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Exploring the Influence of Local Social Context on Strategies for Achieving Fire Adapted Communities

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Abstract: There is a growing recognition that the social diversity of communities at risk from wildland fire may necessitate divergent combinations of policies, programs and incentives that allow diverse populations to promote fire adapted communities (FACs). However, there have been few coordinated research efforts to explore the perceived utility and effectiveness of various options for FACs among residents, professionals, and local officials in disparate communities with different social contexts. The research presented here attempts to systematically explore the combination of local social factors that influence support for coordinated wildfire risk management across locations. We conducted 19 interactive focus groups across five communities spanning five Western U.S. states using a mixed-method design that allowed for the collection of quantitative and qualitative data. Results indicate a number of significant differences in effectiveness ratings for adaptation approaches across communities, including requirement of vegetation mitigations on private properties, fostering Firewise communities, and zoning efforts in fire-prone areas. We used qualitative data to help explain the differences between communities as a function of unique local social context operating in each location. We also compare our results with existing frameworks promoting community "archetypes" to evaluate their continued use in wildfire management planning or response.

Keywords: fire adapted communities; wildland urban interface; community; human dimensions; wildfire planning and policy

1. Introduction

There is a growing recognition that human adaptation to wildfire risk is a contingent exercise that may vary across diverse "communities" forming important building blocks of larger landscapes. The unique combination of local history, culture, interpersonal relationships, trust in or collaboration with government entities, and place-based attachments that human populations develop in a given landscape all can have a large bearing on variable efforts to create "fire adapted communities" (FACs)—a central, yet purposefully nebulous goal designed to help alleviate humans' unsustainable relationship with wildfire [1–4]. Common goals surrounding FACs include reducing potential losses to human infrastructure during wildfires, promoting fire as a natural disturbance force, and lessening the need for fire suppression efforts that continue to drive increases in firefighting injuries and costs [5,6]. One predominant focus of ongoing research surrounding FACs seeks to better characterize, explore, and evaluate a broad variety of mechanisms by which to promote fire adaptation across human populations [7–9]. However, existing research efforts on FACs are not always coordinated or consistent in their approach and findings. The goal of this paper is to extend research on the ways in which

diverse social conditions may dictate variable approaches or options for fire adaptation among human populations. It seeks to systematically evaluate any variation in and influences on potential adaptation options across a variety of fire-prone communities.

A large and disperse literature outlines a variety of mitigations (e.g., reducing wildland fuels near homes, retrofitting exposed residences with fire-resistant materials), policies (e.g., land use planning, community prioritization of fuels reduction), and education or assistance approaches (e.g., Firewise Communities USA, homeowner association building standards) designed to help promote FACs (see [10–12]). Much of the existing research explores the effectiveness, feasibility, or success associated with one or a few of these strategies to advance "fire adaptation" through the reduction of wildfire risk. While studies concerning isolated adaptation strategies continue to yield insights, other segments of research remind us that wildfire management and its associated influences are more complex than a linear, one-way process of providing the "best available science" to diverse human populations [13–16]. Those same populations may be unwilling or unable to adopt adaptation strategies given their existing history with management agencies, attitudes about wildfire, or associated natural resource management, and concerns that regulations will limit their personal freedoms. In sum, longitudinal and cross-comparison studies of human adaptation to wildfire increasingly demonstrate there is no one strategy or set of mitigation actions that will be adopted across all communities [17–20].

A long history of social science indicates that any effort to improve adaptation is more likely to succeed when it adopts a holistic view of wildfire management that is tailored to emergent patterns of local social context [1,21–24]. Social context is a multifaceted concept that often includes (1) broader relationships and understandings that local people develop in their environment or for public lands; (2) perspectives about the feasibility of collective action among stakeholders; (3) local trust and willingness to work with governmental agencies; and (4) the evolving local culture or legacies that bond people to the places where wildfire may play an uncertain, unwanted, or poorly understood role [25–27]. Despite the growing consideration of local social context as an important influence on wildfire adaptation, comparatively less research evaluates the way in which diversity of social context across communities might influence the variable adoption of various planning, mitigation, or policy efforts that collectively constitute what some researchers are calling "fire adaptation pathways" [2].

Our efforts in this manuscript explore stakeholders' perceived effectiveness of potential or ongoing strategies, programs, and approaches for achieving wildfire adaptation in their community. The research includes data from 19 interactive, mixed-method focus groups with residents, professionals, firefighters, local government officials, and land management agency representatives in five communities spanning five Western U.S. states. Our work extends and applies one of the few theoretical approaches for documenting how local social context might variably influence community wildfire adaptation [1,2,28,29]. We used this approach as a lens through which to select communities for the study and as a conceptual guide to help systematically document whether elements of social context in each location studied combine to explain the perceived effectiveness of adaptation strategies.

The goals of this study respond to a number of calls in policy and research to explore tangible, but variable actions that community members might adopt in order to take additional responsibility for wildfire management that crosses ownership boundaries. Our work also explores the application of existing conceptual approaches that might help planners, researchers, and managers: (1) understand the diverse social contexts constituting places where wildfire management needs to occur; (2) tailor or adjust linked management efforts in ways most likely to engender partnerships and support among stakeholders; and (3) refine mechanisms or programs through which managers, practitioners, and residents can share lessons learned about the community specific conditions that influence the variable success of strategies designed to promote fire adaption.

2. Community Diversity and Responsibility for Wildfire

One long-term focus of wildfire science and management concerns the ways that private citizens, landowners, or industries can contribute to larger initiatives that minimize adverse fire impacts on

human populations [4,7,30]. These initiatives stem from a growing recognition that ongoing human development can influence the composition of wildland fuels that drive wildfire risk or increase societal pressure to aggressively suppress fires that might adversely impact human values [31–33]. A focus on private citizens' shared responsibility for fire management reflects an established body of science stressing that while wildfire occurrence is inevitable, coordinated and collaborative efforts among stakeholders (e.g., land management agencies, communities, counties, tribes, private homeowners) can allow it to play a natural, healthy role in local ecosystems without disrupting ongoing human well-being [34–36].

A variety of mitigations, educational programs, policies, and strategies exist to help better promote private contributions to broader wildfire management. Such efforts span a variety of scales, ranging from mitigations performed on individual private properties or performance of fuel breaks around residential neighborhoods to support for large-scale forest restoration projects or statewide policies designed to improve the coordination of fire response [37–39]. For instance, there exists a substantial body of research exploring the adoption of fuels reduction and other property-level mitigations (e.g., building with fire-resistant materials) in the Home Ignition Zone (HIZ)—an area of 100–200 feet from structures that principally influences whether homes can survive wildfire events with little firefighting effort [40–42]. Likewise, researchers conducting simulations of residential development and potential wildfire damages frequently call for land-use planning that discourages additional development in areas at high risk for intense fires, or that require existing property owners to retrofit their structures and manage vegetation in ways that reduce the growing need to protect private properties during fire events (see for example [43–45]).

At the heart of many wildfire mitigation approaches is an aspirational focus on collective action that is coordinated among private individuals and public institutions. For instance, educational programs such as Firewise and FireSmart provide homeowners with information about wildfire risk, management, and role in the landscape, all while providing the structure through which to build support for coordinated efforts across populations who share a common fire risk [46–48]. Planning efforts such as Community Wildfire Protection Plans (CWPP) or comprehensive hazard mitigation plans attempt to coordinate effective preparation, response, and recovery from fire events through the collaborative establishment of mitigation priorities, agreements about the sharing of resources during fires, or evacuation planning that helps reduce the complexity of fire suppression tactics [22,49–51]. Fire districts, residential subdivisions, or governments can invest more resources toward developing firefighting capacity at the local level to improve initial suppression responses or promote pre-fire mitigation among those they serve, potentially through increased taxes paid by private citizens. Finally, coordinated programs at the federal or state level may provide locals with funds to acquire firefighting equipment and additional personnel, fund residential mitigations on private property, or outline the amount of mitigation work municipalities must undertake in order to ensure fire suppression aid from state agencies [52–55].

While the efforts mentioned above are not a comprehensive list of strategies for promoting human adaptation to wildfire, they demonstrate that a well-defined "blueprint" for fire adaptation exists in theory. However, that blueprint is rarely applied fully or consistently in practice across groups of human populations who may be facing similar challenges posed by wildfire management. Instead, research on the application of various adaptation strategies consistently demonstrates that individual efforts are variably supported, adopted, and adapted by human populations across cases or regions (see [1,2,56–58]). Findings also demonstrate that residents, private industries, and local politicians often vary in their engagement with wildfire planning, the strategies that different human populations enact to address changing fire risk (e.g., a focus on suppression effectiveness versus fuels reduction), and in their agreement that wildfire is something for which they can take partial responsibility [17,59–61]. All of this variability can lead to piecemeal or isolated adaptation efforts that may not leverage the benefits of multiple strategies occurring at a variety of scales (e.g., incentives for HIZ reduction paired with municipal codes requiring those efforts) [12,35,37,42]. It implicates a need to more critically evaluate

whether and how components of the emerging blueprint for fire adaptation may take different forms in different places, and whether additional forms of adaptation practices or policies might better reflect the range of local conditions characterizing people and places.

The lack of consistency in support for, contribution to, and adaptation of actions designed to encourage wildfire responsibility among private citizens and local governments is due at least in part to the great deal of social diversity—and thus local social context—that exists across fire-prone landscapes [9,20,23,28]. Unique populations of residents living in and influencing the structure of fire-prone landscapes often develop or perpetuate different relationships with natural resources, capacities for managing wildfire risk, perceptions of wildfire benefit, and willingness to work with others. As a result, those populations may differ in their ability and willingness to enact adaptation strategies that perpetuate or change the places where they live (see [3,27,29,62]). Fire-prone populations also can be characterized by dynamic change in their social, economic, or cultural makeup due to amenity migration, out-migration, and changes in the predominant uses of natural resources (e.g., transition from tree farms to recreational properties, or from subdivided parcels to conservation areas) (see [25,63–65]). Our efforts in this manuscript seek to extend existing research outlining how variable and dynamic conditions of local contexts may lead to differential support for wildfire adaptation strategies across locations.

In sum, one overarching challenge for researchers and policymakers attempting to address the "wildfire problem" concerns a better understanding of why variability in collective capacity to address wildfire adaptation occurs, and at scales that differ across landscapes. It necessitates understanding human populations and stakeholders as potentially distinct populations, and grappling with the ways in which they can retain their unique culture while contributing to broader wildfire management initiatives. There are few research studies that systematically compare how potential support or feasibility of wildfire adaptation strategies may differ across human populations grappling with fire risk, and even fewer that attempt to explain those differences as a function of local context using pre-existing conceptual frameworks. The next section reviews the way that conceptions of community matter for understanding the impact of social diversity on wildfire management and introduces a theoretical approach for systematically documenting how such diversity might help us understand variable preferences for collective wildfire adaptation strategies.

Linking Community Diversity and Variable Wildfire Adaptation

A focus on shared risk and management surrounding wildfire is one reason for the increasing focus on "community" as an important unit of analysis, planning, or monitoring. The concept of community or goals to create FACs appear in many policy documents surrounding wildfire because they broadly implicate the need for diverse stakeholders to consider how their actions, operating in concert with others throughout a shared landscape, might contribute to fire risk and its management. However, the ways in which various researchers, policies, or programs operationalize community is inconsistent, and this may be one source of incongruence across studies of wildfire adaptation among different populations.

Select traditions from rural sociology and hazards stress that community is an emergent process reflecting shared commitment, action, and engagement among individuals operating in a shared locality [66–68]. It places focus on the capacity and willingness of people to collectively mobilize their resources in ways that sustain a culture and way of life beyond initial investment, incentive, or action. Under this perspective, community is a variable product of human interaction that is (1) perpetually created by diverse human populations who interact; (2) occurs in a particular locale that people imbue with common meanings; and (3) which is built from the legacy and ongoing structure of interpersonal relationships, trust, or networks that define their future interaction [66,69–71].

We adopt an emergent conception of community in this research for a number of reasons. To begin, an emergent view of community has demonstrated capacity to explain potential variance in the scale and local context that helps explain differential support for wildfire adaptation strategies

across locations. This may be especially true of rural locations, which constitute a large proportion of private properties at risk from wildfire and that often feature less formal infrastructure or services associated with municipal "communities." Second, an emergent conception of community recognizes that while there may be vast differences in values, histories, trust relationships, or demographics among communities at risk from wildfire, there is also the capacity for shared qualities, experiences, and lessons that may be translated to other populations with a similar local context (see [72,73]). Finally, an emergent view of community reflects an existing theoretical approach for understanding community diversity as it applies to wildfire management. Our work in this research seeks to apply and extend that theoretical approach, which we outline next.

Paveglio et al. [1,2,27,28] developed what they call the interactional approach to adaptive capacity (hereafter the interactional approach) using existing lessons from wildfire social science, climate change, and hazard studies. Original formations of the interactional approach stemmed from a need to better document how site-specific histories, contexts, and interactions between people and their environment might combine (or interact) to influence the collective ability, willingness, and resources that human populations can mobilize to address changing wildfire conditions (what some refer to as adaptive capacity) [74,75]. A central component of the evolving interactional approach articulated by Paveglio et al. stresses that there are likely many different ways that distinct populations can adapt to fire. Adaptation is a contingent process that is driven by perspectives, practices, histories, and related biophysical conditions that are often place-based, and which combine to form distinct expressions of capacity (see [16,76,77]).

Segments of existing research suggest that certain elements of local context might not be fully captured using only demographic variables. This realization is challenging given that one predominant approach for integrating wildfire social science into management revolves around predicting, assigning, or generalizing lessons about influences on adaptive capacity using secondary or remotely obtained data (see [8,25,78,79]). Alternative perspectives suggest that local context is perhaps most actionable and illustrative when it is understood and presented as a narrative set of conditions that define a given community. Such narratives provide an entry point for the design of adaptation efforts that are tailored to the unique conditions of a community and which are most likely to be perpetuated in the future because they reflect who local people are while allowing them to plan who they would like to be [2,4,26,80].

The interactional approach organizes a corpus of 21 local social context characteristics demonstrated to influence wildfire adaptive capacity under four broad conceptual categories that extend beyond simple notions of demographics. Those broad categories include (1) interactions and relationships among residents; (2) place-based knowledge and experience; (3) access and ability to adapt scientific and technical information; and (4) demographic/structural characteristics [27,28,81]. Researchers or practitioners seeking to utilize the interactional approach can use the conceptual categories and characteristics as an organizational heuristic to more rapidly consider which elements of local context (or others yet to be documented) help define the adaptive capacity a given community will bring to bear on collective action. They also can consider how the variable expression of local context characteristics, synthesized from past and ongoing research, might result in different approaches or support for wildfire management strategies. In sum, the interactional approach does not seek to predict action or support for adaptation, but seeks to build a narrative of a place and its people which allows them to plan their best "path" forward [1,2].

Researchers have used the interactional approach to demonstrate how variable adaptation efforts may occur across disperse case studies or communities within the same region (see [20,29,47]). They have also compared case study efforts across the Western U.S. to reveal a set of "archetype communities" which share common patterns of local context characteristics and are likely to approach various adaptation strategies, policies, or incentives in consistent ways. The archetypes provide a further means by which to more quickly generalize the local context influencing potential or actual

community action in response to wildfire while also recognizing that no two communities are exactly alike [1,82].

The latest addition to the interactional approach proposes the structure and makeup of "fire adaptation pathways"—variable collections of approaches, polices, incentives, or programs that are likely to best promote fire adaptation among diverse communities falling along the archetype continuum. Paveglio et al. [2] synthesized existing wildfire social science literature to propose nine broad considerations that may be supported or actualized differently among communities based on their unique local context. Each of these considerations (e.g., governance model/structure of collaborative processes; ways to promote property-level residential adaptation) and examples of their variable expression (e.g., top-down regulation through policy and law vs. grassroots organization or normative pressure; use of voluntary incentives such as insurance premium reduction vs. formal regulations such as HIZ mitigation requirements) can be combined to propose more holistic pathways for advancing wildfire adaptation across diverse communities.

While the interactional approach provides a set of characteristics, considerations, and thought processes for systematically understanding how diverse social context links to potential adaptation action, it can also be complex or difficult to apply. Proposed expressions of social context characteristics, archetype communities, and pathway components have largely been derived via the comparison of existing, disparate case studies, and therefore lack a common methodology for comparison across locations. Thus, there is a need for more evidence documenting divergent support or potential adoption of specific wildfire adaptation strategies (i.e., pathway components) across locations using similar protocols or methods. Other researchers have called for more quantitative evidence outlining the ways in which expressions of local context may lead to significant differences in support or use of adaptation practices across locations [8,20,83]. Accordingly, the following research questions reflect the aforementioned needs and guide this research effort:

1. Will socially diverse communities display variable support or perceived effectiveness for a variety of commonly advocated programs, approaches, and policies related to wildfire adaptation?
2. How can the systematic documentation of diverse local social context help explain support or perceived effectiveness for wildfire adaptation strategies across cases?

3. Materials and Methods

3.1. Site Selection and Participant Recruitment

Researchers adopted a multiple case study approach for the research outlined here because our primary intent was to both document any significant variation in support for adaptation practices across communities and to help explain why such variation might occur using existing theoretical guidance. A case study approach was well suited to this research because it focuses on the triangulation of multiple data sources and comparison across diverse units of analysis to produce robust theoretical conclusions that are not necessarily generalized to a larger population [84–86].

The researchers considered a number of criteria when selecting potential locations for the case studies conducted in this research. More specifically, they sought to select cases: (1) representing a range of diverse local social contexts; (2) spanning multiple Western U.S. states; (3) located in geographic regions that are underrepresented in existing research on wildfire; and (4) which vary based on the formal boundaries or informal relationships that dictate community membership (e.g., established homeowners association (HOA) versus disperse rural regions who identify collectively). Researchers operationalized social diversity by attempting to select a range of communities that were likely to reflect social context characteristics matching at least a few of the "community archetypes" outlined by Paveglio et al. [1,2]. They chose to sample diverse communities both in terms of geographic region and social context as it allowed for comparison across distinct conditions. Collectively, these efforts match a combination of what case study methodologists refer to as maximum variation, theoretical, and

stratified purposeful case study selection because we used existing theory and concepts to help select diverse communities that might help illuminate or explain patterns in wildfire adaptation [84,85,87,88].

The researchers obtained ethics approval from a university institutional review board before data collection to ensure the protection of human subjects and data (protocol #15-863). The site selection process began with a review of existing wildfire social science efforts focused on the Western U.S. The researchers identified broad geographic regions or counties where researchers had conducted less primary data collection associated with wildfire adaptation, management, or attitudes toward agency fire mitigation efforts. They searched for a range of information that might indicate the presence of distinct communities meeting the selection criteria outlined above. Information sought included community wildfire risk assessments, CWPPs, city and county web pages, land use data, and local news articles.

The researchers contacted key informants in a range of potential case study regions to further refine site selection. Key informants typically refer to contacts who have specialized knowledge concerning the phenomena of interest and the unique characteristics defining a particular location [89,90]. In this case, the researchers were interested in contacting those individuals who had a comprehensive understanding of the social diversity within larger units (e.g., county or region) considered during the information gathering phase described previously, and who could help us identify unique communities for further study. Key informants often included university extension professionals, local government officials, residential leaders of wildfire reduction initiatives, emergency planning officials, fire marshals, or fire chiefs. The researchers developed a semi-structured screening protocol that (1) introduced the broad definition of community guiding this research (without explicitly using the term community); (2) asked respondents to identify distinct populations in their region that met this definition of community; (3) asked respondents to describe the defining characteristics of the populations they outlined in step 2; and (4) introduced a number of probing questions developed to indicate elements of the social context characteristics outlined in the interactional approach [1,27,28]. They contacted at least two or three key informants in each location of interest to ensure additional context relevant to site selection.

Case study selection occurred sequentially between November 2016 and January 2018. Researchers chose to select cases and collect data sequentially to ensure that subsequent locations might best reflect diverse local social context conditions. They ultimately selected five locations for data collection: (1) the Story, Wyoming area; (2) the Bull River area of northwestern Montana; (3) a neighborhood of the outskirts of La Grande, Oregon; (4) two subdivisions in the Sun Valley region of Idaho; and (5) the gated community of Timber Lakes, Utah. Table 1 outlines select contexts relevant to each of these locations and initial differences across locations, including preliminary indications about the community archetype(s) that best represented each area selected for study. It is important to note that the researchers sought to document the site-specific social context in each location (see the analysis section below), and compared these emergent findings to existing patterns characterizing archetypes as a final step in the formal coding process. As such, preliminary archetype designations primarily helped ensure diversity in the cases selected.

Table 1. Select characteristics of case study locations selected for research.

Location	Approximate Number of Residential Properties	Formal or Informal Community Boundaries	Community Organizations or Governance	Fuel Type/Fuel Conditions	Approximate Housing Density and Patterns	Proximity to Nearby Public Lands	Existing Collective Fire Mitigation Efforts	Preliminary Archetype
Story, WY	Approximately 500 lots	Informal and unincorporated; geographically bounded by two creeks	Numerous local clubs and organizations (e.g., Story development fund, Women's Club, Lions Club); local volunteer fire department	Ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*), and some lodgepole pine (*Pinus contorta*)	Predominantly small, densely packed residential properties on forested lots	Directly adjacent to the Bighorn National Forest on three sides	Fuel break funded through federal grant; Firewise community; fundraising for volunteer fire department	Rural-lifestyle/working landscape, resource dependent
Sun Valley, ID	Approximately 180 lots	Formal, but unincorporated; defined by homeowners association boundaries	Starweather Homeowners Association; Heatherlands Homeowners Association; Coverage by two local fire departments (some paid professional positions, mostly volunteer).	Black cottonwood (*Populus balsamifera*) and old-growth quaking aspen (*Populous tremuloides*) adjacent to Big Wood River; extends to sagebrush rangeland	Small formal subdivisions with distinct boundaries	Directly adjacent to Bureau of Land Management rangeland; approximately 4 miles to the Sawtooth National Forest	Fuel break in Heatherlands on common ground adjacent to BLM land, initially funded by Firewise grant. Both subdivisions are Firewise communities	Formal subdivision/high amenity, high resource
Bull River, MT	Approximately 129 lots	Informal and unincorporated; defined by landmarks (MT Highway 56, Bull River) and public land boundaries	No community organizations	Douglas fir (*Pseudotsuga menziesii*) and western larch (*Larix occidentalis*)	Widely spaced forest and meadow parcels of varying sizes spread out along a river valley	Surrounded by the Kootenai National Forest on all sides	None reported	Rural lifestyle/working landscape, resource dependent

Table 1. *Cont.*

Location	Approximate Number of Residential Properties	Formal or Informal Community Boundaries	Community Organizations or Governance	Fuel Type/Fuel Conditions	Approximate Housing Density and Patterns	Proximity to Nearby Public Lands	Existing Collective Fire Mitigation Efforts	Preliminary Archetype
Timber Lakes, UT	Approximately 1475 lots	Formal, but unincorporated; Defined by Property Owner's Association	Property Owner's Association; primarily volunteer fire department in nearby Heber City	Predominantly Gambel oak (*Quercus gambelii*) in lower portions; quaking aspen (*Populous tremuloides*) in higher portions	Sprawling parcels interspersed within native vegetation; some residents purchase neighboring parcels to increase their property size and privacy	Adjacent state and federal lands, with recreational trails into Uinta-Wasatch-Cache National Forest	Fuel break on select edges of Timber Lakes funded by a Hazardous Fuels Reduction Grant; chipping program for disposal of excess fuels	High amenity, high resource, rural lifestyle
La Grande, OR	Approximately 206 lots	Formal and incorporated; city limits define outer edge of study area	Local church groups; professional fire department; city ordinances and codes	Ornamental juniper and trees, Douglas fir (*Pseudotsuga menziesii*) within community; patches of lodgepole pine (*Pinus contorta*) and grand fir (*Abies grandis*) beyond community boundaries	Densely packed lots comprising the neighborhood of an incorporated city	Approximately 5 miles from Wallowa-Whitman National Forest	None reported	Formal subdivision

3.2. Participant Recruitment and Data Collection

Researchers used a combination of theoretical and snowball sampling to select participants in each of the locations chosen for the study. Theoretical sampling entails the selection of participants who have specialized knowledge of the topic of interest and who represent the breadth of perspectives interacting to influence conditions driving the phenomena studied [91,92]. In this case, this meant engaging a broad cross section of professionals, residents, managers, and local officials who live in or contribute to wildfire and associated land management in each of the communities selected for the study.

The researchers began the recruitment process by seeking out the contact information of public officials and residents who were likely to be highly involved in fire management associated with each community. This included local fire chiefs, homeowners association (HOA) board members, Firewise community members (if present), county commissioners, fire management officers for federal land management agencies, university extension specialists, Natural Resource Conservation Service officers, state fire wardens, and community planners. The researchers also reengaged key informants from our case study selection. Each of these individuals was invited to participate in potential focus groups and asked to supply the contact information for other officials, residents, or managers who had a good understanding of wildfire management surrounding the community in question or who had specialized knowledge about the fire management actions of people living there. The researchers took specific care to have initial key informants suggest participants who may have diverse or contradictory perspectives compared with others who had already been identified in the recruitment process. The process of having initial informants identify additional viable or knowledgeable participants is known as snowball sampling or chain referral sampling [89,91].

In addition to directed recruitment efforts, researchers disseminated invitations for the focus groups through fliers, postings in local newspapers, homeowners association list serves (if present), fire department websites, and online via social media. The researchers made direct contact with potential resident participants via phone lists for communities (when available) or through internet searches for phone numbers of residents. Finally, the researchers visited each community prior to the focus groups to recruit additional resident or professional participants by knocking on residential doors or visiting offices. They left door hangers inviting participants to the focus groups and providing the researchers' contact information. Researchers conducted the additional recruitment efforts outlined above to ensure that a wide range of residents—including those who might not have high involvement or knowledge of wildfire management efforts in their community—could participate in the focus groups. The researchers only suspended recruitment efforts in each location when participants were unable to identify additional individuals who had not already been contacted and when they agreed that the perspectives articulated during focus groups had stabilized, meaning no new perspectives were forthcoming and that participants agreed upon initial findings discussed across participant groups from the same community (what is sometime referred to as "theoretical saturation") [93]. Table 2 provides an overview of focus group participants by location.

Table 2. Focus group participants by location.

Location	Story, WY	Sun Valley, ID	Timber Lakes, UT	Bull River, MT	La Grande, OR	Total
N	46	32	44	36	30	188

Focus groups are a well-established method for obtaining information about broader populations of interest from a key subset of knowledgeable informants, and have a long history as a means to evaluate the utility of new ideas or products. Focus groups also allow for researchers to observe the interaction between participants and better understand how those relationships influence collective dynamics [89,94,95]. The researchers adopted a mixed-methods focus group approach for this particular

data collection effort. More specifically, the authors sought to combine Likert-scale ratings of various approaches, strategies, or policies related to fire management with a more in-depth discussion of the influences surrounding participant ratings and a collective discussion of the circumstances surrounding each option. This approach also allowed the opportunity for the researchers to prompt discussion about additional influences or approaches that would be important to advance fire adaptation in each community.

The researchers designed a semi-structured focus group protocol comprising seven overarching questions, each with five-point Likert-scale ratings for specific options nested within them. For instance, an overall question in the protocol focused on in this analysis included: "How effective or ineffective would the following policy foci be in reducing wildfire risk in the _____ community?" Meanwhile, Likert-scale ratings of perceived effectiveness nested beneath this question included the following example prompts: (1) increasing voluntary mitigations performed by residents on their properties; (2) requirement of vegetation mitigations on new, existing properties that are enforced with fines or penalties; (3) hiring private contractors to reduce wildfire risk on private lands; etc. (see Table 3 for all prompts).

The researchers made it clear to participants that evaluations of the practices introduced during the focus groups should consider multiple factors. More specifically, focus group facilitators used to the following language to introduce the considerations associated with each rating:

> *During the following questions I want to ask you about the effectiveness of different strategies for promoting effective wildfire adaptation in this area. That is, what strategies are most likely to work well, or have worked well in this area for improving wildfire response? When I say effective, I mean those things that will be both (1) useful in reducing wildfire risk to this area; AND (2) which will be supported by or carried out by people in this area. If a given approach is already being implemented here, please assess its effectiveness in reducing wildfire risk. If usefulness and local support or adoption are at odds for any given strategy, I would like to talk about that more.*

The authors refer to these quantitative evaluations as "perceived effectiveness," "ratings of effectiveness," or "effectiveness ratings" throughout the remainder of this manuscript. The respondents were asked to serve as key informants reflecting how their fellow community members would respond to the policies and initiatives presented, and not just their personal opinions. The researchers added an additional block of commonly advocated approaches for increasing individual or collective wildfire mitigations on private property in later case studies. Additional measures were added in later cases when it became apparent that there were significant differences among locations on existing measures, and to further evaluate the influence of local social context on support for diverse strategies often discussed in existing literature.

Table 3. Mean ratings of strategy effectiveness or ineffectiveness in promoting fire adaptation among participants in case study locations. All ratings were coded with scores ranging from −2 to 2.

Location	Story	Sun Valley	Timber Lakes	Bull River	La Grande	F *
Increasing voluntary mitigations performed by residents on their properties	1.37	1.37	1.17	1.51	1.07	1.09
Requirement of vegetation mitigations on private properties that are enforced with fines or penalties	−0.33 $_a$	1.17 $_b$	0.455 $_{a,b}$	−0.771 $_{a,c}$	0.786 $_b$	16.384 ***
Hiring private contractors to reduce wildfire risk on private lands	0.889	1.063	0.500	0.400	0.793	2.00
Use of prescribed fire to reduce risk near the community	0.744	0.035	0.590	0.177	0.679	1.67
Promoting community-wide fuel breaks using large-scale fuels reduction projects	1.178 $_a$	0.375 $_{b,c}$	1.158 $_{a,b}$	0.972 $_{a,b}$	0.103 $_c$	7.420 ***
Homeowners association (HOA) requirements related to individual mitigations on private properties	−0.897 $_a$	0.844 $_b$	0.526 $_b$	−1.15 $_a$	−0.750 $_a$	18.017 ***
Fostering recognized Firewise communities	1.023 $_a$	1.45 $_{a,b}$	1.15 $_{a,b}$	0.735 $_{a,c}$	0.393 $_c$	7.164 ***

Mean values for each action with different subscript letters, $_{a,b,c}$, are significantly different from each other at the 0.05 level in a one-way ANOVA featuring Welch's F and a Games–Howell post-hoc test. Mean values with the same subscript letter do not have significantly different means; * F-test for one-way ANOVA featuring Welch's F significant at the <0.05 level; ** significant at the <0.01 level; *** significant at the <0.001 level.

The researchers chose to operationalize responses to the quantitative questions in the manner described above for a few key theoretical and methodological reasons. To begin, incorporating the perceived likelihood that community members will enact or support the adaptation actions presented recognizes the significant influence that human agency has on the provision of collective fire adaptation [7,11,34]. Community members can choose whether to perform mitigation actions on their property, enact regulations supporting adaptation actions, or comply with such regulations in the absence of direct enforcement (and sometimes not even then). Likewise, the existing literature indicates how community support and opposition to actions on nearby public lands or common areas can inhibit the completion of mitigation actions [2,10,15,23,36]. These understandings are not always well implicated in some research evaluating the "effectiveness" of adaptation action in that they assume private citizens will adopt or support such actions if researchers demonstrate only how they could reduce potential risk. The lack of consideration for human agency or adoption in wildfire risk reduction planning may be one reason why the well-defined blueprint for wildfire management that we describe above is not always adopted across populations. The mixed-method focus group approach used here provides an opportunity for participants to quantitatively evaluate the complex notion of perceived effectiveness surrounding common wildfire adaptation actions while allowing for in-depth, qualitative discussion about the influences leading to those evaluations. A secondary set of methodological considerations influencing the operationalization of effectiveness described above concerns the cognitive burden of respondents and the need to instigate participant discussion about any salient or emergent issues operating in the locality. It would likely be very repetitive and confusing for respondents in these focus groups to answer two sets of questions implicating how each strategy in question: (1) had the potential to reduce wildfire risk, and (2) whether local people would support or enact those strategies. Asking broader, more holistic questions about the effectiveness of each strategy engages participants in a more deliberative examination of the local conditions influencing wildfire adaptation in each site. Such an approach is common in focus group methodology [89,94,95].

The researchers organized the interactive focus groups using the TurningPoint software (Turning Technologies, Youngtown, OH). TurningPoint utilizes PowerPoint and hand-held electronic devices to allow for real-time, anonymous ratings in focus group settings. The participants rated individual approaches, policies, or programs under each of our overarching questions separately, and were able to see answers from the entire group immediately. The researchers also summarized responses to similar approaches (i.e., the thematic groupings described above) to present average ratings across approaches. Presentation of rating results in real time was then used by the focus group facilitator to initiate a deeper discussion about the specific influences on or reasons for the patterns apparent in the data.

The researchers conducted focus group data collection sequentially in each location between December 2016 and March 2018. They conducted between three and four focus groups at neutral locations in each case study community, including community halls, senior centers, fire halls, or extension offices. At least one focus group in every location was populated with professionals, land managers, local government officials, or fire personnel, while the other groups were composed of residents in each community studied. Researchers conducted separate focus group discussions for professionals and residents to ensure that each group was honest in its assessment of agency-resident interactions and to minimize any pressure to answer in certain ways due to "expert assessment." Focus groups each lasted between approximately 90 minutes and 135 minutes. They were recorded with the permission of participants. Likert-scale ratings for each measure in the semi-structured protocol were saved by the TurningPoint program. Each recording was transcribed word-for-word to allow for subsequent analysis.

3.3. Analysis

All quantitative analyses conducted as part of this research were conducted using the software package SPSS 25 (IBM, Armonk, NY). Researchers focused quantitative examination on a subset of the 40 ratings each individual made to ensure conceptual rigor and because comparison across all

approaches, policies, or mitigation actions assessed during the larger focus groups is too much to present in one article. The researchers decided to focus on two primary groupings of questions that implicate commonly studied strategies for (1) increasing property-level mitigations on private property; or (2) collective planning strategies that would allow private landowners or local governments to influence future wildfire risk. These prompts reflect some of the most commonly studied and cited options for wildfire mitigations among private populations. As such, they provide a good set of initial measures for assessing any significant differences across communities.

See Tables 3 and 4 for a full listing of the approaches implicated in the question blocks used for the quantitative analysis. All 5-point Likert-scale ratings were coded with scores ranging from −2 to 2.

Table 4. Mean ratings of strategy effectiveness or ineffectiveness in promoting fire adaptation among participants in case study locations. All ratings were coded with scores ranging from −2 to 2.

Location	Story	Sun Valley	Timber Lakes	F *
Retrofitting wildland-urban interface (WUI) dwellings with fire resistant materials	0.293	0.741	0.500	1.001
Zoning efforts restricting additional or new development	−0.651 $_a$	0.846 $_b$	0.579 $_b$	15.892 ***
Additional local taxes to support wildfire management	−0.350 $_a$	0.200 $_{a,b}$	.632 $_b$	6.466 **
Strengthening the capacity of local fire districts	1.163 $_a$	0.815 $_b$	1.31 $_a$	3.355 *
Pressure to set insurance premiums based on mitigation actions	0.600 $_a$	1.27 $_b$	1.18 $_b$	5.391 **

Mean values for each action with different subscript letters, $_{a,b,c}$, are significantly different from each other at the 0.05 level in a one-way ANOVA using a Bonferroni post-hoc test. Mean values with the same subscript letter do not have significantly different means; * F-test for one-way ANOVA significant at the <0.05 level; ** significant at the <0.01 level; *** significant at the <0.001 level.

The researchers began the analysis process by exploring the structure of the data, including evaluations of data normality and variance across case study locations using plots and graphs. They also conducted tests that can indicate whether the assumptions of normality (e.g., Levine's test) or homogeneity of variance (e.g., Shapiro–Wilk and Kolmogorov–Smirnov tests) might be violated, which could influence the analysis methods best suited to yield accurate results [96]. Results of the initial analysis suggested that the homogeneity of variance assumption was likely violated for a portion of the data, and there was some indication that portions of the data had a slightly non-normal structure. As such, the researchers explored significant testing of approaches across locations using two primary methods: (1) the non-parametric Kruskal–Wallis test; and (2) the one-way ANOVA. ANOVAs conducted on the subset of the data displaying heterogeneity of variance utilized Welch's F, which corrects the F-ratio in cases where the homogeneity of variance assumption is violated [97,98]. The Kruskal–Wallis test often is suggested when testing for significant differences among groups with non-normal data, though it tests the median of groups rather than the mean, which is the focus of the ANOVA. Results of the Kruskal–Wallis and ANOVA tests performed on the data revealed similar results in terms of significant differences across groups and subsequent post-hoc comparisons, which indicate a robust signal in the data. The researchers report results from the ANOVA in the results section because (1) this test often is advocated as a more robust approach; and (2) because it provides better options for interpreting differences across groups within the larger sample (i.e., post-hoc tests) using the mean, which is an important indicator of agreement on shared approaches. The researchers conducted Games–Howell post-hoc tests on variables with heterogeneity of variance across cases because this test has a high degree of power and accuracy in cases of unequal sample sizes [96,99].

Qualitative analysis was conducted in three distinct phases. The first phase of analysis took part in the field following each focus group. The researchers discussed primary emergent themes characterizing participants' discussions about the wildfire adaptation approaches best suited to their

local circumstances. The researchers also discussed any emergent ideas for place-based wildfire adaptation suggested by participants, additional probing questions to ask about during subsequent focus groups, and whether additional participants were needed to ensure consistent patterns in response (i.e., theoretical saturation) [100].

Analysis conducted during phases two and three utilized the qualitative management software NVivo 12. The second phase of qualitative analysis utilized both inductive and deductive coding strategies [101]. This strategy reflected a dual interest in exploring the interactive approach as a guiding theoretical lens for understanding differences in support for wildfire adaptation approaches and ensured that any additional insights could emerge from the data. The deductive coding approach entailed stages of what is sometimes referred to in the literature as "a priori coding" [102]. More specifically, the researchers coded segments of discussions about local context operating in each case study location or which were cited as an influence on wildfire management into existing categories (e.g., place-based knowledge and experience, amenity migration, etc.) outlined by Paveglio et al. [1,2,27]. The coders also noted the specific form of any characteristics coded (e.g., knowledge of fire history in the area, high rates of amenity migration from other rural areas, etc.) and made notes on how participants related those influences to specific conclusions about the effectiveness or applicability of particular wildfire adaptation strategies. A second phase of the deductive coding process attempted to link specific local context characteristics to participant discussions surrounding the effectiveness or applicability of specific adaptation strategies introduced in the quantitative rankings. This process helped to organize and compare patterns of important influences across locations as described by participants. The latter strategy is sometimes referred to in the literature as "pattern coding" and the researchers helped facilitate it using the matrix query function of Nvivo 12 [102,103].

The inductive portion of the coding process employed a combination of analytic induction and thematic analysis. Analytic induction provides a process to derive causal explanations of processes through examination and comparison of individual cases while thematic analysis focuses on identifying commonalities or differences in experiences surrounding phenomena of interest [104,105]. The researchers began the inductive process with "topic coding"— the broad labeling of any emergent influences not currently documented in the interactional approach or noted by participants as place-specific influences on wildfire adaptation. Subsequent consideration of any emergent codes included "analytic coding" that articulated consistent relationships between local context characteristics and perspectives about effective adaptation in each location. Outcomes of those efforts were compared across locations [101,106].

Finally, the researchers compared their coding outcomes to existing articulations of local context best characterizing different "archetype communities" described by Paveglio et al. [1,2]. The goal of this process was to determine whether the archetype concept was helpful in understanding or explaining new cases. The researchers present the results from the final comparison in the discussion section as it constitutes the comparison of emergent results to existing literature, and not necessarily the analysis of primary data.

Two separate researchers conducted an initial phase of the deductive and inductive coding processes, with each researcher coding all transcripts associated with at least two distinct cases from the larger sample. The senior author then separately coded transcripts associated with all five cases and compared the results with the first two efforts to determine intercoder reliability. The researchers discussed the results of the individual coding efforts and the senior author modified or incorporated any clarifications in subsequent codings of the data. Finally, the authors selected representative participant quotations that best reflect our overarching themes concerning the influence of local context on the support or adoption of wildfire adaptation strategies.

4. Results

4.1. Quantitative Rankings of Adaptation Actions

Participants' effectiveness ratings for approaches included in this analysis were generally mixed, with a slight majority displaying positive ratings across locations (see Tables 3 and 4 for mean ratings across locations). However, there also were a number of approaches with negative ratings in select locations studied, indicating that the strategy was on average viewed by participants as an ineffective tactic for promoting wildfire adaptation in that particular area.

Increasing voluntary mitigations performed on private properties had the highest mean ratings of effectiveness among approaches compared across all five communities ($M = 1.39$, SD = 0.955), followed by the establishment of recognized Firewise communities ($M = 0.9655$, SD = 1.00), and promoting community-wide fuel breaks using large-scale fuels reduction projects ($M = 0.817$, SD = 1.086). Homeowners association requirements related to individual mitigations on private properties had the lowest ratings of effectiveness among approaches compared across all five communities ($M = -0.2807$, SD = 1.50), followed by the requirement of vegetation mitigations on private properties that are enforced with fines or penalties ($M = 0.1845$, SD = 1.38), and use of prescribed fire to reduce risk near the community ($M = 0.468$, SD = 1.36). Strengthening the capacity of local fire districts had the highest mean ratings of effectiveness among approaches tested across a subset of later community cases ($M = 1.12$, SD = 0.780), followed by pressure to set insurance premiums based on mitigation actions ($M = 0.981$, SD = 0.975). Zoning efforts restricting additional or new development ($M = 0.150$, SD = 1.38) and additional local taxes to support wildfire management ($M = 0.150$, SD = 1.27) displayed the lowest average effectiveness ratings across the subset of communities. However, the high standard deviation across many of these comparisons, which in some cases were larger than the average, provide an initial indication that there may be considerable variance among populations with regards to the effectiveness of different approaches across locations.

The results of our ANOVA indicate significant differences across communities for four of the seven approaches evaluated across all five cases (see Table 3 for full outputs). The test results also indicate significant differences in four of the additional five approaches evaluated in a subset of three later cases (see Table 4 for full outputs). Effectiveness ratings for HOA requirements related to individual mitigations on private properties ($F[4, 81.64] = 18.017$, $p < 0.001$) and requirement of vegetation mitigations on private properties that are enforced with fines and penalties ($F[4, 80.69] = 16.384$, $p < 0.001$) had the largest magnitude of differences in approaches tested across all case study locations. The results also indicate highly significant differences among cases with regards to promoting community-wide fuel breaks using large-scale fuels reduction projects ($F[4,80.92] = 7.420$, $p < 0.001$) and fostering recognized Firewise communities ($F[4, 80.754] = 7.164$, $p < 0.001$).

The results of subsequent ANOVA tests indicate additional differences in effectiveness ratings across approaches evaluated in a subset of communities (see Table 4 for full outputs). Effectiveness ratings for zoning efforts restricting additional or new development displayed the largest magnitude of difference in approaches evaluated ($F[2, 104] = 15.892$, $p < 0.001$), followed by additional local taxes to support wildfire management ($F[2, 100] = 6.466$, $p = 0.002$). The results also indicate moderately significant differences in effectiveness ratings associated with pressure to set insurance premiums based on mitigation actions ($F[2, 103] = 5.391$, $p = 0.006$) and weakly significant differences in ratings associated with strengthening the capacity of local fire districts ($F[2, 102] = 3.355$, $p = 0.039$).

Post-hoc tests help reveal similarities and significant differences in ratings across communities. For instance, mean ratings of HOA requirement effectiveness in Bull River, La Grande, and Story were all negative and differed significantly from positive ratings in Sun Valley and Timber Lakes (see subscripts in Table 3 for comparisons). Bull River had significantly lower mean ratings for required vegetation mitigations when compared with Timber Lakes, Sun Valley, or La Grande, but not Story. The more moderate rating of effectiveness related to vegetation management in Timber Lakes was not significantly different from Story, Sun Valley, or La Grande, but was significantly higher than Bull River.

Collectively, many of the post-hoc tests reveal a continuum of acceptability ratings, with significant differences apparent among more extreme views articulated by some communities and a range of more moderate community perspectives. For instance, Story participants had the highest effectiveness rating for community fire breaks, which was significantly higher than La Grande or Sun Valley. However, the next highest mean rating of effectiveness for fuel breaks in Timber Lakes was not significantly different from Story or slightly lower ratings in Bull River and Sun Valley. La Grande had the lowest mean effectiveness rating for fostering recognized Firewise communities, which was significantly lower than Timber Lakes, Sun Valley, and Story, but not Bull River. Effectiveness ratings for Firewise communities in Bull River were significantly lower than in Timber Lakes and Sun Valley, but not Story, where the mean effectiveness rating was the midpoint across cases.

Post-hoc tests of adaptation approaches across a subset of cases provide context for additional differences across cases (see subscripts in Table 4 for comparison). For instance, mean effectiveness ratings for zoning efforts were significantly higher in Sun Valley and Timber Lakes when compared with Story. Story participants had significantly lower effectiveness ratings for additional local taxes to support wildfire management when compared with Timber Lakes, but not Sun Valley. Mean effectiveness ratings for adapting insurance premiums based on mitigation actions was significantly higher in Sun Valley and Timber Lakes compared to lower (but still positive) mean effectiveness ratings in Story. Finally, Sun Valley had a significantly lower mean effectiveness rating for strengthening the capacity of local fire districts when compared with Story and Timber Lakes, which did not differ from one another.

4.2. Qualitative Discussion of Local Context and Fire Adaptation

Analysis of focus group discussions in each case study location broadly indicate that the site-specific context of each case—and the ways that local context influences the character of their communities—were an important consideration that participants made when rating the strategies that were part of our quantitative analysis. Participants were quick to point out that any strategies employed to better manage wildfire would likely require tailoring to the existing culture of each community, which participants in all cases were able to readily distinguish from neighboring populations. Participants also indicated that tailoring wildfire adaptation to local context included convincing residents how any wildfire adaptations would improve their community or the surrounding environment. As one resident in Story, Wyoming, summarized:

> *I've been here 25 years. One of the major hurdles that personally I have seen over those years (for fire management) is that you have to understand the dynamics of what makes up the resident population here.*

The following section provides key results from the qualitative analysis.

4.2.1. Variance in Support for Wildfire Mitigation Regulations

Both our analysis and focus group participants articulated how the unique combination of local social context characteristics operating in each community help provide explanations for the significant differences outlined in our quantitative analysis above. For instance, Bull River focus group participants described how low ratings of effectiveness for vegetation requirements on private properties and related HOA requirements were the result of a strong preference for private property rights and individual-level responsibility for fire mitigations. The Bull River area has few existing homeowner associations and most residents owned larger lots along a narrow river corridor bordered on both sides by rugged mountains of U.S. Forest Service lands. The spacing of residential lots or structures in Bull River reflected a commonly described desire among residents for privacy and immersion in a forested landscape. Bull River residents described having no desire to set up homeowners associations because it did not fit their culture of interacting with neighbors on an informal basis surrounding hunting and fishing or helping each other with common hardships that arose from their rural settings (e.g., weed

management, transportation in the winter). As one participant described: "We moved here for the freedom. If I wanted to be in the community or in an HOA, I'd live somewhere where they had them. I don't want those where I'm at."

That being said, residents and professionals in Bull River described the population as well aware of the risks posed by wildfire and the benefits of performing mitigations on private properties or nearby public lands. A number of residents described individual efforts to clear overstocked forests, create defensible space, or establish water sources and equipment to aid fire suppression efforts in the area. They saw active forest management as necessary for landscape health and wildlife habitat that was a benefit of living in the area (e.g., fishing, hunting, or professional guiding activities), and often talked about the need for more management on nearby public lands. All of these sentiments stemmed from residents' long-term perspective that landowners need to take personal responsibility to reduce fire risk on the properties they manage, and are corroborated by the quantitative rankings in that Bull River had the highest mean effectiveness rating among all cases with regards to voluntary mitigations. It also helps explain lower (but still positive) ratings for Firewise effectiveness in Bull River when compared to other locations—residents indicated that the educational components of the program would not be as useful to residents who already understood the mitigations necessary in their area. As one participant described:

> Yeah, I don't think people need to be babied because they're beyond that, but at the same time it's, look, we're not looking for mandates, we're looking for a way to improve things around here so that people don't get hurt, animals don't get hurt.

Professionals in the Bull River area described having a hard time advertising fuel reduction cost share programs to area residents due to the lack of formal communication networks in the area, and because local people described having a high level of distrust for non-local government programs that might cause them to lose control over choices on their private land. As one participant described: "You do have a faction of the population out here that don't care for the government no matter what. You pull up in a government rig and they don't care for it."

Our analysis of respondent discussions in Sun Valley and La Grande indicate that high levels of support for vegetation requirements on private properties are the result of very different combinations of local context operating in each community. Respondents in Heatherlands and Starweather, the two emergent communities comprising the Sun Valley case, quickly made it clear that the demarcation of communities in that region often is tied to the formal subdivisions that characterize residential development in the northern part of the valley. Residents who chose to live in the subdivisions studied for this research described understanding how they were entering a more formal community setting that included professional property management and a regulation structure that was governed by other members of the community. They also described how the Firewise program provided a logical way to capitalize on their existing organization of homeowners associations. One participant articulated it this way: "I think if we are certified Firewise, the perception of the value of our properties is going to be higher than if we are perceived as an association that is not maintaining the neighborhood." Likewise, Sun Valley residents described how their preferences for "hands off" management of native vegetation in and around the communities was changing due to the decadent growth of sagebrush in Heatherlands and deadfall or overstocked aspen and black cottonwood forests in Starweather, the latter of which borders the banks of the Big Wood River. As one participant articulated: "For a while they [professionals] said . . . 'don't touch your sage, don't touch your sage.' And then the seasons started to change and fires came along. Then they said 'everyone get rid of your sage.'"

The combination of the factors mentioned above and others, including regular interaction with professional firefighters and recent evacuations during large fires, help explain the high level of support for requirements on private properties in Sun Valley and a view that established HOA bodies should move toward facilitating consistent mitigation among private properties that contribute to shared risk. Challenges to that approach included the high proportion of residents that needed to vote on such

issues, absentee landowners who did not participate in HOA governance, and the lack of enforcement capacity associated with such regulations. As one participant described:

> *But actual enforcement of CC&Rs (codes, covenants, and restrictions), the one that I have been involved with, we've had very little success in trying to enforce CC&Rs. And the state, threw out our ability to even fine people, because we couldn't really define damages. And so it sounds like there's a mechanism, because we're a homeowners association, but we really don't have a whole lot of power.*

Respondents described high support for vegetation requirements in La Grande as tied to their familiarity with private property regulations common to incorporated settings and because they felt that fire protection for city residents should be the primary responsibility of government entities. More specifically, La Grande residents described how existing ordinances for maintaining yard vegetation or weeds as something that could be extended to wildfire risk. They also felt that ordinances or rules about open burning and removal of debris (e.g., trash, old cars, etc.) on larger residential properties were reasonable changes that would put some responsibility for fire risk on private property owners. As one resident summarized:

> *So, if there's an inherent risk and you live in town, in city limits, you expect a certain amount of safety from fires. Because you're living in a group. If you have a cabin or a house, it is way out in the forest, I would hope there's less expectation to have all sorts of resources to defend that one house.*

However, participants in La Grande also indicated that residents would prefer efforts to establish normative rules for mitigations or receive education about their merits before establishing outright regulations that carried fines. They saw less use for the Firewise program because they felt education and messaging surrounding fire management could already be well communicated through the fire department or city government officials. Establishing a formal organization like Firewise in the neighborhood was also described as less useful because there was no existing structure or group (e.g., an HOA) for promoting collective action, and because that action had historically taken place through informal means. As one resident described: "But if you were to tell them [residents] why they should try to do it themselves, like he said, education. I think then it becomes a community thing. Because if they do it, they can do it together."

4.2.2. Collective Action, Community, and Variance in Support for Shared Fuel Breaks

Qualitative documentation of local context characteristics in each case also help explain quantitative differences in ratings for community-wide fuel breaks. For instance, participants described how high levels of support for community-wide fuel breaks in Timber Lakes stemmed from the existence of a defined boundary for the gated community, an interested property owner's association (POA) that could structure interaction with landowners or land management professionals, and the presence of large common areas throughout the development that would allow projects requiring less permission from individual property owners. However, participants also indicated that the very large and diverse cross section of owners in the community needed to develop a strong, centralized voice to work on their behalf. As one participant summarized: "Yeah and that's what forming a [property owner's association] committee would be is to have that leader. That brings in and is able to have the power to talk. And to get support from the county."

Both professionals and residents in Timber Lakes recounted previous efforts to create mosaic fuel breaks throughout or on the boundaries of the development due to its large size and the lack of consistent fuel reduction on individual properties. They described how any future fuel reduction efforts would have to be done in ways that were aesthetically pleasing, promoted native species, and that did not adversely impact wildlife habitat because these were primary reasons many residents lived in the area. Likewise, the existing structure of the POA would need to loosen restrictions on removing natural vegetation from private properties without board approval and commit to maintenance of any fuel breaks on their property. As one participant described:

So, there's definitely that dilemma, which when you see these communities burning, you can completely understand why, because everyone wants their trees, they want to feel like they're in the woods, they want to feel like they're in a cozy cabin, and the trees are an important part of that.

High support for community-wide fuel breaks in Story shared both similarities and key differences with Timber Lakes. Story residents described a high level of concern about fire risk to the community and had worked with local professionals for years prior to establish a recognized Firewise community. The Firewise organization in Story was described by local residents and area professionals as an effective way to catalyze collective support for fire mitigations in Story. The organization had since worked in concert with the volunteer rural fire department and a community development group (i.e., the Story Development Fund), both of which served organizing functions in the unincorporated community that is less interested in establishing formal government structures (i.e., homeowners associations, city incorporation). As one participant outlined:

We are much more firewise now than we've ever been before. There's much more awareness, much more talk about it at the bars and on the streets and stuff like that. And people are more likely to hint to their neighbors, 'Hey, that's kind of a fire risk.'

Key residents involved in the aforementioned community groups worked with the U.S. Forest Service and state officials to plan and obtain grants for a community-wide fuel break where it bordered public lands of the Bighorn National Forest. The resultant fuel break included coordinated treatments on both Forest Service lands and private properties. Residents in Story indicated that the fuel break was a highly effective collaborative effort that achieved more than trying to promote consistent performance of fuel reduction across all properties in a community with both variable structure densities and landowner perspectives about the effectiveness of private property mitigations. However, acceptance of fuels reduction on private properties did need to survive initial concerns about removal of vegetation, and not all landowners were supportive. Local leaders in the Story area indicated that they hoped to conduct more fuel breaks in the future. As one resident articulated:

Let me stick up for my neighbors. Eventually, they got used to the changes that we did (i.e., the fuel break). And I think today, they say, 'they're responsible, they did a good thing.' It just took them a while because there's a resistance to change.

Participants described how lower levels of support for community wide fuel breaks in La Grande and Sun Valley were tied to different combinations of local social context and biophysical conditions. Residents in La Grande did not feel that they were at particularly high risk from wildfire because the wildland vegetation that bordered their community was composed primarily of steep grassland slopes. A wildfire in the 1970s burned off most of the forest vegetation on those slopes. As one participant described:

I think for this area we're talking about, our neighborhood, there's no practical physical place to have these kind of barriers [i.e., fuel breaks]. Up and down, could be on top of the hill, in the middle of the hill, halfway down the houses, or 100 yards in town. Where do you put this barrier?

While members of the La Grande case loosely identified their area as a "community," they had little in the way of organizations (e.g., homeowners associations, clubs, etc.) that could coordinate the collective action necessary for a fuel break on nearby private land. They indicated that such efforts would be better focused on public lands further up their drainage. Both residents and professionals described how the relatively dense development patterns in the community often meant that properties did not include the entire Home Ignition Zone, and that wildland vegetation was not as prevalent on their small lots. As one participant described:

I could see maybe if it's more out of the community a little bit, and it's not in a neighborhood with already all these other houses around that don't meet that [HIZ]. If it's by itself a little bit where

it could be pretty exposed to wildfire, then having some wildfire things (i.e., restrictions) on in the construction.

In contrast, residents in Sun Valley described moving to the area to be near the outstanding outdoor recreation opportunities and natural amenities of the area. The Heatherlands HOA had obtained past grant support from state and federal agencies to create a fuel break on the edge of the development where private land is adjacent to steep Bureau of Land Management slopes and Idaho Power transmission lines, both of which were described as potential sources of wildfire risk. That fuel break also extended through highly visible HOA common land with native sage and bitterbrush. The Sun Valley focus group participants described how some residents in the community reacted negatively to the fuel break because they felt that the work left unattractive bare ground and because it created additional challenges associated with invasive species (e.g., cheatgrass) or the need for HOA maintenance (e.g., regular mowing or spraying). As one participant articulated: "For every action, there's a reaction. So, you think you're doing good, and then five years later, you realize that well, we created a bigger problem than we got rid of."

Sun Valley participants indicated that additional fuel breaks in that community would likely take a significant amount of effort and coordination across landowners that might not be possible. Likewise, participants described how fuel breaks on the edge of the Starweather HOA were challenging because of a need to carefully manage resource impacts in the protected river corridor, including a wildlife habitat conservation easement that the community had established within its perimeter. As one participant summarized:

The two areas reach out the river, one's almost directly west of you down below and the other kind of across from [name] down by the, by the bridge. They're both messes, they're both disasters, still are. Need a lot of clean up to be done, vertical as well as horizontal, both ways. It's a fuel box is what it is right now.

4.2.3. Independence and Outside Relationships: Differences in Zoning, Taxes, and Fire District Support

Low ratings for zoning efforts and additional taxes to support fire management in Story were described by participants as stemming from a local culture that values personal freedom and the absence of government intrusion. Many residents and professionals described how those who had moved to Story did so explicitly to get away from increased residential development in other areas, or because their families had owned property there for multiple decades. Newcomers and a growing segment of amenity migrants seeking additional services had increased the diversity of perspectives in the Story community, and had begun to raise some conflict among a population that already is very distrustful of government bureaucracy. As such, participants described how fire management efforts that did not originate in the community were a hard sell. One participant summarized it this way:

One of the primary reasons I moved here is that we're very far away from the rest of the world, and it's very beautiful. But the third point is there's a lot less government. So I think the sentiment, don't you guys agree, in this community is: Nobody tells me what to do. I'm out here away from government. We don't want government telling us what to do, how to run our lives. I think that's a dominant attitude.

In contrast, the local volunteer fire department was a valued and trusted institution in Story that had long been championed by long-term residents who were treated as informal city council members, and who helped champion local causes. Residents in Story described supporting volunteer fire department initiatives in the community and felt that members of that organization could help advance wildfire mitigation efforts by serving as the conduit for broader initiatives from state or federal agencies. All this is reflected in the high effectiveness rating in Story for the strengthening of local fire district capabilities. One Story participant summarized it in this way:

If I were sitting down writing a report on this meeting right now, this is just my view, the most cohesive force we have in the community is our fire department. The community will support it. Having said that, our fire department's very small. We need to figure out a way to augment the fire department.

Effectiveness ratings for zoning efforts were highest in Sun Valley because those residents described value in protecting their substantial property investments from additional sprawl and because such zoning had been used commonly throughout the valley. Many residents were retired or active professionals with experience in legal systems or government processes, and who described being comfortable supporting or steering higher levels of government toward initiatives that they felt improved their communities. In fact, Sun Valley had established a Mountain Overlay Zoning District in the 1970s that restricted development on the iconic peaks surrounding the valley to ensure that it remained a valued destination for high-income retirees who wanted to live in close proximity to both natural amenities and cultural services in nearby towns. Ironically, respondents described how that same zoning district (which respondents referred to as the 'hillside ordinance') could potentially hinder opportunities to create large-scale fuel breaks outside communities because it restricted vegetation management on hillsides to preserve the scenery. One participant summed up the challenge as such:

The county will not give us permission to mow that, because of the hillside ordinance, it's really quite visible from the highway. And so there's the old Idaho way of doing it, and that's you do it, and then apologize, and ask forgiveness ... But I don't know that we can get all of those homeowners to even agree on the plan. So to me, it's so much of this is 'Big Brother's' gonna have to come in and go, 'No, you guys are idiots, this is what we're doing.'

The Sun Valley area has a very well established and formal system of professional rural fire departments due in part to the high net worth of residents, property values that support fire management taxes, and because of its status as an amenity or vacation destination for the wealthy or celebrities. These existing elements of local context help explain the significantly lower effectiveness rating for strengthening the capacity of local fire districts when compared to the other two cases. As one participant described: "But because of the valuation [of properties], it becomes very political, the fight, the suppression happens very quickly. And so the focus is on us, and so we get a lot of resources."

Effectiveness ratings for additional local taxes were highest in Timber Lakes and likely influenced by what professionals and residents described as a longstanding disagreement about the services that local governments should provide to the community in terms of fire response and preparedness. Timber Lakes residents described how the large number of parcels in the sprawling but gated development contributed a large proportion of taxes to the local government. However, some felt that resultant services were not always reinvested proportionally to the benefit of the Timber Lakes community. One participant summarized succinctly in this way: "They [the county] just want our money. They don't want to help us."

The most tangible example of the disparity in wildfire mitigation support from local government, according to Timber Lakes residents, was the development and staffing of the local volunteer fire department. Timber Lakes residents had donated a piece of land to support the building of fire department structures within the community. Area professionals helped community members obtain equipment (e.g., fire engines, tenders, slip-in tanks, etc.) to keep at the location and facilitate timely suppression response. However, there was currently no resident who could legally use that equipment and respond to fire threatening the community because they had not completed the required training to become active volunteer fire department members. Adding to these challenges was the fact that certified firefighters would need to drive the 25+ minutes from nearby Heber City to respond to fires in and around Timber Lakes or to use the equipment in their community. As one participant described:

We could have the most glorious fire engine in there, that is state-of-the-art. You have no way to get that engine out of there. There is no personnel that is going to take that equipment out of there. You

could have a horse and buggy or a grant. We have no plan. The county has no plan or personnel to use the resource.

Timber Lakes residents described all the issues mentioned above as evidence that local government treated them as a "problem child" in the region and that they would not work with residents to address wildfire risk.

For their part, local and regional professionals felt that Timber Lakes was a high-risk area comprised of diverse interests and less unity in their organization. While they acknowledged that the recent strengthening of the Timber Lakes POA may be a positive step in advancing fire protections, they also indicated that residents in the area were somewhat unreasonable—they wanted a level of fire protection that was afforded to more developed areas while still being able to retain the freedoms of a rural development. The outgrowth of these social dynamics help explain not only the effectiveness ratings of Timber Lakes with regards to taxes, but also toward the strengthening of local fire districts and zoning. Timber Lakes residents described being interested in additional taxes for wildfire only if they knew that those taxes would go directly back into their community, and also discussed setting up their own taxable fire district (a form of zoning) in order to take some control of fire management away from the local government that they had less trust in.

5. Discussion

The purpose of this research was to explore patterns of local support and efficacy for commonly advocated wildfire adaptation policies, approaches, or actions across socially diverse communities in the Western U.S. More specifically, we were interested in determining which approaches, programs, or policies key informants in each case study location felt would be effective and contributed to by local people as part of efforts to advance fire management in their communities. Another goal of this research was to better catalog the site-specific influences of social context underlying key informants' ratings for wildfire adaptation actions in each community studied. We utilized the interactional approach outlined by Paveglio et al. [1,27,28] as a theoretical guide to evaluate whether it can help uncover the unique elements of local social context that influence divergent approaches to fire adaptation, and to potentially extend that theoretical approach through additional case study insights.

We found a number of significant differences in effectiveness ratings for specific mitigation approaches across locations, including the requirement of vegetation mitigations on private properties, promoting community-wide fuel breaks, establishing Firewise communities, zoning efforts to restrict new development, and strengthening the capacity of local fire districts. Analysis of our qualitative data also indicates that the site-specific histories, perspectives, and values of community members in each location often combined to help explain observed differences in mean effectiveness ratings for individual adaptation strategies across communities. Collectively, our results support calls to better understand and design diverse strategies for fire adaptation that reflect the social diversity of human communities at risk from wildfire [2–4]. They also extend past outcomes utilizing the interactional approach by employing a consistent methodological approach for validating patterns of social context found in past cases. We expand on each of these points in the following paragraphs.

5.1. Making Sense of Local Adaptation

Our findings both substantiate and extend the growing body of research indicating how wildfire adaptation strategies should be flexible to reflect the great deal of social diversity characterizing communities at risk [16,35,60]. More specifically, our results extend existing efforts by evaluating specific strategies or approaches that are commonly advocated by researchers and policymakers discussing the need to address the "fire problem." Such discussions often take place in the abstract, and imply that broadly conceived wildfire adaptation strategies can be applied or will be well supported by a variety of populations who are often necessary for their success. Results from our work and past efforts suggest that any over-simplified notions about the effectiveness of 'ready-made' wildfire adaptation strategies that are easily adopted without local modification are likely unrealistic [19,24,47].

Participants across every location studied for this research quickly acknowledged in their own words that any adaptation strategy would need to include a better understanding of the local social context that continues to define wildfire conditions. Common factors of local social context mentioned by respondents and which varied across locations reflect existing understandings found in wildfire social science literature, including local community members': (1) values for the landscape; (2) understandings and perceived responsibility for fire management; (3) relationships with other community members; (4) interactions with partner agencies or neighboring populations; and (5) changing demographic patterns, including amenity migration or absentee landowners (see [17,18,58,63]).

Quantitative results of our key informant ratings do suggest significant differences in perceived effectiveness of various strategies for advancing fire adaptation across cases. Those results provide some preliminary indication that the individual components that might compose larger "pathways" for wildfire adaptation may differ across locations featuring different combinations of social context characteristics. They also help substantiate lessons from case study research (see [1,2,26]) by providing quantitative evidence that corroborates past results, namely that members of socially diverse communities may respond or react to wildfire adaptation initiatives in divergent ways. Our efforts advance past work by having key informants evaluate multiple strategies in each location, while results suggest that each individual strategy is the result of various elements of local social context combining to influence individual or collective consideration of approach feasibility.

For instance, results of our quantitative ratings do indicate that regulatory approaches for wildfire mitigation on private properties or through homeowners associations were seen as ineffective—or worse might be actively opposed—by a segment of communities studied for this research. Evaluation of additional approaches in a subset of our larger sample also revealed at least one case where community members and professionals felt that additional taxes and zoning efforts would be ineffective in advancing fire adaptation for their community. Such findings extend results from wildfire social science indicating that there are many rural communities in the U.S.—and likely in other countries—where heavy-handed regulatory approaches are unlikely to succeed or be sustainably supported by local populations (see [12,43,50]). Not only are such strategies seen as an overreach by highly individualistic populations who are distrustful of government, they could further damage the relationships these populations have with agency professionals and local politicians. They also could lead to further conflict over private property rights that have a long history, especially in pockets of the Western U.S.

Beyond local perspectives, the feasibility and plausibility of regulatory strategies for wildfire adaptation may not support their uniform application across cases. The number of specialized personnel, time, and associated monetary resources needed to evaluate, monitor, or enforce such regulations among disperse rural populations is likely infeasible for some local governments. It is likely some local politicians will not support the development of city- or county-level wildfire mitigations policies that heavily restrict the freedoms of individual property owners, especially because those individuals can vote to keep or remove them from office. Finally, it is unlikely there is sufficient stakeholder support across many rural landscapes needed to pass the referendums required to institute those regulations.

In sum, while there are certain places where robust levels of zoning, taxes, or vegetation management restrictions might advance fire adaptation, the effectiveness and sustainability of those efforts may be restricted to places where they fit the local culture and do not need the level of grassroots support that would be required in other locations [25,44,62]. Both our results and existing work suggest that ordinances, policies, or laws enacted in some locations might be largely ceremonial—their integration into local culture could be a long process or are less likely to occur. Such understandings are not well represented in a growing segment of research and policy dialogues stressing the widespread need for wildfire regulations or zoning efforts across portions of the United States (see [45,107]). It implies an important need to consider whether the existing breadth of wildfire programs, incentive structures, and policies reflect the diversity of populations at risk from wildfire and the cultures they

have created in different landscapes. This includes support, adaption, and sustainable enforcement of ordinances, policies, or laws designed to increase wildfire mitigation on private properties.

Many of the wildfire adaptation approaches evaluated by local key informants in this research did display positive rankings across communities. Those results imply that there is some potential to introduce and advance wildfire adaptation through collective strategies at the community level. However, even strategies that did display positive ratings across cases also displayed significant variation in effectiveness ratings across communities. Pairing those outcomes with our qualitative data on social context influences across cases are another indication that different challenges and strategies (i.e., "pathways") might be required to sustain local action. For instance, participants in all cases displayed positive ratings for Firewise, but qualitative results indicate that participants in each case study community ascribed very different benefits and levels of utility for the program. Advancing the utility of Firewise in each of these communities would likely mean different tactics or foci (see [13,46,47] for similar arguments). For instance, establishment of a Firewise community in Bull River could provide a means for more formal interaction with agency representatives accustomed to working with groups or open up additional avenues for access to cost-share grants and other landowner assistance. However, any Firewise organization in Bull River would likely need to be highly informal. In contrast, Sun Valley participants could use Firewise standards as a guide for improved CC&Rs and to build the buy-in necessary to establish outside pressure for enforcement of such regulations among absentee landowners or second homeowners.

The examples given above demonstrate how support or adoption of individual wildfire management strategies are often influenced by a range of local context factors that combine to dictate the trajectory and capacities guiding the form of adaptation in any given community. That is, both our participants and analysis revealed that the perceived effectiveness of any given strategy evaluated often featured a number of salient influences of local social context that interacted to help explain associated quantitative ranking. The exact expression of those factors in each case often intersect with others to provide a more nuanced understanding of whether various approaches will be applicable in a locality, and the specific steps that would be required to make tangible progress on their implementation (see [27] for argument, [20,23] for other examples).

Despite its utility, one primary challenge associated with the interactional approach concerns the number of characteristics that one needs to consider when developing a more holistic narrative of conditions influencing the ways that local populations might adapt differently to fire. It is for those reasons that existing literature synthesizes patterns across disparate cases and provides a continuum of "archetype" communities that might share common expressions, and likely associated adaptation strategies [1,2]. Our next section compares findings from our research with existing findings exploring community archetypes. The goal of that comparison is to determine whether the lessons learned from our new cases support, supplement, or extend existing conceptual patterns of social diversity influencing wildfire adaptation in communities across the Western U.S., and to better understand whether those existing patterns reflect local support for or challenges to specific wildfire adaptation strategies.

5.2. Archetypes of Adaptation Approaches

Comparison of our results with existing research suggests that many of the communities studied for this effort share key patterns of social context with existing archetypes. These comparisons also suggest that study communities share similar patterns of support, past use, or potential adoption of wildfire adaptation strategies commonly ascribed to existing archetypes. For instance, notions of community in Sun Valley were heavily defined by formal subdivision units, HOAs, and a desire for professional wildfire management that was supported—but not necessarily led—by local residents. Ongoing wildfire management was both influenced and modified by a desire to protect property value investments, preserve amenity values, and in response to the relatively small size of formal subdivisions that could not always enact meaningful change for collective mitigation strategies. These

expressions of social context characteristics are very similar to what Paveglio et al. [1,26] outline when describing the "formal subdivision" archetype, though the case also shares key characteristics with the "high amenity-high resource" archetype, including a desire to be near outdoor recreation or natural amenities and be intersected by wildland vegetation.

Quantitative ratings in Sun Valley indicate that they are the case study population who would be most supportive of regulations for fire mitigation on private properties, additional zoning efforts, the establishment of formal programs (i.e., Firewise) related to fire mitigation, and market-based incentives such as insurance premiums tied to wildfire mitigations. These outcomes match well with existing findings from wildfire social science—namely that communities sharing characteristics of the "formal subdivision" archetype are more willing to support professional- or government-led approaches that regulate private property freedoms. They also match findings that populations in the "formal subdivision" archetype are more likely to prefer incentive-based approaches that protect their significant financial property investments, and who have more experience coordinating formal collective action in ways that mesh well with government-based grants or formalized program requirements [26,39,60,108].

In contrast, the Bull River community shares many key characteristics with the "rural lifestyle" archetype. This includes a desire for privacy and informal interactions with neighbors, larger property sizes situated in rural settings near public lands, and high value placed on traditional recreation activities such as hunting and fishing. Bull River and other "rural lifestyle" populations also are more likely to desire personal independence and express less support for formal organizations or rules where they live. Bull River populations described seeing utility in active forest management that benefited the health of the landscape and less desire for establishment of organizations such as Firewise because they felt that most people in the area already had a relatively high level of knowledge about fire risk and what was needed to help reduce it. These same qualities have been observed in other communities sharing "rural lifestyle" characteristics (see [26,50,81,109]). Quantitative ratings of adaptation approaches in Bull River were described as being influenced by the expressions of social context described above and match existing findings in cases with similar circumstances. For instance, populations in Bull River were those most opposed to vegetation requirements on private property and associated HOA restrictions on wildfire mitigation actions. They displayed among the lowest effectiveness ratings for the establishment of Firewise communities, but were those most in support of efforts to increase voluntary mitigations performed by residents on their own properties.

Effectiveness ratings for wildfire adaptation strategies and expressions of social context characteristics often formed continua across the cases studied for this research. For instance, the results of our significance testing often display divergent end points and more moderate cases that do not differ significantly from other locations. Likewise, the strength of many perspectives (e.g., distrust of government programs) or characteristics (e.g., presence and rulemaking authority of local institutions) influencing populations in each case also tend to form a continua or broad spectrum of expressions. These findings support existing perspectives from the interactional approach and community archetypes, which often present the influences and outcomes of social diversity along continua of expressions [1].

For instance, the social context and ratings associated with participants in Timber Lakes closely match many of the expressions that would be expected in what is called the "high amenity, high resource" (HAHR) archetype. That archetype often falls between "formal subdivision" communities and "rural lifestyle" communities with regards to the expression of many social context characteristics and support for approaches to collective wildfire management. HAHR communities are partially defined by their proximity to outdoor recreation opportunities or wildland vegetation that provides privacy from neighbors, but also by more exclusive institutional structures (e.g., HOAs or POAs) that feature some elements of shared management or services. As such, one primary influence on wildfire mitigation action in HAHR communities often revolves around its potential impact on the "natural" character of the community and concerns as to whether vegetation management might

impact associated area aesthetics [2,110,111]. These same dynamics were articulated by participants in our Timber Lakes case. Both Timber Lakes and existing cases of HAHR communities feature a diverse mix of residential types, including a higher proportion of second homeowners or recreational properties alongside higher-end primary residences.

Effectiveness ratings for a number of the wildfire adaptation strategies observed in Timber Lakes often fall between the more extreme views of Bull River and Sun Valley, especially with regards to regulatory or programmatic approaches such as requirement of vegetation mitigations on private properties, regulation through HOAs or POAs, establishment of the Firewise program, and insurance premiums related to mitigation actions. Instances where Timber Lakes ratings break from this pattern of moderation include support for local taxes, strengthening the capacity of local fire districts, and promotion of community-wide fuel breaks. As our results demonstrate, the former two outcomes are associated with place-specific elements of local context—namely the local struggle surrounding the development of volunteer firefighting capacity in Timber Lakes and an interest in ensuring that local tax dollars would be spent within the community rather than distributed across the larger county. Support for community-wide fuel breaks, on the other hand, is more likely in HAHR communities because of their desire to focus on common areas or nearby public lands as a means to reduce the transmission of wildfire risk and the moderate density patterns of residential development.

The La Grande community studied for this research provides an interesting departure from the patterns of social context characteristics and outcomes associated with existing community archetypes. For instance, while La Grande populations did describe a loose sense of community that distinguished their neighborhood from the larger city, and which could facilitate the development of normative standards for wildfire mitigation, they also placed most of the responsibility for fire management in their area on formal agencies or organizations. Stakeholders saw less utility in many of the programs or policies commonly advocated for wildfire response, and felt they were at little risk from wildfire. We would suggest that the lack of correspondence between existing community archetypes and the La Grande case stems from the fact that the latter was originally designed to reflect the wildland-urban interface (WUI), which until recently focused on a range of human development extending from the outskirts of cities to rural populations interspersed within public lands. However, exacerbating trends of wildfire risk are increasingly impacting more developed city settings such as our La Grande case (see [32,107]), and may signal the need for expansion of WUI conceptualizations.

Our results suggest that one primary challenge surrounding city populations such as the La Grande case may be a relatively low level of concern or awareness surrounding potential wildfire risk, and a perception that wildfire management initiatives are not something that they have the responsibility to address. While such populations may be willing to acquiesce more to authorities in terms of regulations, codes, or standards, they also will require additional time and resources to enforce. The small size of residential lots in and near city settings may require a stricter focus on home or structure hardening for fire given that they may not contain wildland vegetation or be large enough for HIZ mitigations. In any case, our results and the increasing trend of wildfire risk to human populations on city fringes necessitate further exploration of social context across such cases, and consideration of whether results can help articulate additional archetypes guiding tailored responses.

Regardless of their specific social context, our intent here is not to say that any community studied in this research is "better" adapted to wildfire than others. It is important to note, however, that the ongoing evolution of community in each case has led to different opportunities and challenges for pursuing fire management strategies. Continued efforts to increase fire adaptation among these populations would be more effective if they responded to those divergent local social contexts by considering a range of adaptation strategies rather than trying to uniformly apply existing strategies or gauge success by monitoring a fixed range of outcomes across communities.

5.3. Future Directions and Limitations

Lessons from our efforts illuminate a number of considerations relating to research or practice surrounding the future of human wildfire adaptation. To begin, the complexity of social context considerations uncovered in this research, and their influence on variable ratings for wildfire adaptation efforts, all indicate that one important investment for advancing fire management includes more systematic data collection efforts and processes intended to advance community-specific wildfire adaptation planning. Making progress toward these goals will require a more proportional allocation of time and resources toward the design and collection of social science data that informs trade-offs associated with individual or paired fire adaptation strategies across landscapes. While the amount of social science research surrounding wildfire has increased during the past decade or two, the amount of time, personnel, funding, and expertise that has gone into developing large-scale data sets or consistent theories that can account for the variable influence of human populations on wildfire management likely pales in comparison to biophysical or simulation modelling efforts on the same topic.

Our efforts in this manuscript attempted to advance interim steps required for developing more systematic processes of data collection surrounding social diversity and wildfire adaptation. More specifically, we piloted a mixed-method approach that allowed for collection of both quantitative data *indicating* the perceived effectiveness for various strategies among communities and qualitative data that helps to *explain* the influences on those evaluations. While both forms of data collection are important, our results indicate that the latter, more inductive approach provides a clear avenue for promoting understanding and action across communities. To begin, inductive approaches such as the interactive approach seek to provide managers, community members, and policy members with rich descriptions of context characteristics and common patterns (i.e., archetypes) that allow them to more quickly recognize or articulate the conditions that most influence their continued efforts toward wildfire adaptation. They are focused on the empowerment of local people and actors in designing site-specific adaptations in places that matter to them.

Comparison of our results with existing typologies (i.e., the archetypes) suggest that the latter can help provide the logic that can facilitate more inductive, deliberative processes designed to produce site-specific adaptation strategies. Other segments of our results also provide some preliminary evidence that researchers and managers can link local social context conditions with "best practices" that articulate the types of programs, incentives, and strategies most likely to advance wildfire adaptation among diverse populations. Our efforts in this research took a next step in the latter process by linking social context and locals' willingness to adopt commonly advocated wildfire adaptation practices. It provides initial evidence for differential recommendations to communities about the strategies most likely to help them advance fire management given their specific context. Future advancement of inductive processes to support wildfire adaptation could include the development of consistent protocols and aggregation of subsequent data collected by local people in order to build more comprehensive data repositories. Such an approach might provide an alternative to formal, researcher-led data collection across the many communities and regions attempting to "live with fire," though systematic evaluation that compares each data collection option would be needed to better explore their trade-offs.

The quantitative data collected for this effort provide a very different, but important utility related to ongoing efforts for improving human adaptation to wildfire. Those benefits relate primarily to the advancement or verification of theory and science surrounding human patterns of adaptation. However, those quantitative lessons will be largely descriptive, and thus less helpful in designing specific management approaches without also considering the narrative of social context characteristics that help articulate what action is possible in each community.

Our quantitative efforts in this research focused on only a small segment of the many interlinked programs, policies, and mitigation actions that have been proposed to advance wildfire adaptation. As such, a logical next step for future research would entail the evaluation of additional approaches or strategies in other communities using methods similar to those described here. Potential options for

those additional comparisons could be adapted from existing FAC literature, including management strategies employed prior to, during, and following wildfires (e.g., evacuation planning, leadership of collaborative risk reduction initiatives, support or opposition to active forest management, etc.) (see [2,3,37] for summaries of such literature). Other avenues for extending the research advanced here could include an explicit focus on the co-variance or multicollinearity associated with ratings for fire adaptation strategies across diverse communities. Focus on either of the above strategies in additional research would require expanded data analysis methods (e.g., analysis of co-variance) or quantitative coding of local social context characteristics (binary presence or absence, for example) across a larger sample of communities. The latter strategy would open up preliminary opportunities for regression analysis of relationships between local social context characteristics and the perceived effectiveness of different wildfire mitigation strategies. Finally, future efforts to explore quantitative ratings of potential adaptation strategies could explore the representativeness or accuracy of key informant ratings as proxies for broader community populations by concurrently employing multiple methods. For instance, researchers could pair focus group ratings completed by a diverse subset of participants and results from a survey administered to a random probability sample of community participants. The advantage of exploring multiple methods concerns evaluating the relative utility and limitations such methods provide in generalizing results across the population.

Additional research employing the tactics described above could begin to scale results up and help confirm whether there are significantly different combinations of adaptation approaches that might constitute "pathways" for communities at various points of the archetype continuum. Finally, future studies of specific program, policy, or approach utility in a smaller set of communities could begin to disentangle our multifaceted operationalization of "effectiveness" as something that will both help reduce wildfire risk in a community and be supported by its local people. That is, future studies could have participants evaluate each of these components separately. While we acknowledge that the two concepts implicated in our quantitative assessment are very different, the intent in this research was to evaluate adaptation in a more holistic way that recognizes how it is contingent on the willingness of populations who are intended to embody it. Future efforts to distinguish between efficacy of a program and its actual adoption by local people may yield interesting insights about the persuasive arguments or program changes that might increase their utility in the future.

6. Conclusions

One enduring challenge associated with wildfire management concerns the diversity of populations who continue to influence or be impacted by fire events. While there has been a growing recognition that the organization and advancement of wildfire management is in fact influenced heavily by the values and perspectives of broader society, there has been less success in characterizing the variable ways that mangers and policymakers should engage diverse populations to best advance progress toward FACs. Our research provides a set of methodological practices and empirical verifications that constitute a next step in systematically tailoring wildfire adaptation at the community level across diverse populations. We purposefully engaged a mixed-method approach to confirm that unique combinations of social diversity operating across communities can lead to significantly different support and potential action surrounding commonly advocated fire adaptation strategies. Perhaps more importantly, we demonstrated how a more inductive and narratively driven understanding of populations and places helps understand the ways that professionals might empower local people to help take more responsibility for wildfire management. Key to those efforts are acknowledging and engaging the range of emergent communities that help create a dynamic patchwork of human populations across the Western U.S.

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