Conservation Impact Project Summaries

April 2019

Formally announced at the World Conservation Congress in September of 2016, The Conservation Impact Project aims to quantify the conservation benefits of SFI's work, and the connection between sustainable supply chains and important conservation outcomes. The Conservation Impact project consists of numerous smaller projects, generated by partnerships within the academic, conservation and research community, and including SFI's own Program Participants. Quantifying the critical contributions of these managed forests will enable the SFI community to understand and promote the conservation values associated with sustainably managed forests, and will facilitate continual improvement. Current investigations are focused across water quality and quantity, climate change related values, and biodiversity.

Summary reports describing the status of current projects have been provided to SFI by grantees and project partners. These reports are included below, unedited by SFI. Final reports for recently concluded projects are available upon request.

Table of Contents

Page # Lead Organization: Project Title

8. Splatsin: Studying culturally significant plant regeneration post-harvest in the Splatsin Territory

9. University of Northern British Columbia: Remote-Sensing LiDAR to Measure Biodiversity on Lands Certified to the SFI Program Standard

Carbon and Climate Resilience Projects:

10. American Forests: A Practice-Based Approach to Increasing Forest Carbon Mitigation through Forest Soils

11. Manomet: The Forest Climate Resiliency Project

11. Saskatchewan Research Council: Investigating Carbon Sequestration in Boreal Upland Forests and Wetlands

12. Saskatchewan Research Council: The Canadian Forest Carbon Assessment

13. University of Maine System acting through the University of Maine: Assessing and Monitoring the Influence of Forest Management Practices on Soil Productivity, Carbon Storage, and Conservation in the Acadian Forest Region

Water Projects:

13. Coalitions & Collaboratives, Inc.: Exploring the Financial Value of Ecosystem Services of SFI Certified Lands

14. Virginia Tech: Conservation Management Institute: Investigating the Relationships Between BMP Implementation and SFI Certification Through Time

15. Virginia Tech: Department of Forest Resources and Environmental Conservation: Monitoring and Quantifying the Effects of State Forestry BMP Programs on Soil Erosion and Sediment Delivery for the Southeastern United States: Module III

16. Fraser Basin Council Society: Monitoring Water Temperatures and Flows for Steelhead in Relation to Forest Management Practices

16. Nature Conservancy of Canada: The Active River Area

Recently Concluded Projects:

17. GreenBlue Institute: Addressing Brand Owner Sustainability Goals Through the Responsible Sourcing of Forest Products

18. Keeping Maine's Forests: Preparing for the Carbon Market in Forests Certified to the SFI Standard

18. Nature Conservancy of Canada: Investigating Biodiversity Impacts of Forest Management on Vernal Pools in the Kenauk Reserve

19. University of Georgia: Quantifying Impacts of SFI's Fiber Sourcing Standards in Georgia

American Bird Conservancy: *Managed Forests for Birds*

Project Lead: EJ Williams, Vice President, Migratory Birds & Habitats, ABC

Project Update: Since 2016, American Bird Conservancy has worked in partnership with SFI and SFI program participants including Weyerhaeuser, Hancock Natural Resources Group, Resource Management Service, Forest Investment Associates, The Westervelt Company, International Paper, Molpus Timberlands Management, Rayonier, Potlatch Corporation, and Campbell Global as well as technical partners including National Council for Air and Stream Improvement (NCASI), Klamath Bird Observatory, and Avian Research and Conservation Institute (ARCI) to better understand the value of managed forests for birds of conservation concern and identify opportunities to enhance habitat conditions and increase that value. Our work in the Southeastern United States has resulted in a very functional partnership, referenced in the "We" in the following results. We have emphasized engagement by the forestry and wildlife conservation community and approaches that inform forest management decisions and incorporate consideration of resulting bird habitat conditions.

We developed estimates of bird populations and species diversity on 4 project areas in North Carolina, Florida, Alabama, and Mississippi. Data were obtained using volunteer birdwatchers through a program of "avicaching," where volunteers visit specific points with SFI program participants' lands on both sides of minor public roads. Volunteers were given a protocol and asked to record and submit all bird species detected to eBird (ebird.org). Avicachers visited 121 points in the New Bern, SC and Aliceville, MS/AL focal areas and recorded 70 species and 54 species of birds respectively, including individuals of all of the key focal species except Red-cockaded Woodpecker (which wasn't expected at these sites). Additionally, using standard scientific protocol, ARCI scientists collected data at point counts using a similar protocol in the Pensacola, FL/AL and Cedar Key, FL focal areas. They visited 168 points and recorded 69 species and 58 species, respectively. These additional data from SFI Program Participants' lands will allow us to refine the estimates of how many individuals of bird species of conservation concern are using those lands, narrowing the wide gap in the confidence limits produced by our earlier literature-based estimates.

We developed a successful workshop format that brings together foresters, bird scientists, state and federal wildlife and forest professionals, university researchers, and non-governmental organization representatives for classroom and in the field discussions of forest management and bird habitat conditions and bird response to that management. We hosted 4 workshops with over 90 total participants. Additionally, we developed an informative guide entitled Bird Friendly Forests: Opportunities for Private Forest Owners in the Southeastern United States that will be released online and in print in Spring 2019.

Anticipated work under 2019 SFI Conservation Grant: Next steps include additional point counts and avicaching surveys on 5 project areas, developing techniques to expand population and diversity estimates from SFI certified forests in the project areas to SFI certified forests across the Southeastern Coastal Plain, better understanding the combined conservation value of the Forest Management and Fiber Sourcing standards at the landscape scale, and developing decision support tools that provide access to bird conservation practices to foresters and other land managers. ABC will also be working with the Boreal Avian Modeling project to develop a cross border bird conservation initiative that integrates ABC's engagement strategies with BAM's bird modeling tools to address top priorities along the Canada/U.S. border.

Boreal Avian Modeling Project (BAM): *Applying data-driven measures to evaluate and improve the conservation value of managed forests for birds*

Project Leads: Fiona Schmiegelow, Professor and Director, Northern ENCS Program, University of Alberta; Erin Bayne, Professor, University of Alberta; Nicole Barker, Coordinating Scientist, BAM; Andrew Crosby, Post-doctoral Fellow, BAM

Project Update: BAM is a continental-scale, collaborative program dedicated to providing data-driven, science-based products and information to support conservation and management of boreal birds. Using a large, comprehensive database of partner-contributed bird survey data that we have harmonized to a common standard, we have created national-scale density models and associated population distribution maps for over 80 songbird species, plus similar maps for 17 waterfowl species or groups (these in collaboration with Ducks Unlimited Canada). These products, combined with approaches and tools developed by the Boreal Ecosystems Analysis for Conservation Networks (BEACONs) Project, are the foundation of the representation analysis presented here.

Exploring Conservation Value using Representation: We used ecological representation as one measure of the conservation potential (value) of SFI lands. The application of ecological representation in conservation biology is based on the objective of conserving the full range of biodiversity within a given geography. In reality, data limitations necessitate the use of surrogates or indicators rather than quantifying every single species. Often, environmental indicators are used for these types of assessments, which is referred to as the coarse filter approach. The complementary fine filter approach can be used for elements that aren't adequately captured by the coarse filter approach, such as rare species, if data exist. We determined representation of SFI-certified lands by quantifying indicators within SFI-certified forests and the larger regions in which they are embedded.

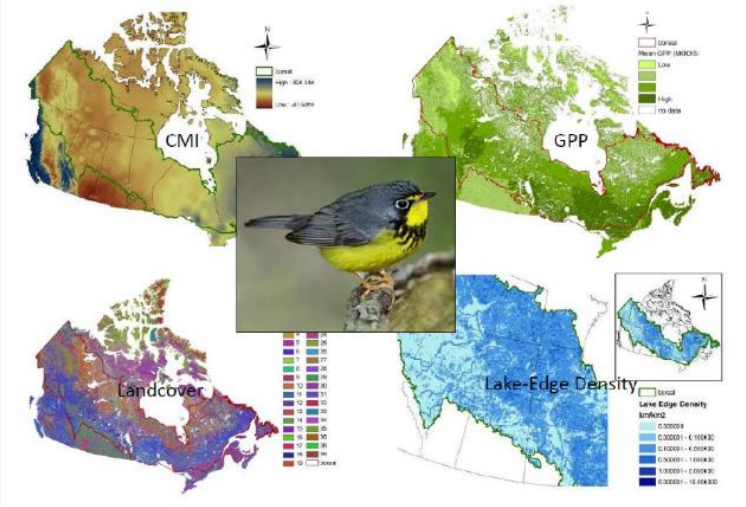

Fig 1. Indicators. Climate moisture index (CMI) is an indication of soil moisture, and a metric that can be projected under climate change. Gross primary productivity (GPP) is a measure of vegetation productivity. Lake-edge density (LED) is an index of riparian interfaces, and land cover (LCC) captures the diversity of cover types. Songbird and waterfowl density maps allowed calculation of potential population. Core range maps for songbirds indicate areas with greater than mean density.

Representation Metrics: Environmental variables – dissimilarity metric: The representation metric for environmental variables measures the difference between the distribution of indicator values in the

target area in comparison to a reference area. The statistic ranges from 0 to 1, where lower values indicate less difference, or greater similarity, between the areas. Species and species groups - core habitat and population: The representation metric for species indicators measures the area-adjusted proportion of the species population or core habitat within the SFI area. Values greater than 1 indicate higher representation than expected based on the species' potential population in the ecoregion.

Anticipated work under 2019 SFI Conservation Grant: Building on previous work by the Boreal Avian Modeling Project (BAM), continued research will enhance our system for defining and measuring conservation value of SFI-certified lands by measuring their contribution to regional diversity of the forest bird community. Our work will determine ways to operationalize conservation value in terms of bird species diversity to encompass rare species and distinctive communities. A major part of this project is to work with SFI program participants (i.e. forest companies) so that we can incorporate the results of the research into the creation of a planning tool for considering bird community diversity and conservation value in short- and long-term forest management plans. We will also work with the American Bird Conservancy to develop a cross-border collaboration that will extend this work to include bird populations throughout North America.

Currently, this project is in the early planning stages. We have held several online meetings between BAM, SFI, and ABC to scope the project and develop an agenda that ensures productive collaboration between all partners. Our next steps will be to start assembling data and meet with project partners to begin the process of co-producing actionable research work. We intend to have conservation value analyses completed by the end of 2019 and submit a collaborative Conservation grant proposal with ABC by October 2019. We will have the conservation planning tool available for use by April, 2020.

---

fRI Research: *Caribou Conservation through Better Cutblock Design*

Project Lead: Laura Finnegan, Caribou Program Lead, fRI Research

Project Update: Declines of woodland caribou are linked to human-caused landscape changes that convert mature forests to early seral stands, and result in abundant forage for primary prey species (deer, moose, and elk). Increasing habitat for primary prey leads to an increase in predators within caribou ranges, and associated unsustainable mortality rates for caribou. Because large areal disturbances like wellsites and cutblocks provide habitat for primary prey, managing these large areal disturbances to reduce use by primary prey could benefit caribou. With a focus on primary prey and forest management, this project is using a combination of trail cameras, GPS collars and vegetation sampling to provide information on forest management that could limit habitat of primary prey, and in turn promote caribou recovery.

In the summer of 2018, we deployed 67 trail cameras in cutblocks in caribou ranges in west-central Alberta, Canada – with sampling stratified across different cutblocks based on ecosites, cutblock age and the density of human disturbance surrounding the cutblock. We also carried out vegetation sampling within cutblocks, and at the interface between the cutblock and the adjacent forest. As of March 2019, we have collected cutblock photo data for approximately 18,000 camera days across the 67 cameras (mean = ~270 trap-days per camera). Photo classification is in process and to date we have classified

summer and fall photos for 13 cameras. At these 13 cameras, we detected whitetail deer at 9 sites, mule deer at 7, moose at 8, and elk at 4. We also detected a range of other species (grizzly bear, black bear, wolf, etc). Cameras will remain in situ over the winter and will be moved to new cutblocks in May and June of 2019 – photo classification from the remaining 54 cameras is ongoing. Between January and March of 2019, we have also been equipping deer with GPS collars. To date we have captured 13 deer and deployed collars on 10 – 7 females and 3 males – 3 deer were too young to collar. We hope to collar more deer this winter, and deploy the remaining ten collars next winter. Combined, information from trail cameras and GPS collars will provide some of the first detailed assessments of primary prey response to forest management in west-central Alberta.

NatureServe: *Quantifying the Conservation Values of SFI-Certified Forests*

Project Lead: Dr. Healy Hamilton, VP Conservation Science & Chief Scientist; Rickie White, Senior Ecologist and Research and Development Manager for Southeast Region, NatureServe

Project Update: Sustainably managed forest ecosystems contribute to a wide range of important ecological values, including 1) habitat for high priority species; 2) unique or at-risk ecosystems; and 3) intact forest landscapes, matrix-scale ecosystems, and their associated ecosystem services, such as timber product supply, pollination services, carbon sequestration, and clean water. However, metrics to quantify and transparently demonstrate ecological values delivered by sustainably managed forests are largely lacking.

To address this important challenge, NatureServe has worked with eight private forestry companies -- all of which are certified to the Sustainable Forestry Initiative (SFI) Forest Management Standard -- the National Council on Air and Stream Improvement, Inc. (NCASI), and the SFI staff to develop quantitative metrics for evaluating conservation value of sustainably managed forest lands with a focus on biodiversity value/measures. The team evaluated potential metrics for quantifying ecological values delivered by sustainably managed forests for ease of implementation, transferability to other geographies, and confidence in the data. The following diagram depicts the categories of landscape biodiversity metrics considered and the finer scale parameters which they represent.

Ultimately, the goal was to choose metrics that 1) use data that are readily available throughout the United States and Canada and 2) are easily transferrable and scalable to various forested ecosystems throughout North America. Data confidence and limitations are expressed

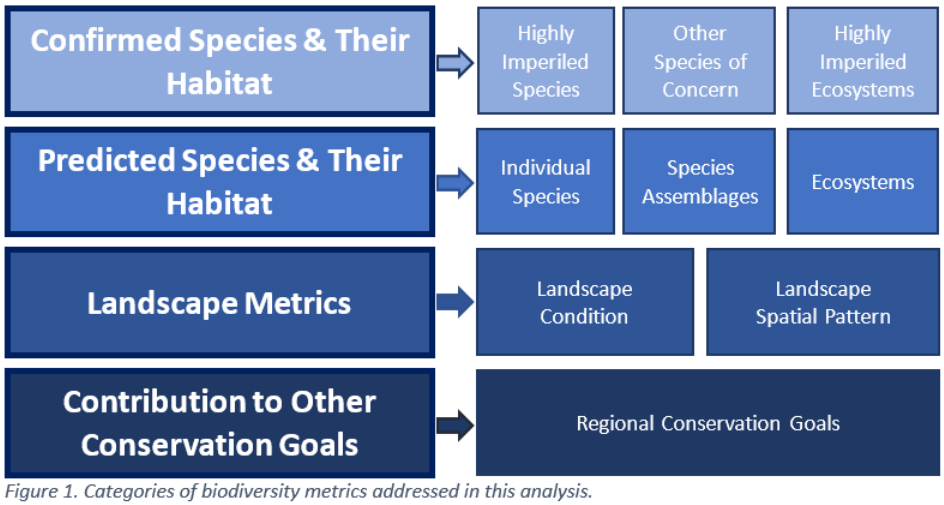

Figure 1. Categories of biodiversity metrics addressed in this analysis.

in the discussion of results associated with each metric.

Classes of metrics that reflect common themes of quantifiable biodiversity value include habitat for priority species (confirmed and predicted), landscape metrics, and contribution to other conservation goals (Figure 1). With support from SFI's Conservation and Community Partnerships Grant Program, the SFI Program Participant partners, and NCASI, NatureServe led a pilot effort to develop and assess metrics in these four broad categories for three locations (one in Florida, one on the border between Florida and Alabama, and one in Washington state). The team chose these locations because each study area contained a significant amount of acreage representing multiple SFI Program Participants and the areas represented two different geographies, allowing the final metrics to be developed in ways that were transferrable among forest types.

Summary Results**:** Results indicate that SFI Certified Lands in the three study areas provide important biodiversity and conservation value. First, SFI Certified Lands in all study areas support confirmed occurrences of critically imperiled or other species of concern. Furthermore, models of predicted habitat for key species indicate that these forests provide significant areas of habitat for a number of declining or imperiled species that reside in the study area footprints.

Second, the analyses show that SFI Certified Lands support a mix of ecosystem types and successional stages within their boundaries, providing a diversity of vegetation conditions to support a suite of animal species that rely on these various successional stages and ecosystem types.

Third, as relatively contiguous areas that have been spared permanent conversion to non-forested use, SFI Certified Lands contribute to large, connected areas of undeveloped lands, with positive implications for species dependent on extensive intact landscapes. These SFI Certified Lands exist in relatively high landscape condition, as measured by their proximity to intensive non-forestry land uses, such as roads, urban or residential development, and row crop agriculture.

Also, SFI-Certified Lands play an important potential role in meeting overall conservation goals independently developed for each region. For example, 95,000 acres of SFI Certified Land in the Cedar Key study area overlap with areas identified as high priority for conservation by the Florida Critical Lands and Waters Identification Project (CLIP). May be worth noting that some part of the Pensacola Study Area has the same designation – not sure the exact number.

Finally, SFI program participants are required to implement forestry best management practices (BMPs) for water quality and non-certified landowners implement these voluntary BMPs at a very high rate overall (>89%). When properly applied during operations, forestry BMPs are increasingly being recognized as providing conservation benefits for aquatic and riparian species. Several recent proposed and finalized U.S. Fish and Wildlife Service listings under the Endangered Species Act have cited either in text or in 4(d) rules the value of forestry BMPs to contribute to conservation of aquatic species.

Anticipated work under 2019 SFI Conservation Grant: NatureServe will work with project partners to produce a metrics-based evaluation of the conservation value of SFI certified lands in the bi-national pilot region. A major outcome of this project is to develop metrics that can be "scaled up" more broadly throughout the SFI footprint and potentially used by any SFI program participant. Eight current metrics have been developed for three U.S. pilot areas, divided among themes of species, ecosystem, and landscape conservation. By extending these metrics to a new bi-national forest ecosystem, we will have sufficient pilot metrics to appeal to any program participant, anywhere in the U.S. or Canada. Since the

geographic scope of this project is specifically designed around attaining 100% inclusion of SFI-certified lands in the project analysis footprint, another outcome will be the first comprehensive assessment of SFI contributions to conservation values across a given region.

Our reporting products will include metrics definition, development, application, results, interpretation, and testing and refinement for expansion into new geographies (Canada) and new forest ecosystems, emphasizing replicability and transferability. Visually intuitive maps and metric 'report cards' will contribute important outreach materials for communicating project results and inspiring other SFI program participants to pursue metrics development for their managed forest lands. We will continue to fully participate in the SFI annual conference, Sounding Board, webinars and other appropriate venues to support awareness and discourse regarding metrics of conservation value for sustainable forestry.

Splatsin: *Studying Culturally Significant Plant Regeneration Post Harvest in the Splatsin Territory*

Project Leads: Mike Simpson, Environmental Scientist/Biologist, Splatsin

Project Update: Understanding and maintaining biodiversity in the forest is critical for both Splatsin and Tolko in their management of the forest lands. This study will provide data on how culturally important plant biota regenerate after a forest industry disturbance. An outcome is to identify management considerations that can inform Tolko's practices to improve or enhance the growth success of these plants post-harvest to ensure their vigour, quality and presence on the landscape for continued use by Splatsin.

All field work related to sample plot establishment and re-measurement will be supervised by the professional biologist from Ecora Engineering and Resources Group (Ecora) and completed by Splatsin staff. Studies completed by its members on the Splatsin traditional area strive to enhance local knowledge of forest management practices, the management of natural and cultural resources and provide employment and capacity building of its members. This project will draw upon scientific and indigenous knowledge to direct management opportunities for important shrub and plant biodiversity on the landscape.

A scalable methodology for measuring conservation-related values for culturally significant indigenous plants and shrubs will be created. Project goals include:

Goal 1: Project Planning and Design. Hiring of a professional biologist from Ecora to develop a statistically defensible study on the changes in growth and distribution of culturally sensitive plants in higher elevation ecosites post harvest disturbance. Splatsin will be using their environmental organization, Yucwmenlúcwu LLP a subsidiary of the Splatsin Development Corporation, to conduct and advise this project. Literature review of existing pre- and post-harvest vegetation assessments and research on effects of changes in light and regeneration. Investigate the opportunity of utilizing previously captured data from the Sicamous Research Forest as additional study information.

Goal 2: Sicamous Research Forest (SRF) Data. Request access to the required vegetation data. Review and assess the previously measured SRF data by ecosite. Determine if it can be used to strengthen the

data set being collected. Summarize data and re-establish sample plots if required.

Goal 3: Sample Plot Establishment Pre-Harvest. Mapping and selection of plot locations. Permanent sample plot site locations are selected in the study area. Hiring of Yucwmenlucwu to establish the plots. Data entry of plot information.

Goal 4: Post Harvest Sample Plot Re-measurements - Immediately post harvest (2020) and 1 year post harvest (2021). Re-measure the sample plots after disturbance in the first year of harvest, and return one year after Tolko has harvested the study area blocks. Record metrics about selected plants status, and regeneration.

Goal 5: Project Outcomes, results and communication. The researcher will summarize the sample plot data findings and incorporate the SRF data (if applicable). Results will be shared in a final report and external presentations.

University of Northern British Columbia: *Remote-Sensing LiDAR to Measure Biodiversity on Lands Certified to the SFI Program Standard*

Project Lead: Dr. Che Elkin Associate, Professor, FRBC/Slocan Mixedwood Ecology Chair, Ecosystem Science & Management Program, UNBC

Project Update: The aim of this work is the development of an Airborne Lidar Survey (ALS) based analysis framework that consistently and accurately characterizes forest stands in the Central Interior Plateau of British Columbia according to their harvest history and diversity potential. While ALS methods have proven to be very effective at classifying broad and distinct forest types using area-based metrics, and estimating individual tree characteristics using individual tree models, work at UNBC has demonstrated that it can also be extremely effective at distinguishing ecological and biodiversity differences between stands that ostensibly are composed of similarly sized trees (height and DBH distribution) at similar densities.

In order to achieve this, UNBC has developed models that incorporate interactions between three categories of ALS derived metrics: metrics that reflect the vertical distribution of vegetation bulk density (both relative and absolute), metrics that reflect gap-fraction at intermediate (1ha) and small (0.01 ha) scales and, importantly, metrics that estimate the volume and size distribution of CWD at each site. The models using these three variable classes have proven to be more effective at accurately distinguishing stands according to their harvest history compared to quantitative models based on commonly collected empirical field data. Up to this point, development and validation of these models has focused on the Aleza Lake Research Forest in the central plateau of B.C. Ongoing analyses are beginning to evaluate the analysis framework in drier forests in the southern part of B.C. and in more topographically complex regions in west central B.C.

American Forests: *A Practice-Based Approach to Increasing Forest Carbon Mitigation through Forest Soils*

Project Leads: Kendall DeLyser, Forest Soil Carbon Specialist, American Forests; Luke Nave, Coordinator, International Soil Carbon Network, Research Scientist, Northern Institute of Applied Climate Science

Project Update: Soils are an often-overlooked component of the forest carbon pool, but they often hold more carbon than a forest's aboveground biomass. Our project aims to develop an approach for including soils in forest carbon calculations, so we can better understand whole-ecosystem carbon dynamics, as well as the impacts of forest management on the entire forest carbon pool. We will use these lessons to construct a menu of forest management practices and guidelines that are beneficial for soil carbon, allowing landowners and land managers to better protect their existing forest soil carbon and enhance it as a climate mitigation tool.

To this end, American Forests and NIACS have conducted a literature review and meta-analysis of relevant soil carbon data from 24 publications from Maryland and its associated ecoregion sections to determine the soil carbon impacts of various forest management practices, namely harvesting, land use change, and fire. We have also analyzed 915 geo-located observational soil profiles within our study area to determine the influence of land cover, land use change, climate, and topographic factors on soil carbon.

This pilot approach to downscaling national and regional datasets to supplement local data is a first of its kind approach. Our early analysis suggests this is an effective methodology for assessing management and forest soil carbon dynamics throughout the country. From this data, we are working towards a menu of forest management practices and guidelines with potential to protect or enhance forest soil carbon in Maryland. While we reviewed over 700 publications, we were only able to identify 24 that met the needs of our review. This lack of data has limited our ability to make prescriptive forest management recommendations, but we can make important observations about the impacts of harvesting, land use change, and fire.

Of particular interest to this analysis, harvesting had no significant overall effect on soil carbon in forests in either the meta-analysis or soil profile datasets. However, there is still a significant amount of soil carbon variation within harvested forests, determined by factors like landform, soil order, and soil horizon. There is also some evidence that treatment of harvest residues, post-harvest site preparation, and stand re-establishment practices can affect post-harvest soil carbon stocks. Soils recovering from land use change had lower soil carbon stocks according to meta-analysis, a result that was corroborated by comparing restored to natural wetlands and reforesting to natural forests in the observational soil profile dataset. Fire, which exhibited significant effects by meta-analysis but could not be analyzed using the observational dataset, also leads to significant decreases in soil carbon storage.

We are continuing to examine our data and results for more nuanced and practical findings regarding forest management and soil carbon. We will use these to make more detailed and informative management and policy recommendations in the upcoming phase of our project, and will work with Maryland's land management agencies to optimize their forest management practices to best protect and enhance their forest soil carbon stocks.

Manomet: *Forest Climate Resiliency Project*

Project Lead: Eric Walberg, Senior Program Leader, Climate Services, Manomet

Project Update: The Forest Climate Resiliency Project is primarily intended to provide forest managers with a framework for better understanding how climate and forest conditions are changing on the lands that they manage. To this end, the framework will support enhanced forest monitoring to better detect local impacts of changing climate conditions and regional trend analysis to better establish context for local changes. Additional goals include linking the insight gained through the framework to forest management plans and supporting comparison of performance of SFI and non-SFI lands in terms of forest health and productivity.

Key Progress to Date

- Four study sites identified: Michigan, New Hampshire, New York, North Carolina
- Evaluation of metrics for each study site underway
- Regional analysis for each study site underway
- Draft version of climate change module for forest management plans created

Over the last six months we have been focused on the regional analysis associated with each of the four study sites. This section of the project includes two components, 1) analysis of changing tree species abundance and growth rates using FIA data, and 2) use of remote sensing to monitor changes in forest health and productivity. The FIA analysis will provide insight on change in two key metrics that are projected to be increasingly influenced by changing temperatures and moisture availability. The remote sensing component will focus on using well-established vegetation indices that can be derived from freely available satellite imagery. The remotely sensed information will serve as a complement to both local forest inventory and the regional FIA analysis, with the advantage of being collected more often and offering more complete spatial coverage. The regional analysis will be coupled with climate trends and projections, and modeled projections of forest response to provide forest managers at the four study sites with regional context for their planning and management decisions.

Saskatchewan Research Council: *Developing Methodologies and Estimates of Carbon Sequestration in Upland Forests and Wetlands on SFI-Certified Boreal Forest Landscapes*

Project Lead: Mark Johnston, Distinguished Scientist, SRC

Project Update: Saskatchewan Research Council (SRC) is developing methods for quantifying carbon sequestration in upland boreal forests and wetlands. The protocol will be affordable, based on internationally accepted methods, and applicable across other SFI-certified landscapes. SRC will create tools to both sample carbon in the field and for calculating carbon, based on vegetation and soil data. SRC will conduct a case study on forestlands managed by Louisiana-Pacific Canada Ltd. to ensure the accuracy of tools and protocol.

The wetland carbon project is complete, with field work having been completed in the summers of 2016 and 2017. Partners on the project include LP Canada Ltd., Spruce Products Ltd., Ducks Unlimited Canada (DUC) and Brandon University (which provided the lab analyses). The lab analysis of peat cores (C content and bulk density) was completed in September 2018. The field and lab data have been combined to produce C estimates for the 60 wetlands that were sampled. These estimates will be combined with previously developed upland forest C estimates to provide a landscape-level view of ecosystem C for LP's Forest Management License area. In addition, a draft field manual for implementing the peatland sampling protocol has been completed. Extensive video was collected during field work in July 2017 by Centric Productions (contracted by DUC). They produced a 6-minute video which has been reviewed by all the partners and released publicly. A poster describing the project was presented at the Canadian Institute of Forestry meeting in Grande Prairie Alberta in September 2018. The final report was submitted to SFI in February 2019.

Saskatchewan Research Council: *Carbon Stocks and Stock Changes on SFI-Certified Landscapes in Canada*

Project leads: Werner Kurz, Senior Research Scientist, Natural Resources Canada; Mark Johnston, Distinguished Scientist, SRC

Project update: The aim of this project is to assess carbon stocks and stock changes on SFI-certified lands in Canada. Forests sequester large amounts of carbon in vegetation and soils throughout their lifespan and therefore provide important ecosystem services, including assisting in removing carbon emissions from human activities, from the atmosphere. Sustainable forest management has the potential to enhance carbon sequestration in forests and can demonstrate one of the values present in SFI certified landscapes. This project will take the first step towards spatially-explicit estimates of carbon stocks and stock changes on SFI-certified landscapes in Canada, and ultimately in North America.

Pilot areas were identified in 5 Canadian provinces (British Columbia, Alberta, Saskatchewan, Manitoba, and New Brunswick), and data sharing agreements to obtain spatial inventory and growth and yield data from provincial governments and/or forest industry have been signed, and the data obtained for 4 of those provinces. One agreement with an industry partner in BC has just been signed and data exchanges are being prepared. The second agreement is in preparation and a road map for project collaboration has been developed. The most up to date Landsat-derived spatial disturbance information has also been obtained from various products (Change to composite, National Burn Area Composite), and verification of these data for the pilot areas is underway.

Progress continues on developing tools and processes for simulating spatially-explicit forest carbon stocks and stock changes using various data sources with the Generic Carbon Budget Model (GCBM) and associated data pre- and post-processing tools. Capability refinements include data input flexibility, processing capacity (cloud infrastructure utilization), and Quality Assurance /Quality Control (QAQC) measures.

GCBM projects have been set up and initial simulations completed for all project pilot areas in 3 provinces (Saskatchewan, Manitoba, and New Brunswick), and project set up and simulation is

underway for pilot areas of Alberta, with the initial simulation of one forest management unit completed. The project with Alberta has been delayed due to a fire in the offices of the AB provincial agency. All data have now been received All projects will be re-run using finalized Landsat-derived disturbance data, and current estimates are to have all modeling completed by April 30th, with the possible exception being pilot areas of British Columbia. Results preparation, review, and outreach will follow.

University of Maine: *Assessing and monitoring the influence of forest management practices on soil productivity, carbon storage, and conservation in the Acadian Forest Region*

Project Lead: Joshua Puhlick, Research Associate, University of Maine

Project Update: This three-year project involves using empirical soils data from across the Acadian Forest Region to inform Sustainable Forestry Initiative objectives related to soil productivity, carbon storage, and conservation. As part of the project, researchers will be measuring soil nutrient status, soil carbon storage, and soil compaction on a subset of the Maine Adaptive Silviculture Network installations.

In 2018, soils were evaluated in northern hardwood stands managed by J.D. Irving and Seven Islands Land Company. The soils series of the study areas fall within the Chesuncook (the Maine state soil) catena. The study areas support a diverse range of species including sugar maple, red maple, yellow birch, American beech, spruces, and balsam fir. The forest management practices that will evaluated for their influence on soils include irregular shelterwood cutting, crop tree release, exploitive cutting, and control (no recent cutting).

Soil samples from 30 quantitative soil pits were collected and soil bulk density and soil strength were evaluated before forest management treatments were initiated. The installations were harvested from mid to late summer. Live and standing dead trees as well as downed woody debris were measured in association with quantitative soil pit locations. Processing of the soil samples has been completed and chemical analysis will be conducted. Post-harvest forest measurements and soil sampling will occur during the summer of 2019.

Coalitions & Collaboratives, Inc. (COCO): *Exploring the Financial Value of Ecosystem Services of SFI Certified Lands*

Project Leads*:* Jonathan Bruno, Senior Operations Director, Coalition for the Upper South Platte; Mike Smith, Managing Partner, RenewWest

Project Update: Sustainable Forest Initiative certified forests have been critical leaders in advancing the value of working forests while providing ecological value to their communities in the form of water outcomes, carbon sequestration, and biodiversity. However, there are somewhat limited examples of

these forests deriving financial value for these ecosystem services.

Coalitions & Collaboratives, Inc. (COCO), proposes to explore the value of a pilot SFI certified forest for ecosystem services valuation and to determine what lessons can be learned for the larger SFI community. Our pilot project will begin with Fruit Growers Supply Company (SFI-00152), examining the value of their 316,647 certified acres. Our strategic partner RenewWest, a Colorado Limited Liability Company specializing in forest-based ecosystem services, will lead the investigation for generating conservation-focused returns through the monetization of carbon, water, and conservation markets. Gathered results will be examined and extrapolated to show potential for other SFI-certified forests.

The COCO / RenewWest team will assess the potential of applying the California Compliance Offset Protocol for U.S. Forest Offset Projects for both Afforestation/Reforestation (A/R) and Improved Forest Management (IFM) carbon offset projects. It will do so by contracting the services of NCRM, a California consultancy providing a range of professional forestry services, including carbon project assessment.

The team will also examine the watershed effects by contracting LimnoTech, a hydrology consultancy whose results are highly valued by multinational corporations seeking water outcomes. Finally, the team will liaise with the California land trust community to determine potential for conservation easements. Project Goals Include:

Goal 1: Determine carbon project suitability. Contract with NCRM to analyze pilot for potential reforestation and/or improved forest management carbon projects.

Goal 2: Determine water values of pilot lands. Contract with LimnoTech to do water outcome analysis.

Goal 3: Examine opportunities for conservation easement. Network with local and national land trusts about conservation easement potential.

Goal 4: Extrapolate data. Work with RenewWest, NCRM, and LimnoTech to identify whether SFI management practices led to carbon, water, and conservation outcomes.

Goal 5: Publish outcomes via press release, conference attendance, and social media.

Virginia Tech: Conservation Management Institute: *Investigating the Relationships Between BMP Implementation and SFI Certification Through Time*

Project Lead: Dr. Joby Kauffman, Research Scientist, Virginia Tech

Project Update: This project focuses on scalable methods for collecting and preparing integral data for conducting robust analyses of coupled forestry and water quality metrics. A sampling of single and repeat harvest locations in Virginia that are within 200m of water gauging stations have been located. The boundaries of the upstream watersheds from these harvests have been delineated using ArcGIS Pro. The project team has also manually delineated (from aerial photography) harvest operations, and related water quality best management practices (BMPs) within harvest boundaries in selected

watersheds; the team then quantified BMP implementation and harvest operations metrics such as harvest area, number of logging decks, SMZ length, and slopes of roads. Automated methods for wall-to-wall identification of SMZ implementation across multi-state landscapes and over decadal time spans have been developed.

Time series maps of metrics related to water quality, including rainfall, land cover, harvest intensity, age class diversity, and reforestation rates have been created. Maps of SFI-certified Fiber Sourcing likelihood and SFI-certified Forest Management density have been created in order to further analyze the relationship between BMP implementation and SFI Forest Management and Fiber Sourcing certification across time in Virginia.

Validation of the automated SMZ implementation metrics is underway, along with further investigation of the availability of water quality measurements in close proximity to harvest locations in Virginia and throughout the Southeastern United States. The next step is an analysis on the cost, feasibility, and potential for acquiring enough data from multiple states to successfully evaluate the specific relationship between SMZ implementation and water quality.

Virginia Tech: Department of Forest Resources and Environmental Conservation: *Monitoring and Quantifying the Effects of State Forestry BMP Programs on Soil Erosion and Sediment Delivery for the Southeastern United States: Module III*

Project Leads: Chad Bolding, Associate Professor; Michael Aust, Faculty; Scott Barrett, Faculty, Virginia Tech

Project Update: This project, jointly funded by SFI and NCASI, will compare and contrast the implementation and efficacy of the 13 southeastern states' forestry best management practices (BMPs) for water quality. Our methods include extensive fieldwork to monitor sediment delivery ratios, erosion rates, and BMP implementation scores across multiple physiographic regions. We anticipate that findings will allow state forestry organizations and other stakeholders to quantify sediment protection provided by state BMP programs and highlight the sustainability of forest management. During the initial phase of the project, we have installed silt fences and determined BMP implementation rates and potential erosion rates for roads, skid trails, harvest areas, landings, and stream crossings on recent harvest sites located in North Carolina and Virginia.

In Virginia, we have completed 5 sites in the Mountains, 5 in the Piedmont, 1 in bottomland hardwoods, and 1 in the Coastal Plain. We have also finished 3 sites in North Carolina's Piedmont and 1 in its Coastal Plain, for a total of 16 finished sites across both states. We have installed approximately 60 silt fences across these sites. Erosion estimates are being developed for roads, skid trails, and stream crossings using the Universal Soil Loss Equation as modified for Forestlands (USLE-Forest) and the Water Erosion Prediction Program (WEPP). Initial results indicate a significant and negative relationship between BMP implementation and erosion rates. Results support the premise that BMP implementation rates can provide an index of water quality protection. We will continue site instrumentation and data collection throughout VA and NC during the Spring and early Summer. Additionally, we will begin phase two of the project involving BMP audits on recently harvested tracts throughout the southeastern 13 states.

Fraser Basin Council: *Monitoring Water Temperatures and Flows for Steelhead in Relation to Forest Management Practices*

Project Lead: Mike Simpson, Senior Regional Manager, Thompson, FBC

Project Update: The Fraser Basin Council (FBC) in partnership with Secwepemc Fisheries Commission, Simon Fraser University, Nicola Watershed and Stewardship and Fisheries Authority (part of Nicola Tribal Association), provincial and federal governments, Stuwix Joint Ventures Ltd. and West Fraser Mills, is monitoring water temperatures in the Thompson watershed to identify areas of groundwater influence and compare and contrast different forest management retention practices around small, upper elevation streams. The project will complement work underway in the adjacent Deadman and Nicola watersheds. Outcomes will help forest industry direct retention where needed, and improve flows and temperatures for steelhead. This comes at a time when fisheries-sensitive watershed designations are being finalized under provincial legislation.

FBC hosted a partner meeting on April 11th, which resulted in refocusing the project objectives to account for impacts associated with a substantial wildfire in the Bonaparte watershed in 2017. New objectives include:

- To understand the impacts of forest disturbances (wildfire, timber harvesting) on water temperatures and to understand future climate change impacts on water temperatures in the Bonaparte watershed
- To collect baseline water temperature data in the Bonaparte watershed
- To compare with water temperature data in the Deadman and Nicola watersheds

In the spring of 2018, 25 temperature loggers were deployed in various locations of the Bonaparte River watershed to identify the impacts wildfire and timber harvesting have on overall water temperature. These loggers were installed in high elevation areas below Bonaparte Lake, tributaries which feed into the Bonaparte River, and near the mouth where the system drains into the Thompson River. This project will also provide baseline water temperature data for the watershed which we can use for comparison with the Deadman and Nicola watersheds. First year results are under analysis, with raw data available upon request.

Nature Conservancy of Canada: *The Active River Area*

Project Lead: Patrick Nussey, Conservation Planner, NCC

Project Update: The Nature Conservancy of Canada (NCC) is developing a spatial tool called the Active River Area (ARA) for the Maritime Provinces and Southeastern Quebec. The Active River Area (ARA) framework aims to define riparian features that are directly integral to stream and river health, which can then be used to better inform conservation, restoration, and sustainable resource management activities. The ARA framework is unique, in that it provides a means for classifying different riparian

ecosystems that directly influence freshwater health, such as floodplains, terraces, meander belts, riparian wetlands and organic material contribution zones in headwaters.

This project will be the first to bring an integrated approach to freshwater ecosystem management, terrestrial and aquatic connectivity, and climate change adaptation in eastern Canada. To date, NCC has collected the necessary datasets and assessed and corrected the regional-scale hydrological network used to delineate the ARA. "Catchments" have been delineated for each stream/river segment in the network (n=203,569), and the "accumulation" technique has been applied to calculate and classify the size of each stream and river. The Active River Area has so far been delineated in select watersheds to test the consistency of cost-distance flow thresholds used in the US version. Current work involves experimenting with various threshold values that result in the best ARA overlap with existing floodplain mapping in the region.

GreenBlue: *Marketplace Education on the Benefits of Responsible Forest Management*

Project Lead: Tristanne Davis, Senior Manager, GreenBlue

Project Description and Results: The goal of this project is to educate brand owners with the message that buying products derived from responsibly managed forests can have extraordinary environmental benefits, like enhancing biodiversity, creating clean air and water, supporting renewable resources, and reducing impacts of climate change. GreenBlue, with support from its project partner, Sappi North America, designed and executed a communications campaign to educate brands about the benefits of responsible forest management and how these benefits support their sustainability goals. The campaign was delivered through four webinars: 1) Responsible forest management in the U.S. and Canada, 2) The role of forest certification, 3) Supporting family woodland owners, and 4) Clean water, climate change and biodiversity.

GreenBlue completed the delivery of all four webinars of the marketplace education campaign in 2018, including the live webinars and dedicated webpages with supporting materials. The webinars were recorded and made available online through a dedicated webpage, complimented by a slide deck, downloadable infographics, web-based informational primers, and printed brochures. Brand owners can use these materials to develop their internal stakeholder messaging as well as consumer outreach, to develop better understanding of the values built into sustainable packaging and other forest products. Resources are all available on individual web pages for each module, accessible through the campaign's main webpage: http://greenblue.org/work/forests/.

GreenBlue has created a Responsible Forestry Education Resource that is valuable to any stakeholder seeking to learn more now and in the future by equipping them with a high-level, yet comprehensive view included in each module. This resources will make it much easier for users to communicate to stakeholders about the benefits of using forest products.

GreenBlue provided a communications report to SFI on audience reached and continues to market the campaign webpage. In total, the campaign reached 49 organizations directly through live webinars. Brands represented the largest stakeholder group reached by the campaign, including 28 companies.

Each attendee was also sent a copy of the recording and directed to learn more on our dedicated webpage for this campaign. Many of those who registered but couldn't attend the webinar in person were able to catch up on what they missed through the email follow up. As of December 7 2018, the website had 608 pageviews and continues to get additional traffic as GreenBlue and SFI market the campaign.

Keeping Maine's Forests: *Preparing for the Carbon Market in Forests Certified to the SFI Standard*

Project Lead: Alison Truesdale, Coordinator, KMF

Project Description and Results: Keeping Maine's Forests (KMF) studied current carbon credit programs to determine the degree to which forests managed to the SFI Program Standards meet their criteria, and develop recommendations to SFI Program Participants to improve alignment. KMF and partners published a report on their findings; that report is available upon request.
KMF found that although SFI Program Participants have resources and systems in place for designing and maintaining a carbon project, the auditing processes for SFI certification and carbon verification are not similar and represent additional costs for landowners.

Additionally, landowners are at risk of having to pay back credits, sometimes with an additional penalty, if the land's carbon stocks decline due to harvests. Sixteen to nineteen percent of a project's credits are automatically transferred into an insurance pool which fully covers carbon losses due to unintentional declines in carbon stocks from weather events; wildfire; and insect, disease, and pathogen outbreaks. It is not clear, however, whether presalvage harvests related to spruce budworm infestation would be covered. Presalvage harvests may require landowners to surrender credits and possibly incur penalties. Given that landowners in Maine can expect two to three spruce budworm outbreaks over the course of a 100-year project, this lack of regulatory clarity represents a substantial risk to current and potential carbon program participants.

Carbon credits are a viable option for landowners whose forestland portfolios have areas with high carbon stocking that can be maintained over the long term. Higher credit prices or poor wood markets could also tip the balance of considerations in favor of improved forestry management projects, relative to carbon.

Nature Conservancy of Canada: *Comparing the Ecological Effects of Even-aged and Uneven-aged Forest Management in the Kenauk Reserve*

Project Lead: Caroline Gagné, Program Director for Western Quebec, NCC

Project Description and Results: This project compared the ecological effects of even-aged and uneven-aged forest management in order to provide a deeper understanding of forest

dynamics and to support the decision-making process in determining silvicultural treatments.

The project also investigated the viability of LiDAR in rapidly locating vernal pools in a forest landscape.

Project findings include:

1. LiDAR Investigation: The study found that vernal pools can be accurately and rapidly detected with the use of areal LiDAR and temporal high resolution spatial satelliteimagery in a forested landscape. This is significant as LiDAR technology has not been previously used to map vernal pools, and there is an increasing need to cost effectively locate these ecologically significant features as climate change is rapidly altering hydrological dynamics across the forest landscape.
2. Hydrology of Vernal Pools: NCC sought to refine understanding of the relationshipsbetween hydroperiod, pool morphology, and hydric location in order to understand the hydrological processes regulating these isolated forest wetlands. One key finding was the degree to which vernal pools vary in area. The studied wetlands have areas ranging from 26.4 to 753.6 m2. Their maximum water depths varied between 0.16 and 1.80 m, and the pools were active between 32 and 86% of the time. Another key finding was the hydrologic regimes of vernal pools were influenced mostly by precipitation and evapotranspiration, and to a lesser extent by infiltration, surface outflow, and ground water levels.
3. Biodiversity and forest resilience: NCC's results show that even-aged silviculture generally results in a higher tree species diversity than uneven-aged stands. In regeneration, the most important result is that uneven-aged silviculture appears to favor beech understory development. For herb species, NCC's analyses shows very distinct responses among families: i) some families do not seem affected by forest management; ii) some families are affected by both approaches or by one of them; iii) when affected some families seem to recover through time while others do not.

University of Georgia: *Quantifying Impacts of SFI's Fiber Sourcing Standards in Georgia*

Project Lead: Dr. Puneet Dwivedi, Associate Professor, Sustainability Sciences, UGA

Project Description and Results: As a first objective, this project analyzed the perceptions of stakeholder groups about forestry best management practices in Georgia, finding that agency and landowners share nearly similar perceptions about forestry best management practices, with a principal focus on education and training needs. Though the perception of loggers differed somewhat, overall stakeholder groups perceived forestry best management practices positively in relation to ensuring sustainability of forestry resources in Georgia. For more details, please refer to Chantal et al. (2018 - Journal of Environmental Management).

As a second objective, this project analyzed the role of SFI's Fiber Sourcing Standard in influencing the implementation rate of forestry best management practices within the wood baskets of mills certified to that standard. Results suggest that the implementation rates are on average higher on those harvested sites which were located within the wood baskets of mills certified to the fiber sourcing standard at 95%

confidence level, as compared to those harvested sites located outside the wood baskets of mills certified to the Fiber Sourcing Standard. Please refer to Dwivedi et al. (2018 - Forest Policy and Economics) for more details.

The third objective involved analyzing the percentage of total wood harvested by mills certified to SFI's Fiber Sourcing Standard in Georgia. Initial results suggest that 72% of the total wood harvested in Georgia is consumed by mills certified to the Fiber Sourcing Standard. Results also indicated that about 90% of total wood supply from 79 Georgia loggers who responded to the survey goes to mills certified to Fiber Sourcing Standard. A manuscript is currently being drafted for the third objective to be submitted soon for review and publication.