



COLORADO FOREST RESTORATION INSTITUTE 2022 ANNUAL REPORT



COLORADO FOREST
RESTORATION INSTITUTE
COLORADO STATE UNIVERSITY

The Colorado Forest Restoration Institute (CFRI) was established in 2005 as an application-oriented, science-based outreach and engagement organization hosted at Colorado State University. Along with centers at Northern Arizona University and New Mexico Highlands University, CFRI is one of three Institutes that make up the Southwest Ecological Restoration Institutes, which were authorized by Congress through the Southwest Forest Health and Wildfire Prevention Act of 2004. We develop, synthesize, and apply locally-relevant, actionable knowledge to inform forest management strategies and achieve wildfire hazard reduction goals in Colorado and the Interior West. We rigorously and objectively integrate the best-available scientific information into decision-making through collaborative partnerships involving researchers, land managers, policy makers, interested and affected stakeholders, and communities. CFRI holds itself to high standards of scientific accuracy and aims to promote transparency in the production and communication of science-based information. Always carefully evaluate sources for appropriateness and rigor before applying in your own work.

The Colorado Forest Restoration Institute at Colorado State University receives financial support under the Southwest Forest Health and Wildfire Prevention Act provided through the U.S. Forest Service, Department of Agriculture. In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. To file a complaint of discrimination, write: USDA, Director, Office of Civil Rights Room 326-A, Whitten Building 1400 Independence Avenue, SW Washington, DC, 20250-9410 or call (202) 720-5964 (voice & TDD).

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CSU Land Acknowledgment: Colorado State University acknowledges, with respect, that the land we are on today is the traditional and ancestral homelands of the Arapaho, Cheyenne, and Ute Nations and peoples. This was also a site of trade, gathering, and healing for numerous other Native tribes. We recognize the Indigenous peoples as original stewards of this land and all the relatives within it. As these words of acknowledgment are spoken and heard, the ties Nations have to their traditional homelands are renewed and reaffirmed. CSU is founded as a land-grant institution, and we accept that our mission must encompass access to education and inclusion. And, significantly, that our founding came at a dire cost to Native Nations and peoples whose land this University was built upon. This acknowledgment is the education and inclusion we must practice in recognizing our institutional history, responsibility, and commitment.

Document Development: The annual report is produced each year in accordance with the fifth (5) duty of the the 2004 Southwest Forest Health and Wildfire Prevention Act (Public Law 108-317). This annual report provides information about accomplishments of the Colorado Forest Restoration Institute at Colorado State University for calendar year 2022 for deliverables approved by the Southwest Ecological Restoration Institutes Executive Team and funded under the Act. Information in this report was compiled by Brett Wolk, Tony Cheng, Camille Stevens-Rumann, and Hannah Brown. Hannah Brown completed document layout and publishing.



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BACKGROUND

The Colorado Forest Restoration Institute (CFRI) at Colorado State University (CSU) supports the development, application, and monitoring of adaptive management processes to assist communities, managers, and policy makers to sort through the overwhelming amount of available scientific information and apply the most locally relevant information to enhance ecological resilience and wildfire risk reduction actions. Our aim is to support fires that can serve their role in renewing forests while mitigating social and economic losses and costs. Land and fire managers, policy makers, and other affected entities must be able to access and apply locally relevant, science-based knowledge to communicate and strategically identify where and what kinds of restoration and wildfire risk reduction actions can provide the most bang for the buck. Federal and university researchers produce scientific information about forest and fire ecology, but their mission is rarely to engage with managers and implementors to inform their research or support integration of these findings into local collaborative work. Conversely, managers and decision-makers rarely have sufficient time and expertise to access, interpret, and localize scientific findings to inform effective forest restoration. Cross-boundary affected entities face complex tradeoffs and management decisions as they work towards a future forest that will align with desired conditions and continue to provide ecosystem services. Entities like CFRI that are specifically directed to act as bridges and translators between research and management are crucial, as they can operationalize science to be useful in action.

To address the need for boundary-spanning organizations, the Southwest Forest Health and Wildfire Prevention Act was enacted by Congress in 2004 (Public Law 108-317). The act authorized the establishment and federal funding support for university-based institutes, which have been established in Arizona, Colorado, and New Mexico. As specified by the Act, the duties of each Institute are to:

- (1) Develop, conduct research on, transfer, promote, and monitor restoration-based hazardous fuel reduction treatments to reduce the risk of severe wildfires and improve the health of dry forest and woodland ecosystems in the interior West;
- (2) Synthesize and adapt scientific findings from conventional research to implement restoration-based hazardous fuel reduction treatments on a landscape scale using an adaptive ecosystem management framework;
- (3) Translate for and transfer to affected entities any scientific and interdisciplinary knowledge about restoration-based hazardous fuel reduction treatments;
- (4) Assist affected entities with the design of adaptive management approaches (including monitoring) for the implementation of restoration-based hazardous fuel reduction treatments; and
- (5) Provide peer-reviewed annual reports.

Per the fifth (5) duty of the act, this annual report provides information about accomplishments of the Colorado Forest Restoration Institute (CFRI) at Colorado State University for calendar year 2022 for deliverables approved in annual work plans funded under the Act.

ORGANIZATION

CFRI is hosted in the Department of Forest and Rangeland Stewardship, one of five academic departments in the Warner College of Natural Resources at Colorado State University. Tony Cheng is

Professor in the Forest and Rangeland Stewardship department and serves as the director of CFRI. Dr. Cheng has been director since April 2008. In calendar year 2022, CFRI had twenty-five full-time employees (including Dr. Cheng) and approximately twenty-one part-time or seasonal employees. Our staffing increased by 5 full-time employees over 2021. Our seasonal and part time employees included undergraduate students, graduate students, and non-student staff. All CFRI employees report to Dr. Cheng. In turn, Dr. Cheng reports to the head of the Forest and Rangeland Stewardship department. Heads of all departments in the Warner College report to the college’s Dean. In addition to staff who hold their primary appointment with CFRI, we leverage other CSU faculty, staff, and graduate students to add their specialized expertise for our projects on an as needed basis.

ACCOMPLISHMENTS

Funding

CFRI funding comes from allocated dollars through the Southwest Ecological Restoration Institutes (SWERI) approved annual work plan, agreements with federal and state government and nongovernmental sources, competitive research grants, and charitable gifts. SWERI workplan funding is appropriated from Congress to the SWERI’s, with the US Forest Service serving as the fiscal agent to oversee the grant. CFRI uses annual work plan funds from Congress to incubate and support innovative new ideas, augment existing CFRI agreements and projects where significant value can be added, and support knowledge transfer and application between projects and partners. Beginning in fiscal year 2021, increased SWERI federal appropriations allowed the three SWERI Institutes to achieve funding equity for the first time, empowered us to be responsive to an emerging wildfire crisis, and expanded our impact across the region. CFRI creates a bridge between research and management, multiplying the impact of applied research and leveraging deep engagement in place-based local monitoring and adaptive management processes to share cumulative broader impacts throughout the Interior West. Many of our agreements span multiple years. As a snapshot of our funding, the table below includes all funding sources and agreements signed during calendar year 2022 with CFRI staff as the Principle Investigator. CFRI staff leverage additional funding by participating as Co-Principle Investigators and collaborators in additional projects not listed here, which further expands our funding and impact.

Source	Project Title	Agreement Number	Amount
US Forest Service, Grand Mesa-Uncompahgre-Gunnison National Forests	Science-Based Support to Inform Collaborative Adaptive Management on the GMUG National Forests MOD 2	20-CS-11020400-035	\$30,000.00
US Forest Service, Grand Mesa-Uncompahgre-Gunnison NF	Uncompahgre Plateau Collaborative Forest Landscape Restoration Program Monitoring	20-CS-11020000-025	\$19,986.00
US Forest Service, Southwest Region	Colorado Forest Restoration Institute, FY22	22-DG-11030000-011	\$2,000,000.00
Colorado Department of Natural Resources	Colorado Strategic Wildfire Action Plan (COSWAP) Monitoring Concept		\$520,706.36

Source	Project Title	Agreement Number	Amount
US Forest Service, Washington Office Fire and Aviation Management	Potential Operational Delineations Development, Refinement, and Coordination	22-CA-11132543-056	\$300,000.00
US Forest Service, Rocky Mountain Research Station	NMFWRI Ecological Monitoring Support for Jemez Common Study	19-JV-11221633-210	\$7,068.00
US Forest Service (subaward with Northern Arizona University)	SWERI Bipartisan Infrastructure Law (BIL) Treatment and Wildfire data applications Subaward	22-DG-11132543-089	\$651,474.48
TOTAL			\$3,529,234.84

In the past five years, CFRI has been successful at leveraging SWERI annual work plan funding to procure additional funds for support of project development, planning, monitoring, and adaptive management on federal (primarily National Forest Systems lands) and non-federal lands. The table below shows these amounts as evidence of the value added by CFRI to the federal SWERI annual workplan funding:

Year	Work Plan Funding (\$thousands)	Additional funded projects (federal, state, non-gov't) (\$thousands)	State funding (\$thousands)
2018	450	698	512
2019	750	890	595
2020	1,100	1,036	604
2021	2,000	414	1,051
2022	2,000	1,207	1,498
TOTAL	4,450	4,245	4,260

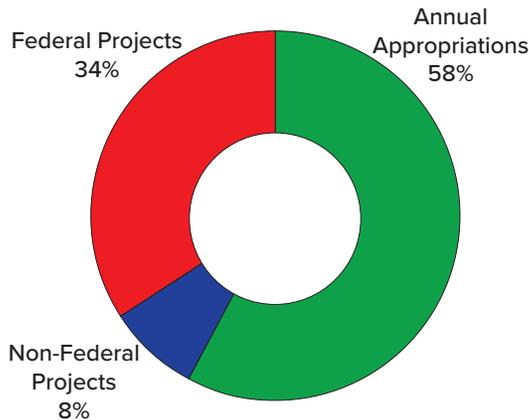
State Support

The State of Colorado, through its support to Colorado State University, provides financial support for CFRI facilities and administration in the form of reduced indirect cost recovery on CFRI federal awards, as well as 9 months of faculty salary to Tony Cheng to serve as Director of CFRI, and 2.75 months of faculty salary to Camille Stevens-Rumann to serve as Assistant Director of CFRI. In 2022, this support totaled approximately \$1,498,146.

Below is a brief highlight of our 2022 projects and accomplishments.

ANNUAL OPERATING BUDGET

Approximate Distribution of Annual Funding Source



\$ In 2022, CFRI's budget was approximately \$2.5-3 million, leveraging federal appropriations with federal subcontracts, competitive grants, and other resources.

\$ The State of Colorado, through CSU, provides in-kind support for CFRI facilities and administration equivalent to nearly \$1.5 million in 2022.

🏛️ CFRI is congressionally authorized (PL 108-317) to receive federal appropriations administered by the USDA Forest Service.

EMPLOYMENT



COLORADO
FOREST
RESTORATION
INSTITUTE
COLORADO STATE UNIVERSITY

Full-time staff: 25

Year-round students: 6-8

Seasonal field crew: 21



**134+ Student Jobs
Provided
(last 5 years)**

EXPERTISE AND IMPACTS - 2022

RISK ASSESSMENT AND SPATIAL DECISION SUPPORT

We apply [decision support tools](#) with collaborative groups to [integrate natural resource planning](#) with fire response, and share best practices for applying these tools on [wildfire incidents](#).



**273 Monitoring Plots
Visited in 2022**

POST-FIRE ADAPTATION STRATEGIES FOR RESILIENT FUTURE FORESTS

We are responding to manager needs by developing [science](#) and [communication tools](#), and convening peer learning opportunities to facilitate adaptation to [novel fire and climate interactions](#).



**Over 1 Million Acres
Informed by Monitoring**

TRANSLATE PRINCIPLES INTO PRACTICE

We support collaborative knowledge development by responding to arising communication needs, and working to make science and collaborative research insights [understandable](#), [accessible](#), and [actionable](#) for multiple audiences using a variety of media.



**Spatial Decision Support
Processes Supported
Across 8 New Landscapes**

COLLABORATIVE READINESS, GOVERNANCE, AND DECISION SUPPORT

We assess what makes collaboration successful in national programs like [Collaborative Forest Landscape Restoration \(CFLR\)](#) and [place-based groups](#) to help collaboratives prioritize restoration and fire mitigation work and get the best [bang for the buck](#).

ECOLOGICAL MONITORING AND RESEARCH

Our [ecological monitoring measures outcomes](#) of individual projects across federal, state, local, and private lands. CFRI [applied research](#) informs management adaptation within dynamic ecological systems.

CAPACITY TO FOSTER COMMUNITIES OF PRACTICE, OF INTERESTS, AND OF PLACE.

We [invest in CFRI staff](#) and partners to [improve working relationships](#), participate in [peer-to-peer learning events](#) and trainings, and ensure our organization efficiently follows through to deliver on partner needs.

PROJECT DELIVERABLES

Following is a report on deliverables under all agreements active during calendar year 2022 funded through Congressional appropriations authorized under the Southwest Forest Health and Wildfire Prevention Act and administered by the US Forest Service through the SWERI annual workplan process. This supports the Colorado Forest Restoration Institute to carry out the duties described in the Act. In 2022, CFRI had three active agreements under the Act. Deliverable accomplishments for each are included in this report:

- FY20 CFRI annual work plan, active 6/1/2020 through 9/30/2022
- FY21 CFRI annual work plan, active 7/1/2021 through 12/31/2023
- FY22 CFRI annual work plan, active 8/31/2022 through 9/30/2024

For FY20 agreement number 20-DG-11030000-008, CFRI reports the following cumulative accomplishments toward each project deliverables in the work plan for dates while the agreement was active, including June 1st, 2020 through September 30th, 2022:

Deliverable	Status of Deliverables
Project 1: Supporting strategic prioritization, monitoring, and adaptive management of cross boundary wildfire risk co-management strategies to operationalize the Shared Stewardship approach.	
<p>1.1 Continue to assist in the identification and facilitation of partnership engagement in a Colorado all-lands wildfire risk assessment process led by USFS Region 2. This includes working with targeted partners to identify the High Values, Resources, and Assets (HVRA’s) that will help frame the risk assessment outputs.</p>	<p>CFRI staff Mike Caggiano has led continued engagement with USFS Rocky Mountain Region fire planning staff (Contact: Brian Keating) to develop risk assessment processes and frameworks. The all lands Colorado wildfire risk assessment has been delayed due to contractor data processing timelines and focused efforts towards other existing risk assessment and prioritizations. With delays in the USFS R2 risk assessment, efforts have been re-directed to participating in a Colorado Shared Stewardship working group, advising on best practices to gather information about HVRA’s and priorities of forest and watershed collaborative groups around the state, and framing the assessment process for the group.</p> <p>CFRI staff participated in Colorado All-Lands Wildfire Hazard and Wildfire Risk Assessment - Response Functions/Relative Importance workshop meetings on July 13th and July 21st, 2021.</p> <p>CFRI Leadership Tony Cheng, Brett Wolk, and Camille Stevens-Rumann, and other staff as appropriate have coordinated and participated in monthly meetings with Rocky Mountain Region leadership to develop shared strategic directions, share lessons learned from monitoring outcomes, hear needs of regional office staff, and develop shared projects.</p>
<p>1.2 In coordination with the Colorado State Forest Service, support cross boundary application of the updated Statewide Forest Action Plan.</p>	<p>Following the November, 2020, 3 day Forest Action Plan introduction workshop for CSFS staff that was co-organized and co-lead by CFRI staff, CFRI created a regular working group with CSFS staff and CSU Forest and Rangeland Stewardship staff to continue assessing FAP implementation and future training needs to support Forest Action Plan implementation. The group has met quarterly in 2021 to facilitate information sharing and applications of FAP by CSFS staff and their partners. Future workshops and trainings are under development to highlight FAP applications that integrate climate change considerations into forest planning and implementation.</p>

<p>1.3 Participate in the Colorado Natural Resources Conservation Service Forest Advisory Committee to develop priorities and advise on strategic prioritization of NRCS forestry conservation practices across the state.</p>	<p>CFRI staff Brett Wolk participated in all NRCS Forest Advisory Committee meetings for 2021, including May 27th and September 15th, to support coordinating efforts and contribute expertise towards developing statewide priorities for NRCS forestry conservation programs.</p>
<p>1.4 Working with RMRS, continue to support development, implementation, and integration of cross boundary landscape planning and prioritization tools in 2-4 landscapes, with a focus on linking spatial fire planning (PODS) with prioritization of forest and fuels management objectives (e.g. RADS, etc.) across multiple scales of planning and implementation.</p>	<p>CFRI continued to support the development, implementation, and integration of spatial fire management strategies in close partnership with the RMRS Wildfire Risk Management Science Team, and coordinated with USFS Region II fire staff and the USFS Washington Office on strategies for POD workshop facilitation and implementation. Many of these efforts were co-developed and co-funded with RMRS partners. CFRI Staff facilitated the initiation and/or continued development and application of PODs across several landscapes:</p> <ul style="list-style-type: none"> - Carson and Santa Fe National Forests in New Mexico and adjacent non-USFS landscapes. - Medicine Bow-Routt National Forest in Colorado and Wyoming and adjacent non-USFS landscapes. - Rio Grande National Forest in Colorado and adjacent non-USFS landscapes. - San Juan National Forest in Colorado and adjacent non-USFS landscapes. - Ashley National Forest in Utah and adjacent non-USFS landscapes. <p>CFRI staff Ben Gannon engaged in a months long process with Envision Chaffee County Recreation and Balance committee to develop and implement Wildlife Decision Support Tools for Recreation. This involved a series of meetings and custom decision support modeling that integrates strategies to maximize recreation opportunities while minimizing impacts, enhance wildlife habitat characteristics, and integrate wildfire risk reduction planning in the upper Arkansas valley. Wildfire Decision Support Tools for Recreation, 2021. https://envisionchaffeecounty.org/wp-content/uploads/2021/04/ChaffeeRecPlanforWildlifeTools_2021F.pdf</p> <p>Results of the technical analysis are summarized in Chaffee County Outdoor Recreation Management Plan, adopted by Chaffee County, and are available on the Envision Chaffee County website Recreation Management section https://envisionchaffeecounty.org/our-tools/</p> <p>CFRI staff Brett Wolk and Stephanie Mueller continued engagement with Envision Chaffee County, including translating landscape analysis into local forestry prescriptions, mapping, and GIS data management to support implementation of their updated Community Wildfire Protection Plan and Outdoor Recreation Management Plan that are driven by CFRI Risk Assessment and Decision Support outcome based planning prioritization tools.</p> <p>Funded by a separate agreement from the Pike San Isabel National Forest, CFRI staff Brett Wolk and Allie Rhea facilitated strategic risk assessment and decision support for an update to the Lake County Community Wildfire Protection Plan. CFRI leveraged this annual workplan funding for several other CFRI staff to share lessons learned from engagement in other similar projects around the state, contribute fire behavior modeling, and facilitate small group discussions at several workshops with the Lake County Forest Health Council to develop shared goals, objectives, and outcome based priorities with the group.</p>

	<p>CFRI staff Brett Wolk and Stephanie Mueller worked with partners in southwest Colorado to build their capacity for implementing Risk Assessment and Decision Support tools on the San Juan National Forest to support the Southwest Environmental Impact Fund and Dolores Watershed and Resilient Forest Collaborative, in an effort to better link spatial fire planning with outcome based prioritization of forest and fuels management strategies. This included regular communication about best practices and sharing information about similar groups across Colorado including Chaffee and Lake County Community Wildfire Protection Plan updates, the Upper South Platte Partnership, and NoCo Fireshed Collaborative, among others.</p> <p>Published paper supporting the development of cross-boundary landscape planning tools: Caggiano, MD, Hawbaker, TJ, Gannon, BM, & Hoffman, CM (2020). Building Loss in WUI Disasters: Evaluating the Core Components of the Wildland–Urban Interface Definition. <i>Fire</i>, 3, 73. https://cfri.colostate.edu/wp-content/uploads/sites/22/2021/01/Caggiano-et-al-building-loss.pdf</p>
<p>1.5 Develop tools to streamline collaborative spatial fire planning analytical processes that facilitate updating and maintaining existing mapping and prioritization efforts. Implement data and analytical updates on 2-4 landscapes where PODs or other prioritization methods have already been developed and implemented.</p>	<p>CFRI staff Ben Gannon developed POD summary geodatabase and POD atlas products in collaboration with the RMRS Wildfire Risk Management Science Team. The POD Atlas was applied with the Carson National Forest and Santa Fe National Forest in their POD workshops to help consolidate information and update spatial fire planning strategies with the latest data.</p> <p>Published paper on PODs atlas methods: Thompson, MP, Gannon, BM, Caggiano, MD, O’Connor, CD, Brough, A, Gilbertson-Day, JW & Scott, JH (2020). Prototyping a Geospatial Atlas for Wildfire Planning and Management. <i>Forests</i> 11, 909. https://www.mdpi.com/1999-4907/11/9/909</p>
<p>1.6 Deliver 2-4 presentations, meetings, peer to peer learning events, etc. to report on the range of methodologies, approaches, and planning processes being used to enhance co-management of wildfire risk in the western US to USFS Forest, Regional, and Washington Office units, Colorado Department of Natural Resources, water providers, watershed coalitions, forest collaboratives, Congressional members and staffs, or other affected entities.</p>	<p>Along with colleagues from Bureau of Land Management and USFS national fire planner, CFRI staff Mike Caggiano and Ben Gannon organized and led a Cross Boundary Wildfire Planning workshop at the 2020 New Mexico Wildland Urban Fire Summit, October 2020.</p> <p>CFRI staff Mike Caggiano co-delivered a webinar presentation with RMRS colleague Kit O’Connor and Carson National Forest AFMO Jamie Long for Southwest Fire Science Consortium. The webinar was titled: Potential Operational Delineations: On the Ground Experiences and Future Directions. November 19, 2020. Video recording here: https://www.youtube.com/watch?v=aVpBq6wWC9g</p> <p>CFRI staff Tony Cheng and Brett Wolk served as panelists for the First Annual Wildfire Summit, organized by Rep. Joe Neguse, to bring together stakeholders from around the state to discuss problems associated with wildfire and seek collaborative solutions. Cheng and Wolk served on separate panels, provided examples of on the ground solutions, and discussed policy directions. Summit was held virtually February 18th, 2021, and included introduction by Rep. Neguse, Colorado Senators Bennett and Hickenlooper, and Colorado Governor Polis.</p> <p>Presented poster: Gannon, BM, Thompson, MP, Caggiano, MD, O’Connor, CD, Brough, A, Gilbertson-Day, JW, Scott, JH (2021). Geospatial analysis and mapping tools to operationalize spatial fire planning. 16th International Wildland Fire Safety Summit & 6th Human Dimensions of Wildland Fire Conference, May 2021, Virtual Conference. https://cfri.colostate.edu/wp-content/uploads/sites/22/2021/06/Gannon_POD_Tools_poster.pdf</p>

	<p>CFRI staff Brett Wolk delivered presentation and facilitated discussion on prioritization methods for a combined meeting of Dolores Watershed And Resilient Forest Collaborative and 4 Rivers Collaborative, titled “Risk Assessment and Decision Support (RADS) Framework and Modeling Process”. Virtual, 6-23-2021. https://cfri.box.com/s/kugp6co0vugy2vr5sjdhnege29ojzcpj</p>
<p>1.7 Produce 4-6 training resources (technical briefs, blog posts, webinars, etc.) to facilitate the broader understanding and application of analytical tools and collaborative planning processes that support strategic investments in cross boundary forest and fire management. Focus on documenting lessons learned that provide guidance for diverse stakeholders to assess what risk assessment and prioritization tools are appropriate for different planning and evaluation purposes.</p>	<p>As a member of the Rocky Mountain Research Station Wildfire Risk Management Science Team, CFRI staff co-developed workshop agenda and material, presented information, and CFRI staff facilitated breakout groups for an online workshop on Potential Operational Delineations titled: PODs: Collaborative Fire Planning Workshop, February 24-25, 2021. The workshop attracted around 500 participants from across the country to engage in discussion and training to better integrate principles of forest restoration and natural resource planning with fire management strategies. https://www.fs.usda.gov/rmrs/groups/wildfire-risk-management-science-team/potential-operational-delineations-pods#Workshop</p> <p>Videos of the February 2021 PODs workshop, including case study examples to demonstrate strategic cross-boundary forest and fire management and for use in training, are available on the workshop website and posted on Vimeo https://vimeo.com/showcase/8231822</p> <p>CFRI staff Tyler Beeton and Katarina Warnick wrote and published a blog post summarizing outcomes and applications from the 2021 Collaborative Fire Planning Workshop. Blog titled: Changing the Game: Using Potential Wildfire Operational Delineation (PODs) for a Better Future with Fire. April 29, 2021. https://fireadaptednetwork.org/changing-the-game-with-pods/</p> <p>As a member of the Rocky Mountain Research Station Wildfire Risk Management Science Team, CFRI staff contribute to development and planning, lead meetings, and engage in the PODs User Community. This is a training resource that provides a forum for fire managers to connect directly with each other and share lessons learned amongst peers. This included two web meetings in 2021, in April and November, that included multi-day workshops to provide training resources for fire professionals across the country and attended by several hundred individuals during each session. https://www.fs.usda.gov/rmrs/potential-operational-delineations-pods</p>
<p>Project 2: Supporting knowledge transfer of monitoring, adaptive management strategies, and outcomes for collaborative forest landscape restoration and resilience</p>	
<p>2.1 Produce and disseminate between 2-4 technical documents regarding multi-party monitoring strategies and results from collaborative forest landscape management projects.</p>	<p>Published two papers highlighting results from Colorado Front Range CFLRP projects:</p> <p>Barrett, KJ, Cannon, JB, Schuetter, AM, Cheng, AS (2021). Effects of collaborative monitoring and adaptive management on restoration outcomes in dry conifer forests. <i>Forest Ecology and Management</i> 488. https://doi.org/10.1016/j.foreco.2021.119018</p> <p>Cannon, J. B., Warnick, K. J., Elliott, S., and Briggs, J. S.. 2022. Low- and moderate-severity fire offers key insights for landscape restoration in ponderosa pine forests. <i>Ecological Applications</i> 32(2). https://doi.org/10.1002/eap.2490</p>

<p>2.2 Conduct and report on at least one field-based workshop per Colorado CFLR project to review and deliberate treatment effects and desired conditions.</p>	<p>CFRI staff helped plan and lead a field trip for the Front Range CFLR Landscape Restoration Team on August 11, 2021. Multiple CFRI staff participated to provide transportation, as well as contribute knowledge of local placed-based collaborative outcomes along the Front Range and beyond. CFRI staff Kevin Barrett produced analysis of pre- and post-treatment stand structure, composition, and changes in wildfire risk, and led discussions of adaptive management actions with the group based on the analysis and review of past treatments.</p> <p>CFRI staff communicated with Uncompahgre Plateau CFLRP partners, and there was no desire or stated need for a field trip in 2021.</p>
<p>2.3 In coordination with CFLRP Program Administrators and other SWERI Institutes, produce 2-4 reports or briefing papers documenting forward looking lessons learned from the CFLRP program in order to facilitate knowledge transfer to newly awarded CFLRP projects.</p>	<p>In collaboration with SWERI colleagues and USFS staff and national leads for the CFLR program, published technical report: Beeton, TA, Cheng, AS, & Colavito, MM (2020). Developing and sustaining collaborative resilience in the face of change: A review of the Collaborative Forest Landscape Restoration Program projects. CFRI-2003. https://cfri.colostate.edu/wp-content/uploads/sites/22/2020/08/CFLRP-Developing-and-sustaining-collaborative-resilience.pdf</p> <p>In collaboration with SWERI colleagues and USFS staff and national leads for the CFLR program, published peer reviewed journal article: Beeton, TA, Cheng, AS, Colavito, MM (2022). Cultivating collaborative resilience to social and ecological change: An assessment of adaptive capacity, actions, and barriers among collaborative forest restoration groups in the United States. Journal of Forestry. https://doi.org/10.1093/jofore/fvab064.</p> <p>Published 2 page briefing paper to facilitate knowledge transfer amongst practitioners and Congress: Beeton, TA, Snitker, A. (2022). 2-Page Summary: Cultivating Collaborative Resilience among Collaborative Forest Restoration Groups. CFRI-2203. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/03/CollaborativeResilience_CFLRP_2Pg.pdf</p>
<p>2.4 In collaboration with the other SWERI institutes, USFS, and other partners, convene a regional Cross-Boundary Landscape Restoration workshop, or series of smaller workshops, with land managers, researchers, and their stakeholders to develop strategies that facilitate the application of lessons learned from collaborative forest landscape management planning, implementation, monitoring, and adaptive management in the intermountain west and southwest.</p>	<p>CFRI staff co-lead planning for a Cross Boundary Landscape Restoration workshop scheduled for March 7-10th, 2022, at Colorado State University in Fort Collins, Colorado. Throughout much of 2021 and into early 2022 CFRI staff Brett Wolk, Angela Hollingsworth, Brooke Simmons, Hannah Brown, and others participated in regular planning meetings every 2 weeks to develop the workshop agenda and logistics, with additional subgroup work developing specific workshop aspects and logistics. CFRI staff secured a meeting venue at Colorado State University, developed the registration website, and is overseeing all financial and logistical considerations for the workshop. The planning team includes multiple representatives from all three SWERI's, as well as representatives from USFS Rocky Mountain Research Station, Forest Stewards Guild, National Wildland Fire Cohesive Strategy, National Forest Foundation, Trees, Water & People, and others.</p> <p>Due to a surge in COVID in early 2022, the workshop was postponed until Spring 2023. Planning continued throughout 2022.</p>
<p>2.5 Working with the Rocky Mountain Research Station, document, produce, and disseminate 2-4 applied scientific publications that leverage data and adaptive management process from collaborative forest landscape management projects and wildfire risk co-management strategies.</p>	<p>In collaboration with Matt Thompson, RMRS scientist, published paper: Gannon BM, Thompson MP, Wei Y (2020). An Operationally Relevant Framework for Mapping Spot Fire Transmission Potential. Environmental Sciences Proceedings 3(1):13. https://doi.org/10.3390/IECF2020-08001</p> <p>Caggiano, MD, Beeton, TA, Gannon, BM, White, J (2021). The Cameron Peak Fire: Use of Potential Operational Delineations and Risk Management Assistance Products. CFRI-2106. https://cfri.colostate.edu/wp-content/uploads/sites/22/2021/06/CameronPeakFirePODsReport.pdf</p>

	<p>CFRI staff Ch’aska Huayhuaca co-authored publication: Wilkins, K., Pejchar, L., Carroll, S. L., Jones, M. S., Walker, S. E., Shinbrot, X., Huayhuaca, C., Fernandez-Gimenez, M., & Reid, R. S. (2021). Collaborative conservation in the United States: A review of motivations, goals, and outcomes. <i>Biological Conservation</i>, 259, 109-165. https://doi.org/10.1016/j.biocon.2021.109165</p>
<p>2.6 Convene and report on between 4-6 webinars, presentations, or peer to peer learning events documenting and distributing monitoring methods, results, and adaptive management processes to research colleagues or multi-stakeholder forest landscape management initiatives focused on forest health, wildfire risk mitigation, or watershed protection</p>	<p>Andrew Slack helped convene, attended, and reported monitoring methods and results at monthly meetings with the Upper South Platte Partnership Management and Science team throughout 2021. This includes co-developing methods to monitor changes in forest wildfire risk and forest resilience, sharing results, facilitating adaptive management with place based partners, and serving on a core group to develop goals for the partnership. Monitoring methods include both field-based plot sampling as well as remote sensing techniques.</p> <p>Kat Morici presented to the Upper South Platte Partnership to share prescribed fire monitoring methods and results during a meeting of the Management and Science team, February 4th, 2021.</p> <p>Andrew Slack and Hannah Brown presented results and key takeaways from interviews and discussions with Upper South Platte Partnership partners assessing past forestry projects and outcomes of adaptive management processes within the group. April 1st, 2021 (virtual).</p> <p>Kat Morici met with staff of the Big Thompson Watershed Coalition on September 3, 2020, to discuss how to use field monitoring data in the Forest and Fuels Extension to the Forest Vegetation Simulator.</p> <p>Marin Chambers trained Calwood Educational Center students and staff in fire and forest ecology, CFRI monitoring protocols, and basic forestry field measurements during a course focused on engaging high school students from underrepresented backgrounds in natural resources, August 5, 2021.</p>
<p>Project 3. Translating ecologically-based forestry principles into practice</p>	
<p>3.1 Working with the Rocky Mountain Research Station, co-produce and disseminate 1-3 applied scientific publications to inform collaborative planning, implementation, monitoring, and/or adaptive management of restoration principles for ponderosa pine forest types in Colorado.</p>	<p>With RMRS and other colleagues, CFRI staff Camille Stevens-Rumann contributed to TAMM review publication. Leveraging additional funding from The Nature Conservancy Fire Learning Network program, CFRI staff Marin Chambers also contributed to the publication. Stevens, JT, Haffey, CM, Coop, JD, Fornwalt, PJ, Yocom, L, Allen, CD, Bradley, A, Burney, OT, Carril, D, Chambers, ME, Chapman, TB, Haire, SL, Hurteau, MD, Iniguez, JM, Margolis, EQ, Marks, C, Marshall, LAE, Rodman, KC, Stevens-Rumann, CS, Thode, AE, & Walker, JJ (2021). Tamm Review: Postfire landscape management in frequent-fire conifer forests of the southwestern United States. <i>Forest Ecology and Management</i>, 502, 119678. https://doi.org/10.1016/j.foreco.2021.119678</p> <p>Working with the RMRS and leveraging funding from a Joint Venture Agreement with RMRS Science communication and Application staff, we are in progress analyzing interview data and assessing effectiveness of science co-development and communication efforts associated with RMRS-GTR-373 <i>Principles and practices for the restoration of ponderosa pine and dry mixed-conifer forests of the Colorado Front Range.</i></p>

<p>3.2 Complete 1-3 written reports that document the translation and application of forest restoration principles for forest types other than ponderosa pine and dry mixed conifer forests, such as Gambel oak, Aspen, wet mixed conifer, or subalpine forests.</p>	<p>A Knowledge Synthesis was developed in response to the San Juan Headwaters Forest Health Partnership (SJHFHP) request in 2019 to CFRI to compile and synthesize the current best available science for mixed conifer forests. Marin Chambers of CFRI and Mountain Studies Institute staff collaborated to create this knowledge synthesis with additional authorship from USDA-Rocky Mountain Research Station and USDA-Forest Service staff. Developed between 2019 and 2021 with engagement and input from the SJHFHP and the San Juan National Forest via collaborative discussions and field trips, the purpose of the presentation and paper is to compile and synthesize current and best available science for mixed conifer forest ecology to inform future management efforts and research needs with specific information relating to the San Juan Mountain Region. Remke, M.J., Chambers, M.E., Tuten, M.C, Pelz, K.A., 2021. Mixed Conifer Forests in the San Juan Mountain Region of Colorado, USA: The Status of Our Knowledge and Management Implications. Colorado Forest Restoration Institute. CFRI-2110. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/03/MixedConiferForests_Chambers_Remke_Dec2021_FINAL.pdf</p> <p>The report was collaboratively developed and presented with San Juan Headwaters Forest Health Partnership members December 8th, 2021. A video of the presentation can be found on the Mountain Studies Institute YouTube channel https://www.youtube.com/watch?v=W-awZdqTfyw</p> <p>Published paper: Schapira, Z., Stevens-Rumann, C., Shorrock, D., Hoffman, C., & Chambers, A. (2021). Beetlemania: Is the bark worse than the bite? Rocky Mountain subalpine forests recover differently after spruce beetle outbreaks and wildfires. <i>Forest Ecology and Management</i>, 482, 118879.</p> <p>Published paper: Schapira, Z. H., Stevens-Rumann, C. S., & Shorrock, D. (2021). Subalpine tree seedlings: Assessing aging methodology and drivers of establishment. <i>Forest Ecology and Management</i>, 497, 119516.</p>
<p>3.3 Develop a technical brief, and report to USFS Rocky Mountain Regional Office staff demonstrating how GTR-373 planning frameworks and ecological concepts can streamline planning for large landscapes (1 million+ acre planning areas) to improve forest restoration and fuels treatment programs.</p>	<p>Brett Wolk delivered virtual presentation and served as panelist for discussion with USFS Rocky Mountain Region Leadership Team meeting. Presentation titled “Knowledge Co-Production Tools and Forward Looking Strategies for Shared Stewardship.” 8-18-2021. https://cfri.box.com/s/qjg60qs83npinmdgwagmxokcxcw1f7qd</p>
<p>3.4 In coordination with the USFS Rocky Mountain Region and Rocky Mountain Research Station, convene a working group and report on opportunities to translate climate vulnerability assessments into actionable climate adaptation strategies that are accessible for use in treatment unit or USFS District level prescriptions or adaptive planning processes.</p>	<p>CFRI staff Tyler Beeton and Stephanie Mueller convened quarterly meetings with USFS Rocky Mountain Region planning staff Ruth Esperance and regional ecologist and climate change coordinator Donna Shorrock to assess needs and opportunities to translate climate change vulnerability into forest plan revision, monitoring, and evaluation, as well as fire management strategies and risk based strategic planning frameworks.</p> <p>In collaboration with Ecological Restoration Institute and others, CFRI staff Andrew Slack, Hannah Brown, and Tyler Beeton facilitated discussions for the USFS Region 3 Climate Adaptation Workshop held virtually March 9th, 2021. CFRI staff contributed climate change adaptation science during the workshop discussions and facilitated breakout groups. Lessons learned from this experience will help better apply climate adaptation strategies with Region 2 staff and partners.</p>

<p>3.5 Collaborating with Rocky Mountain Research Station and partners, improve existing websites and/or build a new website to host information that facilitates application of forest restoration principles in Colorado frequent fire forests.</p>	<p>In coordination with RMRS Science Application and Communication staff, and a larger Front Range forest restoration collaborative group, efforts were redirected away from developing a website to host comprehensive information for Front Range forest ecology and management. Funds were applied to CFRI staff to perform major upgrades and regular content updates to the CFRI website https://cfri.colostate.edu/ have been added, including: formatting, layout, and regular posting of CFRI publications to facilitate sharing and application of forest restoration principles by partners. https://cfri.colostate.edu/publications/</p> <p>Many of our “collaborations” pages were updated and expanded to better describe CFRI’s engagement with collaborative groups around the region, and how we work to incorporate science with local knowledge to move cross boundary shared stewardship forest restoration principles forward. https://cfri.colostate.edu/projects/</p> <p>In addition to website upgrades, CFRI staff developed a strategy for communicating information to facilitate application of forest restoration principles using social media channels, and invested in software to more effectively coordinate information across multiple social media channels.</p>
<p>3.6 In coordination with the Rocky Mountain Research Station, develop, produce, and deliver 1-3 workshops or trainings to support applications of forest restoration principles into practice.</p>	<p>In coordination with Rocky Mountain Research Station staff, CFRI staff Marin Chambers helped organize and facilitate a field workshop on April 2nd, 2021, with Boulder County Parks and Open Space to examine impacts of the 2020 Calwood fire. A group of RMRS, CFRI, Colorado State University, US Forest Service, Boulder County Parks and Open Space staff, and other forest managers participated to discuss fire interactions with forest restoration treatments on Boulder County property to support future application and adaptation of forest restoration principles under changing climates and wildfire behavior.</p> <p>CFRI staff Andrew Slack helped guide the Saint Vrain Forest Health Partnership to apply concepts from RMRS-GTR-373 Principles and Practice of Forest Restoration on the Colorado Front Range to help the group develop desired conditions and adaptive management framework in the watershed. This included a series of 16 meetings and field trips with the Saint Vrain science committee. Funds from this agreement were leveraged with funds from the Arapaho Roosevelt National Forest that supported additional CFRI staff Ch’aska Huayhuaca-Frye, Mike Caggiano, and others to regularly engage in coordination and facilitation of the Northern Colorado Fireshed Collaborative.</p>
<p>3.7 Develop, produce, and distribute 2-4 technical briefs or multimedia resources such as videos, ESRI story-maps, etc., that facilitate application of science based strategic forest restoration principles in Colorado frequent fire forests.</p>	<p>January 12th, 2021, Marin Chambers is featured in Peak Facilitation video series Cocktails and Collaboration episode 3 to discuss the role of science in collaborative forest restoration discussions. Video here: https://www.youtube.com/watch?v=gMmUqsYlmI</p> <p>Camille Stevens-Rumann delivered online podcast, “Awareness of the Spread, Fire Ecology,” as part of Warner College of Natural Resource Podcast series, Season 3 Episode 1 (Fall 2020), available here: https://warnercnr.colostate.edu/tune-into-nature-a-warner-college-podcast/season-3/</p>

Project 4. Supporting planning, monitoring, and adaptive management to improve fuel treatment effectiveness and forest resilience under changing precipitation and rising temperatures.	
<p>4.1 Support the collection, data management, analysis, and reporting for monitoring data at 1-3 forestry projects, focusing on building prescribed fire monitoring knowledge and capacity within Colorado, conducting project scale remote sensing analysis, and/or leveraging existing monitoring networks to collect longer term data that enhances knowledge of fuel treatment effectiveness and maximize fuel treatment longevity.</p>	<p>Following the 2020 wildfires in Colorado and southern Wyoming, with nearly 800,000 acres burning across the area, CFRI dedicated significant resources to opportunistically leverage the learning opportunity presented by these fires and provide actionable knowledge for managers and policymakers about the post fire environment.</p> <ul style="list-style-type: none"> - CFRI staff Marin Chambers and Camille Stevens-Rumann developed new post-fire monitoring and research methods to better understand short and long term understory vegetation trajectories and forest development following the Cameron Peak fire and other Colorado fires in 2020. Kate Weimer was hired as a graduate student and supervised a field crew collecting field data during the summer of 2021. - CFRI supported Camille Stevens-Rumann and graduate student Michael McNorville to develop new methods and collect field data measuring soil ecology in post fire environments within the Cameron Peak wildfire. - In collaboration with CSU research scientist Tony Vorster, to better measure wildfire severity and interactions of fuels treatments and wildfires, CFRI staff co-designed a protocol and collected burn severity data in several of the wildfires that burned in 2020, including the Cameron Peak fire. <p>In collaboration with the Upper South Platte Partnership, CFRI staff collected and analyzed post-treatment monitoring data on private lands fuels treatments conducted at Roller Ranch.</p> <p>CFRI staff Andrew Slack developed dendrochronological monitoring methods and collected field data to better describe long term individual tree resilience and growth responses to thinning and prescribed fire treatments. Data was collected in Jefferson County Open Space, and tree cores were processed in the lab at CSU.</p>
<p>4.2 Document and report on 2-4 monitoring methods to make monitoring protocols more accessible and transparent for other organizations to apply and understand. This includes plot based field monitoring, remote sensing techniques, and/or data management strategies.</p>	<p>Published report evaluating field based monitoring methods and remote sensing techniques to measure prescribed fire treatment effectiveness. Morici, KE, Gannon, BM (2021). Elkhorn 4 Prescribed Fire Monitoring Report. CFRI-2108. https://cfri.colostate.edu/wp-content/uploads/sites/22/2021/09/2021-Elkhorn-4-RX-Monitoring-Report-1.pdf</p> <p>CFRI staff Allie Rhea continued development and implementation of modeled post-fire erosion monitoring methods using CFRI’s Watershed Erosion Simulation Treatment Tool (WESST) to inform watershed health monitoring and post-fire prioritization of erosion control measures. This included a restructured post-fire erosion model to integrate continuous remote sensing dNBR products, rather than classified soil burn severity, which allows for continuous vegetation and soil adjustments and reduces the importance of the somewhat arbitrary threshold between severity classes, enhancing application of monitoring results. Allison Rhea presented post-fire erosion modeling methods and results as a part of the Cameron Peak Fire expert panel at the Colorado Wildland Fire Conference, Grand Junction, Colorado, on Sept 22, 2021.</p> <p>Allison Rhea also presented post fire watershed modeling methods at the CSU Geospatial Centroid seminar series, titled: How GIS was used in post-fire recovery and modeling after the Cameron Peak Fire. October 26th, 2021. Video of presentation available here: https://www.youtube.com/watch?v=Z_xPwHEv_2g</p>

	<p>CFRI staff began efforts to create a monitoring handbook in order to document our ecological monitoring methods using both field and remote sensing techniques. This will increase transparency, but also will serve as a training tool to build capacity for other organizations around the state and West to implement monitoring protocols within a collaborative adaptive management framework.</p> <p>In an effort to increase the accessibility of CFRI’s monitoring protocols and methods to managers, the CFRI spatial imagery team began working on an effort to turn the complex statistical analysis code for the landscape spatial heterogeneity gap and canopy analyses into easy-to-use tools in ArcGIS. We worked intensively with Colorado State Forest Service district staff Matt Piscopo and others to develop methods and processes most applicable to inform management decisions. This project will continue into the new year and will be incorporated into CFRI’s monitoring handbook.</p>
<p>4.3 Complete 1-3 technical reports summarizing fuel treatment effectiveness and treatment longevity in forest types in Colorado and the intermountain west.</p>	<p>CFRI provided funding, hired and trained field crews, and technical assistance for research study investigating tree regeneration and growth to inform reforestation and treatment longevity under changing climates: Carroll, C. J. W., Knapp, A. K., and Martin, P. H.. 2021. Higher temperatures increase growth rates of Rocky Mountain montane tree seedlings. <i>Ecosphere</i> 12(3):e03414. https://doi.org/10.1002/ecs2.3414</p> <p>Morici, K. E., & Bailey, J. D. (2021). Long-Term Effects of Fuel Reduction Treatments on Surface Fuel Loading in the Blue Mountains of Oregon. <i>Forests</i>, 12(10), 1306. https://doi.org/10.3390/f12101306</p> <p>Slack, A. W., Kane, J. M., & Knapp, E. E. (2021). Growth and defense inform large sugar pine (<i>Pinus lambertiana</i>) mortality in a fire-excluded forest of the central Sierra Nevada. <i>Trees</i>, 35(3), 1053-1063. https://doi.org/10.1007/s00468-021-02098-8</p>
<p>4.4 Conduct a pilot analysis and application of methods to assess value of different treatments relative to costs with USFS Regional and Washington Office planning and timber program staff.</p>	<p>CFRI staff Jarod Dunn engaged with USFS staff and colleagues on developing tools to monitor treatment costs and estimate benefits relative to different factors such as NEPA planning process and treatment budget line item funding source. After connecting with multiple people in the USFS Washington Office and others around the region and country, it was determined that the data on treatment costs and documentation needed to proceed with this analysis was not available in USFS corporate databases or other accessible locations.</p>
<p>4.5 Provide technical assistance and training to build capacity for monitoring data collection, analysis, and/or application of results for assessing monitoring data trends for the Colorado State Forest Service and 1-3 additional organizations or forest, fire, or watershed collaborative groups.</p>	<p>CFRI staff continue to coordinate with the Colorado State Forest Service to build capacity for monitoring and adaptive management capacity. We coordinated with CFRI Forest Restoration and Wildfire Risk Reduction monitoring coordinator Zach Mellema to continue aligning monitoring methods and sites monitored. CFRI staff continue communicating with CSFS Science and Data lead Amanda West-Fordham about opportunities for integrating remote sensing monitoring methods into CSFS project evaluations. CFRI staff Camille Stevens-Rumann coordinated with CSU Extension to host a student intern that worked with CSFS to increase science application capacity in 2021. With CSFS staff lacking monitoring and data application capacity, CFRI staff have advised on staffing needs for CSFS to bolster capacity through both a CSFS dedicated field monitoring position and multiple CSFS Community Wildfire Protection Plan coordinator positions to help integrate landscape monitoring data into planning with community groups.</p>

	<p>CFRI staff Andrew Slack, Kat Morici, and Brett Wolk worked with the Longmont Conversation District to develop a monitoring strategy for non-federal lands management and forest management plan development. This included co-developing a monitoring protocol and providing training resources for conservation district staff to implement the inventory and monitoring protocols.</p> <p>CFRI staff Brett Wolk and Stephanie Mueller contributed to Chaffee Chips and Envision Chaffee County helping to translate landscape plans and apply data to local treatment prescriptions. CFRI provided a template for tracking accomplishments with GIS to facilitate monitoring outcomes across the entire county.</p>
<p>4.6 Conduct a needs assessment for post fire reforestation that examines the capacities, constraints, and desired conditions for re-planting high severity burn scars in frequent fire forests of the Southwest under anticipated changing future climatic conditions.</p>	<p>CFRI staff met with federal and non-federal managers in the field multiple times following 2020 wildfires and sustained communication to assess information gaps and monitoring needs and to create collaborative learning opportunities. This culminated in a workshop, co-hosted with RMRS, bridging needs of managers and researchers, held in April, 2021. A summary of the workshop outcomes and needs is available here: Chambers, ME, Rhoades, CC, Brown, H (2021). Post-fire Tree Regeneration and Forest Recovery Workshop Summary. CFRI-2105. https://cfri.colostate.edu/wp-content/uploads/sites/22/2021/06/Post-fire-Tree-Regeneration-and-Forest-Recovery-Workshop-Summary.pdf</p>
<p>Project 5: Supporting Collaborative Capacity-Building and Peer-Learning</p>	
<p>5.1 Conduct, convene, organize, and report on between 8-10 site visits, peer to peer learning events, webinars, or workshops that bring together research scientists from RMRS, other federal agencies, and universities with participants of place-based forest collaboratives to transfer knowledge about, and assist in the development of, science-based methods for collaborative planning, assessment, monitoring, and adaptive management.</p>	<p>Camille Stevens-Rumann (CFRI) co-delivered online webinar with colleagues J. Coop and S. Parks (RMRS) titled “Forest type conversions: how are our landscapes changing” for the North American Congress for Conservation Biology. Virtual, July 2020.</p> <p>CFRI staff helped co-organize the semi-annual Colorado Forest Collaboratives Summit, August 5, 2020 (virtual conference). CFRI Director Tony Cheng delivered presentation, “Statewide network and capacity resources for forest collaboratives: Oregon example” to seed discussion and follow-up actions for Colorado’s forest collaboratives.</p> <p>CFRI staff Ben Gannon delivered presentation and lead discussion with Long’s Peak Society of American Forester’s Meeting: Wildfire risk to water supplies and prioritizing forest management – (August 20, 2020)</p> <p>Delivered presentation: Creating inclusive and actionable community wildfire protection plans. Co-presented by Ben Gannon (CFRI) and Megan Matonis (Forest Stewards Guild), Colorado Wildland Fire Conference – Virtual (September 2020).</p> <p>In November of 2020, Camille Stevens-Rumann (CFRI) delivered a presentation titled “Post-fire tree regeneration in a changing world” for a virtual graduate seminar at Northern Arizona University School of Forestry</p> <p>Ben Gannon delivered presentation titled: An operationally relevant framework for mapping spot fire transmission potential. 1st International Electronic Conference on Forests – Virtual (November 2020). https://sciforum.net/paper/view/8001</p>

CFRI Assistant Director Brett Wolk participated as an expert panelist with USFS Regional Office staff, Colorado State Forest Service, and Denver Water, November 18th, 2020, on a virtual tour discussing how forest management activities are used improve watershed resilience at the Water in the West symposium. The audience included journalists, K-12 educators, corporate executives, and restoration practitioners. Video link:
<https://www.youtube.com/watch?v=gwk8LTLvLMU>

CFRI personnel Marin Chambers, Tony Cheng and Brett Wolk participated in a peer-learning exchange with forest collaboratives in Arizona and New Mexico December 10, 2020 and delivered presentation, “Adaptive management case studies”.

Marin Chambers provided expertise for National Climate-Fire Synthesis workshop, convened and organized by The Nature Conservancy: Estimating the Climate Mitigation Potential of Colorado’s Natural and Working Lands. Virtual, January 6th, 2021.

CFRI Co-convened and co-organized a webinar series titled Forests, Fire, and People, with the Institute for Science and Policy at the Denver Museum of Nature and Science and the Center for Collaborative Conservation. This 4 part series in March and April 2021 included invited experts exploring different aspects of wildfire for a general public audience. CFRI staff Camille Stevens-Rumann lead a webinar discussing the latest science on the ecology of forest wildfire ecology and management, and Tony Cheng lead a webinar discussing the future of western wildfires and future policy challenges and solutions. Videos of presentations available on DMNS website: <https://institute.dmns.org/perspectives/series/forests-fires-and-people/>

CFRI staff contributed to a Colorado Wildfires 2020 webinar series hosted by the Southern Rockies Fire Science Network, Forest Stewards Guild, Graduate Degree Program in Ecology at CSU, and CSU Department of Agricultural Biology. Webinars were broadcast for a wide range of CSU affiliates and collaborative partners (average 100+ attendees). Planning occurred in fall 2020, with webinars occurring January through April 2021.

https://mcusercontent.com/2263fe298f4df255d22b80097/files/bf72cb29-bfe6-4773-8e03-522a92d5693e/ECOL_592_Announcement_New.01.pdf?mc_cid=e902712c0e&mc_eid=c2e4c64c65

CFRI staff led 4 different presentations in the series.

- Camille Stevens-Rumann: Overview of fire ecology.
- Tony Cheng: History forest/fire management and policy.
- Mike Caggiano and Richard Thorpe (Fort Collins City Utilities): Fire effects on ecosystem services.
- Marin Chambers and Chuck Rhoades (USFS RMRS): Cameron Peak & East Troublesome fires: Short-term post-fire land management.

For FY21 agreement number 21-DG-11030000-018, CFRI reports the following cumulative accomplishments toward each project deliverables in the work plan for dates while the agreement was active, including July 1st, 2021 through December 31st, 2022:

Deliverable	Status of Deliverables
Project 1. Develop and deploy outcomes-based, climate-forward decision support for Shared Stewardship of forest landscape resilience and co-managing wildfire risk.	
<p>1.1 Working with USFS Region 2, continue to assist in co-developing and facilitating partnership engagement for regional or state of Colorado all-lands wildfire risk assessment processes with land and fire managers across jurisdictions and ownerships. This includes working with targeted partners to identify Highly Valued Resources and Assets (HVRA’s) and climate change considerations that will help frame the risk assessment outputs.</p>	<p>CFRI staff remained in contact with USFS Rocky Mountain Region 2 fire and fuels staff to participate in the Colorado All-Lands wildfire risk assessment process, and are facilitating application of data products with partners throughout the state by supporting USFS staff to make partners aware the data is available and help share the data. CFRI staff are also working to apply the data as a baseline for monitoring of forest management outcomes to reduce risk to values identified in the wildfire risk assessment.</p> <p>CFRI Leadership Tony Cheng, Brett Wolk, and Camille Stevens-Rumann, and other staff as appropriate have coordinated and participated in monthly meetings with Rocky Mountain Region leadership through 2022 to develop shared strategic directions, share lessons learned from monitoring outcomes, hear needs of regional office staff, and develop shared projects.</p>
<p>1.2 In coordination with the Colorado State Forest Service, support cross boundary application of the updated Statewide Forest Action Plan.</p>	<p>CFRI staff Scott Ritter and Camille Stevens-Rumann served on an advisory team to provide expertise in forest ecology and fire behavior modeling to inform updating the Colorado Wildfire Risk Assessment update. This involved roughly semi-weekly meetings for several months, as well as communications between meetings, to help CSFS develop scientifically robust and applicable fire modeling products.</p> <p>CFRI initiated discussions with Colorado State Forest Service and proposed a framework to co-develop a Colorado all lands forest activity database. The database goals are to better support cross boundary forest and fire management, track and report accomplishments, and measure ecological resilience and outcomes from interactions of activities with wildfires.</p>
<p>1.3 Participate in the Colorado Natural Resources Conservation Service Forest Advisory Committee to develop priorities and advise on strategic prioritization of NRCS forestry conservation practices across the state.</p>	<p>CFRI staff Brett Wolk participated in the NRCS Forest Advisory Committee meeting held virtually 2/16/2022. CFRI staff met multiple times individually with new NRCS Colorado State Forestry Lead Frank Falzone to introduce him to CFRI staff, focal areas, and partnership opportunities to support and advise on NRCS forestry conservation practices.</p>
<p>1.4 Working with RMRS and FAM, continue to support development, implementation, and integration of cross boundary landscape planning and prioritization tools in 4 - 6 landscapes, with a focus on linking spatial fire planning (PODS) and climate change considerations with outcome-based prioritization of forest and fuels management objectives (e.g. RADS, etc.) across multiple scales of planning and implementation.</p>	<p>CFRI staff planned and completed Potential Operational Delineation (PODs) workshops with USFS staff and collaborative partners, and delivered finished PODs network data and associated information for the following national forests and surrounding landscapes:</p> <ul style="list-style-type: none"> - Boise National Forest - Caribou-Targhee National Forest <p>In 2022 CFRI worked with the Lake County, Colorado, Forest Health Council to lead technical analysis and the collaborative planning process for an update of the Community Wildfire Protection Plan using the CFRI Risk Assessment Decision Support outcome based planning framework. Funding from a separate agreement with the Pike San Isabel & Cimarron and Comanche National Grasslands supported the time of Allie Rhea and Brett Wolk to lead technical analysis, collaborative engagement, and contributions to the final technical reports. Additional funding from this agreement expanded engagement of additional CFRI staff to support enhanced climate informed spatial analysis and fire behavior modeling from Scott</p>

	<p>Ritter, mentorship in decision support tool application from Stephanie Mueller, and collaborative support from at least 5 additional CFRI staff to provide expert facilitation during multiple small group meetings with the Lake County Forest Health Council that helped integrate local community input into the process.</p> <ul style="list-style-type: none"> - Lake County Community Wildfire Protection Plan: https://csfs.colostate.edu/wp-content/uploads/2023/02/lake-county-cwpp_update_2022.pdf - Rhea, A and Ritter, S (2022) Lake County Fuel Treatment Prioritization. Colorado Forest Restoration Institute. CFRI-2207 https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/05/LakeCountyFuelTreatmentPrioritization_Rhea_Ritter_CFRI_2207.pdf - Rhea, A and Ritter, S (2022) Lake County Wildfire Risk Assessment. Colorado Forest Restoration Institute. CFRI-2208 https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/05/LakeCountyWildfireRiskAssessment_Rhea_Ritter_CFRI_2206.pdf <p>CFRI staff Andrew Slack and Stephanie Mueller led an application of the Risk Assessment and Decision Support framework with a cross boundary collaborative group to inform the Lower North South Vegetation Management Project, which is a large conditions based pre-NEPA planning process with the South Platte Range District on the Pike National Forest. This involved semi-monthly meetings throughout 2022, extensive spatial analysis, development of communication tools such as sharing data via Arc GIS Online mapping tools, and other activities to support cross boundary partners making informed decisions about the best bang for the buck to implement forest management activities.</p> <p>CFRI staff Brett Wolk and Allie Rhea worked with the Denver Water Forest to Faucets Partnership to engage in a RADS process that will inform how proactive forest management can best protect source watersheds from post fire impacts. This involved convening partners from Denver Water, US Forest Service, Colorado State Forest Service, and Natural Resources Conservation Service to assess risks and develop shared priorities. CFRI staff worked with DW private consultants to incorporate their climate model projections into the fire behavior modeling.</p>
<p>1.5 Continue supporting partners to apply tools to streamline collaborative spatial fire planning analytical processes that facilitate updating, refining, and maintaining <u>existing</u> mapping and prioritization efforts on 4-6 landscapes where PODs or other prioritization methods have already been developed and applied.</p>	<p>CFRI staff continued updating PODs where they already exist by coordinating data updates with RMRS partners, local forest staff, and other non-forest service collaborators where PODs are developed in cross-boundary landscapes. This included these forests and surrounding cross boundary landscapes:</p> <ul style="list-style-type: none"> - Carson and Santa Fe National Forests in New Mexico - Ashley National Forest in Utah - PODs engagement with all national forests in USFS Rocky Mountain Region continued in 2022, and was funded under a separate agreement directly with the USFS regional office. <p>CFRI staff Brett Wolk and Stephanie Mueller provided ongoing engagement with Envision Chaffee County to help partners apply the Community Wildfire Protection Plan and Recreation planning tools. This included activities such as attending Chaffee Forest Health Council meetings and Chaffee Treat team meetings to help foresters apply landscape scale outcomes in project level forest management activities, making maps for communication specialists and grant applications for the group, and sharing the Recreation and Wildlife planning tool with Colorado Parks and Wildlife and the Colorado Natural Heritage Program to post on their Colorado Conservation Data Explorer online portal to facilitate use by a wider audience around the state.</p>

	<p>Completed an update to our 2017 spatial database and report documenting cross boundary forest management projects across all of Colorado.</p> <ul style="list-style-type: none"> - Mueller, SE, Caggiano, MD (2022), Colorado Interagency Fuel Treatment Database. CFRI-2202. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/02/Interagency_GDB_Report.pdf <p>Funding for this study was generously provided by the Arapaho Roosevelt and Pike San Isabel National Forests to support data collection and reporting along the Colorado Front Range. Leveraging additional funding through this agreement 21-DG-11030000-018 supported expanding the project across the entire state of Colorado. CFRI continues to manage, curate, and share data with USFS and other partners for use in cross-boundary collaborative planning. We are working in partnership with the Colorado State Forest Service to host this data in their online mapping Forest Atlas platform to make it accessible for a wider audience and help streamline mapping and prioritization efforts across Colorado.</p> <p>In 2022 CFRI staff continued working with partners in Jefferson County through the Upper South Platte Partnership to help apply county-wide prioritization analysis that CFRI conducted for the Jefferson County Open Space Forest Health Plan. This included helping present the plan at Upper South Platte Partnership Management and Science team meetings, supporting Jefferson County Open Space to implement and communicate the plan, and working one on one with other partners to apply county-wide cross-boundary data to their planning efforts.</p> <p>https://www.jeffco.us/DocumentCenter/View/33433/JCOS-Forest-Health-Plan-?bidId=</p>
<p>1.6 Deliver 8-12 presentations at professional meetings, peer to peer learning events, academic-oriented conferences, and policy-maker briefings to report on the range of methodologies, approaches, and planning processes being used to enhance co-management of wildfire risk in the western US.</p>	<p>Jarod Dunn and Brett Wolk delivered presentation and facilitated discussion on prioritization methods for a meeting of newly formed collaborative group in Gunnison, Colorado, titled “Risk Assessment and Decision Support (RADS) Framework and Modeling Process”. Virtual, 7-30-2021.</p> <p>https://cfri.box.com/s/1gexsm4imlfjb94fmyu9r47fpjl03idw</p> <p>CFRI staff Brett Wolk delivered presentation as invited guest for discussion with Rural Voices for Conservation Coalition governance strategies for large landscape partnerships peer learning group. Presentation titled: “Knowledge Co-Production Tools To Align Collaborative Actionable Knowledge.” September 8th, 2021.</p> <p>https://cfri.box.com/s/03538i94lgn07hddsv9h4yettk2bg5qk The video of this presentation has been shared widely amongst collaborative partners in the Pacific Northwest to facilitate broader understanding of CFRI experience applying spatial analytical tools in a social collaborative context.</p> <p>Mike Caggiano organized and moderated a panel discussion, in coordination with RMRS and other partners, to explore applications and outcomes of pre-fire planning strategies at the Colorado Wildland Fire Conference titled "Potential Operational Delineations: Use and Development in Colorado." Grand Junction, Colorado, September 23rd, 2021.</p> <p>Ch’aska Huayhuaca, along with co-presenters Forrester, C. and Wegert, S. delivered presentation titled: Linking Community & Science Through Landscape-Scale Forest Restoration Planning in the St. Vrain Watershed. Colorado Wildland Fire Conference, Grand Junction, CO, Sept. 23, 2021.</p> <p>Delivered oral presentation at the 16th Biennial Conference of Science & Management on the Colorado Plateau & Southwest Region, September 12-15th, 2022, Flagstaff, Arizona. Beeton, T., M. Caggiano, M. Colavito, and C. Huayhuaca. “Evaluating the US Forest Service Risk Management Assistance program and use during the 2021 wildfire season.”</p>

	<p>Delivered presentation for Fire Adapted Communities New Mexico spring webinar series. Tyler Beeton and Kit O'Connor (RMRS): Pre-planning for fire operations and response - PODs. May 18th, 2022. https://facnm.org/new-events/2022/5/18/webinar-pre-planning-for-fire-operations-and-response-pods</p> <p>CFRI staff Tyler Beeton and Mike Caggiano, along with staff from other SWERI, delivered a virtual presentation and discussion for the Forest Service office of Fire Aviation and Management Risk Management Assistance oversight team summarizing findings from the SWERI technical report assessing the use of risk management assistance during the 2021 fire season. July 28th, 2022.</p> <p>Tony Cheng delivered a keynote presentation at the Routt County Wildfire Mitigation Council Conference, Steamboat Springs, CO (Invited). “Co-existing with wildfire takes a community”. Audience: 130 community mitigation specialists, fire service professionals and community residents from across Routt County. https://youtu.be/CzXTh5fD7V0</p>
<p>1.7 Working closely with partners such as the RMRS Wildfire Risk Management Team and the other SWERI institutes, produce 2-4 technical documents or applied scientific publications that document lessons learned through deployment of spatial analytical decision support processes across the West.</p>	<p>Completed technical report: Beeton, T.A., Caggiano, M.D., Colavito, M.M., Huayhuaca, C. 2022. Use of Risk Management Assistance During the 2021 Fire Season: A technical report. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/12/Beeton_RMA_USE_2021_WildfireSeason_Report.pdf</p> <p>Published peer-reviewed paper with RMRS Wildfire Risk Management Team and other partners: Thompson, MP, O'Connor, CD, Gannon, BM, Caggiano, MD, Dunn, CJ, Schultz, CA, Calkin, DE, Pietruszka, B, Greiner, SM, Stratton, R, Morisette, JT. Potential operational delineations: new horizons for proactive, risk-informed strategic land and fire management. Fire Ecology 18:17 https://doi.org/10.1186/s42408-022-00139-2</p> <p>In Progress, CFRI staff have conducted follow up interviews with participants and are writing up case study and lessons learned from CFRI’s engagement leading risk assessment and prioritization process with Envision Chaffee County collaborative group. The writeup has been delayed due to complications with the COVID-19 Pandemic.</p>
<p>1.8 Produce 4-6 communication and outreach resources (technical briefs, blog posts, webinars, etc.) to facilitate the broader understanding and application of analytical decision support tools and collaborative planning processes that support strategic investments in cross boundary forest and fire management. Focus on documenting lessons learned that provide guidance for diverse stakeholders to assess what risk assessment and prioritization tools are appropriate for different planning and evaluation purposes, including translating information into languages other than English and increasing accessibility to people from diverse backgrounds.</p>	<p>Completed 2 page communication brief: Beeton, Tyler, Michael Caggiano, Melanie Colavito, Ch’aska Huayhuaca, and Ty Aldworth. 2022. Use of Risk Management Assistance During the 2021 Fire Season. CFRI-2220 https://cfri.colostate.edu/wp-content/uploads/sites/22/2023/04/Beeton_et_al_2022_UseRiskMngtAssistancein2021WildFireSeason_CFRI_2220.pdf</p> <p>Beeton, TA, Caggiano, MD (2022). PODs for Non-Incident Management: San Juan National Forest Case Study. CFRI-2204. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/03/SJNF_PODsNonIncidentMgmt.pdf</p> <p>Beeton, TA, Caggiano, MD. (2022), PODs for non-incident management – San Isabel National Forest. CFRI-2209. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/06/SINF_PODsNonIncidentMgmt_Beeton_CFRI_2204.pdf</p> <p>Beeton, TA, Caggiano, MD. (2022). PODs for Non-Incident Management: WADNR Forest Health Assessment and Treatment Framework Case Study. CFRI-2208. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/05/WDNR_PODsNonIncidentMgmt_Final.pdf</p>

	<p>Caggiano, MD, Beveridge, D. (2022). Integrating Potential Operational Delineations (PODs) into Community Wildfire Protection Plans: Guidance Community Planners. CFRI-2210. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/08/Caggiano_Beveridge_IntegratingPODsintoCWPP_GuidanceCommunityPlanners_August2022.pdf</p>
<p>Project 2. Support knowledge transfer, integration, and application of climate-forward assessment, monitoring, and adaptive management strategies to enhance the capacity of affected entities and their partners for collaborative, cross-boundary forest landscape restoration and climate adaptation planning.</p>	
<p>2.1 Produce and disseminate between 2-4 technical documents regarding multi-party monitoring strategies and results from collaborative forest landscape management projects.</p>	<p>Published report on monitoring of multi-party collaboration: Beeton, T., Snitker, A., Colavito, M., Cheng, A.S. (2022). CFLRP Collaboration Assessment Report for the Northern Blues CFLRP. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/11/Beeton_et_al_2022_CFLRP_CollaborationAssessmentReport_NBlues.pdf</p> <p>Published report leveraging results from Front Range Collaborative Forest Landscape Restoration Initiative monitoring efforts: Latif, Q.S., Cannon, J.B., Chabot, E.J. and Sparks, R.A. (2022), Simulated treatment effects on bird communities inform landscape-scale dry conifer forest management. Ecological Applications. Accepted Author Manuscript e2555. https://doi.org/10.1002/eap.2555</p>
<p>2.2 Conduct and report on between 3-5 field-based workshops for multi-stakeholder collaboratives to review and deliberate treatment effects and desired conditions.</p>	<p>8/10/2022: CFRI staff Brett Wolk, Tyler Beeton, and Savannah Lehnert participated in the 2-3-2 Cohesive Strategy Partnership quarterly partnership meeting and field-based workshop near Pagosa Springs, Colorado. CFRI staff led field-based discussions to support partners integrating fire management strategies with recreation management and other natural resource considerations, contributed expertise developing the monitoring plan for the 2-3-2 Partnership, as well as leading portions of a focused meeting to inform ecological and social metrics and adaptive management in the Rio Chama CFLR project monitoring plan.</p> <p>Field tour summary: https://232partnership.org/wp-content/uploads/2022/10/20220810_232_TourBrief.pdf</p> <p>Meeting summary: https://232partnership.org/wp-content/uploads/2022/10/08102022_232_FullMtg_Notes.pdf</p> <p>CFRI staff Andrew Slack convened and participated in visits with interagency partners in the Upper South Platte Partnership on active and recent forest restoration projects in the Upper South Platte watershed to review treatment effects and desired conditions. These included one to multiple days in the field with small groups of staff from each of the following organizations: Jefferson County Open Space, Jefferson Conservation District, Colorado State Forest Service, Denver Mountain Parks, and the USFS South Platte Ranger District silvicultural and fire management staff.</p>
<p>2.3 In coordination with National Restoration Planning and CFLRP Program administrators and other SWERI Institutes, develop, deploy, and report on the effectiveness of “collaboration resilience” assessment methodologies for projects selected for the CFLRP program to support program reporting and adaptive management.</p>	<p>CFRI staff Tyler Beeton, Tony Cheng, and others from CFRI, in collaboration with staff from other SWERI, had regular engagement working with national CFLRP program staff and individual place-based project coordinators to help develop and implement a common monitoring strategy framework for collaborative resilience for all new and re-authorized CFLRP projects announced in 2022. Throughout 2022 this involved at least monthly coordination with national level staff, in addition to presenting at multiple regional and project specific meetings, and providing science-based support with CFLRP projects across the country. Initial project level engagement in 2022 began with the Rio Chama, Southwest Colorado, Dinkey, Deschutes, and Northern Blues CFLRP projects. Project level engagement will continue with these groups and additional CFLRP placed based collaboratives in 2023. Among other outcomes, work with these national and place-based</p>

	<p>collaboratives involved helping to facilitate development and application of survey-based collaboration indicator framework to establish a collaborative baseline, and guidance to support development of successful collaborative governance structures with each place-based collaborative.</p> <p>Examples of our engagement included:</p> <ul style="list-style-type: none"> - May 10th, 2022, Tyler Beeton presented on collaborative resilience questions in the CFLRP workplan for the national CFLRP Onboarding and Orientation webinar series hosted by National Forest Foundation for newly authorized and reauthorized projects. - May 24th, 2022 Tyler Beeton and Melanie Colavito (SWERI-ERI) presented on CFLRP Collaboration Indicator at national CFLRP Onboarding and Orientation webinar series hosted by National Forest Foundation. - CFRI produced two technical reports, including summarizing lessons learned from the pilot collaboration indicator assessment with the Northern Blues CFLRP project, and a report on the standard operating procedure for implementing the assessment with all new and re-authorized CFLRP projects. These helped to facilitate application of collaborative monitoring framework best practices for national office staff, regional coordinators, and local project coordinators.
<p>2.4 In collaboration with the other SWERIs, USFS, and other partners, convene a regional cross-boundary landscape restoration workshop or series of smaller workshops, with land managers, researchers, and their stakeholders focused on applications of and lessons learned across a range of topics advancing management planning, implementation, monitoring, and adaptive management in the Intermountain West and Southwest.</p>	<p>CFRI staff co-led planning for a Cross Boundary Landscape Restoration workshop scheduled for March 7-10th, 2022, at Colorado State University in Fort Collins, Colorado. CFRI staff secured a meeting venue at Colorado State University, developed the registration website, and is overseeing all financial and logistical considerations for the workshop. Due to COVID and other factors, the event was postponed until May 2023. CFRI staff co-led planning for the 2023 workshop throughout all of 2022, with additional planning team members including the other SWERI in Arizona and New Mexico, The USFS Rocky Mountain Research Station, Forest Stewards Guild, the National Cohesive Wildland Fire Management Strategy, National Forest Foundation, and Trees, Water, and People.</p> <p>CFRI leveraged the March 7-10th, 2022, dates and planning efforts to convene an internal CFRI staff strategic planning workshop to incorporate staff perspectives in future organizational directions, including assessing strategic partnerships, breaking down silos and fostering internal collaboration amongst CFRI staff, and developing specific projects within our focal areas of expertise.</p>
<p>2.5 Working with the Rocky Mountain Research Station, document, produce, and disseminate 2-4 applied scientific publications that leverage data, results, and adaptive management processes from broad-scale monitoring, collaborative forest landscape management, wildfire risk co-management approaches, and/or post-fire, climate-forward forest recovery and resilience research.</p>	<p>Downing, WM, Dunn, CJ, Thompson, MP, Caggiano, MD, Short, KC (2022). Human ignitions on private lands drive USFS cross-boundary wildfire transmission and community impacts in the western US. <i>Scientific Reports</i> 12, 2624. https://doi.org/10.1038/s41598-022-06002-3</p> <p>Rhoades, C.C, Fegel, T.E, Hubbard, R.M, Chambers, M.E. 2022. Limited seed viability in long-dead serotinous lodgepole pine trees: Implications for post-fire tree regeneration after bark beetle infestations. <i>Forest Ecology and Management</i>. https://doi.org/10.1016/j.foreco.2022.120565</p> <p>Crausbay, S. D., Sofaer, H. R., Cravens, A. E., Chaffin, B. C., Clifford, K. R., Gross, J. E., Knapp, C.N., Lawrence, D.J., Magness, D.R., Miller-Rushing, A.J., Schuurman, G.W., & Stevens-Rumann, C. S. (2022). A science agenda to inform natural resource management decisions in an era of ecological transformation. <i>BioScience</i>, 72(1), 71-90. https://doi.org/10.1093/biosci/biab102</p>

<p>2.6 Convene and report on between 4-6 webinars, presentations, or peer to peer learning events documenting and distributing monitoring methods, results, and adaptive management processes to research colleagues or multi-stakeholder forest landscape management initiatives focused on forest health, wildfire risk mitigation, and/or post-fire watershed risk reduction and forest recovery and resilience.</p>	<p>Huayhuaca, C. (2021, Nov. 5). Defining Collaboration: insights from the Atlas of Collaborative Conservation in Colorado. Invited presentation for US Fish and Wildlife Service Science Applications Community of Practice, virtual.</p> <p>February 15th, 2022, Tyler Beeton delivered a virtual presentation on the CFLRP collaborative resilience survey framework to the SW collaborative support network of facilitators and collaboration community of practice partners working in the Southwestern US.</p> <p>Andrew Slack delivered an oral presentation: Forest restoration and ecological monitoring at Beaver Ranch Park: A case study of collaborative adaptive management in the Upper South Platte Watershed. High Altitude Revegetation Committee and Society for Ecological Restoration Rocky Mountains Chapter annual conference. April 12-14th, 2022. Fort Collins, Colorado. https://sites.warnercnr.colostate.edu/restoration-conference/wp-content/uploads/sites/123/2022/04/PDF-Program_HAR-SER_2022-April-12-FINAL.pdf</p> <p>May 4th, 2022, Tyler Beeton virtually presented survey results to the Northern Blues All-Lands Partnership and led a collaborative discussion on findings and next steps with the group based in Eastern Oregon.</p> <p>May 12th, 2022, convened, facilitated, and delivered information for the annual peer learning monitoring JAM session meeting in the Upper South Platte Partnership. The workshop was conducted virtually, meeting recording: https://drive.google.com/file/d/1aQySoqdRSuAiPWj8UenSPaZGp6TuMiXn/view?usp=drive_link</p> <p>The agenda included:</p> <ul style="list-style-type: none"> - Using the RAD Framework for planning during times of rapid climate change. Shelley Crausby, Senior Scientist for Conservation Science Partners, and Consortium Partner for the North Central Climate Adaptation Science Center - Using parcel-level rapid wildfire risk assessments to work toward fire adapted communities. James Meldrum, Research Economist, U.S. Geological Survey (USGS) Fort Collins Science Center. - Cultivating collaborative resilience and durability to changing social and environmental conditions – Insights from the first 10 years of the Collaborative Forest Landscape Restoration Program (CFLRP). Tyler Beeton, Research Associate, Colorado Forest Restoration Institute, Collaborative Decision-Support Program Manager. - JCOS Forest Health Plan: Using GIS products from the RADS prioritization. Steve Murdock, Natural Resources Team Lead, Jefferson County Open Space - Denver Water and US Forest Service spent over \$60 million to protect Denver’s water supply. Did it work? Kelly Jones, Associate Professor of Ecological Economics, Colorado State University, and Brett Wolk, Assistant Director, Colorado Forest Restoration Institute.
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Project 3. Monitor and evaluate outcomes of cross-boundary collaborative forest landscape restoration, wildfire risk reduction, and climate adaptation programs and projects.

3.1 Support the collection, data management, analysis, and reporting for monitoring data for between 3-5 forest restoration or fuel treatment projects, with specific emphasis on:

- a. Monitoring the effectiveness of mechanical and/or prescribed fire forest treatments on desired outcomes and conditions;
- b. Conducting project to landscape scale remote sensing analysis to produce outcome measures of the resilience of forest conditions to potential large fires and climate change;
- c. Developing more robust cost-benefit analyses to compare treatment costs with a range of outcomes measures;
- d. Leveraging existing monitoring networks to collect longer term data that enhances knowledge of long-term post-treatment and post-fire forest conditions as the climate changes.

CFRI supported the collection, management, analysis, and reporting of forest vegetation and wildfire fuels monitoring data to examine longer term (e.g. 1-10 year) ecological trends following forest management on the following projects. Field data was collected at over 100 field based plots across 5 forest restoration and fuel reduction projects in 2022, in addition to remote sensing monitoring of changes in forest structure. This also includes the hiring, training, and mentoring of approximately 20 seasonal staff and undergraduate students in field monitoring protocols. Sites monitored in 2022 funded by this agreement included:

- Ben Delatour Scout Ranch forest restoration project to inform Northern Colorado Fireshed Collaborative place based collaborative partners.
- Heavens forest restoration and fuels reduction project in partnership with the Colorado State Forest Service and the Upper South Platte place based collaborative group.
- Resort Valley Ranch phase 2 and 3 in partnership with Jefferson Conservation District and the Upper South Platte place based collaborative group.
- Estes Valley forest restoration and fuels reduction project in partnership with RMRS and the Front Range Roundtable Landscape Restoration Team.

CFRI staff Katarina Warnick developed and applied dendrochronology and field based research methods for assessing lodgepole pine drought resilience in subalpine ecosystems in collaboration with RMRS colleagues Mike Battaglia and Wade Tinkham.

CFRI staff Andrew Slack developed and implemented dendrochronological monitoring methods examining tree growth and resin duct production for inferring individual tree response and climate resilience following forest management along the Colorado Front Range.

CFRI staff Marin Chambers collaborated with partners at The Nature Conservancy, USGS, and RMRS to develop experimental monitoring studies of tree seed sowing and seedling planting to inform reforestation management strategies in recent and old high intensity wildfires along the Colorado Front Range.

CFRI staff Marin Chambers and Camille Stevens-Rumann developed, implemented, and monitored initial results from a common garden tree planting study to examine tree species regeneration success across elevational, topographical, and fire severity gradients in northern Colorado. This was implemented in partnership with the Arapaho Roosevelt National Forest to inform reforestation strategies following wildfires in 2020.

CFRI staff Kate Weimer led field based monitoring data collection of post-fire vegetation development following wildfires in 2020 across northern Colorado and southern Wyoming as part of their graduate research program. This was implemented in partnership with the Arapaho Roosevelt National Forest to inform reforestation and other post-fire recovery efforts following wildfires in 2020.

Marin Chambers collaborated with partners at RMRS and CSU to support the oversight, field data collection, and data management for pre-treatment monitoring at the Adaptive Silviculture for Climate Change experimental site at State Forest State Park. Field crew time was paid on a separate agreement with RMRS, while funding in this agreement was leveraged to expand CFRI’s engagement and enhance monitoring data collection by supporting Chambers’ time leading the project.

<p>3.2 Document and report on 2-4 monitoring methods to make monitoring protocols more accessible and transparent for other organizations to apply and understand. This includes plot-based field monitoring, remote sensing landscape monitoring techniques, socio-economic monitoring approaches, and/or data management strategies.</p>	<p>CFRI continues development of a monitoring handbook to make the theory, approach, protocols, and integration into adaptive management frameworks for field based and remote sensing monitoring protocols more accessible to a wider audience. Effort will also be dedicated to improving documentation of data management frameworks and strategies for collaborative monitoring efforts.</p> <p>Published monitoring methods: Colorado Forest Restoration Institute (2022). 2022 Post-Wildfire Mothership Plot Protocol. CFRI-2205 https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/05/Post-Fire-Protocol-2022-2.pdf</p> <p>Kate Wiemer, Marin Chambers, and Camille Stevens-Rumann have led development and application of post fire vegetation monitoring methods after wildfires in northern Colorado. Examples of the monitoring methods were documented and reported to make more accessible through professional conferences and workshops with cross-boundary partners.</p> <ul style="list-style-type: none"> • Delivered poster presentations at the virtual 9th International Fire Ecology and Management Congress, Nov 30 Dec 3, 2021. <ul style="list-style-type: none"> - Chambers, M.E., Barrett, K.J., Stevens-Rumann, C.S., Weimer, K. 2020 Colorado wildfires: tree germination 1-year post-fire. https://cfri.colostate.edu/wp-content/uploads/sites/22/2023/01/2021_Chambers_AFE_poster.pdf - Weimer, K., Stevens-Rumann, C.S., Chambers, M.E. Understory vegetation recovery following wildfire in the Southern Rocky Mountains. https://cfri.colostate.edu/wp-content/uploads/sites/22/2023/01/40_Weimer.pdf • Delivered poster presentations at the High Altitude Revegetation Committee and Society for Ecological Restoration Rocky Mountains Chapter annual conference. April 12-14th, 2022. Fort Collins, Colorado. <ul style="list-style-type: none"> - “Tree germination 1-year post-fire”. Marin Chambers, Kevin Barrett, Camille Stevens-Rumann, Kate Weimer. - Understory vegetation recovery following wildfire in the Southern Rocky Mountains. Kate Weimer, Camille Stevens-Rumann, Marin Chambers. • Delivered poster presentation at the North American Forest Ecology Workshop, held virtually June 20-23, 2022. <ul style="list-style-type: none"> - Chambers, M., Barrett, K., Stevens-Rumann, C., Weimer, K. “Colorado wildfires: tree germination 1-year post-fire.”
<p>3.3 Complete 2-4 technical reports summarizing monitoring results regarding the effect of forest vegetation treatment on achieving desired forest resilience goals, fuel treatment interactions with wildfires, post-fire forest and watershed recovery, and socio-economic aspects of forest restoration and wildfire risk reduction actions.</p>	<p>Hunter, T, Rhea, A, Morici, K. (2022). Pole Hill Monitoring Report. CFRI-2211. https://cfri.colostate.edu/wp-content/uploads/sites/22/2022/08/Hunter_Rhea_Morici_2022_PoleHillMonitoringReport_CFRI_2211.pdf</p> <p>Chambers, M. E., Fornwalt, P. J., Malone, S. L., & Battaglia, M. A. (2022). Corrigendum to “Patterns of conifer regeneration following high severity wildfire in ponderosa pine–dominated forests of the Colorado Front Range”[For. Ecol. Manage. 378 (2016) 57–67]. <i>Forest Ecology and Management</i>, 507, 119971. https://doi.org/10.1016/j.foreco.2021.119971</p> <p>Coop, D., Jonathan, Parks, A., Sean., Stevens-Rumann, S., Camille, Ritter, M., Scott, Hoffman, M., Chad (2022). Extreme fire spread events and area burned under recent and future climate in the western USA. <i>Global Ecology and Biogeography</i>. https://doi.org/10.1111/geb.13496</p>

	<p>Gelles, R. V., Davis, T. S., & Stevens-Rumann, C. S. (2022). Wildfire and forest thinning shift floral resources and nesting substrates to impact native bee biodiversity in ponderosa pine forests of the Colorado Front Range. <i>Forest Ecology and Management</i>, 510, 120087. https://doi.org/10.1016/j.foreco.2022.120087</p>
<p>3.4 Provide between 2-4 technical assistance and training modules to build capacity for monitoring data collection, analysis, and/or application of results for assessing monitoring data trends for the Colorado State Forest Service and 1-3 additional support organizations or forest, fire, or watershed collaborative groups.</p>	<p>CFRI staff engaged in multiple meetings and technical training with Ethan Bucholz, CSFS Forest Monitoring Program Manager. CFRI trained Ethan in frameworks and applications of CFRI remote sensing monitoring techniques for assessing changes in forest density and arrangement, and explored how CSFS will use the tools to monitor project outcomes and meet CSFS grant program reporting requirements.</p> <p>CFRI staff Andrew Slack and others worked with the Boulder Valley Longmont Conservation District and Natural Resources Conservation Service to develop inventory and monitoring protocols that supports creating efficient and robust forest management plans on private lands in the Saint Vrain watershed.</p> <p>CFRI leveraged this agreement to augment funds generously provided by the Gunnison, Uncompahgre, and Grand Mesa National Forest to deliver training and supervision for the Uncompahgre Plateau Forestry Internship Program. The FIP program develops opportunities for local high school students and teachers to participate in forest restoration monitoring opportunities as members of the Uncompahgre Plateau Collaborative Forest Landscape Restoration Program. In 2022, 3 students and 1 teacher were trained and worked for multiple weeks collecting monitoring data.</p>
<p>Project 4. Climate-forward decision support for post-fire recovery and restoration.</p>	
<p>4.1 Based on post-fire needs assessment activities in FY20 work plan, develop, deploy, and report on pilot decision support methodology to inform operational, climate-forward reforestation strategies.</p>	<p>Based on the needs assessment, CFRI staff Marin Chambers and Camille Stevens-Rumann helped partners develop and led the application of the Southern Rockies Reforestation Tool with partners to inform post-fire reforestation opportunities. The decision support tool helps consider tradeoffs of operational constraints with ecological considerations under current and future climates to inform reforestation policy and management strategies.</p> <p>Rodman, K.C., Davis, K.T., Chambers, M.E., Chapman, T.E., Fornwalt, P.J., Hart, S.J., Marshall, L.A.E., Rhoades, C.C., Schloegel, C.A., Stevens-Rumann, C.R., and Veblen, T.T. (2022). <i>The Historic 2020 Fire Year in northern Colorado and southern Wyoming: A Landscape Assessment to Inform Post-Fire Forest Management</i>. Published by Southwest Ecological Restoration Institutes. https://cfri.colostate.edu/wp-content/uploads/sites/22/2023/01/NFR_2020Fires_Report.pdf</p>
<p>4.2 Co-convene, facilitate, and report on between 2-4 field workshops involving forest and watershed managers, and interested and affected stakeholders, to examine post-fire reforestation successes and failures, and strategies for climate-forward post-fire forest recovery.</p>	<p>In partnership with Leslie Jones, USDA-NRE Senior Fellow for Conservation, CFRI staff Marin Chambers co-convened, co-planned, and facilitated the <i>Reforestation Summit: Identifying Barriers and Solutions</i>, on June 21, 2022. The summit was held hybrid and in-person at the Hall of States in Washington, DC, to inform the USDA national reforestation strategy. Other co-hosts included the National Association of State Foresters, American Forests, Forest Stewards Guild, and the USDA Forest Service. Over 50 participants from across the country participated to identify shared strategies to address persistent challenges with reforestation by bringing together a diverse set of experts to focus not on <i>why</i> to reforest, but <i>how</i> to overcome systemic barriers. CFRI staff Marin Chambers led convening, planning, and facilitating the event, Ch’aska Huayhuaca traveled to Washington DC to support facilitation and coordination of in-person attendees, and Brooke Simmons documented outcomes in meeting notes. Final agenda: https://cfri.box.com/s/ek94sgdaxnjqzkyl06z65o3mkae0a3u7 Participant list: https://cfri.box.com/s/wcsogewd0wt90mlethllci2g7bctxzv</p>

	<p>Delivered presentation and shared lessons learned at the <i>Wildfire Workshop Series: Post-fire restoration and resilience</i>, hosted by The Nature Conservancy and Aspen Institute in Boulder, Colorado, April 27, 2022. Marin Chambers shared insights with the group from “Post-fire tree regeneration and reforestation workshop summary” to examine post-fire reforestation and climate forward forest management strategies. This was a summary presentation of the workshop that Chambers and RMRS scientist Chuck Rhoades developed and facilitated in April 2021.</p> <p>August 5th, 2022, CFRI staff Allie Rhea, Brett Wolk, and Brooke Simmons provided transportation and supported convening and planning for a field workshop in the Cameron Peak fire with the Watershed Wildfire Protection Group to observe and discuss reforestation and watershed success and failures, including reforestation and outcomes of aerial mulching for watershed protection. Tour Summary here: https://www.southernrockiesfirescience.org/event/watershed-wildfire-protection-group-field-trip-aerial-mulching/</p>
<p>4.3 Develop, deploy, and report on post-fire erosion risk analysis and priority investment decision support methods for watershed values-at-risk for between 2-4 catchment areas.</p>	<p>CFRI staff Allie Rhea developed mapping and prioritization planning tools to inform post-fire watershed protection strategies following several large wildfires in 2020. In 2022 we continued deploying these tools with partners to inform post-fire watershed protections strategies, and began monitoring outcomes where emergency watershed protection actions intersect with reforestation activities. This occurred over the following burned landscapes and watersheds:</p> <ul style="list-style-type: none"> - Cameron Peak fire in Cache le Poudre watershed - East Troublesome fire in Grand Lake watershed - Cal-Wood fire in the Saint Vrain watershed <p>In 2022, CFRI staff Allie Rhea conducted technical analysis to quantify aerial mulching effectiveness conducted during 2021 and 2022 within the Cameron Peak fire to support local partners reporting to the Colorado Water Conservation Board. This included revisiting and re-analyzing post-fire sediment yield reductions using new data in order to facilitate risk-reward tradeoffs and adaptive management conversations about watershed recovery strategies with cross boundary federal and non-federal partners.</p> <p>CFRI staff sustained engagement in 2022 with the Colorado Water Conservation Board to inform their Wildfire Ready Watersheds risk analysis and prioritization tools. This involved serving as a technical advisor to inform development of their risk assessment, and being a resource for watershed partners around Colorado to help them understand how the new Wildfire Ready Watersheds assessment can be applied in their local context.</p>
<p>Project 5: Translate science principles into practice.</p>	
<p>5.1 Co-convene, facilitate, and report on between 6 – 10 science delivery products (i.e., fact sheets, technical briefs) spanning high-demand topic areas identified by affected entities, including, but not limited:</p> <p>a. Practitioner-focused lessons learned for restoring Ponderosa pine and dry mixed-conifer forests in the Southwest and Colorado Front Range, based on RMRS-GTR-310 and RMRS-GTR-373, respectively.</p>	<p>Developed a Colorado Forest Restoration Institute Demystifying Data Podcast, and created a first episode: “Inside the Forest to Faucets Partnership.” Published January 19th, 2022. https://podcasters.spotify.com/pod/show/cfri</p> <p>Developed graphical brief and video explaining outcomes of a field workshop that explains how decision support tools helped to inform post fire reforestation and watershed protection strategies following the Cameron Peak wildfire. Summary and video link: https://www.southernrockiesfirescience.org/event/watershed-wildfire-protection-group-field-trip-aerial-mulching/</p> <p>Produced briefing paper: Beeton, T., Snitker, A., Colavito, M., Collaboration Indicator: Summary of findings for the Northern Blues All-Lands Restoration Partnership. October, 2022: Southwest Ecological Restoration Institutes. https://cfri.box.com/s/5uok60e2nvsujkewgrnkchkxzw6mv8n</p>

<p>b. Lessons learned from applications of risk assessment decision support methodologies to prioritize forest restoration and wildfire risk management actions at multiple scales, from Community Wildfire Protection Plans to large watersheds encompassing multiple ownerships and jurisdictions to regional or national programs.</p> <p>c. Lessons learned from applications of the Potential Operational Delineations (PODs) framework to advance pre-fire fuel treatment planning and cross-boundary wildfire response.</p> <p>d. Methods and best practices to enhance collaborative resilience for cross-boundary shared stewardship of high-priority landscapes.</p> <p>e. Operationalizing climate change decision support tools to inform forest landscape planning and wildfire risk assessments.</p>	<p>Helped convene, write, and publish a two-part blog post for the Northern Colorado Fireshed Collaborative describing collaborative efforts that facilitated prescribed burning on the Colorado Front Range to make monitoring results and collaborative processes more accessible to a wider audience.</p> <p>Collaboration Supports Prescribed Burning on the Colorado Front Range – Part 1. <i>by Daniel Bowker, Forest & Fire Project Manager, Coalition for the Poudre River Watershed.</i> CFRI provided photos and editorial comments on the blog. https://nocofireshed.org/collaboration-supports-prescribed-burning/</p> <p>Collaboration Supports Prescribed Burning on the Colorado Front Range – Part 2 <i>by Hannah Brown, Science Communication Specialist, Colorado Forest Restoration Institute.</i> https://nocofireshed.org/collaboration-supports-prescribed-burning-on-the-colorado-front-range-part2/</p> <p>Work continued with partners at RMRS Science Application and Communication developing written products to synthesize lessons learned from communication and outreach efforts around the publication of RMRS-GTR-373 Principles and Practices for the restoration of ponderosa pine and dry mixed-conifer forests of the Colorado Front Range. This included producing an initial translation of an RMRS-GTR-373 briefing paper, and collaborating with RMRS on the publication of a Science You Can Use translated in Spanish (July, 2022).</p> <p>Construyendo resiliencia en los bosques de la Cordillera frontal de Colorado para el future. Ciencia que puede usar, USDA Forest Service, Rocky Mountain Research Station. Julio, 2022. https://www.fs.usda.gov/rm/pubs_journals/rmrs/sycu/2018/sycu5_2018_07_construyendo_resiliencia.pdf</p> <p>Ch’aska Huayhuaca-Frye wrote a summary of the exercise she facilitated “Stepping Through Stages of Readiness: Moving from Collaborative Planning to Implementation” at the Colorado Forest Collaboratives Summit, October 27th, 2022, in Frisco, Colorado. The briefing paper on the activity served to facilitate broader learning how others could apply the stages of readiness framework in their own context, and was distributed through the Colorado Forest Collaboratives Network. Final workshop summary: https://collaborativeconservation.org/wp-content/uploads/2023/01/Summary-of-2022-Annual-Forest-Collaboratives-Summit.pdf</p>
<p>5.2 Develop, maintain and regularly update CFRI online platforms and social media to communicate latest science applications that produced outcomes from forest restoration and wildfire risk management projects and programs.</p>	<p>CFRI staff developed a new organization and search function on the CFRI Publications webpage to make our publications easier to find and more accessible to a wider audience. We also improved organization and updated graphics and information on the About CFRI webpage to make it easier to understand who we are and what our impact is.</p> <p>CFRI staff continued growing social media strategies and coordinated stories to deliver relevant information that informs forest restoration and wildfire risk reduction projects and programs. This includes maintaining platforms across Twitter, Facebook, and Instagram.</p>

<p>5.3 Synchronize science application and communication events with other SWERIs, Fire Science Exchange Networks, RMRS, and other research entities that feature between 2-4 case studies of ways in which managers and their stakeholders actually used scientific results and decision support methodologies to produce measurable outcomes. These may include, but not limited to: webinars, story maps, or multi-media expositions.</p>	<p>Forests, Fires, and People: The Marshall Fire Tragedy and the Changing Wildland Urban Interface. This special bonus episode of Forests, Fires, and People is presented by the Institute for Science & Policy at the Denver Museum of Nature & Science and the Center for Collaborative Conservation, with support from Gates Family Foundation and in partnership with the Colorado Forest Restoration Institute, the Southern Rockies Fire Science Network, the Colorado State Forest Service, and the Climate Adaptation Partnership. February 16th, 2022. https://institute.dmns.org/perspectives/series/forests-fires-and-people/</p> <p>Developed ESRI Storymap with SWERI partners to help operationalize post fire reforestation strategies in northern Colorado and southern Wyoming. Kohn, M., Rodman, K.C., Chambers, M.E. (2022). Natural forest recruitment probabilities for five 2020 Colorado/Wyoming wildfires. https://storymaps.arcgis.com/stories/37a45c47b37b4cd18dcd9ad831a49094</p> <p>Helped delivered presentation for webinar co-hosted with SWERI and RMRS Science for Managers Webinar Series: Too Much, Too Little, or Just Right? Forest regeneration in fire-adapted landscapes. Camille Stevens-Rumann delivered presentation: Natural tree regeneration in a changing climate. May 5th, 2022. https://vimeo.com/706996892</p>
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6. Collaborative capacity-building and peer-learning across diverse perspectives

<p>6.1 Conduct, convene, organize, and report on between 8-10 site visits, peer to peer learning events, webinars, or workshops that bring together research scientists from RMRS, other federal agencies, and universities with participants of place-based forest collaboratives to transfer knowledge about, and assist in the development of, science-based methods for collaborative planning, assessment, monitoring, and adaptive management.</p>	<p>Camille Stevens-Rumann delivered an invited keynote talk titled Fungi through the flames: understanding fungi response to fire. Telluride Mushroom Festival, August 2021, Telluride, Colorado.</p> <p>Camille Stevens-Rumann delivered a talk with co-authors Jonathan Coop (Western State University), Sean Parks (USFS Rocky Mountain Research Station), and Susan Pritchard (U. Washington) titled: Wildfire-driven conversion and metrics for regeneration failure. Ecological Society of America conference, August 6th, 2021.</p> <p>Camille Stevens-Rumann delivered an invited talk titled “Quantifying forest resilience in an era of change.” Biology Department Fall Seminar, University of New Mexico, September 2021.</p> <p>Ch’aska Huayhuaca coordinated roundtable presentations and moderated a panel discussion with collaborative partners from Fire Adapted Colorado, NRCS, The Nature Conservancy, and Mountain Studies Institute titled: Community Capacity for Collaboratives. Western Governors' Association: Working Lands, Working Communities Workshop, Denver, CO, United States. Oct. 7, 2021.</p> <p>Camille Stevens-Rumann participated as panelist on the Colorado State University Climate Adaptation Partnership Panel discussion, open to the public, titled: Fire Climate Adaptation Challenges. October 2021, Fort Collins, Colorado.</p> <p>Convened and led the first post-COVID Firelab peer learning session August 10th, 2022, in Fort Collins, Colorado. The CFRI Firelab peer learning series is an informal group that meets once a month for fun and learning about wildland fire and forestry. Our goal is to bring together professors, students, professionals, and agency personnel from CSU and the local community to discuss current fire and forestry topics. One Firelab was held in 2022, with plans to host more regularly occurring meetings in 2023.</p> <ul style="list-style-type: none"> - August 10th, 2022. Mike Caggiano led a discussion: Northern Colorado Fireshed Risk Assessment & Colorado POD Atlas: Covering 2 Examples of Spatial Decision Support
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	<p>Delivered oral presentation at the virtual 9th International Fire Ecology and Management Congress, Nov 30 – Dec 3, 2021. Stephanie Mueller: Fire-weather Drivers of Severity and Spread: Learning from Past Fire Patterns to Inform Future Wildfire Decision Making.</p> <p>Delivered oral presentation at the virtual 9th International Fire Ecology and Management Congress, Nov 30 – Dec 3, 2021. Scott Ritter. Restoration and fuel hazard reduction treatments result in equivalent reductions in potential crown fire behavior in dry conifer forests.</p> <p>CFRI provided mentorship and support to help establish the Colorado Forest Collaboratives Network. This involved helping plan and attend several regional forums to determine the networks next steps and development. CFRI staff Brett Wolk and Ch’aska Huayhuaca-Frye helped convene, plan, facilitate, and delivered presentations at the Colorado Forest Collaboratives Summit, October 27th, 2022, Frisco, Colorado, attended by over 30 collaborative leaders and partners from across Colorado.</p>
<p>6.2 Conduct a needs assessment that examines the capacities, constraints, and opportunities for CFRI to implement an internship program focused on building collaborative capacity, enhancing peer to peer learning, and/or providing workforce training for traditionally underrepresented populations in forestry and fire collaborative adaptive management processes.</p>	<p>An initial, informal assessment of CFRI capacity identified a need for additional CFRI staff education and shared understanding of diversity, equity, and inclusion principles in order to effectively develop a program to better serve outside partners. In the fall of 2021, CFRI worked with experts from the CSU Warner College of Natural Resources office of Diversity and Inclusion to host a workshop for CFRI staff to develop a shared understanding of Diversity, Equity, and Inclusion amongst staff. Following the workshop, a CFRI team was formed around Diversity, Equity, Inclusion, and Social Justice to increase understanding and practice of DEI principles within CFRI and carry out a needs assessment of capacities, constraints, and opportunities for CFRI to better incorporate traditionally underrepresented populations and individuals in forestry and fire research and collaborative adaptive management.</p> <p>CFRI conducted a series of staff trainings in 2022 to enhance CFRI staff ability to incorporate diverse perspectives into our work and develop partnership opportunity with traditionally underrepresented populations in forestry and fire professions. This included a 3 day all-staff strategic planning workshop March 7th- 10th, 2022, to explore our focal areas of expertise and organizational partnerships. CFRI also implemented a series of Clifton Strengths and Emergenetics trainings to develop more self-awareness of our own identities and develop tools for us to better communicate how we interact with each other and our partners.</p>

For FY22 agreement number 22-DG-11030000-011, CFRI reports the following cumulative accomplishments toward each project deliverables in the work plan for dates while the agreement was active, including August 31st, 2022 through December 31st, 2022:

Deliverable	Status of Deliverables
Focal Area 1. Develop and deploy risk-based, outcomes-focused decision support frameworks for restoring forest landscape resilience and co-managing wildfire risk in the face of a changing climate	
1.1 Collaborate and coordinate with affected entities to advise, customize, apply, update and report on RADS frameworks that inform cross-boundary assessment, planning, NEPA processes, and adaptive management on priority focal landscapes identified in federal-state Shared Stewardship strategies, NRCS strategic investments, State Forest Action Plans, US Forest Service focal investment areas, and other landscapes targeted for investments by collaborative partnerships.	CFRI staff Andrew Slack and Stephanie Mueller continued to lead an application of the Risk Assessment and Decision Support framework with a cross boundary collaborative group to inform the Lower North South Vegetation Management Project, which is a large conditions based pre-NEPA planning process with the South Platte Range District on the Pike National Forest. This involved semi-monthly meetings, extensive spatial analysis, development of communication tools such as sharing data via ArcGIS Online mapping tools, and other activities to support cross boundary partners making informed decisions about the best bang for the buck to implement forest management activities.
1.2 Collaborate and coordinate with affected entities in landscapes <u>not identified</u> in priority focal area lists to advise, customize inputs to, apply, update and report on RADS frameworks to inform cross-boundary assessment, planning, NEPA processes, and adaptive management to restore/enhance forest resilience and reduce wildfire risks.	In Progress.
1.3 Collaborate and coordinate with RO-Fuels, RMRS and WO-FAM and other partners to refine and adapt risk analysis decision support analytical tools and data products based on updated local conditions and locally-relevant knowledge.	In Progress.
1.4 Collaborate and coordinate with researchers and science delivery specialists at CSU and other academic institutions, Forest Service R&D, the USDA Climate Hub, USDI Climate Adaptation Science Centers and other climate change experts to identify opportunities for integrating climate vulnerability decision support frameworks, tools, and data products with risk analysis decision support frameworks and tools.	In Progress.

<p>1.5 Develop and publish written products, and deliver oral presentations at professional meetings, peer-learning events, academic-oriented conferences, and policy-maker briefings to report on strategies, capacities, and best practices regarding the use and effectiveness of science- and risk-based methodologies, approaches, and planning processes being used in collaborative forest restoration, resilience and risk mitigation approaches across the Interior West.</p>	<p>In Progress.</p>
<p>Focal Area 2. Enhance collaborative readiness, resilience, and adaptive management</p>	
<p>2.1 Collaborate and coordinate with affected entities to co-design, deploy and adapt strategies to monitor, assess and report on factors affecting the readiness, effectiveness, resilience and adaptiveness of multi-stakeholder collaborative processes associated with forest restoration, resilience and wildfire risk mitigation. Potential projects may include, but are not limited to:</p> <ul style="list-style-type: none"> • Collaborative Forest Landscape Restoration Program “2.0” re-authorization selections in R2, R3 and elsewhere • Firesheds identified in the National Fireshed Registry • Community Wildfire Protection Planning groups 	<p>CFRI staff participate in regular meetings of the Southwest Colorado and Rio Chama CFLRP programs to inform monitoring and adaptive management strategies, as well as assess and apply collaborative governance strategies to improve collaborative resilience.</p> <p>CFRI staff continue coordinating with national CFLR Program Managers to conduct an assessment of collaborative resilience across all currently funded CFLRP projects across the country. This will establish baseline data that can be used to inform long term trends for re-authorized and new CFLR multi-stakeholder collaborative projects.</p>
<p>2.2 Collaborate and coordinate with affected entities to co-design, deploy and adapt strategies to monitor, assess and report on social and economic outcomes of multi-stakeholder collaborative activities associated with forest restoration, resilience and wildfire risk mitigation.</p>	<p>In Progress.</p>
<p>2.3 Based on monitoring and assessment results, collaborate and coordinate with affected entities to co-develop, deploy, and report on training, mentoring, and peer-learning methodologies and events that enhance the readiness, resilience and adaptiveness of multi-stakeholder forest and wildfire risk mitigation collaboratives across broader geographies, including areas traditionally under-served or overlooked in national and state focal priority area lists.</p>	<p>In Progress.</p>

<p>2.4 Develop and publish written products, and deliver oral presentations at professional meetings, peer-learning events, academic-oriented conferences, and policy-maker briefings to report on strategies, capacities, and best practices regarding strategies, capacities, and techniques to enhance the readiness, resilience and adaptiveness of multi-stakeholder forest and wildfire risk mitigation collaboratives to inform collaborative capacity-building investment strategies.</p>	<p>In Progress.</p>
<p>Focal Area 3. Measure biophysical outcomes of forest, wildfire, and climate adaptation projects and programs</p>	
<p>3.1 Collaborate and coordinate with affected entities, other SWERI, other university researchers, and Forest Service R&D to develop, deploy, and adapt monitoring strategies, and report on monitoring outcomes that measure the biophysical outcomes pre- and post-fire treatments across spatial and temporal scales relative to collaboratively-defined desired conditions and outcomes. Outcomes may include, but are not limited to:</p> <ul style="list-style-type: none"> - Changes in fire metrics - Post-fire forest recovery - Woody biomass volume from mechanical treatments - Effects on wildlife (i.e., pollinators) - Interactions with outdoor recreation uses 	<p>In Progress.</p>
<p>3.2 Collaborate and coordinate with affected entities (i.e., other SWERI, and researchers with Forest Service R&D and other institutions to develop, deploy, adapt, and report on training, peer-learning and technical assistance resources (i.e., protocols, field guides, desk guides, short-courses) aimed at building and enhancing the capacity of agencies, organizations and collaboratives to monitor and measure the ecological, economic and social effects of landscape restoration, resilience and wildfire risk mitigation investments on achieving collaboratively-defined desired conditions and outcomes.</p>	<p>In Progress.</p>

<p>3.3 Leverage and combine CFRI and SWERI monitoring data and outcomes measures with existing monitoring networks to draw stronger inferences and enhance knowledge of long-term post-treatment effects on forest conditions as the climate changes.</p>	<p>In Progress.</p>
<p>3.4 Collaborate and coordinate with affected entities, other SWERI, other university researchers, and Forest Service R&D to convene, facilitate and report on peer-learning and knowledge exchange workshops specifically focused on multi-scale (spatial and temporal) monitoring strategies, methods and data systems to ensure integration, utility and contributions towards adaptive management.</p>	<p>In Progress.</p>
<p>3.5 Develop and publish written products, and deliver oral presentations at professional meetings, peer-learning events, academic-oriented conferences, and policy-maker briefings to report on strategies, capacities, and best practices regarding monitoring treatment outcomes on achieving forest and wildfire risk mitigation ecological, economic and social objectives.</p>	<p>In Progress.</p>
<p>Focal Area 4. Develop and deploy outcomes-based and climate-forward decision support for post-fire recovery and restoration</p>	
<p>4.1 Collaborate and coordinate with affected entities, other SWERI, other university researchers, and Forest Service R&D to co-sponsor, co-convene and report out on workshops and symposia that bring together researchers and managers to share knowledge and lessons learned about post-fire reforestation and watershed recovery outcomes.</p>	<p>CFRI staff helped convene and plan a webinar workshop with Southern Rockies Fire Science Network, RMRS, SWERI, and CSU research staff. CFRI staff were co-authors on all four topics presented on the webinar, and Marin Chambers delivered one of the presentations during the workshop.</p> <ul style="list-style-type: none"> - Southern Rockies Fire Science Webinar Series - Rising from the Ashes; Post-fire regeneration strategies from recent Front Range fires (December 7, 2022). - Webinar agenda, recording and resources here: https://www.southernrockiesfirescience.org/event/rising-from-the-ashes-post-fire-regeneration-management-strategies-from-recent-front-range-fires/ - Recording: https://youtu.be/ew6ouMzs7-Q
<p>4.2 Collaborate and coordinate with affected entities, other SWERI, other university researchers, and Forest Service R&D to compile, synthesize, apply and report on current research findings on post-fire reforestation and watershed recovery trends in collaboration with on-the-ground managers.</p>	<p>In Progress.</p>

<p>4.3 Collaborate and coordinate with affected entities, other SWERI other university researchers, Forest Service R&D, and other entities with science expertise in this topic area to advise on, customize inputs to, and deploy site-specific decision support tools that can be used by, and useful for, local-level reforestation and watershed recovery program managers to assess “biggest-bang-for-the-buck”, optimal management actions.</p>	<p>In Progress.</p>
<p>4.4 Develop and publish written products, and deliver oral presentations at professional meetings, peer-learning events, academic-oriented conferences, and policy-maker briefings to report on strategies, best practices, and outcome measures regarding post-fire reforestation and watershed recovery.</p>	<p>In Progress.</p>
<p>Focal Area 5: Translate science principles into practice</p>	
<p>5.1 Collaborate and coordinate with the other SWERI, land and wildfire managers, regional and statewide boundary organizations and collaboration networks, RMRS and other science delivery entities to co-organize, convene and report on the SWERI workshop, “Cross-boundary Landscape Restoration and Resilience in the Southwest” and follow-up topic- or geography-specific workshops.</p>	<p>CFRI staff co-led planning for a Cross Boundary Landscape Restoration workshop scheduled for May 2nd-4th, 2023, at Colorado State University in Fort Collins, Colorado. CFRI staff are leading all logistical planning for the workshop, in addition to co-leading agenda development and other workshop aspects with cross boundary partners, including the other SWERI in Arizona and New Mexico, The USFS Rocky Mountain Research Station, Forest Stewards Guild, the National Cohesive Wildland Fire Management Strategy, National Forest Foundation, and Trees, Water, and People.</p>
<p>5.2 Develop and disseminate a range of media (i.e., video, podcasts, social media, Story Maps) and products (i.e., colorful graphics, photos guides) that distill the scientific and management complexities about forest restoration, resilience and wildfire risk mitigation in a changing climate targeted to general audiences. Topics may include, but are not limited to:</p> <ul style="list-style-type: none"> a. Basics of forest restoration, resilience and wildfire risk mitigation in the Southern Rocky Mountains and Interior West. b. Lessons learned from applications of risk assessment decision support methodologies to prioritize forest restoration and wildfire risk management actions at multiple scales, from Community Wildfire Protection Plans to large watersheds encompassing multiple ownerships 	<p>In Progress.</p>

<p>and jurisdictions to regional or national programs.</p> <ul style="list-style-type: none"> c. Lessons learned from applications of the Potential Operational Delineations (PODs) framework to advance pre-fire fuel treatment planning and cross-boundary wildfire response. d. Methods and best practices to enhance collaborative resilience for cross-boundary shared stewardship of high-priority landscapes. e. Operationalizing climate change decision support tools to inform forest landscape planning and wildfire risk assessments. 	
<p>5.3 Develop, maintain, and regularly update CFRI online platforms and social media to communicate latest science applications that produced outcomes from forest restoration and wildfire risk management projects and programs.</p>	<p>CFRI staff worked to improve organization and updated graphics and information on the CFRI Collaborations webpage.</p> <p>CFRI staff continued growing social media strategies and coordinated stories to deliver relevant information that informs forest restoration and wildfire risk reduction projects and programs. This includes maintaining platforms across Twitter, Facebook, and Instagram.</p>
<p>5.4 Synchronize science application and communication events with other SWERIs, Fire Science Exchange Networks, RMRS, and other research entities that feature ways in which managers and their stakeholders actually used scientific results and decision support methodologies to produce measurable outcomes. These may include, but not limited to: webinars, story maps, or multi-media expositions.</p>	<p>In Progress.</p>
<p>5.5 Translate science delivery and communication materials and multi-media expositions into languages other than English to increase accessibility to and audience for knowledge resources pertaining to forest restoration, resilience and wildfire risk mitigation.</p>	<p>In Progress.</p>
<p>5.6 Develop and publish written products, and deliver oral presentations at professional meetings, peer-learning events, academic-oriented conferences, and policy-maker briefings to report on lessons learned and best practices for translating science-based principles into practice for forest restoration, resilience and wildfire risk mitigation.</p>	<p>In Progress.</p>

Focal Area 6: Collaborative capacity-building and peer-learning across diverse perspectives	
6.1 Develop, sponsor, support and report on training, continuing education and leadership development in collaborative processes for CFRI staff	CFRI staff are planning a 3 day internal strategic planning workshop March 6 th -8 th , 2023, to develop clarity around focal areas of expertise, break down silos between staff and program areas, and discuss strategic partnerships.
6.2 Develop, sponsor, support and report on training, continuing education and peer-learning opportunities around collaboration principles and best practices for forest and wildfire managers, researchers, collaborative leaders and interested and affected stakeholders.	In Progress.
6.3 Develop, sponsor, support and report on outreach, internships and collaborative learning events involving individuals from under-represented populations in forest restoration, resilience and risk mitigation decision-making and management.	In Progress.



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