

Navigating Social Entropy: A Case Study of Scaling Up Wildfire Adaptation in Southwest Idaho

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Abstract

As governments invest more into wildfire adaptation, a central challenge is ensuring that the pace and geographic reach of new initiatives match the capacity of the communities and organizations expected to carry them out. This study seeks to characterize the challenges associated with efforts to rapidly accelerate the pace and scale of wildfire risk reduction through a single case study of Southwestern Idaho. We use the framework of social entropy to describe the disorganization and uncertainty that can characterize a governance system experiencing rapid acceleration of work and deployment of federal dollars in a region. We conducted 19 semi-structured interviews and 16 hours of participant observation with local, county, state and federal actors in Southwest Idaho to better understand the challenge of scaling up wildfire adaptation efforts within a single geographic region. We identified three key lessons specific to Southwest Idaho: 1) place-based collaboratives and regional partnerships have complementary strengths that suggest scale-dependence from local to landscape-scale wildfire adaptation; 2) rapidly scaling wildfire adaptation can introduce challenges even when funding, policy attention, and shared risk-reduction goals are in place; and 3) challenges associated with scaling up from place-based collaboratives to regional partnerships can be interpreted through the sociological framework of social entropy. Our findings suggest that achieving landscape-scale wildfire adaptation through federal initiatives need longer and more flexible timelines. Perhaps more importantly, increasing the “pace and scale” of wildfire adaptation depends on sustaining the continuity of non-federal networks already collaborating within a region.

1. Introduction

Increasing focus on wildfire adaptation efforts in the Western US, and globally, requires careful attention to the temporal and spatial scales of proposed initiatives (Edgeley & Paveglio, 2024). While the biophysical sciences emphasize the importance of addressing forest conditions and ecological processes that contribute to wildfire risk at the landscape scale (Churchill et al., 2022; McWethy et al., 2019; Spies et al., 2019), social science has found that sustainable land management approaches often emerge at more localized scales through heterogeneous decision-making processes within communities (Palsa et al., 2022; Wyborn et al., 2015; Wyborn & Bixler, 2013).

To reconcile the inherent tension between the scale difference of these realities, scientists conceptualize community wildfire adaptation as a complex socioecological system of interacting and nested scales (Kelly, Charnley, and Pixley, 2019; Wyborn & Bixler, 2013). Within a nested scale model, localized forest management and community risk-reduction efforts form the foundation, scaling up to reinforce and advance larger landscape-level forest restoration goals. Practitioners, managers, and policy-makers alike have recognized the importance of rapidly and substantially increasing applied forest restoration and wildfire risk reduction efforts to address the growing risk posed by wildfire globally (Hessburg et al. 2021; Schoennagel et al. 2017). Matching landscape-scale ecological recommendations for wildfire stewardship with micro- and macro-scale collaborative efforts to implement wildfire adaptation is indeed a wicked problem. As large, high-severity wildfires in the intermountain West move some forest conditions outside of historic and desired future ranges of variability (Churchill et al., 2022), it is even more important to

coordinate strategic thinning and prescribed fire efforts at a landscape-scale. However, this coordination of adaptation efforts introduces new complexities as recommendations for land management must adapt not only to changing ecological disturbance, but to changes within environmental governance regimes as well.

Social entropy is a sociological theory for considering holistic social systems (people, policies, physical landscape boundaries) that flux in equilibrium depending on the movement of information or energy, similar to the concept of entropy. In this case study, social entropy conceptually applies to the flow of federal funding initiatives into smaller, place-based natural resource groups and collaboratives. To better understand how scales of communities and regions adapt environmental governance regimes to accelerate forest restoration and fire mitigation, this study investigates the case of Southwest Idaho. We seek to characterize the challenges associated with efforts to rapidly accelerate the pace and scale of wildfire risk reduction and use the framework of social entropy theory to describe the disorganization and uncertainty that can characterize a governance system experiencing rapid acceleration of work and deployment of federal dollars in a region. This is a question of particular interest to resource-constrained regions that also face significant threat of catastrophic wildfire. Attention to what happens between local collaboratives and regional initiatives when large-scale programs arrive quickly is an understudied relationship.

2. Background

Wildfire adaptation is a practice encompassing multiple social and ecological scales (Platt et al., 2022; Saunders & Briggs, 2002; Steelman, 2016), from the hyper-local (e.g. individual property or ecological niche) to the community (neighborhood, municipality, ecological community) to the regional (landscape-scale across an ecologically connected region). From an infrastructure and emergency management perspective, activities for individual homeowner mitigation include making homes more fire-resistant by activities such as thinning trees and creating defensible space around homes or upgrading wooden roofs to metal roofs (National Interagency Fire Center, 2025). Community-scale wildfire mitigation includes activities such as creating shaded fuel breaks around edges of towns or neighborhoods, hardening of electrical transmission systems, providing public support for fire and emergency management operations (including municipal, county, and regional fire departments and districts), and developing code requirements to ensure that newly built and remodeled structures are built to high fire-resistance standards.

Wildfire adaptation at the federal scale often takes the form of national policy guiding the management of forested lands. Taken together, the 2003 Healthy Forest Restoration Act, the 2009 National Cohesive Strategy and the Collaborative Forest Landscape Restoration Program, the 2019 Shared Stewardship Strategy and the 2021 Wildfire Crisis Strategy have provided limited-duration funding for large-scale wildfire mitigation, including forest treatments to reduce excessive build-up of fuels on forested lands, as well as providing community, county and regional grants that fund mitigation actions covering larger areas.

Collaborative groups have addressed wildfire risk at different scales as well, from place-based collaboratives to regional partnerships. While these two types of groups are not always mutually exclusive, we use these categories within this case study to support our comparative analysis. *Place-based* refers to an initiative or collaborative that is tied specifically to a local or National Forest, and whose members are largely residents or representatives of that particular area (Cheng and Daniels 2003). *Regional* partnerships refer to collectives or formal groups whose focus spans multiple National Forests or local forests, several counties or jurisdictions, and often have a federal leadership presence. Over the past two decades, the federal government has created initiatives that have sought to implement wildfire adaptation at a broader scale. These initiatives have led to the formation of different types of collaborative groups that exhibit characteristics unique to their size and contexts, as shown in Table 1. The Collaborative Forest Landscape Restoration Program (CFLRP), implemented in 2009, funded wildfire risk reduction and forest restoration efforts through building place-based collaboratives at the national forest scale. In order to qualify for CFLRP funding, proponents must establish or work through a place-based group or collaborative that has active projects in a National Forest and is chaired by diverse local stakeholders (Urgenson et al., 2017). In Southwest Idaho, several place-based collaboratives emerged or benefited from CFLRP funding, including the Boise Forest Coalition, the Payette Forest Coalition, and the Clearwater Collaborative.

More recently, the Wildfire Crisis Strategy (WCS; implemented in 2021 and funded through appropriations under Infrastructure Investments and Jobs Act (IIJA) and the Inflation Reduction Act (IRA)), initiated the development of regional All-Lands Partnerships in Southwest Idaho (Anderson et al. 2025; Woolsey et al. 2024). The WCS set national forest treatment targets, including treating 20 million acres on National Forest system land in the US West; treating up to “an additional” 30 million acres on Federal, State, Tribal, and private lands (USDA, Wildfire Crisis Strategy, 2022). Table 1 shows that in contrast to CFLRP, All-Lands Partnerships under the WCS did not have the requirement to be tied to a place-based collaborative or one National Forest. These large-scale partnership efforts span jurisdictional boundaries, encompass multiple National Forests, counties, state lands, and fire protection districts (USDA, Wildfire Crisis Strategy, 2022), and include both public and privately-owned lands.

Table 1
Place-based versus Regional Partnerships Characteristics

Examples	Scale A:	Scale B:
	Placed-Based Collaboratives	Regional Partnerships
	Boise Forest Coalition (BFC), Payette Forest Coalition (PFC)	Southwest Idaho All-Lands Partnership (ALP)
Scale	One National Forest or place-specific; community forest or land area; member-led	Multiple counties and National Forests; Cross-boundary, landscape-scale; strong federal leadership presence
Priority	Multi- land management priorities; balance risk reduction with restoration and recreation	Fulfill Wildfire Crisis Strategy (WCS) objectives; rapid treatment implementation; emergency response coordination
Initiative	Collaborative Forest Landscape Restoration Program	Infrastructure Investment and Jobs Act, Wildfire Crisis Strategy

Challenges of wildfire governance often lie in bridging these diverse scales of adaptation efforts, as identified in the nested scale model (Fig. 1). Communities are often better able to develop robust wildfire governance networks and comprehensive wildfire management strategies when local priorities are integrated into county, statewide or national forest management planning (Paveglio & Edgeley, 2023; Kelly, Charnley, and Pixley, 2019; Abrams, J., Schultz, C., Huber-Stearns, H. et al., 2026). Despite good faith action and communication from federal agencies, large-scale federal land and wildfire management objectives may not always align with local community objectives related to land management (Evers et al., 2019).

That wildfire is an ongoing socioecological issue is not a new finding. Fischer et al. (2016) characterized wildfire management in the Western U.S. as a “socioecological pathology,” calling attention to the interwoven social and ecological processes that contribute to the “nearly intractable problem of wildfire risk” (Fischer et al., 2016, p.276). Steelman et al. (2016) addressed the need for a reorientation of wildfire governance goals to address wildfire as a “social-ecological problem,”. Building on these perspectives, we are the first to bring the concept of “social entropy” to bear on the environmental governance challenges associated with increasing the temporal and spatial scale of wildfire risk mitigation. This concept emerged during the course of our research as a useful framework for land management experiences. While we did not set out to fit real-life examples to the social entropy model, during the analysis phase we found that themes emerged within the results that could be better explained through this framework.

Social entropy theory describes the randomness and temporary disorder that occurs when a social system (in this case, multijurisdictional wildfire governance) rapidly increases in scale, or “receives energy from an outside source” (Bailey, K., 1990). The rapid increase in scale leads to increased complexity in social relations, potentially contributing to disorder, confusion, and the diffusion of uncertainty through social systems. Therefore, it is important to understand what mechanisms, or which actors, within nested social scales (Fig. 1) may impede or facilitate wildfire adaptation efforts towards more resilient landscapes and communities.

Our overarching question considers how the intent to rapidly scale wildfire risk reduction within Southwest Idaho impacts collaborative networks and active wildfire adaptation efforts. We answer this overarching research question by addressing the following study area-specific questions: (1) How do place-based collaboratives and landscape-scale partnerships approach wildfire adaptation in Southwest Idaho? (2) What are the socioecological outcomes of wildfire adaptation efforts as they scale up from place-based to regional objectives within the same geography?

3. Methods

3.1. Study Area and Historical Context

This case study focuses on a region in Southwest Idaho, also known as the Boise Front Range. The Boise Front Range encompasses areas of the Boise and Payette National Forests in six counties of Southwest Idaho with an increasing wildfire risk (Fig. 2). Collaborative forest restoration efforts in this region of Idaho coalesced in the late 2000s with the formation of the Payette Forest Coalition (PFC) in June 2009 and the Boise Forest Coalition (BFC) in September 2010. These groups were founded as citizen- or stakeholder-led groups aiming to build consensus around large, multi-benefit restoration on the Payette, Boise, National Forests. To support peer to peer learning among these and other collaborative efforts across the state, a state-wide umbrella group was formed called the Idaho Forest Restoration Partnership.

Idaho was the first state to sign a Shared Stewardship agreement with the U.S. Forest Service in December 2018, formalizing a cross-boundary approach to prioritize fuel reduction and forest health treatments. In 2019, the Boise and Payette National Forests and their associated collaboratives, PFC and BFC, advanced a broader “West Central Idaho Initiative” Collaborative Forest Landscape Restoration Program (CFLRP) proposal spanning ~ 2.25 million acres of National Forest land that explicitly tied collaboration to Shared Stewardship, Good Neighbor Authority, and multi-party monitoring by BFC/PFC.

The U.S. Forest Service’s Wildfire Crisis Strategy (WCS) (launched in 2021) designated Southwest Idaho as one of Idaho’s priority landscapes with a plan to treat roughly 230,000 acres on National Forest System lands over 5–7 years. This designation led to the creation of the Southwest Idaho All-Lands Partnership (ALP), a regional coalition coordinating fuel mitigation across ownerships. In 2024, the ALP secured \$20.7 million in Natural Resource Conservation Service Regional Conservation Partnership Program funding to accelerate private–public wildfire resilience work. Newer collaborative groups, including the Sawtooth Wildland Fire Collaborative and the 5B Restoration Collaborative, have also joined in wildfire adaptation activities.

Though the different federal initiatives (CFLRP and WCS) supported wildfire risk reduction within an overlapping geographic region, they also supported new and existing collaborative groups at different scales, with the former providing stable funding over 10 years to the PFC, and the Clearwater Basin Collaborative, and the latter initiating the Southwest Idaho All-Lands Partnership. They also operated on different (though overlapping) timelines. The CFLRP was enacted in 2009 and the Payette Forest Collaborative on the Payette National Forest received 10 years of dedicated funding for forest restoration

projects. In 2019, the Shared Stewardship program leveraged state-scale planning methods in a similar geographic area (USDA, Shared Stewardship, 2018) for fuels reduction work on public lands. In 2021, the Wildfire Crisis Strategy was overlaid across a similar footprint as the Shared Stewardship area in Southwest Idaho and supported the development of the All-Lands Partnership.

This study has compiled wildfire adaptation experiences from diverse groups involved in Southwest Idaho to compare and contrast how wildfire adaptation is occurring across multiple scales, and to understand how the succession of federal policies has impacted wildfire adaptation progress across social networks in Southwest Idaho.

3.2. Data Collection

Data were gathered through 19 semi-structured interviews, 16 hours of in-person participant observation during a workshop and two field tours in the study area between September-December 2024. Site visits were made to current fuels treatment sites, planned future treatment areas, and areas that focused on fire history. The workshop included an all-day discussion and walk through of the Southwest Idaho All-Lands Partnership's treatment planning methods.

Semi-structured interviews examined stakeholders' perspectives on the wildfire risk mitigation efforts made through the WCS and their relationship to ongoing efforts by other actors on the landscape. We identified partners who work in or around the wildland-urban interface as well as remote areas within the Boise and Payette National Forests, the Clearwater and the Sawtooth Valley. All participants were active members of either a place-based collaborative, the regional All-Lands Partnership, or both, and had been involved for at least one year. A diverse range of participants were purposefully selected to provide a broad representation of values and management objectives across the same landscape. We developed an initial list of potential contacts by reviewing WCS documentation, local Community Wildfire Protection Plans (CWPPs), and other documents, as well as direct contacts provided by research partners in the Southwest Idaho All-Lands Partnership and the Idaho Forest Restoration Partnership. We narrowed this list to an initial group of potential interviewees (approximately 15) with a focus on representing diverse perspectives from different institutional roles and collaboratives working at different scales. This research was also conducted in tandem with interviews in other priority landscapes of the WCS which provide the basis of a broader cross-case comparison of WCS outcomes across four U.S. states, with 10–20 interviews in each state (Mockrin et al, in prep). We recruited participants through email communication and used snowball sampling in the interviews to further refine our contact list. Our final interview list included 19 interviewees representing the All-Lands Partnership, the Boise Forest Coalition, the Sawtooth Valley Wildfire Collaborative, the 5B Forest Restoration Collaborative, and the Clearwater Basin Collaborative.

This sample is not intended to systematically represent the population of the region, but instead to reflect the perspectives of knowledgeable individuals directly involved in collaborative forest management and wildfire risk governance during the CFLRP and WCS periods. The Clearwater Basin Collaborative, though outside of the Boise Front Range, was selected due to their past experience with CFLRP and their historic knowledge of the region. Overall, participants came from the following sectors: federal agencies (35%),

NGOs (30%), state or county-scale actors (20%) and private sector actors (15%). We provided study information and obtained informed consent from all participants about the study before conducting the interviews (IRB 206804-18). We conducted interviews virtually over Zoom, except for one in-person interview in Boise, Idaho. Interviews, which were voluntary and confidential, lasted one to two hours and were conducted between August-December 2024.

An interview guide and codebook were developed prior to the interviews based on a literature review of wildfire adaptation, fire-adapted forests, and collaborative governance in the western United States. Initial coding was conducted by multiple coders, and results were compared to ensure reliability of interpretation and application of the coding scheme (Lofland et al. 2005; Neuman 2003). Interviews were transcribed and coded in NVivo through an iterative coding process using codes previously agreed upon by the research team, as well as new codes emerging from themes observed within the interview data, such as evidence of social entropy. The coding process included thematic analysis that enabled a comparison between participants in a forest collaborative versus those in a regional partnership.

[Table 2 **APPEARS HERE**]

Table 2 Summary of interviews conducted by group and scale			
Group	Regional	Local	Total
Federal	6	1*	6* (35%)
NGO	2	4	6 (30%)
State/County	0	4	4 (20%)
Private	1	2	3 (15%)
Total	9 (45%)	11 (55%)	19

* This individual spanned regional and local scales and therefore ‘Federal’ only receives 6 counts.

4. Results

The Southwest Idaho region experienced an influx of federal funding from the Wildfire Crisis Strategy made over the period of 2022-2024. Funding was distributed through the National Forest Foundation, which supported the development of the Southwest All-Lands Partnership. Though the funding was intended to rapidly increase the regional capacity for wildfire risk reduction efforts, the scale of funding was also described by interviewees from place-based and regional groups as having unintended consequences that disrupted existing momentum throughout the study area. To characterize the challenges associated with increasing the pace and scale of wildfire risk reduction, we found a useful mental model in the sociological phenomenon of social entropy. We use this term to refer to the way interview participants described rapid scaling creating tension and uncertainty amongst existing wildfire governance networks. Social entropy may impact socioecological outcomes such as delaying wildfire risk

reduction projects (such as prescribed burns or forest restoration treatments), stalling funding pass-throughs across programs, or creating tension in social networks that require more time to rebuild trust in relationships. We organize these results in three broad thematic findings: 1) capacities and constraints; 2) social entropy as an unintended consequence; and 3) examples from interviewees of successful social entropy navigation.

4.1. Funding-constrained versus bureaucratically constrained collaboratives

Results revealed a set of key themes, including funding disparities between place-based collaboratives and partnerships, friction in governance, capacity differences as well as differences in the size and scope of wildfire mitigation projects. In-person field observations revealed a discrepancy between what place-based groups and regional partnerships wrestled with through their internal collaborative processes. For example, the Boise Forest Coalition's work focused on finding common ground in a multi-use forest restoration or wildfire mitigation plan among its diverse representatives by maintaining a National Forest-scale project-by-project perspective. In contrast, the All-Lands Partnership members already shared the goal of reducing wildfire risk in the wildland-urban interface, but given the increase in scope across multiple National Forests and jurisdictions, members used a conflict-resolution model to talk through differing agency and county-scale administrative and hazard planning approaches that influence the implementation of those efforts.

Interviewees from the All-Lands Partnership repeatedly emphasized that scaling up implementation from smaller, localized projects to landscape-scale size (such as from 100 acres treated per year to 100,000 acres) is not simply a matter of increased funding, but of personnel and administrative capacity:

"It's easy enough to pick up 1,000 acres here or there, but to realistically pick up 100,000 acres, there's not the staff capacity to do that kind of work." SIL_11b

While the WCS emphasized protection of private lands, funding streams did not always align with those stated priorities. According to one interviewee:

"I think that it poses significant challenges [when] the priority is for the protection of the private lands, but there's no funding stream increase in order to address the work as we engage with communities and develop those relationships [on private lands]..." SIL_11a

The relationship between funding opportunities and capacities became a major theme in our results, with the ALP supported by a budget secured through federal appropriations, and place-based collaboratives supported by multiple smaller grants and contributions.

Within this case study, place-based groups were funding-constrained while the All-Lands Partnerships was bureaucratically constrained. In one funding installation, the All-Lands Partnership received around \$22 million dollars with a timeline of three months to obligate the funding. In total, the WCS distributed

\$133,440,000 dollars to the ALP over the lifespan of the funding initiative from 2022-2025 fiscal years (U.S. Forest Service. Internal Landscape 360 Dashboard accessed 12/26/24). Interviewees with the place-based collaboratives reported that their prior, largest funding source (CFLRP, which ranged between \$5 million to more than \$35 million to be used over 10 years) had ended. It is more common now for forest collaboratives to piece together funding project-by-project. Funding availability has a significant impact on the implementation of wildfire adaptation activities, as well as the rate at which they are executed.

The majority of place-based collaboratives examined in this study focused their work on public lands and public goods, involving themselves in the environmental analysis process and in long-term relationship building to enhance environmental restoration and rural economic outcomes. The All-Lands Partnership also focused on public lands and public goods, but extended their scope to include private lands, public lands at many scales, and the long-term treatment and maintenance of wildfire risk reduction with federally designated treatment targets of 20 million acres on National Forest system land and an additional 30 million acres on Federal, State, Tribal and private lands (Woolsey et al. 2024).

4.2 Scaling up overrode prior place-based planning and introduced social entropy

Participants from established forest collaboratives and the regional partnership group shared their experience of the WCS shifting priorities away from place-based collaboratives and previous policy initiatives like the Shared Stewardship Strategy into the WCS-initiated All-Lands Partnerships. While many noted the positive developments from the WCS funding and development of the All-Lands Partnership, interview participants also laid out the dilemma of having to reprioritize a program of work that had been developing for three to fifteen years. Forest restoration projects shared with place-based collaboratives in the national forest system, as well as programs developed by Shared Stewardship, experienced disconnects in their social networks as WCS funding placed an emphasis on developing a network of actors within Idaho's wildfire governance system adjacent to prior place-based efforts. One participant described having to rebuild relationships with cooperators and partners after several wildfire risk reduction projects were put on hold while WCS appropriations were distributed through the National Forest Foundation to create the All-Lands Partnership:

"The Forest Service did not take into account existing partnerships, programs, and collaboratives. They essentially rolled out these All-Lands Partnerships over top of existing programs and asked all of our partners to drop what they're doing with their other programs and be part of an All-Lands Partnership. That has created a considerable amount of frustration and I think resentment from partners." - SIL_18; LOC_8

Place-based collaboratives shared a similar sentiment. One place-based collaborative member noted that they were no longer engaging on a particular treatment project with their Forest, despite being engaged since the initial planning. Later, during a site visit, a member from the ALP noted that their partnership was now the lead collaborative engaging on that project. A member from the place-based collaborative noted that while they did not want their collaborative to stand in the way of progress, they felt that they should

have been better informed when their federal partners hired a Wildfire Crisis Strategy program manager to take the lead on project engagement and implementation. This participant also noted that they would have liked more communication from their U.S. Forest Service partners when the Wildfire Crisis Strategy funding rolled out and planning meetings began:

“No one has been at those meetings from the collaborative, nor did we even know that [someone] had been hired [as a WCS coordinator]... There's a major communication disconnect with that project. I would say with the public, not just with the [collaborative], but just in general, no one seems to really know what's going on.” - SIL_5; LOC_2

Another place-based collaborative participant shared their experience of how the Wildfire Crisis Strategy funding impacted their collaborative, which had started with seed money from the U.S. Forest Service in 2012 after a high-severity fire burned near town limits:

“The National Forest Foundation, their priorities shifted dramatically [with the WCS rollout]. They had a lot of staff that were managing collaboratives, but because of the national level of funding that was pouring in and needed to be managed, their staff all had to operate with different responsibilities. They quit facilitating all these small collaboratives. Once NFF quit facilitating [our] collaborative, then of course, it was a little bit more dead in the water with fewer meetings, fewer conversations.” -SIL_7; LOC_3

There may be a tendency to blame federal partners for communication gaps, but it is also important to recognize that such gaps are likely to occur as federal priorities shift or as social networks change over time. One participant and member of the ALP group noted the challenge of integrating the previous programs of work into the Wildfire Crisis Strategy's long-term vision, stating it has been a delicate process. This participant described how the Shared Stewardship Strategy allowed for flexible communication and project implementation between federal, state and county partners, which they wanted to try to replicate during WCS implementation.

“Typically, Shared Stewardship... was initially the linchpin between the Forest Service and partners. With the Wildfire Crisis Strategy landscapes... [We're] trying to figure out how all these pieces fit together and how we can capitalize on what Shared Stewardship may have started and is still operating, and where we grow beyond that, or if it's two different groups or [if] all the different pieces fit together. Those are the growing pains that I think are very typical when you see huge programmatic shifts from the Forest Service.” - SIL_18; LOC_8

These examples show a wildfire governance system in flux, during which fine-scale interactions between individuals impact network-scale dynamics. These finer-scale examples include: Stable working relationships that experienced communication gaps; Uncertainty with the direction of projects as priorities were redefined to fit new programmatic guidelines; Competing needs as bridging actors who work across jurisdictional boundaries attempted to find where priorities from the Shared Stewardship and CLFRP initiatives blended into WCS goals.

4.3. Navigating the challenges of scaling to landscape-scale adaptation

Across all collaborative groups, interviewees described ways they have been able to mitigate the sense of social entropy, or the diffusion of uncertainty that often accompanies new policy goals. Many noted that being able to reduce confusion between different public land policies helped them to reach goals related to wildfire risk reduction, as well as improve collaboration and enhance forest health. Participants acknowledged that building the social infrastructure necessary to mitigate these challenges requires sustained investment of time and effort. As one participant explained:

“Collaboration takes time... there’s overlapping histories, rivalries, contentions, that need to be discussed and overcome... Right now, really we’re building the relationships that will ultimately allow us to do that... We’re building trust with partners.” (SIL_03)

Interviewees who demonstrated knowledge about how to navigate uncertainty during programmatic changes also demonstrated an understanding that each scale of wildfire adaptation has a strength that may be complementary to actions in smaller or larger scales. One participant from the All-Lands Partnership described how one could mitigate the sense of being overwhelmed when taking on such a large initiative. By dividing the federally designated area into smaller, more localized parts, managers can locate potential project areas and invite relevant people into the decision-making process:

“It’s a big landscape, it’s a little more than 2 million acres. I think that one of the challenges over the last year has been how do you bring the right people along at the right scale? Let’s break it into smaller chunks, and just bring the relevant people into that planning process.” - SIL_16 REG_8

This participant makes the case for applying a nested governance model to a specific landscape, such as where the WCS has been designated, to help break down the scope from one large piece into smaller and smaller pieces. A nested governance model plays a role in showing where bridging actors that work between jurisdictional scales can help connect people as large groups navigate uncertainty.

In nested governance settings, funding initiatives can build on past programs in order to leverage pre-existing work, similar to how the WCS has leveraged past work from CFLRP as well as the Shared Stewardship Strategy. One participant described their experience in a program before the WCS role out, and emphasized the role the State can play as a bridging actor when using different agreements with the U.S. Forest Service:

“The State can do things that the Forest Service can’t do as well. If we were to enter into supplemental project agreements, basically then the State could channel funds to those rural fire departments. There’s not been a lot of institutional knowledge about how to use agreements on the forest.” - SIL_9; REG_6

The same participant shared how, after learning to navigate grants and agreements creatively, they were able to scale up prescribed burn efforts across public and private ownership boundaries. With permission and interest from a willing private landowner, this federal employee was able to partner with the state and

Boise County to test prescribed fire, bringing local knowledge about the ownership history as well as the landscape needs:

“Since I already knew those fire chiefs, I just called them together... and had them get Sharpie markers and help me draw some lines on a map... places where I thought we would have success of stopping a fire... We projected that on a big screen and people had an opportunity to update it and say, ‘Let’s consider these.’ There were more people at that meeting than just the fire chiefs... You can’t just come in with a bunch of money and tell them what they’re going to do and expect it to be lasting in any sustainable way. You need local support for any program to be sustainable... we created a participatory agreement to where we could [prescribe] burn across the ownership boundary from Forest Service land under a private land owner.” - SIL_9; REG_6

While several in the All-Lands Partnership noted the challenge in spreading out into private lands and working with homeowners, a federal employee shared positive experiences of building trust in a local community over time by having conversations with individual landowners. They noted their one-on-one communication led to whole neighborhoods signing on to a treatment or mitigation project on their adjacent properties. In this instance, this participant built trust with a Road Users Association who signed on to giving private road access for a fuels reduction project on their properties:

“I’ve tried to engage people when they come into the office through a lot of our project planning... It’s just something that you need to constantly message. It’s not going to be a one and done thing, it needs to be part of your regular dialogue... that you have with different individuals. I do see that it’s gaining some traction, and people are making movement in the right direction. Particularly, with the Road Users Association, that was one big success... that I found just in working with one entity. It was about 80 different landowners or so.” - SIL_10; REG_7

This participant highlights the importance of one-on-one conversations between private landowners and their Forest contact with social capital to be effective for doing work on private lands. This participant said that their ability to communicate effectively with individual landowners led to the partnership doing a large-scale prescribed burn on private lands. They emphasized that because the landowner had previous professional wildland fire experience and had been a rural fire chief, it was easier to get approval to test prescribed fire across their private property and the adjacent national forest land.

“We did a pilot program of [prescribed fire] on a pretty small acreage, truthfully, but it was a proof of concept that we could. We had to get an agreement with the local landowner, and the local landowner happened to be one of the rural fire chiefs in the area, so he was pretty agreeable to fire type of treatments on lands. I think doing small things like that and slowly growing that program would be helpful, but I understand that it’s going to be a challenge to do large, landscape-level burns across neighborhoods where there’s homes and structures.” - SIL_10; REG_7

This participant noted that the prescribed fire program will be able to grow at a pace that is both manageable and understandable by local landowners, emphasizing the importance of incorporating both local knowledge and support in efforts to scale up. Another participant from a place-based collaborative

emphasized the importance of building trust over time with homeowners by including them in planning processes as the U.S. Forest Service developed prescriptions for adjacent parcels:

"I have had projects work best... where we had the homeowners in the room. Some of them had silvicultural backgrounds. Some of them were really helpful in saying, 'Okay, here's my subdivision over here, and over here is the project. Let's coordinate efforts.' We really tried to coordinate with their homeowners' association and the Forest Service so the prescription matched. That to me is ideal." -SIL_4; LOC_1

Another participant shared that they had noticed a marked difference recently in messaging about upcoming prescribed fire events to the public, noting that since the Wildfire Crisis Strategy funding has arrived, education and wildfire awareness has increased in some cases:

"We've been doing a lot of this stuff all along, but I think we have increased the scale of it really is the biggest thing. That's been super helpful to get some of the additional funding with. Also, I think our messaging to the public has been enhanced. Previously it was like, 'Oh, we're going to burn. There could be some smoke. Just letting people know.' Now it's more trying to tell the story of why we're burning, and talking about the benefits of the burning instead of just there's going to be smoke." - SIL_10; REG_7

Beyond improved communication with the public, participants also emphasized the importance of maintaining honest, direct communication among partners themselves. One participant described how their collaborative group navigates challenges:

"What I've been most impressed with is how they are willing, when something comes up, especially after a big fire season, they'll close the doors and have the hard truths conversations. Everybody will participate in those and talk about the positives and the negatives. It's just done and everybody feels open to communicate our truths. When they leave the room, it's like, 'Hey, we're good.' Everybody shakes hands because they're all committed to solving problems. The same people keep coming back and continuing to have these hard conversations and find solutions." (SIL_18)

Our study shows that scaling up wildfire mitigation efforts and forest health treatments with appropriate silvicultural prescriptions and prescribed fire methods can be a challenge. At the same time, we also documented several successful examples of these activities, showing that strong trust at the community-scale and the national forest scale makes large-scale wildfire adaptation possible when done collaboratively. State and county agencies in Southwest Idaho are positioned to balance insights from local, place-based perspectives with federal perspectives and act as bridging actors that increase coherence between micro- and macro-objectives. For example, one participant from the regional partnership emphasized the importance of developing shared frameworks to enable this coherent approach:

"The goal of that tool is to create a shared language or vocabulary in regard to risk assessment, and planning across that landscape... The idea here is to both create a partnership of those folks and give them

a shared planning language such that we can act in a collaborative, and I like the word coherent way. Versus resorting to opportunistic random acts of conservation.” (SIL_03)

Another participant noted the importance of county fire working groups:

“Utilizing that fire working group as a technical advisory to each other, not just for the work that's going to happen on private lands or on federal lands but cooperatively, how do we leverage the expertise in the room for the implementation of the work so we can establish this expansive impact for the communities across these inhabited landscapes?” SIL_11; LOC_4

The interviewee followed up this thought by posing a question to make scaling up more meaningful for the community, not just an individual homeowner:

“How do we get [people] to talk more regularly to create that collaborative effort across the designated boundaries of counties or forests to ensure, again, that the impact that we're trying to create is meaningful? That it's at the right scale? Doing these microscopic inserts into the forest have great meaning to that particular landowner, but the overall impact to the community is negligible.”

A member of the Boise Forest Collaborative shared an example of bringing biophysical needs along at scale by demonstrating an appropriate treatment around a remote WUI area. They remarked that their group was able to incorporate important ecological factors, through actions such as considering sensitive species when determining where strategic fuel thinning would occur. The success of this project), which had shaded fuel-break, strategic thinning and prescribed fire, helped contain the Mustang Fire in 2012:

“There was an opportunity to bring a collaborative together to recommend project components for the Hughes Creek project. This was one where they really were starting with the community to develop the project instead of proposing a project and then only addressing the community interests that were within their predefined scope. As a result of that project, the Forest Service adopted the group's recommendations that were submitted in a collaborative format. Basically, the project was focused on a shaded fuel break, some thinning, prescribed fire in-- I think it was an 8,000 or 12,000-acre project area in the Wildland-Urban Interface outside of the town of Gibbonsville. That was a new step for us. It was about 2012 when the Mustang fire came out of the Selway-Bitterroot Wilderness and was approaching the town of Gibbonsville. It hit the treatment area and dropped down to the ground. That area is actually used by the local firefighters as an anchor point. The treatments were deemed effective at that time of day for stopping the fire, or at least putting it so it was more manageable. Then since that Hughes Creek project, we have seen the Forest Service become more and more interested in forest restoration collaborative efforts.” SIL_4; LOC_1

5. Discussion

This study was designed to understand the challenges and opportunities of scaling up wildfire adaptation efforts to offer solutions as overlapping governance networks morph over time. We acknowledge that WCS timelines and agency priorities shifted during the course of this study. WCS was envisioned as a

decade long-strategy when proposed, but funding challenges meant funding was largely depleted by 2025. As a result of budget challenges and workforce incentives, the Forest Service has experienced significant staff reductions since 2025. Agency priorities under a new administration shifted from WCS to an 'Active Management' approach focused on timber production (USDA, National Active Forest Management Strategy, 2025). These changes have continued to have an effect on the wildfire and forest governance networks in Southwest Idaho.

We interpret interviewees' descriptions of their experience with the implementation of new federal programs aimed at landscape-scale forest management in Idaho through the lens of social entropy, a valuable framework for understanding consequences that can arise in a rapid expansion of the scale of a social system, such as an environmental governance network. Collaboratives working at smaller scales of forest restoration and wildfire mitigation experienced an influx of energy and a destabilizing of existing capacity throughout the study area. Participants of regional partnerships also expressed a sense of social entropy as the goal of scale-growth created tension and uncertainty among existing wildfire governance networks (Figure 4). Social entropy may impact socioecological outcomes such as delaying wildfire risk reduction projects (such as prescribed burns or forest restoration treatments), stalling funding pass-throughs across programs, or creating tension in social networks that require more time to rebuild trust in relationships and navigate shifting power dynamics.

These challenges are expected within the framework of social entropy, which leans on the law of thermodynamics to understand large-scale social systems as ebbing in and out of equilibrium. Rather than considering a wildfire governance network in a state of permanence, social entropy as a mental model allows flexibility in conceptualizing the expected and normal changes that occur as significant components of a governance network shift with funding, personnel, and federal guidelines. Normalizing these challenges supports finding solutions that help wildfire practitioners and land managers navigate uncertainty, power differentials, and mitigate problems within social networks as they arise.

In this case study, we conclude that scale strongly influenced the feasibility of completing necessary wildfire adaptation actions such as growing a robust governance network, creating defensible space, and long-term planning for forest resilience. Evidence of scale-dependence emerges when examining unique needs and complementary strengths for localized collaborations versus regional partnerships, which suggests community wildfire adaptation will rely on breaking down sectoral silos and coordinating cross-scale decision-making and communication, aligning with existing literature on collaborative natural resources management (Nesbitt, 2026). Social entropy introduced at varying scales creates challenges that might be navigated with the help of bridging actors.

The effect social entropy may have on a land management social network can be: 1) loss of momentum in NEPA-ready hazardous fuel removal projects; 2) reduced buy-in for prescribed burning programs; 3) or turnover in key community building positions that support CWPP organizing. Because sustainable land management has often occurred at the stand or local forest scale, scaling up both wildfire risk reduction and forest restoration across jurisdictions advances small-scale social systems into a potential upwelling of social entropy.

Rapidly scaling wildfire adaptation can introduce challenges even when funding, policy attention, and shared risk-reduction goals are in place. Congressional funding, creative agreements between federal and state agencies, and strong local buy-in are just a few important building blocks identified by study respondents for building long-term adaptive capacity for wildfire stewardship. Because place-based collaboratives share a unique relationship both with place and local identity, there is an ongoing opportunity for capacity building programs to support relationship development with regional partners. Similarly, regional partnerships could benefit from defining shared terminology at the beginning of the planning process, as well as having a centralized communication strategy not just for formal partnership members, but for external partners as well.

Though place-based collaboratives may approach wildfire adaptation with goals, capacity and funding that differ from regional partnerships, their involvement is crucial in efforts to scale up wildfire adaptation regionally. In this case study, we found that place-based collaboratives and regionwide partnerships are complementary and offer different strengths that make adaptation more possible when they work together rather than separately. The All-Lands Partnership cited a need for a larger pool of forestry contractors, which many place-based collaboratives could provide or connect them with. Additionally, place-based collaboratives cited a desire to monitor the effectiveness of treatments, which could also be included in work done by contracting foresters or county-scale fire mitigation programs.

The Southwest Idaho Landscape has built capacity for wildfire adaptation over decades, making it possible to shift from more traditional fire suppression approaches to a broader set of land management tools such as prescribed fire, variable density thinning in appropriate elevations, and advancing progressive WUI codes and land use policies that incorporate wildfire behavior. However, as the interviews with participants demonstrated, conversations around land use, silvicultural treatments, and homeowner adaptations can happen in different sectors, leading to siloed communication rather than in collaborative planning workshops.

County commissioners and land use policy experts do not always have the capacity to close the communication gap by joining these conversations. However, place-based collaboratives, including fire working groups, tend to set up a member-representative model for sharing time and resources amongst members who have local expertise and insight into a dynamic timber economy. Given many of their past successes in working with federal partners to integrate forest health treatments into mitigation strategies, and their ability to speak on behalf of a specific geographic region, place-based collaboratives can provide additive local insight to wildfire adaptation strategies and plans that could increase local buy-in and long-term sustainability of forest health treatments.

This study aligns with Urgenson et al.'s (2017) conclusion that small-scale collaborative efforts at the community- or watershed-scale combine flexible decision-making with trusted biophysical and regional knowledge. It also shows that communication gaps between multi-scale agencies present barriers to integrating forest resilience priorities with wildfire risk reduction in federal programs that scale up community-led projects. When programmatic shifts occur at large scales or via top-down directives, public land managers and local communities spend considerable time and energy rebuilding strategies, social

networks, trust and forest management plans. Increasing flexibility at the federal-scale for policy directives to be interpreted in a locally informed context can provide coherence and nimbleness for expanding wildfire stewardship and community wildfire adaptation outcomes across a landscape.

Moving beyond theory, we offer this notion of social entropy as a pragmatic early warning sign for practitioners to plan ahead for and consider when working within socioecological systems (Garcia and Fearnley 2012). Rapidly scaling wildfire adaptation can introduce challenges even when funding, policy attention, and shared risk-reduction goals are in place. It is inevitable for complex socioecological systems to experience shifts in network dynamics and for local and federal land management objectives to experience disconnection. However, identifying the early warning signs of social entropy can support practitioners and land managers plan ahead for eventual and navigable challenges, such as a lack of preparation time for prescribed or cultural fire burning as climatic windows shorten, or developing stakeholder consensus for insect or invasive species outbreak.

Wildfire adaptation taking place at localized and federal scales across time and space suggest that a model of scale-dependence, or nested scales, would support the development of cohesive bridging between micro- and macro-perspectives (Wyborn & Bixler, 2013; Cheng and Daniels 2003). Additionally, integrating ecologically appropriate treatments (e.g., Jones et al., 2021), localized expertise and federally resourced programs can create opportunities for public engagement in the National Environmental Policy Act (NEPA) process and funding sustainability (Platt et al., 2022). Wildfire adaptation can be viewed at the level of one parcel or one watershed at a time, but the flexibility to approach forest management efforts through a nested governance model can reduce coordination challenges when bridging actors connect organizations across levels and sectors. At the same time, a nested governance model can also cause some vulnerabilities, including staff turnover, uneven communication, or unclear roles which may increase social entropy by weakening the relationships that hold the network together. Bridging actors who work across scales of a wildfire governance network can help ameliorate those challenges and allow for complementary strengths to emerge and facilitate wildfire adaptation at a landscape-scale.

6. Declarations

6.1. Ethics approval and consent to participate

This study was approved by the Portland State University Institutional Review Board under reference number IRB 206804-18. Verbal informed consent was obtained from all participants before interviews and participant observation.

6.2. Consent for publication

Not applicable. The manuscript reports anonymized interview data and does not include identifiable individual person data, images, or videos.

6.3. Availability of data and material

The datasets generated and/or analyzed during the current study are not publicly available due to IRB restrictions and the sensitive and confidential nature of the interview data.

6.4. Competing interests

The authors declare that they have no competing interests.

6.5. Funding

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6.6. Authors' contributions

Conceptualization: OA, CE, MNP, AH. Data curation: OA, RA, MM. Formal analysis: OA, RA, MNP, MNH, MM. Funding acquisition: MHM, LKC, CE, MNP. Investigation: OA, RA, MHM. Methodology: OA, RA, CE, MHM. Project administration: RA, OA, MHM, KH, CE, LKC. Supervision: LKC, MHM, CE, KH. Visualization: OA, CE, KH. Writing – original draft: OA. Writing – review & editing: OA, RA, MM, CE, MHM, MNP, LKC, RM, AH. All authors read and approved the final manuscript.

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Figures

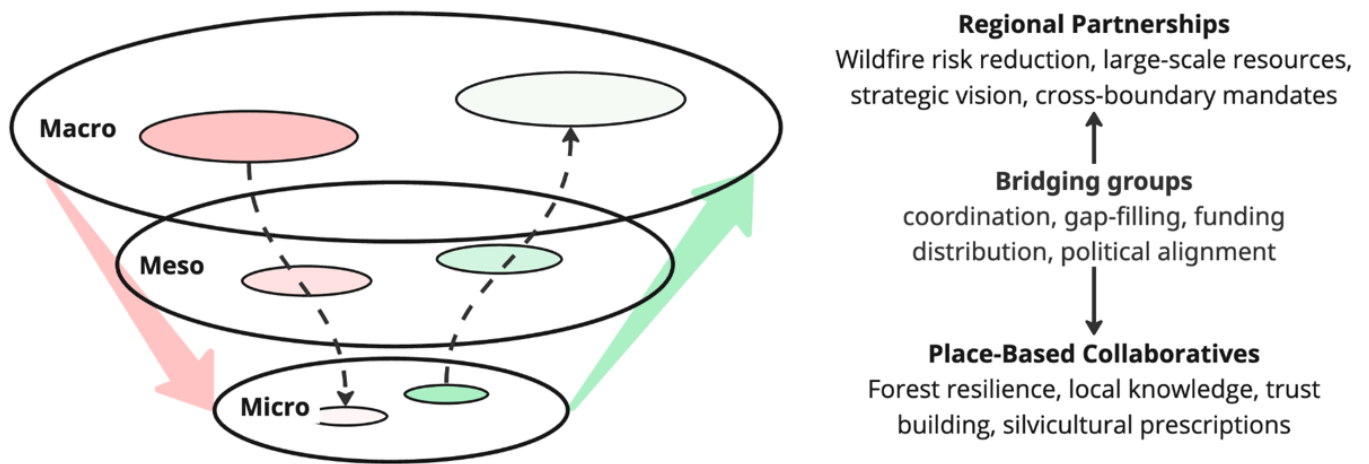


Figure 1

Nested governance and micro- vs. macro-scales of wildfire risk mitigation activities.

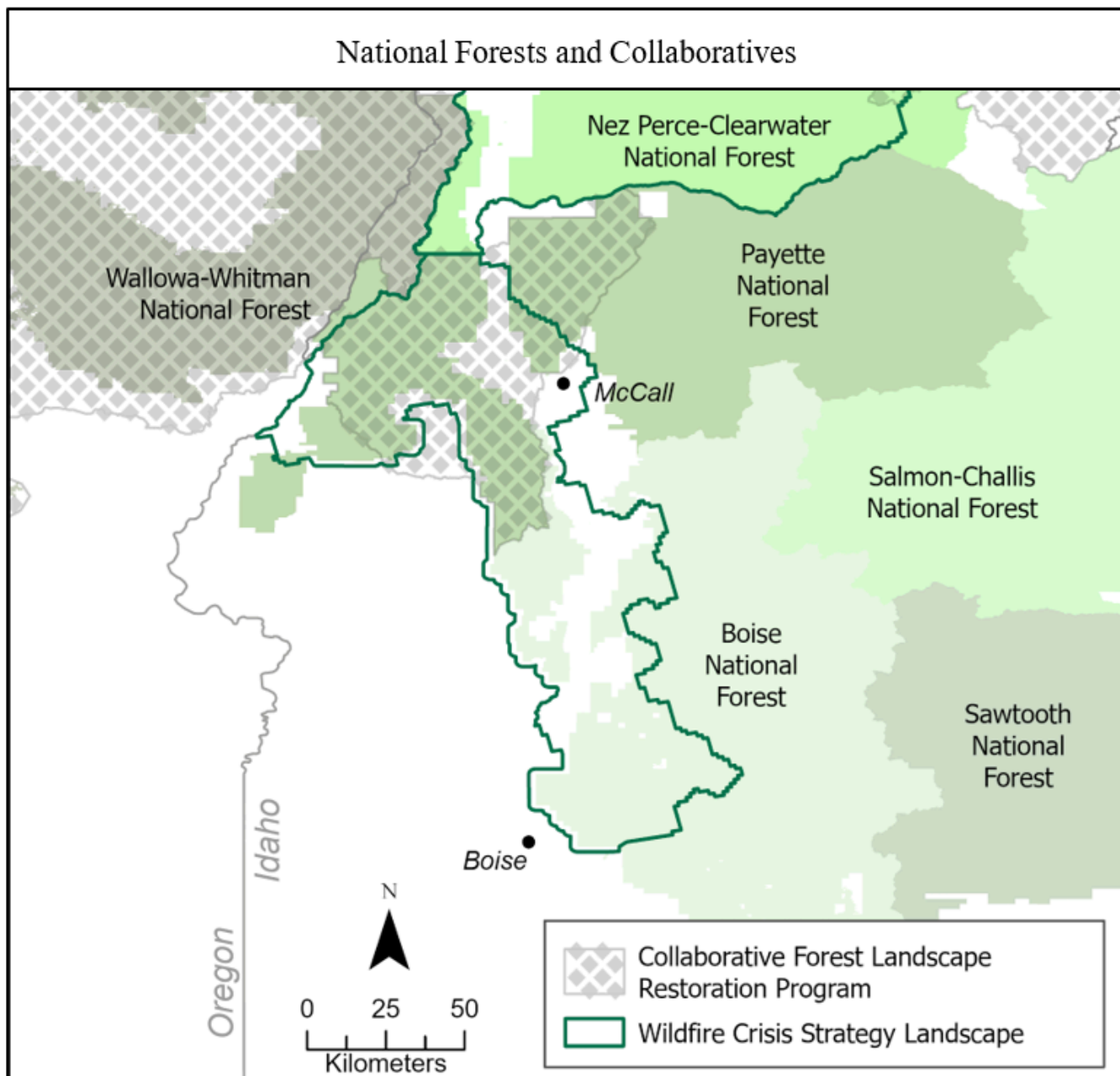
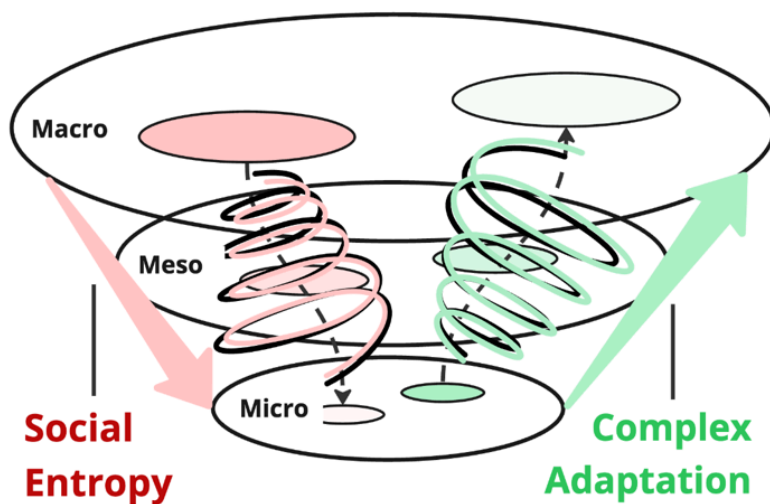


Figure 2

Map of Southwest Idaho showing WCS boundary and CFLRP Landscapes. Map by Kathryn Hixson. Source: U.S. Forest Service Collaborative Forest Landscape Restoration Project Boundaries and U.S. Forest Service Administrative Forest Boundaries.



Regional partnerships

well-resourced, less nimble, moves slower, paid involvement, system-focused, large scopes, model-based approach to choosing projects

Shared challenges

lack of sustainable funding, turnover at the national forest, barriers to prescribed fire

Place-based collaboratives

Community buy-in, local knowledge, funding-constrained, volunteer involvement, flexible, nimble, small scopes, iterative 'zones of agreement' for choosing project locations

Figure 3

Figure 4. Differences in adaptation strategies between regional All-Lands Partnership and Place-based Collaboratives and social entropy as a consequence of rapid scaling in adaptation efforts and the notion of complex adaptation.

Supplementary Files

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- [Supplemental1InterviewGuideldahoFuelingAdaptations.docx](#)
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