC made a key investment

from the TNC Natural Climate Solutions Accelerator Grant in the feasibility study for the Cold Hollow Carbon project. Throughout the project development, local TNC staff Jim Shallow and Troy Welty, and TNC Working Woodlands director Josh Parrish, provided advice on structure and marketing. TNC was key in helping to bring a multi-million-dollar investment in the CHC carbon credits from Amazon.com (described below) at a critical point in the project's evolution. With that funding, the project was able to reach its current 8,000-acre scale. The investment was referenced by Lynn Scarlett, former Acting Secretary at the United States Department of the Interior, who now serves as the Chief External Affairs Officer at The Nature Conservancy headquarters in Arlington, Virginia:

> "Family forest owners are a critical piece of the puzzle when it comes to tackling climate change. But many of America's nearly 11 million family forest owners may face barriers that prevent them from taking action. Those who own small acreages have not been able to access existing carbon markets – which can provide income as well as help sequester carbon on their lands – due to high development costs. This funding from Amazon will, for the first time, allow small-scale forest landowners to tap into the economic opportunity linked to the carbon sequestration and storage potential of U.S. forests."[9]

- *Public Sector Engagement*: Both the Vermont Housing & Conservation Board (VHCB, an agency of the State of Vermont) and the USDA's Regional Conservation Partnership Program (RCPP) made grants to the Cold Hollow Carbon project during its developmental phase. The USDA RCPP grant, made on January 3, 2017 at the very end of the Obama Administration in Washington, awarded $640,000 to expand the Cold Hollow to Canada woodlot program, a critical precursor to the Cold Hollow Carbon project.[10]

- *Private Sector Engagement*: The Spatial Informatics Group (SIG) is a developer of forest carbon offset projects that hand-selects projects aimed at mitigating climate change through improved forest management. SIG connects their clients to revenue in the carbon market, creating a pathway for them to receive payment for implementing sustainable forest management. SIG, where Bill Keeton has served as a Senior Scientist since September 2009, assisted the CHC project in building and using a Geographic Information System (GIS) model that was instrumental in the analysis of carbon storage potential on various forest parcels. During project development, SIG provided full project services, including inventory design, mapping, carbon modeling, management, registry documentation, and verification guidance.

- Lyme Timber Company, based in Hanover, New Hampshire, was an early financial advisor to the VLT as it sought to structure an aggregated carbon project. It was the Managing Director of Lyme Timber, Peter Stein, who put the CHC project in touch with Gratitude Railroad, an impact investment company which made a key initial investment in the project.

- In addition, Amazon.com became the anchor investor in the project. Kara Hurst, Vice President for Sustainability at Amazon, explained that the company's investment in the CHC project is part of its larger program focused on nature-based climate solutions.

> "These projects will conserve forests and wildlife for future generations – and the planet – and help remove carbon from the atmosphere… Amazon's Right Now Climate Fund will be investing $100 million in nature-based climate solutions like these that tackle the climate crisis while also having a positive economic impact in the community and in nature. We are delighted to work with The Nature Conservancy, the American Forest Foundation, and the Vermont Land Trust on our road to achieving Amazon's Climate Pledge goal of being net zero carbon by 2040.[11]"

In sum, the Cold Hollow Carbon project is a large landscape initiative that required nearly a decade to gestate. It engaged a great many key players from the public, private, civic and academic sectors, and leveraged a deep sense of place and environmental responsibility. Replication on a broad scale may take similar patience and building of trust across sectors, disciplines and communities-of-practice. The project may well, however, be a harbinger of effective forest conservation mechanisms that, in aggregate, can have a substantial and beneficial impact for generations to come.

Introduction and Context

Global Climate Change

Global climate change is perhaps the greatest existential threat to humanity today. Greenhouse gas (GHG) emissions, largely from fossil fuel burning, have risen dramatically over the past century, with the majority (78 percent) of GHG emission increases happening since 1970. Carbon dioxide (CO_2) is the largest component of overall GHG emissions and has increased by 90 percent since 1970.[12] The global scientific community has reached overwhelming consensus that GHG emissions are driving anthropogenic climate change, with increases in temperature and increased precipitation variability and intensity very likely in the coming decades. Unless mitigated in the very near future, the impact of these changes on ecosystems and biodiversity, agriculture, fresh water supplies, human settlement patterns and myriad other physical, social and economic systems are believed by the global scientific community to very likely be profound.

The time to act is now. In order to keep global warming under 1.5°C, the United Nations Framework Convention on Climate Change (UNFCCC) states that global GHG emissions must be reduced by 7.6 percent per year every year from 2020-2030.[13] Unfortunately, emissions appear to be rising. The United Nations Environment Programme's (UNEP) annual Emissions Gap Report in 2019 found that emissions had risen 1.5 percent annually from 2010-2020 and hit a record high of 55.3 gigatons of CO_2 equivalent in 2018. Importantly, this includes emissions from deforestation, which releases stored carbon into the atmosphere and also precludes future sequestration that the forested area may have provided if it were still standing.[14]

Natural Climate Solutions as a Mitigation Solution

While emissions reductions must necessarily include significant reductions from the transportation, energy, and building sectors, attention to the important role forests and other natural systems can play in absorbing GHGs and mitigating climate change is growing. Forests, in addition to other ecosystems such as wetlands, oceans, and grasslands, sequester and store carbon. That is, trees and plants in these ecosystems remove CO_2 from the atmosphere through photosynthesis and the CO_2 they retain is stored in forested areas across different carbon pools: aboveground biomass (trees and shrubs/understory); belowground biomass (roots); dead wood; litter; and soils. The current standing forest in the U.S. stores 56 billion metric tons of carbon.[15] U.S. forests sequestered 774 million metric tons CO_2 equivalents in 2018, an offset of roughly 12 percent of gross GHG emissions in the U.S. that year.[16]

The ability of natural systems to sequester and store carbon, and meet other climate-related needs for adaptation and resilience, has led to their inclusion under the banner of "natural climate solutions". Natural climate solutions are defined as: "conservation, restoration and improved land management actions that increase carbon storage or avoid greenhouse gas emissions in landscapes and wetlands across the globe".[17] Recent research by The Nature Conservancy and 15 other institutions has shown that mitigation pathways provided by nature-based solutions, such as avoided forest conversion and natural forest management, can achieve up to 37 percent of GHG emissions reductions necessary by 2030 to prevent a 2°C rise in global temperature.[18] Similar research on the U.S alone found that natural climate solutions could reduce up to 21 percent of its current annual net emissions. Among all pathways, reforestation and natural forest management have the greatest climate mitigation potential,[19] while also providing important conservation co-benefits such as clean air and water, habitat and biodiversity benefits, and climate resilience. And, natural climate solutions are available now and are often a cost-effective way to remove CO_2 from the atmosphere compared to other carbon-capture technologies.

The potential forests have to remove CO_2 and help mitigate climate change is threatened by deforestation, degradation and conversion of forest to other land uses. Keeping forests as forests and improving their management to maximize carbon storage and sequestration is therefore critical. Land use designations (e.g. protected areas, conservation easements, zoning), fiscal incentives (e.g. tax deductions, subsidies), and market mechanisms (e.g. payments for timber, water protection, or carbon sequestration) are among the methods for encouraging the conservation and sustainable use of forest resources to secure climate mitigation and other benefits.

Carbon Offset Markets

Payment for carbon sequestration through carbon offset markets is a market-based mechanism that seeks to provide another income stream to forest landowners to incentivize them to retain their forestland, and to manage it in a way that increases carbon sequestration over an established baseline. They layer on to existing revenue streams in the fields of conservation finance and sustainable forestry: conservation easements and enrollment in current use programs to reduce tax burdens; federal and state cost-share programs that support and incentivize sustainable forest management; and forest certification that connects forest owners practicing sustainable forest management to markets.

Carbon offset markets are an important tool in the solution space for climate change mitigation. They allow individuals, organizations and companies to offset their emissions through purchasing carbon credits generated from landowners, who through conservation or better management of their natural resources (primarily forests and grasslands) increase the carbon sequestration on their lands above business-as-usual or baseline practices. Offsets must be measurable, quantifiable, verifiable, and trackable. Offsets must also address issues of permanence, leakage and additionality. Permanence refers to the length of time for which management activities must be conducted for carbon benefits; leakage is the potential for changes in harvest and other practices resulting from offset terms to be transferred elsewhere, reducing the overall carbon benefit of the offset; and additionality is the need for practices to improve carbon sequestration and storage above baseline, or what would occurred naturally without them.

Both compliance and voluntary markets exist, with varying requirements for carbon measurement, verification, and monitoring. Two primary regulatory compliance markets in the U.S. are the California Air Resources Board (CARB) and the Regional Greenhouse Gas Initiative (RGGI), which are both cap-and-trade programs. RGGI is a cap-and-trade program for reducing CO_2 emissions from the power sector and includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.[20] Emitting companies or individuals are able to offset all or a portion of their emissions by purchasing offsets from verified projects.

While carbon offset markets are promising, the barriers to entry are high due to significant costs associated with project identification, development, implementation, and monitoring.[21] The kinds of projects typically included in a carbon offset project are afforestation/reforestation; avoided forest conversion; and improved forest management to increase carbon storage and sequestration on already forested lands. Carbon registries, such as the American Carbon Registry (ACR), Climate Action Reserve (CAR) and the Verified Carbon Standard, now Verra, develop offset protocols and serve as registries that can list, report, and verify offset projects and issue offset credits.

Given their multiple requirements, forest carbon projects may provide significant financial resources to forestland owners under the following conditions:[22]

- Landowners are willing to make binding and long-term commitments of carbon stocking on their properties beyond existing legal requirements;
- Maintaining high levels of carbon stocking on forested lands, which is a common requirement for carbon credits, is not incompatible with other uses of the property;
- The forested parcel has a relatively high level of timber stocking or has the ability to produce a high forest growth rate, and;
- The forest property is of a size that makes a carbon project financially viable.

Vermont's Forest Resource Base

The meaning of Vermont comes from the French "vert mont" or "green mountain", an apt name for a state containing 4.5 million acres of forestland that cover approximately 76 percent of the state's area. The Green Mountains run along the western side of Vermont, while the Appalachian Mountains are to the east (see Figure 1).

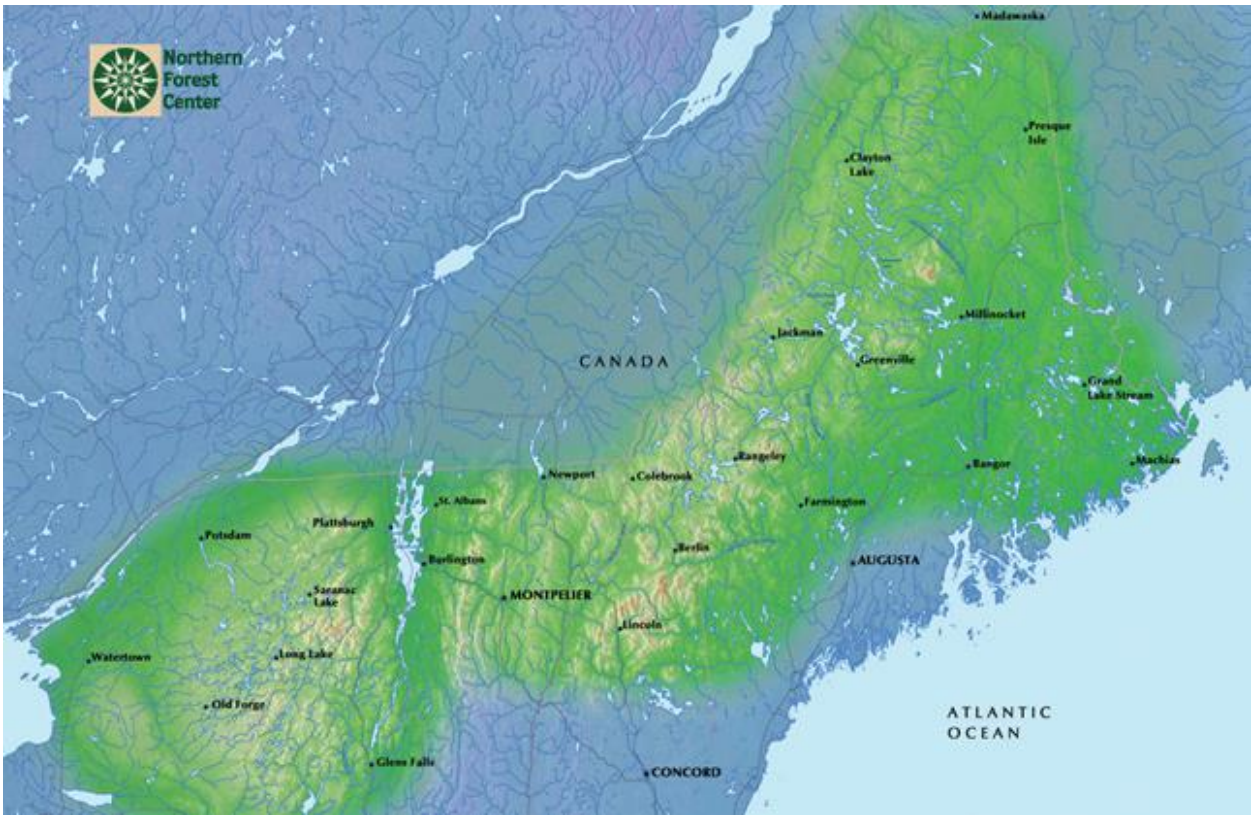

Figure 1: Vermont's forests are part of the Great Northern Forest, the largest remaining Broadleaf forest in the world. Note that the Montpelier, Burlington, St. Albans and Newport Vermont are all located within the Great Northern Forest. (Source: Northern Forest Center)

An estimated 3.3 billion live trees grow on this forestland, with a combined volume of 10.9 billion cubic feet. These forests are a critical source of multiple ecosystem services that underpin

the environment and economy of the state. From providing habitat for a myriad of species, to supporting rural communities through agricultural and timber products, and tourism, to filtering both water and air, the forests are the backbone of the state. Further, these forests capture the hearts and minds of both the local Vermont population as well as the millions of tourists that visit Vermont each year.[23] In fact, the State of Vermont has worked to develop a "Vermont Brand" based on research into who visits Vermont and the experiences and activities visitors are likely to engage in.[24] In a survey more than 70 percent of state visitors responded that they would "…like to be seen as active, independent, responsible, natural and adventurous".[25] No doubt the green mountains, resplendent in forest, features largely into creating this image.

Forestland ownership in Vermont is predominantly private (~79 percent); of the total forest land, 3.6 million acres are owned by 88,000 non-industrial forestland owners.[26] Families own the majority of private forestland; corporations and other private ownerships own the remainder.[27,28] A recent survey conducted by the Vermont Department of Forests and Parks, in coordination with the U.S. Forest Service's Family Forest Research Center, found that 62 percent of forestland in Vermont is owned by family forest ownerships (10+ acres in size). Most of these family forest ownerships (64 percent) are smaller than 50 acres in size; however, the families with parcels larger than 50 acres own more than 77 percent of the forestland. Family forest owners have largely managed their forestland in some active way, such as by harvesting timber, through a management plan, and by participating in the state's current use tax program. The greatest reasons they cited for owning forestland with 10+ acre parcels in Vermont were beauty and scenery, protecting wildlife habitat or nature, and privacy. Only 25 percent rated timber production as an important or very important reason for owning forestland.[29]

While forests are currently abundant in the state and are crucial to Vermont's economy, recent data suggests that forests are under threat. Owning forestland is expensive, and many forestland owners require financial return from the land in order to preserve it. Data from the USFS show that Vermont loses an average of ~15,000 acres of forestland each year and that 50,000 acres a year are harvested.[30] Forestland losses occur from a number of factors, such as conversion to development and agriculture, and degradation from insects and invasive plants. Vermont's forestland is also becoming parcelized: from 1983 to 2008, ownership of smaller forestland parcels (1-9 acres) doubled.[31] Forest parcelization, a greater number of landowners owning smaller parcels, and the aging demographic of forestland owners, who may sell forestland to other uses, threaten the continued existence of unbroken forest tracts capable of delivering multiple ecosystem services to humans and wildlife.

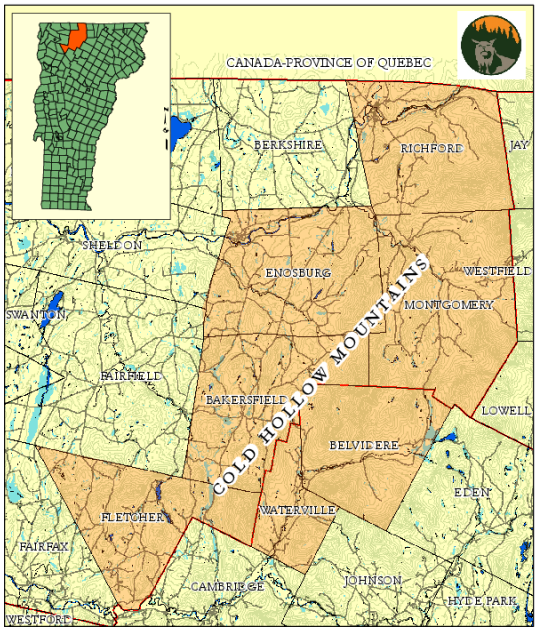

Figure 2: Cold Hollow Mountains Map. (Source: Cold Hollow to Canada)

The Cold Hollow Mountains

The Cold Hollow Mountains are a critical component within this important regional forest landscape, They extend roughly 170,000 acres across the northernmost point of the Green Mountain Range in the U.S., and encompass seven towns in northern Vermont (Fletcher, Waterville and Belvedere in the south and Bakersfield, Enosburgh, Montgomery, and Richford in the north up to the border with Canada) (see Figure 2). The Cold Hollow Mountains support a wildlife corridor from Vermont to Canada and are a critical area for a large diversity of bird species. Priority Forest Blocks, identified in Vermont's 2018 Conservation Design Plan, cover 117,000 of these acres (70 percent of the total area).[32] The area is also a working landscape, with an active and economically important forest products industry.

The Cold Hollow Mountains also lie within the Northern Appalachian-Acadian Ecoregion, which is the geographic focus of the Two Countries, One Forest initiative that has been carried out by Canadian and U.S. organizations working to conserve the region's forests (see Figure 3). The initiative has identified the 1.8 million-acre Northern Greens (located where Vermont's Green Mountains cross the Canadian border to the Sutton Range in Quebec) as one of five large and ecologically irreplaceable zones that are at risk of fragmentation.

Cold Hollow to Canada

Through meetings facilitated by the Enosburgh Conservation Commission in Enosburgh, VT, local landowners gathered to discuss elements of the landscape that were important to them, including for recreation and timber production. Eventually, in 2008, they formed the Cold Hollow to Canada (CHC) group to protect the landscape, and a steering committee from the group worked with Vermont Fish & Wildlife, VLT and the Staying Connected Initiative to develop a map of high-value habitat and connectivity areas. CHC helps landowners work on conservation easements to protect elements of the landscape, and at the end of 2012, it completed the Adams Pond conservation project through funding from the Staying Connected Initiative and VLT.[33]

CHC is a non-profit Regional Conservation Partnership (RCP) with a vision of "…a healthy and intact forested landscape that supports a strong and sustainable local economy through stewardship, with permanent protection of core wildlife habitat and connectivity across the entire Northern Forest."[34] The CHC RCP has existing conservation goals: currently, 20 percent (23,500 acres) of the Priority Forest Blocks within CHC are conserved; the CHC goal is permanent protection of 40 percent of the Priority Forest Blocks by 2030, which will require an additional 23,500 acres conserved. CHC RCP activity fits into a broader conservation ethic in New England. According to the RCP Network:

> "Across New England and eastern New York, conservation organizations and communities are banding together to meet the interests of countless landowners who wish to protect their land from development. These collaboratives, called Regional Conservation Partnerships (RCPs), vary in size and scope but share a desire to increase the pace and connectivity of their conservation activities. RCPs are informal networks of

people representing private and public organizations and agencies that develop and implement a shared conservation vision across town and sometimes state and international boundaries. RCPs in New England and eastern New York play an increasingly important role in achieving large- landscape-scale conservation that is also firmly woven into the needs and interests of the local communities."[35]

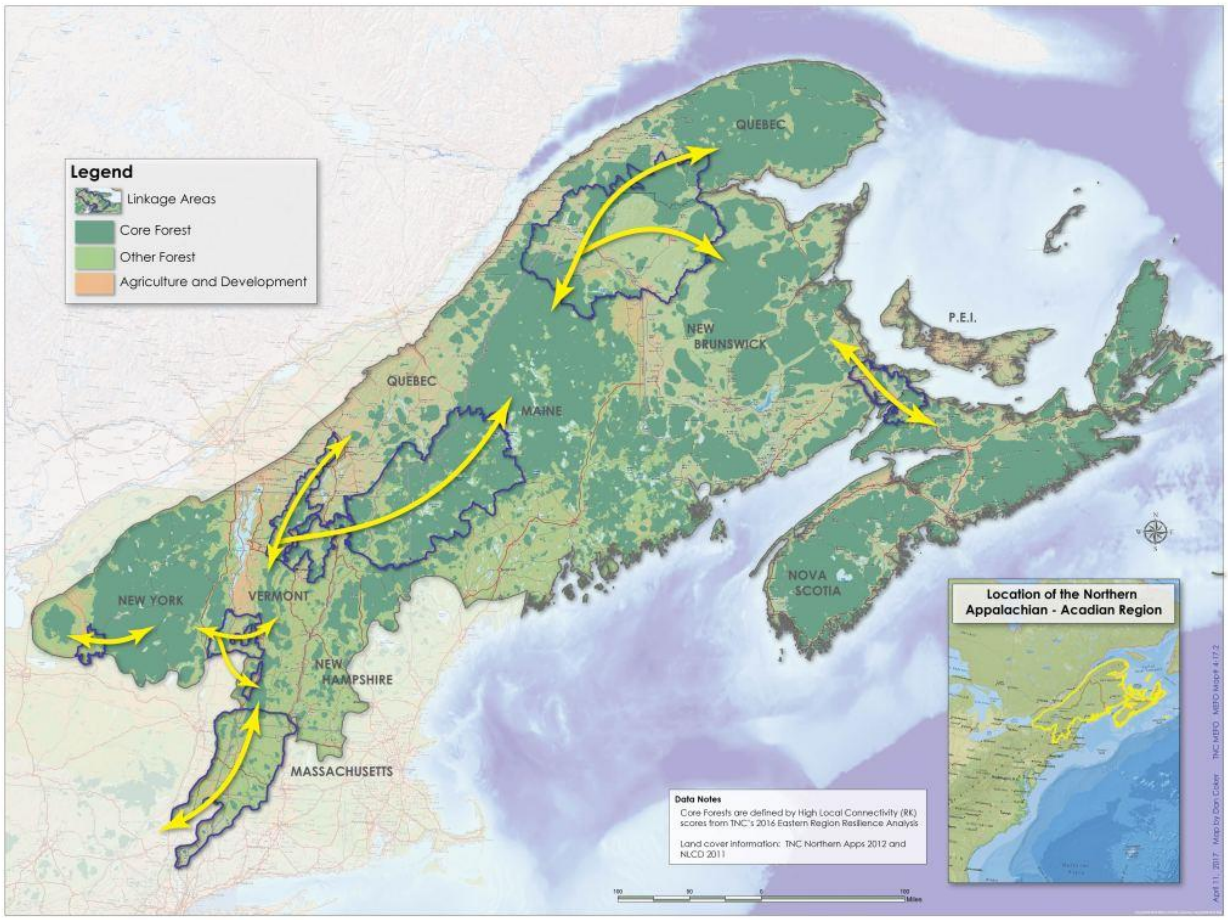

Figure 3: The Northern Appalachian-Acadian Ecoregion
(Source: The Nature Conservancy, Maine at https://2c1forest.org/ecoregion/)

In 2017, CHC received funding from an initiative of the United States Department of Agriculture's Natural Resource Conservation Service (USDA NRCS) called the Regional Conservation Partnership Program (RCPP). The RCPP grant funded the expansion of the Cold Hollow Woodlots Program, an element of the CHC RCP that "…engages a group of landowners from a town with contiguous or nearly contiguous forested properties, focusing their management activities on a landscape scale. The neighbor-to-neighbor collaboration results in a cumulative impact which is more significant compared to the effect one property owner can have on their own."[36] The RCPP program seeks to facilitate "…conservation partners and agricultural producers to work together to harness innovation, expand the conservation mission, and demonstrate the value and efficacy of voluntary, private lands conservation. The program is increasing investment in conservation from a diversity of partners, leading to cleaner and more abundant water, improved soil and air quality, enhanced wildlife habitat, and stronger rural economies."[37]

Prior to the RCPP federal funding, the CHC Woodlots Program had enrolled 12 landowners across 2,000 acres in the town of Enosburg with funding from a grant awarded by the Northeastern Area State and Private Forestry, U.S. Forest Service and the High Meadows Fund, and. RCPP funding was sought to increase the number of landowners participating to 50, and the number of acres covered to 8,000, by adding two additional woodlot groups in Richford and Montgomery, while continuing to serve the Enosburgh woodlot group. A total of $640,000 in RCPP project funds will support conservation practice implementation conducted by these groups. [38] While each landowner has an individual forest management plan and goals, the groups meet multiple times annually to share knowledge and to work collaboratively around activities such as wildlife habitat development, best management practices (BMPs) for working lands, and climate change resiliency. According to the NRCS, "[t]he peer-to-peer woodlands management approach of the Cold Hollow Woodlots Program is unique because it engages landowners with contiguous properties in prioritized forest blocks".[39]

The Vermont Land Trust

The Vermont Land Trust offers a brief description and history of itself on its website.

> The Vermont Land Trust saves the land that makes Vermont special. Since 1977, we have protected farmland and forestland from subdivision and development – knowing that once farms and forests are gone, they rarely come back. We want our children, grandchildren, and future generations to enjoy local food, farming, clean air and water, hiking, hunting, forestry, and sugaring.[40]

Since its founding in 1977, the Vermont Land Trust has protected over half a million acres of land in VT across over 2,500 properties, including 420,000 acres of forestland, through a legal tool called a conservation easement. Conservation easements are voluntary agreements between a landowner and land trust or government agency that restrict certain types of development, but allow some active land management, such as farming and timber harvest.[41]

In exchange for managing the land in ways that protect the underlying natural resource base and avoid land conversion, degradation and/or fragmentation, the landowner receives a tax benefit. Land trusts such as VLT are nonprofit organizations that typically have strong working relationships with communities and landowners in their area of operation, because they educate landowners about the conservation easement as an option to protect part of their land, and help them through the process. Stewardship of the land is included in a conservation agreement, building an on-going relationship between the land trust and the landowner. VLT is governed by a Board of Trustees and the Trust's conservation easement purchases are made possible through private, state and federal grants.[42]

Problem Statement

The many small forestland owners in Vermont face high barriers to entry into carbon credit markets, due to high soft (transaction) costs associated with each carbon credit sale. How can stored carbon be aggregated for sale to carbon markets, across multiple forestland owners and forest parcels in Vermont, in order to reduce per parcel soft costs and thereby lower barriers to entry? Who will lead and implement the aggregation project?

As outlined in the Introduction to this paper, forests have gained increasing recognition for their ability to serve as a natural climate solution by pulling carbon out of the atmosphere through sequestration and storing it both above and below ground. Vermont is part of a contiguous block of a vast and carbon-rich forest and has a history of forest management and conservation. However, one of the largest threats to forests is conversion to non-forest use, which is apparent in the state. Vermont is losing forestland and experiencing forest parcelization into smaller plots. In addition, private forestland owners comprise the majority (roughly two-thirds) of forestland ownership in the state. At the same time, Vermont's forests sequester and store a tremendous amount of carbon, and provide numerous important co-benefits to the state's social, economic, and environmental fabric. Preventing forest loss necessarily means incentivizing Vermont's private forestland owners to keep their forests as forests, which in turn requires that income streams make forestland ownership financially feasible.

Vermonters care deeply about their forests and understand that the health of their forests underpin their social, economic, and environmental well-being, in addition to being central to the culture of the state. Vermonters also recognize that their forest assets can contribute to national and global solutions to mitigate, adapt to, and be resilient in the face of climate change. Accordingly, many state-level agencies, non-profits and other stakeholders are active in working towards conservation and sustainable management of Vermont's forests. In 2016, the VT Comprehensive Energy Plan set GHG reduction goals; in 2017 Governor Phil Scott convened the Climate Action Commission to develop strategies to meet these goals. In 2017, VT also released a Forest Action Plan that including maintaining and enhancing the forest's contribution to ecosystem services. In 2018, in addition to offering strategies for direct emissions reductions, the Report of the VT Climate Action Commission estimated that Vermont's forests sequester 50 percent of the state's annual CO2 emissions.[43] The Vermont Department of Fish and Wildlife released a report in 2018 entitled "Vermont Conservation Design": a landscape-level conservation design plan for Vermont that identifies the highest priority areas for maintaining ecological integrity. In 2019, Act 83 established the Vermont Forest Carbon Sequestration Working Group to evaluate opportunities for forest carbon projects in Vermont. The groups' final report lists seven policy recommendations for how Vermont forest landowners may leverage carbon markets. Appendix I provides additional detail on these recommendations.

Vermont's forestland owners have existing tools that provide such income streams, such as the Use Value Appraisal Program in Vermont, commonly known as the "Current Use" program that provides tax benefits for forests. The carbon offset market presents an opportunity to add another income stream to these private owner's bottom-lines while protecting forests and generating additional carbon sequestration and storage, but the barriers to entry to the carbon

markets are high for small- and medium-sized forestland owners, which represent the majority of Vermont's forest parcels. Vermont has few carbon offset programs primarily due to the small average size of parcels in the state. The average size of forest holdings for family forest owners in Vermont with 10 or more acres is 63 acres.[44] Analysis completed by the Vermont Forest Carbon Sequestration Working Group found that the average size for a carbon offset project in the Northeast is nearly 40,000 acres with a median size of over 11,000 acres.[45]

Strategy and Implementation

This section details the evolution of the carbon aggregation idea in VT, the perspectives of the various partners and stakeholders in the project, the different options pursued, and the challenges faced. It details key project partners at each step of the process, key milestones and decision points, and implementation of the selected option. This multi-consortium partnership involved numerous organizations with deep roots in Vermont. These organizations are profiled throughout this section.

Early Days: Planting the Seeds for Carbon Projects in Vermont

Dr. William (Bill) Keeton, Professor of Forest Ecology and Forestry at the University of Vermont (UVM), has been working on forest carbon dynamics, carbon management, and carbon project development for decades, conducting significant research and outreach around carbon offset opportunities in the Northeast. He conducts this work particularly through the Carbon Dynamics lab that he directs at UVM. In 2008, even before the California Air Resources Board (CARB) compliance offset program had come online, Keeton published a frequently cited paper proposing that landowners in the Northeast think about managing forests for carbon and carbon markets.[46] In 2015, with Dr. Charles Kerchner, then a doctoral student in Keeton's lab and now the Forest Carbon Director at Spatial Informatics Group (SIG), Keeton published another paper on the potential for Northeast forestland owners to participate in CARB.[47] He had also actively presented to leading conservation-minded NGOs in Vermont, such as the VLT and TNC. At the time, Keeton's message about the opportunities around carbon offset projects in the Northeast didn't move the needle with forestland owners and policymakers – because New Englanders have "a healthy dose of Yankee skepticism" --- but the seed was planted.[48] Keeton says that "…like turning a big ocean liner, you turn the wheel and then slowly, maybe 10 knots downstream, the ship starts to turn."[49] Later in the 2010s, after the compliance market had come online, things began to change and stakeholders began to see the financial potential of carbon market participation and the many co-benefits that could result from this method of financing conservation. The Vermont legislature also started to consider carbon market opportunities, and Keeton continued to advocate through testifying in front of some of the committees. While the legislature showed tentative interest, none of the bills ended up moving forward. In total, Keeton worked for over a decade promoting the potential benefits of carbon market participation as another income stream for landowners that could help meet the greater goal of keeping Vermont's forests as forests.

In 2012, a discussion at a VLT Board meeting at which Keeton was an invited guest marked a turn of events for carbon markets in Vermont. Keeton joined the Board three years later, and when a Board conversation about large tract forest conservation brought forest carbon to the table, he asked whether VLT was going to take any action in this space. At the time, Nick Richardson, then Vice President for Enterprise and Finance at VLT, but now its President & CEO, didn't think there was an opportunity for VLT to participate. He was unsure about how the markets for carbon offsets would develop. "I didn't think it would work, and Keeton said respectfully 'I disagree…the markets are changing, and there is opportunity".[50] After the meeting, Richardson and Keeton spent months talking about the carbon markets and VLT, and thinking about what work in this space might look like for a land trust with deep roots in Vermont. Keeton brought extensive knowledge about forest carbon management overall, and in the Northeast specifically, together with Richardson's project development experience at VLT, in a series of conversations they had at the New Moon Café, a coffeeshop in Burlington. Things in the carbon world were changing. The California compliance market had taken off, and landowners all over the country were enrolling, but none from Vermont. Their key questions were how to make carbon aggregation work in VT, which was the pathway to reducing the cost and other barriers associated with participating in carbon offset markets. At the New Moon Café, Richardson and Keeton hatched the idea of study the feasibility of carbon markets in VT, and design and develop a demonstration project. The ball was in motion to see if this idea had wings and could fly.

Phase 1: Feasibility Analysis

Phase 1 included the funding and completion of a feasibility analysis showing that a forest carbon project on aggregated landholdings could work on CHC lands.

Determining the Feasibility of Forest Carbon Offset Projects in VT
Partners: VLT, UVM, CHC, SIG
Funders: High Meadows, VHCB, VLT

The feasibility study, entitled "Vermont Forest Carbon: A Market Opportunity for Forestland Owners" was completed in 2018 by Keeton, along with co-authors from UVM and the Spatial Informatics Group (SIG), a consulting firm that conducted the carbon and financial modeling within the feasibility study.[51] The study was funded by the High Meadows Fund, the Vermont Housing and Conservation Board, and VLT. Its purpose was to "…provide landowners, conservation organizations, policy makers, and others with targeting information on market opportunities and forest carbon project feasibility, in a manner specifically applicable to Vermont. In so doing, the study aims to stimulate broader consideration of carbon market participation within our state, benefiting landowners, communities, and the working landscape generally".[52]

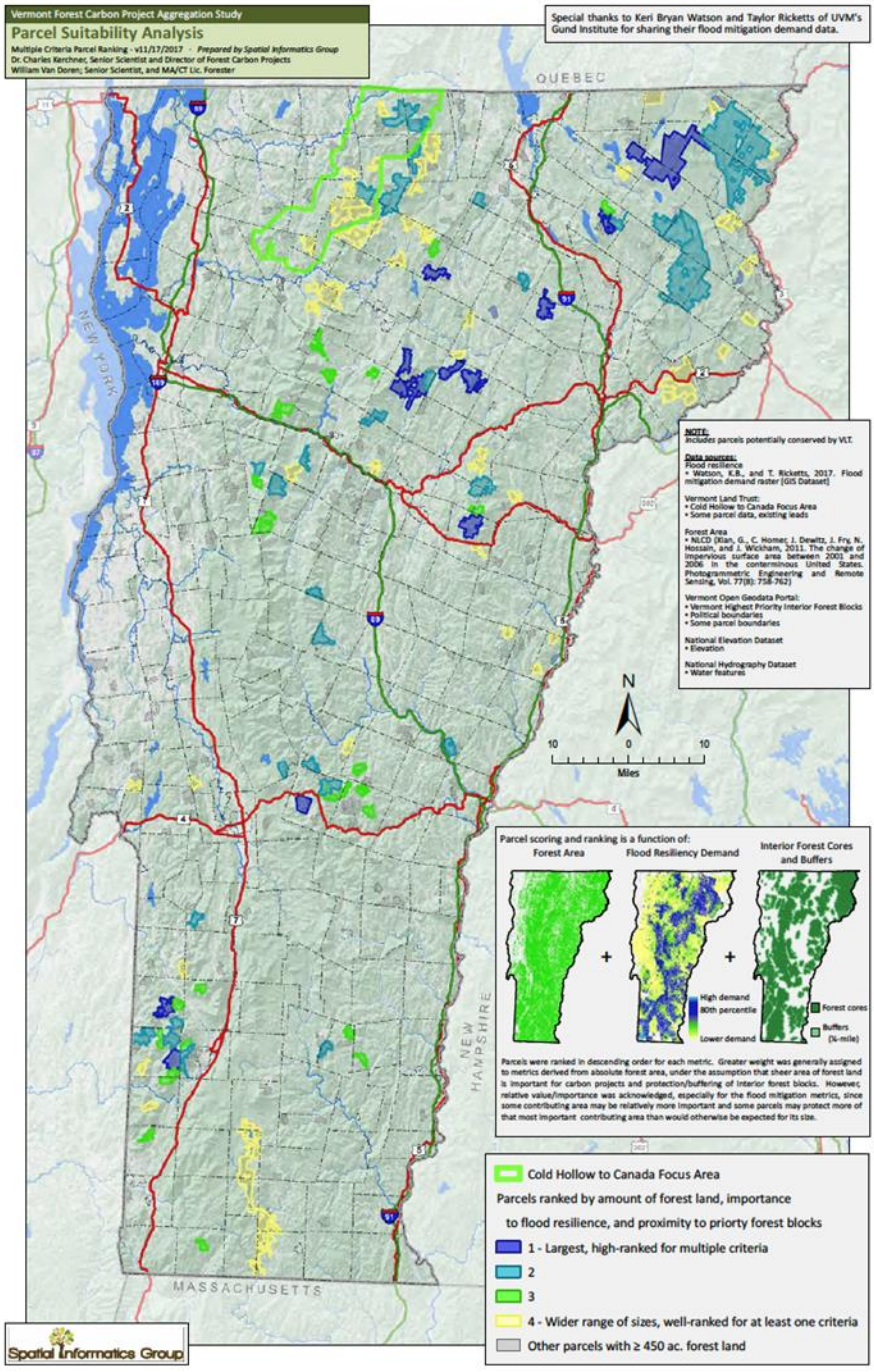

Figure 4: Suitability Analysis Using All Candidate Parcels (Source: Keeton et al, 2018.)

From the outset, VLT and UVM formed a steering committee for the feasibility study work, leveraging knowledge and partnerships from key nonprofit, policymaking, and practitioner organizations that lent broad stakeholder input to the design and development of the analysis, and buy-in to any results generated. Importantly, the steering committee held representation from conservation, rural economic development, forestry, and timber industry stakeholder groups. Keeton led the committee, which included Charlie Hancock (North Woods Forestry), Phil Huffman (TNC), Ben Machin (Redstart Consulting), Christine McGowan (Vermont Sustainable Jobs Fund), Nancy Patch and Sandy Wilmot (Vermont Department of Forests, Parks and Recreation), John Roe (Upper Valley Land Trust), Lisa Sausville (Vermont Coverts), Joe Short (Northern Forest Center), Peter Stein (Lyme Timber Company), Robert Turner (R.J. Turner Company), Kate Wanner (The Trust for Public Land), and Kathleen Wanner (Vermont Woodlands Association). This type of active up-front engagement from the project's beginning allowed key thinkers and practitioners, relevant to forest carbon aggregation in VT, to be integrated into future phases and decision-making for the initiative.

Assessing the feasibility of Vermont forestland owners participating in compliance and voluntary carbon markets, the study concluded that voluntary markets present the greatest opportunity. This is because most forest parcels in Vermont are small, and voluntary markets allow aggregation where compliance markets do not. For compliance markets, a minimum of a 5,000-acre forest parcel is typically financially viable; the study identified at least six private forest landholdings in the state greater than 5,000 acres. Feasibility for the voluntary market was much higher, based on financial viability (privately-owned parcels greater than 500 acres with at least 450 acres of forestland), potential for co-benefits (priority forest block conservation, identified through the Vermont Conservation Design project, and flood resilience, identified through a dataset provided by the UVM's Gund Institute), and existing conservation measures such a conservation easements that may preclude or limit additional carbon credits.

Based on these metrics, the study identified 140,000 acres that are privately owned, in priority forest block conservation and flood reliance areas, and that lack existing conservation easements. The study also concluded that carbon project development in Vermont would be compatible with other existing forest stewardship programs, such as forest certification, Environmental Quality Incentives Program (EQIP), the Forest Legacy Program, and the Current Use program in Vermont. For example, managing forests for carbon can complement existing management plans for timber; current use tax policies do not preclude carbon offset eligibility. Compatibility with existing conservation easements is less clear, because certain easements may include harvest limits, which can influence the baseline level of carbon storage and additional credits possible. With this analysis, the feasibility study also serves as a roadmap for landowners to guide them on carbon project eligibility, enrollment, and integration with other forest management programs and plans.

Knowledge exchange during steering committee meetings led the study partners to CHC as a potential demonstration site for the feasibility study. During a coffee break at one of the first steering committee meetings, Keeton learned of CHC from Nancy Patch, who was working closely with Charlie Hancock on the CHC RCP. Patch put a spotlight on CHC, where a

collaborative project working across forestland owners was already underway in an ecologically important area of the state.

SIG, the consulting firm conducting the case study on CHC, was able to use detailed forest inventory data for 5,900 acres of land in the CHC project. The results of SIG's analysis on CHC parcels is presented in Appendix I of the feasibility study. Using these detailed data, SIG was able to determine that a carbon aggregation project was financially feasible on these properties.

This first phase of the project leveraged philanthropic funding to demonstrate the overall feasibility and viability of developing carbon offset projects in Vermont, given land use dynamics and existing forest conservation and management mechanisms; and more specifically, the financial feasibility of developing an aggregated carbon offset project on certain CHC lands. The feasibility phase benefited from the existing relationships held across multiple organizations that coalesced within this project. The feasibility study, through providing a detailed and specific recommendation on implementing a carbon aggregation project in Vermont, also opened the door to funding a Phase II of the project.

Importantly, the "Vermont Path" and "story" were discussed as an important element of the carbon market opportunity. The feasibility study states that "[t]he Vermont Path toward forest carbon projects, both in terms of stimulating landowner interest and getting projects up and running, would be facilitated by active branding of offset credits generated here, telling the 'story' of the multiple co-benefits (climate, working landscapes, biodiversity, open space, flood resilience, etc…) provided by 'grown in Vermont carbon'".[53]

Phase 2: Carbon Project Development: Cold Hollow Carbon

Forest carbon project development is complicated, time-intensive and expensive. The expertise and transaction costs required to develop a project can be an insurmountable barrier for many smaller landowners. According to Forest Trends, "Successful project development requires complying with rigorous standards of analyzing and documenting carbon benefits, working through an array of legal, business, and community relations issues, and actually carrying out the challenging work of reforestation and forest and land management activities that go beyond business as usual in order to create carbon benefits."[54]

Forest Carbon Project Development in CHC
Partners: VLT, UVM, CHC, SIG, TNC
Funders: TNC

Forest carbon project development involves multiple steps from project origination to landowner outreach to credit marketing and sales. Richardson and his partners could draw from the experiences of forest carbon projects developed across the country, including in Vermont, but "in many ways," Richardson reports, "we were starting from scratch".[55] A case study or model for a large-scale aggregated forest carbon project in the U.S. didn't exist yet; there was no obvious vehicle through which to move small, privately-owned forest parcels into the carbon offset market; and the barriers to entry were high.

The feasibility study completed in Phase I detailed pathways the Vermont Land Trust could take for developing a forest carbon offset program in the state. The first path involved a "do-it-yourself" approach, where VLT would work with one for-profit company to provide "soup-to-nut" project development from project origination to credit marketing and sales. The second approach outlined in the feasibility study would have VLT assume a portion of the project development services and partner with other companies for some of the technical work and credit marketing and sales. The report recommended that VLT leverage existing partnerships to both bring technical expertise to the project and to facilitate carbon credit purchases.

VLT decided to go with the second option of leveraging existing partnerships. This decision flowed naturally from the effort, which was from the beginning a collaborative process purposely integrating key players in Vermont's forest carbon nexus. A recent publication based on results of a mailed survey to Vermont forestland owners participating in the state's Current Use Program also lent support to this path, as the authors concluded that:

> "…small forest landowners see revenue as the most important factor in a carbon credit program and the duration of the program as the least important factor. Landowners reported that shorter program duration, higher revenue, and lower withdrawal penalties positively impact their willingness to accept forest carbon credit programs. Notably, our study includes carbon credit program implementer as a key program attribute, allowing us to quantify landowners' tradeoffs between non-profit, for-profit, and government organizations. ***Overall, we found that landowners significantly prefer working with a non-profit organization*** [emphasis added]. Based on monetary estimates of willingness-to-accept compensation, our results suggest that aggregated forest carbon offset projects incorporating small forest landowners could be piloted successfully in Vermont by non-profit organizations while maintaining relatively strict guidelines of existing carbon offset protocols."[56]

To move the effort into the second phase of project development with VLT as the convener, Richardson and Keeton co-wrote a proposal for a grant from The Nature Conservancy's Natural Climate Solutions (NCS) Accelerator Grant Program as a collaboration between the Vermont Land Trust and the University of Vermont. This program, supported by the Doris Duke Charitable Foundation, will "…support projects with potential to substantially increase the use of natural climate solutions. This grant-funded program focuses on helping kick-start innovative and scalable approaches for reducing greenhouse gas emissions and storing more carbon on natural and working lands across the United States".[57] The NCS Accelerator Grant Program was an outgrowth of research on the potential for natural climate solutions to substantially contribute to global climate mitigation goals.[58] The proposal, under the banner of a collaboration between VLT and UVM, successfully won a Round 1 award in 2018 "to prove the value of aggregation of forest carbon markets".[59]

A Multi-Entity Partnership with Many Strengths

The effort continued as a multi-entity partnership, involving many of the same partners from Phase I and with each partner leveraging their comparative strengths in the carbon project

development process. VLT assumed overall responsibility and convening authority for the project and was the primary proponent for pioneering the governing structure, determining how to form and finance the collaborative, and how to develop landowner agreements. UVM focused on education and outreach; the Chair of CHC, Charlie Hancock, worked with the CHC landowners. SIG performed the carbon development work of forest carbon modeling (e.g. growth and yield modeling and carbon quantification) and hiring third parties to complete specific forest inventories (Green Timber was hired for the inventory) and on-site verification. TNC participated in the regular partnership meetings, and provided legal and credit marketing advice, as well as shared the organization's experience in developing projects across the country.

A Multi-Step Process

Phase II of the VT forest carbon project had multiple steps, each leveraging the skills and experience of different project partners. The first step involved identifying the forestland owners as potential participants in this project, and then reaching out to and educating this group. The second step involved determining the structure for bringing the forestland owners together into a formal aggregated arrangement, which required further, significant education and outreach to get the forestland owners sign onto the aggregated project. The third step involved implementing the forest carbon inventory and verification process in order to generate carbon credits.

Identification, Education and Outreach to Forestland Owners

CHC continued to be a strong choice for identifying specific landowners for a carbon aggregation offset demonstration project. Forestland owners had been working together in the Cold Hollow landscape within the CHC RCP through peer-to-peer learning and engagement. The group had accumulated a fair amount of social capital and shared story built into their relationships. The team identified forestland owners from within the CHC RCP that would qualify for the aggregation project and proceeded to contact them.

All told, the team spent three years after the feasibility study was completed on education and outreach to the CHC forestland owners. According to Richardson from VLT, "90 percent of what we did over the last 2 years was to engage with the uncertainty people felt…and getting them to trust VLT."[60] A meeting in Montgomery kicked-off the landowner engagement at the home of one of the principal landowners the team was working with. Roughly 12 forestland owners attended. The team approached the forestland owners with the results of the feasibility study, the goals and objectives of the demonstration project, and a clear indication that this was a novel project and results were uncertain. Importantly, the forestland owners were not asked to commit to anything during the education phase, which focused on explaining carbon science and how the science connects to outcomes through carbon offset markets. The team discussed key elements of forest carbon market eligibility and participation with the landowners (e.g. additionality; requirements for carbon measurement and monitoring; and contract options), complicated topics that were distilled by Keeton through his significant experience conducting this type of education and outreach across the state with UVM's Carbon Dynamics Lab. In sum, VLT and UVM held two in-person forestland owner workshops in Montgomery, VT, and UVM and

SIG held three Zoom calls with forestland owners to update them on the project and answer technical questions about carbon offsets.

Through the education effort, the team developed a guide on techniques for managing carbon stocks that was not prescriptive but allowed landowners to understand the general bounds of what they could do for project eligibility. This tool was deliberate in its clear and straightforward discussion of carbon science and elements of forest carbon project development. Understanding it proved critical to securing landowners' participation.

The outreach and education step on managing forests for carbon and the Vermont forest carbon project also extended to the broader forestry community in Vermont and New England. According to Keeton, who led the outreach and education effort, the partnership aimed to reach two different key groups. The first group is comprised of county foresters, who provide forest management and stewardship information and technical assistance to forestland owners in Vermont.[61] County foresters are crucial because they can facilitate folding carbon projects into the state's Current Use Value Appraisal program. This was a key factor in making the carbon project work. Keeton held workshops with the county foresters to share the basics of forest carbon markets and carbon forestry, as well as the results of the feasibility study. Buy-in from consulting foresters such as Charlie Hancock was also important. Doing so allows for forest management plans of individual forest owners to align with forest management requirements for carbon offset projects.[62]

The second group is the general landowning population in Vermont. Keeton delivered a talk called "Climate-Friendly Forestry" to Sustainable Woodstock, at the Craftsbury Nordic Center, and at an event in Middlebury, organized by Vermont Family Forests, as well as others. Further outreach included talks and interviews on public radio and through conferences. He also presented the Seward Weber Lecture in Montpelier in the fall of 2019. Keeton reached the scientific community through venues such as the Cary Institute for Ecosystem Science, and he testified at the state level when the legislature was considering carbon legislation and reauthorizing Vermont's growth management law. In these sessions, Keeton made the case for how carbon offset projects could maintain intact landscapes and larger parcels of continuous forest.

Developing the Carbon Aggregation Agreement: Cold Hollow Carbon

Of the twelve forestland owners who participated in initial meetings about the forest carbon project, 10 owners, covering 12 parcels, ended up participating. Owners ranged from individuals to LLCs and represented roughly 60 percent of the land considered in the feasibility study. It is important to note that the forestland owners who participated in the VLT CHC project had management objectives for their lands that were highly aligned with the practices employed to manage forests for carbon. Some of the participants produce maple products and are not harvesting timber. Some employ silviculture and harvest practices. Others have worked on enhancing songbird habitat. Still, the space is not one heavily tilted towards maximizing the economic productivity of the forestlands.[63]

Developing the novel carbon aggregation agreement involved leveraging existing models (e.g. contract law, cooperative agreements) and adapting them to an aggregated project and to the specific forestland owners. During a meeting with landowners in Montgomery in 2019, the team presented their recommended model: a limited structure partnership. This partnership model would bind the landowners to each other in a cooperative framework for the 40-year time period. This more traditional aggregation model placed risk and liability on the forestland owners, who would contribute credits to a pool. Despite their experiences working together under the CHC RCP, the forestland owners had concerns about the approach.

Accordingly, the landowners were quick to deliver a resounding "no" to the limited structure partnership model. According to Richardson from VLT, "the structure looked really good on a whiteboard but totally died when [we] tried to roll it out to real people".[64] According to the landowners, the structure was too complicated and put too much risk on the individual landowner, to whom forests were an important part of their wealth. Furthermore, very few had participated in private equity arrangements. VLT and the project team recognized the challenge their forestland owner partners were having as first movers in this space, especially given that the forest is intimately connected with their financial well-being, legacy, and values.

The team went back to the drawing board and reconfigured the proposed contracting arrangement to more closely resemble a timber lease, which was more familiar to the forestland owners, and better received. The framework also resembled structures used for VT maple syrup aggregators, adding to familiarly among Vermont forestland owners. A third-party subsidiary of VLT was formed, the Vermont Forest Carbon Company (VFC) in early 2019. VLT worked with carbon attorneys in California and Washington DC to develop proprietary carbon rights agreements that transfer carbon attributes associated with management practices from forestland owners to the VFC. In exchange, the forestland owners in the project receive 70 percent of net proceeds from the sale of carbon credits. In other words, VFC purchases carbon credits from individual forestland owners, pools and sells the credits as a single project, and then compensates the forestland owners generating the credits. In this model, VLT took some of the credit share to cover the cost of risk. Landowners would therefore receive a lower price per credit in exchange for the lower risk.

VFC has been structured to support all stages of forest carbon program development, from providing upfront financing to forestland owners, to reviewing forest management plans, to supporting project development, to marketing and selling credits.[65] Experts within VLT's broader network, including a forestland owner with venture capital startup experience and advisors from Lyme Timber Company and Finite Carbon, contributed significantly to the development and structuring of VFC. Importantly, the CHC project is funded by grant money that created a starting pool of resources and will be replenished by VLT's share of the credit purchases, which will in turn be used to develop other projects. This differs from other carbon offset projects that are funded by the sale of credits to either a landowner or to a private carbon development company, depending on which one assumes the transaction costs, In other words, instead of landowners or a private company paying for the transaction costs associated with developing a

forest carbon project, VLT, a land trust, maintains a revolving fund that covers transaction costs in exchange for credits that replenish the fund and allow it to finance additional projects.

Developing the aggregation agreement was an iterative process. The forestland owners formed a sub-committee to work on their behalf, in conjunction with an external legal counsel. This provided independent legal counsel for the forestland owners, apart from VLT and the CHC RCP. Two agreements were incorporated into the framework: an agreement between each forestland owner and VFC, and an agreement between the forestland owners themselves, because together they have a seat at the VFC table. The forestland owners agreed to select and change the representative to the VFC over specific time periods, which gave the group a modicum of control over activities at the VFC level. Through the course of developing the aggregation agreement, VLT held two meetings and one conference call for VFC steering committee members to discuss the project and share input received from forestland owners.

After the agreements were designed and finalized, the last step was signing the agreements. While a substantive education and implementation process integrating the forestland owners had been undertaken, it wasn't certain that the landowners as a group would agree to the terms until near to the day that the contracts were actually signed. Letters of Intent were signed with 15 forestland owners in June 2019, enabling the project team to start the forest inventory work that would inform credit generation. The last of the final landowner participation agreements was signed in the spring of 2020; bringing a total of 11 forestland ownerships and 8,600 acres of forestland over 12 parcels into the aggregated project under VCF.

Requirements for Participation

The Cold Hollow Carbon project is registered under the American Carbon Registry (ACR) standard for the voluntary market. In order to participate in Cold Hollow Carbon, forest landowners agree to do two primary things. First, they make a commitment to maintain a certain level of carbon stocking on their forested lands and to increase it over time. The market pays them for the amount of carbon they stock over a calculated baseline of carbon conditions, absent the agreement. The participants have flexibility in how they manage their forests for stable or increasing carbon stocks. Figure 5 lists silvicultural principles that help to increase carbon, and which the Cold Hollow Carbon participants could implement on their land.[66]

Importantly, landowners are allowed to sustainably use their forestland, including timber harvest, within certain limits established by the agreement under the ACR and with VLT. The landowner agreement states that the "…landowner shall not undertake any timber harvest producing merchantable material at least equal to the value of the direct cost of harvesting (each a 'commercial harvest'), nor otherwise alter the physical condition of the Property in such a way that has an impact on the Property's timber stocking levels (except for de minimis firewood collection for personal use by the Landowner) prior to the Start Date without written approval by Project Proponent."[67]

Second, the landowners agree to allow access to their property for the purposes of "…registration, Validation, Verification, monitoring, marketing, and sale of ERTs…".[68] Importantly, the agreement runs with the land and is binding on any transfer of ownership of the property.

Silvicultural Practices to Increase Carbon

1. "Efficient timber harvest scheduling over time and space to ensure that net annual removals are at or below the net annual carbon stocking increment for a property overall;

2. Incorporation of no-harvest or minimal harvests zones, such as riparian buffers and ecologically significant treatment areas;

3. Use of extended rotations, where harvest rotations or entry cycles for individual stands are lengthened;

4. Use of carefully designed intermediate treatments, such as stand improvement thinning, variable density thinning, and crop tree release methods, that enhance stand quality, health, and growth over time;

5. Use of retention practices in regeneration harvests. These practices retain "biological legacies" of all sorts (e.g., live and dead trees, standing and downed material, and soil organic matter) over multiple rotations or entry cycles. A wide variety of retention practices are available for northern hardwood, conifer, and mixed-woods forest types, including modifications of even-aged (e.g., dispersed and aggregated tree retention within harvest units), multi-aged (e.g. irregular shelterwood method), and uneven-aged (e.g. Structural Complexity Enhancement; group or gap-based selection systems with retention). There is no "one-size-fits-all" approach for retention forestry as a means to maintain or enhance carbon stocking. Rather a landowner, working with a professional forester, will want to select the system most appropriate to a given stand, site, and mix of objectives; and

6. Use of monitoring data to track changes in stocking over time and to update timber harvest schedules and management plans accordingly."

Source: William Keeton (UVM) and Charlie Hancock (CHC) as cited in Hancock (2020).

Figure 5: Silvicultural Principles to Increase Carbon

Inventory and Verification

SIG led on the inventory and verification process, completing growth and yield modeling and carbon quantification; managing all aspects of the carbon inventory process (carbon plot placement/inventory design, inventory contracting and QA/QC); and managing the verification process (contracting and being onsite for verification). Green Timber, a company based in Minnesota with forest carbon inventory experience, was hired to develop field-based forest carbon inventories for the intended forestlands in the fall of 2019; VLT staff members participated in the inventory process for capacity-building purposes. Project verification was completed during the summer of 2020.

Phase 3: Marketing and Selling Carbon Credits

An Early Credit Sale

The VLT CHC project gained early momentum for carbon credit sales when Gratitude Railroad, an impact investment organization, purchased the first credits through a forward commitment in the fall of 2019. This organization has a commitment to sustainability and was interested in supporting the project, both to voluntarily offset their travel emissions, and to show support for the growing field of carbon offset markets more generally.

Placing Carbon Credits on the Voluntary Market

To market and sell the remaining registered credits, scheduled to be issued in January 2021, VLT turned to the Vermont Chapter of TNC. Carbon credit pricing in voluntary markets is more uncertain than in the compliance markets, underscoring the need for project partners, like TNC, who can engage potential voluntary buyers and secure a reasonable price. Many of these voluntary buyers are corporations seeking to meet their internal corporate social responsibility requirements. TNC has engaged in substantial forest carbon work, including through its Working Woodlands program where family forestland owners are paid for practices to sequester additional carbon. The organization was seeking to increase participation in forest carbon markets. They had not, however, attempted any carbon aggregation work before participating in the VLT CHC project. From an organizational perspective, TNC is committed to using natural climate solutions to address climate change, but standard Working Woodlands projects are feasible for only a relatively small number of landowners. TNC was interested in expanding the number of landowners able to participate in carbon markets, and so working with VLT on the CHC project was a strategic opportunity. It is important to note that while TNC was focused on marketing and selling credits in the voluntary carbon offset marketplace, some credits were reserved for purchase by VLT members to offset personal emissions.

Phil Huffman, Director of Government Relations and Policy for TNC Vermont, was on the steering committee for the feasibility report, and Jim Shallow, Director of Strategic Conservation Initiatives for TNC Vermont, is both involved in the VLT CHC project and in the state-level policy discussion, as a member of Vermont's Forest Carbon Sequestration Working Group. TNC was an early funder of the VLT CHC project through the NCS grant. Moving into the project development phase, it became a project partner through a joint project development agreement with SIG to market the carbon credits generated. The VLT CHC project leveraged TNC's experience in developing carbon projects on the Working Woodlands scale, including the types of contracts developed and the structure of partnerships. The project also benefited from TNC's success in marketing charismatic carbon credits through the TNC "stamp", and TNC was able to attract a large buyer (Amazon) who will purchase multiyear credits for a good price. Unlike TNC's other carbon projects, such as the Working Woodlands project, where the goal is to permanently protect the properties, and add a carbon project, the VLT CHC project is a carbon project where permanent protection is not a requirement. The 40-year commitments required for this project are still significant. They do, however, seem to be a reasonable measure, taken in order to complete an aggregated carbon project.

A Large Corporate Commitment

Amazon is the first corporate purchaser of carbon credits generated by the VLT CHC project. In 2019, Amazon announced the Climate Pledge, through which companies commit to achieve net zero carbon by 2040, 10 years ahead of the Paris Agreement.[69] Amazon was the first signatory to the Pledge, committing the be net zero carbon by 2040 through both reducing emissions of its operations and through investing in nature-based solutions that remove carbon from the atmosphere. Other companies that have signed the Pledge include BestBuy, InfoSys, and Verizon. In order to do meet its net zero carbon goal, Amazon established a $100 million fund to restore and conserve forests, wetlands, and peatlands globally.[70] Part of this funding ($10 million) will support the Family Forest Carbon Program and Forest Carbon Co-ops, in partnership with TNC, the American Forest Foundation, and VLT. The Family Forest Carbon Program, a partnership between TNC and the American Forest Foundation, has been piloted in Pennsylvania and is focused on ownerships of 30 to 2,400 acres, seeking to connect small family forest owners with carbon offset markets. The Forest Carbon Co-op program launched with VLT in 2019 will connect mid-sized forestland owners (200 to 2,000 acres) to the carbon offset markets.[71] Both of these programs have potential to make significant impact on carbon offset market supply, as family forest landowners in the United States own on average 67.2 acres of land, and more than 80 percent of ownerships hold less than 500 acres of forestland.[72]

TNC's success in marketing the carbon credits and securing buyers for the VLT CHC project was buoyed by their involvement in project development. Further, TNC will continue to advise VLT as the project progresses.

Results to Date

To date, 10 forestland ownerships in Vermont representing 8,625 acres over 12 parcels are enrolled in the CHC aggregated carbon project. Net revenue of $3.5 million is projected over the first 10 years of the project; around 70 percent of this will go to the landowners, yielding them an average of $282 per acre. This project is innovative in many ways and is a first mover in terms of including multiple private landowners with a diversity of parcel sizes, from 125-acres to up to 4,000 acres. Both conserved and unprotected land are included.

Under the agreements, the forestland owners will deploy practices on their lands that increase carbon sequestration and storage to generate credits; these practices include allowing trees to grow older, restoring wetlands, and thinning that helps the understory to grow and sequester carbon. At the same time, these forestland owners will continue to benefit financially from continued timber harvest and other forest uses, such as maple sugar harvesting.

Credit purchases have been arranged with Gratitude Railroad and Amazon, and additional purchasers will be added as the project continues.

Lessons Learned

Lessons learned from the novel CHC carbon aggregation project are numerous and offer important best practices for other entities looking to develop aggregated projects for the voluntary compliance markets.

A strong, sustainable forest management; conservation; and climate change mitigation ethic in Vermont supported carbon project development. Sustainable forest management and conservation is present at the local and state level in Vermont, both through governing bodies in local and state government and through nonprofit organizations. The project team could rely on the balanced conservation-minded groundwork laid by many entities, which was mainstreamed into the project process through the collaborative partnership led by VLT. Importantly, the importance of reducing GHG emissions and addressing climate change is an active topic at the state government level.

Partnerships and patience are critical to the success of a novel, large-landscape initiative with many stakeholders from multiple sectors. The multi-consortium partnership between VLT, UVM, CHC, SIG, and TNC is a useful model carbon project development in novel areas such as the co-op model piloted with CHC. Unlike carbon projects that hire one firm to take forestland soup-to-nuts, from project origination to credit sales, the model employed by VLT followed a deliberately horizontal structure. This structure involved multiple organizations with deep, cross-cutting knowledge about forests, managing forests for carbon and other co-benefits, rural economic development in Vermont, and the values of Vermont landowners. Through collaboration and partnership, this model allowed capacity to be built in all phases of project development, from feasibility to landowner engagement and project inventory, to credit sale.

Mitigating risk for forestland owners participating in an aggregated carbon project is critical. The VLT CHC case profile shows that project success can hinge on ensuring that landowners understand and are comfortable with the business model. For the VLT CHC, education was an important part of this, as was the agreement structure for the project. The project team assumed that a high degree of project ownership would be attractive to the group, helping to align with the group's experience and interest in shared land stewardship and sustainable forest management. The forestland owners considering participation in the deal were instead interested in a direct contractual relationship with Vermont Forest Carbon Company, the subsidiary of VLT created through the course of the project, rather than a pooled ownership structure as a way to mitigate risk. VLT has suggested that this lower appetite for risk may be better served by a broader "retail" forest carbon project development ethos in Vermont rather than developing projects as sophisticated investor opportunities.

Land trusts and their subsidiaries can serve as an appropriate home for carbon co-op projects. Carbon co-op projects necessarily engage small- to medium-size forestland owners who likely have deep connections to their land, both financially and emotionally. Land trusts, by virtue of their focus on conserving both protected and working lands for the many ecosystem services and benefits they provide to both people and wildlife, understand this connection. Because they

focus on using conservation easements as a primary tool for land conservation, land trusts are used to technical, legal agreements about land and land management; working with landowners to develop agreements for continued stewardship of lands under a conservation easement; and enforcing the terms of land conservation contracts where agreements are broken. They are no stranger to long-term commitments: the 40-year commitment under the CHC project is relatively short compared to conservation in perpetuity that land trusts normally engage in under a conservation easement. Land trusts are also highly experienced in working directly in their communities with landowners, as they educate them about conservation opportunities that may provide financial resources for land to stay in families, while continuing to provide social, economic and environmental benefits.

Social capital, personal relationships, and trust are key to making a novel endeavor successful. The VLT CHC project benefited from multiple existing professional relationships across all stakeholder groups that had been formed not just in context of the carbon aggregation project, but through previous projects and engagements over time that allowed for trust and effective communication.

Policy Recommendations

The Cold Hollow Carbon aggregation project has broad potential for replication across New England. Because most of New England has forests predominantly in small parcel private ownership, as well as an active and vibrant land trust community, the model pioneered by VLT is applicable and potentially scalable to other areas in the region. The transparent process followed by the VLT CHC project team has generated transferable lessons that can be disseminated to other land trusts and entities interested in aggregated carbon project development.

However, policymakers need to address barriers that still remain to aggregating forest carbon projects. For example, even though the 40-year commitment required by this project, through the voluntary market, is far less than the 100-year commitment required in the compliance markets, forestland owners may still be uncomfortable with the length of commitment. Trust will remain another significant barrier, as will educating forestland owners about aggregation, the carbon offset market, and the generation of carbon credits. Whether the model of signing forestland owners up as participants to an aggregated carbon project at the same time is scalable is an open question.

Recent developments that allow for rolling sign-ups to aggregated projects across both time and geographies are promising and may be a more scalable model for aggregation. Through this model, forest lands across different states and regions could be combined over certain time periods. Rolling protocols will address the barrier present through forestland owner hesitancy to be the first mover on a project, and the difficulty involved in getting multiple forestland owners to confirm participation in a project at the same time. A new 5-year pilot has been developed through a partnership between the Land Trust Alliance, Finite Carbon, and The Climate Trust to pool land trust resources for the voluntary carbon market.[73] Under this partnership, Finite Carbon will support land trusts with their forestlands and The Climate Trust will support

purchasing no-till grassland easements for the carbon market. This model will allow land trusts to pool land that is otherwise too small to participate in carbon markets. SIG and Northeast Wilderness Trust (NEWT) are also the first to implement a new aggregation methodology, the Programmatic Development Approach, which is authored by the American Carbon Registry and allows landowners to enroll in a project over time. The Wild Carbon Initiative project will be implemented among various landowners encompassing roughly 10,000 acres in the Northeast and will utilize many of the lessons learned (i.e., establishing strong regional partnerships, mitigating landowner risk and creating a subsidiary company) from the Cold Hollow Carbon project.[74]

Demand for carbon credits is likely to grow, and land trusts can be natural allies in the process. Corporate sustainability and net-zero commitments translate into increasing demand for carbon credits. Lands trusts can both support and enable market development. VLT is supportive of more forest carbon offset projects happening in Vermont and is actively considering best strategies to engage, including at the state level. VLT has also begun discussions with the Northern Forest Center and other regional organizations, in an effort to strengthen forest carbon offset protocols and activity under the Regional Greenhouse Gas Initiative (RGGI) and the Transportation Climate Initiative (TCI), the emissions reduction schemes that Vermont participates in. While RGGI has protocols for forests, demand for forest projects has so far been limited. The design of the VCF subsidiary is a critical piece of potential future activity, as under the subsidiary, VLT could develop additional aggregated forest carbon projects in the state.

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About the Author

Kavita Kapur Macleod has broad expertise and experience conducting analysis around environmental policy issues and integrating economic, scientific, and policy considerations for public, private, and NGO institutions both domestically and internationally. Clients have included the World Bank, the Jane Goodall Foundation, the Highstead Foundation, the Environmental Policy Innovation Center, the U.S. EPA, U.S. Fish & Wildlife Service, and the U.S. Coast Guard. Kavita's work experience also includes management and financial support for the Massachusetts Executive Office of Environmental Affairs, and international program development and implementation at Harvard University. She holds a B.A. in International Relations/Minor in Art History from Tufts University and an M.P.P. from Harvard University, where she focused on environmental science, policy and economics.

Appendix I: Vermont Forest Carbon Sequestration Working Group

In 2019, Act 83 establishing the Vermont Forest Carbon Sequestration Working Group was passed by the Vermont General Assembly. Through the Working Group, "[t]he Vermont General Assembly…is interested in evaluating the opportunities for public and private landowners to create forest carbon sequestration offset projects with their forestland and enroll such projects in carbon offset markets, including ways in which the State could play a role in facilitating landowner participation. Ideally, landowners, including private landowners and state or local governments, would receive financial payments for a newly quantified forest product (carbon), while the State could support policies that maintain or increase the levels of carbon sequestration and storage in Vermont forests, thus promoting climate stabilization".[75] During the Fall of 2019, the Working Group met six times to assess how to create a state program to help Vermont forestland owners enroll their lands in carbon offset markets.

In its Final Report, the Vermont Forest Carbon Sequestration Working Group (Working Group) made seven policy recommendations[76]:

1. The Department of Forests, Parks, and Recreation (DFPR) develop public information materials, including online and print materials, regarding the components of forest carbon offset protocols and markets, appropriate silvicultural practices, project development, and additional resources available for assistance and information. These materials should be designed for use by the general public, forest landowners, municipalities, and private organizations and businesses. Such materials should outline the compatibility of forest carbon offset projects with the Vermont Use Value Appraisal (UVA)/Current Use Program and other state and federal programs related to forestland management and carbon cycling and accounting.

2. By July 1, 2022, the Agency of Natural Resources (ANR) analyze the feasibility of developing a forest carbon offset project for at least one parcel of state land. The purpose of this project would be to: a) build staff expertise that could be used to assist municipalities and private land owners with enrollment in carbon markets; b) provide a public model of exemplary pro-carbon, climate-resilient forestry; c) serve as a potential anchor, if feasible, around which an aggregation project could be developed; and d) generate revenue that could be appropriated to fund land management stewardship, recreational improvements, greenhouse gas (GHG) emissions reduction projects, and additional land conservation or carbon offset efforts. Such an analysis may include engaging the services of an expert forest carbon project developer.

3. Department of Forests, Parks, and Recreation work with municipalities to explore opportunities to develop a pilot carbon offset project that includes town forests and/or urban forestry activities. FPR should use insights gained from the pilot effort to create a framework for providing assistance to Vermont municipalities in developing forest carbon offset projects. This pilot would also help determine viable options for aggregation and

provide local examples of climate resilient forestry for municipalities, forest landowners, and community members.

4. The Agency of Natural Resources explore partnerships, through a formal contract or memorandum of understanding, with private sector organizations that have experience in carbon offset projects in order to create statewide public-private partnerships that could work to minimize the costs and maximize the benefits of enrolling public and private lands in carbon offset market programs.

5. If the State of Vermont were to create a state carbon accounting system or protocols as a component of a greenhouse gas emissions reduction program or climate initiative, the State should develop and adopt rules that prevent double counting of carbon. For example, if Vermont forest carbon offsets were sold to account for GHG emissions in California, they should not also be counted as offsets for Vermont GHG emissions.

6. If changes were to be considered in the UVA program, the State should avoid program requirements that may constrain carbon offset project viability for lands enrolled in UVA.

7. Given the need to expand ANR and FPR capacity, funding options should be explored to provide additional staffing and resources to complete the work recommended above.

The Forest Carbon Sequestration Working Group's final report states that

> "Vermont has a strong interest in protecting and enhancing forests and the many values and benefits they provide. Mitigating climate change, enhancing efforts toward clean air and water, maintaining healthy soil and flood control, supporting the forest economy, promoting recreation and tourism, and preserving Vermont's identity as the Green Mountain State all depend on conserving healthy and productive forests. Forest carbon offset programs may offer one potential tool to help preserve Vermont forests by providing additional revenues to landowners and creating a financial incentive for the goal of keeping forestlands forested and ensuring the benefits we all receive from them continue."[77]

Appendix 2: Study Group Questions

One of the several uses of this case profile is in an academic setting. Following are several questions that an instructor can pose to their study group to engage participants in the details of the narrative.

1. Is this a novel initiative? How have the protagonists creatively addressed the barriers to entry facing small family forest owners in Vermont and in the broader Cold Hollow to Canada region?

2. Is the solution profiled in this case measurably effective and strategically significant for the practice of land and biodiversity conservation and climate change mitigation? Why and why not?

3. Is the solution emerging from this case transferable to other jurisdictions and will it endure?

4. Is this a large landscape solution that crosses sectors and political jurisdictions? Who are the key players from various sectors essential to the success of this initiative? What are the key technologies and organizational methodologies?

5. If you were manager of the Forest Carbon Aggregation project, what would be your priorities for action in the next year? Over the next ten years?

References

"About: Vermont Land Trust Conserves Farms and Forests for the Future." Vermont Land Trust. https://vlt.org/about.

Amazon, 2020. "As Part of Its Plan to Be Net Zero Carbon by 2040, Amazon Commits $10 Million to Restore and Conserve 4 Million Acres of Forest in the Appalachians and Other U.S. Regions in Partnership with The Nature Conservancy." https://press.aboutamazon.com/news-releases/news-release-details/part-its-plan-be-net-zero-carbon-2040-amazon-commits-10-million/.

Boden, T.A., Marland, G., and Andres, R.J. (2017). Global, Regional, and National Fossil-Fuel CO2Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. https://cdiac.ess-dive.lbl.gov/trends/emis/overview_2014.html

Butler, Brett J., Sarah M. Butler, Jesse Caputo, Jacqueline Dias, Amanda Robillard, and Emma M. Sass. 2020. "Family Forest Ownerships of the United States, 2018: Results from the USDA Forest Service, National Woodland Owner Survey." NRS-GTR-199. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. https://doi.org/10.2737/NRS-GTR-199.

Butler, Brett J., Jaketon H. Hewes, Brenton J. Dickinson, Kyle Andrejczyk, Sarah M. Butler, and Marla Markowski-Lindsay. 2016. "Family Forest Ownerships of the United States, 2013: Findings from the USDA Forest Service's National Woodland Owner Survey." *Journal of Forestry* 114 (6): 638–47. https://doi.org/10.5849/jof.15-099.

Butler, Sarah M, Brett J Butler, and Jaketon H Hewes. 2014. "Vermont Woodland Owner Survey 2014 Final Project Report," December, 100.

Chamas, Paula, and Mark Berry. 2018. "Forest Carbon Offsets." Conservation Finance Network. June 26, 2018. https://www.conservationfinancenetwork.org/2018/06/26/forest-carbon-offsets.

The Climate Pledge. "Net Zero Carbon by 2040." https://www.theclimatepledge.com.

Cold Hollow to Canada. "Cold Hollow to Canada - Northern Vermont Land Stewardship and Wildlife Habitat Conservation." Accessed November 1, 2020. https://www.coldhollowtocanada.org/.

Cold Hollow to Canada. 2017. "Cold Hollow Woodlots Program Expands Through NRCS Funding." https://www.coldhollowtocanada.org/what/woodlots/nrcs-regional-conservation-partnership-program.

Cold Hollow to Canada. "Woodlots Program." https://www.coldhollowtocanada.org/what/woodlots/.

Fargione, Joseph E., Steven Bassett, Timothy Boucher, Scott D. Bridgham, Richard T. Conant, Susan C. Cook-Patton, Peter W. Ellis, et al. 2018. "Natural Climate Solutions for the United States." *Science Advances* 4 (11): eaat1869. https://doi.org/10.1126/sciadv.aat1869.

Foster, David, David Kittredge, Brian Donahue, Glenn Motzkin, David Orwig, Aaron Ellison, Brian Hall, Betsy Colburn, and Anthony D'Amato. 2005. "Wildlands & Woodlands: A Vision for the Forests of Massachusetts." Harvard Forest. http://www.wildlandsandwoodlands.org/sites/default/files/Wildlands%20%26%20Woodlands%20Massachusetts.pdf.

Green Timber Forestry. "Green Timber." https://greentimberforestry.com/.

Griscom, Bronson W., Justin Adams, Peter W. Ellis, Richard A. Houghton, Guy Lomax, Daniela A. Miteva, William H. Schlesinger, et al. 2017. "Natural Climate Solutions." *Proceedings of the National Academy of Sciences* 114 (44): 11645–50. https://doi.org/10.1073/pnas.1710465114.

Halik, Shari. 2018. "Bill Keeton Manages Forests for Old Growth Traits to Boost Carbon Storage, Fight Climate Change." Rubenstein School of Environmental and Natural Resources. https://www.uvm.edu/rsenr/news/bill-keeton-manages-forests-old-growth-traits-boost-carbon-storage-fight-climate-change.

Hancock, Charlie. 2020. Personal Communication with Charlie Hancock.

Hancock, Charlie. 2020. "Forest Carbon: A Natural Climate Solution and Tool for Advancing the Pace of Conservation." Cold Hollow to Canada. July 6, 2020. https://www.coldhollowtocanada.org/what/news/article/forest-carbon-a-natural-climate-solution-and-tool-for-advancing-the-pace-of-conservation.

High Meadows Fund. "High Meadows Fund." Accessed November 1, 2020. http://www.highmeadowsfund.org.

Kart, Jeff. 2020. "Carbon Markets Program Puts More Nonprofits On Path To Increase Land Conservation." Forbes. September 24, 2020. https://www.forbes.com/sites/jeffkart/2020/09/24/carbon-markets-program-puts-more-nonprofits-on-path-to-increase-land-conservation/.

Keeton, William. 2020. Personal Communication with Bill Keeton.

Keeton, William S., William VanDoren, Charles Kerchner, and Mackenzie Fuqua. 2018 "Vermont Forest Carbon: A Market Opportunity for Forestland Owners." https://www.vlt.org/wp-content/uploads/2018/07/Vermont_Forest_Carbon.pdf.

Kerchner, Charles D., and William S. Keeton. 2015. "California's Regulatory Forest Carbon Market: Viability for Northeast Landowners." *Forest Policy and Economics* 50 (January): 70–81. https://doi.org/10.1016/j.forpol.2014.09.005.

Labich. 2015. "The Regional Conservation Partnership Handbook." https://dnr.maryland.gov/met/Documents/MLCC2017/RCP_Handbook.pdf.

The Nature Conservancy. "Amazon: Unlocking Natural Climate Solutions." https://www.nature.org/en-us/about-us/who-we-are/how-we-work/working-with-companies/companies-investing-in-nature1/amazon/.

The Nature Conservancy. "Natural Climate Solutions." https://www.nature.org/en-us/what-we-do/our-insights/perspectives/natural-climate-solutions/.

The Nature Conservancy. "Natural Climate Solutions Accelerator Grant Program." https://www.nature.org/en-us/what-we-do/our-priorities/tackle-climate-change/climate-change-stories/natural-climate-solutions-accelerator-grant/.

Northern Forest. "Northern Forest Center: Economic & Conservation Initiatives." https://northernforest.org/.

Natural Resources Conservation Service Vermont. 2017. "RCPP Expands Woodland Management Program in Vermont." https://www.nrcs.usda.gov/wps/portal/nrcs/detail/vt/newsroom/releases/?cid=nrcseprd1308856.

Nunery, Jared S., and William S. Keeton. 2010. "Forest Carbon Storage in the Northeastern United States: Net Effects of Harvesting Frequency, Post-Harvest Retention, and Wood Products." *Forest Ecology and Management* 259 (8): 1363–75. https://doi.org/10.1016/j.foreco.2009.12.029.

Olander, Jacob, and Johannes Ebeling. 2011. "Building Forest Carbon Projects: Step-by-Step Overview and Guide." Washington, DC: Forest Trends. https://www.forest-trends.org/wp-content/uploads/imported/building-forest-carbon-projects_step-by-step_final_7-8-11-pdf.pdf.

RGGI. "Regional Greenhouse Gas Initiative." Regional Greenhouse Gas Initiative. https://www.rggi.org/.

Richardson, Nick. 2018. "Nick Richardson: Our Forests, Our Future: Can Vermont Landowners Sell Carbon Offsets?" Bennington Banner. August 23, 2018. https://www.benningtonbanner.com/opinion/columnists/nick-richardson-our-forests-our-future-can-vermont-landowners-sell-carbon-offsets/article_bb16f7a8-7fbc-5d40-aa71-ee140c45d1f9.html.

Richardson, Nick. 2020. Personal Communication with Nick Richardson.

Schwartz, Anne. 2014. "Linking a Landscape." Center for Northern Woodlands Education. February 7, 2014. https://northernwoodlands.org/articles/article/landscape.

Snyder, Michael C, and Steven J Sinclair. 2017. "2017 Vermont Forest Action Plan." Department of Forests, Parks and Recreation. https://fpr.vermont.gov/sites/fpr/files/Forest_and_Forestry/Vermont_Forests/Library/2017_VT_ForestActionPlan.pdf.

Snyder, Michael, John L Bartholomew, Jack Byrne, Cecilia Danks, Ruth Hardy, Mark Higley, Corey Parent, Jim Shallow, Robert Turner, and Stephan Webster. 2020. "Vermont Forest Carbon Sequestration Working Group Final Report." https://legislature.vermont.gov/Documents/2020/WorkGroups/House%20Energy%20and%20Technology/Agencies%20&%20Departments/Department%20of%20Forest,%20Parks,%20and%20Recreation/W~Michael%20Snyder~Vermont%20Forest%20Carbon%20Sequestration%20Working%20Group%20Final%20Report~1-8-2020.pdf

Sorenson, Eric, and Robert Zaino. 2018. "Vermont Conservation Design: Summary Report for Landscapes, Natural Communities, Habitats, and Species." https://vtfishandwildlife.com/sites/fishandwildlife/files/documents/Conserve/VT%20Conservation%20Landscape-level%20Design/Vermont-Conservation-Design-Summary-Report-February-2018.pdf.

Spatial Informatics Group. "About: SIG." https://sig-gis.com/about/.

Staying Connected Initiative. "The Staying Connected Initiative." http://stayingconnectedinitiative.org/.

State of Vermont Agency of Commerce and Community Development. "The Vermont Brand." https://accd.vermont.gov/tourism/promote-your-business/tourism-marketing/brand.

State of Vermont Agency of Commerce and Community Development. "Tourism and Marketing." https://accd.vermont.gov/tourism.

Two Countries, One Forest. 2019. "The Northern Appalachian Acadian Ecoregion." April 9, 2019. https://2c1forest.org/ecoregion/.

Two Countries, One Forest. "Two Countries, One Forest." https://2c1forest.org/.

UN Environment Programme. 2019. "Emissions Gap Report 2019." http://www.unenvironment.org/resources/emissions-gap-report-2019.

United Nations Climate Change. 2019. "Cut Global Emissions by 7.6 Percent Every Year for Next Decade to Meet 1.5°C Paris Target - UN Report." November 26, 2019. https://unfccc.int/news/cut-global-emissions-by-76-percent-every-year-for-next-decade-to-meet-15degc-paris-target-un-report.

USDA Forest Service. "The USDA Forest Service Forest Inventory & Analysis One-Click Factsheet." https://public.tableau.com/views/FIA_OneClick_V1_2/StateSelection?%3AshowVizHome=no.

U.S. EPA, OAR. 2020. "Inventory of U.S. Greenhouse Gas Emissions and Sinks." Reports and Assessments EPA 430-R-20-002. EPA. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks.

"U.S. Natural Climate Solutions Accelerator Finalist: Vermont Forest Carbon Phase Two. Collaboration between Vermont Land Trust and University of Vermont." https://www.nature.org/content/dam/tnc/nature/en/documents/VLT_US_NCS_Accelerator_2018.pdf.

Vermont Agency of Natural Resources, U.S. Forest Service Eastern Region. "State and Private Forestry Fact Sheet." 2020. https://apps.fs.usda.gov/nicportal/temppdf/sfs/naweb/vt_std.pdf.

Vermont Business Magazine. 2020. "Amazon Commits $10 Million to Support Small Forest Owners in Vermont, PA." April 21, 2020. https://vermontbiz.com/news/2020/april/21/amazon-commits-10-million-support-small-forest-owners-vermont-pa.

Vermont Climate Action Commission. Report to the Governor. Executive Order 12-17, July 31, 2018. Available at https://anr.vermont.gov/sites/anr/files/Final%20VCAC%20Report.pdf.

Vermont Department of Forests, Parks and Recreation. “County Forester Program.” https://fpr.vermont.gov/CountyForesters.

Vermont Department of Forests, Parks and Recreation. “Finding a Consulting Forester.” https://fpr.vermont.gov/finding-consulting-forester.

Vermont Land Trust. “Forest Carbon Cooperative - Vermont Forests Reduce Carbon Pollution.” https://vlt.org/forestcarbon.

Vermont Natural Resources Council. “Conservation Easement.” https://vnrc.org/community-planning-toolbox/tools/conservation-easement/.

Werneke, Christine. 2010. “Opportunities for VT Vacation Providers,” 154.

White, Abby. 2020. “A Local Solution with a Global Impact.” *Vermont Land Trust* (blog). October 8, 2020. https://vlt.org/forests-wildlife-nature/local-solution-global-impact-forest-carbon.

White, Alisa E., David A. Lutz, Richard B. Howarth, and José R. Soto. 2018. “Small-Scale Forestry and Carbon Offset Markets: An Empirical Study of Vermont Current Use Forest Landowner Willingness to Accept Carbon Credit Programs.” *PLOS ONE* 13 (8): e0201967. https://doi.org/10.1371/journal.pone.0201967.

Endnotes

[1] Green Timber Forestry.
[2] Ketchner and Keeton, 2015, page 70-81.
[3] Vermont Land Trust. "Forest Carbon."
[4] Halik, 2018.
[5] Foster, Kittredge, Donahue, Motzkin, Orwig, Ellison, Hall, Colburn, and D'Amato, 2005.
[6] Richardson, 2018.
[7] Cold Hollow to Canada.
[8] High Meadows Fund.
[9] Vermont Business Magazine, 2020."
[10] Cold Hollow to Canada, 2017
[11] Vermont Business Magazine, 2020.
[12] Boden *et al.*, 2017.
[13] United Nations Climate Change. 2019.
[14] UN Environment Programme, 2019.
[15] US EPA, OAR. 2020. Table 6-12 in Chapter 6, "Land Use, Land-Use Change, and Forestry."
[16] US EPA, OAR. 2020. Table 2-1 in Chapter 2, "Trends in Greenhouse Gas Emissions."
[17] The Nature Conservancy, "Natural Climate Solutions."
[18] Griscom *et al.*, 2017.
[19] Fargione *et al.*, 2018.
[20] RGGI.
[21] Keeton *et al.,* 2018.
[22] Chamas and Berry, 2018.
[23] State of Vermont Agency of Commerce and Community Development. "Tourism and Marketing."
[24] State of Vermont Agency of Commerce and Community Development. "The Vermont Brand."
[25] Werneke, 2010.
[26] USDA Forest Service. "The USDA Forest Service Forest Inventory & Analysis One-Click Factsheet."
[27] Butler *et al.*, 2020.
[28] Butler *et al.,* 2014.
[29] Butler *et al.,* 2014.
[30] USDA Forest Service. "The USDA Forest Service Forest Inventory & Analysis One-Click Factsheet."
[31] Snyder and Sinclair, 2017.
[32] Sorenson and Zaino, 2018.
[33] Schwartz, 2014.
[34] Cold Hollow to Canada. "Cold Hollow to Canada - Northern Vermont Land Stewardship and Wildlife Habitat Conservation."
[35] Labich, 2015.
[36] Cold Hollow to Canada. "Woodlots Program."
[37] Natural Resources Conservation Service Vermont, 2017.
[38] Natural Resources Conservation Service Vermont, 2017.
[39] Natural Resources Conservation Service Vermont, 2017.
[40] Vermont Land Trust, "About."
[41] Vermont Natural Resources Council. "Conservation Easement."
[42] Vermont Land Trust, "About."
[44] Vermont Climate Action Commission, 2018.
[44] Butler *et al.*, 2014.
[45] Snyder *et al.*, 2020.
[46] Nunery and Keeton, 2010.
[47] Ketchner and Keeton, 2015, pages 70-81.

[48] Personal communication with Bill Keeton, June 12, 2020.
[49] Personal communication with Bill Keeton, June 12, 2020.
[50] Personal communication with Nick Richardson, May 27, 2020.
[51] Keeton *et al.*, 2018
[52] Keeton et al., 2018, page 5.
[53] Keeton et al., 2018, page 29.
[54] Olander and Ebeling, 2011.
[55] Personal communication with Nick Richardson, May 27, 2020.
[56] White et al., 2018.
[57] The Nature Conservancy. "Natural Climate Solutions Accelerator Grant Program."
[58] Griscom et al., 2017. Fargione et al., 2018.
[59] "U.S. Natural Climate Solutions Accelerator Finalist: Vermont Forest Carbon Phase Two. Collaboration between Vermont Land Trust and University of Vermont."
[60] Personal communication with Nick Richardson, May 27, 2020.
[61] Vermont Department of Forests, Parks and Recreation. "County Forester Program."
[62] Vermont Department of Forests, Parks and Recreation. "Finding a Consulting Forester."
[63] Personal communication with Charlie Hancock, May 29, 2020.
[64] Personal communication with Nick Richardson, May 27, 2020.
[65] White, 2020.
[66] Hancock, 2020.
[67] Cold Hollow to Canada Carbon Project, Landowner Participation Agreement.
[68] Cold Hollow to Canada Carbon Project, Landowner Participation Agreement.
[69] The Climate Pledge. "Net Zero Carbon by 2040."
[70] Amazon, 2020.
[71] The Nature Conservancy. "Amazon: Unlocking Natural Climate Solutions."
[72] Butler *et al.*, 2016. pages 638–647.
[73] Kart, 2020.
[74] https://newildernesstrust.org/wilderness-conservation/climate-change/
[75] Snyder*, et al*, 2020.
[76] Snyder, *et al*, 2020.
[77] Snyder, *et al*, 2020.