# Conservation Impact Project Summaries

June 2020

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 SFI's forest certification programs, 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 SFI's certification programs, and associated 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, with minimal editing by SFI. Final reports for recently concluded projects are available upon request.

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**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.

**Updates on Work:**

- ABC coordinated and hosted several partner meetings that reviewed findings and prepared the next phase of work. Pilot Areas evolved into Project areas including: New Bern, Cedar Key, Pensacola, and Aliceville.
- ABC was successful in negotiating with Mississippi State University to share data and add point counts in the Aliceville project area in both commercial and non-commercial forests.
- A fifth project area was established on the Texas and Louisiana border, including the recruitment of a new project partner, Lower Mississippi Valley Joint Venture. ABC developed survey points for this pilot region, and efforts to recruit volunteers is underway. This project is especially noteworthy in

that it focuses on SFI Fiber Sourcing Program Participants (rather than Forest Management certificate holders), thus broadening the learnings to be gained from the project.
- Working with SFI Staff and Boreal Avian Modeling project (BAM), ABC hosted successful workshops at the April 2019 and October 2019 Sounding Board Workshop to launch the US and Canada cross-border initiative contemplated under this grant. A third collaborative workshop is planned for June 2020.

**Boreal Avian Modeling Project (BAM):** ***Operationalizing conservation value through multi-species evaluation and implementation on SFI-certified lands***

**Project Leads:** Erin Bayne, Professor, University of Alberta; Andrew Crosby, Postdoctoral Fellow, Boreal Avian Modeling Project

**Project Update:** The Boreal Avian Modeling Project (BAM) is a continental-scale, collaborative research consortium 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 harmonized to a common standard, we have developed analyses to estimate population size and distribution, and responses to environmental conditions, for over 80 songbird species. These data and analytical approaches are the basis for the conservation value analysis described below.

Building on previous work by BAM, the objective of this research is to 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 operationalizes 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 are also working with the American Bird Conservancy to develop a cross-border collaboration that will extend this work to include bird populations throughout North America.

To date, we have developed models of bird species richness and community composition throughout the boreal and hemiboreal forest regions of Canada, applied these models to calculate conservation value of SFI certified lands for bird species diversity in three Bird Conservation Regions (BCRs), and developed a framework for the cross-border collaboration among BAM, ABC, and SFI. Our models show that diversity contribution of SFI certified lands varies among BCRs, being very strong in the Atlantic Northern Forest (BCR 14) and Boreal Hardwood Transition (BCR 12) regions. Diversity contribution of SFI lands in the Boreal Softwood Shield (BCR 8) region is less strong, but still higher than that of the surrounding matrix. In our cross-border collaboration framework, we have delineated a study region (BCR 12 excluding the area in Quebec; Fig. 1), held a workshop at the SFI annual meeting in October 2019, begun acquiring new bird data within the region, and prepared a webinar with potential project partners to be held in June 2020. The webinar and subsequent discussions will lead to development and submission of a grant proposal to fund a collaborative research and implementation project. The project will focus on understanding the impacts of large-scale forest management systems on bird populations

in the cross-border region, and developing recommendations for increasing the value of forest management for avian biodiversity.

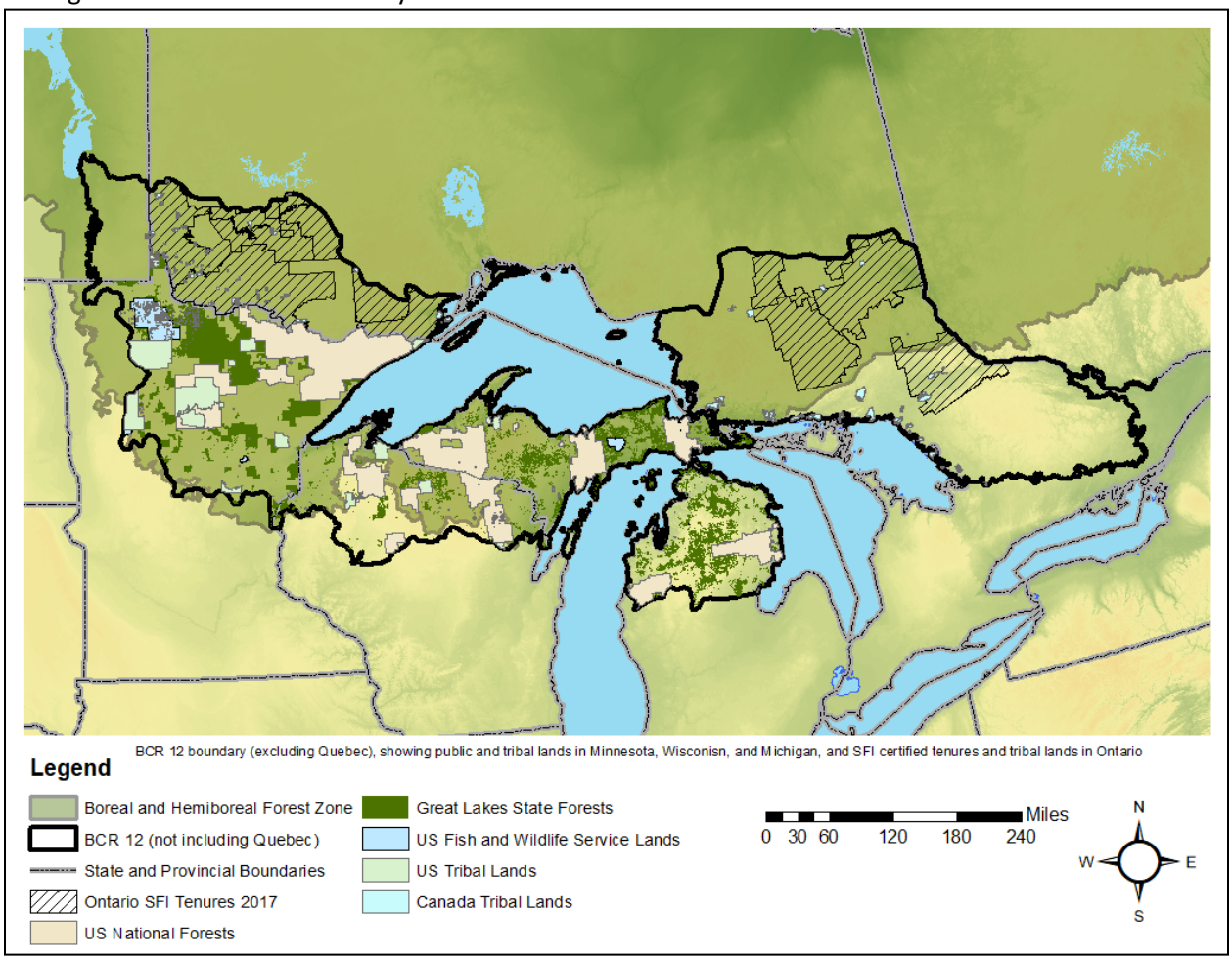



**Fig 1.** Map of Bird Conservation Region (BCR) 12 (excluding Quebec), showing public land, tribal land, and Ontario forestry tenures certified sustainable by SFI. All state owned land, and some tribal lands, maintain sustainable forestry certification. US Forest Service land does not maintain certification.

**fRI Research:** ***Caribou Conservation through Better Cutblock Design***

**Project Lead:** Laura Finnegan, Caribou Program Lead, Tracy McKay, Wildlife Biologist, 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 spatial disturbances like wellsites and cutblocks provide habitat for primary prey, managing these 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.

Trail cameras: In 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. In 2019, we set up 54 trail cameras at new locations in cutblocks, revisited all 66 cameras deployed in 2018, and collected detailed data regarding vegetation, ungulate forage availability, and forest stand characteristics at 31 cutblock sites. Preliminary analysis of photo data indicates detections of all age-sex classes of ungulates within cutblocks, including whitetail deer, mule deer, moose, and elk. All photos collected to date have been classified. The 2020 field season has been delayed until June 2020 because of COVID-19.


Deer capture and GPS data: Between January and March 2018 we captured 12 white-tailed deer across 13 capture events – 6 female and 6 males. 3 collared female deer were predated – two by wolves and one by cougars. Between January and March 2020, we collared 12 white-tailed deer (6 females, 6 males) and 2 female mule deer, bringing the total number of deer collared during the first two years of this project to 23 (21 white-tailed deer, 2 mule deer). 3 deer collared in 2020 sent mortality signals in the spring of 2020, however we have been unable to visit their mortality sites because of COVID-19. Preliminary analysis of GPS collar data revealed deer home range sizes varied among seasons and individuals, with some individuals using distinct winter and summer ranges, and a large proportion of home range areas were found in regions with conifer forest and with cutblocks between 10 – 25 years old. However, response to disturbance varied across seasons.

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 in the discussion of results associated with each metric.

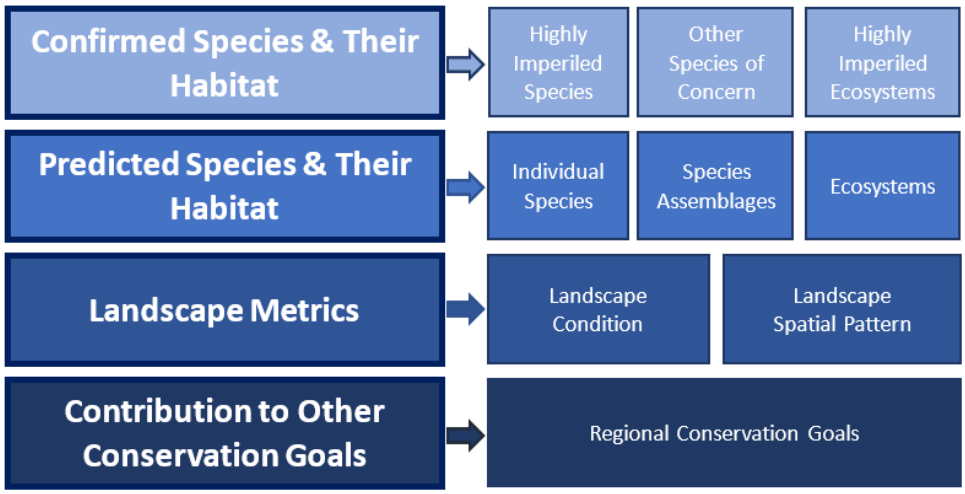



*Figure 1. Categories of biodiversity metrics addressed in this analysis.*

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.

**2019-2020 Phase II Work**: NatureServe is working 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:** Robyn Laubman, Environment Manager

**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 vigor, 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. Key progress includes:

- The protocol was designed by a professional forester at Ecora with input from Ecora and Yucwmenlúcwu biologists and Tolko forest managers. Field locations were selected.

- Because of limited numbers of forest stands available, the list of focal species was reduced from three to just black huckleberry (*Vaccinium membranaceum*). Huckleberry should serve as an indicator for originally targeted species. For statistical purposes, individual forest stands were replicates for the study. Ten sets of co-ordinates were randomly selected in each stand as potential plot locations.

- The field methods were tested in mid-June and fieldwork proper commenced in July. An experienced Splatsin technician and biologists from Yucwmenlúcwu and Ecora established permanent plots in 5 forest stands. Three plots were established in each stand to increase the odds of finding a plot in each stand next summer for the first post-harvest survey. During and after fieldwork was completed, data were checked for errors and data entry was started.

- Literature on pre- and post-harvest vegetation assessments and research on effects of changes in light and regeneration on the project's focal plants is underway and will be ongoing throughout the term of the Project.

- Splatsin is in the process of obtaining existing data from the Sicamous Creek Research Forest.

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

**Project Leads:** Kendall DeLyser, Forests and Climate Manager, American Forests, Luke Nave, Associate Research Scientist, University of Michigan and Northern Institute of Applied Climate Science

**Project Update:** Soils are a frequently 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. We are also creating decision support tools for our project partner, the Maryland DNR Forest Service, to identify areas of high vulnerability and opportunity for soil carbon impacts in Maryland's forests.

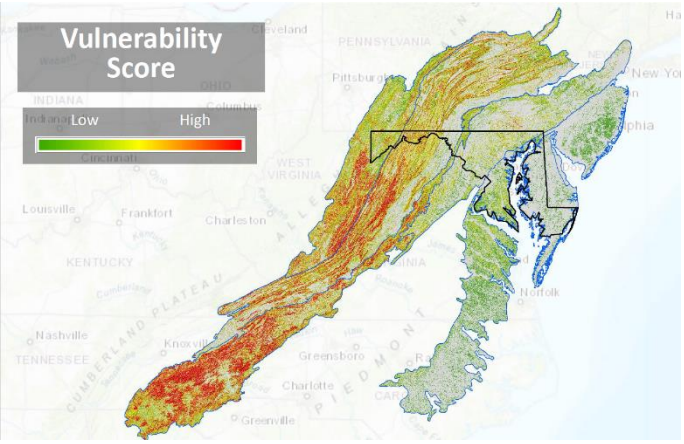
American Forests and NIACS have conducted a literature review and meta-analysis of relevant soil carbon data from 24 publications from Maryland and its associated ecoregion sections to determine the soil carbon impacts of various forest management practices, namely harvesting, land use change, and fire. 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.

We published our research in *Forest Ecology and Management* in June 2019. Highlighted results include:

- Harvest impacts on soil carbon depend upon landform and soil order.
- Harvest practices, such as residue removal, site preparation, and regeneration methods, influence the magnitude and variability of soil carbon change.
- Reforestation of cultivated soils increases soil carbon.
- Biomass and soil carbon recover concurrently during reforestation.
- Fire causes variable and potentially large soil carbon losses

From these results, we are working towards a menu of forest management practices and guidelines with potential to protect or enhance forest soil carbon in Maryland. We will compare this menu to those practices encouraged under the SFI Forest Management Standard to evaluate the benefits of SFI certification for soil carbon. We are also creating decision support tools for the Maryland DNR Forest Service, in the form of maps that identify areas of high vulnerability and opportunity for soil carbon impacts in the state. The figure below is an example of our preliminary vulnerability map:




We are currently working to refine this vulnerability map with our Maryland partners, and will also create similar maps of opportunities to increase soil carbon sequestration from forest management (especially from reforestation). The vulnerability and opportunity maps can be combined to highlight potential areas of caution or action on forest soil carbon in Maryland, which landowners and land managers can use as one input in their forest management decision-making process.

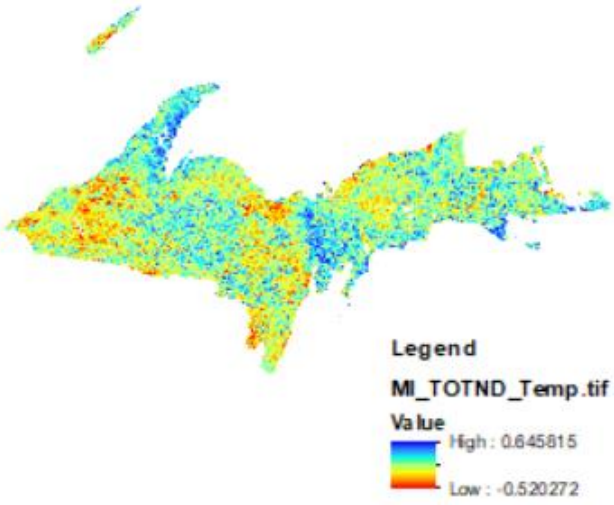
**Manomet:** ***Forest Climate Resiliency Project***

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

**Project Update:** The Forest Climate Resiliency Project will provide a toolkit for monitoring several climate change related impacts including changing forest health and productivity. In addition, the toolkit will provide guidance on linking this information to forest management plans. Monitoring considerations at both the stand level and regional scale are included.

**Key Progress to Date**

- Four study sites identified: Michigan, New Hampshire, New York, North Carolina
- Monitoring protocol for tracking climate change impacts on forest health at the stand level completed
- 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. We are utilizing a mix of FIA data and satellite imagery in an examination of forest change in response to temperature and precipitation change. The figure to the left shows preliminary results of an analysis of the correlation between annual

temperature and NDVI for the period 1989 – 2013 for the region surrounding the Michigan study site. 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:** ***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 five 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 were signed, and the data obtained for four of those provinces. One agreement with an industry partner in BC was signed and data exchanges were completed. The most up to date Landsat-derived spatial disturbance information was obtained from various products (Change to composite, National Burn Area Composite), and verification of those data for the pilot areas was completed.

Spatially-explicit forest carbon stocks and stock change analyses were conducted at one hectare resolution for the period 1990 to the 2016 using the Generic Carbon Budget Model (GCBM) and associated data pre- and post-processing tools. This also included improvements to the tools required to "roll-back" an existing forest inventory to the 1990 start year of the simulations. Other refinements included increased flexibility for data, processing capacity (using local cloud infrastructure), and Quality Assurance /Quality Control (QAQC) measures.

Over the summer of 2019, GCBM projects were set up for all pilot areas and preliminary and final simulations and QA/QC checks were completed. A preliminary draft project report was written and discussed with all project partners in September. Based on feedback, a draft of the final report is being prepared for delivery to project partners. Any remaining recommended revisions resulting from feedback will be incorporated into the final report to be submitted to the SFI and FPAC funding partners. Discussions will also shift focus to communicating results to project stakeholders, developing communications products and materials, and preparing a scientific manuscript, in the final months of the project.

**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:** The research team will use empirical soils data from across the Acadian Forest Region to inform SFI objectives and measures related to soil productivity, carbon storage, and conservation. Specifically, the project will evaluate the influence of different forest management practices and site qualities on short-term soil carbon stocks as well as on soil health and conservation of the soil resource across research installations in Maine. Researchers will be measuring soil nutrient status, soil carbon storage, and soil compaction on a subset of the Maine Adaptive Silviculture Network installations to extrapolate impacts at scale.

On two of these installations in northern Maine, soils supporting northern hardwoods were evaluated before and after timber harvesting. The soils series of each approximately 100-ha installation are 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 are being evaluated for their influence on soils include crop tree release, partial harvesting, and control (no cutting since the 1950s to 1970s). Timber harvesting occurred during the summer months in 2018, and soil sampling occurred during the summers of 2018 and 2019.

Before harvesting, nutrient stocks and metrics related to soil productivity were derived using results from laboratory analysis on soils collected from quantitative soil pits. The carbon to nitrogen ratios of soil organic horizons indicated that nitrogen in organic materials exceeded microbial growth requirements and that excess nitrogen was available to plants. For the combined pools of the organic horizon and mineral soil to a depth of 30 cm, P, Ca, Mg, and K stocks varied by installation. There were also differences in the effective base saturation in the upper B horizon between installations, with one installation having values shown to adversely affect sugar maple. Hence, soil properties will be drivers of future species composition and carbon trajectories, and these trajectories will likely vary by installation.

The summer after harvesting, soil compaction was measured as the difference in bulk density between trails and non-trafficked areas. Soil compaction in trails was greatest where soils adjacent to trails had low bulk densities. Locations in trails that were closest to landings and that had minimal slash also tended to have the greatest compaction. These results are important in the context of climate change as more summer logging is expected to occur in areas traditionally cut in the winter because of longer frost-free periods and more winter precipitation occurring as rain. More logging during the expanding snow-free season could translate to a greater degree of compaction and longer soil recovery times over a larger portion of the forested landscape.

**The Department of Forest Resources and Environmental Conservation at Virginia Polytechnic Institute and State University:** ***Monitoring and Quantifying the Effects of State Forestry BMP Programs on Soil Erosion and Sediment Delivery for the Southeastern United States***

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

**Project Update:** This project, jointly funded by SFI and the National Council for Air and Stream Improvement (NCASI), is comparing and contrasting the implementation and efficacy of the southeastern states' forestry best management practices (BMPs) for water quality. We are performing 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. To date, 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.

We are now beginning the final phase of data collection that will be conducted this summer. We are remeasuring silt fences after being installed for one year to determine sediment accumulation. We have 33 sites left to visit, 31 in Virginia and 2 in North Carolina. For phase II of the study, we are developing erosion estimates the Universal Soil Loss Equation as modified for Forestlands (USLE-Forest) across the southeastern US. We have evaluated 93 recent harvests across 12 southeastern states and subdivided into topographically driven harvest regions (Coastal Plain, Piedmont, and Mountains) and also characterized broad state regions (Atlantic, Gulf Coast, Interior Southern States). Average, median, maximum, and minimum erosion rates of the five different harvest operational features (deck, haul road, skid trail, stream crossing, harvest area) were estimated using the USLE-Forest model. Areas of all operational features were measured. Across the southeast, the trafficked features related to site access (deck, haul road, skid trail, stream crossing) were responsible for the majority of the percentages of bare soil and erosion although they represented a smaller percentage of area for the site. Harvest areas maintained the lowest levels of bare soil and sediment loss. Skid trails typically had the largest areas as well as the highest predicted erosion rates of all the features followed by haul roads and stream crossings. Differences in both physiographic and state regions also showed to have an influence due to differences in topography, and BMP implementation.

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

**Project Lead:** Mike Simpson, Senior Regional Manager, Thompson Region, Fraser Basin Council

**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 Scw'exmx Tribal Council), 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 were recently finalized under provincial legislation, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) identified Interior Fraser Steelhead as endangered, and the federal Environment Minister did not list them as endangered under the Species at Risk Act.

Temperature loggers were deployed from June through October 2018 in the Bonaparte River watershed in 25 locations. Temperature data was collected in the Nicola watershed throughout the summer months in 2018. This was repeated in 2019, and the third and final year of monitoring in the Bonaparte watershed will commence in June 2020.

Representatives from the forest industry, First Nations, academia and the provincial government participated in a half-day meeting in Kamloops in January 2019 to review results, share recommendations or suggestions for data collection in 2019, and identify opportunities for collaboration and continued communication. The same meeting was held in January 2020 to review 2019 data.

**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 spatially 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 is 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. By adopting the tools and methods developed by The Nature Conservancy (TNC) in the US, the ARA delineation had now been completed. With the use of satellite imagery on existing floodplain and riparian wetland mapping, we will be testing the accuracy of the GIS delineated ARA boundaries.

By incorporating the results of the ARA delineation, a freshwater climate change resiliency analysis has also been completed. This analysis has assessed all rivers and streams in the study area for their: functionally connected length, gradient and temperature diversity, intactness of the ARA, and watershed imperviousness. This will help resource managers identify those networks most highly

resilient to current and future changes in climate.

The next steps will be finalizing reports and creating web applications where the results of the ARA and the resilience analysis can be shared and viewed by the public.

**University of Georgia:** ***Examining the Role of Forest Certification in Improving Biodiversity and Water Quality in the Southern Coastal Plains Ecoregion of South Carolina, Georgia, Florida, and Alabama***

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

**Project Update:** This project was newly initiated in spring 2020. The overall aim of the project is to define the impacts of the SFI Sustainable Fiber Sourcing Standard on water quality and biodiversity for ensuring the sustainability of forest resources at the ecoregion level. The first objective of the project is to establish the relationship between the implementation rates of forestry best management practices and the adoption of the Fiber Sourcing Standard in the Southern Coastal Plain Ecoregion. The second objective is to ascertain the degree of overlap between wood baskets of certified mills and habitats of at-risk species and explore the relationship between the rate of increase in the implementation rate of forestry best management practices within and outside the habitats of at-risk species across the Coastal Plain Ecoregion. The Southern Coastal Plain Ecoregion is part of the North American Coastal Plain, which was identified in 2016 as the 36$^{th}$ global biodiversity hotspot. This region is extremely rich in plant and animal biodiversity, harboring more than 1,500 species of native vascular plants, 114 native mammal species, 113 native reptile species, and 57 endemic amphibian species. Additionally, the region is the major producer of the roundwood nationwide, in general, and softwood, in particular, where family forest landowners own the majority (about 60%) of forestlands. We have selected four large roundwood producing states (South Carolina, Georgia, Florida, and Alabama) for this project.

**National Council for Air and Stream Improvement (NCASI):** ***Development of a Carbon and Water Calculator for SFI Lands***

**Project Lead**: Erik Schilling, Director, Forestry Research, Southeastern U.S., NCASI

**Project Update**: This project was newly initiated in spring 2020. The project will develop an online tool that will estimate and display forest carbon stocks, forest carbon stock changes, and water resources on SFI certified lands across the conterminous US. This would allow the public to interactively view the contribution of private lands, and SFI-certified forests in particular, to achieving environmental objectives such as the provision of clean water and mitigating climate change through carbon sequestration in forests.

Approach: NCASI staff will extract relevant data from databases such as the national FIA Database (FIADB) for the 48 conterminous US states, forested land cover, and watershed data. We will then analyze those data to obtain summaries of regional carbon and water-related data as they intersect with

SFI-certified forestlands. Regional estimates of the proportion of forested land that is under management by SFI certification can then be applied to data on provision of water and carbon storage to develop a basis for estimates of ecosystem services from SFI-certified forestlands.

More detailed approaches may exist that depend on additional source data layers, but this effort focuses on the development of an initial tool using broad averages applied to larger geographic regions (i.e., states or aggregates of states). As techniques, future data availability, and privacy constraints allow, this tool could be refined to produce finer-scale results.

Forest carbon pools will include:
- Aboveground live tree
- Belowground live tree
- Above and belowground dead tree
- Understory (seedlings/shrubs/bushes)
- Coarse woody debris
- Organic soil carbon

All estimates will use FIA-approved methods for carbon estimation. The underlying data could be updated on an as-needed basis to incorporate the latest available FIA inventory data. In addition to carbon stocks (estimates of forest carbon from most recent inventories), we will estimate annual average sequestration rates (change in carbon stocks from prior inventories).

Water metrics such as evapotranspiration, precipitation, and runoff rates for forested areas in different geographic regions will be used to develop estimates of water yield from forested watersheds. These estimates can then be applied to private acres, and SFI-certified acres, within geographic regions to obtain water production from private and certified lands.

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

**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 resource 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 could not 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.

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**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 satellite imagery 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 relationships between 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.

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**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 Description and Results**: Through this project we have advanced a methodology for using Aerial Laser Scanning (ALS) data to rapidly assess forest structure and estimate forest diversity in the Central Interior Plateau of British Columbia. This was accomplished by linking high resolution ALS data from the Aleza Lake Research Forest (ALRF) with field-based forest structure and biodiversity data collected during an intensive field sampling campaign during the summer of 2016 (Objective 1). Our field sampling was designed such that we were able to collect data across a range of forest types that encompassed differences in forest age, management history and topographic conditions (Objective 1, 3), while also permitting us to sample at several nested spatial scales within each forest type. Sampling across spatial scales provided the ability for us to analyze the scale at which structural and diversity differences between forest types could best be discerned, and to evaluate the spatial resolution at which ALS metrics were best suited for estimating forest characteristics (Objective 4). Working with the ALS data we calculated and developed a range of metrics relating to forest state and forest structural attributes (Objective 2). We analyzed these ALS derived metrics with regard to their correspondence with empirically derived estimates of forest structure and diversity in each of the forest types we considered (Objective 4). We then evaluated what combinations of ALS metrics best distinguished between our sampled forest types and provided the best means for remotely estimating forest diversity (Objective 4). The results from this analysis are then used to develop forest diversity models directly from ALS data (Objective 4).

Our work produced two key findings with regard to how best to use ALS data to evaluate forest biodiversity. First, we demonstrated that ALS metrics need to be evaluated simultaneously at multiple spatial scales in order to best model forest vegetation diversity. Our analysis used area-based ALS metrics that were evaluated between small (200m2) and large (625m2) spatial grains. The models that were found to be the best predictors of below ground vegetation diversity, and biodiversity in general, were ones that combined metrics from the large and small end of this spectrum. Second, we demonstrate that biodiversity estimates are increased when using a combination of high-resolution

Digital Elevation Model (DEM) derived metrics, and metrics that reflect the height distribution and variance of forest canopy vertical structure. Specifically, for our research area in the central interior of British Columbia, were topographic variation is reasonably low, and small edaphic changes can induce substantial shifts in vegetation diversity and community structure, small changes in the estimated water holding capacity of the soil and modeled surface roughness can influence species richness. These fine grain landscape changes were revealed through our use of ALS data and provide a means of assessing these fine grain drivers of ecological structure at a landscape scale.

The analysis framework that we developed in this project is currently being used to inform and improve the long-term forest management plan for the Aleza Lake Research Forest (ALRF) by providing a means of using ALS data to estimate forest diversity value at a landscape scale, thereby facilitating landscape level planning that aims to identify and manage areas supporting high forest diversity value and promote the economic and ecological sustainability of the forest.

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**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 pre-salvage harvests related to spruce budworm infestation would be covered. Pre-salvage 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.

**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 Description and Results**: 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 is available upon request.

**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.

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**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 Description and Results**: 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), explored 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. The pilot project was conducted with Fruit Growers Supply Company (SFI-00152), examining the value of their 316,647 certified acres. COCO's strategic partner RenewWest, a Colorado Limited Liability Company specializing in forest-based ecosystem services, lead the investigation for generating conservation-focused returns through the monetization of carbon, water, and conservation markets. Additionally, project contractor, TerraCarbon is reviewing SFI standards to determine additive carbon values. Gathered results could be examined and extrapolated to show potential for other SFI-certified forests.

For the 12,292 acres considered for reforestation, the final, best estimate of reduced runoff is 3,687,000 Liters / 2,990 acre-feet of increased aquifer recharge per year. A similar sized aquifer recharge project would be likely valued at $1,166,100 per year. Additionally, 4,917 metric tons of avoided erosion / stream sedimentation per year will be created by the reforestation.

The TerraCarbon report demonstrated a qualitative but not quantitative value in SFI certification, based upon reporting standards. That is, adhering to SFI standards will make practicing foresters and landowners well acquainted with best practices of forestry and forestry accounting, which translates well to participation in carbon markets, but that there is not an identifiable carbon benefit from standard adherence above what the market common practice shows.

**Conservation Management Institute Conservation at Virginia Polytechnic Institute and State University:** ***Investigating the Relationships between BMP Implementation and SFI Certification through Time***

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

**Project Description and Results:** This project focused 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 were located. The boundaries of the upstream watersheds from these harvests were delineated using ArcGIS Pro. The project team has 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 were 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 were 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 was explored, 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 methods developed result in stronger results with a greater availability of data. In some regions, data limits the usefulness of methods. Although a phase II project is not currently being developed, next steps would include 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.