

Evaluating Supply and Demand of Northern Forest Branded Carbon Credits

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Completion date: January 31, 2015

There is high potential for both generation of and demand for northern forest branded carbon credits. However, a number of conditions must be met for regionally branded credits to be financially attractive both for suppliers and buyers, and will largely depend on integration with existing carbon market systems.

Funding support for this project was provided by the Northeastern States Research Cooperative (NSRC), a partnership of Northern Forest states (New Hampshire, Vermont, Maine, and New York), in coordination with the USDA Forest Service.

<http://www.nsrcforest.org>

Project Summary

Voluntary and compliance carbon markets have the potential to dramatically enhance the long-term sustainability of working forests and rural communities in the U.S. Northeast. Our multidisciplinary research project evaluated the potential for financially viable forest carbon projects, generation and selling offsets into existing markets, as well as demand from potential buyers for a regionally branded offset credit. The project's twin goals of understanding supply and demand required different methods but provided a comprehensive picture of the potential for generating carbon offsets in the northern forest region, and adding value to the sale of these through regional branding. Using forest inventory data from 25 non-industrial, privately owned properties, combined with intensive interviews with potential buyers, we found high potential for both supply and demand for northern forest carbon credits, but there are important limitations to both. There are pronounced economies of scale that render financially feasible mostly those carbon projects conducted on medium to larger sized properties (e.g. >1,000 acres) and/or with initial carbon stocking (i.e. timber volume) higher than regional averages. As carbon markets develop, for instance through the addition of project aggregation mechanisms in compliance markets, opportunities for smaller landowners may improve. Choice of silvicultural approach and policy choices markets will face in the future are also important considerations, potentially affecting cash flows and returns on investment. Buyers expressed interest but also reservations with the idea of locally or regionally branded carbon credits. Of greatest concern were price points, holistic integration with other sustainability values, and departure from existing market systems rapidly gaining traction. For northern forest branding to work, the credits would need to be acknowledged by and registered with credible systems such as the California compliance market or international voluntary market standards. Working with these systems will be critical for developing locally branded credits, gaining legitimacy, and providing a price premium that would maximize benefits to forest landowners in the northern forest region.

Background and Justification

Goal 1. Northern Forest carbon credits supply side: Identify the potential quantity of Northern Forest carbon credits that can be delivered under various management scenarios and market protocols.

- Carbon markets, which provide payments to landowners for sequestering carbon dioxide through reforestation, improved forest management, and avoided conversion of forestland, offer a financially viable alternative to subdivision, real-estate development, and overharvesting.
- When this study was initiated, only voluntary carbon markets (also called “over the counter”) were available to landowners in the U.S. However, with advent of and explosive growth in the California compliance market, a cap-and-trade regulated market, the greatest potential shifted to this new market opportunity, which offers higher prices for offsets. Therefore our study was modified to focus primarily on the California market, to which other regional compliance markets, including the Regional Greenhouse Gas Initiative, have been linked.
- Forest landowners in the northeastern U.S., however, have little scientific and practical guidance on generating and successfully selling forest based carbon offsets.
- Despite the potential for C markets to incentivize sustainable forest management, several barriers impede landowner participation. Developing a C offset project can be a challenge due to market factors (i.e. price and demand), transaction costs imposed on landowners for meeting offset protocol requirements, uncertainty over the continued survival of carbon markets, and unfamiliarity with carbon forestry practices.
- To address this gap, we examined the property, forest management, and policy variables that would affect the financial viability of forest carbon offsets sold into the California compliance market (termed “ARB”) from forestlands in the northern forest region (Kerchner and Keeton 2015, Forest Policy and Economics). A companion paper also evaluated potential under the Voluntary Market (Russell-Roy et al. 2014, Canadian Journal of Forest Research), but focused on rehabilitation scenarios for poorly stocked forestlands.

Background and Justification (Cont.)

Goal 2. Northern Forest carbon credits demand side: Assess the market feasibility for branded Northern Forest carbon credits.

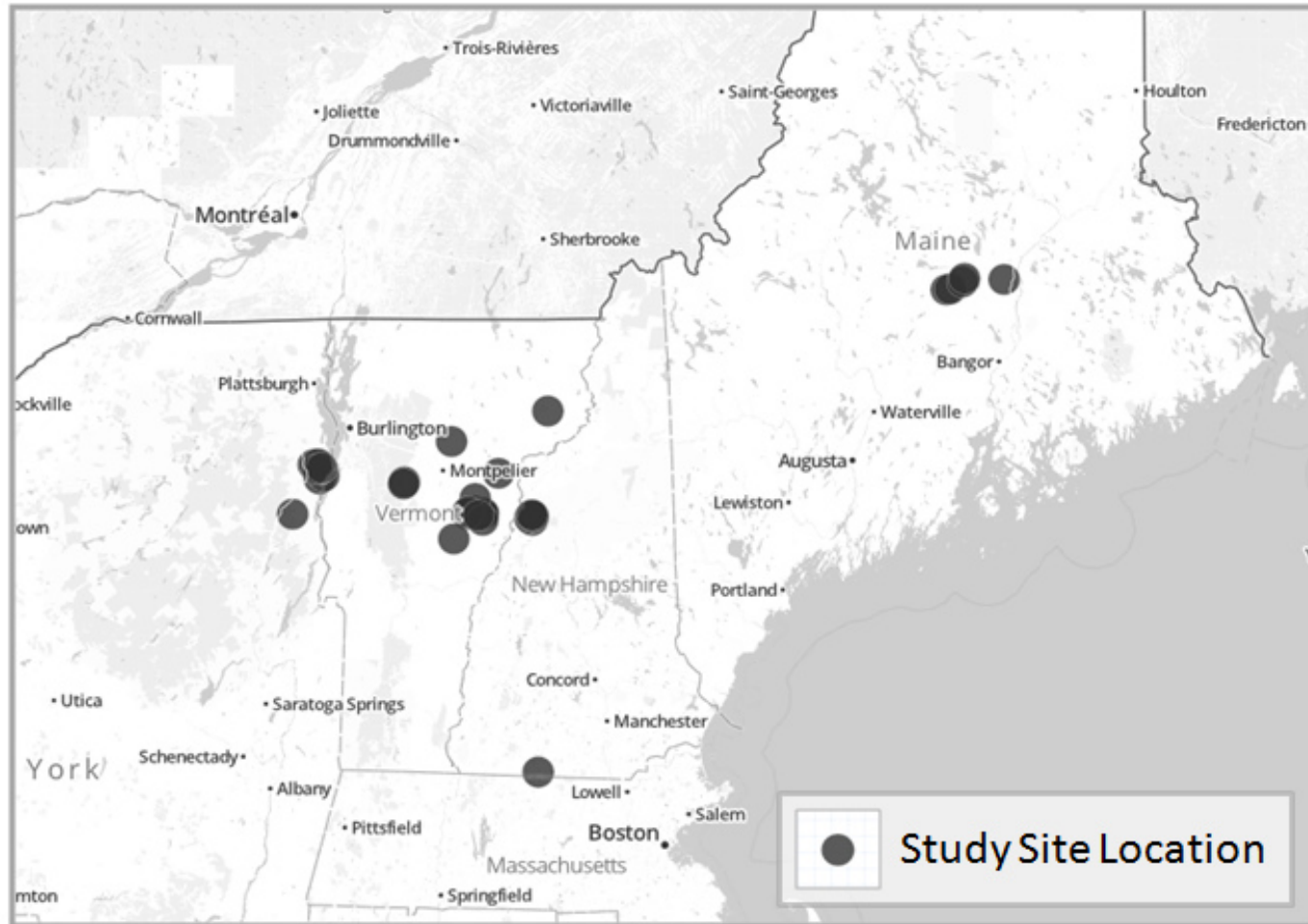
- Of equal importance to supply side consideration is whether there is market demand for Northern Forest branded carbon offsets, and in particular what brand attributes would make them attractive, and how this could be integrated into existing or new market frameworks.
- Research has shown that carbon credit market price is determined by environmental and social co-benefits that come along with offset projects. Likewise, previous NSRC research has shown that a Northern Forest brand (state and regional) for forest products greatly influences consumers' purchasing decisions, and the brand effect is greatest for those who live the Northeast U.S.
- Therefore, understanding the viability for Northern Forest carbon offsets requires an analysis of both the demand and supply side of the equation. However, to date, no research has examined potential demand side interest in carbon offsets generated in the Northern Forest.
- To address this information gap, we explored the following questions:
 - Are universities and businesses in the Northern Forest area interested in purchasing locally generated forest based carbon offsets?
 - What brand attributes are most attractive to potential buyers in the region?
 - How would potential buyers of branded offsets define “local” and how important is this factor in decision making?
 - How are trade-offs between price, verification, and location assessed?
 - Smaller-scale projects, which would be typical in the Northern Forest, are more expensive because they would not benefit from economies of scale. Would these potential purchasers be willing to participate in an innovative local market that lacks some of the oversight of the international voluntary market to support local projects?

Methods

Goal #1, Supply:

- Assembled forest inventory data from 25 non-industrial private forest properties located in northern New York, Vermont, New Hampshire and Maine.
- Applied nine carbon management scenarios to the inventory data for each property and projected growth and yield using the U.S. Forest Service Forest Vegetation Simulator.
- Calculated carbon pools associated with management scenarios and carbon credit outcomes following the protocol required by the California compliance market.
- Calculated a variety of financial viability indicators for each property and management scenario, including annual net cash flow, Net Present Value, and Mean Internal Rate of Return. Modeled transaction costs and revenues based on market data.
- Used Classification and Regression Tree analysis to evaluate the relative predictive strength of multiple factors that would affect financial outcomes for improved forest management projects in the Northeast, including choice of management approach, potential future changes in carbon market policies, credit prices, site productivity and stocking, property size, and other variables.
- Results of the multivariate analysis used to develop a spreadsheet based feasibility assessment tool

Locations of the 25 properties for which carbon data were assessed in the supply-side portion of this study



From Kerchner and Keeton (2015)

Multivariate Analysis of Property Level Drivers of C Value

Independent variable	Type	Levels
% conifer	Continuous	
Site Class	Categorical	High (I-II) Low (III-V)
Hectares	Continuous	Numeric
% C above common practice	Continuous	Percentage
Silvicultural treatments	Categorical	No management Single-tree selection Shelterwood Irregular Shelterwood Group Selection Patchcut
Certification	Categorical	Yes No
Conservation easement	Categorical	Yes No
Current Use	Categorical	Yes No
Type of Landowner	Categorical	Land Trust/Foundation Private landowner
Policy Assumption	Categorical	1. ARB continues post 2020 and long-term monitoring 2. ARB expires 2020 - "buy your way out" 3. ARB expires 2020 - no long-term monitoring cost

Methods (Cont.)

Goal #2, Demand:

- To address questions on the demand side of the equation, we surveyed potential purchasers and intermediaries and quantitatively assessed their interest in forest-based carbon offsets from the Northeast as well as their preference for a regionally branded product.
- We employed a qualitative study approach consisting of interview with potential buyers of northern forest branded carbon credits. and followed by a quantitative study.
 - Quantitative study included 21 in-depth interviews with sustainability directors and decision-makers from universities (public & private) and businesses (food & beverage, tourism, clothing manufacturing, etc.).
 - Selected organizations with ties to the Northern Forest Region AND with interest or stated commitment to sustainability
- Researchers conducted two rounds of coding and analysis of the interview results.
- Quantitative survey of landowners prepared for Survey Monkey. Distribution and analysis of the survey is on-going and will be completed following expiration NSRC funding.

Results/Project outcomes

Goal #1, Supply:

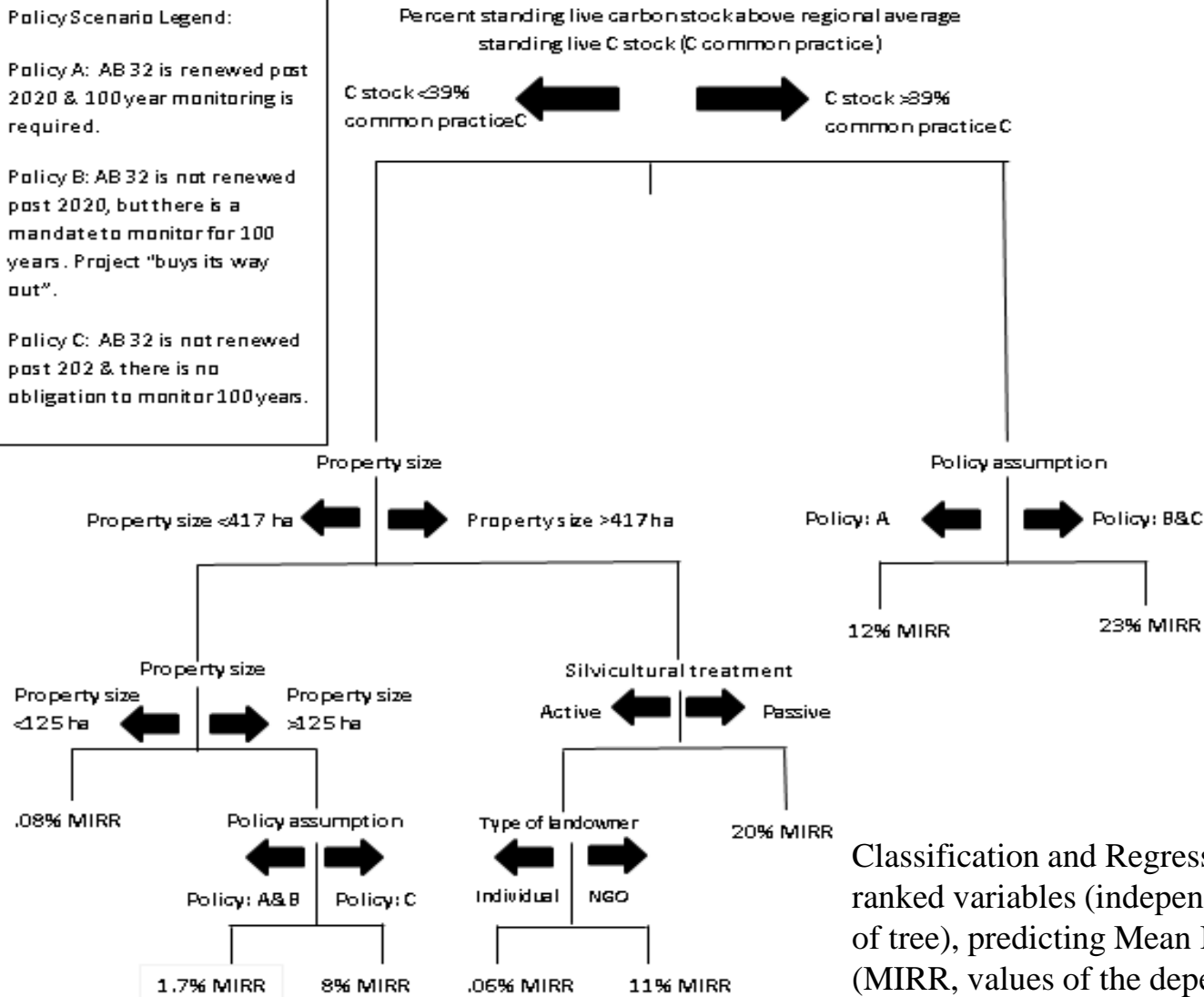
- Compliance forest carbon offset projects are financially attractive under a spectrum of property sizes, ranging from 600 – 4,800 ha.
- Results show compliance forest offset projects with high initial C stocking had the greatest Return on Investment.
- It is the interaction of several variables, such as stocking level, property size, silvicultural treatment, policy assumption, and finance option that determines the financial viability of compliance offset projects, rather than a single factor.
- While a U.S. compliance carbon market has the potential to affect forest management across large areas, opportunities for family forest owners will remain limited until an aggregation protocol is accepted by lawmakers.
- However, protocol requirements and legislative assumptions impacting long-term monitoring costs are also important factors. While reduced price risk in a compliance carbon market has the potential to improve forest management in North America; high initial project development costs, long-term monitoring obligations, and legislative uncertainty are significant barriers that will limit landowner market participation.
- The model developed here can be used by U.S. landowners to assess the financial viability of their property as a compliance offset project and can be utilized by policy makers to develop cost-effective climate change policy.

Policy Scenario Legend:

Policy A: AB 32 is renewed post 2020 & 100 year monitoring is required.

Policy B: AB 32 is not renewed post 2020, but there is a mandate to monitor for 100 years. Project "buys its way out".

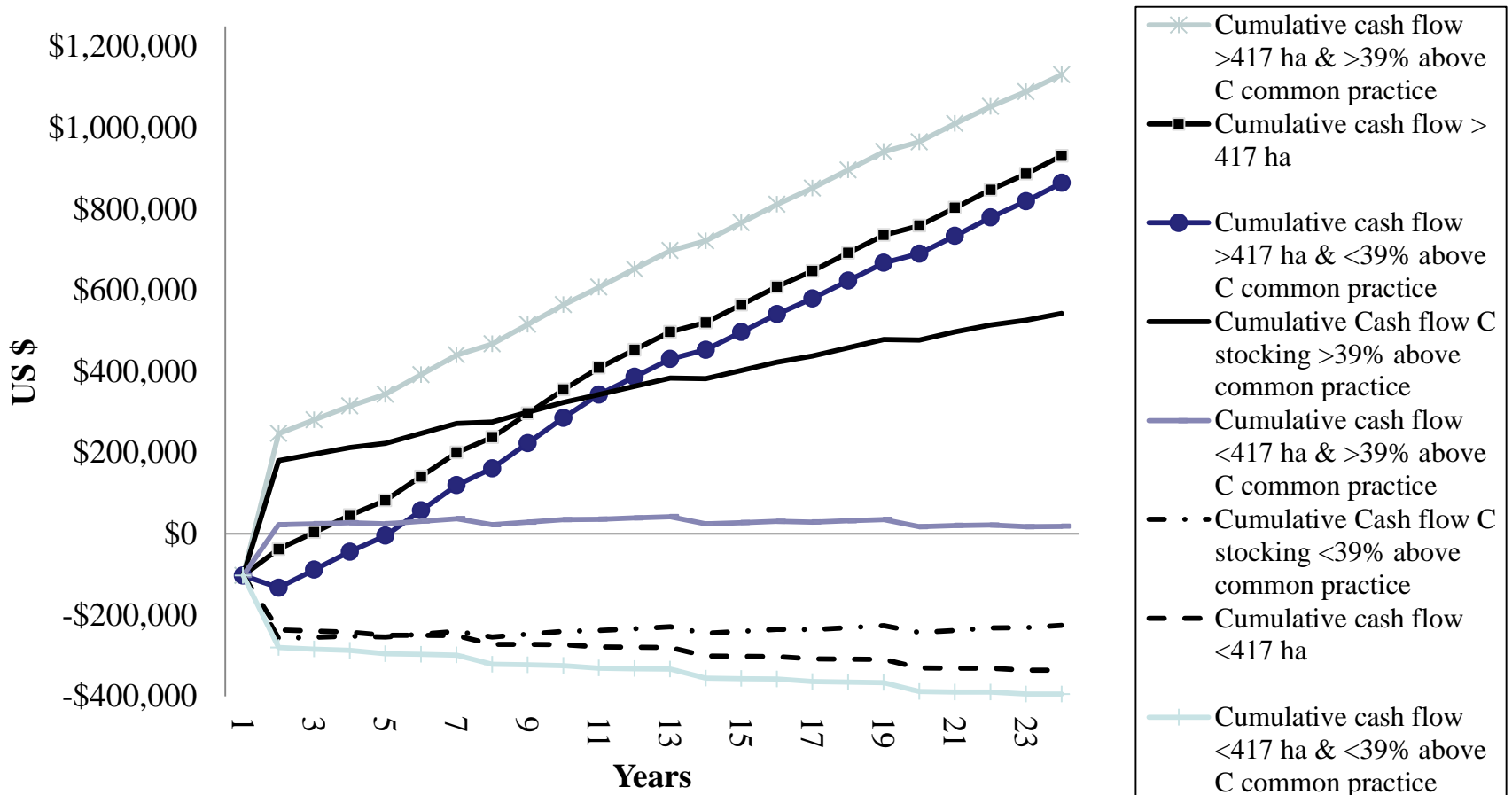
Policy C: AB 32 is not renewed post 2020 & there is no obligation to monitor 100 years.



Classification and Regression Tree, showing the top ranked variables (independent variables at branches of tree), predicting Mean Internal Rate of Return (MIRR, values of the dependent variable at bottom) for potential carbon projects. The tree demonstrates that high carbon stocking, larger properties, and favorable policy scenarios have the greatest likely rate of return on investment.

From Kerchner and Keeton (2015)

Cash flow by scenario, combining the breakpoints for property size (in hectares) and carbon stocking (% above “common practice,” which is forest-type specific regional average). The breakpoints were identified in the Classification and Regression Tree.



Results/Project outcomes

Goal #2, Demand:

Climate Change & Offsets

- Most respondents articulated how climate change affects their organization (e.g., planning for more frequent floods) and supply chains (e.g., growing season, product availability).
- Universities, all signatories of The American College & University Presidents' Climate Commitment, are determining how to use offsets to meet commitments.
- Several of the larger companies interviewed are determining their path forward, which may not include offsets. Companies that are not interested in offsets are focused on other sustainability outcomes in their supply chain or internal operations.
- Aligning offset purchase with mission is a key factor in decision-making
 - Offset purchases by universities should support their mission of research and teaching. Pragmatic issue as well as a philosophic. A sustainability director explained, “Most of the money in a university is for research and teaching. If we want to pay for carbon, we need to align the purchase with where the money is.”
 - Although mission alignment is not always possible, respondents consider it.

Definition of “local”

- Local was defined as proximity to main campus, business headquarters, or satellite offices. Several respondents used the image of “concentric circles,” moving from their surrounding area, to their state, to the region.
- State boundaries are more important than distance (e.g., miles) in perception of local as applied to branding.

Results/Project outcomes (Cont.)

Key attributes

- Carbon offsets, with attributes that satisfy the requirements of relevant third party program (e.g., Princeton Review, STARS, LEED) were most attractive to certain buyers.
- Several respondents focused on a “holistic approach” to sustainability and “impact,” and would not identify one project attribute (e.g., social, environmental, location) as most important
- Larger companies in the food & beverage industry focused on positively affecting the sustainability of their supply chain.

Price, proximity, and attributes

- Price break points and relevant trade-offs were difficult to define for institutions that had never purchased carbon offsets.
- Although some experienced buyers articulated a maximum price, they still would consider projects with high impact and mission alignment.
- Universities and small and medium sized business valued local projects as they were more closely aligned with mission. These potential buyers nevertheless also would consider impact and price.
- Institutions considered buying a blend of products to meet multiple goals and stay within budget.

Interest in scale-appropriate local market for voluntary offsets

- Larger institutions with a global reach face more public scrutiny and are more interested in nationally accepted market approach.
- Regional and local companies are more willing to experiment with new models that reduce transaction costs.
- All institutions are concerned about rigor and legitimacy of offsets and not willing to sacrifice quality of the offset.

Implications and applications in the Northern Forest region (Cont.)

Project selection of Northern Forest carbon offsets should consider customer's needs and wants:

- Align with goals of potential purchaser (e.g., research and teaching for a University requires local proximity and involvement of University in project development)
- A new product or carbon exchange must satisfy the requirements of external programs (e.g., Princeton Review) to add maximum value
- Ensure that brokers and buyers are aware that Northern Forest Carbon offsets can be part of a carbon offset blend to reduce price
- To develop a scale-appropriate local market for voluntary offsets, develop and work with a consortium of local and regional potential buyers. As these organizations are an important target market, ensuring that their needs and concerns are addressed upfront is critical.

Decision making process: For large organizations, expenditures above a certain threshold moved beyond the sustainability director's budget and required approval by president, finance VP, and/or facilities VP and in some cases, Board of Directors.

Future directions

- Subsequent work will integrate results of this project with spatial analysis tools that will help landowners quickly and easily identify carbon offset potential for a given property.
- Subsequent work is needed to continue to explore the utility for land conservation of “layering” and integrating multiple revenue streams, including payment for ecosystem services (such as carbon offsets), cost-share, and tax-incentive based programs (e.g. Current Use Appraisal).

List of products

Peer-reviewed publications:

Kerchner, C. and W.S. Keeton. 2015. California's regulatory forest carbon market: panacea or Pandora's box for northeastern landowners? *Forest Policy and Economics* 50:70–81.

Russell-Roy, E.T, W.S. Keeton, J.A. Pontius, and C.D. Kerchner. 2014. Rehabilitation forestry and carbon market access on high-graded northern hardwood forests. *Canadian Journal of Forest Research*: 44: 614–627

Technical Reports:

Saligman, L., E. Russell-Roy, W.S. Keeton, C. Danks, J. Gunn, and B. Machin. 2014. Can rehabilitative forestry and carbon markets benefit degraded forestland in Vermont? Final Report Prepared for Vermont Natural Resources Conservation Service, Conservation Innovation Grant# 69-1644-09-02. Conservation Collaboratives, Victory, VT. 62 pp.

Doctoral Dissertation:

Kerchner, C. D. 2013. Sustainable financing of protected areas: application of valuation tools to overcome barriers. Doctoral Dissertation. University of Vermont, Burlington, VT. 161 pp.

Leveraged grants:

USDA Natural Resource Conservation Service, Conservation Innovation Grant. Optimizing the greenhouse gas storage capacity and productivity of degraded forest lands: using rehabilitation forestry and carbon market participation to benefit overharvested forests in Vermont. L. Saligman (PI), W.S. Keeton, C. Danks, and B. Machin (Co-PIs). \$43,973. Grant# 69-1644-09-02.

List of products (Cont.)

Webinars:

Keeton, W.S. Opportunities for northeastern landowner participation in forest carbon markets. Webinar conducted for the Northeastern States Research Cooperative, October 22, 2014. <https://vimeo.com/110070681>

Testimony:

Keeton, W.S. Opportunities for forest carbon projects in Vermont. Invited testimony to the Vermont State Legislature, House Committee on Natural Resources and Energy. Montpelier, VT, April 30, 2015.

Technical presentations:

Keeton, W.S. We can make forest carbon projects work in Vermont. Invited presentation to the Vermont Forest Roundtable. Randolph, VT, Dec. 18, 2014.

Keeton, W.S., J.R. Nunery, E. Russell-Roy, and C.D. Kerchner. Exploring the potential for forest carbon management in northeastern forests: a research synthesis. Invited presentation. Vermont Agency of Natural Resources, Northeastern States Research Cooperative speakers series. Montpelier, VT, May 15, 2014.

Keeton, W.S. Forestry practices for climate change adaptation in northern hardwood forests. Invited speaker. Forest Guild National Meeting. Burlington, VT. June 19, 2014.

Keeton, W.S. Forest-stream interactions in late-successional systems: a guide for restoration. Invited session presentation. International Scientific Conference on Earth Bioresources and Environmental Biosafety: Challenges and Opportunities. Kiev, Ukraine. Nov. 4-7, 2013.

Keeton, W.S.. Cross-regional perspectives on ecosystem management in temperate forest systems. Invited plenary presentation. 92nd Congress of Quebec Forest Engineers, Gatineau, Quebec, Canada. Sept. 11, 2013.

Keeton, W.S. Towards a holistic forest carbon management approach. Invited seminar. Gund Institute for Ecological Economics, University of Vermont, Burlington, VT. Jan. 25, 2013.

Keeton, W.S., J.R. Nunery, E. Russell-Roy, and C.D. Kerchner. Exploring the potential for forest carbon management in northeastern forests: a research synthesis. Invited presentation. New England Society of American Forests Annual Conference, Saratoga Springs, NY. Jan. 31, 2013.

List of products (Cont.)

Technical presentations (Continued):

Keeton, W.S. Holistic forest carbon management. Polish Agricultural Academy. Krakow, Poland, Dec. 13, 2012.

Keeton, W.S. Toward a unified theory of forest carbon management. Middlebury College, Environmental Colloquium, Middlebury, VT. Oct 11., 2012.

Keeton, W.S. , E. Russell-Roy, and J. Pontius. Prospects for rehabilitation forestry through carbon market participation on former industrial timberlands. ECANUSA 2012, Durham, NH, Nov. 1-3, 2012.

Keeton, W.S. Bioenergy harvesting impacts on stand structure and carbon fluxes in northern hardwood forests. Vermont Monitoring Cooperative annual meeting, Oct. 29, 2012, Burlington, VT.

E.T. Russell-Roy, W.S. Keeton, J. Pontius, and C. Kerchner. Rehabilitation forestry and carbon market access on overharvested, former industrial northern hardwood-conifer forests. Ecological Society of America annual meeting. Portland, OR, Aug. 5-11, 2012.

Keeton, W.S. Toward a unified theory of forest carbon management. Cornell University, Division of Neurobiology and Behavior. Ithaca, New York. September 16, 2011

Keeton, W.S. Toward a Unified Theory of Forest Carbon Management. Invited presentation to the Society of American Foresters, Green Mountain Division Annual Meeting. Montpelier, VT. 2011.