

Summer 2023 Newsletter



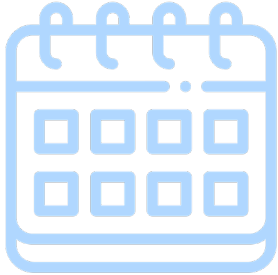
COOPERATIVE FORESTRY RESEARCH UNIT

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SAVE THESE DATES



September 20th - Field Tour, location TBA. As part of Laura Kenefic's most recent CFRU project, Mixedwood Management: Silviculture for Hardwood-Softwood Mixtures in Maine, a practitioner-oriented workshop will be held on Wednesday, September 20. This daylong workshop will be supported by a new report on the status and trends of mixedwood in Maine. Invited speakers will include mixedwood ecology and management researchers with expertise in spruce-fir-hardwoods, oak-pine, and hemlock-hardwoods, in addition to other regionally important forest types, both from the research team and the larger Mixedwooder group (e.g., Dave MacLean, Christel Kern, and others). FMI contact laura.kenefic@usda.gov.

September 22nd - Workshop - 2nd Annual Forest Carbon Partner Workshop. Last year, Wheatland Geospatial Lab, held the first annual Maine Forest Carbon Workshop. The workshop included a half-day of presentations on forest carbon science and applications, followed by a facilitated discussion and brainstorming activity for the design and needed components of a forest carbon monitoring system for Maine. This year's meeting will focus on providing updates from the carbon monitoring system (CMS) program and introducing preliminary forest carbon data products and decision support tools. Feedback from partners and potential You can view last year's meeting materials and recordings here. FMI contact anthony.p.guay@maine.edu

October 19th - Meeting - CFRU Advisory Committee Meeting. Join us for our fall advisory committee meeting at Buchanan Alumni House at the University of Maine Orono. This meeting will feature funded research updates from a variety of CFRU projects.

October 20th - Field Tour, Rangeley area. Join the CFRU on a tour of member lands in western Maine. This event will focus on project updates in the field including the Northern Conifer Silviculture Guide and how it might be used for member lands management, eDNA monitoring, MASN, and more. Stay tuned for the full agenda.



Welcoming Eric McPherson, our new Research & Internship Coordinator!

Eric McPherson completed his Master of Forestry in the spring of 2022 from the University of Maine. His thesis utilized Maine Adaptive Silviculture Network data for evaluating sequestered and stored carbon potential across various silvicultural treatments have been implemented. Eric started working for the CFRU in the summer of 2022 and was integral in supervising a smooth field season. He stayed on during the school year to complete an internship with us and began to meet many of our members through his MASN updates at our advisory committee meetings.

Eric is funded by a new shared position between the CFRU and the School of Forest Resources (SFR) (80% CFRU, 20% SFR). In his time with SFR, he will be helping students prepare for industry internships. This position will also assist CFRU members in advertising and finding students for internships and job placement. Eric can be reached at eric.mcpherson@maine.edu.

2023 CFRU field crew - introductions & updates

The CFRU hired 3 students for long-term research re-measurements & pre-harvest MASN inventories for the summer. Our crew has been hard at work despite the soaking start to the summer, completing a full remeasure at Weymouth Point Study Area in early July. They recently finished the pre-harvest inventory for one of our newest MASN sites on AMC land. Now they are on to their second MASN site on Manulife land. These new MASN installations fill geographic gaps while also helping to round out our site replicates. Our heartfelt thanks goes out to our field crew for their hardworking and positive demeanor, attention to detail, and willingness to get their boots wet to get the job done.



Meet the crew (right to left in photo below)

Ashley Carter comes to us from SUNY ESF as a recent graduate. She is starting as a graduate student this fall with Dr. Mike Premer and will be working on his funded CFRU project, Silvicultural Systems for Adaptive Planted Spruce Forests. Ashley is enjoying working for the CFRU to better her field and applied research skills.

Eddie Nachamie is majoring in Ecology & Environmental Sciences at the University of Maine and comes to us with a wealth of field experience that he gained from working for AmeriCorps. Eddie is passionate about food sustainability and works for the Mitchell Center during the school year.

Mac Mackenzie spent the first half of the field season conducting bird surveys for us on all of our MASN sites and is now joining the rest of the field crew to assist with forest measurements. Mac is a third year student in the Wildlife Ecology program at the University of Maine and we are all benefiting from their shared knowledge of observing, identifying, and tracking wildlife in the field this summer.



Photo right - Ashley Carter snags a shed near Chesuncook Lake.
Photo above - (by Mac Mackenzie) - Mac documents black bear tracks.

SILVICULTURE & MANAGEMENT

A New Northern Conifer Silviculture Guide

Principle researcher: Laura Kenefic, U.S. Forest Service

The writing team of Laura Kenefic, Nicole Rogers, Carolyn Ziegler, Bob Seymour, and Keith Kanoti is hard at work completing the draft guide. Jenna Zukswert, former CFRU employee, is now a Science Delivery Specialist with the U.S. Forest Service and has joined the team to assist with editing. Once complete, the draft will be shared with the Advisory Panel and others for review. The team will be presenting some of their work during the CFRU Fall Field Tour.

Silvicultural Systems for Adaptive Planted Spruce-Fir Forests

Principle researcher: Mike Premer, University of Maine

The Silvicultural Systems for Adaptive Planted Spruce Forests (SSAPSF) project has been initiated and a total of 6 experimental installations have been strategically identified for 2024 planting and establishment, with another 6 planned for 2025. Collaborators (JDI, Seven Islands) and UMaine staff and researchers spent a day in the woods in late June discussing project objectives, approaches, and field logistics. Weyerhaeuser has contributed an ongoing spruce plantation project that will be used for preliminary analysis. Ashley Carter, currently a summer intern with the CFRU, has been recruited to work on the SSAPSF project as a MSc student and will begin in the fall of 2023.



Secrets in the CTRN: Causal factors of thinning response and transfer to adaptive management regimes in Maine spruce-fir forests

Principle researcher: Mike Premer, University of Maine

The Secrets in the CTRN project (use of Carbon and Oxygen Isotopes to assess thinning response) is in progress with tree core samples collected from 2 installations (Rump Road and Katahdin Ironworks sites) with another 4 planned for field sampling in Fall 2023 and Spring 2024. Collaborators from Wagner Forest Management (Mike Jurgiewich) and the Appalachian Mountain Club (Carolyn Ziegler and Steve Tatko) provided field logistical support and valuable feedback for project objectives and expected deliverables. Tree stem map data has been processed and competition metrics calculated for all sites. Lila Beck, an incoming M.Sc. student has been recruited to work on the project and will begin in August 2023.



HABITAT & BIODIVERSITY



Thirty Years of Change in Commercial Forest Management and Implications for Bird Conservation in Maine (1992-2022)

Principle researcher: John Hagan, Our Common Climate

With all the field data collection completed in 2022, this summer (2023) the research team is concentrating on analyses, writing up results, and public outreach. We've given three presentations at various Maine birding festivals since late May (2023) and published a lay article in Bird Observer about the study. Public outreach is critical for helping people understand the role of Maine's commercial forest for regional and continental scale bird conservation. As reported at previous CFRU meetings, we have a mostly 'good news' story to tell about bird populations in Maine's working forest since the original bird study in the early 1990s.

As expected, forest types and age classes have changed in our 1-million-acre study area around Moosehead Lake in the last 30 years. There is more mid-aged forest and less early and late-successional forest. This has implications for the different bird species that use different age classes, but most species are flexible enough in their habitat use that they are still abundant in the study landscape. The densities (bird per hectare) of many species have increased in the last 30 years. A few species have decreased in density. Our study contrasts in interesting ways from a recent study of birds and forestry in New Brunswick. As we say in our Bird Observer article, Maine's commercial forest remains "10 million acres of bird habitat." Our work on the "30-YR Bird Study" will wrap up by the end of calendar 2023, except for completing the installation of public birding trail through the commercial forest near Greenville in June of 2024.

Mapping and Managing for Late-successional Forest in Maine's Commercial Forest Landscapes

Principle researcher: John Hagan, Our Common Climate

The summer we are ground-truthing to test the ability of LiDAR to identify ecologically significant late-successional (~100-200 years old) and old-growth (~200+ years old) forest throughout the unorganized townships of Maine. We pre-selected 120 sites across the breadth of Maine's commercial timberlands based on the LiDAR "signature" for canopy height. For most of Maine's productive forestland, canopy height is tightly correlated with age of the forest. When the dominant canopy exceeds 22 or 23 m tall in Maine's commercial forests, the stand is usually late-successional or old-growth.

Ground-truthing so far this summer (about 80 of our 120-plot goal) is verifying the effectiveness of LiDAR for mapping LSOG forest. In fact, so far, it has not mis-identified a single LSOG stand. LSOG stands are characterized by a high density of large trees, large snags, and large downed logs. The older the stand, the higher the density of these simple forest metrics. With the data we are collecting this summer we will be able to compare these metrics with economically mature forest using tree data from the 30-YR Bird Study and other sources.

Landowners/managers have been great to work with this summer, helping us understand road accessibility before we arrive in a sector. This assistance has saved us a lot of time and has been a big help due to endless rain delays in June and July. Next summer (2024) we will work with foresters to apply a variety of stand-level LSOG management strategies at the stand and landscape level. These strategies will ultimately be compiled in an LSOG guidebook for landowners. We have already seen examples of innovative LSOG management throughout the commercial forest this summer. We look forward to learning from, and with, foresters in the field next summer.



Ben Shamgochian measuring a huge white pine in Big Reed Reserve. The tree is 4.2' in diameter and 123' tall. Using our LiDAR map of the forest canopy, we were able to walk directly to this tree in the "sea" of old forest above.



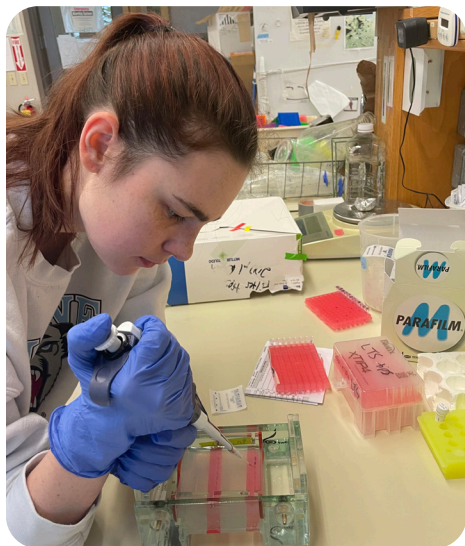
A typical late-successional northern hardwood stand that is readily detected with LiDAR. This stand is on J.D. Irving timberland near Allagash, ME. (photo by J. Hagan)

Using eDNA for Biodiversity and Rare Species Monitoring

Principle researcher: Noah Charney, University of Maine (update provided by Harrison Goldspiel, PhD student)

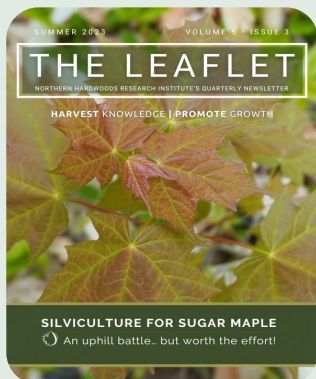
This spring and summer we have been working in the field and the lab to better understand the capacity of eDNA for monitoring cryptic wildlife in freshwater wetlands.

In April, we began conducting intensive surveys of fauna in over 30 forested vernal pools, ponds, and floodplains in Orono and Old Town, Maine by comparing eDNA samples from water with a suite of conventional monitoring approaches for studying birds, mammals, and amphibians. We installed camera traps at eight wetlands and have been collecting continuous images of fauna alongside monthly samples of eDNA. These data will help us understand how effective eDNA metabarcoding is compared to passive photography for detecting birds and mammals. We also performed intensive trapping surveys of breeding amphibians in 15 wetlands, focusing on populations of blue-spotted and unisexual salamanders, and collected eDNA at all of those sites. We plan to use these data to validate eDNA assays and see how well eDNA quantity relates to amphibian abundance in vernal pools. We have also been collecting some important environmental covariates from these wetlands, such as water chemistry data, to better understand how abiotic conditions affect detection of different species with eDNA.



In the lab, we have been working on testing and optimizing eDNA assays for wildlife in vernal pools. We have designed and tested dozens of primers for detecting rare amphibians, such as blue-spotted salamanders, and vertebrates more broadly. We are making good progress on identifying some working primers and hope to use them on our eDNA samples later in the summer and fall. We identified some species of interest that are missing available genetic references online and submitted tissues samples for mitogenome sequencing to fill those gaps for future biodiversity studies with eDNA. We have also been processing and sequencing hundreds of eDNA samples from wetlands during pilot surveys in 2020 and 2021 to answer some fundamental questions about biodiversity monitoring schemes with eDNA in vernal pools (i.e., how many samples are necessary from one wetland; how far apart should they be in space and time?).

All of our research this year has been made possible thanks to the generous support of CFRU and the crucial assistance of many dedicated undergraduate technicians.



Have you read our column in The Leaflet?

Northern Hardwoods Research Institute is an applied research institution focused on providing the forestry sector with the knowledge and tools required to ensure the growth and sustainability of northern hardwood and mixedwood forests. Similar to the CFRU, they are a solution oriented organization that provides high quality communications and tools for technology transfer. The Leaflet is a quarterly newsletter by NHRI that provides useful summaries and solutions for challenges that forestry practitioners are facing today. CFRU has a column in the publication and we hope you take the time to check out our write-ups. Check out our most recent blurb: [The Leaflet - "Can NHRI's form and risk assessment be used to predict sawlog potential in hardwood forests in Maine?"](#)

American Marten: Refining the Umbrella Species Concept in Maine

Principle researcher: Erin Simons-Legaard

This summer we are in the process of analyzing the acoustic recordings collected last summer (May to August) by WFCB grad student Kirstin Fagan. Recordings were collected at 60 sites distributed across the two townships west of Baxter (T5 R11 WELS and T4 R11 WELS), which have served as the location of a long-term study of American marten habitat use and selection. Using marten home range data, sites were selected to represent a diverse combination of marten use status (high, medium, no use) and forest type (hardwood, softwood, mixed). High use sites include both female and male occupancy, and medium use include only males. Recorders were deployed at each site for 10+ days.

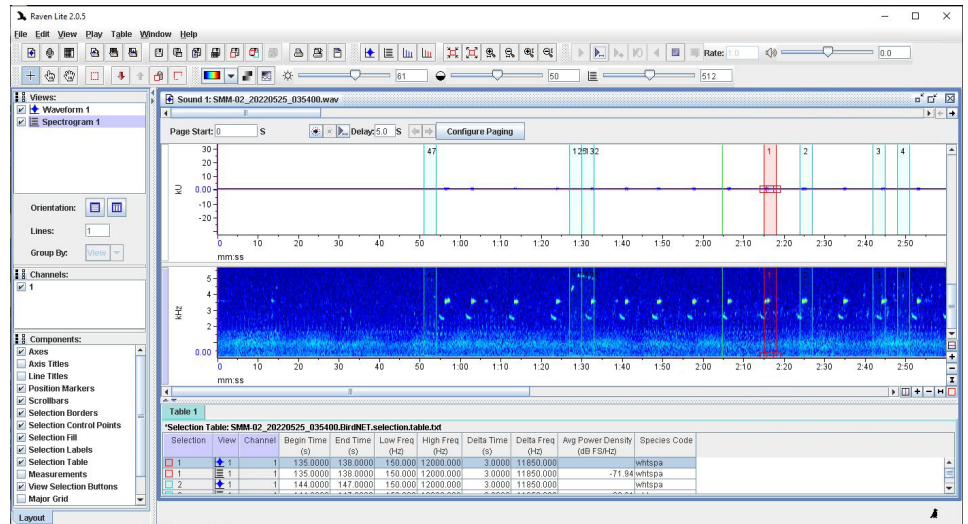


Figure 1. Song identifications can be reviewed in the companion RavenLite GUI.

We are using the freely available BirdNET software (<https://birdnet.cornell.edu/>) to develop species lists for each site. BirdNET, developed by researchers at the Cornell Lab of Ornithology, is based on a deep neural network algorithm that was trained to identify nearly 200 individual bird species based on spectrograms of songs. Song identifications can be reviewed in the companion RavenLite GUI (Figure 1). To date we have compiled initial species lists for approximately half of our sites and also completed a preliminary analysis comparing species lists between high use vs. no use softwood-dominated sites. Overlap was high (approximately 85%) overall, but the boreal chickadee was an interesting and notable exception that only occurred in areas with high marten use.

INVENTORY & GROWTH MODELING

Improved Digital Soil Maps for Maine's Working Forestland

Principle researcher: Nicole Rogers, University of Maine

Work for our CFRU project on digital soil mapping is underway! We have identified 60 possible sites for the first round of soil and vegetation plots and are coordinating access with CFRU members. Thank you to everyone that has been involved so far! Our plan is to begin sampling next week in northern Penobscot County. Initial sampling will include digging a soil pit for classification of soil series and vegetation sampling.

Measurements, Models, and Maps: Toward a Reliable Cost-Effective Workflow for Large Area Forest Inventory From Airborne LiDAR Data

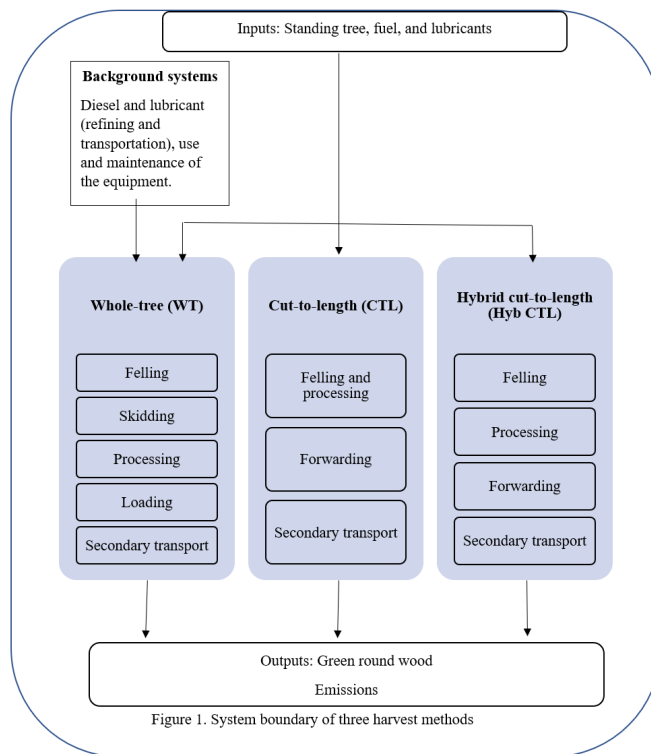
Principle researchers: Wheatland Geospatial Lab, University of Maine

We have now completed a series of case studies across varying conditions that we are using to compile a "lessons learned" report as well as inform a "best practices" guide for developing LiDAR-based enhanced forest inventories (EFI) in Maine's managed forests. So far we have developed and tested these methods with the Seven Islands Land Company, Baskahegan Company, Rangeley Lakes Heritage Trust, and at the University of Maine's Penobscot Experimental Forest (PEF). The PEF case study, supported by new field calibration data collection last summer, has provided the most quantitative results for comparing varying plot designs on LiDAR model performance. These results contributed to Stephanie Willsey's M.S. thesis, which was completed and defended this spring. This summer we are also starting work on the statewide photo point cloud data, which currently mostly involves Dave Sandilands processing the NAIP surface models with LiDAR elevation data in preparation for new EFI model development.

Carbon footprint of predominant mechanized timber harvesting methods in the Northeast U.S.

Principle researcher: Ashish Alex, University of Maine

Even though the forests are considered carbon neutral, timber harvesting activities to attain the forest management objectives leave a carbon footprint. This study assesses 1) the carbon footprint of whole-tree (WT), cut-to-length (CTL), and hybrid cut-to-length (Hyb CTL) harvest methods and processes involved from felling to trucking in the Northeastern region of the US. The internationally accepted Life cycle assessment (LCA) was done to assess the carbon footprint using TRACI v 2.1 impact assessment method in Simapro 9.3.0.3 software and followed ISO 14040 and 14044 standards. The databases were USLCI and US-EI 2.2. The system boundary of cradle-to-gate LCA was from stump to mill gate and the functional unit was 1 tonne of green round wood (Figure 1). The results showed that the WT method (11.57 kg CO₂ eq) had the highest average carbon footprint followed by Hyb CTL (11.09 kg CO₂ eq) and CTL (9.91 kg CO₂ eq) methods. The trucking (8.51 kg CO₂ eq) to the processing facility was the major contributor among the processes. These results can be used as the upstream processes for the future LCAs for the various wood products manufactured in the region. We have submitted the abstract for the IUFRO World Congress 2024. The manuscript preparation is progressing, and we are planning to submit it to The International Journal of Life Cycle Assessment.



Forest Carbon and Timber Potential for Northern Maine's Working Forests

Principle researcher: Adam Daigneault, University of Maine

We wrapped up modeling, analysis and write up of a report to understand the role of forest management in increasing carbon storage in New England's working forests as part of the Forest Carbon for Commercial Landowners (FCCL) Initiative, a broad coalition of large forest landowners, conservationists, nonprofit organizations, scientists, and economists. The FCCL initiative came together to determine whether northern

Maine's commercial forestlands could sequester more carbon through improved forest management, and, if so, how much it might cost to incentivize landowners to implement. This effort was partially funded by our CFRU project, Forest Carbon and Timber Potential for Northern Maine's Working Forests.

In June, UMaine researchers expanded upon this work to draft and submit a manuscript to Forest Policy and Economics that evaluated whether carbon, timber, and biodiversity outcomes be simultaneously optimized across extensive, complex, managed forests of Northern Maine. We used a landscape optimization model measure management impacts on forest ecosystem services, and found clear tradeoffs between forest carbon and timber, with mixed impacts on biodiversity. We also estimated that the optimum management mix was achieved on the landscape with an approach that primarily used set asides and intensive clearcut and planting. We also found that shifting away from partial harvest to broader management mix increases both carbon and timber relative to the status quo.

Our next steps in this project are to evaluate the potential impacts under a wider set of carbon and wildlife habitat indicators. We will also explore the relative effects of climate change on different indicators and how management can be used to adapt to these effects.

Soil Carbon Sequestration Dynamics Post-harvesting: Effect of Stand Characteristics and Site Factors

Principle researcher: Libin Louis, University of Maine

The project took a meta-analysis approach to address the research questions in the project. The primary goal of the project was to conduct a detailed data collection from previously published articles on the variation of forest soil carbon after harvesting and test to see if there is any correlation to the stand and site level factors. In this study the pre- and post-harvest conditions of the stand were recorded from the publications. The data collection began during the Spring of 2023 and several keywords, and cross reference searches were used to select articles. Previous meta-analyses were also used for data collection. Currently, there are 44 articles data collected with about 1000 data points. Even though there are a few meta-analyses published previously, none of the articles have answered this question. However, the data collected is highly diverse in terms of the geographic location, stand, and site characters. The current searches and review of articles showed that there are a significantly small number of articles that have reported the pre- and post-harvest stand and site conditions which resulted in the tremendous reduction in the number of articles and data points collected so far. That is more than 5 times the articles selected has undergone detailed review.

Presently, articles are being added to the data using keywords search and cross references in various databases accessible to the University of Maine. The data search results will be screened multiple times before being added to the selected articles. The data collection will continue for the rest of the summer and is expected to reach saturation by the end of August. About 150 articles are expected to be added to the final analysis. The methodology for data analysis will be finalized and completed.

By the end of the year 2023, the manuscript will be ready to be submitted to peer reviewed journal.



Stay in touch with the Center for Research on Sustainable Forests

In June, the Center for Advanced Forestry (CAFS) met in Louisville, Kentucky for their annual meeting and field tour, which focused on white oak research initiatives. CRSF is a leader in CAFS and helps facilitate the connections between forestry research programs and industry members to solve complex, industry-wide problems through CAFS. [Click here to view CRSF's summer newsletter and to learn more about CAFS.](#)

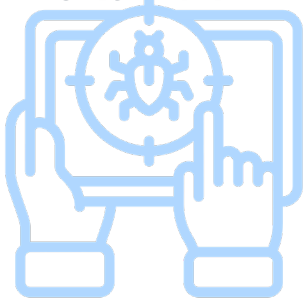


Refining the Acadian Model

Principle researcher: Ben Rice, Midgard

Good progress has been made in refining the Acadian model. An updated mortality approach has been fully integrated and tested. A new stand basal area increment equation, designed to complement the individual tree diameter increment model, has also been implemented. Additional FVS functions have been developed, allowing the FVS Acadian variant (FVS-ACD) to utilize Acadian equations to fill in missing crown ratio and height values and creating a new pathway to allow users to pass diameter increment, height increment and mortality calibration factors from the FVS environment. Many of the updates are expected to be available in the July 2023 FVS release.

Validation of growth and mortality functions is currently underway. A subset of FIA data from across northern New England was projected using several versions of FVS-ACD and the FVS Northeast variant (FVS-NE). We also plan to include the OSM growth model in the comparisons. Preliminary stand level and tree level comparisons of the model projections are being conducted this month. The CFRU spring webinar included a demonstration of FVS-ACD and a question and answer session. Missed the webinar? [You can watch the recording here.](#)

FOREST HEALTH

[Subscribe to receive insect & disease condition reports from the Maine Forest Service](#)

This seasonal newsletter provides timely information about insects and diseases affecting Maine's forest and shade trees. Several issues are produced each growing season with the first issue usually appearing in mid- to late-April and the last in late- summer.



Venturia blight, photo
Maine Forest Service

"Venturia blight of poplars was documented in a handful of spots in Kennebec County this June and July; however, occurrence of the disease is likely more widespread in Maine, with dispersal and infection enhanced by the wet spring/early summer weather. Venturia blight is characterized by dark blotches on leaves and wilting and blackening of new growth tips resulting in a shepherd's crook with a scorched appearance. The blight has not been documented causing significant damage in Maine, although serious impacts have been reported in Canada." - Maine Forest Service Conditions report, July '23

Establishment of Effective Workflows for Pest-induced Damage Detection and Forest Health Monitoring in Maine by Integrating Remote Sensing Technology and Field Data

Principle researcher: Parinaz Rahimzadeh, co-researcher Rajeev Bhattarai, University of Maine

Plans and progress from July to December 2023:

The PI held three meetings with the co-PI Bhattarai in July 2023 for planning following activities for the next 6 months:

- 1) Working on improving the spruce budworm host species composition map developed by Bhattarai et al., (2022) by incorporating NAIP canopy height data and some updated site variables:
 - Some preliminary results demonstrate that the incorporation of NAIP canopy height data improves the host composition model initially suggested by Bhattarai et al. (2022).
- 2) We reached out to one of our collaborators to provide some ground truth data for better validation of the new product.
 - Developing a general forest change detection map using Sentinel-2 data at 20 m spatial resolution:
 - PI Rahimzadeh and co-PI Bhattarai are working on the model development.
 - We also will contact co-PI Mech and some of our project collaborators in the next 1-2 months to set up a field visit and acquire field data to train our models.

Developing Strategies to Reduce Damage Caused by the White Pine Weevil

Principle researcher: Bill Livingston, University of Maine

Maeve Noon-Price has agreed to serve as the Graduate Research Assistant for the project. Maeve earned a BS in Natural Resource Conservation from the University of Massachusetts at Amherst in May 2023. The FIA database for Maine has been processed and identified 151 plots with > 60 tpa of eastern white pine on which incidence of weevil damage has been measured. The data is ready for be analyzed geospatially with site variables that Mike Premer has prepared for the state. The analysis later this fall will screen if any site variable has a significant statistical relationship to explain the variation in white pine weevil damage. Bill Livingston, Josh Sherill, and Justin Whitehill (NC State) have begun discussions on assessing the current knowledge on white pine weevil resistance in white pine and spruce

High Resolution Land Cover and Forest Type Data for the State of Maine

Principle researcher: Kasey Legaard, University of Maine

Our goal for this summer is to produce forest type data over 80-90% of the state, integrating multiple improvements to satellite image processing we developed and tested over the winter and spring. During the month of June, we completed the integration of these improvements and reprocessed satellite imagery across approximately 10

million acres of northern Maine. Our plan is to complete species and forest type mapping across northern Maine during the month of July, while simultaneously preparing imagery acquired over southern Maine. By the end of August, we plan to have constructed forest type data across most of the state, with some remaining areas in western and Downeast Maine requiring the preparation of additional imagery in the early fall. Throughout the summer we will also prepare statewide forest change maps spanning the period 2016-2021, to be integrated with forest type predictions this fall. Lastly, we are awaiting delivery of new land cover data from the NOAA Coastal Change Analysis Program (C-CAP), and we will integrate that data with our forest type mapping workflows as soon as possible. This data integration step may slow our forest mapping progress should we obtain C-CAP data this summer. Regardless, we plan to complete statewide forest mapping this fall.



Lobaria pulmonaria is a large epiphytic lichen that most often occurs in shady environments and is an indicator for rich, healthy ecosystems such as old growth forests. This photo was taken during a visit in Big Reed with John Hagan's research team.

Cooperative Forestry Research Unit

A Core Program of the Center for Research on Sustainable Forests



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