### **Outreach for a Forest Restoration Framework:**

Efforts, successes, and lessons learned during publication and communication of RMRS-GTR-373









### Colorado Forest Restoration Institute

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 facilitate collaborations between researchers, managers, and stakeholders to 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. Our work aims to reduce uncertainties and conflicts between managers and stakeholders, streamline planning processes, and enhance the effectiveness of forest and fire management actions. We strive to earn trust through being rigorous and objective in integrating currently-available scientific information into management decision-making through collaborative partnerships involving researchers, forest land managers, interested and affected stakeholders, and communities. The Colorado Forest Restoration Institute holds itself to high standards of scientific accuracy, and strives to promote transparency in the production and communication of science based information. Always carefully evaluate sources for rigor and appropriateness 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).

### Rocky Mountain Research Station

The Rocky Mountain Research Station is one of 7 Forest Service Research & Development units. Within the 12 state RMRS footprint, we maintain 14 research locations; conduct long-term ecological research on 14 experimental forests, ranges and watersheds; and work in hundreds of research natural areas. RMRS researchers work in a range of biological, physical and social science fields to promote sustainable management of the Nation's diverse forests and rangelands. The Station develops and delivers scientific knowledge and innovative technologies with a focus on informing policy and land-management decisions. Our researchers work in collaboration with a range of partners, including other agencies, academia, nonprofit groups, and industry. The Rocky Mountain Research Station serves the Forest Service as well as other federal and state agencies, international organizations, Tribes, academia, non-profit groups and the public. Research has been part of the Forest Service mission since the agency's inception in 1905. The Rocky Mountain Research Station (RMRS) is an integral component of USDA Forest Service Research and Development (R&D).

Publication date: October 2021

Cover photo credit: 2018 RMRS-GTR-373 Field Workshop, Karina Puikkonen

Editing and layout: Hannah Brown

Authors: Brown, Hannah LC1, Clark, Nehalem2, Kathie Mattor1

1. Colorado Forest Restoration Institute (CFRI), Department of Forest and Rangeland Stewardship, Colorado State University (CSU), Fort Collins,

2. USDA Forest Service Rocky Mountain Research Station (RMRS), Fort Collins, CO

**Document Development Statement:** This white paper focuses on communication and outreach efforts that surrounded the publication of RMRS-GTR-373, and relies on evaluations given to participants during outreach events. This paper is a companion piece to a larger effort still in preparation that evaluates the use of the GTR-373 restoration framework in forest restoration practice. The direction and concept for this pair of papers was developed by Kathie Mattor (CFRI & CSU faculty), in collaboration with Hannah Brown (CFRI), Nehalem Clark (Science Delivery Team, RMRS). Feedback from Tony Cheng and Brett Wolk (CFRI), and Jen Hayes (RMRS) improved this manuscript. This paper is intended to inform future outreach and science communication efforts by highlighting the outreach team's successes and lessons learned.

Funding: This report was funded by a Joint Venture Agreement 16-JV-11221631-139 between the USDA Forest Service Rocky Mountain Research Station and Colorado Forest Restoration Institute

Please use the following citation when referring to this paper:

Brown, HLC, Clark, N, Mattor, K(2021). Outreach for a Forest Restoration Framework: Summary of efforts, successes, and lessons learned during publication and communication of the GTR-373 restoration framework. CFRI-2109.

Colorado State University Colorado Forest Restoration Institute Department of Forest & Rangeland Stewardship Mail Delivery 1472 Colorado State University Fort Collins, Colorado 80523 (970) 491-4685 cfri.colostate.edu



Colorado State University is an Equal Opportunity/Affirmative Action Institution.

# Table of Contents

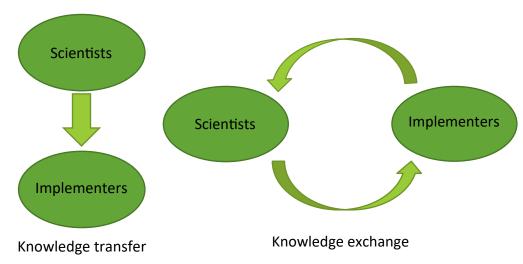
INTRODUCTION	01
KNOWLEDGE EXCHANGE VS. KNOWLEDGE TRANSFER	01
GTR-373 was developed using a "knowledge exchange" approach	02
THE GTR-373 KNOWLEDGE EXCHANGE PROCESS	03
Informal Outreach During Development	03
Formal Outreach During Development.	03
Field workshops are the gold standard for outreach	05
WE SURVEYED OUTREACH PARTICIPANTS TO EVALUATE OUTREACH EFFORTS	05
Crucial components of successful workshops:	08
Areas of improvement for future workshops:	09
Outreach Lessons Learned	09
REFERENCES	10
APPENDIX A: EVALUATION FORM FOR PRESENTATIONS	11
APPENDIX B: EVALUATION FORM FOR FIELD WORKSHOPS	12

### Introduction

Science communication and delivery seeks to bridge the gap between academic research and practice on the ground, and bring new science into the field to inform how forested lands are managed. Successful scientific outreach, and subsequent integration of new knowledge into land management, is a continuous, iterative process that can serve to improve communication and relationships across agencies and organizations for the long term. When successful, this exchange also informs and improves academic research capacity to better address pertinent management and policy practitioner needs. A key goal of science outreach is to improve outcomes on the ground. During the writing and publication of the forest restoration framework outlined in Rocky Mountain Research Station General Technical Report 373: Principles and Practices for the Restoration of Ponderosa Pine and Dry Mixed-Conifer Forests of the Colorado Front Range (Addington et al., 2018; hereafter GTR-373) a committed team of authors, land managers, and members of collaborative groups formed an outreach team to make sure that the anticipated report was relevant, applicable, and well circulated to on-theground forest restoration practitioners. This paper outlines the extensive development, publication, and outreach process that surrounded GTR-373, and presents lessons learned to enhance science communication strategies and outreach for similar publications and landscape restoration frameworks.

### Knowledge Exchange vs. Knowledge Transfer

The Colorado Front Range Forest Restoration Framework, herein referred to as GTR-373, was developed using a knowledge co-production model in which managers and scientists consistently exchanged ideas to ensure end products were useful for their intended audience (Figure 1). In a traditional "knowledge transfer" approach, scientists publish and then unidirectionally present information to potential users and practitioners. This approach assumes that a major barrier to the use of scientific information in decision-making and implementation is knowledge deficit (Simis et al., 2016). That is, that practitioners either don't have access to or don't understand the scientific information available (Davies, 2008; Besley et al., 2011). However, it generally is not effective to simply publish scientific papers and expect conclusions to be enacted in practice by the end user; in one study, Archie et al. found that "less than half of land managers and community officials consulted peer-reviewed journals on a regular basis" (2014). This is especially true in a land management context, where managers juggle multiple pressures and objectives, which may not be compatible (Biber, 2009). Other important factors managers consider—like budget constraints, political challenges, and stakeholder conflicts-impact how science is integrated (Archie, 2014). Managers also cite the need for scientific information at relevant spatial and temporal scales (Archie et al., 2014, Briske



"Knowledge networks should be designed for learning rather than knowing" (Feldman & Ingram, 2009)

Figure 1. Knowledge transfer vs. knowledge exchange models. Knowledge transfer models are uni-directional knowledge delivery models, while knowledge exchange models are multi-directional and iterative. Over time, knowledge exchange models create knowledge networks where participants learn together to improve practice.

et al., 2017). Spatial scales could be highly localized at the forest stand scale, or at the scale of a National Forest or watershed, while temporal scales could include planning for the upcoming year, or planning over the next 20 years to confront climate change. When new scientific information does not address management concerns at the scale of the decisions they are intended to inform, it is difficult to enact new practice based on the information.

In contrast to knowledge transfer, knowledge exchange is a multi-directional, iterative process in which scientists, managers, practitioners, and stakeholders are engaged in conversations about challenges, opportunities, and results (Kocher et al., 2012). Managers and practitioners are able to share their information needs with scientists, and scientists then have the opportunity to do research that is directly applicable to management concerns. Scientists might share preliminary results of monitoring data, or involve other stakeholders in data collection. Continuous co-production is important, as science is continually updated, and manager information needs change over time (Colavito et al., 2019). When scientists are empowered with information about what constraints, opportunities, and management decisions are being made on the ground, and managers have a sense of what scientists are working on even before it's published, groups can adaptively manage and collaborate more effectively.

### GTR-373 was developed using a "knowledge exchange" approach

When federal Collaborative Forest Landscape Restoration Program (CFLRP) funds were awarded to restore 34,000 acres of forests along the 1.5 million acre landscape of Colorado's Front Range, collaborative partners realized they needed to answer a very important question: what does forest restoration actually look like in Front Range forests? Other science-based forest restoration frameworks like RMRS-GTR-310: Restoring Composition and Structure in Southwestern Frequent-Fire Forests: A science-based framework for improving ecosystem resiliency (Reynolds et al., 2013) provided guidance for restoration in ponderosa and dry mixed-conifer forest types in other areas of the U.S., but managers on Front Range forests were seeking a science-based

framework that was locally relevant to Colorado's Front Range. They expressed the need for science related to Front Range historic reference conditions and forest structure, and supporting spatial data. The challenge presented an opportunity for all stakeholders to come together to co-develop forest management guidelines that would inform locally-specific ecological restoration practices, including reducing forest densities and fuels and enhancing spatial heterogeneity across scales, while retaining drought- and fire-tolerant species, old trees, and wildlife habitat.

Partners from over a dozen fields and organizations developed GTR-373, including The Nature Conservancy (TNC), Rocky Mountain Research Station (RMRS), US Forest Service, Natural Resource Conservation Service (NRCS), The Wilderness Society, and Colorado Forest Restoration Institute (CFRI). The process was designed from the beginning to be responsive to manager need, and ensure that information would be developed and presented at operationally useful scales. In the "knowledge exchange" model utilized in the GTR-373 process, scientists, managers, practitioners, and other stakeholders engaged in conversations about challenges, opportunities, and results. This process helped to build and expand relationships between GTR authors and managers, and resulted in a forest restoration framework co-authored by a diverse group of scientists and managers. Additionally, an extensive outreach program ensured that the framework was widely and effectively shared with stakeholders who had not been directly involved in the knowledge exchange process.

Collaborative groups of mixed science and manager participants like the Front Range Roundtable, Upper South Platte Partnership, and Front Range Collaborative Forest Landscape Restoration Program (CFLRP) were already in place, and these groups were critical to the co-production of GTR-373. Regular meetings of these groups provided sustained forums where both research-focused forest scientists and practitioners of that forest science continually stayed engaged with one another. Field trips and workshops hosted by these collaboratives also provided opportunities for authors and managers to discuss direct, place-based questions. Long-term collaborative

groups served as incubators for co-developing the restoration framework, provided opportunities for targeted outreach and implementation, and contributed vital funding. Long term collaborative groups are critical to developing and speeding adoption of new forest restoration science. When practitioners have had a hand in co-producing the science, it is more likely to be relevant to practitioner needs, and they are much more likely to trust it and adopt it quickly (Roux et al, 2006; Feldman & Ingram, 2009; Dilling & Lemos, 2011; Cook et al., 2013; Polk, 2015).

# The GTR-373 Knowledge Exchange Process

The GTR-373 knowledge exchange process started during document development, and continued with a dedicated outreach program after publication. Our outreach process was informed by learning from other forest restoration outreach efforts, informal connections among participants, and a more formal outreach strategy. For the most part, the informal outreach process can be defined as the steps the author team took during the writing of GTR-373 to incorporate perspectives outside the author team. The formal outreach was undertaken by a dedicated outreach team both before and after publication.

### Informal Outreach During Development

The informal outreach strategy relied on existing networks and interpersonal connections, and leveraged existing networks already in place from collaborative groups like the Front Range Roundtable, Upper South Platte Partnership, and CFLRP to gather feedback throughout the GTR-373 process and publicize the framework after publication. GTR-373 authors also did extensive outreach within their professional networks to gather and share information. As the restoration framework took shape during the development of the GTR, review sessions on drafts of the publication, updates, and field trips made information accessible to those beyond the immediate author team.

### Formal Outreach During Development

One example of the kind of interaction authors had with agency staff while writing GTR-373 were two workshops held in 2013 for staff from the Pike & San Isabel and Arapaho & Roosevelt National Forests to give feedback on an early GTR draft. These were well attended by more than 30 staff from each office and 3-5 authors at each workshop. The primary author gathered feedback and incorporated it directly into the next draft of the GTR. This kind of responsive outreach during the research and writing process for the report ensured relevancy of the information it ultimately contained, and built trust in the final product.

Within the CFLRP, there were meetings specifically designated to exchange results from monitoring on CFLRP projects called "Jam Sessions." Many of the concepts that became the GTR-373 framework were presented and discussed in these Jam Sessions. The Jam Sessions were important opportunities to share monitoring results from already-implemented forest treatments and give managers information that could be used to adapt restoration treatment approaches. For example, early monitoring results showing more remaining Douglas-fir than desired in some of the treatment areas prompted managers to increase Douglas-fir removal in future treatments. Over time, treatments were designed to remove more trees and reduce forest density overall, with later treatments on the Colorado Front Range reducing density more than earlier treatments (Barrett et al. 2021).

### Coordinated Outreach After Publication

A designated outreach team came together as publication of the report grew near. The core outreach team relied heavily on the expertise of the RMRS Science Delivery Team and Colorado State University/CFRI staff who worked closely with the GTR-373 author team to design and implement a consistent outreach strategy. The team included representatives from the RMRS Science Delivery Team, RMRS scientists, Colorado State University and CFRI, Rocky Mountain Tree-Ring Research, The Nature Conservancy, and Natural Resources Conservation Service. This broad range of participants allowed connections to be made with multiple audiences.

The outreach team's first task in the months preceding the publication of the GTR-373 restoration framework was to consider similar forest restoration frameworks from other regions to understand how they had been developed, and the outreach strategies their authors had used. Interviews with the authors of past frameworks, including the those for southwestern frequent fire forests (RMRS-GTR-310), dry forests in eastern Oregon (Franklin et al., 2013) and Sierra Nevada forests (PSW-GTR-237) identified that:

- 1. Though they are resource intensive in terms of time and cost, field workshops were the most effective way to share information.
- 2. Demonstration sites are key in helping people to visualize concepts in action. As Richard Reynolds, lead author of the Southwest ponderosa restoration framework (RMRS-GTR-310) author says, "A picture is worth a thousand words, but a demonstration site is worth a thousand pictures."
- 3. Agency leadership support is crucial to adoption of any scientific concepts.

Using past restoration framework outreach processes as a guide, the outreach team defined a clear goal and objectives:

**Goal:** The GTR-373 publication and/or the restoration framework should become a well-known reference and resource for managers to use to implement forest restoration projects and communicate the concepts synthesized within the report to decision makers, stakeholders, and the public.

### **Objectives:**

1. For public and private forest managers and partners to know the restoration framework is published and available.

- 2. Improve application and use of Front Range restoration framework concepts
- 3. Enhance dialogue about how GTR-373 restoration concepts can be integrated across forest planning & management efforts
- 4. Provide opportunities for academic researchers to continue interacting with and learning from users of their science

To reach managers in multiple agencies and organizations, the outreach team shared information about the GTR and its contents through the existing collaborative networks mentioned above, the Society of American Foresters Colorado/Wyoming chapter, the Southern Rockies Fire Science Network, the Central Rockies chapter of the Society for Ecological Restoration, and agency leadership listservs. The RMRS Science Delivery staff published and widely circulated two science briefs through their Science You Can Use publication series that summarized the main findings of GTR-373 (a detailed and a twopage summary). In subsequent interviews with intended end-users of the restoration framework, these Science You Can Use documents were both frequently highlighted as crucial products that managers used to understand the framework and communicate it to others.

Formal outreach also included multiple presentations to forest leadership and staff from the Pike & San Isabel and Arapaho & Roosevelt National Forests, the Rocky Mountain Region (R2) Leadership Team and more informal "pub talks" to wider interested audiences working in academia, forestry, fire, and restoration along Colorado's Front Range (Table 1). These efforts included discussion opportunities that were important for information exchange. The GTR-373 authors used common slides and presentation material so they would give unified messages

Table 1: Key GTR-373 Outreach Audiences	
US Forest Service Region 2 Office	Colorado State Forest Service
Front Range Collaborative Forest Landscape Restoration Program	Colorado State University Society of American Foresters student chapter
Staff and leadership of the Pike & San Isabel and Arapaho & Roosevelt National Forests	Community Groups: Forsythe Multiparty Monitoring Group, pub talks
Colorado Forest Restoration Institute's Fire Lab	Front Range Community College Natural Resources Program
Colorado/Wyoming Society of American Foresters Meeting	Society for Ecological Restoration Rocky Mountain Chapter
Colorado State University Forest and Rangeland Stewardship Department	

no matter which member(s) of the author team were giving the presentation. Rather than having one spokesperson, the author and outreach team focused on developing consistent themes that could be presented by many voices. These presentations carefully took their audiences into account; for example, the pub talks were much more informal and contained more pictures than the presentations to forest leadership. Some authors were more skilled in connecting with specific audiences—in choosing a speaker to give a particular presentation, the goal was to send the best author possible to speak to that specific audience.

# Field workshops are the gold standard for outreach

Based on the information the outreach team gathered from the authors of other restoration frameworks about the effectiveness of field workshops as knowledge-exchange mechanisms, the outreach team designed two field workshops that hosted over 150 forest management practitioners from a variety of organizations (Table 2). These workshops were extremely time and resource intensive; we estimate that around 1,000 employee hours between 4 staff were dedicated to logistical support work alone. However, these were crucial opportunities to connect with practitioners.

Table 2: Field workshop participant organizations						
Organization	Number of participants					
U.S. Forest Service	32					
Other Federal Agencies	11					
State Agencies	13					
Local Agencies	40					
Collaborative Groups	10					
Academia	25					
Non-Profit	13					
Industry/Consulting	10					
Other	16					
Total	161					

The guiding principles for these workshops were:

1. Host a wide range of participants and mix them up so they didn't spend all day talking to people they already knew.

- 2. Adopt a hands-on/interactive approach to integrate key concepts from GTR-373 associated with restoration planning, implementation, and monitoring.
- 3. Visit areas where these concepts had been implemented to tell the story "worth a thousand pictures."
- 4. GTR-373 authors and the outreach team would be present and heavily involved so that practitioners could connect with them and ask questions about the framework.

Offering two field workshops at north and south Front Range sites gave participants multiple opportunities to attend, and made information even more locally relevant, as there are differences between these two geographies. The North Field Workshop focused on the implementation of GTR concepts on private lands, while the South Field Workshop was focused on public lands. The curriculum highlighted specific topics in the GTR: environmental gradients, "forensic forestry," stand level monitoring, landscape level monitoring, turning desired conditions into prescriptions, and adaptive management. Each of these topics was turned into a place-based "station" through which workshop participants rotated.

# We surveyed outreach participants to evaluate outreach efforts

At presentations and workshops, the outreach team gave a standardized survey about the effectiveness of outreach efforts. This survey was given to federal, non-profit, and state employees, academics, and leadership, planners, and implementers at 5 presentations and 2 workshops between November 2017-November 2018. Surveys were administered at: a presentation given to the Pike & San Isabel National Forests' leadership team, 1 pub talk, a CFRI Fire Lab meeting, 2 seperate presentations given to staff at the Arapaho & Roosevelt National Forest, and at both field workshops (Figures 2 & 3). Questions on the evaluation form sought to assess whether the information about the restoration framework was useful in a management context, and whether the communication surrounding the framework was effective and appropriate (See Appendix A & B

Figure 2. Evaluation results from GTR-373 presentation-type outreach, n=64.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I learned something that will help me address my forest management information needs.	1	2	3 <b>3.</b> (	5 4	5
I learned something I can use immediately.	1	2	3 <b>3.</b> (	4	5
The information that was presented today is valuable.	1	2	3	4	<b>4.5</b> 5
I will share the information I learned about today with other people.	1	2	3	4.1	5
I plan to learn more about the information presented today by contacting the scientists involved.	1	2	3 <b>3.</b> (	5 4	5
I plan to review the research study that was presented today.	1	2	3	4 4.2	5
The Rocky Mountain Research Station has a positive effect on how science is distributed to natural resource managers.	1	2	3	4 <b>4</b> .	<b>4</b> 5
The way the material was presented today made it easy to understand.	1	2	3	4 <b>4.3</b>	5
I am interested in learning more about this topic through additional outreach opportunities.	1	2	3	4	5



Pub-talk environment where attendees learn about forest and fire ecology in a relaxed setting. Photo Credit: Brett Wolk

Figure 3. Evaluation results from GTR-373 field workshop-type outreach, n=69.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I learned something that will help me address my forest management information needs.	1	2	3	4 <b>4.4</b>	5
I learned something I can use immediately.	1	2	3	4.1	5
The information that was presented today is valuable.	1	2	3	4	<b>4.8</b> 5
I will share the information I learned about today with other people.	1	2	3	4	<b>4.7</b> 5
I plan to learn more about the information presented today by contacting the scientists involved.	1	2	3	4.1	5
I plan to review the research study that was presented today.	1	2	3	4 <b>4.4</b>	5
The Rocky Mountain Research Station has a positive effect on how science is distributed to natural resource managers.	1	2	3	4	<b>4.6</b> 5
The way the material was presented today made it easy to understand.	1	2	3	4 <b>4.3</b>	5
I am interested in learning more about this topic through additional outreach opportunities.	1	2	3	4 4	<b>1.5</b> 5



Participants learn about the GTR-373 restoration framework in a place-based, multi-site workshop. Photo Credit: Karina Puikkonen

for full evaluation forms). Overall, the presentation and field workshop evaluations were very positive, though there are a few key differences that speak to the strength of field workshops as knowledge exchange mechanisms compared to more traditional presentations. When averaged across surveys, every metric measured was rated either the same or more highly in the field workshop evaluations compared to the presentation evaluations. In both event formats, participants felt information was valuable, and they would be like to share it with others. They also indicated that they planned to review the information presented, and would be interested in additional learning opportunities. Participants felt that information was presented in a way that made it easy to understand in both presentations and field workshops.

There are key differences in the evaluation results from presentations compared to field workshops. After the workshops, participants were more likely to report that they learned something that would help them to address their forest management needs. They also reported more frequently that they learned something they would be able to use immediately. This speaks to the power of field-based and interactive learning opportunities for contextualizing the information in the restoration framework for use in the field. The evaluation results also suggest that after the field workshops, practitioners were better able to see how the concepts explained in GTR-373 could be applied to forest management in practice.

The GTR-373 restoration framework and outreach workshops especially were designed to honor manager need for information at locally-relevant scales. However, practitioners are still seeking information that is not just locally relevant, but also actionable. Common feedback in both workshop and presentation evaluations identified the need for more information about how these concepts could be applied to specific management areas, including how to design and implement prescriptions on the specific lands where managers are working.

Following field workshops, participants were more likely to report their interest in contacting scientists than after presentations. Because field workshops allow for face-to-face interactions and hands-on

perspective building, our results suggest workshops may support building long-term knowledge sharing better than presentations. Further, scientists and managers may feel more comfortable forming new working relationships after spending several hours in the field discussing concepts and engaging in conversation. The development of long-term communication networks over time is important for improving relationships and sharing scientific information, and local knowledge networks are a very important way for scientists and managers to determine what they need from one another (Seipen & Westrup, 2002; Feldman & Ingram, 2009; Dilling & Lemos, 2011).

# Crucial components of successful workshops:

- **Commitment** of the authors, field workshop station facilitators, and RMRS and CFRI funding and staff throughout the process. The authors of the report were committed to sharing their knowledge and experience at presentations and workshops, and reaching out to partners. Author involvement that does not end with the publication of the report has been a hallmark of other successful GTR outreach efforts.
- **Connecting** the concepts to the landscape. It was very important to select sites that could illustrate how the GTR-373 restoration framework could be used in practice. Scouting trips and dry runs gave presenters the opportunity to connect their curriculum to the landscape, and helped the outreach team avoid logistical pitfalls.
- Interactive field workshop stations provided detailed information in small group settings, and received specific, positive feedback in workshop participant evaluations.
- The workshops reached a wide range of participants from academia, the scientific community, private, state, and federal land managers at different levels, and from different agencies, non-profits, contractors, and others.

- Pre-Planning extensively with a team dedicated to coordination and logistics was absolutely crucial to making these events happen and run smoothly.
  - Our estimates are that approximately 1,000 employee hours were dedicated just to logistics work for these field workshops (50% time for 4 people over 3 months). For a well-organized workshop, anticipate that this will be someone's (or several someones') entire job in the runup to the trip.
  - Scouting trips and dry runs gave on-theground information about travel time between sites, where to eat lunch, where to host stations, and where to put portapotties.
  - A day-of facilitator from the outreach team kept the workshop running smoothly and on time.

# Areas of improvement for future workshops:

 Though one of the workshop goals was to include interactive stations that would move beyond "presentations outside," not all stations were interactive. The outreach team could have: more clearly defined expectations for interactivity with station leaders; provided training for station leaders about how to facilitate interactive learning; or required

- presenters to prepare activities in advance, and present them for feedback from the outreach committee.
- Dry runs to workshop locations measured driving time and scouted parking locations. However, these dry runs did not include the presentations at each station. Presentations ran more smoothly and on-time in the second workshop, which suggests presenters benefited both from practice and feedback from evaluations of the first workshop.
- Time limitation was a concern, as many stations felt rushed.

### Outreach Lessons Learned

- Develop clear communication objectives and revisit often to evaluate whether the steps support the objectives.
- Identify appropriate outreach mechanisms for various audiences.
- The author team should be heavily involved in and committed to the outreach process.
- Interactive learning is very valuable. Audiences responded positively to strong visual, placebased, and interactive components, and the opportunity to build relationships through in person interaction.
- Evaluating the outreach process provides the outreach team the opportunity to adapt and improve outreach in progress, and measure impact and relative success of efforts.



Participants at the North Front Range field workshop learn about landscape restoration principles in a prescribed burn area at the Ben Delatour Scout Ranch, Red Feather Lakes, CO. Photo Credit: Karina Puikkonen

### References

- Addington, R. N., Aplet, G. H., Battaglia, M. A., Briggs, J. S., Brown, P. M., Cheng, A. S., Dickinson, Y., Feinstein, J. A., Pelz, K. A., Regan, C. M., Thinnes, J., Truex, R., Fornwalt, P. J., Gannon, B., Julian, C.W., Underhill, J. L.. Wolk, B. (2018). Principles and practices for the restoration of ponderosa pine and dry mixed-conifer forests of the Colorado Front Range. RMRS-GTR-373. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Archie, K. M. (2014). Mountain communities and climate change adaptation: barriers to planning and hurdles to implementation in the Southern Rocky Mountain Region of North America. Mitigation and Adaptation Strategies for Global Change, 19, 569-587.
- Archie, K. M., Dilling, L., Milford, J. B., Pampel, F. C. (2014). Unpacking the 'information barrier': Comparing perspectives on information as a barrier to climate change adaptation in the interior mountain West. Journal of Environmental Management, 133, 397-410.
- Barrett, K.J., Cannon, J.B., Schuetter, A.M., Cheng, A.S. (2021). Effects of collaborative monitoring and adaptive management on restoration outcomes in dry conifer forests. Forest Ecology and Management 488.
- Besley, J.C., & Nisbet, M. (2011). How scientists view the public, the media and the political process. Public Understanding of Science, 6, 644-659.
- Biber, E. 2009. Too many things to do: how to deal with the dysfunctions of multiple-goal agencies. Harvard Environmental Law Review 33:2-63.
- Brown et. al., in prep.
- Briske, D.D., Bestelmeyer, B.T., Brown, J.R., Brunson, M.W., Thurow, T.L., Tanaka, J. A. (2017). Assessment of USDA-NRCS rangeland conservation programs: recommendation for an evidence-based conservation platform. Ecological Applications, 27(1), 94-104.
- Colavito, M. M., S. F. Trainor, N. P. Kettle, and A. York. 2019. Making the transition from science delivery to knowledge coproduction in boundary spanning: a case study of the Alaska Fire Science Consortium. Weather, Climate, and Society 11:917-934.

- Cook, C. N., Mascia, M. B., Schwartz, M. W., Possingham, H. P., Fuller, R. A. (2013). Achieving Conservation Science that Bridges the Knowledge– Action Boundary. Conservation Biology, 27(4), 669-678.
- Davies, S. R. (2008). Constructing Communication: Talking to Scientists About Talking to the Public. Science Communication, 29(4), 413–434.
- Dilling, L., Lemos, M. C. (2011). Creating usable science: Opportunities and constraints for climate knowledge use and their implications for science policy. Global Environmental Change, 21, 680-698.
- Feldman, D. L., Ingram, H. M. (2009). Making Science Useful to Decision Makers: Climate Forecasts, Water Management, and Knowledge Networks. Weather, Climate, and Society, 1(1), 9-21.
- Kocher, S. D., E. Toman, S. F. Trainor, V. Wright, J. S. Briggs, C. P. Goebel, E. M. MontBlanc, A. Oxarart, D. L. Pepin, T. A. Steelman, A. Thode, and T. A. Waldrop. 2012. How can we span the boundaries between wildland fire science and management in the United States. Journal of Forestry 110 (8):421-428.
- Laatsch, J., Ma, Z. (2016). Climate-Change Communication Within Public Natural Resource Agencies: Lessons Learned From the U.S. Forest Service. Society & Natural Resources, 29(10), 1169-1185.
- Polk, M. (2015). Transdisciplinary co-production: Designing and testing a transdisciplinary research framework for societal problem solving. Futures, 65, 110-122.
- Roux, D. J., Rogers, K. H., Biggs, H. C., Ashton, P. J., Sergeant, A. (2006). Bridging the Science–Management Divide: Moving from Unidirectional Knowledge Transfer to Knowledge Interfacing and Sharing. Ecology and Society 11(1):4.
- Simis, Molly. J., Haley Madden, Michael A. Cacciatore, and Sara K. Yeo. 2016. The lure of rationality: why does the deficit model persist in science communication? Public Understanding of Science 24(4):400-414.
- Siepen, G. L., Westrup, J. (2002). Communicating Vegetation Management Science to Land Managers and Other Stakeholders. The Rangeland Journal, 24(1), 170 - 181.

### Appendix A: Evaluation form for presentations

### **EVALUATION**

### Location (e.g. Pub Talk)

#### **Date**

Please take a few minutes to respond to the following questions to evaluate the information presented today. Your responses will help us to plan for and improve future outreach efforts. Thank you!

1. Please indicate your agreement with the following statements, on a 1 to 5 scale (1 = Strongly Disagree; 5 = Strongly Agree; 0 = Not Applicable)

	Strongly Disagree		Neutral	Agree	Strongly Agree	Not Applicable
I learned something that will help me address my forest management information needs.	1	2	3	4	5	0
I learned something I can use immediately.	1	2	3	4	5	0
The information that was presented today is valuable.	1	2	3	4	5	0
I will share the information I learned about today with other people.	1	2	3	4	5	0
I plan to learn more about the information presented today by contacting the scientists involved.	1	2	3	4	5	0
I plan to review the research study that was presented today.	1	2	3	4	5	0
The Rocky Mountain Research Station has a positive effect on how science is distributed to natural resource managers.	1	2	3	4	5	0
The way the material was presented today made it easy to understand.	1	2	3	4	5	0
I am interested in learning more about this topic through additional outreach opportunities.	1	2	3	4	5	0

<ol> <li>What did you like most about today's presen</li> </ol>	itation?
---	----------

- 2. What did you like least about today's presentation?
- 3. What do you think are the best ways to share this information?

4. Which category best describes your area of employment? (Please choose only one)							
	4.	Which category	best describes	your area of e	employment?	(Please choose or	ily one)

U.S. Forest Service
Other Federal Agency
State Agency
Local Government
Non-profit
Consulting Firm
Academia
Other (please specify)

1.	How many years have you been in this position?
	Less than 2 years
	2 - 5 years
	6 - 10 years
	10 + years
2.	In what ZIP code is your place of work located?
3.	Any additional comments?

## Appendix B: Evaluation form for field workshops

### **EVALUATION**

### **Location (e.g. South Front Range Field Workshop)**

#### **Date**

Please take a few minutes to respond to the following questions to evaluate the information presented today. Your responses will help us to plan for and improve future outreach efforts. Thank you!

1. Please indicate your agreement with the following statements, on a 1 to 5 scale (1 = Strongly Disagree; 5 = Strongly Agree; 0 = Not Applicable)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable
I learned something that will help me address my forest management information needs.	1	2	3	4	5	0
I learned something I can use immediately.	1	2	3	4	5	0
The information that was presented today is valuable.	1	2	3	4	5	0
I will share the information I learned about today with other people.	1	2	3	4	5	0
I plan to learn more about the information presented today by contacting the scientists involved.	1	2	3	4	5	0
I plan to review the research study that was presented today.	1	2	3	4	5	0
The Rocky Mountain Research Station has a positive effect on how science is distributed to natural resource managers.	1	2	3	4	5	0
The way the material was presented today made it easy to understand.	1	2	3	4	5	O
I am interested in learning more about this topic through additional outreach opportunities.	1	2	3	4	5	0
While planning forest management projects, it is important to consider the environmental gradients (e.g. latitude, elevation, slope, soils, moisture etc.) present at a site.	1	2	3	4	5	0
Past stand structure can help to inform forest management.	1	2	3	4	5	0
Monitoring is a tool to determine if management objectives are being met at a stand or treatment level.	1	2	3	4	5	0
Monitoring can help inform future forest management decisions.	1	2	3	4	5	0

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable
At the watershed scale, monitoring should be focused on vegetation patterns and their influence on landscape-level ecological processes such as fire behavior and watershed function.	1	2	3	4	5	0
GTR 373 empowers me to operate at a watershed scale to achieve landscapelevel goals across jurisdictions and ownerships.	1	2	3	4	5	0
I feel comfortable using the concepts introduced in GTR 373.	1	2	3	4	5	0

- 1. What did you like most about today's workshop?
- 2. What did you like least about today's workshop?
- What do you think are the best ways to share this information?
  What challenges do you foresee implementing the concepts presented in GTR-373?
  What opportunities do you see after the GTR-373 workshop?

8. In what ZIP code is your place of work located? \_\_\_\_\_

9. Any additional comments?

6.	Which category best describes your area of employment? (Please choose only one)
	U.S. Forest Service
	Other Federal Agency
	State Agency
	Local Government
	Non-profit
	Consulting Firm
	Academia
	Other: (please specify)
7.	How many years have you been in this position?
	Less than 2 years
	2 - 5 years
	6 – 10 years
	10 + years