FINAL REPORT

Navigating collaborative wildfire risk reduction across boundaries: the influence of policy and science translation

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Table of Contents

List of Abbreviations/Acronyms

2-3-2 Partnership	2-3-2 Cohesive Strategy Partnership
BAK	Best Available Knowledge
BASI	Best Available Scientific Information
CFLRP	Collaborative Forest Landscape Restoration Program
JFSP	Joint Fire Science Program
NGO	Non-Governmental Organization

Abstract

Collaborative efforts are an effective tool for managing the growing social and ecological complexities of wildfire adaptation at the landscape level. However, efforts to document the decision-making processes of collaborative groups around fire management, particularly as they relate to best available science and related policy directives, are scarce. This project presents a case study of the 2-3-2 Cohesive Strategy Partnership, a collaborative spanning the New Mexico-Colorado border, with the intent to characterize how members access and use best available science to make management decisions at the landscape scale. We conducted 26 semi-structured interviews with 2-3-2 members, including representatives from land and fire management agencies, local governments and non-governmental organizations in 2023. The National Cohesive Wildland Fire Management Strategy initially guided the partnership's development and purpose, but interviewees felt that the 2-3-2's work has since evolved to align with a broader constellation of policies, positioning them to readily apply for more collaborative federal and state funding opportunities. This flexibility was possible because of the grassroots evolution of the partnership, allowing the group to pivot in response to funding mechanisms that aligned with their purpose. Discussion regarding organizational processes revealed that terms like "best available science" do not accurately describe the information sources the partnership used to make decisions. Instead, the partnership blended western science with traditional ecological knowledge and local expertise, often favoring the term "best available knowledge" to more comprehensively capture the range of sources they drew from. We suggest that entities funding landscape-level restoration that can address wildfire risk consider broadening requirements related to use of science in decision making to support more holistic and inclusive management decisions on the ground.

Objectives

The New Mexico and Colorado based 2-3-2 Cohesive Strategy Partnership brings representatives from a diverse assortment of governmental and non-government al organizations together to coordinate management decisions, many of which focus on or support the reduction of wildfire risk. We conducted semi-structured interviews with partnership members to understand the role of policy and science influenced management discussions and decisions at the landscape scale. Our research sought to achieve three main objectives:

- Obj.1: Examine how fire policy influences the formation and mission of land management collaboratives
- Obj.2: Examine how land management partnerships incorporate best available scientific information into decision making about wildfire risk reduction
- Obj.3. Develop recommendations for effective policy integration among boundary-spanning partnerships or collaborative groups across landscape and sub-landscape scales

Understanding how collaborative fire management partnerships function at the science-management nexus is critical for designing and disseminating effective communication about emergent research. Findings from this study can also point to best practices for translating national policy to local contexts and identify recommendations for decision-making around

BASI. Additionally, this study has implications for more effective science-management communications and partnerships through the JFSP exchange network. This will help policymakers understand how to better support cross-boundary fire management as mitigation, suppression, and recovery become increasingly socially and ecologically complex.

These research objectives aimed to address two task statement foci: (1) fuels management and fire behavior, by examining partnership activities in related to these topics and (2) human dimensions of fire, by exploring how social dynamics related to science and policy influence wildfire risk reduction actions. This research will help collaboratives, policymakers, and scientists advance and document their decision-making processes by leveraging diverse users and interpretations of science and policy in landscape level fuels projects.

Background

Creating and implementing science-driven policy is one of the best tools for widespread social-ecological adaptation to fire. There has been a recent uptick in national fire and forest policy that guides collaborative management, adaptive management, and shared stewardship across the U.S. (Koontz et al., 2010, Timberlake and Schultz, 2017). For example, the National Cohesive Wildland Fire Management Strategy is a national directive that lays out a three-pronged approach to fire adaptation by developing resilient landscapes, encouraging and supporting the creation of fire-adapted communities, and promoting a safe and effective wildfire response (WLFC, 2014). However, existing research indicates that many of these terms (e.g., "fire adapted community") are ambiguous and open to interpretation, which may lead to inconsistent implementation at the local level where social-ecological contexts are diverse (Paveglio and Edgeley, 2020; Paveglio et al., 2020, Roos et al., 2016). Examining the role of that ambiguity in decision-making at the local level requires the development of diverse case studies examining divergent approaches to policy utilization (Paveglio et al., 2015; Edgeley and Paveglio 2024). Collaborative organizations may incorporate policy goals into their mission, requiring the translation of policy to better align with their local ecosystems and communities. However, it remains unclear how these collaborative groups navigate this process or how this may benefit or challenge the effectiveness of the policy being interpreted (Schultz et al., 2018).

Policy is often used to direct collaborative actions. Collaboration is necessary for understanding management challenges, supporting collective action, and working across jurisdictions within federal, state, and local policy (Schultz and Mosley, 2019). Collaborative groups can extend the scale of fire mitigation and fuels management by collectively implementing forest management techniques like prescribed fire across jurisdictions and boundaries (Davis et al., 2018, Gottfried et al., 2009). These partnerships, whether formal or informal, help increase the scope and pace of forest management by producing alignment of values and land management missions to create management consistency (Gottfried et al., 2009). Additionally, collaborative groups translate national policy to local contexts and summarize it for partners, although it is often unclear how successful translation may be measured or expanded (Koontz et al., 2010). Despite an abundance of research on collaboratives, partnerships, and other coordinated approaches to tackle fire management and forest health challenges, less is understood about how collaboration can intersect across scales, how they access, interpret, and

implement best available science, and the extent to which this supports efforts to promote adaptive management (Butler et al., 2015, Colavito, 2017, Davis et al., 2018).

The use of best available scientific information (BASI) to drive management actions and support policy is ingrained in the success of collaboratives and often mandated by funders. BASI can be used to create more effective policy that provides the support and direction for managers. Collaboratives use BASI to understand policy directives, translate it into management actions, and support decisions (Colavito, 2017). Efforts to document identification and use of BASI in fire management at the landscape scale remain scarce, yet can provide important guidance and implications for collaboratives as they establish and evolve in the Southwest and beyond (Edgeley, 2023). The 2-3-2 Cohesive Strategy Partnership offers an ideal opportunity to explore this gap in the literature. The 2-3-2 partnership (Fig. 1) identifies the translation of best available science from researchers to managers as one of their primary objectives. Understanding how to most effectively complete this translation and dissemination is important to deal with increasingly complex fires. This context highlights the need to understand how collaborative groups like the 2-3-2 Partnership navigate policy and integrate scientific knowledge.

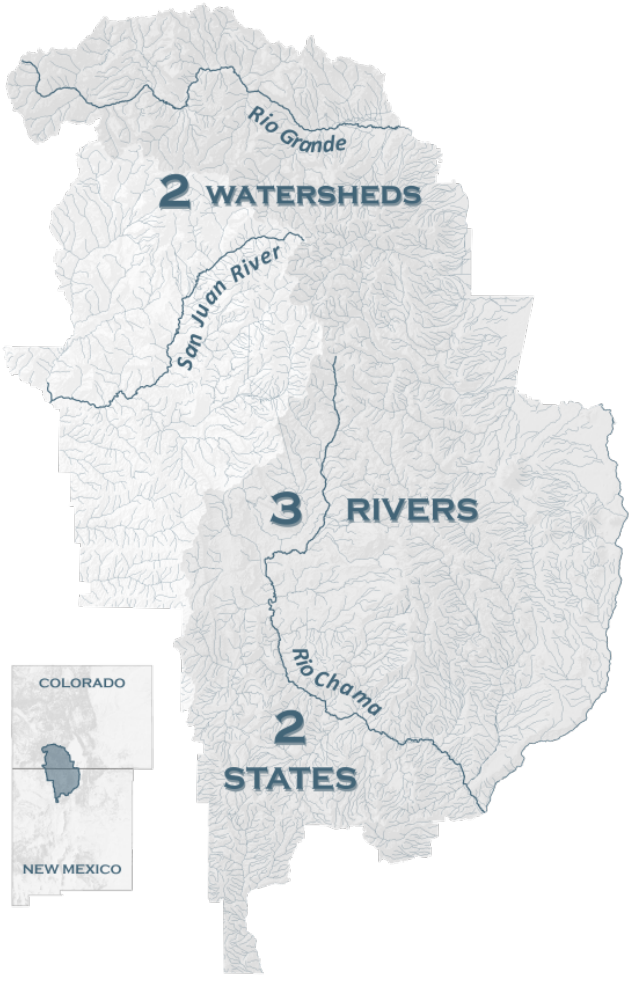

Fig. 1: *The area covered by the 2-3-2 Cohesive Strategy Partnership (Image by the 2-3-2 Cohesive Strategy Partnership).*

Materials and Methods

Our research focused on the 2-3-2 Cohesive Strategy Partnership and their work across the Colorado-New Mexico state line. The Partnership's namesake comes from its geography, which incorporates two watersheds, three rivers, and two states. It also spans four different national forests (San Juan, Rio Grande, Carson, and Santa Fe) and interspersed private, state, municipal, and tribal lands. The partnership involves ten major agencies, twelve large NGOs, and numerous private owners, with over 100 members contributing to land management. The 2-3-2 Partnership broadly outlines its mission to work together to protect and preserve forest health, water quality, wildlife habitat, and communities within the San Juan, Chama, and Rio Grande watershed landscapes (2-3-2 Partnership, 2023). Formalized in 2016, the partnership aims to develop resilient landscapes by addressing forest health concerns and protecting watersheds. The partnership recently secured $30 million in funding over 10 years through the Collaborative Forest Landscape Restoration Program.

Approach

We approached leadership of the 2-3-2 Partnership to co-develop this study prior to submission of the proposal to JFSP in order to understand partnership needs and questions. With their input, we developed a semi-structured interview protocol that was shared with 2-3-2 Partnership leadership prior to interview recruitment Semi-structured interviewing to allow identification and expansion of emergent themes, enabling researchers to find and expand on new information (Bryman, 2012). Protocol questions focused on four topics: (1) the interviewee's background, (2) interviewee and partnership interactions with policy, (3) the role of best available scientific information in the partnership, and (4) future of 2-3-2 Partnership. We followed up with probing questions based on each interviewee's response.

To identify interviewees, we used a combination of theoretical and snowball sampling (Bryman, 2012). Partnership key informants provided contact information for several suggested interviewees as a starting place for recruitment. This list was curated by the coordinators to include a somewhat representative sample of partnership members. This theoretical sampling gave a baseline sample of interviewees to question who had a range of experience with the 2-3-2 Partnership. We were also able to provide a message that was shared with the entire 2-3-2 Partnership mailing list to invite additional participation. At the end of each interview, we asked interviewees to recommend other individuals who might be able to provide insights into our study, both within and outside the 2-3-2 Partnership. This snowball sampling helped widen representation and ensure comprehensive documentation of perspectives (Biernacki and Waldorf, 1981).

We conducted 26 semi-structured interviews with an average length of 43 minutes. Interviews were conducted virtually over Zoom, or phone call when necessary. Interviewees affiliations were: 12 federal, 7 NGO, 3 state, 2 private, 1 private, and 1 university. Interviewees had a wide range of experience with the partnership, with varied levels and durations of involvement. We concluded interviewing once no new themes emerged or were expanded, indicating theoretical saturation (Thornberg and Charmaz, 2014). Additionally, the student PI attended an in-person partner meeting and participated in online events with the 2-3-2 Partnership to help contextualize interviews and confirm that interview conversations were representative of the partnership in general.

Analysis

All interviews were audio recorded with the permission of study participants. The recorded interviews were transcribed verbatim and analyzed using QSR NVivo, a qualitative software that supports text coding. Transcripts were coded using a combination of analytical and inductive coding to develop a grounded theory approach to data investigation (Gibbs, 2007). Transcripts were analyzed through QSR NVivo using two rounds of coding. The first round of coding focused on descriptive coding, where the authors categorized the discussions in the interviews by topic. Descriptive coding is a method used to assign labels to qualitative data to categorize the topic present (Saldaña, 2016). The first group of codes was developed using the notes and conversations between authors, and the interview protocol. As analysis continued progressive falsification was followed, where each portion of the interview was coded into an existing category or used to label a new code. The second round of coding focused on thematic coding, where authors worked to connect concepts between interviews. The thematic analysis focused on the topics that related to the research questions and goals. Multiple interviews were coded by both authors to test intercoder reliability Intercoder reliability and ensure consistent coding (Saldaña, 2016). The connections and themes identified from the thematic coding is the information presented in our results. Finally, we identified representative quotes for each emergent theme to include in project outputs such as manuscripts and presentations.

Results

How does the 2-3-2 Partnership adapt policies and related guidance like the Cohesive Strategy to collectively manage wildfire risk in their local contexts?

Interviewees described the Partnership's evolution in three stages: (1) building the collaborative structure, (2) finding funding, and (3) engaging in on-the-ground implementation. Discussions surrounding forming a new partnership originally started in local place-based collaboratives around 2014. Members of the San Juan Forest Health Partnership identified watersheds that did not influence their community but affected others downstream. They recognized those downstream communities were looking upstream to protect their watershed. This underscored a need to communicate and collaborate at a greater scale; thus, the 2-3-2 Cohesive Strategy Partnership was formalized in 2016. The initial group was composed of members from existing local collaboratives with established relationships. Interviewees described how smaller place-based collaboratives were accomplishing good work; however, much of those efforts were performed at a scale that did not match the extent of the challenges that watershed protection necessitated. This interest in complimenting place-based collaboratives at a landscape scale drove the Partnership's identity as a "conglaborative" or a conglomerate of place-based collaboratives. By incorporating the smaller place-based collaboratives into their structure, the 2-3-2 Partnership was able to focus on larger landscape scale questions and funding opportunities while simultaneously allowing smaller collaboratives to engage their place-based strengths. One interviewee described:

> *So the* [name of small collaborative]*, I kind of see that as we call them a local place-based collaborative, but they're kind of the voice for the local community here in my*

mind. And the way I vision the 2-3-2 is the collection of all those local collaboratives to speak with a bigger voice at a grander scale.

Additionally, the larger scale of the 2-3-2 Partnership allowed it to attract a healthy membership base with diverse interests across the entire landscape, supporting more comprehensive, robust, and actionable management outcomes. The Partnership also chose to connect itself with the National Cohesive Wildland Fire Management Strategy because its encouragement of collaboration at larger scales and potential for funding through clear alignment with the policy. One interviewee explained:

The 2-3-2 Partnership works in a historically underfunded region of the country. Attaching ourselves to a national policy in 2016, 2017, at the formation of the partnership, that would've been kind of the formal recognition of our association with the National Cohesive Strategy was for a couple of reasons… the partners that were coming together to form the 2-3-2 and who were thinking at a landscape scale and thinking that we needed to go big to meet some of the challenges that we were up against, the Cohesive Strategy resonated with those people that were in those formative leadership roles at the time.

The National Cohesive Wildland Fire Management Strategy provided a clear guiding framework in the Partnership's initial stages to connect them to agencies, funders, and new members. It also served as a set of guiding principles when making key decisions and deciding group priorities. Eventually, funds associated with the National Cohesive Wildland Fire Management Strategy were provided to the 2-3-2 Partnership to help facilitate and coordinate the group. This funding was foundational in formalizing the group's identity and scope of work. One member explained:

The National Cohesive Strategy also ended up providing us with funding and resources to facilitate the partnership, to coordinate people, to get people to the table. I think one of the most important things about partnership is creating the space for people to show up consistently so they form relationships over time instead of having one-off events and Cohesive Strategy dollars. And that policy allowed us to do that and gave us the flexibility to do so.

Over time, the Partnership began to diversify their funding sources as new programs emerged or existing programs were extended. A successful Collaborative Forest Landscape Restoration Program (CFLRP) proposal for the 2-3-2 Partnership's area demonstrated how initial alignment with the Cohesive Strategy opened clear pathways to funds that shared similar objectives. Interviewees felt that the structure for the CFLRP project was already established prior to proposal development because of their existing policy grounding. One interviewee described:

I think when the CFLR process came along, it was pretty clear that the conversations that we had had for the relationships that were built through the 2-3-2, even though they didn't always seem like they were essential to getting work done, they really were like the glue for a really good conversation around CFLR planning. There's a lot of trust already built. People already knew each other. And so, it was almost like [the 2-3-2 Partnership]

was the stakeholder group we needed for CFLR before we even knew CFLR was coming down.

Expansion of Partnership efforts into the Rio Chama CFLRP introduced discussions about the next iteration of work for the group, with interviewees indicating interest in funding and projects that supported management on state, private, or tribal lands:

> *If you read the CFLRP, it acknowledges the need to address private lands, and to help move the needle on private lands and to measure that private land work in alignment with the CFLRP. So it was built into the culture of this 2-3-2 that then got written into the CFLRP. And so that was a big part of it…The Forest Service has their priorities, but the 2-3-2 is actively working to make sure that private land priorities, state priorities are also acknowledged and put on and waived in a similar way so that it is not overlooked.*

Additionally, some interviewees saw a greater role in influencing policy as a natural progression of the partnership, driven by the growing positive reputation of the 2-3-2 as a collaborative mechanism for landscape-level restoration.

How do 2-3-2 Partnership members identify, translate, and implement BASI across their shared landscape?

Interviewees sought and identified best available science based on numerous considerations, including source, location, time since publication, diversity of sources, and policy mandates or definitions. Many interviewees prioritized peer reviewed science or internal research within their agency, with an overwhelming preference for science that used data collection within the 2-3-2 landscape. While more recently research was often sought, many interviewees noted that newer science did not always equate to better science. Some interviewees mentioned searching for a diversity of sources and working to come up with a range of sources that may even be opposing in order to assess which solution or recommendation within the science was "best" for their context. While these considerations were often related to personal preferences, interviewees often triangulated what they found with policy-based definitions of BASI, with many citing the Forest Service's 2012 planning rule language as their point of reference.

When looking for BASI, interviewees searched for a combination of published sources (journals, white papers, etc.), internal resources (agency databases, internal research outputs, etc.), and communicated with technical experts through collaborative or organizational relationships to determine the suitability of available science. One interviewee described that it was common to leverage existing relationships with other professionals who had similar projects or more knowledge in the area to select relevant BASI:

> *In my position, I have the benefit of having a lot of technical specialists. So, generally if I have a question about something fire related, I go to our fire and fuel specialist or I have a question about trees or forest health, they go to the silviculturist, and I would say that they're getting their information from their education training and then hopefully staying up to date on the latest information in their particular field.*

In many cases, relationships with subject matter experts were established through membership in the 2-3-2 Partnership. Collaborative relationships were especially valuable to interviewees who worked in smaller organizations who did not have as many internal technical experts or internal research mechanisms. These relationships were often used to identify managers who had accomplished similar projects or sought similar BASI in the past, particularly in instances where capacity to keep up with emerging science was limited. One interviewee explained:

> *I try and keep up on what's being published, but I find it more valuable to just go to some of these meetings and talk to people that are doing stuff. A perfect example is the wet mixed conifer. How do you treat wet mixed conifer? [Name] has put on a couple different workshops where he invited a bunch of Forest Service people to kind of talk through that, because that's something that's been really ignored by the Forest Service and people are trying to understand: how do we treat wet mixed conifer?*

Despite policy mandates to incorporate BASI into land management decisions–particularly those funded by federal entities– interviewees were quick to note that policy definitions of BASI did not incorporate all the information they were using to make decisions. Interviewees articulated that the value of the 2-3-2 Partnership was its ability to incorporate BASI in tandem with local experience, traditional ecological knowledge, and place-based understandings, among other ways of knowing. Triangulation of information across these varied sources provided the context and information needed to produce relevant and suitable action on the ground. One partner explained the difference between BASI and the knowledge the Partnership cultivated by saying:

> *We're interested in best available knowledge, and science is a part of that best available knowledge. But knowledge doesn't come just from science. Knowledge comes from experience, knowledge comes from traditional ecological knowledge, knowledge comes from kicking back and talking to the old timers about things, and knowledge comes from tying in with the ranch managers who have been watching stuff. So, we use science, and we try to use the best science, but we don't think of science as a knowledge source that is the only place to go for knowledge.*

Interviewees described how best available science and best available knowledge approach land management decisions from opposite directions. The use of BASI often starts with a policy mandates or agency guidance that require managers support their decisions and actions with BASI. One member explained how this top-down approach to characterizing BASI served as a defense against litigation, but limited more inclusive use of knowledge:

> *It [BASI] was a way to counter and build defenses against lawsuits with the environmental community. And so, the Forest Service is wedded to science as the source of knowledge because it works in court. We're not interested in what works in court. We're interested in what works on the landscape. We're interested in having fire adapted communities, having a fire resilient landscape, having a connection between community and land. There's just a whole lot more, from a collaborative standpoint, from all the different members of that collaborative than whether or not the Forest Service can be successful in court.*

Interviewees explained that BAK (best available knowledge) worked in the opposite direction, starting with local and place-based understandings before building upward. It evolves by understanding the problems on the ground then combining traditional ecological knowledge, scientific information, and local experience to determine management action. Interviewees saw BAK as an approach for generates ideas and approaches from a diverse, inclusive collection of experiences and observations, while BASI is sourced from a select group of researchers.

Interviewees applied BAK by having conversations with locals combining it with their experience, then bringing that information back to their respective organization or agency with the provider's consent. The value of this collective development of BAK within the 2-3-2 Partnership was, in part, driven by their inclusion of small, place-based collaboratives:

> *We have local knowledge and we have folks that live here that both have degrees in the natural resources. Ranchers, they're also hunters. We have fishermen. And they bring that knowledge to us and so they know that is all part of our formula for implementation. It's the biggest priority. People will tell you, the locals will tell you, where they think it is and then you have to kind of blend that with science and, as you said, available knowledge. It's just the way of doing business. And that's why it's so important to start at the local level and move up.*

The 2-3-2 partnership actively worked to locate and elevate voices that were historically missing or ignored in past management decisions. The 2-3-2 Partnership facilitated the adoption of BAK through non-academic presentations, local field trips, and providing a platform to people with place-based understandings to disseminate and deepen their knowledge. Interviewees articulated that field trips were particularly useful to encourage communication within the Partnership. One member explained:

> *We brought them out and we went through the whole prescription and then discussed it with them as we were on the ground looking at the acre to be thinned. Then we went back and in our next meeting we had a long discussion about changes that we thought should be incorporated into the prescription, and we submitted those requests to the silviculturalist and the small sales forestry person.*

Discussion

This research sought to understand the origin and evolution of the 2-3-2 Partnership, the role of national policy in their establishment and mission, and document how members interacted with the concept of "best available science" to make decisions. Early formation, intentional parallels with emergent fire policy and funding opportunities, and the proactive nature of landscape-scale collaboration allowed the 2-3-2 Partnership to evolve its mission and capacity over time. Strategic upscaling–geographically and capacity wise–positioned the 2-3-2 to apply for and receive large competitive funding allocations that furthered foundational work. While working to understand how science was used in decision-making, interviewees articulated that Western ideas of science constituted only a portion of the information they used to determine management actions. "Best available knowledge" more accurately describes the diversity of

sources interviewees used, triangulating information from traditional ecological knowledge, local experience, and best available science. This study highlights the 2-3-2 Partnership's success in proactive collaboration, adaptable focus on policy opportunities, and the integration of diverse knowledge sources beyond what policy mandates require in decision making.

The Partnership strove to work together to protect and preserve forest health, water quality, wildlife habitat, and communities within the San Juan, Chama, and Rio Grande watershed landscapes (2-3-2 Partnership, 2023). The grassroots emergence of the partnership likely contributed to many of the successes described above – a finding that is common in studies of natural resource collaboratives (e.g., Edgeley and Paveglio, 2024). In contrast, collaborative groups that are formed and lead by a single agency can create tension between leaders and members over management decisions (Butler, 2013). The Partnership was also intentional when deciding what scale to operate at, using geographic boundaries like watersheds instead of socio-political boundaries like state lines. This allowed the development of clear criteria for involvement while also complementing local place-based organizations, elevating them as key voices in management decisions. Accomplishing landscape level objectives often takes a larger-scale collaborative that focuses above the local level (Butler et al., 2015); the "conglaborative" nature of the partnership allowed local representation and considerations to overcome limitations related to multi-scale work within the 2-3-2 landscape

The 2-3-2's origins, grounded in the National Cohesive Wildland Fire Management Strategy, provide a successful model for other emerging collaborative groups to consider. Use of policy guidance to structure and define the organization early on allowed rapid alignment with funding opportunities. Focusing a collaborative on a single purpose tied to policy allows partnerships to clearly identify goals and make decisions (McIntyre and Schultz, 2020). The shift to CFLRP funding indicates a critical point in the organization's evolution where organizational functioning, structure, and goals were able to transcend one policy to become broadly relevant to other landscape-level directives. We suggest that strategic policy alignment as a core tenet of collaborative establishment and development has the potential to streamline applications for federal funding related to fuels management and other wildfire-related initiatives in the future.

This study also contributes to enhanced distinctions between best available science and best available knowledge, underscoring the importance of the latter for place-based social and ecological wildfire adaptation. The use of best available science in management decisions is widely recognized as a valid source for managers and collaborations (Colavito, 2017); however, this research indicates that landscape level treatments must go beyond science in order to be effective. Interviewees described how recognizing and incorporating discussion and action related to this distinction was essential for collaborative success across scales and social contexts within the 2-3-2 Partnership's boundaries. The bottom-up approach that characterizes best available knowledge begins with people who live and work on the landscape and gather understandings of the local environment, its processes, and interactions over time to begin identifying patterns and responses that can be incorporated to benefit land management. Recognition of the differences between BASI and BAK allowed the Partnership to navigate complex, multi-scalar policy systems and management strategies in a more culturally meaningful way than BASI alone could provide. Unfortunately, current research and policy mandates do not always recognize BAK, including Indigenous and local knowledge, as a valid justification for land management decision making. Encouraging policy makers and agency leadership to

consider inclusion of different knowledge in land management decision making related to fire could result in more cohesive, sustainable collaborations at larger scales.

Conclusions and Implications for Management/Policy and Future Research

Our three project objectives were to: (1) Understand how policy influences the establishment and evolution of fire-prone land management collaboratives, (2) Understand how land management partnerships use science to make decisions, (3) Develop recommendations for collaboratives engaged in land and fire management.

Our research found that policy directives like the National Cohesive Wildland Fire Management Strategy can play a meaningful role in the development of collaborative organizational identities related to wildfire. While best available science played a central role in supporting and justifying land management decisions, the 2-3-2 Partnership placed greater value on the use of best available knowledge, which draws from more diverse sources of information such as intergenerational relationships with the land. Implications and recommendations for land management collaboratives concerned about fire are outlined below.

Management Implications

Our research has several important takeaways for land managers, especially those involved in collaborative natural resource efforts related to wildfire:

- Seek to form collaboratives in spaces where when there is already an established interest or need, rather than when funding or policy mandates it.
- Create space and capacity for grassroots organization to allow landscape-scale collaboratives to grow steadily and maintain an active, committed membership; this may include prioritizing the inclusion of local, place-based collaboratives to help anchor and scale up efforts.
- Consider aligning collaborative missions with relevant wildfire policy directives or guidance, particularly in spaces where funding opportunities are tied to project alignment with policy goals.
- Collaboratives that establish an initial identity or mission related to a specific policy should balance specificity with broadness to avoid becoming irrelevant or misaligned as policy evolves at different levels.
- Include individuals and organizations who have different knowledge (and ways of knowing) within the collaborative landscape to promote use of best available knowledge.

Policy Implications

The 2-3-2 Partnership's initial success provides key insights for policy development, and the implementation of policy mandates at the landscape scale, moving forward:

- Broaden guidance for, and encourage the use of, knowledge beyond best available science in policy directives and mandates. This could be incorporated into documentation at the Congressional, state, or agency level.

- Policy makers should encourage strategic scaling of collaboratives to suite the needs and demands of emerging policy directives, and recognize that not all places where wildfire risk is present have the social infrastructure to begin collaborating at the landscape level immediately.
- Policy initiatives should continue to promote long-term investment in collaboration and provide funding to establish new or enhance existing partnerships.

Future Research

Future research at the intersection of wildfire, collaboration, policy, and BASI should explore the following:

- Ways to better support land management collaboratives and integrate best available knowledge into broader land management practices beyond wildfire adaptation contexts.
- How policy can be used to foster collaboration in fire adaptation management and support the sustainability of natural resource partnerships.
- Approaches to embed best available knowledge practices not only within collaboratives and partnerships but also within land management agencies themselves.
- The extent to which wildfire-related collaborations operating at the landscape scale vary in terms of their establishment and evolution.

Literature Cited

Biernacki, P., & Waldorf, D. (1981). Snowball Sampling: Problems and Techniques of Chain Referral Sampling. *Sociological Methods & Research*, *10*(2), 141–163. https://doi.org/10.1177/004912418101000205

Bryman, A. (2012) Social Research Methods, 4th ed., Oxford University Press, New York, NY.

Butler, W. H. (2013). Collaboration at Arm's Length: Navigating Agency Engagement in Landscape-Scale Ecological Restoration Collaboratives. *Journal of Forestry*, *111*(6), 395–403. https://doi.org/10.5849/jof.13-027

Butler, W. H., Monroe, A., & McCaffrey, S. (2015). Collaborative Implementation for Ecological Restoration on US Public Lands: Implications for Legal Context, Accountability, and Adaptive Management. *Environmental Management*, *55*(3), 564–577. https://doi.org/10.1007/s00267-014-0430-8

Colavito, M. M. (2017). The Role of Science in the Collaborative Forest Landscape Restoration Program. *Journal of Forestry*, *115*(1), 34–42. https://doi.org/10.5849/jof.15-142

Davis, E. J., Cerveny, L. K., Ulrich, D. R., & Nuss, M. L. (2018). Making and Breaking Trust in Forest Collaborative Groups. *Humboldt Journal of Social Relations*, *1*(40), 211–231. https://doi.org/10.55671/0160-4341.1071

Edgeley, C.M. (2023). Social science to advance wildfire adaptation in the southwestern United States: a review and future research directions. *International Journal of Wildland Fire* 32(12), 1647-1662

Edgeley, C. M., & Paveglio, T. B. (2024). Bridging scales for landscape-level wildfire adaptation: A case study of the Kittitas Fire Adapted Communities Coalition. *Journal of environmental management*, *351*, 119818.

Gibbs, G. (2007). *Analyzing Qualitative Data*. SAGE Publications, Ltd. https://doi.org/10.4135/9781849208574

Gottfried, G. J., Allen, L. S., Warren, P. L., McDonald, B., Bemis, R. J., & Edminster, C. B. (2009). Private-Public Collaboration to Reintroduce Fire into the Changing Ecosystems of the Southwestern Borderlands Region. *Fire Ecology*, *5*(1), 85–99. https://doi.org/10.4996/fireecology.0501085

Koontz, T. M., Steelman, T. A., Carmin, J., Korfmacher, K. S., Moseley, C., & Thomas, C. W. (2004). *Collaborative Environmental Management: What Roles for Government-1*. Routledge. https://doi.org/10.4324/9781936331185

McIntyre, K. B., & Schultz, C. A. (2020). Facilitating collaboration in forest management: Assessing the benefits of collaborative policy innovations. *Land Use Policy*, *96*, 104683. https://doi.org/10.1016/j.landusepol.2020.104683

Paveglio, T. B., Moseley, C., Carroll, M. S., Williams, D. R., Davis, E. J., & Fischer, A. P. (2015). Categorizing the Social Context of the Wildland Urban Interface: Adaptive Capacity for Wildfire and Community "Archetypes." *Forest Science*, *61*(2), 298–310. https://doi.org/10.5849/forsci.14-036

Paveglio, T. B., & Edgeley, C. M. (2020). Fire adapted community. *Encyclopedia of wildfires and wildland-urban interface (WUI) fires*, 320-328.

Saldaña, J. (2016). The Coding Manual for Qualitative Researchers. Sage: Thousand Oaks, CA.

Schultz, C. A., Mclntyre, K. B., Cyphers, L., Kooistra, C., Ellison, A., & Moseley, C. (2018). Policy Design to Support Forest Restoration: The Value of Focused Investment and Collaboration. *Forests*, *9*(9), Article 9. https://doi.org/10.3390/f9090512

Schultz, C. A., & Moseley, C. (2019). Collaborations and capacities to transform fire management. *Science*, *366*(6461), 38–40. https://doi.org/10.1126/science.aay3727

The National Cohesive Wildland Fire Management Strategy. (n.d.). Retrieved March 24, 2022, from https://www.forestsandrangelands.gov/strategy/thestrategy.shtml

Timberlake, T. J., & Schultz, C. A. (2017). Policy, practice, and partnerships for climate change adaptation on US national forests. *Climatic Change*, *144*(2), 257–269. https://doi.org/10.1007/s10584-017-2031-z

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Appendix B: List of Completed/Planned Scientific/Technical Publications/Science Delivery Products

Completed

Conference presentations

Haarmann, N. and Edgeley, C.M. (2023). Negotiating best available science versus best available knowledge through fire focused collaboratives. Poster presentation at the Association for Fire Ecology 6th International Fire Congress. Monterey CA, December 4-8th.

Partner presentations

Haarmann, N. and Edgeley, C.M. (2024). Policy and Science Translation Through Collaboration: A Case Study of the 2-3-2 Partnership. 2-3-2 Cohesive Strategy Partnership Meeting, Abiquiu, NM, February 7th.

Fact sheets

Haarmann, N. and Burnett, J. (2023). How to find the 'best available science'. Southwest Fire Science Consortium fact sheet, November 2023. Available here: https://www.swfireconsortium.org/2023/11/30/best-available-science-information-basi-fact-sheet/

Planned

Articles for submission to peer-reviewed journal

Haarmann, N. and Edgeley, C.M. Policy and Science Translation Through Collaboration: A Case Study of the 2-3-2 Partnership. Manuscript for submission, target journal TBD.