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social sciences

Categorizing the Social Context of the Wildland Urban Interface: Adaptive Capacity for Wildfire and Community "Archetypes"

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Understanding the local context that shapes collective response to wildfire risk continues to be a challenge for scientists and policymakers. This study utilizes and expands on a conceptual approach for understanding adaptive capacity to wildfire in a comparison of 18 past case studies. The intent is to determine whether comparison of local social context and community characteristics across cases can identify community "archetypes" that approach wildfire planning and mitigation in consistently different ways. Identification of community archetypes serves as a potential strategy for collaborating with diverse populations at risk from wildfire and designing tailored messages related to wildfire risk mitigation. Our analysis uncovered four consistent community archetypes that differ in terms of the local social context and community characteristics that continue to influence response to wildfire risk. Differences among community archetypes include local communication networks, reasons for place attachment or community identity, distrust of government, and actions undertaken to address issues of forest health and esthetics. Results indicate that the methodological approach advanced in this study can be used to draw more consistent lessons across case studies and provide the means to test different communication strategies among archetypes.

Keywords: wildland fire, adaptive capacity, wildland urban interface, social diversity, hazards

Recent social science research related to wildfire management has revolved primarily around understanding how private citizens can take more personal responsibility for actions or planning that could reduce damage caused by wildfires. Researchers have sought to understand what motivates or facilitates collective and individual action in response to the risk of wildfire and how to increase that capacity (McCaffrey et al. 2013, Toman et al. 2013). This research focus reflects the understanding that increased wildfire risk is driven in part by expanding residential development into fire-prone areas. That research focus also attempts to alleviate the financial burden that public land management agencies bear for the protection of private property and values (Thompson et al. 2011, Westerling et al. 2011).

A significant portion of wildfire social science work has focused on populations in the wildland urban interface (WUI), the area where homes intermingle with wildland vegetation and a significant policy target for exposure to wildfire risks (USDA and USDI 2001, Stewart et al. 2009). Yet, the WUI is not geographically continuous and contains diverse sets of human populations. This diversity presents a challenge to wildfire policy as communities with different motivations and constraints for wildfire risk reduction may respond differently to various policy strategies (McCaffrey et al. 2013, Fischer et al. 2014). For instance, existing research has documented how communities differ in the way they interact with or use their local landscape and how they organize themselves in response to fire risk (Carroll et al. 2004, Collins 2009, Steelman and McCaffrey 2011, Fischer et al. 2012).

Existing social science research on wildfire has uncovered many factors that influence peoples' ability to plan for and respond to wildfire, including perceived risk, willingness to collaborate, sense of place, the presence of community initiatives, previous experience, financial capacity, willingness to work together, knowledge of local wildfire regimes, and many others (Kyle et al. 2010, Olsen and Shindler 2010, Holmes et al. 2013, Jakes and Sturtevant 2013). Much of this research has focused on one or a few variables that may affect individual or collective actions. Fewer research efforts have attempted to understand how various social influences, local history and culture, or regional setting collectively form the social context

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that influences planning or local wildfire response across cases (Luloff et al. 2007, Gordon et al. 2013). Even fewer attempt to explain how differences in the local expression of that social context give rise to differential response across those cases (Jakes et al. 2007, Jakes and Langer 2012). In short, past research has been hampered by the lack of systematic accounting for the social complexity of populations at risk from wildfire (Paveglio et al. 2009, Gordon et al. 2012, Prior and Eriksen 2013).

We contend that sorting the diversity of WUI communities into categories of similar social context is an important intermediate step toward understanding different pathways for fostering fire-adapted communities (FACs), a significant and emerging policy target in wildfire management (FACC 2013, WFEC 2013). FACs are communities of place that can collectively plan for, mitigate or recover from, and adapt to changing wildfire events without losing function or sustaining significant loss of life and property (Jakes and Langer 2012, WFEC 2013, FACC 2013). While developing FACs is a relatively new goal for fire policy, it builds on and needs to acknowledge lessons from existing wildfire research concerning community response to fire risk.

Existing research focusing on the relationship between social context and community wildfire response is generally case study based. A common critique of such work is that the results may not provide generalized lessons for scholars and practitioners (McFarlane et al. 2011, McCaffrey et al. 2013). The research presented here responds to this critique by synthesizing findings from 18 case studies of community wildfire risk, recovery, or planning across the US West. The work was guided by the following research questions: (1) Are there patterns of influences on wildfire risk management that can be identified across case studies? and (2) does the evidence suggest that communities exhibiting similar patterns constitute distinct "archetypes" that approach wildfire risk differently from others?

This research uses and expands Paveglio et al.'s (2009a, 2010b, 2012) conceptual framework for identifying the characteristics of social context that influence peoples' capacity and willingness to plan for, respond to, and recover from wildfire. That framework, called the interactional approach to adaptive capacity, recognizes the social diversity of communities at risk from wildfire across the US West. More specifically, we use the interactional approach to adaptive capacity to organize and compare social context uncovered across the 18 cases studies analyzed for this research effort.

There are multiple benefits to the systematic documentation of how local context influences capacity to deal with the risk and reality of wildfire, including: (1) a means to better understand a comprehensive set of influences that predicate mitigations to wildfire risk; (2) an explanation for the often contradictory or variable findings that characterize the wildfire social science literature; (3) a way to document what existing resources and understandings diverse communities bring to bear on the wildfire problem; (4) more rapid assessment of the resources, understandings, or capacities that could be fostered to overcome barriers to local wildfire mitigation or promote collective action and; (5) a means to begin tailoring outreach or communication efforts in a way that resonates with diverse local populations.

Literature

"Living with Fire" and the Two Traditions of Wildfire Social Science

The Fire Adapted Communities Coalition (FACC) stresses local responsibility for becoming a FAC through actions such as developing a community wildfire protection plan, enhancing suppression capacity, establishing local building codes, and treating and maintaining hazardous fuels (FACC 2013). Yet emerging guidance on FACs and other wildfire planning policy programs such as Community Wildfire Protection Plans and Firewise efforts also have increasingly stressed flexibility in their implementation to account for the diversity of social context influencing populations in the WUI (Jakes et al. 2011, Williams et al. 2012, Davis et al. 2013).

Better characterizing the social context that can influence wildfire preparation or response needs to draw lessons from the large body of existing wildfire social science. There has been considerable research on private citizens' mitigation efforts and planning for wildfire risk, the outcomes of those efforts during wildfire events, and their recovery from any damages. These studies have yielded great insight during the past few decades (McCaffrey and Olsen 2012, Toman et al. 2013). Yet closer examination reveals a bifurcation in the approaches and findings of these studies. One set is driven primarily by the "social-psychological" tradition that emphasizes individual action, cognition, and decisionmaking. The social-psychological tradition has sought to predict the drivers and influences of mitigation action. A second line has been driven by traditions from rural and natural resource sociology. The "process" tradition often emphasizes how action is rooted in ongoing place-based understandings and interactions among people with their landscape.

Literature from the social-psychological tradition has identified many factors that influence protective behavior from wildfire. Examples include: (1) previous wildfire experience; (2) primary versus secondary home ownership; (3) formal versus informal outreach programs; (4) personal efficacy; (5) community identity; (6) demographics; and (7) income (Absher et al. 2009, Ojerio et al. 2011, Ascher et al. 2013, Brenkert-Smith et al. 2013). However, results from different studies have indicated substantial variability in the relative importance or impact of these and other factors across specific populations (Sturtevant and Jakes 2008, McGee et al. 2009, McFarlane et al. 2011, Champ et al. 2013).

The social-psychological tradition is predominantly quantitative and survey based. It focuses on drawing generalizable conclusions about individual perceptions and/or demographic patterns at larger scales (Martin et al. 2009, Holmes et al. 2013). Outputs from the social-psychological tradition often are used as static benchmarks or indicators in larger target-based assessments (e.g., quantification of mitigation behaviors) of progress toward fire-adaptation (see, for example, Johnson Gaither et al. 2011, Collins 2012, Champ et al. 2013). Yet, to date, there have been few efforts to determine whether such indicator approaches predict later individual or collective action toward wildfire protection (Ojerio et al. 2011).

Literature from the process tradition also has yielded insight into the ways that local residents become aware of, plan for, or adapt to wildfire risk and damages. These studies frequently employ case study, participatory, or content analysis methods. They focus on the ways that knowledge or planning about wildfire has emerged in a given locality and describe the interactions or collaborations that led to those outcomes (Sturtevant and Jakes 2008, Brenkert-Smith 2011, Champ et al. 2012). This includes the relationships among people and organizations and between people and landscapes, both of which influence individuals' perceptions of their own well-being and capacity to act (Fischer et al. 2013). These constantly evolving social processes give rise to a community's capacity for realizing goals and acting collectively (Beckley et al. 2002).

Research in the process tradition often recognizes many of the same influences found in the social-psychological tradition above but provides more depth about how those characteristics developed through local interaction. For instance, some process-based approaches have focused on: (1) the influence of individuals on one another; (2) the way awareness of, or motivations for, action proliferate through community ties; (3) the ways that residents respond to different outreach efforts or planning efforts; and (4) how place attachment or historical relationships with the landscape influence wildfire mitigation (Eriksen and Gill 2010, Paveglio et al. 2010a, Brenkert-Smith 2011, Carroll et al. 2011, Jakes and Langer 2012). Research from the process tradition often focuses at the community scale to both facilitate in-depth analysis and in recognition of the scales that collective initiatives among rural or WUI residents often emerge (Davis et al. 2011, Gordon et al. 2012). It explicitly focuses on describing the reasons behind local contextual diversity and helps to explain contradictory findings in results from the social-psychological tradition (see above).

The process tradition often fails to produce results immediately generalizable beyond a particular setting because researchers' methods focus on characteristics that can only be uncovered with time- and resource-intensive case studies, content analysis, or focus groups. Results from process-based research generate hypotheses or indicators that are not easily translated to larger sample studies, focusing instead on rich description of social relationships. Finally, studies from the process-based tradition often rely more heavily on the interpretation of researchers with specialized knowledge of the topic and, thus, are not as easy to replicate (see, for example, Carroll and Cohn 2007, Jakes et al. 2007, Monroe et al. 2013).

One recent attempt to better understand social diversity in the WUI and its effect on wildfire mitigations is the Community Cluster and Resiliency Appendix to the Cohesive Wildlland Fire Management Strategy. That process uses secondary data analysis to identify "community clusters" at the county level that are likely to need different strategies for achieving FACs (WFEC 2013). Identification of community clusters in the cohesive strategy is a good start, but it also suffers from a number of pitfalls, including: (1) the analysis uses only static demographic indicators drawn from secondary data sources such as the US Census; (2) provides broad recommendations that are unlikely to hold true for populations across entire counties; and (3) contains little input from local stakeholders that might provide more detailed information about local perceptions, history, and culture, all of which have been demonstrated to potentially influence wildfire planning and mitigation in diverse locations (Paveglio et al. 2011, Brenkert-Smith et al. 2012, Frazier et al. 2013). Perhaps more importantly, the Community Cluster and Resilience Appendix does not fully capture how local peoples' ongoing interaction in a given place strongly influences how they approach wildfire risk or broader ecosystem management (Bihari and Ryan 2012, Champ et al. 2012).

Distinctions among the wildfire social science traditions described above obviously are not absolute (See Prior and Eriksen 2013, for example). Yet, it is still rare to see mixed-method study approaches that truly bridge more fundamental divides of qualitative versus quantitative and individual versus collective action approaches. Our work here begins from the process tradition of wildfire social science and provides the means to bridge divides between the traditions by drawing larger conclusions from site-specific observations and focusing on collective action. Likewise, the framework we are using recognizes characteristics of local context identified by both the process and social-psychological traditions of wildfire social science.

The Changing Character of Western WUI Communities

Amenity migration is one significant force behind the expansion of the WUI and the increase in social diversity among populations at risk from wildfire. It drives continued low-density development and subdivision establishment in areas where there is high risk from wildfire (Hammer et al. 2009, Yin 2010). Debates over how best to manage nearby forests, often divided by varying perspectives about resource use and conservation, are also are influenced by the clash of perspectives—and cultures—that characterize the intersection of amenity migrants and longer-term residents (Gordon et al. 2010).

There is a large body of research documenting demographic and cultural change in western communities during the past few decades. Although populations in rural areas of the US West have been increasing rapidly, a significant portion of this increase is due to in-migration of residents from other regions of the country or urban areas (McGranahan et al. 2010). Concurrently, other studies have highlighted how existing or longer-term residents of western communities are moving away from the places in which they previously lived (Travis 2007).

The coincident trends of demographic change and amenity migration are complex and not uniform across the landscape. Amenity migrants are often drawn to particularly scenic or resource-rich places and those with cultural and recreational resources. That uneven development continues to increase the local social diversity of rural and WUI communities through the diversification of perspectives, uses of, and values for the landscape (Gosnell and Abrams 2011, Abrams et al. 2012). For instance, differences among rural and urban populations regarding community organizing (informal versus formal), interpersonal relationships (weak ties versus community organizational contacts), perspectives about environmental resource management (e.g., sustainable utilitarian versus strict conservationist), and views on property rights (e.g., rugged individualism versus local government regulations) have long been a prominent theme in natural resource, environmental, and rural sociology. These divisions in perspectives among longer-term residents and amenity migrants are best characterized as gradients or continua (Smith and Krannich 2000, Krannich et al. 2011).

Perhaps the best known characterization of demographic diversity and change across western landscapes is the continuum used to describe "Old West" and "New West" communities (Krannich et al. 2011). Old West communities are characterized by economies based on traditional resource extraction and local services. The conversion of local economies from resource extraction (e.g., mining, forestry, oil and gas) to greater dependence on service-based industries such as tourism, outdoor or public land recreation, and cultural amenities has changed the composition of some rural western communities into New West communities (Winkler et al. 2007, Irwin et al. 2010). Shifting to the New West can also include the addition of higher income amenity migrants that bring with them higher expectations of community services. They may also have different perspectives about how the landscape should be managed or conserved and often feel they are better suited than existing residents to support sustainable landscape management through funding resources, community programs, and conservation practices. Many Old West residents might not agree that amenity migrants are better suited to support sustainable landscape management. In addition to amenity

migration, recent booms in oil extraction, wind farms, and mining have the capacity to bring in new migrants from various backgrounds of the Old West or New West and sustain rural jobs (Travis 2007, Abrams et al. 2012).

The Interactional Approach to Adaptive Capacity

The need to tailor policies, programs and communication strategies to the unique characteristics of people and places is well recognized (Linder 1989, Schnider and Ingram 1990, Howlett 2011). Communication and policy scholars discuss "segmenting"—or better understanding the perceptions, abilities, or barriers to actions among at-risk portions of the public—before designing risk communication messages attempting to foster personal mitigations or prohealth behaviors (Featherstone et al. 2009, Howlett 2011). Segmentation and tailored communication allows professionals to engage stakeholders in a way that reflects potential impacts to things or people they value and their existing conceptions of the risk in question (Fischer et al. 2012).

Extension professionals or consultants often work with stakeholders to collectively define the risk in question, identify information or planning needs, and develop plans to address local shortcomings. They frequently acknowledge the need to first understand and document the dynamics of local culture to promote collective action about wildfire or other hazards (Monroe et al. 2013, Steelman and McCaffrey 2013). Yet, wildfire research has largely failed to figure out how to segment diverse populations at risk except by using methods that are resource intensive, such as qualitative case studies (Carroll et al. 2004, Fischer et al. 2012).

Paveglio et al. (2009) introduced a conceptual framework for understanding the impact of local context on motivations for wildfire management or mitigation by building on existing literature. That conceptual framework included insights from existing wildfire research and understandings about the rural-urban continuum or the New West–Old West distinction (Kemmis 1990, Lee 1991, Wilkinson 1991, Jakes et al. 2007) to discuss how four broad conceptual categories of local social context could variably influence the concept of adaptive capacity. Paveglio et al.'s (2009) concept of adaptive capacity built on definitions from climate change and hazard literatures (Nelson et al. 2007, Ford et al. 2010) and the four conceptual categories of their framework included: (1) residents' knowledge of the local ecosystem and experience with wildfire (place-based knowledge); (2) access and ability to adapt scientific/technical information to a local context; (3) demographic (e.g., median income, age, and ethnicity) and structural characteristics (e.g., road infrastructure, building materials, and access to resources); and (4) interactions and relationships within the community that support (or fail to support) collective action.

Adaptive capacity is defined as the combination of local social characteristics and external forces (including ecological processes or larger social forces) that influence whether and how human communities take action to reduce their exposure or modify the severity of disturbance events (Jakes and Langer 2012, Paveglio et al. 2012). It places emphasis on the need for local will, resources, and collaborations to perform local collective or individual action. Populations with higher adaptive capacity will be more likely to perceive change or risk, evaluate potential impacts or opportunities, decide how to adapt their functioning, and implement processes that minimize adverse outcomes. In that respect, adaptive capacity encompasses both latent ability to adapt when necessary and the skills developed from existing adaptations (Wall and Marzall 2006, Longstaff et al. 2010). Adaptive capacity fits well the goals for a FAC in that both focus on how locals can plan for or respond to changing risks and the way ongoing interactions among locals drive that process.

Paveglio et al.'s (2009, 2012) approach draws its theoretical base from the interactional approach to community (hereafter referred to as the interactional approach), which focuses on the way local characteristics of social context, tied to a specific locality and defined by peoples' relationships to the landscape and its biophysical properties, help shape individual or collective action among residents (Wilkinson 1991). The interactional approach recognizes how the everyday and extraordinary interactions among people and their landscape continually influence behavior. It begins from the premise that each community may be unique in the particular interactions that will influence action and dictates that researchers first characterize the local characteristics that define collective life in a locality imbued with meaning by its residents. However, the interactional approach also acknowledges that some communities are more similar in terms of those interactions than others and that communities can be roughly grouped into categories. It necessitates a focus on how people communicate and relate to one another to modify or uphold local culture (Luloff and Krannich 2002, Theodori and Kyle 2013).

Paveglio et al. (2010a, 2012) used the framework, referred to as the interactional approach to adaptive capacity, to explain alternatives to evacuation during wildfire (2010a) and differences in wildfire planning or mitigations among communities in the same region (2012). They demonstrated how adaptive capacity for wildfire is not dictated by any one element of their framework. Rather, it "emerges" from the interaction between locals and with their local environment, which shape people and the locality they live in or care about.

The most recent version of the interactive approach to adaptive capacity (Paveglio et al. 2012) focuses on the need to systematically document local characteristics that are likely to dictate local adaptive capacity and how they vary among unique localities. The intent is to provide a method for generalizing lessons about the influence of social context, including local relationships with landscape processes, across the social diversity of the WUI. Paveglio et al. (2012) provided a preliminary set and description for 20 local characteristics likely to influence adaptive capacity for wildfire. Not all of these characteristics will operate in every location, and the interaction between them will influence varying approaches to fire management, so the first step in understanding wildfire response is to better understand which characteristics of social context are at play in a given community. Their descriptions reflect and extend existing wildfire social science foci from both the social-psychological and process traditions.

Building on that approach, we seek to determine whether systematically documenting local context across multiple cases can draw more consistent lessons about the various paths that human populations might pursue to become FACs. Specifically, we seek to understand whether patterns of interactions, perceptions, histories, and relationships among people in their locality, as observed across existing case studies, can help better identify archetypes of communities that help explain commonalities within that diversity. It also allows us to explore whether and how amenity migration or development patterns in the western United States differ across cases and then affect adaptation at the local level. This work advances efforts to "segment" communities for the unique development of messages

Table 1. Adaptive capacity characteristics (modified from Paveglio et al. [2012]).

Conceptual category of adaptive capacity framework	Adaptive capacity characteristic	Subthemes or examples
Access to and ability to adapt scientific or technical knowledge	Community organizations	Local homeowners associations; land preservation or conservation groups; community-based development organizations, resource conservation districts, citizens' groups
	Land use, building, or fuels reduction standards	County requirements for Firewise landscaping on new properties, homeowners association codes and covenants for fire-resistant building materials
	Community fire organizations	Firewise community groups; FireSafe Councils; subcommittees of community organizations dedicated to fire preparedness
	Diversity of people/skills in a locality	Residents have previous experience with: logging, grant writing, management, law enforcement or firefighting experience
	Locals understanding of fire suppression responsibilities and limitations	Personal responsibility for fire protections versus expectations of firefighting service
Place-based knowledge and wildfire experience	Perception and action related to forest health/aesthetics	Forest health as a motivation for vegetation management versus privacy or conservation as barrier to forest treatments
	Local peoples' experience with wildfire	The frequency of and impacts previous fire events have had on community members
	Place and community attachment	Strong bonds with physical landscape; strong bonds to community, relationships in place
	Local independence or distrust of government	Opposition to standards and codes; ability to manage vegetation and/or fire risk without outside help; distrust of government officials
	Local awareness of wildfire risk	Understanding of area fire regimes, fire risk
	Local ability to reduce wildfire risk	Capability to perform fuel reduction, modifications to structures or infrastructure to reduce wildfire risk
Demographic and structural characteristics	Development patterns/landscape fragmentation	Size of average parcels, continuity of fuels across management or property types; housing patterns; average housing price
	Local wood products industry capacity	Local and regional demand for logs or biomass; price paid for logs or biomass; local employment in forest products industry; trends in number of contractors or workforce over time
	Proximity and capacity of mill facilities	Hauling distance of material from fuel reduction sites; presence of local mills
	Willingness/ability to pay for fire mitigation actions	Perceived cost effectiveness of mitigations; available capital (income)
	Amenity migration	Number of residents moving to area based on natural or cultural amenities; conversion of economies due to in-migration/tourism
	Number of second/seasonal homeowners and turnover rate	Average residency time; proportion of residents that do not live in the area full-time; number of second homes
Interactions and relationships within the community	Community identity/collective action	Common hardships; shared values or norms; experience mobilizing collective resources; willingness to mobilize collective resources
	Communication networks (e.g., formal and informal)	Sharing of information among locals (e.g., formal and informal); sharing of information among agencies and/or locals
	Presence of local champions	Firewise leaders; active local fire chiefs; agency outreach specialists; community-based organization leaders, knowledgeable longtime residents; county supervisors/commissioners
	Risk reduction initiatives among agencies and locals	Community Wildfire Protection Plans (CWPPs); community fuel breaks; codes and standards for fire mitigations
	Local firefighting capacity supported by community volunteerism	Resources, training and number of firefighters; community support or participation in firefighting

or outreach strategies that resonate to specific local needs or circumstances.

Methods

This study synthesizes data from 18 existing community wildfire case studies and reanalyzes data using an expanded methodology to derive broader lessons about the influence of local social context across cases. The various authors of this paper served on the research teams for the studies analyzed here. These case studies all used in-depth interviews with key informants, although some of them involved additional data collection methods such as document analysis and focus groups. Authors had access to primary data from all cases studied. Cases used in the analysis cover an approximate time period of 15 years, represent seven different western states and include communities at various stages of WUI urbanization. The geographical scale of cases selected for study were focused at levels smaller than the county scale to provide the in-depth knowledge of local characteristics described by Paveglio et al. (2009, 2010a, 2012).

The authors first engaged Paveglio et al.'s (2009, 2012) conceptual approach and collectively agreed on the local characteristics previously identified as influencing adaptive capacity. Hereafter, we refer to these local characteristics as adaptive capacity characteristics. Collectively agreeing on adaptive capacity characteristics entailed a process of: (1) iteratively developing descriptions for each characteristic through discussion and written definitions; (2) documenting how each characteristic could be operationalized; and (3) determining how that characteristic fit the broad conceptual categories of the framework. During the process of collective agreement, we created two new adaptive capacity characteristics by decomposing two of Paveglio et al.'s (2012) categories. The final set of 22 adaptive capacity characteristics used in this study is outlined in Table 1.

Once there was collective agreement on common meanings for the adaptive capacity characteristics in the approach (achieved in the three steps above), researchers who had performed each individual case study included in the review revisited their data, documents, or contacts from the communities studied. Researchers drew on data collected and analyzed for the case studies, including interview

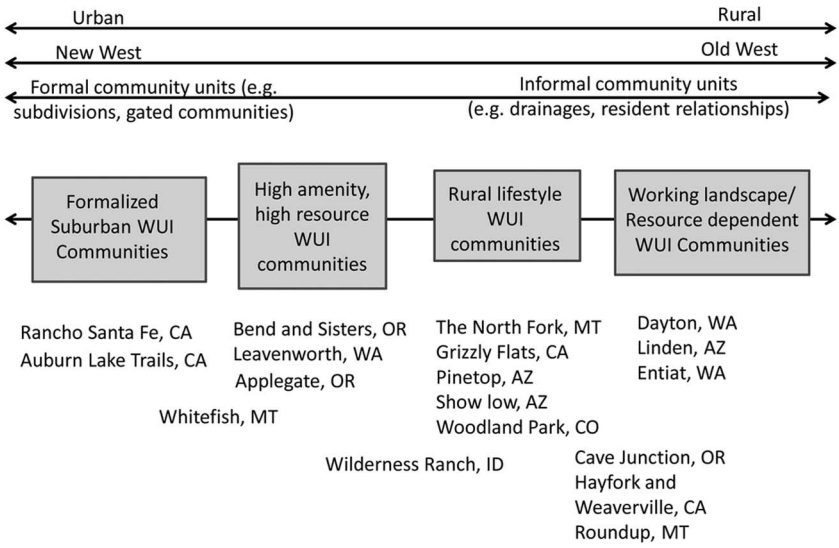

Figure 1. WUI archetypes across study areas and broader themes.

transcripts, field notes, and secondary socio-demographic data to provide case-specific descriptions for each of the 22 characteristics adapted from Paveglio et al. (2012). These insights were organized in a single matrix that contained descriptions of each category for each of the cases. Descriptions relevant to each characteristic of the study area were typed into the cells of the matrix. Fields were also included for information on outcomes of initiatives or mitigations undertaken by residents and professionals in their case areas.

Researchers then met multiple times to discuss the initial comparison of cases using the matrix and characterization of any "themes" or similarities in community context illuminated by the comparison. Similarities in community context were gauged by the expression of individual characteristics in the area or approach taken by disparate communities to adapt to wildfire risk. Barriers to adaptation also were grounds for consideration of community groupings. Analysis and comparison of cases followed a process of progressive falsification (similar to the constant comparison method) and thematic analysis (Boyatzis 1998, Charmaz 2000, Lindlof and Taylor 2010). During the process of progressive falsification, researchers iteratively considered community archetypes, represented by similarities in local context or approach to wildfire adaptation and determined whether additional cases were explained by those archetypes. An archetype was acceptable if it helped explain multiple cases and was appreciably different than other archetypes established by earlier comparisons. The absence of adaptive capacity characteristics among archetypes also were considered as themes, following methodological insights from qualitative content analysis (Titscher et al. 2002). Initial archetypes were selected by authors during the course of the meetings described above additional details for specific characteristics in the interactional approach to adaptive capacity were sought from study contributors. The senior author worked with contributors to clarify any confusion over the meaning of, additional detail about, or expression for individual characteristics.

A final step involved analysis of the matrix. More specifically, researchers sought to identify which characteristics, if any, adapted from Paveglio et al. (2012) most define and distinguish community archetypes from one another. A defining or distinguishing characteristic was one that had internal consistency across cases within the archetype and differed in its expression or consistency when compared to other archetypes. Two authors coded every adaptive characteristic for each individual case to ensure intercoder reliability. Coding entailed the following: (1) comparing the individual case study expression of a given adaptive capacity characteristic against every other case study expression of that characteristic in the same archetype; (2) coding similar expressions of that characteristic within or across archetypes using the same color and coding different levels of the same expression using a simple weighting (e.g., 3 being highest expression, 1 being lowest); and (3) comparing each individual case study expression of a given adaptive capacity characteristic against every other case study in the matrix. This systematic review of cases is similar to thematic or qualitative content analysis in that continued review and comparison of cases, at different levels of aggregation, allows for identification of common themes and appreciable differences in characteristic expression (Titscher et al. 2002). Such a method was necessary as quantitative data is not available for or could be accurately represented for many of the characteristics described by Paveglio et al. (2009, 2012).

Results

Communities studied for this effort were grouped into four archetypes by the authors using the methods described above. We named these archetypes in ways that reflect primary elements of their local social context, as such: (1) formalized suburban communities; (2) high amenity, high resource communities; (3) rural lifestyle communities; and (4) working landscape/resource dependent communities (Figure 1). Certain communities (those between bulleted lists) are best described as "hybrids" because they share various characteristics of two archetypes. This fits with a larger finding of our comparisons across case studies—that WUI communities fall along a continuum that is best characterized by various characteristics representing their specific local context. These broad continua are a good starting point for thinking about the differences between archetypes because they build off existing conceptualization of community diversity such as the rural-urban and the New West–Old West continua described above. The rural-urban and New West–Old West continua also are embedded in the interactional approach to adaptive capacity that guided our analysis. As such, we have organized this section using subcategories that describe differences

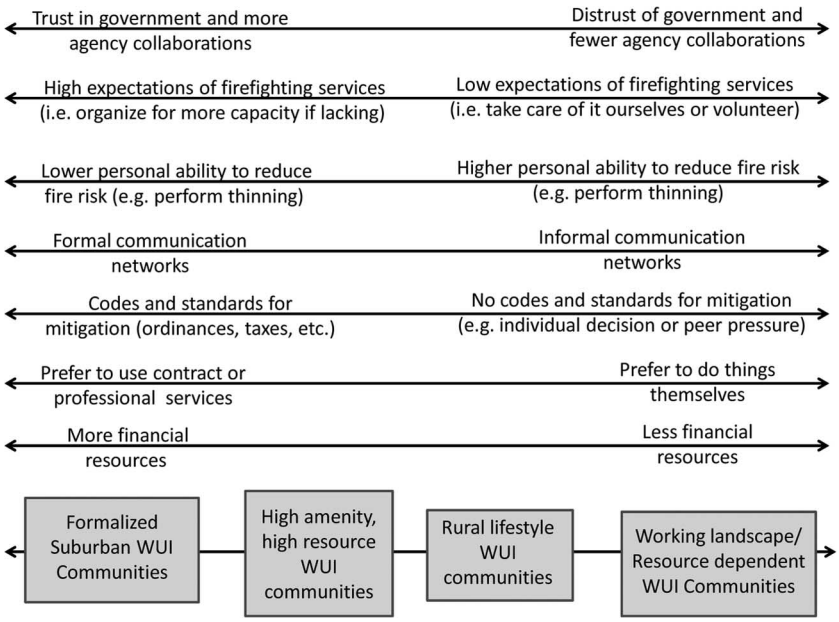

Figure 2. Continuums characterizing differences in adaptive capacity characteristics among WUI archetypes.

among the four WUI archetypes along continua and at various levels of aggregation. More specifically, we will progress from discussing broad patterns of difference among archetypes to more nuanced differences among individual characteristics in the modified version of Paveglio et al.'s (2009, 2012) approach.

Broad Continua Distinguishing WUI Archetypes

The archetypes listed above are characterized by a number of continua describing their local context. At the broadest level, the archetypes presented above represent a progression along existing concepts: from urban to rural, from New West to Old West, and from highly demarcated subdivisions and preplanned communities to low density development along drainages, valleys, or mountainsides. For instance, rural lifestyle communities contained a diverse mix of residents. This included amenity migrants living in more rural areas, seeking solitude or commuting to jobs in nearby cities; some long-term or intergenerational residents, including farmers and ranchers; and some residents' whose livelihoods are tied to resource-extraction-based economies such as forestry and mining. Development patterns in rural lifestyle communities studied were more likely to feature larger lot sizes, independent people who are used to the challenges of rural living (e.g., poor roads, land clearing, fewer services), and large tracks of nearby wildlands that feature fewer landmarks or well-known parks when compared to residents further along one side of the continuum (high amenity, high resource communities; formalized suburban communities).

Meanwhile, high amenity, high resource communities studied were often further along the progression to urbanization—these communities were nearer to small or mid-sized population centers, featured formal subdivisions or predesigned lot structures with homeowners' associations, and contained residents with higher expectations for community and firefighting services (e.g., road maintenance, parks, fire protection). Economies of high amenity, high resource communities also were more likely to be service or recreation based and centered on exceptional natural amenities, outdoor recreation or cultural opportunities, and high-profile public lands such as national parks or wilderness areas.

Finer-Scale Continua Distinguishing WUI Archetypes

Comparison of adaptive capacity characteristics across archetypes illuminates additional social continuums that advance those already described above. Some primary continuums of adaptive capacity characteristics across archetypes are represented in Figure 2. We also provide citations to existing summaries of case studies used in the analysis to help provide context or foreshadow the comparison findings presented in this section. Comparison of our cases revealed, for instance, that residents of formal suburban communities seemed to place substantial trust in government agencies working on wildfire mitigations and collaborate with them on those efforts. In communities outside Rancho Santa Fe, this meant providing the local fire protection district the authority to forcibly remove flammable landscaping and determine whether residents could shelter in their homes during wildfires (Paveglio et al. 2010b). The prominence of these features diminished while progressing to the other side of the WUI archetype continuum, with working landscape/resource dependent communities often featuring distrust of government agencies (especially higher levels of government) and demonstrating an unwillingness or inability to collaborate with them on resource management. In Linden, Arizona, and Hayfork and Weaverville, California, this included local frustration about the reduction in timber harvesting in national forests and anger about the ways in which previous wildfires have been handled (Carroll et al. 2005, Davis et al. 2014). Some of this may be related to the progression of other characteristics along the same continuum, such as the tendency for formal suburban and high amenity, high resource communities to use outside services and nonlocal businesses for fuels reduction efforts. For instance, amenity migrants in Whitefish, Montana, and the Applegate Valley, Oregon, described employing contractors for fuel reduction work due to lower personal ability, knowledge, equipment, or skills to reduce fuel loads. It is also partly due to higher financial resources among these communities. Rural lifestyle or working landscape communities often contained locals who prefer to do things themselves or can help one another perform forest thinning. In Wilderness Ranch, Idaho, this meant that some residents were able to cut down and dispose of trees

themselves and organized through the volunteer fire protection district to help reduce fuels on properties of those who could not (Paveglio et al. 2010a).

We found that the implementation of codes and standards for wildfire mitigations (e.g., fuel reduction standards, taxes for fire districts, etc.) seemed less prevalent while progressing along a continuum from formalized suburban communities to working landscape/resource dependent communities, with working landscape/resource dependent communities featuring little support and virtually no codes or standard for mitigation. Likewise, working landscape/resource dependent communities are most likely to be dominated by informal resident communication networks. For instance, in Dayton, Washington, any successful inroads regarding communication about wildfire mitigations were most effective when using familial, drainage, or kinship ties. Rural lifestyle and high amenity, high resource communities feature a mixture of informal and formal communication networks, with high amenity, high resource communities trending toward formal communication and outreach networks. For example, Project Wildfire in the Bend-Sisters, Oregon, area works in collaboration with community members and a network of partners to develop and administer wildfire prevention and education strategies (Deschutes County 2013). The Bend-Sisters area is also home to a dense network of wildfire-related organizations (Fischer 2012).

Distinguishing Archetype Characteristics That Do Not Follow Continua

Other adaptive capacity characteristics differ among archetypes but are more difficult to put on a particular continuum. Place-based and community attachment were important across archetypes and cases studied for this effort. Both factors influenced collective action or wildfire mitigation planning among case study communities revisited for this analysis effort. But the basis for those place-based and community attachments varied among archetypes.

Place-based attachment among high amenity, high resource communities such as Leavenworth, Washington, and Whitefish, Montana, is often heavily tied to exceptional outdoor recreation or natural resource amenities (Rodriguez-Mendez et al. 2003, Paveglio et al. 2012) while place-based attachment in rural lifestyle communities such as Woodland Park, Colorado, and Grizzly Flats, California, is tied to the rural character of a place, its lack of development, and nearby wildlands (Jakes et al. 2007, 2012). Place-based attachment in working landscape/resource dependent communities such as Hayfork, California, and Eniat, Washington, was tied predominantly to "working the land" or intergenerational ties to an area (Findley et al. 2001, Davis et al. 2014) while in formal suburban communities, place-based attachment was often tied to recreational opportunities or is present in lesser qualities. Community attachment in formal suburban communities such as Auburn Lake Trails and Rancho Santa Fe, California, was most often tied to the exclusivity of living in the community and the in-group, out-group mentality it created (Paveglio et al. 2009, Paveglio et al. 2010b), while community attachment in rural lifestyle communities such as the North Fork, Montana, and Weaverville, California, is predicated on the need for residents to help one another with common problems (e.g., road maintenance, chores, erosion, etc.) and loan each other money or resources after a wildfire (Davis et al. 2011, Paveglio et al. 2012). Among working landscape/resource dependent communities strong, often intergenerational, ties among family and friends motivate community attachment. Rural lifestyle community attachment is similar to working landscape/resource dependent communities with regard to mindsets about property rights and/or ecosystem management. For instance, in Pinetop and Show Low, Arizona, (Carroll et al. 2011) and Roundup, Montana, residents were resistant to any provisions that would reduce their right to manage private property as they chose. In fact, many of these residents indicated they had moved to or enjoyed living in the area because they did not feel regulated by local or government agencies.

We are not able to describe all the differences that characterize WUI archetypes. However, we have provided a summary of comparisons for "distinguishing" characteristics for each archetype (Table 2).

Diversity of skills among residents also does not follow the typical progression from formal suburban to working landscape/resource dependent communities. Rural lifestyle communities such as Grizzly Flats, California, and Wilderness Ranch, Idaho, often featured a diverse set of local skills needed to adapt to wildfire risk, including professionals with grant writing experience, local leaders, residents with local ecological knowledge or the ability to thin forests, local organizational capacity, and/or those with other applicable professional experience (e.g., emergency management, firefighting) (Paveglio et al. 2010a, Davis et al. 2011, Williams et al. 2012). High amenity communities contained a lesser diversity of residents with these and other skills when compared to rural lifestyle communities, most notably with regard to local ecological or wildfire knowledge and ability to reduce fuels. Formal suburban and working landscape/resource dependent communities studied displayed less diversity in local skills, the former dominated by professionals, suburbanites,or amenity transplants and the latter predominantly characterized by those in resource extraction professions such as forestry and mining or those related to agriculture and ranching.

The influence of seasonal or second homeowners varied across archetypes, but in a way that matches the Old West to New West progression. Second or amenity homeowners were rare in the working landscape/resource dependent communities included in the study, but their influence increased in rural lifestyle and peaked in high amenity, high resource communities. For instance in Rancho Santa Fe, California, the importance of second or seasonal homeowners in formal suburban communities was less common than in other archetypes identified, primarily due to: (1) the stabilization of development and lack of property for sale; (2) the opportunity to commute (or telecommute) to work; and (3) the exclusivity of living in those subdivisions. This trend is similar to the process of "gentrification" described in New West literature (Travis 2007, Abrams et al. 2012).

Figure 3 presents some additional comparisons of wildfire mitigation approaches across archetypes at the times of study. It illustrates how both community influences and plans for wildfire mitigation differed in each of the communities studied. The relationships expressed were not measured quantitatively but rather represent relative levels of outcomes among cases studied.

For instance, our comparisons among cases and archetypes revealed that the scale of mitigation efforts such as forest thinning or fuel breaks was smallest in working landscape/resource dependent communities, increased in rural lifestyle and high amenity, high resource communities, and then decreased again in formal suburban communities. More specifically, mitigation efforts in high amenity, high resource and rural lifestyle communities were often conceived of as region- or communitywide firebreaks necessitating collective

Table 2. Distinguishing adaptive capacity characteristics among WUI archetypes.

Adaptive capacity characteristic	Formal suburban WUI communities	High amenity, high resource WUI communities	Rural lifestyle communities	Working landscape/resource dependent WUI communities
Place attachment	Tied primarily to social networks, exclusivity	Tied primarily to outstanding outdoor amenities	Primarily tied to rural nature, wildlands	Tied primarily to "working the land" intergenerational ties
Local independence or distrust of government	High trust in government; less local independence	Relatively high trust in government; relatively low independence	Not distrustful of government but more likely to work on their own	Highly independent and distrustful of government
Perception and action related to forest health or aesthetics	Wildfire problem framed as fuels reduction	Mitigations linked to ecosystem health and aesthetics	Mitigations linked to forest health, fuels reduction, wildlife habitat	Mitigations linked to forest health, fuels reduction, wildlife habitat
Local ability to reduce wildfire risk	Little to no local ability to reduce fuel loads	Less local ability to reduce fuel loads	Higher local ecological knowledge and ability to reduce fuels	Residents have highest local ecological knowledge/ability to reduce fuels
Land use, building, or fuels reduction standards	Local restrictions and strict enforcement	State or county restrictions and push for local; no enforcement	State or county restrictions and push for local; no enforcement	No restrictions
Amenity migration	"Gentrified" amenity migration already occurred and stabilized	Significant and ongoing amenity migration	Slower amenity migration to "rural" settings	Little to no amenity migration
Diversity of people/skills in a locality	Predominantly professional skills	Predominantly professional; some resource management emergency services skills	Near equal amounts of professional, resource management and emergency service skills	Primarily resource management, local ecological knowledge, less professional skills
Communication networks	Mostly formal (e.g., programs, news, outreach)	Combination of formal and informal communication (e.g., social networks, friends)	Primarily informal with formal networks as a compliment	Predominantly informal, little to no formal networks
Collective identity	At small scales and tied to exclusivity, amenities of area	At community or drainage scales; primarily tied to natural amenities and recreation	At community or drainage scale; tied to rural lifestyle, challenges	At drainage or county scale; tied to working the land, intergenerational ties
Development patterns/landscape fragmentation	High-end subdivisions or gated communities	Relatively high density, low sprawl	Lower density rural, more difficult ingress and egress	Development limited by landscape features; low density rural
Personal responsibility for fire protections	Personal responsibility required through formal programs	Mixed opinion with leaders spearheading programs	Lack of professional capacity prompts grassroots efforts	Residents take primary responsibility due to lack of services
Number of second or seasonal homeowners	Primarily high-end primary homes; second homes elsewhere	Higher proportion of second homes	Mixed second homes and primary residences	Mostly primary homes; few second homes
Collective action	Collective action centered on social issues (e.g., clubs, common areas); can include fire	Collective action centered around environmental management and fire	Collective action centered around rural challenges (e.g., road conditions, water use, fire)	Less collective action (mostly individual); agreement about resource use
Presence of local champions	Multiple champions representing professionals and locals	Multiple champions representing professionals and locals	Local resident Firewise "spark plugs" lead the charge	Local champions come primarily from nongovernment organizations or agencies

action among many partners. Rural lifestyle communities planned similar initiatives at the community or disperse subdivision scale, while working landscape/resource dependent community mitigation efforts were often focused on a few adjacent parcels or at the individual level. Formal suburban communities focus on discrete, often gated communities led to a mitigation focus specific to subdivisions.

The linked focus of fuel mitigation efforts as a means for landscape conservation and/or to support local timber industries also differed among WUI archetypes. Both formal suburban and working landscape/resource dependent communities focused little on landscape conservation, defined by management with a primary goal of maintaining historical ecological processes. In the former, this was potentially due to less place-based attachment or use of the broader landscape, and in the latter, it could be attributed to perceptions that harvest and forest use is a viable means to promote forest health. Rural lifestyle and especially high amenity, high resource communities like Applegate, Oregon, were focused on landscape conservation due to their use of the landscape for recreation, the upkeep of natural amenities that drew people to the area, and to retain the more rural character of the area. Conversely, a focus on forest use and harvest was highest among working landscape/resource dependent communities and decreases along a familiar continuum progressing to formal suburban communities. A focus on forest use and harvest was tied to traditional logging practices that included larger volumes of timber removed from stands than wildfire-related forest thinning and larger harvest areas not tied to residential home protection from wildfire.

Discussion

This study sought to begin the process of generalizing wildfire case study work by asking whether fire-prone WUI communities could be meaningfully grouped or categorized into archetypes with common characteristics. The idea is that communities with important characteristics in common would face similar challenges and draw on similar resources while adapting to wildfire risks and becoming FACs. The key is to identify which characteristics, if any, are the most important in defining archetypes, and we reviewed 18 case studies from previous research to help us begin that process.

We applied an existing approach (Paveglio et al. 2009, 2010a,

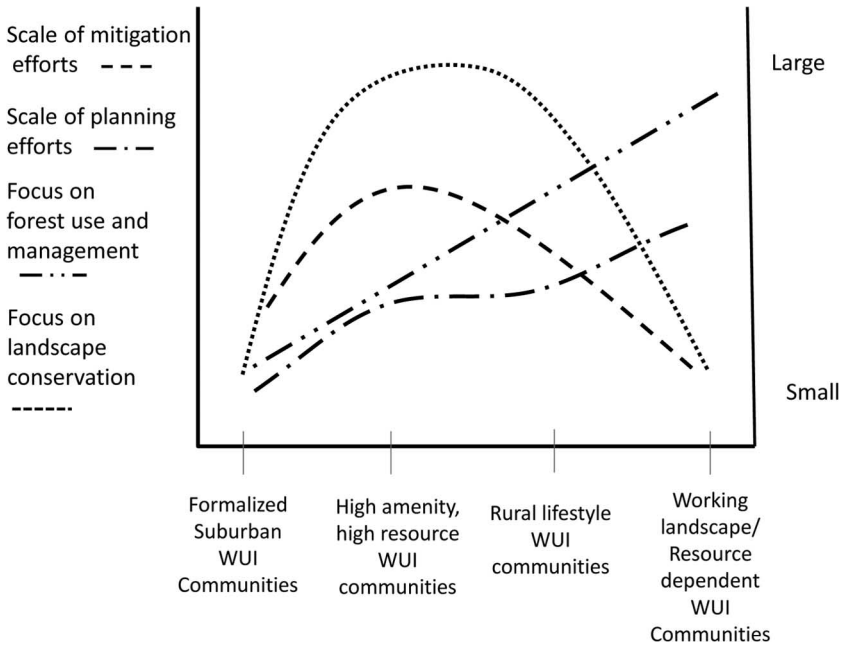

Figure 3. Relative approaches to fire mitigation planning among WUI archetypes.

2012) that identifies and organizes characteristics of local context influencing adaptive capacity to wildfire as a means to more systematically compare social context across diverse case studies. Comparison of case studies across seven western states suggests there are four WUI community archetypes. Our archetypes also share commonalities with and reflect existing understanding about development and change in western US communities, including ideas about the New West–Old West distinction and the rural-urban continuum (Irwin et al. 2010, Krannich et al. 2011). The four archetypes identified in this study could be refined, expanded, and used to test or adjust policies and strategies designed to increase wildfire adaptation at the community level. We will expand on these ideas in the following paragraphs.

Results from this analysis and comparison of previous case studies demonstrate that communities with different social context are likely to establish different strategies for planning, mitigating, and recovering from wildfire. For instance, in formal suburban communities efforts are often institutionalized into local policy or regulations that can be enforced. We observed that such policies would not be sought out or acceptable to working landscape/resource dependent communities for a number of reasons, including a higher distrust of government, a preference for organizing efforts themselves and a lack of support for codes and standards. Instead, working landscape/resource dependent communities were more likely to use information from trusted local sources (e.g., firefighters, select agency professionals) to organize their own practices in line with traditional skills and practices of landscape management. Similarly, high amenity, high resource communities in our sample were more likely to frame wildfire management as an effort to restore ecosystem health and retain the quality to recreational activities near their community while rural lifestyle communities often focus first on a preference for local autonomy and recognition of higher risk from wildfire, with a secondary focus on retaining the health of nearby wildlands for more traditional resource uses (e.g., hunting, fishing, nontimber forest product harvest).

The social context frequently operating in each archetype we uncovered is not static. Rather it is the result of historic and continued interactions among residents in an area. For instance, in rural lifestyle communities that meant the historic conversion from resource- or forestry-based economies and the influx of amenity migrants with different values for the landscape. These influences, and others, dictated different approaches to wildfire management, including more of a focus on neighborhood-level fuels reduction strategies, and a focus on landscape conservation (Carroll et al. 2004, Paveglio et al. 2010a, Davis et al. 2014). Historic and ongoing interactions surrounding wildfire management strategies and the past impacts of wildfire events also influenced current wildfire adaptation across many archetypes and are likely to do so in the future (Eriksen and Gill 2010, Carroll et al. 2011).

A key point here is that the progression toward "fire adaptation," no matter the WUI archetype, has no real end point—a community cannot achieve some stable climax of "fire adaptation" any more than a plant community can reach a "final" endpoint of succession. The goals of fire adaptation are constantly changing along with the populations being exposed to changing risk from wildfire (WFEC 2013). For instance, we observed hybrid communities that shared characteristics of multiple archetypes because the social dynamics in those communities are in a state of change. Setting quantitative benchmarks and testing dependent variables for FAC are useful *indicators*, but they are just waypoints in the continued evolution of wildfire management. Being a FAC requires maintenance and reflexive management—including periodic assessment of the local social context that drives the process of adaption (Jakes et al. 2011, Jakes and Sturtevant 2013).

Our use of Paveglio et al.'s (2009, 2012) interactional approach to adaptive capacity suggests that it can be used to characterize the diversity of WUI communities into more manageable archetype classifications. It does so by organizing elements of social context in a way that recognizes how social characteristics from both the social psychological and process traditions dynamically influence ongoing approaches to wildfire risk. Prior to this effort, there was no specific method for applying and comparing insights from the interactional

approach to adaptive capacity across cases. Our efforts in this paper have provided such a method. Further development and dissemination of the definitions and methods used for this effort can more easily characterize and encapsulate the complex social interactions that continually influence local peoples' reactions to wildfire risk, outreach policies, risk communication programs, and adaptations. We view this as an important step in identifying different pathways for achieving FACs that can be followed by diverse types of communities facing wildfire risk.

Identifying groupings of communities that are more likely to approach or respond to aspects of wildfire adaptation in the same way represent both a methodological step in the systematic documentation of influences on wildfire adaptation and in framing testable hypotheses concerning the cause-and-effect of fire mitigation. For example, future research could compare communities in each archetype with regard to a number of measures commonly used to gauge progression toward policy targets of "living with fire" or FACs. Such measures could include the number of individuals performing mitigations in the home ignition zone on private property (Cohen 2008), the incidence of recognized Firewise communities, the amount of damage or number of wildfires impacting private property, recovery efforts among communities impacted by similar wildfires, and other characteristics of interest (Absher et al. 2009, Collins 2012, Brenkert-Smith 2013).

A next logical step would be the development of methodologies or policy mechanisms that will facilitate consistent data collection on aspects of the interactional approach to adaptive capacity among populations. One lesson from our synthesis of case studies in this effort is that the collection of such data should occur at a variety of scales that reflect the complexity of the WUI. The scale at which action is likely to occur is often different among localities (Jakes et al. 2012, Williams et al. 2012). This was the case among our case studies. It reiterates the importance of first understanding the scale at which collective action is possible before attempting to advance wildfire adaptation among populations. Segments of existing wildfire research and policy explicitly assume that communication or collaboration surrounding risk will apply in the same way to individuals or groups in different areas of the WUI. Our results and a growing segment of wildfire research call that assumption into question (Brenkert-Smith et al. 2011, Monroe et al. 2013). In light of this, we suggest that it is necessary to more fully engage the notions of "segmenting" publics (Howlett 2011, Fischer et al. 2012) with regard to the WUI and wildfire risk. This means acknowledging that populations in the WUI differ from one another. We believe that these WUI archetypes allow for needed differentiation without having to assume that every place is totally unique, something that is untenable when creating policy.

Our efforts to segment WUI populations with regard to natural resource management and hazard risk also advances the literature by focusing more broadly on the social and contextual factors that distinguish populations rather than just predominant foci concerning their level of interest, awareness, attitude, or perceived efficacy for an issue (Vaske and Needham 2007, Featherstone et al. 2009, Clement and Cheng 2011). These existing foci hint at parallels with the wildfire social science "traditions" we described above in that they focus on the social-psychological tradition of research while failing to acknowledge ongoing social context and interactions among residents that are more prevalent in the process tradition. We believe that scholars and outreach professionals cannot separate stakeholder evaluation of a message or their awareness and interest in a topic from the social processes that influence them.

Our recognition of community archetypes can potentially facilitate the development of tailored communication or outreach strategies for populations who are likely to need or use information in different ways. For instance, programs that foster grassroots organizing efforts with local leaders and use informal communication networks would be more effective in rural lifestyle WUI communities when compared to formal suburban communities because the former are more comfortable with those means of organizing. In formal suburban WUI communities, formal communication programs led by firefighting or emergency management professionals are a better communication strategy because those populations respond well to and are more apt to take advice from those with formal expertise. The point here is that efforts to work with populations in fostering wildfire adaptedness will require different communication strategies that correspond with the capacities local people have, need to develop, or apply to the fire problem. The identification and continued testing of communication strategies across the archetypes we have presented here can aid that processes by uncovering what form of information is likely to achieve perpetuation of mitigations among different populations.

There is unlikely to be one set of criteria that define or constitute a fire adapted community across locations and community types. Our results and existing research suggest that the idea of generalizability across all populations with regard to adaptive capacity for wildfire is an erroneous one. However, it is possible that there are a discrete number of pathways that individuals, as members of larger collectives, can take to increase their adaptive capacity to wildfire. Along the way, they are likely to update and revise what it means to be fire adapted, creating a reciprocal feedback loop that serves to advance both resilience to changing risks and their capacity to learn and plan for disturbance. The work presented here has provided a first step in understanding what those discrete pathways to fire adaptation might look like, why they are necessary, and what local characteristics necessitate those varied approaches. It provides a framework through which wildfire researchers and practitioners can share insights from diverse locations and in a way that goes beyond simple metrics to deeper meanings of local situations.

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