



Center for Research on Sustainable Forests

Center Review, 2018-2022

Dr. Aaron Weiskittel, Director

February 18, 2022

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Center for Research on Sustainable Forests

Director: Dr. Aaron Weiskittel

Director's Note

The Center for Research on Sustainable Forests (CRSF) was founded in 2006 to build on a rich history of leading forest research and to enhance our understanding of Maine's forest resources in an increasingly complex world. Forest research and its application are rapidly evolving due to unprecedented availability of data provided by emerging technologies such as high-resolution digital imagery, cloud computing, and artificial intelligence. As CRSF looks to the future, we hope to lead the development, integration, and application of these emerging technologies to address current and future issues in natural resources.

Under my leadership since the retirement of former Director Robert Wagner in 2016, CRSF has grown significantly in its capacity and overall impact as outlined in this summary document. I believe this has been accomplished on multiple fronts, including research, outreach, and education, all of which have been funded primarily through external sources. This growth has been achieved by the strategic reimagining and reinvigoration of several regional and even nationally critical programs that had shown signs of faltering given transitions in leadership and funding. The revitalized programs, which include the Cooperative Forestry Research Unit (CFRU; <https://umaine.edu/cfru/>), the Northeastern States Research Cooperative (NSRC; <https://nsrcforest.org/>), and the NSF's Center for Advanced Forestry Systems (CAFS; <https://crsf.umaine.edu/forest-research/cafs/>), represent unique partnerships between key stakeholders, other universities, and Federal agencies and provide crucial workforce development opportunities for graduate/undergraduate students and early-career faculty.

For the CFRU, I led the organization through a period of significant transition by serving as the Interim Program Leader from December 2019 to October 2021, which included the successful negotiation of a MOU between the University of Maine and the CFRU members that outlined roles and responsibilities of both entities for the first time in the organization's nearly 50-year history. I also successfully recruited and created a joint appointment for the new CFRU Program Leader, Dr. Neil Thompson of the University of Maine of Fort Kent. I have been the Co-Director of the NSRC since 2016 and helped to regain Federal funding and successfully launch version 2.0 of this organization, which has included a new charter across the four states, an external advisory

board, and three recent multi-million dollar requests for proposals, including a new annual program to support Native American researchers. For CAFS, I took over as the Director and Lead Site in 2018 at the end of Phase 2, and successfully led six other universities to Phase 3 proposals that generated over \$3.5M in new funding and has resulted in a variety of new collaborative proposals. CAFS engages with over 75 unique organizations spanning the entire US and representing various sectors of the forest industry.

In addition to reinvigorating these organizations, I have successfully rebranded and reinvented CRSF's primary role and responsibility. This strategy includes developing novel programs and tools aimed at gaining understanding of and providing potential solutions for current issues facing forested ecosystems. Over the past several years our Forest Climate Change Initiative (<https://crsf.umaine.edu/forest-climate-change-initiative/>) has conducted rather well-attended online seminar and field tour events and successfully completed the State of Maine's Carbon Budget report in 2020, which has been widely used in policy discussions and led the state to formalize their carbon accounting procedures. In addition, CRSF was the primary lead in the launch of the university-wide, multi-disciplinary UMaine FOREst Economy, Sustainability and Technology (FOREST; <https://umaine.edu/forest/>) initiative, which brings together university, industry, government, and community collaborators for the advancement of forest-based economy in Maine and beyond. Within FOREST, CRSF is spearheading ongoing efforts like UMaine's FOREst Carbon Economy (FORCE; <https://umaine.edu/force/>) to help guide forest carbon policy at both the state and national levels. These related efforts have brought much greater interest and attention to the importance of research centers like CRSF.

As a research center, a primary function is to significantly build the capacity for and promote effective collaboration on large-scale research efforts. To this end, I serve as Co-PI on the University of Maine's first NSF National Research Traineeship (NRT), led by CRSF-affiliated faculty Dr. Sandra De Urioste-Stone, and several recent NASA grants led by Dr. Daniel Hayes. I am the PI of the University of Maine's first lead NSF EPSCoR Track 2 grant, a joint effort between UMaine, University of New Hampshire, and University of Vermont now in its third year. In the past year, we have received two NSF supplemental grants that present highly unique opportunities for CRSF. The first is to enhance collaboration with a Minority Supporting Institution and supports our partnership with Alabama A&M University, the only professionally accredited forestry program at an historically Black university in the US. The other is a NSF START, which provides funding to build research collaboration and capacity with a two-year technical program like University of Maine Fort Kent's forestry program. Through these numerous grants, CRSF has become one of the largest units on campus and has produced a remarkably high ROI as detailed in this report. Furthermore, I am currently collaborating on a number of large research proposals including a \$10M USDA SAS with University of Georgia and Purdue University, working with Dr. Ali Abedi on a \$20M NSF AI research institute with various partners, and leading a concept paper for the state's next Track 1 EPSCoR proposal. Each of these efforts is a significant undertaking yet complementary to the ongoing initiatives within CRSF.

Although I am truly delighted by the recent growth and success of CRSF, I believe it is important to also note that I have continued to fulfill my primary faculty duties within the School of Forest Resources (SFR). This includes teaching an upper-level undergraduate course with 40-60 students every spring semester and a graduate course of 8-10 students every other year, while also regularly advising senior undergraduate capstone students. In addition, I serve on the SFR Administrative Peer Committee (including serving as Committee Chair during the 2020-21 Academic Year) and am faculty mentor to several early-career faculty. I believe these additional faculty responsibilities are quite unique among research center directors at the University of Maine, and I would hope this evaluation process is a good opportunity to reassess both CRSF and my role within it.

Sincerely,



VISION

Provide the tools,
technology, and
science for
tomorrow's forest..

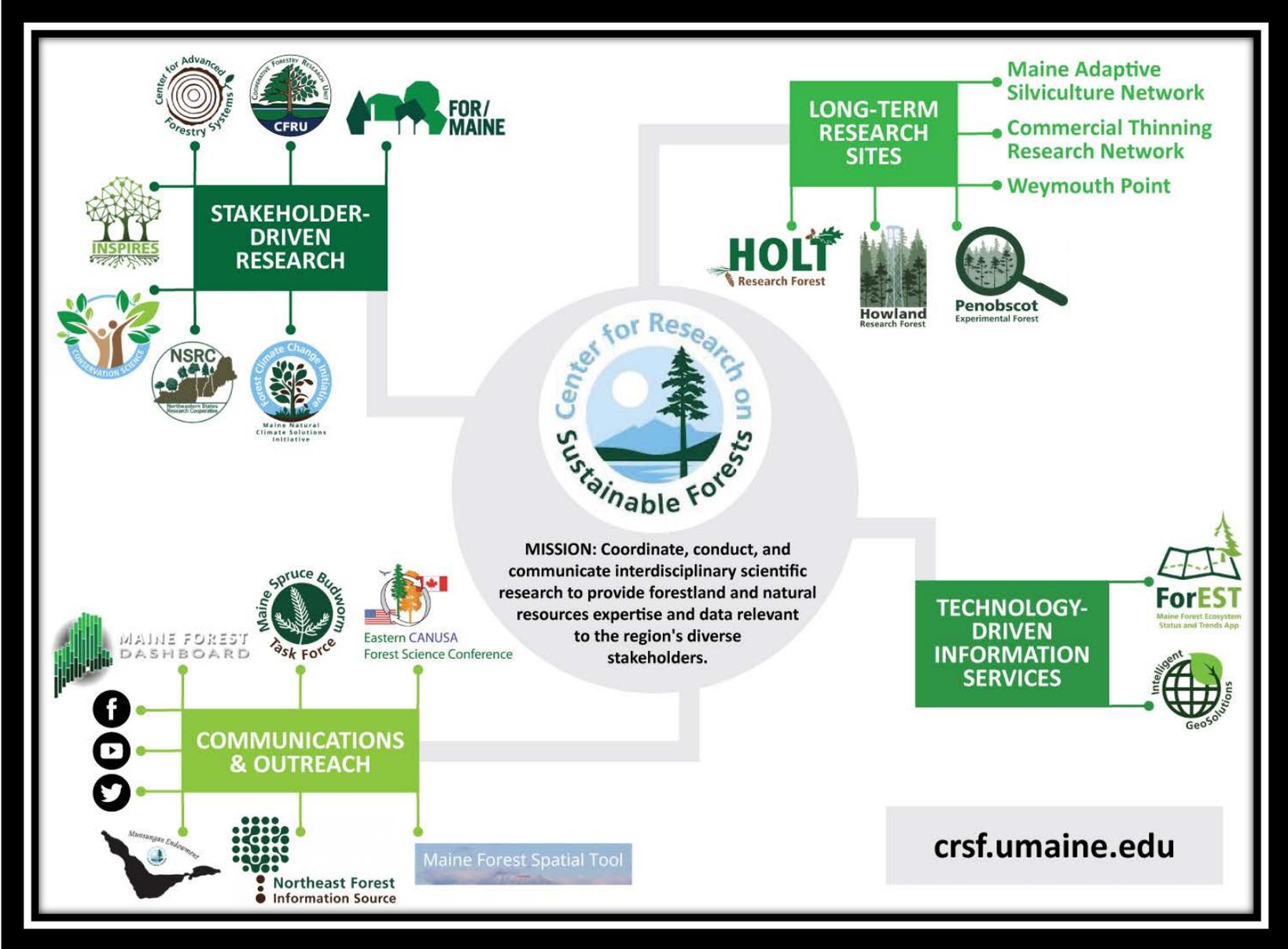
MISSION

To coordinate, conduct, and
communicate
interdisciplinary scientific
research to provide
forestland and natural
resources expertise and data
relevant to the region's
diverse stakeholders.

Envisioning the Future

Coordinate, communicate, and collaborate across the University of Maine System with external partners to develop and deliver integrated research, education and outreach solutions that enhance the economic and ecological sustainability of forest-based communities.





Strategic Goals

Short-term

- ⇒ Continue to support and grow ongoing strategic initiatives
- ⇒ Increase CRSF brand and outreach efforts
- ⇒ Successfully complete and document outcomes from the NSF EPSCoR Track 2 grant
- ⇒ Successfully graduate NSF's Center for Advanced Forestry Systems (CAFS) from Phase 3
- ⇒ Via CAFS, obtain NSF supplemental funding for INTERN, REU, and REM
- ⇒ Maintain strong working relationships with key external stakeholders and Federal partners
- ⇒ Present CRSF Strategic Plan to Forest Resources Advisory Committee
- ⇒ Continue to grow CRSF website and social media traffic
- ⇒ Continue to add content to CRSF's YouTube Channel
- ⇒ Continue to lead large, multi-institutional Federal proposals
- ⇒ Continue to support the Maine Climate Council
- ⇒ Continue to grow the Northeastern States Research Cooperative and provide an annual request for proposals
- ⇒ Maintain Cooperative Forestry Research Unit membership and long-term research program
- ⇒ Continue to support statewide collaborative efforts like the Maine Spruce Budworm Task Force
- ⇒ Maintain support and provide professional developmental opportunities for CRSF staff
- ⇒ Increase student and faculty involvement in CRSF
- ⇒ Maintain at least \$2 million per year in external funding
- ⇒ Secure a large integrated Federal grant of at least \$20M
- ⇒ Recruit and secure an Associate Director

Long-term

- ⇒ Establish working relationships with private foundations
- ⇒ Increase CRSF annual gift contributions
- ⇒ Increase annual external funding to \$5 million per year
- ⇒ Become a national and internationally recognized research center
- ⇒ Create and lead a national network of research centers focused on digital forestry
- ⇒ Formalize and grow international collaborations
- ⇒ Help support and guide national policy efforts focused on forest management
- ⇒ Increase faculty with formal joint appointments in CRSF
- ⇒ Grow full-time staff to 12
- ⇒ Generate steady annual program income through a fee for services model

CRSF Staff and Affiliated Faculty/Researchers

Despite expanding initiatives and funded grants, the CRSF staff (Table 1) consisted of just 3 full-time employees until 2021 who served in a variety of roles: CRSF Director (CFRU Program Leader, CAFS Director, NSRC Co-Director), Communications & Outreach Specialist (for CRSF, CFRU, FCCI, SBW; responsible for five annual reports, video and digital production, and maintaining websites/related webpages and social media output), and an Administrative Specialist (managing more than \$6M across 30 CFRU projects, external grants, and MEIF accounts). Following the new MOU between CFRU cooperators and UMaine in FY21, CRSF hired a new full-time Research & Outreach Coordinator and a part-time, cost-shared faculty Program Leader. With growing project reporting requirements and expanding CRSF initiatives, the Center has recently added (primarily external soft-money supported) an IT specialist for IGS and web/tool management (0.5 FTE), a collaborative project coordinator (1.0 FTE; grant writing & reporting), and part-time (0.25 FTE) administrative support for the INSPIRES project. CRSF also supports numerous research scientists as well as student field crews and researcher assistants.

Continued efforts to increase faculty affiliations, particularly external to SFR and the University of Maine, have been a primary focus for CRSF Director Weiskittel over the past 4 years. Currently, CRSF is home to more than 40 Cooperative Forestry Research Unit (CFRU) and externally-funded projects, as well as research programs that include the multi-institution (UM, UVM, UNH) NSF Track 2 INSPIRES project, the regional Northern States Research Cooperative (NSRC), lead site for the Center for Advanced Forestry Systems (CAFS), as well as our Forest Climate Change (FCCI) and Intelligent GeoSolutions (IGS) Initiatives. As a result, we partner with nearly 50 faculty and researchers across UMaine (Table 2) and an additional 28 faculty/scientists/researchers from more than a dozen institutions external to UMaine (Table 3).

Table 1. CRSF Personnel

Position	Person	Start	Status/Funding	Responsibility
Director (Acting Director 2016-18)	Aaron Weiskittel	2018	Full-time Hard money	Oversees program and program initiatives, supervises staff, NSRC and CAFS Director, EPSCoR T2 Co-PI
Communications & Outreach Specialist	Meg Fergusson	2018	Full-time Soft money	Communications (webinars, fact sheets, program news, social media), annual reporting, off-site meeting & conference coordinator, NSRC manager, websites content manager, outreach materials
Administrative Specialist	Leslee Canty- Noyes	2017	Full-time (2019) Soft money Part-time (2017- 18)	Oversees financials for all CRSF and CFRU accounts, CFRU meeting & admin support, office manager, purchasing and requisitions, CFRU fleet oversight
Research Scientist	Jack Witham	2018	Part-time Soft money; Emeritus (2022)	Lead the science, outreach, and education activities at Holt Research Forest

Position	Person	Start	Status/Funding	Responsibility
Research Faculty	Kasey Legaard	2019	Full-time (2019) Soft money	Leads the Intelligent GeoSolutions (IGS) Initiative and provides support for CRSF's ForEST web-based application
Scientific & Technical Computer Prog.	Leo Edmiston-Cyr	2020	Part-time (.5) Soft money	Technical support, oversight, maintenance, and creation of scientifically-based computer code
Collaborative Project Coordinator	Emily Uhrig	2021	Full-time (1.0) Soft money	Develop proposals and project strategic materials
EPSCoR Admin Support	Stefania Marthakis	2021	Part-time (.25) Soft money	Maintain NSF-required Data Entry Portal, team profile development
CFRU Program Leader	Neil Thompson	2021	Part-time (.5) Soft money	Oversee CFRU finances, primary liaison with CFRU cooperators and researchers, supervise CFRU employees, develop & implement research projects, maintain research data
CFRU Research, Communications Coordinator	Regina Smith	2021	Full-time Soft money	Research development and dissemination, field crew recruiting & supervisor, manage long-term research sites, safety coordinator, cooperator outreach

Table 2. UMaine Affiliated Faculty and Researchers, 2018-2022

Name	University of Maine		
	Dept./Center	Formal Appointment	Program/Project/Initiatives
Aaron Weiskittel	CRSF/SFR	Director, 2018-	
Adam Daigneault	SFR		FCCI, Natural Climate Solutions
Alessio Mortelliti	WFCB		CFRU, FCCI
Ali Abedi	Engineering/CS		INSPIRES
Amanda Klemmer	Biology		CFRU
Amber Roth	SFR/WFCB		CFRU
Anil Raj Kizha	SFR		CFRU
Anthony Guay	Wheatland Lab		CFRU
Bruce Segee	Elec & Comp Eng		INSPIRES
Caroline Noblet	Economics		Tourism
Cen Chen	CRSF		CFRU, CAFS
Cheryl Spencer	SFR		NSRC
Dan Harrison	WFCB		CFRU
Daniel Hayes	SFR		FCCI, GEDI, INSPIRES, CFRU
Darren Ranco	Anthropology		INSPIRES
Erik Blomberg	WFCB		CFRU
Erin Simons-Legaard	SFR		IGS, FCCI, INSPIRES, CFRU
Franziska Peterson	RiSE Center		INSPIRES
Hamish Grieg	Biology		CFRU
Ivan Fernandez	SFR, CCI		FCCI
Jack Witham	CRSF		Holt Research Scientist
Jane Haskell	Cooperative Extension		Tourism
Jay Wason	SFR		FCCI
Jereme Frank	SFR		CFRU, CAFS
Josh Puhlick	SFR		CFRU, CAFS, soil carbon projects

University of Maine			
Name	Dept./Center	Formal Appointment	Program/Project/Initiatives
Kasey Legaard	CRSF/SFR	Joint Appointment, 2019 -	IGS, INSPIRES, CFRU, CAFS
Kate Beard-Tisdale	Comp & Inf Sci		INSPIRES
Keith Kanoti	SFR		FCCI
Laura Millay	RiSE Center		INSPIRES
Marina Van der Eb	RiSE Center		INSPIRES
Mindy Crandall	SFR		CFRU
Neil Thompson	UMFK	Program Leader, 2021-	CFRU
Nicole Rogers	SFR		CFRU
Parinaz Rahimzadeh	SFR		CFRU, NSRC
Peter Nelson	UMFK		INSPIRES
Sam Roy	Mitchell Ctr		INSPIRES
Sandra De Urioste-Stone	SFR	Program Leader, 2014-	Nature-based tourism, FCCI
Sara Lindsay	Marine Sciences		INSPIRES
Sarah Nelson	SFR		FCCI
Shawn Fraver	SFR		Howland Research Forest (PI); FCCI
Silvia Nittel	Comp & Inf Sci		INSPIRES
Sonia Naderi	Elec&Comp Eng		INSPIRES
Susan McKay	RiSE Center		INSPIRES
Thomas Buchholz	Spatial Informatics		NSRC
Torsten Hahmann	Comp & Inf Sci		INSPIRES

Table 3. Affiliated Faculty and Researchers External to UMaine

Person	Institution	Program/Project/Initiative
Adrienne Leppold	Maine Dept. of IF & W	CFRU
Aimee Classen	UVM Rub Sch of E & NR	INSPIRES
Alix Contosta	UNH Earth Systems Research Ctr	INSPIRES
Andrew Ouimette	UNH Earth Systems Research Ctr	INSPIRES
Anthony D'Amato	UVM Rub Sch of E & NR	INSPIRES
Apryl Perry	UNH, Research Scientist	INSPIRES
Brian Sturtevant	USFS-NRS	NSRC
C. T. Smith	University of Toronto	CFRU
Carol Adair	UVM Rub Sch of E & NR	INSPIRES
Chris Hennigar	University of New Brunswick	CFRU
Chris Woodall	USFS-NRS	NSRC, PEF, INSPIRES, CFRU
Clarke Cooper	Scientific Researcher/data manager	Holt
Dan Walters	US Geological Survey	CFRU
Daniel Kneeshaw	University of Quebec at Montreal	CFRU
Dave Lutz	Dartmouth, Env. Studies	INSPIRES
David Hollinger	USDA Forest Service	Howland
David MacLean	University of New Brunswick	CFRU
Dawn Lemke	AAMU, Bio & Env. Sci	INSPIRES
Dedrick Davis	AAMU, Bio & Env. Sci	INSPIRES

Person	Institution	Program/Project/Initiative
Donna Rizzo	UVM Rub Sch of E & NR	INSPIRES
Elizabeth Burakowski	UNH Inst for Study of EO&S	INSPIRES
Eric J. Gustafson	US Forest Service	NSRC
Gaetan Pelletier	Northern Hardwoods Research Institute	CFRU, NSRC
Heather McInnis	TIG, NSF Evaluator	INSPIRES
Helen Czech	AAMU, Research Scientist	INSPIRES
Inge Stupak	University of Copenhagen	CFRU
Jane Foster	UVM Rub Sch of E & NR	INSPIRES
John Campbell	US Forest Service Center	CFRU
John Gunn	University of New Hampshire and Spatial Informatics Group	NSRC, INSPIRES
Joseph Young	Maine Office of GIS	CFRU
Karin Rand	UVM Rub Sch of E & NR	INSPIRES
Laura Kenefic	USFS-NRS	NSRC, CFRU
Luben Dimov	UVM Rub Sch of E & NR	INSPIRES
Maria Kimpe	AAMU, Research Scientist	INSPIRES
Marie-Cecile Gruselle	Friedrich-Schiller University	NSRC
Mark Ducey	Univ. of New Hampshire	NSRC, INSPIRES
Mary Martin	UNH Earth Systems Research Ctr	INSPIRES
Michelle Gregoire	UNH EPSCoR	INSPIRES
Patience Knight	AAMU, Research Scientist	INSPIRES
Patrick Hiesl	Clemson University	CFRU
Regina Toolin	UVM College of Educ & Soc Serv	INSPIRES
Robert Wagner	Purdue University	CAFS
Scott Ollinger	UNH Earth Systems Research Ctr	INSPIRES
Shaik Hossain	AAMU, For, Ecol & Wildlife	INSPIRES
Zaixing Zhou	UNH Earth Systems Research Ctr	INSPIRES

Financial Summary

CRSF faculty have brought in nearly \$2M annually in funding over the past four years. These funds are used to support research projects and field work, students, CRSF staff, outreach, and general operating expenses (Table 4). As identified in the 2017 CRSF Self-Study, Director Weiskittel has been working successfully to find new sources of long-term funding for CRSF: a \$6M EPSCoR Track 2 grant was awarded in FY18, a new 5-year Phase 3 NSF award for the Center for Advanced Forestry Systems (CAFS), renewed funding of the Northern States Research Cooperative (NSRC) due to efforts by Director Weiskittel and the regional executive team, and NASA awards to PI Dan Hayes to map carbon in forests (\$0.5M) and nearly \$1M to integrate remotely-sensed data into a forest landscape model framework. In the first half of FY22, CRSF-affiliated faculty have already secured 10 grants worth over \$1.28M (only 3 other research centers have been awarded more in FY22), and CFRU researchers have already leveraged an additional \$936K in support of their work.

The Maine Economic Improvement Fund (MEIF) provides a small portion of financial support for CRSF. A majority of Director Weiskittel’s salary and fringe (FY18-21: \$621,673) is also budgeted through MEIF. **Over the past four years (FY18-FY21), the \$168,012 investment from MEIF funds, which help cover the center’s personnel, stipends, and operating costs, helped to leverage over \$9M from extramural and CRSF sources—a \$55 return on investment for every dollar of MEIF funding (Table 5).**

Table 4. Income and allocation of CRSF funds. Center sources include MEIF, CRSF gift funds, and CFRU contributions; external sources reflect grants awarded by outside institutions. Admin costs cover salaries for CRSF director & support staff, CFRU program leader & support staff, field crews, student employees & support, office supplies, web support, meetings & conferences. FY22 numbers are for July-Dec 2021. Detailed budget reporting in appendix.

	Income				Allocation of Funds			
	Center Sources	Extramural Sources	Leveraged	TOTAL	Admin	Research Projects	Student Support	Outreach
FY18	\$700,609	\$1,094,728	-	\$1,795,337	\$286,453	\$1,339,789	\$139,518	\$29,577
					15.96%	74.63%	7.77%	1.65%
FY19	\$718,393	\$517,743	\$191,060	\$1,427,196	\$432,606	\$931,795	\$21,154	\$41,642
					30.31%	65.29%	1.48%	2.92%
FY20	\$749,002	\$4,303,096	\$594,367	\$5,646,465	\$302,391	\$5,234,883	\$67,254	\$41,937
					5.36%	92.71%	1.19%	0.74%
FY21	\$646,641	\$1,269,472	\$936,073	\$2,852,186	\$210,000	\$2,456,764	\$159,722	\$25,700
					7.36%	86.14%	5.60%	0.90%
FY22*	\$715,344	\$1,281,763	\$737,304	\$1,997,107				
TOTALS	\$2,814,645	\$7,185,039	\$1,721,500	\$11,721,184	\$1,231,450	\$9,963,231	\$387,648	\$138,856
FY18-21	24.01%	61.29%	14.70%	-	10.53%	85.20%	3.31%	1.19%

Table 5. MEIF ROI

	MEIF Operating Support	Income from All Other Sources	ROI
FY18	\$36,410	\$1,617,999	\$44
FY19	\$45,576	\$1,008,494	\$22
FY20	\$43,470	\$4,850,040	\$109
FY21	\$41,338	\$1,708,707	\$41
FY18-FY21	\$194,029	\$9,185,240	\$55

Scholarly Products

From FY18 through FY21, a total of 130 scholarly products (journal articles, book chapters, research reports, theses, conference papers) were produced by CRSF-affiliated researchers. In addition, our team members made multiple presentations (118) and participated in workshops (15), webinars (26), videos (22), and media articles (21) despite significant covid limitations of the past three years. As evidence by Figure 1, output has been especially strong over the past three years and is expected to continue to grow given current efforts. Complete details of all products are available in the CRSF annual reports.

In 2020, the IGS team launched the web-based, interactive decision-support tool, Maine Forest Ecosystem Status and Trends (ForEST; <https://forestapp.acg.maine.edu/>) App, designed to provide decision support to private and public forest managers, natural resource agencies, conservation organizations, and other stakeholders. In its first year of release, Google analytics showed 1,869 site visits, which has grown in FY21 to 17,253 visits (and 10,905 in the first half of FY22).

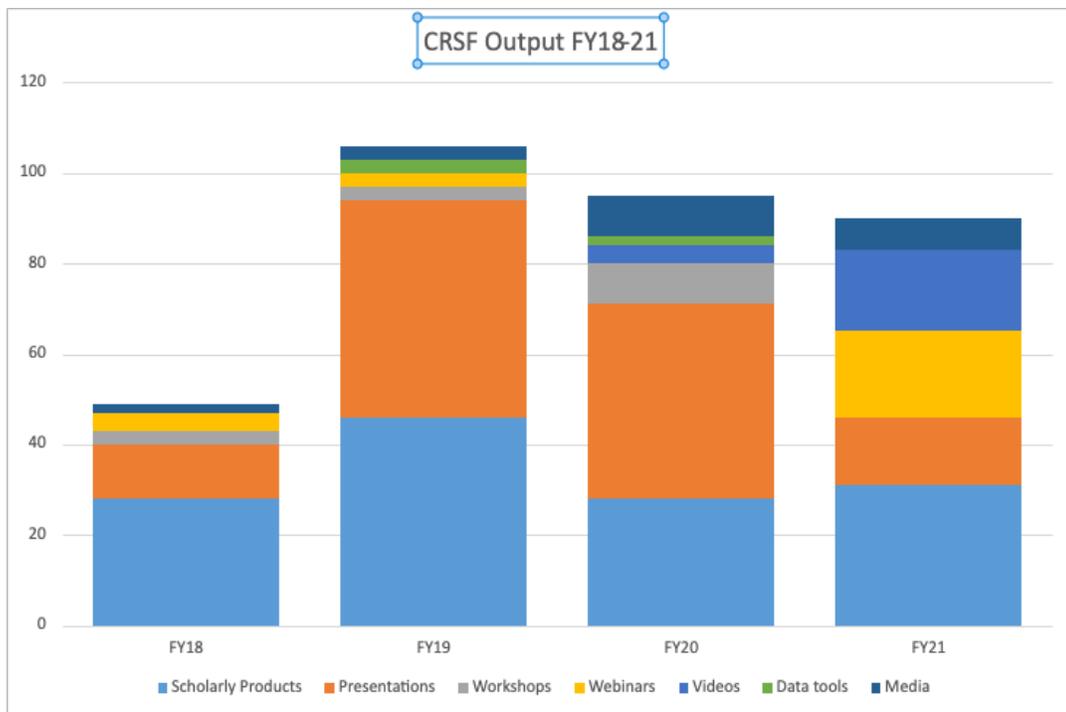


Figure 1. Output by CRSF-Affiliated Researchers

Outreach and Communications

A key aspect of the CRSF is its staff’s ability to engage and share our research with diverse audiences; not just stakeholders, but those who have an interest in our programs and use them to inform their land management decisions, which includes scientists, researchers, collaborators, community members, donors, organizational and government leaders, evaluators, partner organizations, policy makers, and the general public. Since 2018, we have greatly expanded our reach (see

[Websites](#) Data in Appendix) via our websites, webinars, annual reports (CRSF, CFRU, CAFS, NSRC, INSPIRES), fact and information sheets, research reports, social media outlets, and virtual and in-person field tours. We now have 46 videos available on our popular YouTube channel ([Center for Research on Sustainable Forests, UMaine](#)), which has generated 2,772 views and a watch time of nearly 350 hours.

Of particular note is our recent [FCCI webinar series, Science & Practice: Addressing Forest Climate Change in Maine](#). The series evolved from an in-person forum held on campus in February 2020, weeks before the pandemic outbreak. Co-hosted by the Forest Stewards Guild, and funded by the Munsungan Gift Fund (created to support outreach and education projects that educate the public about forest resources in Maine), the webinar series was launched in October 2020 to catalyze scientist-manager discussions about current research and stakeholder needs, grow Maine’s forest climate adaptation community of practice, and provide useful information for the work of the Maine Climate Council. Topics cover forest ecology, operations, and socioeconomics as well as communicating with landowners and the public about climate change. For year 2 of the series (2021-22), we have expanded the program to include a field tour portion to complement each webinar. Webinar attendance for both years has averaged above around 60 attendees, and all field tours held to date have reached capacity. The success of this series is evidenced by the 446 (to date) webinar attendees comprising researchers, scientists, policymakers, foresters, natural resource professionals, conservationists, and the general public (as of June 2021, 275 had attended 2-4 sessions, and more than 75 had attended five or more). Since 2018, CRSF websites have had 24,567 users and 81,444 page views with an average session length of 3 minutes and 25 seconds (Figure 2). Twitter impressions have grown from 8.2 to 11.2 from 2020 to 2021.

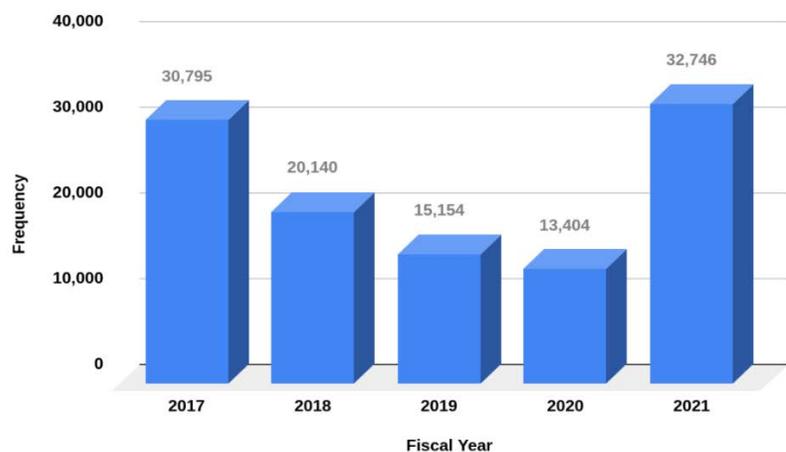


Figure 2. Growth of CRSF Website Views by FY.

Student Involvement



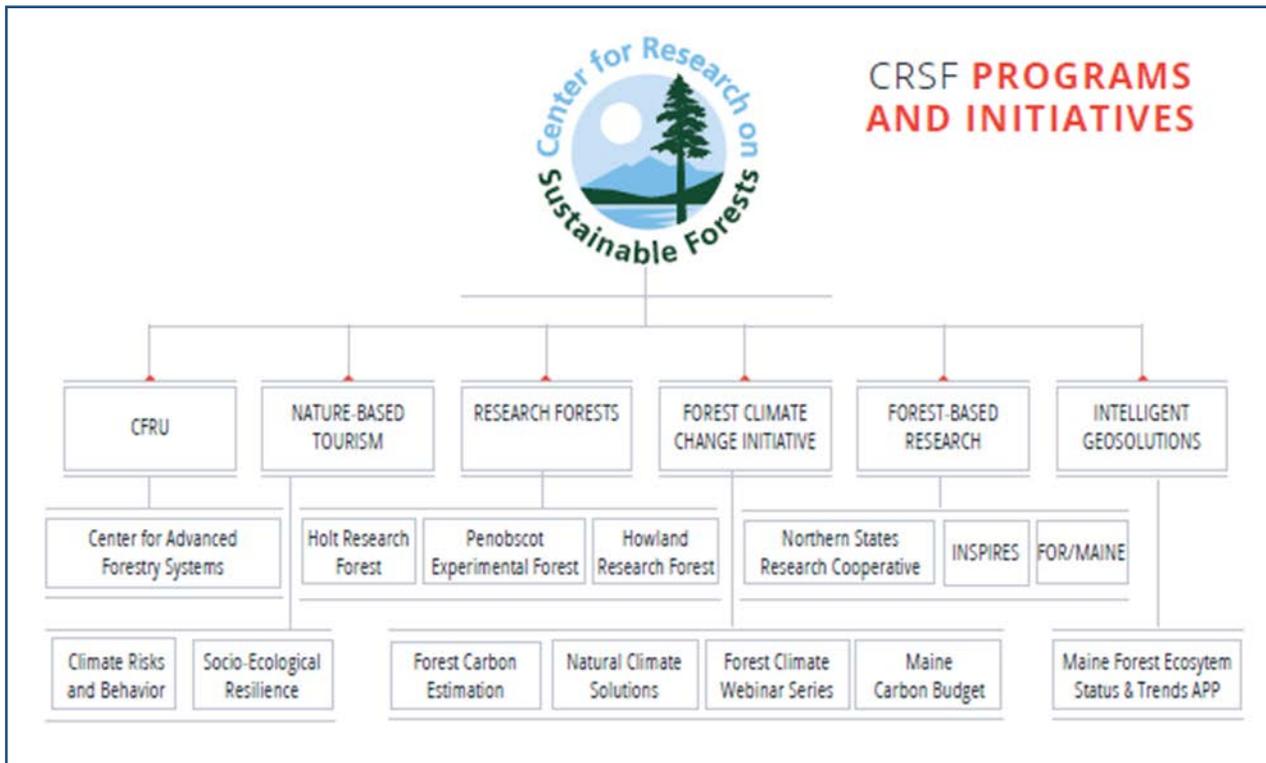
CRSF engages graduate and undergraduate students in a variety of scenarios: research assistants, field crews, workforce development, office support, data analysis, computer coding, website support, and so forth (Table 6). The pandemic has been especially difficult for graduate students due to the challenges of adjusting to new environments with limited support and high isolation. Although the majority of the undergraduates affiliated with CRSF are studying in the School of Forest Resources,

we also have student involvement from several departments across campus: EES, PRT, WLB, Zoology, Engineering, and Computer Sciences. In many cases, particularly CFRU experiences with cooperators, research and work experience in the CRSF has led to employment in the forest industry and academia (e.g., Seven Islands, Huber Resources, US Forest Service, University of Maine Fort Kent). Since 2020, the EPSCoR Track 2 INSPIRES project greatly expanded cross-institutional and interdisciplinary research opportunities for PhD and MS students from SFR, Spatial Information Science & Engineering, Computer Science, and the RiSE Center including several underrepresented minorities. Several undergraduate students supported by INSPIRES during years 1 and 2 of the project were accepted into forest science graduate programs for fall 2021, with one representing an inter-jurisdictional collaboration between UVM and UMaine.

Table 6. Distribution of CRSF Students Gaining Work and Research Experience FY18-22.

	FY18	FY19	FY20	FY21	FY22
Undergraduate	-	37	27	15	29
Undergraduate (UM)	-	27	25	13	27
Undergraduate (Other Institutions)	-	10	2	2	2
Graduate	17	28	18	16	17
MS	15	20	6	9	10
MF	-	4	3	2	1
PhD	2	2	9	5	6

CRSF Highlights



FY2022 (July-Dec)

- FCCI Natural Carbon Solutions team released its final report Forestry and Ag GHG Mitigation (crsf.umaine.edu/forest-climate-change-initiative/ncs/).
- In July, leaders from the RiSE Center who are part of our EPSCoR Track 2 INSPIRES project Theme 4 (Quantitative Reasoning in Context) hosted a 4-day workshop/teacher's tour at the Schoodic Peninsula to develop lessons for the classroom focused on forestry.
- CRSF staff initiated a series of interviews/profiles of INSPIRES graduate students on the project (<https://www.newenglandsustainabilityconsortium.org/inspires-team-profiles/>). Profiles will be expanded over next year to include faculty.
- FCCI Natural Climate Solutions faculty (UMaine Drs. Adam Daigneault, Aaron Weiskittel, Ivan Fernandez) released and widely distributed fact sheets culled from the NCS final report on Maine Forestry and Agriculture Natural Climate Solutions Mitigation Potential. The fact sheets focus on NCS for forestry and agriculture--can be accessed on our FCCI website: crsf.umaine.edu/forest-climate-change-initiative/ncs/
- NSF awarded PI Weiskittel \$599,999 in supplemental funds to the INSPIRES T2 EPSCoR project. The INSPIRES team will use the funding to build a strategic partnership with the Alabama Agricultural & Mechanical (AAMU) University, an Historically Black College and University (HBCU), to gain understanding of the transitional forest response to unique

stressors when species are primarily at the southern extent of their biological ranges, rather than at their northern extent (an integral part of the original INSPIRES northern forest research).

- CRSF's Forest Climate Change Initiative is again teaming with the Forest Stewards Guild to launch year 2 of their series: Addressing Forest Climate Change in Maine. This year will combine 1-hour webinars with in-person field tours around the state to examine climate impacts and management on different forest types found in Maine.
- CRSF Director Weiskittel and co-author Chris Woodall of the US Forest Services published research in Nature's Scientific Reports that indicates US forests, particularly those in Maine and the rest of New England, are becoming increasingly crowded and at risk of becoming less resilient to future disturbances.
- CRSF Director Weiskittel helped to successfully launch UMaine FOREst Economy, Sustainability and Technology (FOREST) initiative in October, which is working to bring together university, industry, government, and community collaborators for the advancement of forest-based economy in Maine.
- In October, CRSF hosted the first webinar and field tour focused on the Penobscot Experimental Forest, the webinar was attended by over 90 participants region-wide and field tour was sold out.
- CRSF welcomed new staff: CFRU program leader Dr. Neil Thompson and CRSF Collaborative Project Coordinator Dr. Emily Uhrig.
- CRSF's Dr. Aaron Weiskittel and Dr. Shawn Fraver, along with FOREST-affiliated researchers Dr. Mehdi Tajvidi and Dr. Douglas Gardner (all faculty in UMaine's School of Forest Resources) have been ranked in the top 2% of scientists worldwide for their scholarship impact by a metric from Elsevier BV.
- CRSF's Cooperative Forestry Research Unit (CFRU) held its fall advisory meeting and annual field tour last week under the new Program Leader, Dr. Neil Thompson of the University of Maine Fort Kent, with strong attendance from across forest industry.
- In November, CRSF's CFRU Program Leader (Neil Thompson) and Research & Outreach Coordinator (Regina Smith) organized and launched a reboot of the Maine Spruce Budworm Task Force, which is a coalition between University of Maine, Maine Forest Service, and Maine Forest Products Council to prepare for the next spruce budworm outbreak in Maine.
- CRSF Director Weiskittel led NSF's Center for Advanced Forestry Systems (CAFS) fall Industry Advisory Board (IAB), which involved over 60 participants from across multiple university and forest industry companies from across the US. NSF Program Leader Dr. Prakash Balan joined the meeting and provided a short update.
- Dr. Weiskittel continues leading the ESPCOR INSPIRES project quarterly all-team meetings, focused on team building, graduate student participation, and project updates.
- NSRC regional executive and management teams reviewed 51 preproposals submitted for approximately \$1.8 million in funding to support forest research projects starting in 2022.
- CRSF Director Weiskittel presented current activities for the Smart Forestry Task Team to the Embassy of Finland for the Maine-Michigan-Finland joint initiative.

- CRSF Director Weiskittel and Forest Climate Change Initiative faculty member Dr. Adam Daigneault presented their Natural Climate Solutions research to over 75 participants across the US for the 2021 SAPPI Sustainability Ambassador Assembly.
- CRSF staff published annual reports for NSRC, CRSF, CFRU, and CAFS.
- CRSF Director Weiskittel served as an invited panelist to the NSF Track 2 Project Kick-Off workshop to discuss his experience as a PI on INSPIRES.
- CRSF/FCCI hosted its second webinar/field tour to the Holt Research Forest, field tour again reached capacity and webinar had over 70 attendees.
- In Dec, CRSF/CFRU hosted a faculty and student meet and greet to discuss research funding opportunities through the CFRU, while undergraduates were able to learn about summer field research opportunities.

FY2021

- MEIF funds helped to leverage a total \$2.64M from extramural and CRSF sources.
- CRSF's 2 FTE administrative personnel supported 45 projects and oversaw more than \$2.5M in project budgets.
- A Vulnerability Assessment Model of climate change integrates biophysical and socio-economic data; the model was tested and validated for the State of Maine.
- FCCI co-hosted 10 webinars on forest climate change and adaptation in Maine, with more than 400 attendees. Supported by the Munsungan Gift Fund.
- CRSF greatly expanded its social media reach with new Instagram and Twitter accounts for the INSPIRES projects and added 25 videos to its YouTube channel.
- Maine Public aired "Holt Research Forest: Four Decades of Long-Term Ecosystem Research", and Maine public access channels across the state aired many of the FCCI webinar recordings.
- Output for CRSF researchers include 16 journal articles, 39 presentations/meetings, 8 research reports, 5 theses, 7 media-related publications, 45 videos.
- CRSF researchers were awarded \$2,205,545 to support their research, with an additional \$645,945 in funding provided by gifts and internal support.
- CRSF's tourism program continues to gather, analyze, and communicate information about the trends and factors that influence tourism development in Maine.
- CRSF welcomed new CFRU Science and Outreach Coordinator Regina Smith.
- CRSF Director Weiskittel with PI Daniel Hayes were selected for a \$900,000 NASA Carbon Monitoring Systems grant.
- CFRU members contributed \$427,952 to support research activities during FY20-21, as well as indirect contributions of \$247,541.
- PI Shawn Fraver continues to lead research on Howland Research Forest; Dr. Fraver has been awarded \$220,000 USFS in additional funding to support that work.

FY2020

- CRSF researchers brought in 13 awards worth \$4,303,096. This is an increase of nearly \$3.75M from FY19.
- The \$202,058 investment from MEIF leveraged \$546,944 from other CRSF sources and \$4,303,096 in extramural grants for a total leverage of \$4,850,040 of additional research funding.
- Director Weiskittel awarded \$500K from NSF for a 5-year Phase 3 of I/UCRC CAFS program.
- Director Weiskittel received the 2019 Maine Forest Products Council's Presidential Award.
- Director Weiskittel awarded \$6 million NSF EPSCoR Track 2 INSPIRES project.
- IGS released the web-based, interactive decision-support tool, Maine Forest Ecosystem Status and Trends (ForEST) App.
- CRSF helped relaunch the Northeastern States Research Cooperative with UVM, UNH & SUNY-ESF.
- FCCI co-hosted a Science & Practice forum for nearly 60 stakeholders from across Maine to catalyze scientist-manager discussions about current research and stakeholder needs.
- FCCI release version 1 of Maine's Carbon Budget fact sheet.
- CFRU engaged thirty-three members representing 8.15 million acres of Maine's forestland this year.
- CFRU members contributed \$541,465 to support research activities during Fiscal Year 2019-20.
- CRSF researchers produced 14 journal articles, 45+ presentations, 6 research reports, 14 media-related publications, 8 theses, and 2 data tools/publications.
- Output for CRSF researchers include 33 presentations/meetings, 5 research reports, 10 journal articles, 5 theses, and 7 media-related publications.
- 48 graduate and undergraduate student researchers worked on CRSF-affiliated projects.

FY2019

- During FY19 (July 1, 2018-June 30, 2019), CRSF researchers submitted proposals totaling \$7,719,941.
- 10 grants totaling \$482,318 were awarded.
- MEIF funds helped leverage \$526,176 from other CRSF sources and \$482,318 in extramural grants for a total leverage of \$1,008,494 of additional research funding.
- Forest Climate Change Initiative (FCCI) formed to better link cross-campus expertise on issues related to climate change in the Northern Forest region. Core leadership group includes 7 faculty & 2 conservation group leaders.
- Intelligent GeoSolutions (IGS) team formed to leverage artificial intelligence algorithms to produce large-scale geoproducts to support novel research & effective land management.
- A \$1M Phase II proposal for FOR/Maine was successfully submitted to the Economic Development Administration with CRSF Director Aaron Weiskittel as Co-PI.

- ➔ Cooperative Forestry Research Unit (CFRU) hosted webinars on spruce budworm, mixedwood productivity following biomass harvesting & prescribed burning, and the value of long-term forest research in Maine.
- ➔ Expanded efforts to communicate and brand the CRSF; established CRSF YouTube channel and Twitter accounts.
- ➔ Hosted regional Climate Change Meeting with Forest Stewards Guild, Spruce Budworm Communications Task Force meetings, CFRU quarterly cooperator meetings, CAFS industry advisory board meetings.

FY2018 (Jan-Jun)

- ➔ Dr. Aaron Weiskittel took over leadership of NSF's Center for Applied Forestry Systems (CAFS).
- ➔ As lead CAFS site, CRSF organized and hosted 30 academic and industry members of the Center for Applied Forestry Systems annual meeting and field tour in Burlington, VT.
- ➔ Initial meeting of cross-campus faculty to discuss a forest climate change initiative led by Drs. Aaron Weiskittel and Ivan Fernandez.
- ➔ CFRU cooperators donated nearly half a million dollars for ongoing and new applied and management-related research projects.
- ➔ In collaboration with the USDA Forest Service and the four state NSRC directors, published the NSRC Business Report, a comprehensive report on the program's contributions to research and applied knowledge about the Northern Forest over the past 16 years.
- ➔ CRSF began managing and coordinating the Climate and Forest Network, an outreach effort to improve networking and communications as well as collaborative research on climate change and challenges.
- ➔ The Nature-based Tourism Research Program led by Dr. Sandra De Urioste-Stone received a \$150K research grant from the USDA National Institute of Food and Agriculture to study how to foster forest resource resilience in the face of climate change.
- ➔ The Nature-based Tourism Research Program conducted an undergraduate and graduate student service-learning project to facilitate tourism destination planning in western Maine in collaboration with local stakeholders.
- ➔ A 3-decade assessment of climate-associated changes in forest composition study by CRSF-affiliated researchers Dr. Arun Bose, Dr. Aaron Weiskittel, and Dr. Robert Wagner, published in the Journal of Applied Ecology, gained national attention via the Washington Post, Newsweek, and NPR.
- ➔ Benchmarking Maine's Forest Product Sector and Assessing Future Markets for Rural Community Sustainability project completed in the fall of 2018.
- ➔ CFRU staff launched a new initiative to provide members with timely updates of research findings via webinars, workshops and monthly research notes.
- ➔ CFRU student field crews (undergraduate SFR and wildlife students) gained valuable experiences with field data collection, vegetation surveys, songbird surveys, and forest inventory methods.

Appendix

Budget Detail

Center Sources					
	Total	CFRU	MEIF	CRSF Gift Fund	Munsungan
FY18	\$701,250	\$493,694	\$177,979	\$26,421	\$3,156
FY19	\$691,775	\$463,714	\$201,024	\$22,567	\$4,470
FY20	\$750,220	\$541,465	\$203,276	\$901	\$4,578
FY21	\$646,641	\$427,952	\$207,406	\$6,687	\$4,596
FY22 (1sthalf)	\$715,344	\$496,852	\$209,688	\$6,503	\$2,301
External Sources					
	Grants Total	No. of Awards	Leveraged Funding		
FY18	\$1,094,728	15	FY18	Information not collected	
FY19	\$517,743	12	FY19	\$191,060	
FY20	\$4,303,096	13	FY20	\$594,367	
FY21	\$1,269,472	10	FY21	\$936,073	
FY22 (1sthalf)	\$1,281,763	10	FY22	Not yet available	

Websites Data

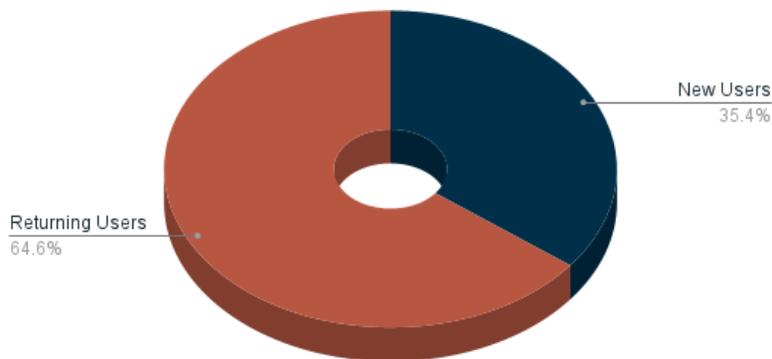
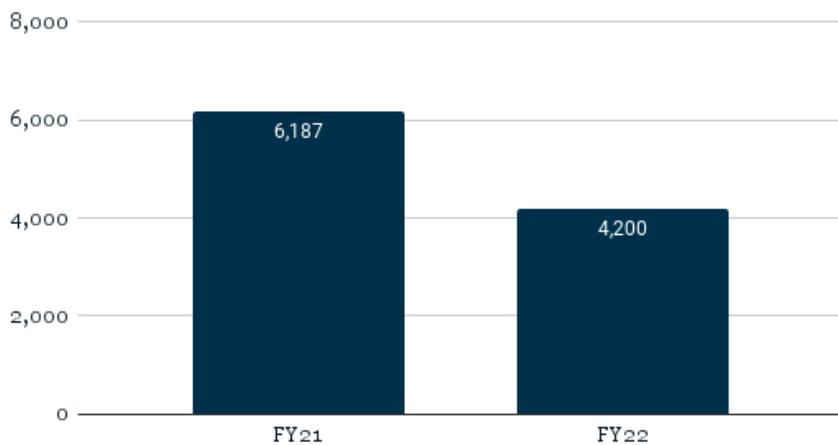
Table 7. CRSF UMaine Website Top 25 Page Visits (Note: Analytics collected since Sept 10, 2020)

Page Title	Page views
Home: Center for Research on Sustainable Forests at The University of Maine	2,897
Maine Forest Climate Change Webinar Series	2,720
Forest Climate Change Initiative	1,350
Maine Natural Climate Solutions Initiative	1,112
Center for Advanced Forestry Systems	1,030
Smart Data for Resilient Forests	919
Maine's Carbon Budget	918
Forest-Based Research	600
CAFS 2021 Semi-Annual IAB Meeting (June)	414
Our Team	399
Post Doc Opportunity: Forest Carbon Economics & Modeling (News)	320
Resources	303
Intelligent GeoSolutions	265
INSPIRES Faculty and Researchers	263
Nature-Based Tourism	253
Graduate Research Assistantships in Remote Sensing Forest Inventory and Carbon Monitoring (News)	243
FCCI Webinar #6: Forest Health and Pests	232
CAFS 2021 Semi-Annual IAB Meeting (Nov)	219

Page Title	Page views
FCCI Webinar #4: Forest Biodiversity & Species Shift	206
FCCI Webinar #1: Forest Operations in a Changing Climate	201
Spruce-Fir Climate Adaptation & Biodiversity (PEF) Webinar and Field Tour	193
Tools - Center for Research on Sustainable Forests	188
NASA Awards Funding for a Carbon Monitoring Framework in Forestry Decision-Making to UMaine (News)	186
FCCI Webinar #5: Forest Vulnerability Assessment	179
FCCI Webinar #3: Warming/Changing Winters	178
Total Page Views Since Sept 10, 2020	20,802

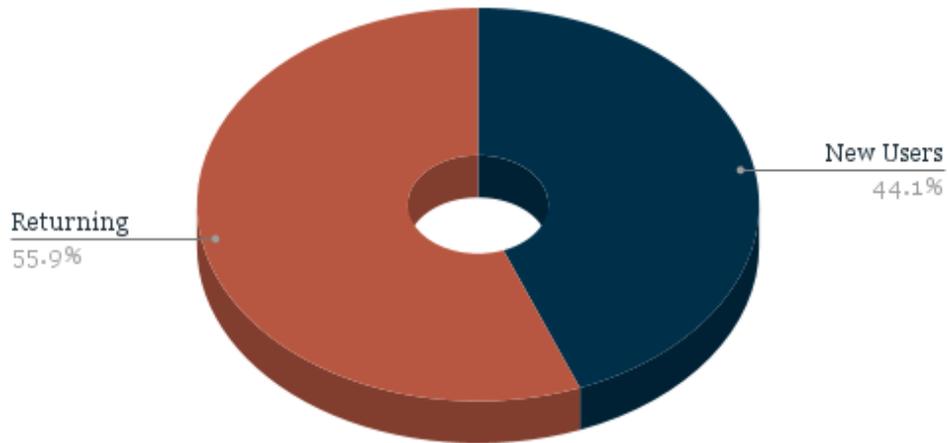
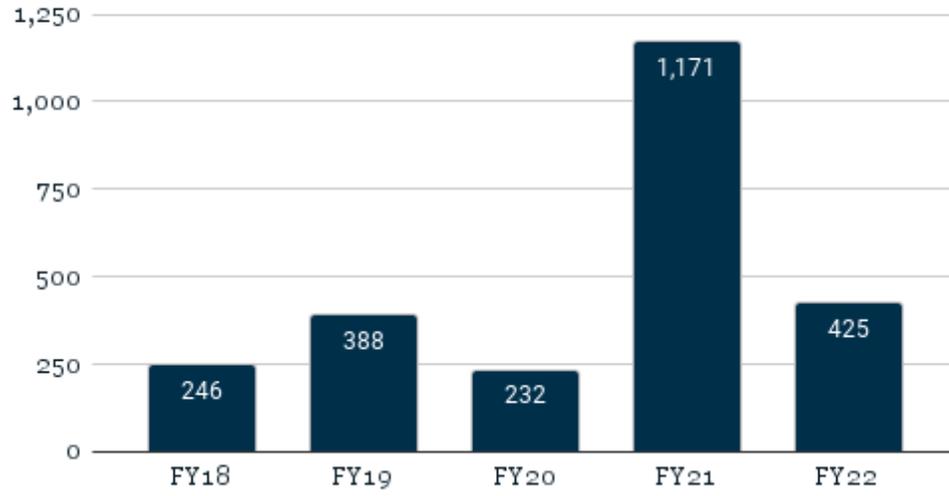
CRSF Website

CRSF Site Visits



Cooperative Forestry Research Unit

CFRU Member Site Visits

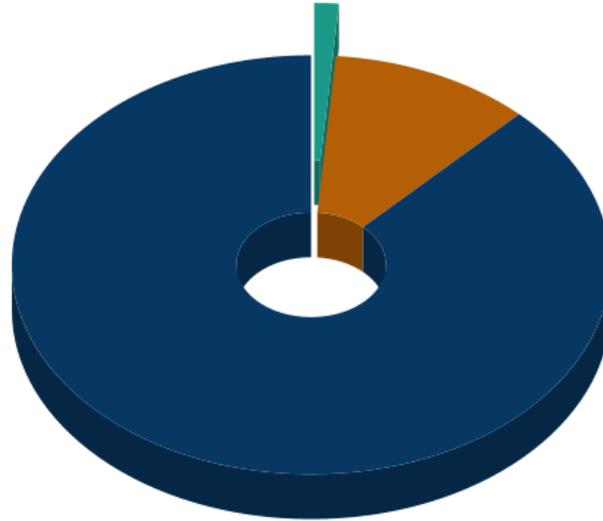


CRSF YouTube Channel

October 2018-January 2022

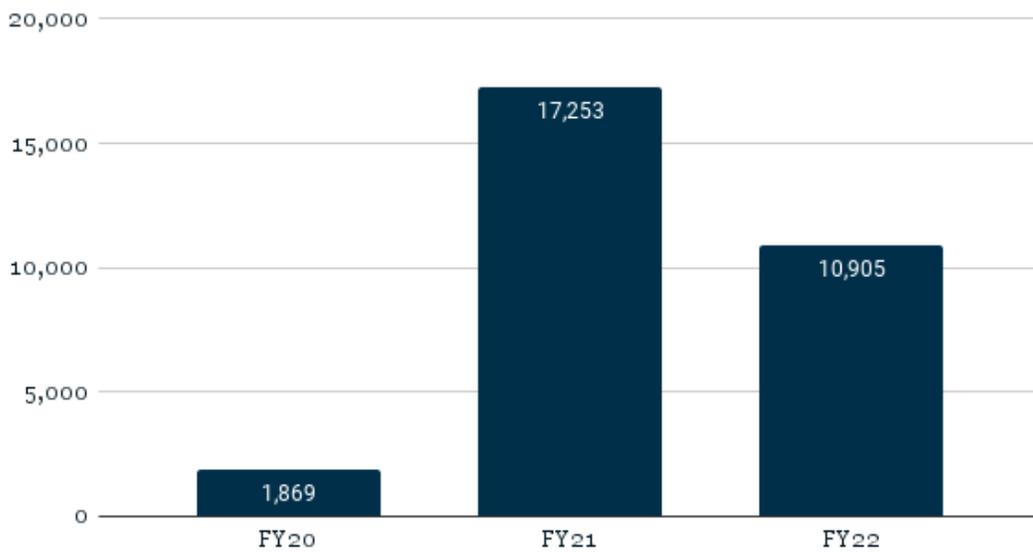
CRSF YouTube Channel

- Number of Videos: 41
- Total Viewing Hours: 340
- Total Views: 2,734



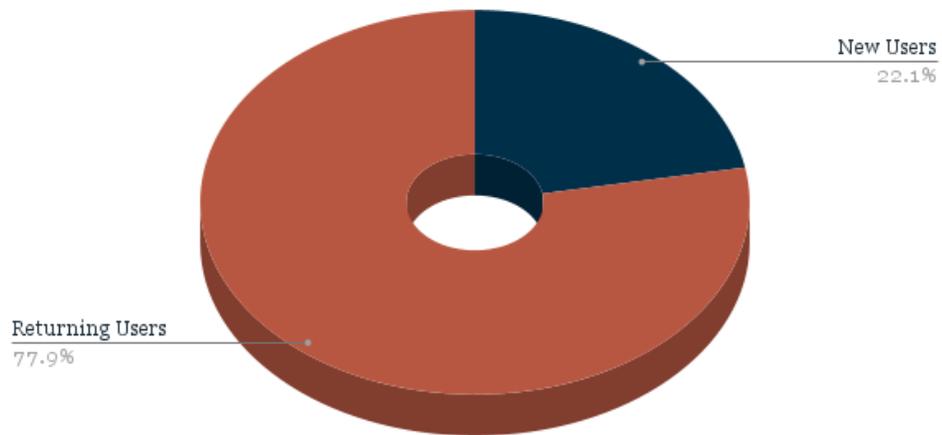
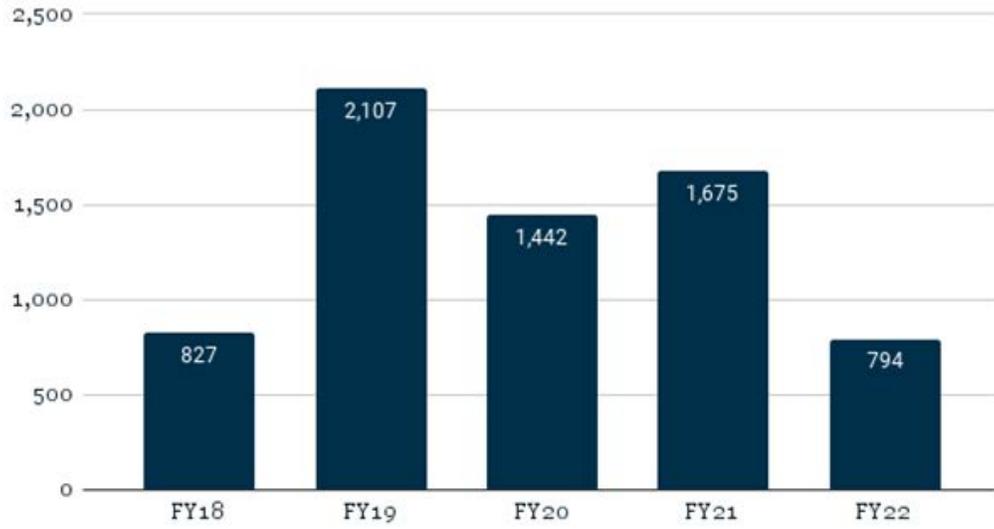
ForEST App

ForEST Site Visits



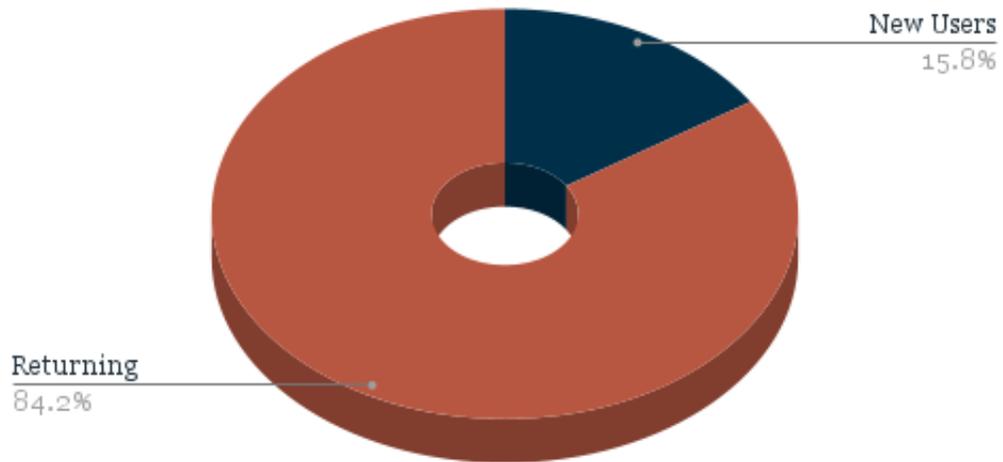
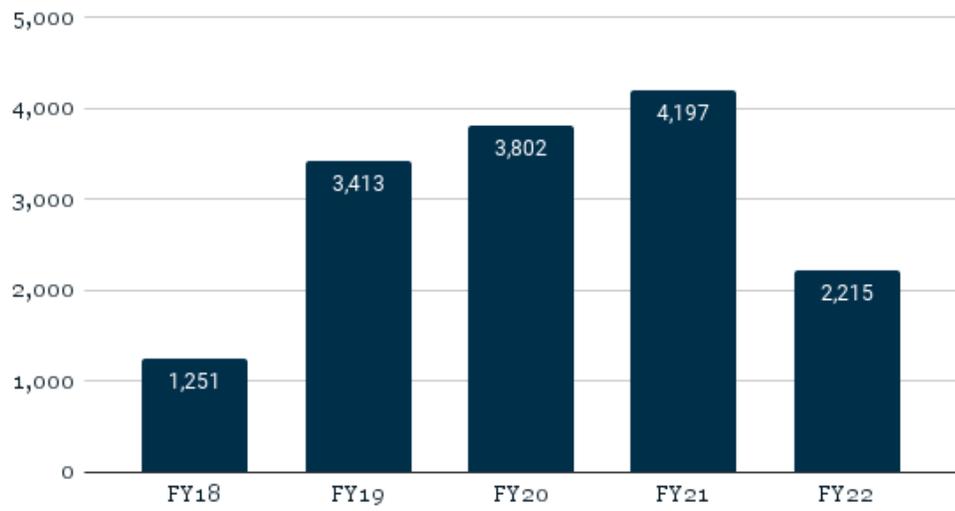
Northeast Forest Information Source

NEFIS Site Visits



Spruce Budworm Task Force Website

Spruce Budworm Site Visits



Annual Reports

CRSF

2018, <https://crsf.umaine.edu/publication/2018-annual-report/>

2019, <https://crsf.umaine.edu/resource/2019-annual-report/>

2020, <https://crsf.umaine.edu/resource/2020-annual-report/>

2021, <https://crsf.umaine.edu/resource/2020-annual-report/>

CFRU

2018, <https://umaine.edu/cfru/resource/annual-report-2018/>

2019, <https://umaine.edu/cfru/resource/annual-report-2019/>

2020, <https://umaine.edu/cfru/resource/annual-report-2020/>

2021, <https://umaine.edu/cfru/resource/2021-annual-report/>

CAFS

2020, <https://crsf.umaine.edu/resource/cafs-year-1-ph-3-progress-report/>

2021, <https://crsf.umaine.edu/resource/cafs-2021-annual-report/>

INSPIRES

2020, https://crsf.umaine.edu/wp-content/uploads/sites/214/2020/09/INSPIRES-Annual-Report_revisedFINAL.pdf

2021, https://www.newenglandsustainabilityconsortium.org/sites/newenglandsustainabilityconsortium.org/files/yr2_final_nsf.pdf

NSRC

2021, https://nsrcforest.org/sites/default/files/attachments/NSRC_Annual%20Report_2021.pdf