*Research*

# Equity in resilience: a case study of community resilience to wildfire in southwestern Oregon, United States

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ABSTRACT. In the fire-prone and fire-adapted landscape of the Rogue River Basin of southwestern Oregon, communities mobilize to prepare, respond, and recover from wildfire while modifying the current social and ecological system. Marginalized communities are often most affected and least prepared for disturbances of this kind, where racism, colonialism, and structural equities prevent meaningful inclusion and equitable allocation of resources. This research centers these voices in an empirical study of the situated resilience of the Rogue River Basin, rooted in the work of community-based organizations, land managers, conservation organizations, and private contractors. We take an embedded and qualitative approach, considering resilience "of what to what," "for whom," "by whom," and "how" within the confines of the Rogue River Basin. We engaged those most affected by wildfire in the process of designing research, detailing experiences, and shaping outcomes. Relying on descriptive accounts and perceptions of what constitutes community resilience to wildfire, this research shows resilience is context-dependent with different paths to resilience for different groups. We co-produced multiple attributes of resilience, and describe how cross-cutting themes within attributes indicate perceived shifts from less-resilient to more resilient system states. For those in the Rogue Basin, more resilient systems involve local engagement in decision making, acknowledgment of the value of non-dominant knowledge systems, and reciprocity and shared resources between the community's most vulnerable. We found that as actors sought more radical change through the creation of new systems, their capacity to address social inequities grew. Moreover, outcomes of this research challenge decision makers invested in community resilience to consider who benefits and is burdened not just by disturbance itself, but policies and programs designed for preparation, response, and recovery. Ultimately, in relying on lived experience, we construct policy and management recommendations in service of the communities most affected.

Key Words: *adaptation; community-based natural resource management; community resilience; equity; fire; situated resilience; transformation*

## INTRODUCTION

Globally, communities are faced with increasingly severe disturbances as a result of shifting climatic conditions. Fire-adapted Indigenous peoples in the West were, and continue to be, active managers of their landscapes, relying on fire disturbance for the health of social and ecological systems (SES). However, decades of colonial land and fire management have led communities in fire-prone regions of the Western United States to experience extended fire seasons, health impacts from smoke, and the loss of life and property as fires become larger, more frequent, and more severe (Abatzoglou et al. 2021). In response, communities often seek intentional shifts to SES to prepare, respond, and recover from wildfire disturbance (McWethy et al. 2019). Marginalized communities are often disproportionately affected by wildfire (Méndez et al. 2020, Masri et al. 2021, D'Evelyn et al. 2022) and efforts to shift systems are challenged by the same structural factors that drive disturbance and produce social inequities (Tschakert and Tuana 2013, Méndez et al. 2020). How communities prepare, respond, and recover from wildfire can be captured by the concept of resilience: the capacity of a system to meet the challenges of disturbance through resistance, adaptation, or transformation (Walker et al. 2004, Folke et al. 2010). Advancing social and ecological resilience to wildfire, and disturbance more broadly, requires contextual consideration of diverse ways humans relate to fire, the preconditions of a system that shape social inequities, and the role of environmental governance in moderating the human relationship to fire-prone landscapes (Cote and Nightingale 2012, Copes-Gerbitz et al.

2021). Research that reflects the lived struggles and diverse experiences of communities adapting to changing fire regimes is essential to shaping solutions. This research explores what community resilience to wildfire looks like, based on how it is experienced and interpreted in the fire-prone Rogue River Basin of southwestern Oregon.

Community resilience to wildfire is experienced differently by different social groups based on structural inequities that shape the recognition of diverse knowledge systems, participation in governance, and the distribution of wildfire risk across communities (Schlosberg 2004, Higuera et al. 2019, Copes-Gerbitz et al. 2021). Equity is an important supplement to the resilience concept in understanding how and why some groups may feel the impacts of wildfire more acutely than others (Auer 2021). Resilience and equity similarly describe the conditions of interacting and interdependent SES. Where resilience is concerned with the capacity of a system, community, or individual to cope with disturbance, equity is concerned with the relative circumstances of individuals or communities within a system that can shape resilience outcomes (Matin et al. 2018). Equity describes the fairness of a system, implying more resources for those who need it; resilience describes the ability of a system to cope with disturbance. As shown in Figure 1, basic resilience allows a social-ecological system (SES) to return to its current state, while adaptation seeks incremental change, and transformation is the creation of a new system when existing systems become untenable (Folke et al. 2010, McWethy et al. 2019). Figure 1 also shows the three interacting forms of equity.

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**Fig. 1.** Main conceptual frameworks used in the study.
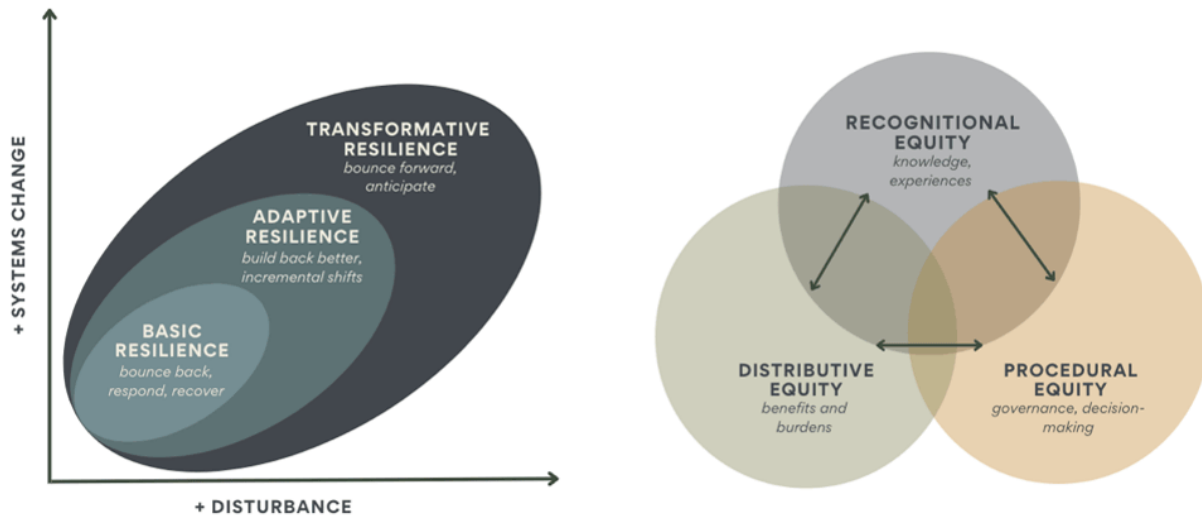


Recognitional equity is concerned with how diverse knowledge systems and experiences are valued (Leach et al. 2018). Procedural equity relates to the fairness of decision-making processes within governance structures and institutions (McDermott et al. 2013). Distributive equity addresses the distribution of benefits and burdens, like wildfire risk, across a community (Löfqvist et al. 2023).

The resilience concept is applied across social and ecological domains (Adger 2000). In recent years, public land managers have increasingly used the term resilience as an organizing principle and policy goal in forest planning and management in response to increasing disturbance from wildfire and pest outbreaks (Benson and Garmestani 2011, Abrams et al. 2021, Chapin et al. 2021, Beeton et al. 2022). Where forest and fire resilience are ecosystem-dependent, community resilience to wildfire is similarly subjective, that is, experienced differently by different groups (Tschakert and Tuana 2013, Copes-Gerbitz et al. 2021) and situated in cultural, historical, and political contexts (Cote and Nightingale 2012). Despite this, resilience discourse often fails to acknowledge the underlying social, economic, and political forces that drive undesirable change while producing and sustaining social inequities and unequal vulnerabilities (Shah et al. 2018). Garcia and Tschakert (2022) present a political ecology lens for studying resilience capacities: by addressing and challenging the power relations and processes that produce and maintain inequities, we can better understand how to support marginalized groups and make fair and inclusive adaptations and transformations. To analyze underlying power relations and processes, scholars pose four questions to those studying the resilience of SES: "resilience of what to what," "resilience for whom," "by whom," and "how" (Tschakert and Tuana 2013, Cutter 2016).

Case studies are central to this effort, where we can analyze equity and resilience dynamics bounded by an explicit SES. Using a case study approach, we look to the Rogue River Basin of southwestern Oregon, where socially, economically, and culturally diverse communities are embedded in an extremely fire-prone landscape, and concerns of equity and resilience to wildfire are salient (Metlen et al. 2018). As a complex SES, conditions in the Rogue Basin are socially and ecologically untenable, and a network of organizations seek intentional change (Metlen et al. 2017). This paper presents a situated understanding of community resilience to wildfire in the Rogue River Basin through the co-production of resilience attributes: actions or features of this SES that support resilience. These attributes interacted to allow shifts in the SES toward system states seen as more resilient. The critical and qualitative methods employed here allowed for a contextualized understanding of resilience as a situated experience and process. Where prominent research seeks to understand resilience through indices and indicators, our qualitative approach examines the lived experiences of community members engaging in wildfire preparation, response, and recovery, as well as the inequities associated with these processes. Relying on descriptive accounts and perceptions of what constitutes community resilience to wildfire, this research provides policy and management recommendations in service of the communities most affected.

## METHODS

### Setting

The Rogue River Basin in southwestern Oregon was chosen as an exploratory case study because of the region's high wildfire risk, experience with wildfire, rich social and ecological diversity, and complex wildfire governance scheme (Fig. 2). The dry-mixed conifer forests of the Rogue Basin have evolved with fire because of a history of Indigenous burning and fire adaptation (Boyd 1999). Under Indigenous stewardship, fire regimes were low to moderate severity with intervals of 5 to 14 years (Metlen et al. 2018). Violence and genocide initiated by white settlers in the mid-1800s resulted in the forced removal of Indigenous communities to what eventually became the Siletz Reservation in northwest Oregon (Schwartz 2022) and the 1.9 million hectares of the Rogue Basin were allotted to federal agency management and private ownership. Rural and urban communities

**Fig. 2.** Map of the study area depicting interview locations, wildfire history, and land ownership categories in the Rogue Basin of southwestern Oregon. Interviews took place in the Applegate and Illinois Valleys, and the communities of Grants Pass, Medford, Phoenix, Talent, and Butte Falls where interviewees live and work. These population centers are surrounded by a patchwork of public and private lands, managed primarily by the Bureau of Land Management (BLM), local governments, National Park Service (NPS), private owners, and the U.S. Forest Service (USFS). The Rogue Basin is a fire-prone region, with wildfire perimeters between 1980 and 2023 indicated on the map. Fire perimeter data was secured through the BLM Fire Occurrence and History Perimeter dataset. Land ownership and population center data was secured through the Oregon Geographic Information Council (OGIC) GeoHub.
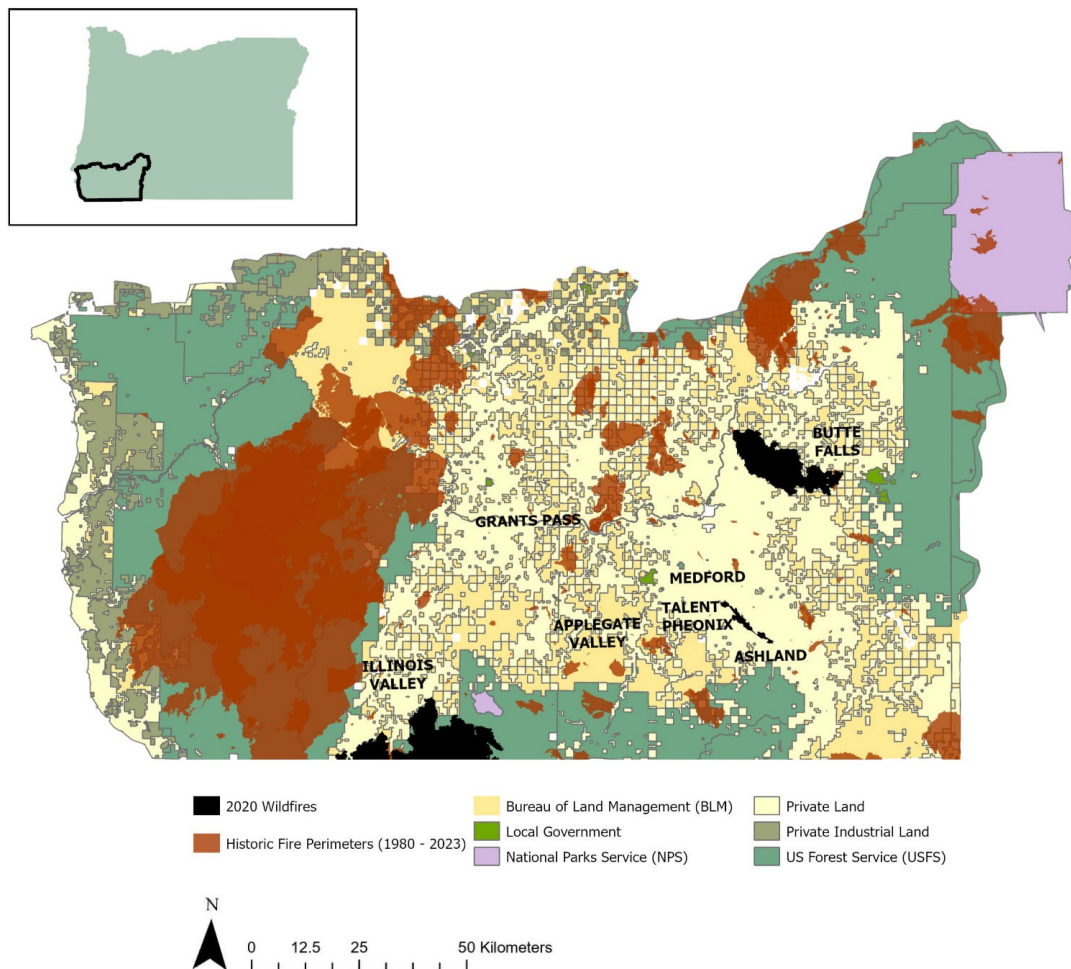


intermingle, with population centers along Interstate 5 in Ashland, Medford, and Grants Pass, rippling out to small, peri-urban, and rural communities. The Rogue Basin's population is primarily white, with about 15–20% identifying as Hispanic and People of Color (U.S. Census Bureau 2020).

Fire suppression and colonial forest management over the last 150 years, along with climatic changes, have disrupted historic fire intervals and increased ignition probability and fire intensity in the Rogue Basin (Gilbertson-Day et al. 2018, Hessburg et al. 2019). Rogue Basin fires now often burn with higher severity and larger spatial extents as compared to historic regimes (Weber et al. 2022). In 2002, the Biscuit Fire was the largest in Oregon history at the time, burning 162,000 hectares. In 2017, the Chetco Bar Fire reburned areas of the Biscuit Fire, covering a total of

nearly 8100 hectares total (Thompson and Spies 2010). Over the last two decades, numerous large wildfires have continued to burn and reburn in the Rogue Basin, crossing management boundaries and public and private ownerships (Fig. 2). On 8 September 2020, three significant wildfires ignited in the Rogue Basin during a historic wind event and are consistently referred to in this research. The Almeda Fire was a human-caused urban conflagration fueled by riparian vegetation along the Bear Creek greenway, burning 18 mobile home communities, businesses, and infrastructure, and primarily affecting Latino/a, elderly, and lower-income populations. The Slater Fire burned from over the California border and into the Illinois Valley, affecting extensive public lands, and the South Obenchain Fire claimed numerous homes east of Medford.

Wildfire governance in the Rogue Basin is complex. A patchwork landscape of public and private industrial timber lands and federal lands managed by the U.S. Forest Service, U.S. Bureau of Land Management, and U.S. National Park Service can make wildfire planning and response a challenge (Kelly et al. 2019, Metlen et al. 2021). Under this complex management structure, the Rogue Basin has a history of creative and often novel forest governance, from the establishment of Oregon's first watershed council in the early 1990s (Hibbard and Madsen 2003), to now, where forest governance takes novel forms across scales and within communities through forest collaboratives. These region- and place-based groups bring together scientists, land managers, academics, private landowners, and community anchor institutions to augment federal land management capacity through restoration contracting and multi-party monitoring (Davis et al. 2017, Metlen et al. 2021).

**Approach**

In considering community response to disturbance, critical resilience scholarship asks four questions, "resilience of what to what," "resilience for whom," "by whom," and "how" (Tschakert and Tuana 2013, Chaffin et al. 2016, Cutter 2016, Meerow et al. 2019). As the Rogue Basin is increasingly marked by wildfire, with disturbance often disproportionately affecting marginalized groups and deepening inequities, answers to these questions can guide conscious adaptations toward more resilient and equitable system states. To address these four questions, we chose an embedded qualitative case study approach that is well-suited to understanding (1) the situated resilience in the Rogue River Basin through co-produced resilience attributes, and (2) how cross-cutting themes within attributes indicate perceived shifts from less-resilient to more resilient system states.

With the goal of grounding our research in local priorities and experience with wildfire, we began our research process with conversations with leaders of forest collaborative groups and partnerships in the Rogue Basin in the fall of 2021. These are key organizations that convene landowners and managers, scientists, and community anchor institutions for dialogue, planning, and implementation of forest management and fire resiliency projects. In this region's public land context, they also augment federal land management capacity through restoration contracting and multi-party monitoring (Metlen et al. 2021). In three joint work sessions with members of the Rogue Forest Partners and Southern Oregon Forest Restoration Collaborative, we discussed mutual research priorities, paired priorities with expertise and interests, and eventually shaped research goals around equity and resilience in the Rogue Basin. We sought to understand deeply and describe (1) the situated resilience of the Rogue Basin in the context of wildfire disturbance through the identification of resilience attributes specific to this place, and (2) how attributes reflected shifts in current systems and impacted equity. We relied on semi-structured interviews, follow-up interviews, and results validation exercises with leaders of organizations working at the nexus of community and forest resilience in the Rogue Basin. These efforts took place between fall of 2021 and spring of 2023.

**Participant selection**

Following joint work sessions with forest collaboratives and in recognizing the social, economic, and ecological diversity present in the Rogue River Basin, we employed a non-probability sampling methodology to select organizations working at the intersection of community and forest resilience in the region (Bhattacherjee 2012). Under a network approach, we asked forest collaborative partners to identify and connect us with groups involved in community and forest resilience and often left out of land management discussions. Collaborative partners identified four organizations fitting this description, three of which were willing to participate. We simultaneously used maximum variation sampling to research and engage community-based and social service organizations on our own through web and social media searches (Merriam and Tisdell 2015). We sought an overrepresentation of community-based organizations (CBOs), and of the 32 individuals interviewed (representing 21 organizations), over 30% were leaders of CBOs focused on resilience, representation, economic development, farm worker advocacy, rural prosperity, and health. The remaining organizations comprised environmental and conservation-based organizations (5), local governments (2), land management agencies (3), private sector contractors (2), and forest collaboratives (3). This research does not address Indigenous conceptions of resilience. We saw Indigenous conceptions of resilience as distinct from Euro-American settlers, built on their relationship with the ecology of the region and challenged by the current settler colonial reality. Without the proper resources to build reciprocal relationships with Indigenous groups and meaningfully represent their unique conceptions of resilience, we did not specifically recruit Indigenous groups for this research. However, Indigenous individuals hold multiple identities and participated in this research as representatives of one of the above organizations.

**Operationalization of resilience**

Resilience has become a common goal of policy and programs, and measurement of the concept often relies on proxy indicators (Beeton et al. 2022). These indicators reflect underlying assumptions and generalizations about what constitutes resilience and whose values are captured in resilience research (Ensor et al. 2021). Reducing resilience to discrete units risks oversimplifying system dynamics and obscuring resilience's situated nature. Resilience is context-dependent, with adaptive capacities overlapping, interacting, and combining to create different outcomes for different groups (Cote and Nightingale 2012, Tschakert and Tuana 2013). To capture a broader array of experiences of resilience and prompt deep participant reflection on their unique experiences of resilience, we operationalized dominant (diversity, connectivity, redundancy, social capital, innovation, modularity) and non-dominant forms of resilience (fear, hope, time, mobility, relations) from the literature (Walker et al. 2004, Walsh-Dilley and Wolford 2015). From where authors are situated in natural resource social sciences, dominant forms and expressions of resilience are those commonly articulated in high-impact publications and expressed widely in practitioner circles. Conversely, and again, from our position, non-dominant expressions of resilience are those found less commonly in the literature on resilience and social-ecological systems and are rather communicated by prior works as subjective understandings of resilience as understood by rural marginalized communities or marginalized knowledge holders (Walsh-Dilley and Wolford 2015). We understand both dominant and non-dominant expressions, understandings, or forms of resilience to be partial

and situated within particular contexts. And as we seek a situated understanding of resilience within this geographic context, we look to individuals from non-dominant and dominant contexts to provide form and shape to resilience in the Rogue River Basin. Although categorized in this manner to underscore our commitment to critical inquiry, non-dominant and dominant forms of resilience were operationalized in the same fashion and prompted consistently across interviews. Dominant and non-dominant conceptions of resilience formed our predetermined codes and shaped interview questions. To capture the situated nature of resilience, we began semi-structured interviews with an open and unprompted question: "What does community resilience to wildfire mean to you?" To prompt dominant forms of resilience, like social capital, for example, we asked, "In what ways do relationships support your idea of community resilience?" To prompt non-dominant forms of resilience, like emotions, we asked, "Can you describe how you were feeling during or after the fire?"

### Operationalization of equity
Equity carries the implication of unequal advantage held by some groups through recognition of knowledge and experience (recognitional equity), involvement in governance procedures (procedural equity), and the distribution of burdens and benefits across a population (distributional equity; McDermott et al. 2013, Meerow et al. 2019). The conditions that lead to unequal advantage shape experiences and conceptions of resilience across a community (Cote and Nightingale 2012, Matin et al. 2018). We operationalized these broad categories of equity by drawing on primary concepts for each, as found in literature on community-based natural resource management (McDermott 2009, McDermott et al. 2013) and resilience planning (Meerow et al. 2019). We began this section of the interview with a reflection on the previous section on resilience, and a prompt for distributive equity. "After reflecting on your experience of resilience, are there some groups in your community that are more at risk to wildfire than others?" We further encouraged reflection of distributive equity with questions about relative resources to prepare, respond, and recover from wildfire. Procedural equity was prompted with questions on civic participation and decision-making spaces and avenues around wildfire preparedness. For recognitional equity, we prompted participants to explore their unique perspectives to how wildfire should be managed in the Basin, and the broader acceptance of their perspective within the decision-making spaces they were familiar with.

### Data collection
Interviews, follow-up interviews, and results validation occurred at participants' places of work in Illinois, Applegate, Bear Creek, and Big Butte Creek River valleys. Over the course of a year, the lead author spent three months in the Rogue Basin. Initial interviews, follow-up interviews, and results validation sessions lasted between 30 and 90 minutes. All interviews and validation sessions were audio-recorded for later transcription and coding. Before beginning semi-structured interviews, we obtained participants' free, prior, and informed consent and communicated to participants that their interviews would remain confidential while giving participants the opportunity to be quoted by name in publications. Approval from Oregon State University's Institutional Review Board (IRB) Human Resources Protection Program to protect the rights and welfare of research participants was obtained prior to beginning data collection.

### Data analysis
Data analysis consisted of three rounds of coding and thematic analysis using Nvivo (a qualitative analysis software), interspersed with follow-up and results validation sessions with key informants. We began with preliminary coding for broad themes and fine-scale examples. Predetermined codes from dominant and non-dominant community resilience literature were used for broad themes, and emergent codes were utilized for fine-scale examples (Saldana 2015). Both a priori and emergent codes were applied based on the interviewee's emphasis on the concept and the consistency across interviews (Small and Calarco 2022). Broad themes gave us an understanding of how the Rogue experience fits within the broader resiliency literature, while emergent codes described situated resilience in the Rogue Basin.

Codes were subject to multiple rounds of organization and thematic grouping in Nvivo and supplementary spreadsheets to arrive at nine attributes of situated resilience: features or actions in support of community resilience. We arrived at emergent themes using an inductive approach; we sought to identify patterns in our interview data and shape theory around those patterns (Blackstone 2012). In this way, themes arose as interpretive constructs, not pre-existing categories (Braun and Clarke 2024). The process of assigning attributes a resilience capacity and form of equity took place in two phases. First, we provided five graduate students studying related topics with diagrams and descriptive terms for equity and resilience frameworks from the literature, the attribute in question, and an interview quote from which the attribute was derived. The students were asked to station the attribute within forms of equity (recognitional, procedural, and distributional) and capacities of resilience (basic, adaptive, transformative) through consensus discussion. Following this qualitative intercoder reliability exercise, attributes were refined and contextualized through follow-up interviews and participant validation with the original interviewees. Follow-ups served to confirm, correct, refine, and contextualize attributes. Participants were provided with the same diagram, attribute, and related interview quote and asked to position attributes within resilience capacities and forms of equity. When there were differences among participants, we chose to follow the majority view. Through these processes, our coding and analytical procedures progressively clarified our understanding of attributes of community resilience to wildfire, their relationships, and how they act upon the Rogue Basin SES to reflect capacities of resilience and forms of equity. In follow-up interviews and through ongoing and collaborative pattern identification and iterative theme refinement, we compared attributes across categories (resilience capacities and forms of equity) to arrive at three cross-cutting themes, described herein as shifts to a more resilient state.

## RESULTS AND DISCUSSION
This research sought situated understanding of experiences wildfire preparation, response and recovery, and the inequities associated with these processes by co-producing attributes of community resilience in a fire-prone landscape. We first describe attributes, actions, or features of the Rogue Basin SES that support preparedness, response, and recovery from wildfire. Attributes, italicized below and defined in Table 1, are classified within one or more capacities of resilience (basic, adaptive, and transformative) and forms of equity to explain their system impact. We then return to the question, "from what to what, and

**Table 1.** Attributes of community resilience to wildfire.

| Attribute | Attribute description | Quote | Resilience capacity | Equity impact | Supporting literature |
|---|---|---|---|---|---|
| Community Staying Power | Staying and persisting following a wildfire disturbance | "I really think our community is resilient because they would have left already if it didn't mean so much to be in harmony with everything around" - Forest Collaborative | Basic | None | Marshall et al. 2012, Bonaiuto et al. 2016, Schumann et al. 2020, Moloney et al. 2023 |
| Social-Emotional Connection | Sharing of recovery experiences between fire survivors built social bonds | "I let [fire survivors] know their feelings are valid. I offer a listing ear and a space for patients to share. By realizing they're not alone, that's resilience" - CBO | Basic | None | Bihari and Ryan 2012, Prior and Eriksen 2013, Fischer and Jasny 2017, Carmen et al. 2022 |
| Mutual Aid | Community members within survivor communities provide reciprocal support following a wildfire | "[After the Almeda Fire] FEMA took weeks to show up, but the community set up resource centers... it all happened on the ground with people who saw their community in crisis" - CBO | Basic Adaptive Transformative | Distributional (when basic) Recognitional (when adaptive) Procedural, Distributional, and Recognitional (when transformative) | Matarrita-Cascante and Trejos 2013, Barnes et al. 2017, Spade 2020, Harrington and Cole 2022 |
| Boundary-Spanning Organizations | Span jurisdictional, cultural, and governance boundaries to prepare for future wildfire | "We collaboratively treat forests and create jobs. We need to build our communities to be more resilient and restore our forests so they can withstand fire" - Forest Collaborative | Adaptive | Recognitional Procedural | Guston 2001, Berkes 2009, Cheng et al. 2017, Davis et al. 2021 |
| Collaborative Funding Mechanisms | Joint funding opportunities for forest collaboratives to support landscape-scale restoration | "[Agencies] hunt down grants, make them available to underserved or at-risk communities to support them ahead of fire seasons to come" - Land Management Agency | Adaptive | Distributional | Cheng and Sturtevant 2012, Abrams et al. 2015, Fischer et al. 2016, Kelly et al. 2019 |
| Shared Knowledge and Learning | Regional-scale forest collaboratives share technical and scientific information and bureaucratic knowledge to design and implement forest restoration treatments | "[Local knowledge] is key in order to get that exchange where there's feedback coming from the local groups and they're learning from the bigger [restoration] project" - Forest Collaborative | Adaptive | Procedural Recognitional Distributional | Folke et al. 2005, Brondizio et al. 2009, Bihari and Ryan 2012, Cheng and Sturtevant 2012, Abrams et al. 2015, Schultz et al. 2021 |
| | Use of local knowledge and resources to support wildfire response | | | | |
| Community-Based Natural Resource Management | Local communities managing surrounding natural resources through community forests, forest collaborations, and prescribed burn associations | "I believe in [communities] making decisions about forest health and fire management. How can we empower people and devolve power from agencies or private ownership?" - Forest Collaborative | Transformative | Recognitional Procedural | Brosius et al. 1998, Kellert et al. 2000, Armitage 2005, Dressler et al. 2010 |
| Stewardship Economy and Culture of Caretaking | Economy and workforce centered on restoration and in relationship with place | "An ecocultural restoration economy is a workforce with a strong sense of place and a relationship with the forest that supports the community in reaching adaptation goals while providing social supports" - Private Sector Contractor | Transformative | Procedural Recognitional Distributional | Lurie and Hibbard 2008, Franklin and Johnson 2012, Gómez-Baggethun et al. 2013, Ruiz-Mallén and Corbera 2013, Whyte 2013, Formosa and Kelly 2020 |
| Wealth-Building Mechanisms | Policies and programs that grow financial wealth in marginalized communities | "To build resiliency we need to build wealth in our community ... help people build wealth educate them on how to save in the bank" - Community-Based Organization | Transformative | Recognitional Procedural Distributional | Ratner and Markley 2014, Baradaran 2017, Wainer and Zabel 2020 |

Note: Although most attributes listed here are emergent (except for Community-Based Natural Resource Management, Boundary-Spanning Organizations, and Mutual Aid), and all are "situated" (making their presentation unique to the Rogue Basin), we provide literature citations where the attribute's broader meaning has been supported by other studies.

for whom?" by using emerging themes that cut across these attributes to describe desired shifts in system state toward greater resilience and equity.

**Attributes**

*Basic resilience*
Basic resilience attributes facilitate immediate recovery following a disturbance, allow communities to return to a pre-disturbance state, or shape the conditions for adaptive or transformative attributes. *Community staying power* was the practice of staying in or returning to a place despite social or ecological disturbance. For Lomakatsi, a grassroots forest restoration contractor, community staying power was modeled by decades of Indigenous

persistence and became central to their work in forest restoration and efforts to *build a stewardship economy*. For Almeda Fire survivors, basic resilience was found through sharing stories of loss and recovery with fellow survivors (*social-emotional connection*). Where traditionally emotions are kept private, fire survivors found that sharing their experiences of loss as a result of wildfire facilitated their recovery, built bonds within their community, and grew a practical knowledge of wildfire causes and responses in anticipation of future disturbances. Social-emotional connections following the Almeda Fire sewed systems of reciprocity within survivor communities. As the communities surveyed the devastation, many recounted that it was not the local or federal government that facilitated recovery. Rather,

participants reported that immediate and sustained support came from within the affected community. Termed "informal *mutual aid*" by leaders of CBOs, these interactions of reciprocity and collective support were not directed nor designed by organizations or governments but collectively led, organized, and reorganized by the community for the community. In conversations with CBOs, the attribute of informal *mutual aid* was integral to immediate recovery following the Almeda Fire, allowing for the provision of food, clothing, and shelter for survivors. During results validation, CBOs described how mutual aid extended beyond the recovery process as communities sought to rebuild stronger than they were before the fires. In this way, informal mutual aid facilitated basic resilience in returning the communities of Talent and Phoenix to their pre-fire states, supported adaptation to their post-fire context, and was in some ways transformational through the creation of a fundamentally new social support system.

*Adaptive resilience*
Adaptive attributes anticipate future disturbance by managing or modifying conditions within the current SES. Organizations that span jurisdictional, cultural, and governance boundaries (*boundary-spanning organizations*) supported adaptive resilience to wildfire by pooling resources, exchanging knowledge, and coordinating actions toward ecosystem restoration. Within the Rogue Basin, boundary organizations meet at junctures between cultural differences and land management jurisdictions. While taking multiple forms, boundary organizations consistently elevated local voices and experiences to shape management, policy, and funding mechanisms. This boundary work improved engagement in decision making and grew representation for groups often under-represented in traditional management and governance. Drawing on years of boundary-spanning efforts, the highly networked group of individuals and organizations forming regional-scale forest collaboratives in the Rogue Basin hold the power to attract and direct resources toward forest and fire resilience at a landscape scale (*collaborative funding mechanisms*). Composed of land management agencies across jurisdictions, NGOs, and private sector contractors, regional-scale forest collaboratives attract private and public funding to design and implement fuel treatments across the Rogue Basin. Regional-scale forest collaboratives in the Rogue Basin have attracted funding from state and federal sources to meet restoration needs specific to local conditions. Pooled resources, organized and directed by forest collaboratives across scales, supported forest resilience, thereby protecting community values and private property from wildfire. In addition to shared financial resources, participants emphasized how shared knowledge and learning across groups supported wildfire adaptation measures. For regional-scale forest collaboratives and land management agencies, scientific information on forest and fire ecology, ecological restoration, and climate change adaptation were combined with bureaucratic knowledge held by state and federal land managers to design, fund, and implement forest restoration treatments in anticipation for future wildfire disturbance (*shared knowledge and learning*).

*Transformative resilience*
Transformative attributes built off basic and adaptive attributes and created new systems when existing systems were ill-fitting or untenable. In describing transformations, participants often looked to examples of local communities managing surrounding

natural resources toward social and ecological resilience. *Community-based natural resource management* (CBNRM), as termed in the literature, takes the shape of community forests, prescribed burn associations, and local-scale forest collaboratives, all of which recognize the value of local knowledge while creating the space for empowered decision making and self-determination in communities of place. Institutions working toward CBNRM often played a role in shaping a new economy and culture around fire, a *stewardship economy and culture of caretaking*. Land management agency representatives, private sector contractors, and forest collaboratives emphasized the importance of a restoration economy and workforce in achieving landscape-scale forest and fire resilience while providing living wage jobs and connecting people to place. Living wage jobs contributed to another attribute of transformative resilience: *wealth building opportunities*. Participants recognized the importance of wealth in insulating individuals and families from the negative consequences of fire and sought enduring change through shifts in land and homeownership.

In their ability to support resilience, attributes of resilience were also able to reshape relationships and relative circumstances between people, thereby impacting equity (Table 1). In returning a community to the status quo, basic attributes formed the foundation for adaptive attributes but did not bring about equitable systems change. Adaptive and transformative attributes held greater capacity to address systemic inequalities by recognizing diverse knowledge systems, greater representation in decision making, and fair distribution of burdens and benefits across communities. Adaptive attributes were generative, often related to building capacity and collective action toward transformation. Through more substantial systems change, adaptive attributes often reflected one or more forms of equity. Transformative attributes built upon basic and adaptive attributes and were often aspirational. In spanning multiple spheres of resilience, transformative attributes held the greatest capacity to reflect equitable systems change.

**From what to what, and for whom: three shifts toward community resilience to wildfire**
Considered collectively, attributes of community resilience to wildfire hold three cross-cutting themes, presented as three system shifts toward more desirable system states (that move the system from basic to transformative resilience), as articulated by participants during the validation exercises: (1) decentralized power, (2) reciprocity and resources, and (3) non-dominant knowledge systems. Each shift acts upon the current system differently, with different outcomes for different groups (in some cases, enhancing procedural, distributional, and/or recognitional equity in the system). Here, we describe these shifts, and outline "from what to what" and "for whom" these shifts were sought. Although interviewees collectively identified three broad shifts toward a more resilient SES, perceptions, motivations, and experiences of these shifts were diverse, interacting, and interdependent.

*Decentralized power*
Following Euro-American colonization, land in the Rogue Basin became managed primarily under a command-and-control model, where power is centralized within private ownership and federal agencies (Winkel 2014), leaving management decisions to

be often ill-fitting of regional social-ecological conditions (Fischer 2018, Marks-Block and Tripp 2021). In this region, community groups sought to decentralize management power through CBNRM institutions (watershed councils, forest collaboratives, prescribed burn associations, and community forests) and boundary-spanning organizations. Both CBNRM and boundary-spanning efforts aimed to bridge central governance and funding with community-led initiatives. Under both efforts, participants operated under a common goal of greater social-ecological resilience through increased local involvement in management decisions. Despite this unified vision, groups had varying trajectories toward resilience with different perspectives on the role and extent of decentralization. For a forest collaborative member, top-down management was counter to resilience: "Unified top-down hierarchical decision-making is a threat to resilience. Community-based, distributed forms of governance and resource sharing is something worth exploring." Following a collaborative fuels reduction demonstration project with the U.S. Forest Service and residents of the Page Creek drainage, one forest collaborative member saw this form of decentralized management as a venue for trust-building and learning.

> *[The community] is learning, they're trusting the agencies that the forest needs to be thinned; that years of doing nothing was not the answer because the fires burned it up.*

For its greatest advocates, decentralized management was a way to counter top-down decision making while drawing on place-based knowledge through prescribed burn associations. As expressed by one forest collaborative member:

> *Fire management is a very hierarchical and concentrated type of decision-making. Agencies have control over fire, and there's very little community input into fire management. So, community-based fire management is how we get people to be able to make decisions and have a say in [fire management]. I think we'd see better outcomes in terms of wildfires. Local populations have knowledge on the ground, but we have this crazy system where we fly people in from wherever to fight fires, and they don't know the area. Ultimately, local people don't have any input on decisions made on the ground. [Decisions] are not informed by local ecology. Prescribed burn associations are an antidote to this concentrated authority the agencies have over fire where normal people are using fire in their communities.*

For leaders of a local community forest, decentralized management meant greater control over fire management and a move away from corporate forest ownership. In purchasing 460 acres of industrial timberland and managing it locally, the small community of Butte Falls felt they could be better prepared for local wildfires:

> *We don't want to depend on someone else to manage the forest for us, whose primary concern is timber, but we want to be able to manage it, and our primary concern is preserving the forest and preserving our community and not letting it burn.*

Despite differences, advocates for decentralized management had a shared vision: local communities making decisions about surrounding landscapes, tailored to the local context. Local institutions are often more attuned to local ecosystems and, therefore, able to adjust to changes in ecosystem dynamics more swiftly than centralized agencies (Cumming et al. 2013, Fischer 2018). Some scholars suggest land management agencies may be more successful if their approaches are informed by local knowledge through opportunities for public engagement (Platt et al. 2022). Others argue that no single spatial or temporal level is appropriate for governing ecosystems, however. Rather than turning resources over to local control, multilevel governance approaches must be considered in responding to complex environmental problems sustainably and equitably (Andersson and Ostrom 2008, Brondizio et al. 2009).

Through the pathways described here, a shift to more decentralized management is a move from adaptive to transformative resilience, where communities envisage novel forms of forest and fire management to respond to novel fire regimes while anticipating future changes. For rural areas of the Rogue, where public and private lands intermingle, CBOs advocated for local community voice to inform federal and management decision making. This often meant sharing information on behalf of federal agencies or organizing community conversations between land managers and the public. For CBOs positioned in urban and peri-urban areas, representation of fire survivors within recovery decisions was essential to prevent future loss. Coalición Fortaleza, a community-based social justice organization, spanned cultural boundaries, gathering survey data from Indigenous and Latino/a communities to influence the distribution of community block grant funding following the Almeda Fire of 2020. In this way, boundary-spanning CBOs supported community resilience by ensuring policy responses reflect local needs and realities. In their efforts to achieve this shift, groups involved in decentralization efforts build recognitional and procedural equity for holders of non-dominant knowledge systems and those historically unable to participate in standard engagement procedures for land management (i.e., National Environmental Policy Act, private land use review). While expanding the scope of participation and weaving local knowledge, this shift directly impacts those with the time, capacity, knowledge, representation, or identity necessary to participate in decision making across scales.

*Reciprocity and resources*
Burdens of wildfire are held disproportionately across communities like the Rouge Basin, as rural, low-income, and undocumented groups are made vulnerable by inequitable policies and government systems (Davies et al. 2018, Méndez et al. 2020, Masri et al. 2021). Whether due to housing location, construction, or a lack of access to information and resources, communities across the Rogue Basin experienced the 8 September 2020, wildfires differently. In the case of the Almeda Fire, low-income and Latino/a communities were disproportionately affected, as the fire burned 18 mobile home communities. Following the Almeda Fire, community members in rural, low-income, and immigrant communities sought a shift from the status quo: from inequitable and ineffective government systems to a fundamentally new social support system founded in mutual aid, social-emotional connection, and wealth-building.

Following the Almeda Fire, interviewees from community-based organizations serving the affected community reported that immediate and sustained support came from within the affected community: "FEMA and Red Cross took weeks to show up, but the community set up resource centers ... it was all within the community with people who saw their community in crisis and stepped to the forefront." Described as "mutual aid" by CBOs, this collective act of care is founded in reciprocity, solidarity, and self-determination and relies on the experiential knowledge of peers facing similar situations (Spade 2020, Harrington and Cole 2022). For some, mutual aid following the Almeda Fire made them feel more connected to their neighbors. As one CBO employee and Almeda survivor described, "It was the same community that helped the community that was struggling, and that makes me feel embraced. That makes me feel that Oregon is now my home. That is resilience." Social cohesion, feelings of belonging, and place attachment described by fire survivors are often the outcome of natural hazard events (Bihari and Ryan 2012, Prior and Eriksen 2013, Fischer and Jasny 2017). As community cohesion grows, community resilience often follows (Matarrita-Cascante and Trejos 2013).

When asked about their future vision for community resilience to wildfire, leaders of CBOs emphasized the importance of wealth in insulating individuals and families from the negative consequences of fire: "Resiliency is a stage, and I don't think we're there yet. I think to build resiliency, we need to learn how to build wealth in our community." In one example, building wealth in the Latino/a communities was achieved through a resident-owned mobile home community, a form of land and homeownership, that held the potential to protect communities against future losses and empower groups to sit at decision-making tables. During participant validation, one CBO participant emphasized that for Almeda survivors, building wealth meant protecting their futures: "Dreams were lost, life savings were lost. People who were planning to send their child to college are no longer able to. They kept their money under the mattress, and that mattress burned." Many participants also saw wealth as a path toward engaged governance: "You start building wealth, and you empower people to feel capable of being in places where decisions are being made."

For one CBO, effective transitions to more resilient and equitable states occur both outside and within systems of power, often achieved through boundary-spanning. Others agreed, describing actions taken to build wealth and power within their communities while also formulating "policy demands" for elected officials. For Harrington and Cole (2022), and as evidenced in the Rogue Basin, mutual aid at the community scale, coupled with boundary spanning by CBOs enhances resilience through alterations in economic and political systems necessary for equitable responses to climate change. Within capitalist and colonial systems, communities often survive through participation in extractive relationships between people and land. Survivors of the Almeda Fire presented an alternative. In the words of one CBO leader:

> *Existing systems have so many barriers to access. How can we eliminate as many of the barriers as possible? I see solutions outside of colonial and racist systems as community-based and community-centered, trusting that we help us. And that if a community can show up for each other, you circumvent the need for a lot of that bureaucracy.*

This shift from harmful government systems to informal systems of reciprocity bridges the three capacities of resilience: basic, as communities convalesced over shared experiences of loss; adaptive, in the exchange of resources and knowledge during recovery; and ultimately transformative; in building wealth, constructing informal social support systems, and spanning governance boundaries, communities are anticipating future disturbance and bouncing forward to a new system state. Where the equitable and safe provision of recovery resources were allocated based on need, not government qualifications and bureaucracy, this shift inflates distributional equity for wildfire survivors. Procedural equity was seen as forged through financial security; by securing land and homes, minoritized and undocumented groups gained access to local governance not previously afforded to them.

*Non-dominant knowledge systems*
Under command-and-control management, land managers rely on Western science to inform management decisions, and under this paradigm influence the social and ecological resilience of their jurisdictions (Pierotti and Wildcat 2000, Abrams et al. 2015, Copes-Gerbitz et al. 2021). Fire knowledge founded in settings and assumptions different from Western science and held by local forest and fire users and Indigenous peoples has been long overlooked by fire managers, an oversight perpetuated by the marginal consideration of this knowledge within fire research (Sousa et al. 2022). Even within the Western science perspective, institutions, organizational structures, and Western research isolate fire knowledge into greater silos and hinder communication and meaningful integration of solutions (Smith et al. 2016). Our current system, where Western scientific knowledge is privileged over all other forms of knowledge, has deep implications for community resilience and can lead to inequitable solutions to the wildfire problem (Copes-Gerbitz et al. 2021). As fires continue to grow in intensity and severity, researchers and practitioners have looked to other knowledge systems for support in addressing the wildfire problem (Long and Lake 2018, Lake 2021). In the Rogue, our interviewees sought a shift from a narrow reliance on Western science; through collaborative settings, they spoke of the importance of weaving local, experiential, and Indigenous knowledge with Western scientific and bureaucratic knowledge to adapt human and natural communities to intensifying wildfire. In shifting whose knowledge was considered valuable in fire management settings, members of the Rogue Basin community challenged prior conceptions of who belongs at the decision-making table. In challenging prior notions of whose knowledge is valuable, this shift held the potential to impact groups traditionally under-represented in forest and fire management and governance: underserved or at-risk communities, communities with wildfire experience, and Indigenous communities. Despite the acknowledgement that Indigenous knowledge is valuable, participants struggled to implement this ideal in practice. Many collaborative members, and land managers generally, do not hold Indigenous identities, and land management systems are not designed to meaningfully include Indigenous voices in decision making.

Local knowledge: For many rural Rogue Basin residents, the threat of wildfire is imminent, and rural living comes with a keen awareness of forest conditions and local resources for wildfire response. Across the Rogue Basin, local knowledge and resources

supported effective wildfire preparedness and response efforts. When asked about practices that supported community preparedness for wildfire, residents of the rural Applegate and Illinois Valleys spoke of the value of local-scale forest collaboration for two-way communication between land management agencies and the public. Local-scale forest collaboratives created space for the exchange of local and scientific knowledge between community members and agency representatives in support of fuels treatments and fire-adapted spaces while repairing trust between community members and land management agencies. For one agency representative, the mutual benefit from local collaboration was clear:

> We lend technical expertise to [local-scale collaborative] by setting up funding avenues at the community level. [Local-scale forest collaborative] knows their community better than anyone else; they represent their communities and give us a good pulse on what the needs are, and what the needs aren't.

When considering wildfire response efforts, interviewees similarly looked to local knowledge as an attribute of resilience. In Butte Falls, retired loggers held the fire line before professional firefighters arrived at the South Obenchain Fire. Similarly, when firefighters arrived in the Illinois Valley during the Slater Fire, they looked to local knowledge and resources. As one CBO leader recounted:

> Residents were able to point out ponds, water resources, this is where our water truck lives, here are the keys … usually [firefighters] just want everybody to leave without talking to them, but it actually makes a difference when you have those local connections.

Indigenous knowledge: For some interviewees working at a regional scale, the use and existence of Indigenous or traditional ecological knowledge (TEK) was a source of resilience. However, TEK remained more of a discursive point rather than an actionable concept for most. Many acknowledged that Indigenous stewardship shaped the fire-adapted ecosystems of the Klamath-Siskiyou region and was central to reversing declining forest conditions. For some, TEK was best used in concert with Western science to return landscapes to pre-settlement conditions. For others, the adoption of TEK practices and perspectives was the sole path toward forest management for community resilience. Both perspectives came with challenges of representation, cooption, and procedural equity. From the perspective of one forest collaborative member:

> Use of Tribal peoples' time and knowledge to achieve [restoration] objectives is common … if we want Tribes to be involved, they need to be setting the agenda, and we need to be funding them and building a table for them to be present. We can't just say here's the table. There's a seat.

Many saw the value of TEK extend beyond simply informing restoration. For leaders of the Lomakatsi Restoration Project, TEK was foundational to a new way of relating to the landscape under a stewardship economy and culture of caretaking. In the words of one Lomakatsi leader: "By implementing strategic [fuels] treatments, we create a culture of caretaking modeled after Indigenous ecological knowledge." The vision for a stewardship economy was echoed by a forest collaborative member who saw

this shift as a responsibility to place, "Part of living here is having a workforce that cares for the forest as the Native Americans did once." CBOs built on this vision to acknowledge the structural shifts necessary to implement a stewardship economy: "Let's work with the forest; let's become stewards again and really create a culture and a social structure for some of this forestry work."

The role of local and Indigenous knowledge in shifting systems to live with wildfire is evidenced across the literature. Leveraging local knowledge, local-scale forest collaboration provided space for learning, trust, and adaptive management (Folke et al. 2005, Brondizio et al. 2009, Abrams et al. 2015). Research indicates that residents in fire-prone areas often have a high degree of understanding of forest health and wildfire risk, making local knowledge valuable for land managers and response agencies in understanding context-specific challenges to resilience (Diaz 2013, Lieberknecht 2024). This body of research shows that local knowledge can foster greater trust, ownership, and responsibility over disaster preparedness and recovery (Dickson-Hoyle et al. 2024) and when married with scientific and technical knowledge from land management agencies, communities can access centralized resources to enhance local fire preparedness and management (Paveglio and Edgeley 2017).

Where advocates for the use of local knowledge provided a coherent message, advocates for the use of TEK were discordant; where some participants called for integration, others called for complete reliance on TEK, and others cautioned against performative use of TEK. With TEK tied to place and living and non-living relations, Whyte (2013) argues it cannot be transferred into different structures like forestry or fire science unless people who participate fully in TEK are at the table equally with non-Indigenous scientists and policy makers. Sharing, or devolving power to Indigenous communities, is central to perspectives posited by other Indigenous scholars. For Lake and Christianson (2019), promoting and integrating Indigenous Fire Stewardship with Western science can grow community resilience to wildfire for Indigenous and settler communities alike.

In considering this shift from management decisions that rely solely on Western science to one that accepts and utilizes local and Indigenous knowledge, we must consider the settler colonial reality of our current system. Settler-colonialism is ongoing as colonial institutions exercise their power over Indigenous communities through policies and practices that harm Indigenous SESs (Norgaard 2020). Fire suppression, as mandated by federal and state policies, has worked as an engine of colonialism in tandem with the genocide, forced removal, relocation, and efforts to curtail cultural burning and halt the expression of TEK (Norgaard 2020). While organizations like Lomakatsi work to counter the consequences of a century of fire suppression, their efforts may be constrained by colonial institutions through which contracting and federal grant dollars flow. Past research has acknowledged this challenge faced by CBOs, where efforts to engage new groups and shift practices are often constrained by the larger systems in which their work is tied (Abrams et al. 2015). Broadening the scope of whose knowledge is valuable in informing forest and fire management benefits many and grows recognitional equity; however, this shift remains squarely within adaptive resilience with true transformative change impossible without a critical eye to ongoing settler structures. For true

transformative change and in a departure from settler-colonial structures, one CBO interviewee suggested that the wildfire problem may only be solved when dispossessed land was return to Indigenous communities under the #LandBack movement.

## CONCLUSION

This research empirically studies situated resilience in a fire-prone SES rooted in practice. In analyzing intentional change, this work operationalizes theorizing from critical geographers (Tschakert and Tuana 2013, Garcia and Tscharkert 2022) and pyrogeographers (Higuera et al. 2019, McWethy et al. 2019) while providing actionable and validated knowledge for this case study community. In detailing multiple attributes of resilience, interviewees present three distinct shifts to a more resilient state built on local engagement in decision making, acknowledgment of the value of non-dominant knowledge systems, and reciprocity and shared resources between the community's most vulnerable. Our findings align with prior research, indicating that when centralized agencies falter, CBOs are galvanized, often leveraging local and Indigenous knowledge and relationships to serve local needs (Edgeley 2022). As organizations sought more transformative change through the creation of these new systems, their capacity to address social inequities grew. The experience of those living within fire-prone ecosystems, as presented here, challenges decision makers to consider who the winners and losers are from policies and programs targeting resilience, with considerations as to who is leading the way. More narrowly, programs and policies designed to support community resilience to wildfire should consider how dedicated funding can support those most acutely responsive before, after, and during a wildfire event. Policy attention and investment should be directed to small-scale CBOs who play an important role in facilitating all capacities of resilience in ways that are compatible and effective within the communities they serve.

By examining community resilience to wildfire through an equity lens, this research provides tractable insights about approaches that may reduce inequities created and recreated from wildfire disturbance. Through our co-production process, where data were created, validated, and communicated with study participants, interviewees came to hold greater awareness of peer organizations within and toward other resilience capacities. Awareness of resilience attributes and actors shapes the potential for basic and adaptive attributes to progress, and transformative attributes to be broken down into more achievable steps. Prevailing work on community resilience to wildfire places an emphasis on social vulnerability, seeking to understand resilience through generalizable and quantifiable indicators that are challenging to apply at the community-scale. However, there is an enduring need to explore community resilience through qualitative work and thereby apply contextualized knowledge to policy and management changes within communities. In detailing community-scale efforts to prepare, respond, and recover from wildfire, qualitative research can activate action and reflection toward increased acceptance of wildfire on the landscape and support meaningful and effective change within communities (Brenkert-Smith et al. 2017).

Although attributes of resilience detailed here remain subjective and temporally, spatially, and contextually bound, these methods and patterns of attributes may be applied to studies in other fire-prone regions of the U.S. Similar geographies and contexts may use this research as a mirror to understand their unique pathways toward equitable resilience. Despite our efforts to move beyond top-down conceptions of resilience, the nature of our sampling methodology was limited in its ability to reach interviewees beyond those already in position of power (organization, collaborative, and agency leaders), and using collaborative groups as an entry point for study design may neglect those who are not well represented in these groups (Davis et al. 2017). Future research could instead begin participant selection within marginalized communities, more thoroughly centering their conceptions of resilience in study findings. Building on this work, deeper consideration of the barriers to equitable transformations, i.e., racism, extraction of private advantage following natural disasters, and ongoing colonial land relations in North America, may yield more actionable results for organizations and individuals working toward equitable community resilience to wildfire. Ultimately, research and practice within this vein should regularly consider who leads and who benefits from actions to adapt and transform our systems in anticipation of and response to wildfire.

**Data Availability:**

*De-identified data/code that support the findings of this research are available upon request from the corresponding author, ES. None of the data/code are publicly available as containing information may compromise the privacy of research participants. Ethical approval of this research was granted by Oregon State University's Institutional Review Board (IRB) Human Resources Protection Program to protect the rights and welfare of research participants.*

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