

YALE FOREST FORUM
SPEAKER SERIES SUMMARY

FALL 2022

YFFReview

What Makes a High-Quality Forest Carbon Credit?

August – December, 2022
New Haven, Connecticut, USA



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YFFReview

YALE FOREST FORUM AND YFF REVIEW

The Yale Forest Forum (YFF) is the convening hub of The Forest School at the Yale School of the Environment. YFF offers weekly webinar Speaker Series during the academic year to provide opportunities to hear from leaders in forest management, conservation, academia, and policy. Each YFF Speaker Series is organized around a key theme or challenge facing forests, forestry, and people. Guest speakers represent a wide range of perspectives and organizations, including government, NGOs, and businesses, and across scales from local to international. The *YFF Review* is a publicly available output of the series, summarizing key learnings and examples from the [YFF Speaker Series](#).

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Introduction

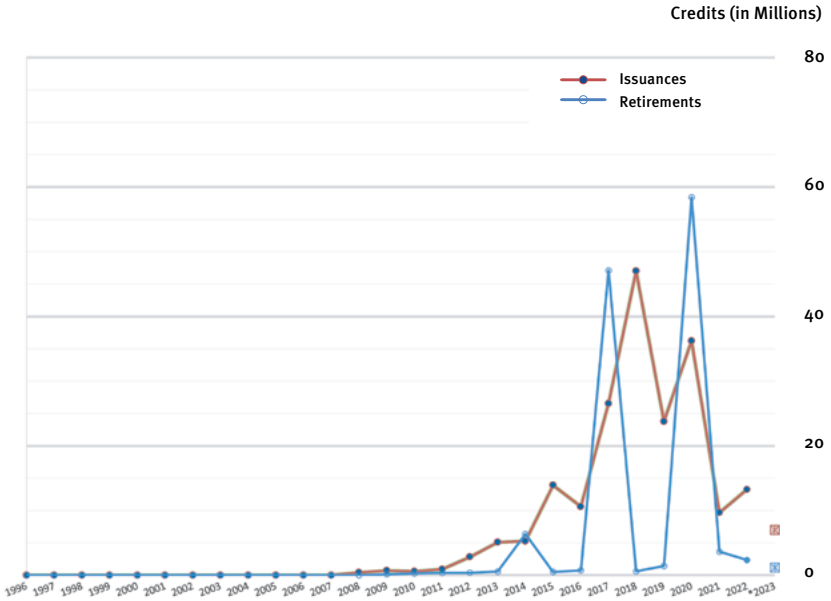
By: Reid Lewis

The Yale Forest Forum (YFF) has been engaging people with the most important issues in forestry since 1994. In the fall of 2022, YFF brought together more than 800 registered attendees from around the world to hear from twelve leaders, experts, and critics of forest carbon offsets in the United States to address the question: what makes a high-quality forest carbon offset?

Forests store vast amounts of carbon in vegetation and soils. In the U.S., the [EPA estimates](#) that forests stored 769 million metric tons of carbon dioxide equivalent (CO₂e) in 2021, the storage equivalent of 12% of total emissions in the same year. By protecting, managing, and restoring forests, people may increase the amount of carbon that forests sequester and store. Forest carbon offsets are a market mechanism to finance such carbon-oriented interventions. For this series, we focused on forest carbon offset creation in the United States (for coverage of the tropics, see the spring 2023 series, “[How Can the Voluntary Carbon Market Make a Meaningful Contribution to Protecting Tropical Forests?](#)”)

According to the [Berkeley Voluntary Registry Offsets Database](#), U.S. forest carbon offset projects have issued nearly 204 million credits throughout their history — the equivalent of nearly 204 million metric tons of additionally stored CO₂e. The market has grown substantially over the last decade. This growth has led to new, innovative offset protocols that increase the market’s accessibility, including to smaller forestland owners and for a greater variety of forest stewardship actions. The past few years have also seen a series of critiques against U.S. forest carbon offsets, through forums as diverse as scientific articles to late-night television segments.

Credits Issued and Retired Over Time



The number of forest carbon offsets created from projects in the United States has grown substantially over the last decade. Figure by [So et al., the Berkeley Voluntary Registry Offsets Database](#).

In this series, we — the Yale Forest Forum, Yale Center for Natural Carbon Capture, Yale Applied Science Synthesis Program, and The Forest School at the Yale School of the Environment — invited speakers to help us explore the growing, complex world of U.S. forest carbon offsets. We were fortunate to be joined by a diverse group of experts. **Coeli Hoover** (USDA Forest Service’s Northern Research Station) introduced the science of how forests remove, store, and emit carbon dioxide. **Rajan Parajuli** and **Stephanie Chizmar** (NC State University) gave an overview of the U.S. forest carbon offset market and the components of a typical offset project. **Mark Trexler** (The Climate Web; Climatographers) critiqued U.S. forest carbon offsets, particularly around additionality, leakage, and perverse

market incentives. **Marissa Spence** (Climate Action Reserve) described how registries work with stakeholders to create new offset protocols. **Christine Cadigan** (American Forest Foundation) introduced a new methodology targeted at family forest owners and diverse stewardship actions. **Bryan Van Stippen** (National Indian Carbon Coalition) showed numerous ways that carbon offsets can benefit Indigenous nations, and described how tribes are working to ensure the quality of forest carbon offsets. **Jim Hourdequin** (Lyme Timber Company) shared an industrial forestland owner's perspective and described how forest carbon offset prices are not enough to incentivize meaningful change in industrial harvest behavior. **Tracy Johns** (Meta) outlined an offset buyer's perspective, highlighting the importance of community involvement, environmental justice, and market growth. **Jacqueline Patterson** (Chisholm Legacy Project) named offsets as a false solution, describing environmental injustices and highlighting more just alternatives. **Tom Hodgman** (Goldman Sachs-AIMS Imprint) described different approaches to investing in nature-based solutions and the importance of nature-based solutions in climate impact portfolios. **Frances Seymour** (World Resources Institute) concluded the series by comparing U.S. forest carbon finance to tropical forest carbon finance, highlighting concerns and opportunities that are specific to the tropical forest carbon space.

A note to the reader from the editing team: Forest carbon credits and the voluntary carbon market are a rapidly evolving field. The contents of this review reflects the state of the market and information at the time of the series, fall 2022, as shared by each participating speaker. There have been changes and transformations in the field that have taken place since that time.

You can find speaker bios, presentation recordings, and slides on the [Yale Forest Forum website](#). To all our excellent speakers: thank you for joining us and sharing your knowledge. To you, reading this Review: we hope you find it informative and helpful. May we continue to steward forests, for their climate benefits and so much more.

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The Nuts and Bolts of Forest Carbon Storage

Presented: September 8, 2022

COELI HOOVER, PhD, *Research Ecologist, Northern Research Station, USDA Forest Service*

Summary by: Gracie Bachmann, Isobel Campbell, Jon Gewirtzman, Maude Gibbins



Coeli Hoover

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INTRODUCTION

Understanding forest carbon credits requires knowledge of the crucial role forests play in the carbon cycle and climate regulation. Coeli Hoover, research ecologist at the USDA Forest Service's Northern Research Station, laid this foundation for the Yale Forest Forum series "What Makes a High-Quality Forest Carbon Credit?" by presenting three key concepts: 1) forests and the carbon cycle, 2) forest carbon storage, and 3) carbon sequestration and forest management. Hoover underscored that many U.S. forests have been human-managed for millennia. To holistically address the current climate, ecological, and equity crises, U.S. forests will likely require management to secure their carbon benefits and ecosystem services. Forest cover and species diversity remain key to achieving this, and the need for management may be growing as climate change exacerbates stressors, such as drought, fire, insects, and disease. Further, carbon is one among many values of forests — including sustainable timber production, wildlife habitat, and recreation — and can be highly compatible with those additional values.

FORESTS AND THE CARBON CYCLE

Forests store carbon in both soil and plant material, plant tissues are approximately 50% carbon (dry mass). In aggregate, U.S. forests represent a net sink for carbon, storing more carbon than they emit, with the net difference offsetting approximately

10% of all U.S. greenhouse gas emissions. Forests, however, are dynamic: a forest can be a carbon source or sink depending on biogeophysical factors including stand age, species composition, soil fertility, water availability, forest health, disturbance, weather, and management practices.

Forested lands store carbon in many ecosystem compartments — referred to as carbon stocks or pools — including living trees, soil, the forest floor, standing dead wood, downed dead wood, shrubs and herbs, and wood products. The amount of carbon in each pool varies by forest type; for example, tropical forests store relatively more carbon in aboveground biomass and less in soils compared to boreal forests. While aboveground woody biomass and soil make up the largest pools in temperate forests, each about 40% of total forest carbon, carbon in aboveground woody biomass is easiest to reliably quantify. Foresters and ecologists have measured pools of aboveground living carbon for decades

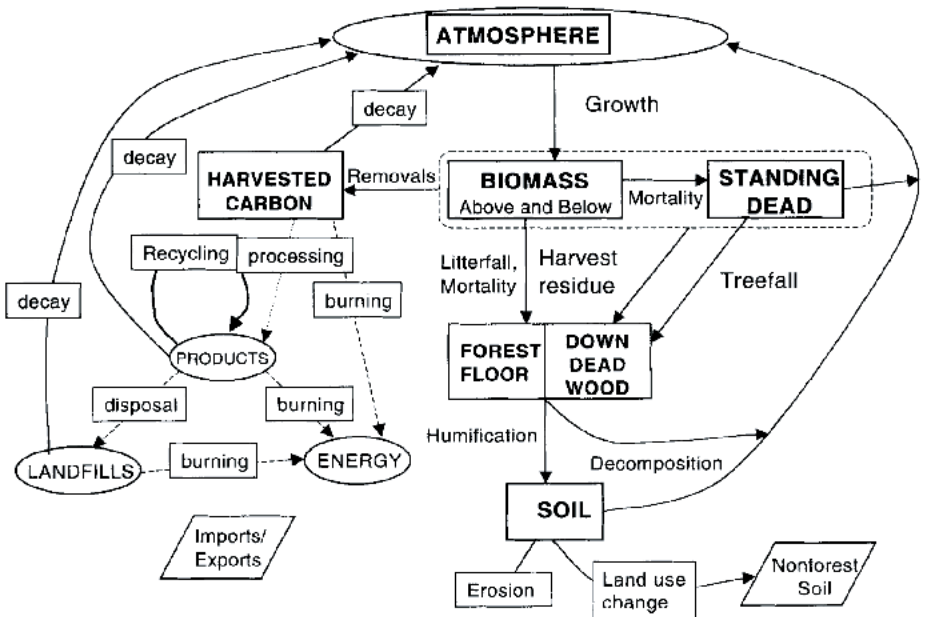


Diagram of stocks and flows of carbon in the forest sector. Figure from Heath et al.



using well-established methodologies. Though this carbon pool can change significantly over short time periods (decreasing due to timber harvesting and wildfire, or increasing quickly through forest plantations, natural regrowth, or improved management), carbon in aboveground woody biomass is tangible, measurable, and modeled at a large scale. Regional snapshot data are available through programs like the U.S. Forest Service's Forest Inventory and Analysis (FIA) program.

FOREST CARBON STORAGE

Hoover highlighted two key metrics for forest carbon storage: stocks/pools and rates/fluxes. Clarity regarding the metric being used is important to avoid confusion. Total standing carbon stock provides a snapshot in time, indicating the amount of carbon currently stored in the given forest carbon pool. This can be expressed in absolute terms (typically metric tons) or on a per area basis (typically metric tons per hectare). The rate of carbon uptake expresses the amount of new carbon accumulated/sequestered in a given interval of time. This measurement is typically expressed in tons of carbon per hectare per year. Rate comparisons are useful for comparison of different stands and when initial stocks vary. Hoover explained that carbon accumulation rates are analogous to “interest” earned on carbon stock “savings” in the bank. The relative importance of each of these metrics is dependent on the priorities and objectives of the carbon assessments.

To assess the impact of an intervention, both carbon stock and flux assessments require a baseline, or starting point in time, for measuring carbon removed from the atmosphere by live trees. A variety of methods can be used to determine the baseline including carbon measurement over time, regional averages, and growth and yield models like the Forest Vegetation Simulator.

FOREST MANAGEMENT

In addition to biophysical characteristics, forest management also shapes the carbon dynamics of a forest. Younger forests have

lower standing carbon stocks than older forests but accumulate carbon quickly due to high growth rates. Meanwhile, carbon stocks of older forests are typically higher than those of young forests, but older trees have a slower rate of growth and sequestration. Due to the shifting relative importance of rates versus stocks with forest age, the average annual accumulation rates of a forest will look different depending on the time scale under consideration.

When it comes to administering carbon credits, accurate and transparent data about a forest's carbon content over time is critical. Forest Inventory and Analysis (FIA) data, even from similar forest types, is generally not appropriate for estimating the management impacts on smaller projects. This is because data is collected at too coarse a scale (i.e., one FIA plot per 6,000 acres). Hence, local-scale variability may result in discrepancies between modeled stock and flux estimates and on-the-ground measurements on any specific parcel of land. On smaller spatial scales, forests need to be measured directly. This ensures accuracy of the carbon stock or rate accounting. For many landowners, especially small landowners, the expense of monitoring, reporting, and verification components of forest carbon accreditation represents a significant barrier-to-entry. There are some ideas about how to reduce this barrier, including paying landowners directly for management practices that are known to increase carbon content, rather than on a per-ton basis.

Ultimately, the best management strategy for forest carbon is one that keeps forests as forests, rather than conversion or development of the forest to another ecosystem type or human infrastructure. Beyond this, forests with a mix of tree types and ages suited to their local landscapes are desirable. Their diversity of species and age classes allows them to be resilient, and therefore less susceptible to sustained carbon losses from disturbances, such as extreme weather, pests, or fire. The funding from carbon credits can be important for forest management and protection, thereby supporting robust, healthy forests.

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Introduction to the U.S. Carbon Markets

Presented: September 15, 2022



Rajan Parajuli

RAJAN PARAJULI, PhD, *Assistant Professor*
STEPHANIE CHIZMAR, PhD, POSTDOC, *NC State University
College of Natural Resources*

Summary by: Charlotte Benishek, Philipp Hoehme, and Jimena Terrazas

OVERVIEW

Forest carbon offsets are designed to encourage additional removal of carbon dioxide or avoided emissions of greenhouse gases like carbon dioxide, methane, or nitrous dioxide from the atmosphere. Credits can be created in four ways: 1) avoided conversion of existing forests, 2) improved forest management practices, 3) establishment of forests on previously unforested land (afforestation), or 4) restoration of trees to previously deforested land (reforestation). Each of these activities has the potential to remove carbon dioxide from the atmosphere or to avoid new emissions, resulting in an emissions credit, generally measured and sold in the unit metric tons CO₂e (carbon dioxide equivalent). Today, forest credits are primarily created through the management of private forest lands. Businesses are currently the largest purchasers of forest carbon offsets, which are considered a forest product. The standardized and fungible nature of offsets has enabled the creation of an offset market in the United States. Offset credits are issued to the market by multiple registries that monitor, track, and verify eligible forestry activities.



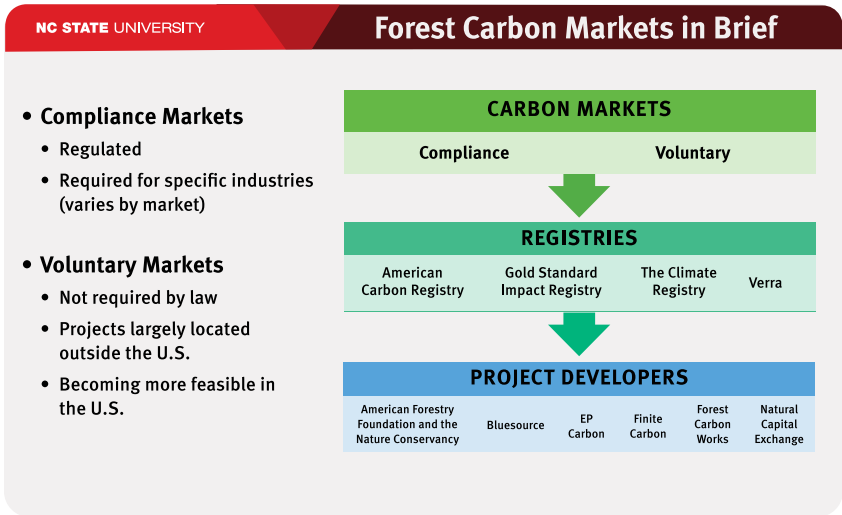
Stephanie Chizmar

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VOLUNTARY VS. COMPLIANCE MARKETS

Two types of carbon markets exist in the United States: compliance markets and voluntary markets. Compliance markets are regulated and mandatory for specific industries at a regional, national, or international level. The state of California governs the largest

compliance market in the U.S., created in 2013 as the first nationwide carbon market. The program was recently extended to 2030. It currently regulates greenhouse gas emissions of oil and gas companies, manufacturers, and utilities. In 2017, the law mandated that 50% of offsets used for compliance in the 2021-2025 period demonstrate direct environmental benefits to California.



Carbon markets in the United States can be either compliance or voluntary, and each style of market involves myriad stakeholder relationships. Figure courtesy of Parajuli and Chizmar.

By contrast, voluntary markets are not established by law. Individuals, organizations, institutions, or government entities can choose to participate in voluntary markets in order to achieve their net zero emissions commitments and move toward more sustainable production and operations. While most projects for the voluntary market are located outside of the U.S., carbon projects are becoming more and more feasible in the United States. Voluntary carbon markets have experienced an overall upward trend in demand, and demand is expected to continue to rise in the years to come.

QUALITY CONSIDERATIONS

However, despite the increase in interest and demand for voluntary carbon credits, prices fluctuated significantly in the past decade. This fluctuation is mostly due to the fact that carbon credits can be obtained by offsetting carbon through different methods. Credits can come from forestry, agriculture and other land uses, renewable energy, energy efficiency, waste disposal, transportation, household devices, and chemical processes.

Different projects in the carbon market will have different attributes associated with the category, type, project location, carbon standard, and vintage, which consequently will affect how buyers value that credit. These differences in production, price, and geography ultimately show that this is an increasingly segmented market.

Ultimately, carbon credits must be scientifically measurable and real, and developers must ensure that they account for leakage. Leakage refers to emissions generated outside of the project boundary due to project activities. For example, reducing logging in the project boundary can lead to increases in logging outside the project, in which case, credits should be subtracted to account for the project's "leaked carbon emissions." Project developers have to estimate the amount of leakage from a proposed project and adjust their issued credits to compensate for future leakage.

OVERVIEW OF REGISTRY LANDSCAPE AND CRITERIA

Historically, small landowners have encountered financial obstacles to participating in forest carbon credit projects owing to high costs for developing and maintaining forest projects. Many efforts have focused on determining how to remove this barrier for small landowners. While former project developers demanded high fees for the initial carbon inventory, new project developers use remote sensing or photos taken by the landowners to offer the initial assessment of the carbon stock for free. These efforts to reduce costs can decrease the minimum amount of land required from about 5,000 acres to just one acre.

Photo courtesy of Geranimo on Unsplash.



Although new program developers aim to address small landowners, developers offer a wide range of contract terms, including variation in duration, ability to harvest, treatment of natural disasters, or ability to enroll only a portion of one's land. Finally, various carbon developers differ in the type of work for which they are willing to issue credits. For example, Natural Capital Exchange (NCX) plans to issue credits for improved forest management projects (as of 2022), while Working Trees and Green Trees issues credits for afforestation projects. This heterogeneity among developers provides an opportunity for landowners to choose an option that best suits their unique circumstances and goals.

State of the Debate: Critiques of Forest Carbon Credits

Presented: September 22, 2022

MARK TREXLER, PhD, *Developer, The Climate Web; Director, Climatographers*

Summary by: Annie Miller, Amelia Napper, and Madeleine Tran

Mark Trexler built the Climate Web, a collective intelligence for understanding and tackling climate change. He participated in the development of and due diligence on offset projects both in the United States and worldwide and has published extensively on the environmental integrity of the offsets market. Trexler's presentation addressed the popular but contentious climate change mitigation tool of carbon offsets. Trexler posed the question whether carbon offsets are a reasonable approach to address climate change considering the difficulty in getting them right. This is important because offsets — either explicitly, implicitly, or morally — justify an emission elsewhere. The offset project must be directly tied back to the carbon market (additionality), have an equivalent lifetime impact (permanence), and not cause increased carbon emissions elsewhere (leakage), according to Trexler. The issues of additionality, permanence, and leakage are not absolute or technical but rather rely on subjective policy decisions. Trexler said the

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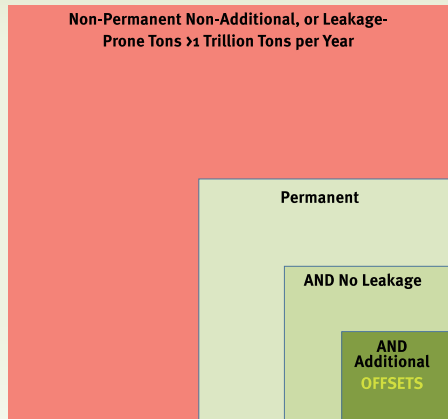
Mark Trexler

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following questions must be asked: How much additionality and permanence are enough? How much leakage is acceptable? In his view, these components are not — and have not been — adequately addressed in today’s market, resulting in a small percentage of offsets that are legitimate and effective.

CO₂e Tons that Could Theoretically be Turned into Offsets

- All Natural CO₂e Reservoirs (as Avoided Emissions)
- All Economics-Driven Avoided Emissions
- All Existing or Anticipated Policy-Driven Avoided Emissions
- All Voluntary Avoided Emission Initiatives
- Carbon Market-Driven Avoided Emissions
- All Natural CO₂e Sinks (as Removals)
- All Economics-Driven Removals
- All Existing or Anticipated Policy-Drive Removals
- All Voluntary Removal Initiatives
- Carbon Market-Driven Removals



A nesting diagram to visually describe the relatively few offsets that meet the criteria for permanence, leakage, and additionality. Figure courtesy of Mark Trexler.

Trexler explained that additionality is a difficult criterion to screen for because it can only be assessed theoretically (as a counterfactual scenario) given that it is impossible to prove with certainty what the future would have been in the absence of a carbon market. Additionality “testing” differs from something like pregnancy testing because unlike additionality, a person who takes a pregnancy test would eventually know whether they are pregnant (or not) regardless of whether the initial test was positive or negative. Therefore, pregnancy tests allow us to evaluate the number of correct results versus errors (false positives and false negatives). Because of the counterfactual nature of a forest credit project, it will never be obvious whether the

counterfactual scenario (often a harvest) would have happened in the absence of the carbon market. That means that for carbon credit projects it is difficult to “test” for additionality or reliably quantify false positives and negatives. The realities of statistical hypothesis testing make things even more challenging because efforts to decrease false positives will only increase false negatives and vice versa. Thus, policymakers need to decide whether false positives or false negatives should be minimized. Policymakers must also ask what fraction of false positives is politically acceptable and ask about the potential for false positives to slip into this market. Further, in Trexler’s expert opinion, many non-additional offset projects are now entering the market based on a desire to expand market inclusivity and “fairness,” even if false positives are the result.

Permanence of an offset refers to how long carbon will remain stored in forests before it is released back into the atmosphere. While permanence would ideally apply over geological timescales, Trexler emphasized there is not an objectively correct length of time that carbon needs to remain stored for it to be considered an effective offset. He then explained that permanence is another policy decision and must balance the goal of long-term storage with the reluctance of forest landowners to commit themselves to such storage, which would interfere with their future options for using or selling their land.

The final criterion for carbon offsets is leakage, which refers to the possibility of transferring greenhouse gas emissions from one place to another. This can happen, for instance, if protecting one area of a forest leads to the deforestation of another area. “No leakage” is a key carbon offset criterion, but Trexler posits that it is almost impossible to measure and, therefore, manage.

Lastly, Trexler raised the potential for a perverse incentive around pricing, where the highest-profit offsets may be the lowest quality. That is, non-additional, non-permanent, or leakage-prone tons might be almost costless and risk-free to bring to market for a project developer, which means these low-quality credits would have the largest profit margins for the developer.

Photo courtesy of Brian Garrity on Unsplash.



Overall, Trexler presented myriad challenges and critiques of the carbon offset market. He explained that quantifying and regulating high-quality carbon credits is a scientifically, economically, and politically difficult endeavor, and ultimately, there are no right answers to ensure that these credits are effective tools for mitigating climate change. Issues of permanence, leakage, and additionality plague the market, and addressing each is mired with varying levels of uncertainty. A possible solution Trexler presented is instituting a scoring system around the confidence a buyer can have in the climate impact of an offset, as opposed to today's "good or bad" binary determination. Trexler concludes that a lack of consensus around the definition of quality credits, coupled with perverse incentives for low-cost credit production, have created a market that, after 35 years of trying, remains easy to game and difficult to get right.

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What Role Do Carbon Protocols Play in Creating High-Quality Forest Offsets?

Presented: September 29, 2022



Marissa Spence

MARISSA SPENCE, PhD, *Forestry Manager, Climate Action Reserve*

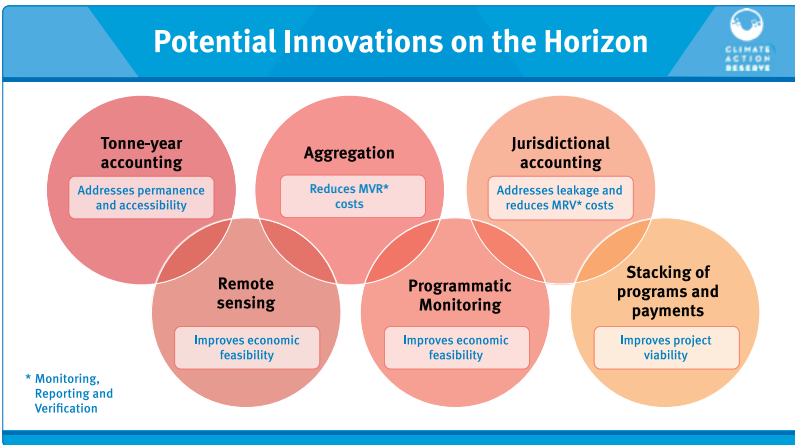
Summary by: Colleen Flynn, Robin Happel, Seung Min Kim, and Josie Watson

Carbon credit protocols serve as the foundation for carbon markets, providing guidance on how project activities must be designed, quantified, and monitored in order to produce carbon benefits that a registry can verify and sell as a credit. Marissa Spence, forestry manager at the Climate Action Reserve (CAR), joined the Yale Forest Forum to provide insight on how registries like CAR approach the protocol development process, their key challenges and tradeoffs, and emerging issues and opportunities in forest carbon credit markets.

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Protocols serve as a guidepost for project development by articulating key aspects of project design, including specifying which projects are

eligible, defining additionality, setting out environmental and social safeguards, establishing a quantification approach for the carbon associated with a project, and prescribing protocols for monitoring, reporting, and verification (MRV). In defining these parameters for project design, protocols reflect policy choices and must balance multiple competing aims that include enabling broad participation by landowners, ensuring the integrity of their programs, and building market confidence. Balancing accuracy and practicality, along with other objectives, is a key challenge for protocol developers. However, these competing considerations serve as checks and balances to ensure protocols remain rigorous and feasible. Registries regularly iterate on existing protocols based on feedback and new information to achieve balance between these objectives.



Potential innovations in forest carbon offset protocols have overlapping and intertwined elements. Image courtesy of Marissa Spence.

Protocols may be developed through a range of approaches. First, registries may develop protocols internally if they have the requisite in-house expertise, which can be a quick and low-cost approach to bring projects to market faster. However, internal development limits stakeholder engagement and may be less transparent, which can lead to lower external legitimacy. Alternatively, protocol development may be externally led by a



third-party, which often involves a carbon developer drafting a protocol and submitting it to a registry for review. This approach is fairly common and has a number of advantages, as it leverages the expertise of developers with deep knowledge and practical experience in the field and is likely connected to a clear project pipeline. However, external development may reflect the interests of the specific stakeholder group that drafts the protocol, which can result in a protocol that is more narrowly written and thus less widely applicable to the full range of potential projects in the space. A third approach, which is typically used by CAR for its voluntary protocols, is internally-led development with a stakeholder process, whereby the registry convenes a multi-stakeholder group to discuss key aspects of the protocol design and drafts the protocol based on their input, followed by a public comment period and review and approval by the registry's board. This approach allows registries to capitalize on diverse external expertise and may enhance credibility by providing a forum to discuss key issues. Downsides of this approach include a potentially larger time commitment, higher costs, and challenges in determining how best to include different stakeholders.

A number of innovations on the horizon offer new opportunities for forest carbon protocols. Spence discussed how advances in remote sensing may allow registries to grow their project portfolios more quickly by enabling estimation of forest carbon without boots-on-the-ground surveys. Ton-year accounting, which CAR is using in its new Climate Forward Program at the time of Spence's presentation, can also increase market accessibility and address permanence concerns by allowing landowners to make land management commitments of less than 100 years but still generate credits that represent a 100-year permanence period. Other developments, such as the use of jurisdictional accounting and new approaches to project aggregation, can further reduce costs and improve project feasibility. Spence noted that programmatic monitoring, whereby registries take on some of the monitoring and verification responsibilities to reduce project costs, and stacking projects with multiple layers of financing, such as from conservation grants, are two approaches

that can improve project viability and expand the market. Registries like CAR are exploring how these developments can help to address perennial challenges around permanence, additionality, and leakage, as well as ultimately help grow the market for these credits.

Although the rapid proliferation of forest carbon credit projects offers a number of potential upsides, there are also risks. Ex ante crediting, for instance, whereby landowners are granted credits for the expected future climate benefits of verified practices they undertake, can fund forest projects with high up-front costs that might otherwise not be feasible (e.g., fuel reduction and tree planting). Yet there is also the possibility that projects credited in advance may not capture the carbon they promised. To acknowledge this risk, ex ante crediting is usually conservative in the number of credits issued. Buffer pools, a tool used by CAR and many other forest offset protocols to address reversal and permanence risk, can help hedge against forest loss to storms or wildfires, but may not be sufficient to meet widespread or catastrophic losses that exceed typical disturbance regimes. However, to date, Spence reported that the CAR credit buffer pool is performing well in terms of its anticipated ability to protect the integrity of the projects in its portfolio. Spence concluded that, as with all aspects of protocol development, the CAR registry is thinking about ways to adapt and iterate to improve how these programs perform in an ever-evolving landscape.



Photo by Annie Spratt on Unsplash.

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Developing High Quality Carbon Projects on Family-Owned Forests

Presented: October 6, 2022



Christine Cadigan

CHRISTINE CADIGAN, *Senior Director of the Family Forest Carbon Program, American Forest Foundation*

Summary by: Jake Barker, Michael Culbertson, Nick Nugent, and Raffa Saposhnik

Christine Cadigan is the senior director of the Family Forest Carbon Program, a program of the American Forest Foundation and The Nature Conservancy that aims to make forest carbon markets more accessible to family forestland owners. Speaking to the Yale Forest Forum, Cadigan shared that natural climate solutions can help the U.S. reach one third of its mitigation targets by the end of the decade. Reforestation and natural forest management are [pathways for CO₂ storage](#) that are cost-effective and beneficial to local communities and landowners.

Thirty-nine percent of forested land in the U.S. is family owned. However, there is inequitable market access, with less than 1% of forest carbon projects enrolling landowners with fewer than 1,000 acres. There is a significant opportunity to include these small landowners, especially those with less than 100 acres, in carbon markets.

The American Forest Foundation (AFF) and The Nature Conservancy (TNC) formed the Family Forest Carbon Program (FFCP) to promote equitable access to carbon markets for small family-owned forests. Their marketing team identifies target landowners using messages, social media, direct mail, billboards, paid ads, local reporters, and landowner referrals. As conservation organizations, AFF and TNC have been able to bring new people and properties into conservation through this program. AFF's primary goal is to help finance conservation and long-term sustainable management through a carbon program that provides high-integrity, high-quality credits.

The minimum size requirement to qualify for FFCP is 30 acres. For those without forest management plans, the FFCP provides planning

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assistance through program enrollment from either an FFCP staff forester or a consulting forester approved by the program. Silvicultural prescriptions are intended to be flexible for each landowner's interests while still ensuring a net carbon benefit. In one approved central Appalachian practice, for example, forestland owners have the option to harvest up to 25% of basal area over the contract period, but can also opt to harvest nothing. At the time of Cadigan's presentation, the program has enrolled 230 landowners in the Northeast and Appalachia, who collectively manage over 36,000 acres of forest. The program is rapidly expanding to the Midwest and beyond.



WHAT ARE THE CORE CARBON PRINCIPLES?

The CCPs are designed to establish interlinked, fundamental principles for high-quality carbon credits that create real, additional and verifiable climate impact with high environmental and social integrity.

01. ADDITIONALITY
02. MITIGATION ACTIVITY INFORMATION
03. NO DOUBLE COUNTING
04. PERMANENCE
05. PROGRAM GOVERNANCE
06. REGISTRY
07. ROBUST INDEPENDENT THIRD-PARTY VALIDATION AND VERIFICATION
08. ROBUST QUANTIFICATION OF EMISSION REDUCTIONS AND REMOVALS
09. SUSTAINABLE DEVELOPMENT IMPACTS AND SAFEGUARDS
10. TRANSITION TOWARDS NET-ZERO EMISSIONS

The Integrity Council for the Voluntary Carbon Market maintains ten [Core Carbon Principles](#) meant to ensure that carbon credits developed and sold on the voluntary market are of high quality. Figure courtesy of Christine Cadigan.

At the time of the presentation, \$8.8 million had been paid to landowners, who generated an estimated 904,001 credits and sequestered 1 million tons of gross CO₂e. Shortly after the presentation, Cadigan explained via email that the contracts were forward agreements with buyers, contingent upon credit delivery. The credits are retroactively validated for properties still eligible after validation. The program uses philanthropy and debt financing to pay landowners upfront, and the principal and interest are repaid by the eventual sale of verified carbon units. The program assumes the risk of credit performance. Cadigan also confirmed that Verra

had subsequently approved the project and the first verification would occur in mid-2023, after which they could begin selling credits.

Cadigan explained that pricing is based on carbon opportunity rather than total acres enrolled. For example, the program looks at the landscape to determine whether acres may provide a greater benefit (e.g., due to a greater risk of harvest in that area). The average payment in the central Appalachians is \$215 per acre per year.

The FFCP provides landowners additional income and is focused on maintaining transparency with landowners and buyers. To achieve high-integrity, the FFCP follows the “core carbon principles” (CCP) for developers and registries issued by the Integrity Council for the Voluntary Carbon Market (ICVCM):

The FFCP focuses on meeting the following specific principles:

- 1. Buyer Vetting:** The FFCP analyzes the history and industry of each buyer to identify how the buyer has first avoided, minimized, rectified, and reduced emissions before offsetting residual emissions. They follow buyers’ reports and public commitments for net zero or sustainability goals and what measures buyers have taken toward those goals. The purchasing of offset credits is the last part of the buyer carbon mitigation hierarchy and should only be used when there is no cost-effective emissions reduction solution. FFCP turns down buyers who do not meet their criteria.
- 2. Rigorous Accounting:** The FFCP methodology establishes a dynamic baseline by matching enrolled plots to highly similar plots outside the program. FFCP sells credits through the Verra Registry and collaborated with Verra to develop a crediting methodology using dynamic baselines. FFCP uses publicly available Forest Inventory and Analysis (FIA) data to create cohorts of similar plots at the property and stand level. They [assess similarity](#) using 14 variables: non-project area, same origin, forest type group, ownership class, ecoregion, proximity, stand age, soil class, density of young trees, density of mature trees, elevation, slope, quadratic mean diameter, and distance to an improved road. The control is a composite



of ten FIA plots weighted by likeness to the enrolled plot. The difference in growth and sequestration over time between the enrolled forest plot and the unenrolled control forest plots determines the additional carbon stored by the project. This process is dynamic, as each verification event in turn updates the baseline, informing later verifications. The FIA plots are updated every five years so the baseline is also dynamic. The enrolled plots are initially verified annually to catch any issues and then shifted to longer verification events over time. Several plots are currently being remeasured.

- 3. Permanence Strategy:** To ensure lasting, permanent claims, the FFCP remotely monitors enrolled properties with an external data provider to ensure compliance and to detect post-contract changes. This allows them to determine reversals and provide compensation for enrolled landowners. The FFCP also strives to foster a robust and engaged landowner community to help educate newly enrolled landowners, which helps to create better long-term outcomes. For example, many landowners are not familiar with management plans, but the FFCP can provide them with these plans along with access to technical consultants. This helps to protect the landowner from management practices such as high grading, which can negatively impact long-term landowner income, carbon storage, and forest health.

The FFCP is an innovative carbon program that provides an accessible, affordable carbon solution to small and medium landowners, who traditionally would not be eligible to enroll their forestland in carbon projects. By bundling small carbon projects from multiple properties and using a dynamic baseline, Cadigan claims that the FFCP is increasing integrity in the forest carbon market while increasing access for American landowners.

Some criticisms that carbon markets do not result in additional carbon storage are well-founded, says Cadigan. These criticisms challenge project developers to make improvements in upcoming developments, like the dynamic baseline methodology mentioned above. At the same time, Cadigan concluded, we must not let perfection get in the way of progress, as this decade is important for responding to the climate crisis. The FFCP is committed to contributing improvements and following updated research.



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Developing a Project: Indigenous Forest Owners

Presented: October 13, 2022



Bryan Van Stippen

BRYAN VAN STIPPEN, *Program Director, National Indian Carbon Coalition*

Summary by: Jillian Aicher, Vincent Haller, Katie Michels, Elisse Roche

NICC BACKGROUND

The National Indian Carbon Coalition (NICC) is a project of the Indian Land Tenure Foundation and Intertribal Agriculture Council. NICC was created in response to carbon project developers taking advantage of tribal land to produce carbon offsets without fair tribal agreements. NICC seeks to protect tribal interests while facilitating tribal engagement and entry into carbon markets. Bryan Van Stippen, NICC's program director and an expert in Indigenous law and policy, built this initiative from the ground up by identifying different funding sources and engaging in key partnerships.

NICC supports the development and sale of forest carbon, soil carbon, and renewable energy credit projects by working as a trusted intermediary with non-profit and carbon developer partners. They contract over the life of each carbon project to support tribes with paperwork, reporting, and verification requirements during the full project period. Through the Tribal Land Conservation Initiative (TLCI), a partnership with The Nature Conservancy, NICC works to enable tribes to issue high-integrity carbon offsets through higher standard baselines.

BENEFITS OF CARBON PROJECTS ON TRIBAL LAND

NICC hopes that carbon management will provide a new and more sustainable revenue stream and deliver the following benefits to tribes:

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REVENUE GENERATION THROUGH CREDIT SALES

Tribes own approximately five percent of forestlands and grasslands across the United States. Tribal ownership of forestlands alone accounts for 88 million acres. Historically, tribes have been pressured to extract natural resources from their lands to generate revenue and support community wellbeing. By engaging in carbon sequestration projects and selling credits, tribes can generate revenue for their communities and protect and preserve the value of their lands against extractive industries, in turn promoting preservation of tribal land ownership and effective land stewardship. Because forest carbon offset projects currently require 3,000 acres for economic viability, NICC also works on sequestration projects beyond the forest base, including carbon sequestration on grassland and pastureland soil.

The Tribal Land Conservation Initiative
Protection. Preservation. Prosperity.

A partnership with The Nature Conservancy that helps tribes implement sustainable management practices, develop carbon projects and partner with socially responsible corporations - not irresponsible industrial polluters - to achieve financial security for the tribe.

The partnership enables tribes to sell carbon offsets on the voluntary market where companies make the choice to participate, not because they are compelled by regulations but because it is the right thing to do.

TLCI Benefits FDL KBIC MBICI

The Nature Conservancy
Protecting nature. Preserving life.™

Bryan Van Stippen

Van Stippen describes the Tribal Land Conservation Initiative and its partnership with The Nature Conservancy. Image capture from YFF presentation given by Bryan Van Stippen.

PRESERVATION OR REACQUISITION OF TRIBAL LAND

NICC aims to preserve Native land tenure and ensure that tribes retain access and ownership to natural resources. They ensure that sharing data and information about natural resources on tribal



lands – a historic area of exploitation – is conducted appropriately. For instance, NICC requires memoranda of understanding and non-disclosure agreements from all potential partners to ensure confidentiality of sensitive understandings about land ownership and natural resources and to ensure individual tribes control information transmission. Moreover, revenue from carbon credit sales can be used to reacquire traditional lands and restore tribal ownership.

GREENHOUSE GAS EMISSIONS REDUCTIONS

After criticism of carbon projects in 2019-2020, and while launching the TLCI, NICC started to identify the best methods to develop additional, high-quality, and high-integrity carbon credits. NICC uses a higher quality baseline and more stringent data – compared to the protocol standards set by most registries – in the voluntary marketplace to confidently claim the credits they generate and sell are truly additional. For example, to ensure additionality in issued credits, NICC exempts land from its baseline calculations on which timber and forest products would never be harvested by identifying these specific areas through carbon work groups and continued engagement with tribal members and leaders. While this might result in the generation of fewer credits per project, NICC hopes the credits will sell at a higher price point because of their high value. In addition, NICC advocates for improved baseline calculations in the marketplace more broadly. As such, NICC is benefitting carbon markets beyond the specific projects on tribal land.

PROMOTION OF CO-BENEFITS

Carbon sales may also support improved land stewardship and sustainable management practices, which can promote soil health, ecological diversity, and water and air quality. Moreover, forest carbon projects can lead to protection of cultural resources and sites. For example, NICC currently works with the Fond du Lac Band of Lake Superior Chippewa in northern Minnesota to protect wild rice beds — a key food source and cultural resource for the tribe — by entering land surrounding wild rice beds into carbon programs.

NICC'S ROLE IN THE PROJECT DEVELOPMENT PROCESS

As a Native-run organization, NICC prioritizes sensitivity to tribal culture, norms, and histories of extraction of Native resources by non-Native people. NICC offers education and guidance to ensure that tribes, not third-party developers, receive the major benefits of carbon projects. For example, NICC engages with tribal leadership staff and membership to determine and communicate what a carbon project would entail, and the organization works to obtain approval from tribal councils. While these processes take time, reaching consensus and securing approval at the project's outset promotes tribal sovereignty.

During the project development process, NICC provides tribes with unbiased data, develops project feasibility studies, and transfers ownership of this information to the tribes. If needed, NICC additionally assists tribes in navigating federal landownership recognition (e.g., the fee to trust process) and visualizing their landholdings through a web mapping platform. NICC seeks to ensure that as much funding from carbon projects as possible returns to tribes. As such, NICC covers the costs of project development on the front end and takes only a small portion of credit sales to support operations and staff capacity.

Finally, NICC has committed to engaging only with credit buyers that have the same or similar values to the tribe in each project. The organization vets potential partners and carbon developers in advance and advocates for tribal interests throughout transactions.

CONCLUSION

Van Stippen believes that tribal natural resources must benefit tribal nations first and foremost. By serving as an advocate for tribes in carbon project development, NICC works to ensure that carbon credits will support tribal interests, improve land management and stewardship, and mitigate climate change.

Photo by Annie Spratt on Unsplash.



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You Get What You Pay For: A Timberland Investor's Perspectives on Forest Carbon Offsets and Evolving Carbon Markets

Presented: October 27, 2022

JIM HOURDEQUIN, *CEO and Managing Director, The Lyme Timber Company*



Jim Hourdequin

Summary by: Alex Healey

Jim Hourdequin, CEO and managing director of The Lyme Timber Company, joined the Yale Forest Forum to discuss the trajectory of the United States' forest carbon offset market and its potential to provide long-term climate solutions.

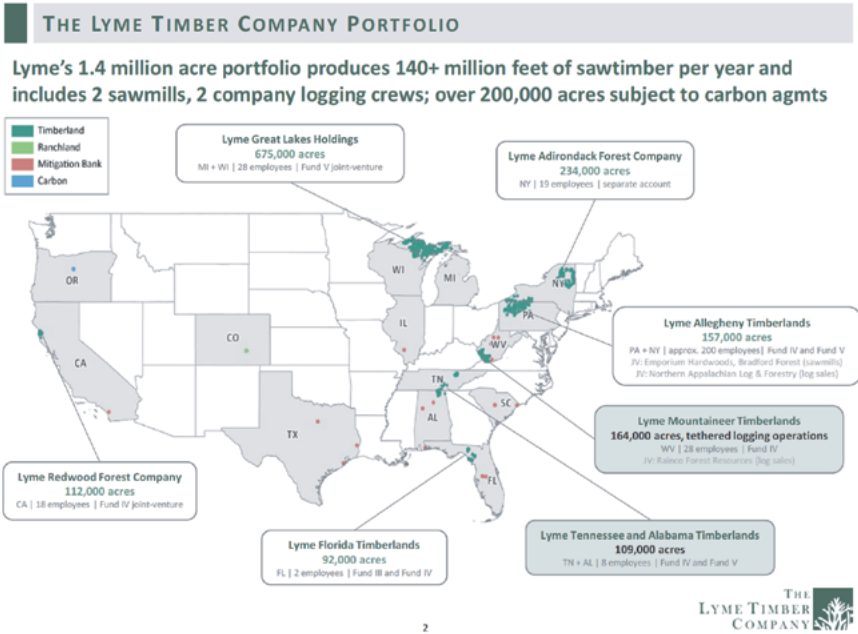
The Lyme Timber Company is a private timberland investment management company that owns approximately 1.3 million acres of working forests across the United States. Hourdequin explains that Lyme Timber is committed to sustainable stewardship practices and seeks to combine its conservation strategies with operational performance to generate attractive financial returns from timber harvesting.

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DO IMPROVED FOREST MANAGEMENT (IFM) PROJECTS DELIVER REAL CLIMATE VALUE?

Hourdequin opened his remarks by acknowledging the lofty expectations that many hold for forest carbon markets. Since companies will not be able to achieve net zero through emissions reductions alone, the purchase of high-quality carbon offsets generated from activities such as improved forest management is widely viewed as an essential step in achieving global climate goals. Lyme Timber has been an active participant in carbon markets within the United States, selling over \$50 million of

compliance offsets from five different projects on 200,000 acres of timberland to date.



The Lyme Timber Company owns an extensive portfolio of forestland across the U.S., deriving both timber and carbon benefits across its land base. Image courtesy of Jim Hourdequin, Lyme Timber Company.

Based on Lyme Timber's experience with forest carbon markets, Hourdequin has become increasingly skeptical of whether forest carbon offsets are delivering real climate value to offset buyers. The root of his concern lies in whether carbon project protocols have required meaningful departures from business-as-usual forest management practices that reduce net carbon emissions. "While legal and fully compliant with the protocols," Hourdequin observed, "[forest carbon projects] may not have required the forestland manager to reduce near-term harvest levels relative to historical harvests or change management practices to increase carbon sequestration." If project developers are following business-as-usual operating plans, then it is likely that many of today's projects are not satisfying the 'additionality' requirement that underpins forest



carbon market integrity. And, even if carbon markets compel a landowner to reduce harvesting and thereby increase carbon sequestration and storage, it is not clear to Mr. Hourdequin that this activity will produce a net climate benefit. He thinks that leakage rates — shifting of harvesting activities from the project area to other locations — could be as high as 100% in the near-term.

APPROACHING FOREST CARBON FROM THE BOTTOM UP

If current protocols and credit prices are insufficient to incentivize a departure from business-as-usual, Hourdequin asked his team, then what would it take to spur the adoption of forest management practices that do optimize for carbon storage? To answer this question, Hourdequin and his team used a bottom-up approach to evaluate their assets. “Essentially, we modeled harvest reductions and rotation extensions relative to our existing, planned operations — our own, internal [business-as-usual] baselines,” he explained to the Yale Forest Forum. From there, his team calculated the long-term financial impact of implementing these changes to estimate a minimum price per ton of carbon that would be required to incentivize their adoption of carbon-focused forest management practices. Lyme Timber’s analysis suggested that the firm would need to receive a price of \$30 to \$60 per ton, depending on the property, to cover the costs of implementing these practices. This is far higher than the prices available in today’s carbon markets. For comparison, Ecosystem Marketplace estimates the global average price for forestry and land use related voluntary offsets to be less than \$5 per ton.

CO-BENEFITS OF EXISTING CARBON PROJECTS

Hourdequin also emphasized that, although current protocols may not result in substantial changes in management practice, he does not believe that forest carbon project developers have extracted rents from the market. In a sense, he argued, carbon credit purchasers have asked to buy one thing, but developers have delivered something that — while still valuable — is different from what was agreed. According to Hourdequin, timberland managers have been justifiably compensated for

placing multi-decade encumbrances upon their land that protect biodiversity and result in environmental benefits. “We have had to reduce the size of clearcuts, maintain third party forest certification, and give up the right to sell off retail land parcels.” In effect, he observed, forest carbon developers have been given “a pass on meaningful carbon removal and climate mitigation because the projects have protected forests and delivered so many important conservation benefits.”

WHERE NEXT FOR U.S. FOREST CARBON MARKETS?

In his closing remarks, Hourdequin emphasized that there are many more unresolved issues within U.S. forest carbon markets. These include leakage, the capital inefficiency of investing in timberland solely for climate benefits, and the magnitude of carbon that might reasonably be sequestered. On this latter point, he shared a thought-provoking statistic: “By my rough calculations, it takes management changes on over 400 acres of our land to equal the carbon removal benefits that would result from installing solar panels on just one acre.”

Circling back to the question of how to improve credit pricing, Hourdequin pointed to the value of the environmental co-benefits that developers are already producing. In the future, he suggested, the sector might benefit from “a nature credit, one that makes fewer claims about carbon removal and better incorporates the many co-benefits of conserving land.”

Hourdequin ended the webinar by suggesting that, given the challenges facing U.S. forest carbon markets, the commercial timber industry’s greatest opportunity to provide climate solutions may instead lie in shifting the nature of demand for wood products. “A better solution,” he argued, “is to figure out ways to substitute wood products for materials with higher carbon footprints while also investing in forest restoration activities that can reduce fire risk and potentially increase carbon storage.”

Photo courtesy of Jace & Afsoon on Unsplash.



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Buying Carbon Credits

Presented: November 3, 2022

TRACY JOHNS, *Carbon Removal Specialist, Meta*

Summary by: Yiqing Cai, Helena Lam, Calla Rosenfeld, Jikai Wang



Tracy Johns

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Tracy Johns, the carbon removal program lead at Meta, spoke about the role that carbon credits play in corporate climate action and Meta's perspective on determining the quality of carbon credits. Johns brings more than a decade of experience across the dimensions of climate policy, finance, and land use. Over the past four years, she has focused on nature and technology-based carbon removal strategies. Johns joined Meta in 2021 following the company's 2020 announcement of its 2030 net zero target.

In 2020, Meta became one of many major technology companies to [commit to reaching net zero emissions](#) for their entire value chain by 2030. Meta has already eliminated about 94% of its operational GHG emissions compared to a 2017 baseline and reached 100% renewable energy in 2020. In her presentation, Johns explained that while Meta has been successful in reducing its Scope 1 and 2 operational emissions — emissions directly produced by Meta operations and indirectly by the production of the energy Meta uses, respectively — most of Meta's emissions (99%) can be attributed to Scope 3 — emissions produced upstream and downstream of Meta's value chain, by consumer use of Meta products for example. Due to the nature of Meta's business, there are increasingly hard-to-abate Scope 3 emissions, including emissions associated with business travel, data centers, and infrastructure hardware. This is where Johns steps in as the carbon removal specialist; all residual emissions that the company cannot eliminate directly must be offset through the purchase of carbon credits so Meta can reach net zero emissions across its value chain.

While Meta recognizes the importance of avoided emissions projects, their carbon credit strategy focuses on carbon removal projects and investing in both natural and technological carbon



Carbon Removal Project Criteria

removal, according to Johns. Most carbon removal projects that Meta supports are nature-based projects, which sequester carbon through afforestation and reforestation, improved forest management, or other ecosystem restoration projects.

A more nascent way to purchase carbon credits is to invest in technological removal projects, including direct air capture and biochar. Corporate climate commitments have led to an enormous growth in demand in the voluntary carbon credits market, and looking forward to the many 2030 and 2050 corporate net zero commitments, the [market will have to grow](#) 15-fold over the next 10 years. Moreover, only 1% of the voluntary market is comprised of carbon removal credits. Therefore, Meta is working to help grow the market while purchasing carbon credits.

In general, the key barriers to market growth are time required to develop and scale new approaches, financial access, information, testing standards, and sustained market confidence. Meta plans to address these barriers by contributing to pilot projects, leveraging their buying power to support diverse project types, financially innovating to balance the up-front payments issues, vetting and contributing to the development of new methodologies, and supporting and investing in new transparency tools. As Johns said in her talk, “Our procurement strategy, out to 2030 and beyond, is not just about buying; it’s a market growth strategy.”

As demand for carbon credits has increased in recent years, so has the price. In the future, Johns expects a continued price increase for nature-based carbon removal projects as carbon credit purchasers aim for higher quality and added value, particularly on social and environmental issues. Meta is willing to pay more for carbon credits if the project can achieve the following: incorporate community leadership into design and implementation; create local positive economic and ecological impacts; help elevate climate equity and justice issues; and connect with the communities that either Meta already partners with, or those its users or employees find important.

Meta uses these key criteria when evaluating a carbon removal project. Figure courtesy of Tracy Johns.



Designed for Durable Storage and Impact



Demonstrates Additivity



Local Social and Environmental Impacts




Quantified using Existing Standards



Enables Climate Justice and Equity



Assured by a Third Party

An aerial photograph of a lush green forest. A dirt road winds through the trees, starting from the bottom left and curving towards the top left. The forest is dense and vibrant green, with some small structures visible in the distance.

To evaluate and choose carbon removal projects that align with their values, Meta developed internal criteria as part of their due diligence process. Recognizing a gap in the current standards, Meta's due diligence process goes beyond the third-party verification required by carbon registries. Before buying a credit, Meta completes an extensive multi-week process where they bring in experts to assess: 1) that a project is designed for durable storage and impact, 2) the local, social, and environmental impacts of a project, 3) whether a project enables climate justice and equity, 4) if a project demonstrates additionality, 5) that carbon benefits are quantified using third-party validated standards, and 6) that the project is assured by a third party. This robust due diligence process helps Meta ensure additionality in their carbon credits and center projects with community leadership and local benefits. Acknowledging that this process requires significant staff and resources, Johns recognized that many companies purchasing carbon credits do not have the ability to conduct this same due diligence.

To bolster market innovation, Johns believes there is a lot the whole industry — including corporate buyers, registries, and project developers — can do by applying new technology, incorporating community engagement and leadership, stacking benefits, and managing environmental risks. On the technology side, blockchain technology can improve transparency in the transaction process, and remote sensing images can monitor forest dynamics and land changes, which then assists in monitoring, reporting, and verification. To help the market better incorporate community engagement, Meta sees opportunities to aggregate smaller projects, reduce barriers to entry, and transform stakeholder engagement into community leadership. To stack environmental benefits and control climate risks, companies should look for opportunities to link commitments on water and biodiversity to climate commitments and integrate climate and financial models and approaches. Johns believes corporate carbon credit buyers therefore have an important role to play in shaping the future of the voluntary market.

Carbon Markets and Environmental Justice

Presented: November 10, 2022

JACQUELINE PATTERSON, *Founder and Executive Director, Chisholm Legacy Project*

Summary by: Nadia Ahmad, Dan Alberga, Ismini Ethridge, and Ritika Jain

CONTEXT AND HISTORICAL FRAMING

Jacqueline Patterson is the founder and executive director of the Chisholm Legacy Project, as well as the former senior director of the environmental and climate justice program at the NAACP. During her presentation at the Yale Forest Forum, she provided a perspective on carbon markets and carbon pricing from the stance of frontline communities and environmental justice.

Patterson began her presentation by explaining how global markets have played a critical role throughout history in facilitating extractive activities that have detrimentally impacted frontline communities and historically marginalized groups, namely descendants of enslaved Africans and Black American communities in the United States. She cited a 2021 NAACP report titled, “[Nuts, Bolts, and Pitfalls of Carbon Pricing: An Equity-Based Primer on Paying to Pollute](#),” which illustrates the historical injustices caused by extractive market-motivated actors. “Enacted through exploitation, domination, extraction, and murder, these fortune seekers drove the original inhabitants off of their lands, as well as traveling to Sub Saharan Africa to violently extract and enslave African people for the purpose of building this nation [USA] and further amassing wealth and power,” says the report. The extraction of labor from the African continent parallels the capitalist systems at play in the modern era that extract natural resources causing environmental degradation. After discussing the trans-Atlantic slave trade, Patterson provided details about the Tulsa Race Massacre to demonstrate how African American communities have been excluded from participating in these economic markets.

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Jacqueline Patterson

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CARBON PRICING AS A “FALSE SOLUTION”

Patterson continued by stating her core thesis: carbon pricing is not a genuine or just tool for climate mitigation. She introduced the term “false solution” to express the contention that carbon markets have been systematically and deliberately constructed to benefit polluters at the expense of marginalized groups. Referring to the fees or costs incurred by the corporate sector through carbon pricing, she brought up the refrain, “give them a fine, it’s fine,” implying that carbon credit prices function simply as a price to allow for and justify continued real emissions. Rather, carbon prices could actually have a regressive effect by increasing the cost of essential goods and services for low-income individuals and communities.

Patterson noted that carbon pricing does not attempt to address the systemic problem of extraction, capital accumulation, and ecological destruction. By side-stepping this core issue, she argued that carbon pricing – and other market-based approaches to pricing externalities or natural assets – acts to further the power and wealth dynamics that underlie social marginalization. Patterson emphasized these carbon market shortcomings by highlighting a key component: markets’ lack of attention to local emissions and impacts on vulnerable communities.

ALTERNATIVE APPROACHES

Beyond the critiques of carbon pricing and market approaches, Patterson proposed a framework for a just transition from an “extractive economy” to a visionary “living economy.” Patterson articulated some of her main arguments against carbon markets from moral, ethical, religious, spiritual, human rights, economic theory, socio-economic impact, and environmental impact standpoints. She also highlighted her support for the [Peoples’ Demands for Climate Justice](#), which include the following:

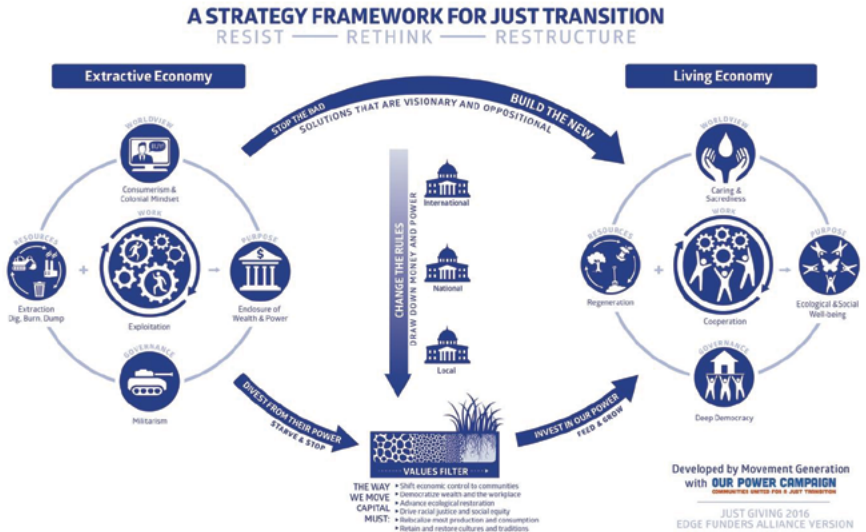
- Keeping fossil fuels in the ground.
- Rejecting false solutions that are displacing real, people-first solutions to the climate crisis.

Photo courtesy of Kostiantyn Li on Unsplash.



- Advancing real solutions that are just, feasible, and essential.
- Honoring climate finance obligations to developing countries.
- Ending corporate interference in and capture of the climate talks.
- Ensuring developed countries honor their “Fair Shares” for largely fueling this crisis.

Moving toward policy recommendations in the U.S. context, Patterson gave an overview of the kinds of “audacious and necessary” solutions that should be implemented. She gave the example of restructuring utility systems, shifting away from centralized energy generation that prioritizes investors and profit making and toward community-owned and -distributed energy generation. She also highlighted the importance of setting aggressive targets to “completely transition the entire economy away from fossil fuels.” Ultimately, Patterson calls for the rejection of policies built on “false solutions” to the climate crisis and considers carbon markets to be such a false solution.



Movement Generation with Our Power Campaign’s strategy framework for a just transition.

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Risk, Return, and Impact: Tradeoffs in Nature-Based Solutions Investment Strategies

Presented: November 17, 2022

TOM HODGMAN, *Vice President, Nature-Based Solutions,
Goldman Sachs-AIMS Imprint*

Summary by: Will Gardner, Zexi “Cicy” Geng, and UB Qiu

INTRODUCTION TO GOLDMAN SACHS IMPRINT

Tom Hodgman is the vice president in the Alternative Investments & Manager Selection (AIMS) Group and a member of the Imprint and Environment, Social, and Governance (ESG) Investment Team at Goldman Sachs. The team manages over \$6.3 billion in assets.

There are three main trends in sustainability that drive Goldman Sachs' strategy in impact investing. The first trend is the changing preference of consumers, workers, companies, assets owners, and regulators from a narrow financial focus to a broader consideration that includes the impact on the planet and society. The second is the growing impact that climate change will have on both assets (via climate risk) and society (via human costs and social tensions). The third is the improving economics of sustainable solutions, driven by increasing efficiency, innovation, and inclusive growth. These trends inform Imprint's two broad investment themes: inclusive growth and climate transition. Inclusive growth covers focus areas such as accessible and innovative healthcare, financial inclusion, and accessible and affordable education. Climate transition covers areas such as clean energy, sustainable transport, sustainable food and agriculture, waste and materials, and ecosystem services. Hodgman focused the remainder of the talk around climate transition, particularly on ecosystem services.

Hodgman highlighted that meeting the goals in the Paris Agreement will require massive emissions reduction and removal. The cumulative



Tom Hodgman

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expected demand from existing climate commitments is projected to be 60 billion tons of CO₂e by 2050. These commitments are expected to drive strong demand for carbon offsets, with prices increasing up to 10 times by 2050. Currently, the capital available from government and philanthropy is insufficient to meet these carbon reduction and removal objectives. Therefore, there is a role for investors and businesses to invest in new CO₂ removal projects to meet this future demand. However, Hodgman also reiterated that businesses should first focus on reducing their own carbon footprints and only look to offsets for their residual emissions.

MARKET FOR NATURE-BASED SOLUTIONS

There are broadly two ways to offset emissions: 1) purchasing offsets in the open market and 2) investing in nature- and technology-based solutions. Nature-based solutions (NbS) can include reforestation, avoided deforestation, improved forest management, biochar, conservation agriculture, and blue carbon.

Hodgman shared that over 70% of the NbS climate mitigation potential is in the forestry sector. Unlike new technologies, forestry NbS do not require massive investment to be perfected and scaled and to offer unique biodiversity co-benefits. Hodgman stated that NbS give investors the opportunity to maximize the impact of their funds, especially in the near term, as they are on the lowest end of the carbon sequestration cost curve. Considering the drivers of quality for carbon offsets, NbS have strong co-benefits but struggle with additionality, permanence, and leakage more than technological solutions do.

Due diligence is necessary to understand the quality of an offset or investment from financial, environmental, social, and governance perspectives. Within the environmental perspective, a detailed analysis of underlying carbon projections, protocol choice, and compliance is needed for all investments that include a carbon component. Hodgman stated that developers tend to struggle most with carbon projections and protocol complexities. Imprint works with investees to help them apply protocols correctly and go above and beyond when protocols are lacking.

Photo courtesy of Markus Spiske on Unsplash.





BBS INVESTMENT STRATEGIES

Hodgman listed the four main approaches that Imprint is taking to invest in carbon markets: 1) spot offset purchases (purchasing existing credits on the open market), 2) forward offset purchases (committing to buy offsets that have not yet been created at a specific price in the future), 3) investing in a project or developer, and 4) investing in real assets (including agricultural land and timberland) that sequester carbon. Hodgman shared how these approaches differ in risk, return, required capital, and impact.

Purchasing offsets on the spot market has the lowest risk, as the carbon has either already been sequestered or the emissions have already been reduced and the price is certain. Investing in a project has the highest risk as the investor faces both delivery risk and carbon price risk. These approaches also have very different financial return profiles. Offsets purchased on the spot market and then retired have a certain negative financial return. The financial return of other approaches depends on future carbon prices as well as the financial returns of the underlying real assets in the real asset approach. Purchasing existing offsets on the open market has the lowest capital requirements, while purchasing real assets, such as purchases of farmland or timberland, has the largest capital requirements. Projects that provide incremental capital, either by funding new projects or committing to buying credits from projects through forward credit purchases, are likely to have a greater impact in driving carbon outcomes than do projects that purchase existing credits.

Imprint is primarily investing in the real asset strategy. Hodgman stated that Imprint prefers this approach as it hedges the carbon price risk with the investment retaining the underlying land asset and its potential non-carbon financial flows. Timberland and farmland asset returns have low correlation with other investment assets and thus are an attractive option for investors looking to diversify their portfolios. Timberland and farmland are also effective inflation hedges, something that is increasingly desired in today's macro environment.

Additionally, the preferences of individual investors have a large impact on their approach. The preference for removals versus avoided emissions drives investors to very different types of projects, as do investors' different planned uses for the carbon (i.e., monetizing the carbon or using it against their own net zero goals). Finally, it is important to consider what blend of objectives different investors are seeking to optimize for, from financial return and total volume of carbon sequestered to ecological and human co-benefits.

Hodgman says there are several opportunities to improve the market for NbS. The blended investment objectives that these projects present make them ideal for blended finance. Longer-term, more impact-focused investors can partner with more financially focused investors to reduce risk and drive more funding into these types of investments. There are also very high transaction costs, with a plethora of protocols and due diligence requirements that are often difficult for new companies and managers to navigate. New monitoring, reporting, and verification tools, like remote sensing, will help to drive down these transaction costs and increase participation by investors. Finally, there is significant promise in the bioeconomy, with forest products being substituted for historically fossil fuel-derived products. Government policies and increased investment in this space will also help. With so much demand in NbS and carbon credits, Imprint is working to enable the flows of private capital needed to fund carbon removals and emission reductions in the run up to 2050 and beyond.



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Domestic vs. International Forest Carbon Crediting: What's the Same? What's Different?

Presented: December 1, 2022



Frances Seymour

FRANCES SEYMOUR, *Associate Research Scientist and Distinguished Senior Fellow, World Resources Institute; McCluskey Fellow, Yale School of the Environment (2022)*

Summary by: Urmila Mallick, Isaac Merson, and Angela Xue

Presenting an introduction to global perspectives on “What Makes a High-Quality Forest Carbon Credit,” Frances Seymour shared her expertise in tropical forest protection, climate change, and their inter-dynamics. Seymour is a distinguished senior fellow with the World Resources Institute, where she is studying the many impacts that tropical forests have on climate systems and human well-being. In addition, Seymour is a McCluskey Fellow at the Yale School of the Environment, leading independent studies in this topic, and is chair of the board of the Architecture for REDD+ Transactions. She is lead author of the book, *Why Forests? Why Now? The Science, Economics, and Politics of Tropical Forests and Climate Change*. In spring 2023, she will help lead a companion series to this Yale Forest Forum series entitled, “How Can the Voluntary Carbon Market Make a Meaningful Contribution to Protecting Tropical Forests?”

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Carbon credit markets — both nationally and internationally — are rapidly evolving, and Seymour says there are open questions largely centered around the following topics:

- Differentiating between ‘removal’ and ‘avoided emissions’ credits and pricing credits accurately.
- Ensuring permanence, additionality, and reduced leakage from credit issuance.
- Navigating the biophysical, social, and political contexts for sellers of carbon credits.

Within each of these questions, there are similarities and differences between domestic and international markets, which lead to different risks and opportunities. For example, the presence or absence of compliance markets within the country of interest changes how credits are issued and evaluated. Some areas, such as California in the U.S., have compliance markets, while most of the global carbon credit market is voluntary.

The final layer of complexity Seymour explored in this presentation is the push-and-pull between private project-level carbon crediting markets and jurisdictional-scale credits related to climate pledges made by countries. This is of particular concern as international “reducing emissions from deforestation and forest degradation” (REDD+) credits become more available in the market, as private projects may or may not be nested within the jurisdictional-scale system of carbon accounting of REDD+.

Similarities and differences between the U.S. and international market under a general framework

Seymour introduced a framework to examine the carbon market in three categories: demand-side concerns, transaction infrastructure, and supply-side concerns.

Demand-side concerns focus on how carbon credit purchasers use credits to meet compliance obligations or for making business claims. The key concern is greenwashing. Instead of prioritizing emissions reductions in their value chains, some companies may use carbon credits to substitute for decarbonization. Under the Science Based Targets initiative (SBTi) standard, companies should only use carbon credits for Beyond Value Chain Mitigation (BVCM), where companies can compensate for remaining unabated emissions in their decarbonizing pathway to net zero. Demand-side concerns are similar between U.S. domestic and international markets because these concerns are independent of credit supply and credit type.

Transaction infrastructure concerns focus on how institutions and market players develop norms to facilitate market transactions, assess credit quality, and monitor transparency. Quality assurance of credits is conducted by crediting programs and independent

Photo courtesy of David Clode on Unsplash.





verification bodies. Credit registries serve the purpose of avoiding double counting and promoting transparency. While methodologies can vary among crediting programs, their general approach and framework are similar between U.S. domestic and international markets. Some programs credit both domestically and internationally. However, for the international market, there are ongoing discussions on the need for registries to present information on whether a credit is accompanied by authorization. The purpose of the authorization is to make “corresponding adjustment,” which ensures that the country selling the credit internationally does not also use the credit toward its Nationally Determined Contribution (NDC).

Supply-side concerns focus on the attributes of the credits. These attributes consider the additionality, permanence, and leakage risk of emission reductions and removals as well as other elements of environmental and social integrity. Both U.S. domestic and international markets face similar challenges in the robustness of the quantification of emission reductions and removals, additionality, leakage, impermanence, social and environmental safeguards, equity of access to the market, and the unfair exclusion of past good stewards (individuals, communities, or countries) with a higher baseline of performance. Despite these similar concerns, the scale of implementation and the sociopolitical contexts can be very different between domestic and international credits. The spring 2023 YFF seminar on tropical forest credits will delve into these discussions.

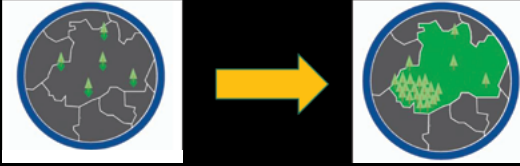
How is international tropical forest crediting different from the U.S. domestic market?

While the U.S. market largely focuses on Improved Forest Management (IFM) projects, forest carbon crediting in the tropics is more focused on efforts that directly prevent deforestation and land conversion. Due to the higher magnitude of carbon flux and storage in tropical forest systems, these projects have greater overall potential to impact greenhouse gas emissions and removal. Annual REDD+ credits in these systems are expected to drastically increase once jurisdictional-scale issuances are introduced into the international market.

Photo courtesy of Ma Ti on Unsplash.

Relationship to the UNFCCC

- REDD+ developed under the UNFCCC, and as negotiated, performance is based on national-scale accounting (with subnational on an interim basis)



Jurisdictional-scale crediting

- Helps mitigate risks of non-additionality, leakage, and impermanence
- But increases uncertainty of quantification of emissions reductions, and requires nesting of project-level accounting
- Most importantly, it incentivizes governments to do what only governments can do

Jurisdictional-scale crediting plays a synergistic role in effective forest carbon credit accounting. Figure courtesy of Frances Seymour.

Investing in tropical forest carbon credits provides the unique opportunity to also address a wide range of non-carbon biophysical effects that impact climate stability locally and globally. Non-carbon effects include shifts in albedo, evapotranspiration, surface roughness, and biogenic volatile organic compounds, which can exacerbate global temperature increases from deforestation in the tropics by 50% in comparison to carbon-only effects. Biophysical factors in tropical forests also play a critical role in maintaining the resilience of neighboring forests through “positive leakage” effects, which remain unaccounted for in crediting systems.

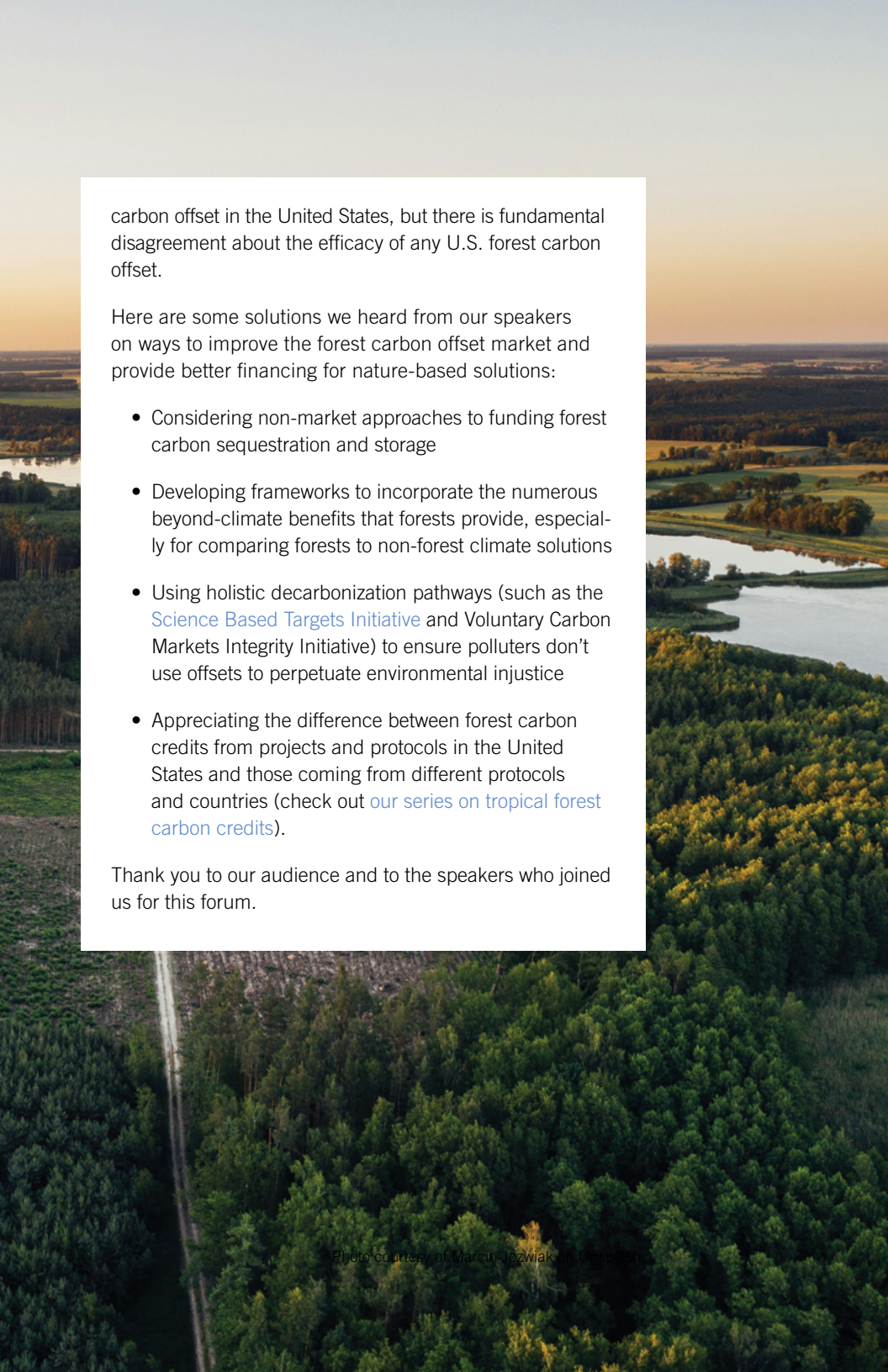
From a social, political, and economic perspective, tropical forest crediting is often more complex due to weaker governance and forest land ownership structures. In many cases, additionality in REDD+ projects may need to directly address ongoing illegal deforestation, while projects may also face challenges with forest land tenure uncertainties or disputes. In comparison to the U.S. domestic market, the international market emphasizes social integrity to a greater extent, in terms of substantive and procedural rights such as Free, Prior, and Informed Consent, as well as carbon credit revenue-sharing with stakeholders such as Indigenous peoples.

Conclusion

By: Reid Lewis

The Yale Forest Forum's Speaker Series "What Makes a High-Quality Forest Carbon Credit?" brought together speakers to explore the rapidly evolving world of U.S. forest carbon offsets, including the opportunities and pitfalls that forest carbon offsets can have for stewarding forests and the climate. So, what does make a high-quality forest carbon credit? Well, it depends on who you ask. We had speakers share perceived successes: a tool to further Indigenous sovereignty and Indigenous forest management; a revenue stream for small forestland owners to maintain and improve their forests; a proven climate technology for investment; a framework to help end tropical deforestation. We also had speakers share perceived failures: markets flooded with credits at too low a price owing to a lack of true additionality; payments to industrial timber companies without meaningful change in harvesting behavior; and perpetuating environmental injustice by permitting continued pollution in frontline communities.

In light of these contrasting points, it is clear that there is not only no consensus on what makes a good forest

An aerial photograph of a lush green forest landscape. In the foreground, a dirt road winds through a dense forest of tall, thin trees. To the right, a river flows through a valley, surrounded by green fields and scattered trees. The background shows a vast expanse of forest under a soft, golden sunset sky. The overall scene is peaceful and natural.

carbon offset in the United States, but there is fundamental disagreement about the efficacy of any U.S. forest carbon offset.

Here are some solutions we heard from our speakers on ways to improve the forest carbon offset market and provide better financing for nature-based solutions:

- Considering non-market approaches to funding forest carbon sequestration and storage
- Developing frameworks to incorporate the numerous beyond-climate benefits that forests provide, especially for comparing forests to non-forest climate solutions
- Using holistic decarbonization pathways (such as the [Science Based Targets Initiative](#) and Voluntary Carbon Markets Integrity Initiative) to ensure polluters don't use offsets to perpetuate environmental injustice
- Appreciating the difference between forest carbon credits from projects and protocols in the United States and those coming from different protocols and countries (check out [our series on tropical forest carbon credits](#)).

Thank you to our audience and to the speakers who joined us for this forum.

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