Community Diversity and Wildfire Risk: An Archetype Approach to Understanding Local Capacity to Plan for, Respond to, and Recover from Wildfires

MATTHEW S. CARROLL, TRAVIS PAVEGLIO, AUTUMN ELLISON, JESSE ABRAMS, AND CASSANDRA MOSELEY

SUMMER 2014

ECOSYSTEM WORKFORCE PROGRAM WORKING PAPER NUMBER 50

Ecosystem Workforce Program

UNIVERSITY OF OREGON

WASHINGTON STATE UNIVERSITY

University of Idaho

Portland State UNIVERSITY

About the authors

Matthew S. Carroll is a professor in the School of the Environment, Washington State University.

Travis Paveglio is an assistant professor in the College of Natural Sciences, Department of Conservation Social Sciences, University of Idaho.

Autumn Ellison is a faculty research assistant, Ecosystem Workforce Program, Institute for a Sustainable Environment, University of Oregon.

Jesse Abrams is a faculty research associate, Ecosystem Workforce Program, Institute for a Sustainable Environment, University of Oregon.

Cassandra Moseley is director of the Ecosystem Workforce Program and the Institute for a Sustainable Environment, University of Oregon.

Acknowledgements

Thank you to the interviewees who provided their time during our case study on the Track Fire and affected communities. Melanie Knapp provided proofreading services. This research was supported by the USDA National Institute for Food and Agriculture, Grant # 2011-67023-30695.

Photo credits:
Front cover, p.10, p.14: Autumn Ellison—Ecosystem Workforce Program
Cover inset, p.2, p.5, back cover: U.S. Forest Service, Coconino National Forest
p.13: U.S. Forest Service, Southwestern Region, Gila National Forest
p.16: Emily Jane Davis—Oregon State University.

For more information:
Ecosystem Workforce Program
Institute for a Sustainable Environment
5247 University of Oregon
Eugene, OR 97403-5247
541-346-4545
ewp@uoregon.edu
ewp.uoregon.edu

UNIVERSITY OF OREGON

The wildfire dilemma in the United States (and particularly in the U.S. West) has been well documented and its broad parameters are well understood. A very small fraction of wildfire igniting in wildland settings each year turn into major conflagrations that burn homes and infrastructure, pose significant threat to human life, and upend the budgets of federal land management agencies. Although the mandates of federal land management agencies also dictate a focus on protecting public land and associated natural resources such as habitat, the reality is that much of the effort and expense at federal, state, and local levels is directed toward protecting human infrastructure and other societal "values at risk."

The need to protect communities, infrastructure, and lives from wildfire has spawned a number of federal and state initiatives aimed at resolving the growing tension between people and wildfire. These include major provisions in the Healthy Forests Restoration Act, the Healthy Forests Initiative, the National Fire Plan, the Firewise Communities USA program, the Cohesive Wildland Fire Management Strategy, and recent efforts to promote "Fire-adapted" communities.[1] A common thread throughout these programs is the need to acknowledge that the problem of uncontrolled fire in the backcountry is different than fire in the wildland urban interface, or WUI, where human settlement is adjacent to or interspersed with flammable wildland vegetation.

Recent social science research concerning wildfire management has revolved around understanding how private citizens and communities can take more personal responsibility for actions and planning that contribute to reduced damage from wildfires. Researchers have sought to understand what motivates or facilitates collective and individual action in response to wildfire risk, as well as how to increase capacity for actions that have been proven to reduce risk and promote recovery. A significant proportion of this research has focused on residents of the WUI as a policy target for exposure to wildfire risks. Yet the WUI is not geographically continuous, nor is it uniform in terms of residents. This diversity presents a challenge to wildfire policy as residents with different perceptions about, experiences with, and constraints for dealing with wildfire risk reduction respond differently to various messages and incentives.

Existing research has documented how communities differ in the ways they interact with or use local landscapes and how residents organize themselves in response to wildfire risk.[2] Not only do communities across the WUI have (often drastically) different needs in terms of dealing with fire risk, but they also have different resources, knowledge, experience levels, action orientations, and abilities to work collectively to solve local problems. As a result, different WUI communities face different opportunities and challenges in becoming fire-adapted. This research is an ongoing effort to understand and organize these differences among WUI communities in the American West to more effectively develop wildfire risk reduction approaches that address the unique needs, capacities, and obstacles in different places. The underlying questions in this working paper, which synthesizes and builds on recently completed work by Paveglio et al. (in press), were: 1) Are there patterns of influences on wildfire risk management that can be documented across case studies?; and 2) Does the evidence suggest that communities exhibiting similar patterns constitute distinct "archetypes" that approach wildfire risk differently from others?

Methods

In order to answer these questions, we reviewed 18 case studies to identify characteristics of social context that influence WUI residents' capacity and willingness to plan for, respond to, and recover from wildfire (see Paveglio et al. in press). The research team included authors from each of the 18 cases; in any case where additional information about specific cases was needed, it was obtained from researchers involved in the original studies.

We based our analysis around 22 characteristics that Paveglio et al. (2009, 2010a, 2012)[3] outlined in prior research as influencing adaptive capacity to wildfire risk. For each of the 18 cases, the research team first created descriptions of the characteristics in each case study community. Characteristics unique to each case study were analyzed through iterative processes of agreeing upon common expressions and levels of the characteristics across cases.[4] These processes allowed researchers to group the cases into tentative archetypes. Two authors then separately coded each adaptive capacity characteristic for each community and the tentative archetypes were refined iteratively based on this coding. See Paveglio et al. (in press) for additional details on the methods used for this analysis.

In May 2014, we conducted another case study on community preparation, response, and recovery surrounding the June 2011 Track Fire that burned 27,792 acres in New Mexico and Colorado. In total we conducted semi-structured interviews with 23 individuals involved in wildfire preparation, response, and/or recovery efforts, and 10 landowners affected by the Track Fire. We used the characteristics that define the archetypes to investigate how unique social context in two communities affected by the fire (Raton, New Mexico and Santa Fe Trail Ranch, Colorado) influenced community approaches for dealing with wildfire risk, as well as their response and recovery to the Track Fire.

In this working paper, we first summarize the general tendencies and characteristics identified for each community archetype during the 18-case analysis (see Paveglio et al. in press for details). We then provide examples from the cases to illustrate how the tendencies in different archetypes can influence wildfire adaptation actions in communities. Finally, we discuss the 2011 Track Fire case study through the lens of the archetypes approach. Through this example, we show in greater depth how WUI communities' preparation, response, and recovery efforts may differ even among communities that are geographically close and exposed to the same wildfire events, and how future efforts can consider the unique social context of communities at risk from wildfire.

Results

Four distinct archetypes emerged from the cross-case comparisons outlined in Paveglio et al. (in press): 1) formalized suburban communities; 2) high amenity, high resource communities; 3) rural lifestyle communities and; 4) working landscape/

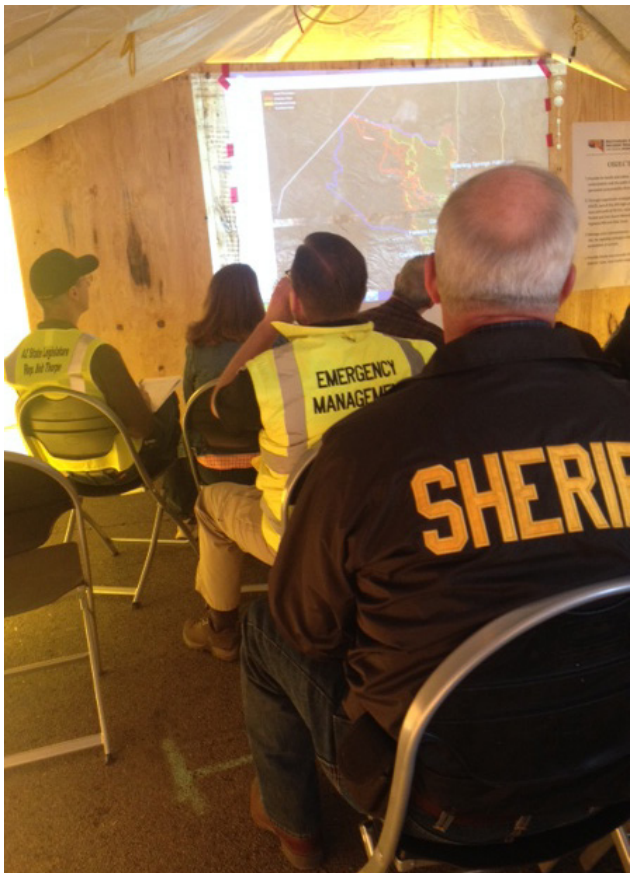
resource dependent communities (see Table 1, page 6). Community archetypes represent common social contexts and outline specific combinations of characteristics that are likely to drive ongoing adaptation to wildfire. It should be noted that some communities are best described as "hybrids" because they share characteristics of two archetypes. This fits with a larger finding of our comparisons across case studies—that the social context of many WUI communities is in flux and communities can evolve over time. The following sections describe each archetype outlined in Paveglio et al. (in press), explain how key differences in characteristics across archetypes affect adaptation to wildfire risk, and illustrate the different ways that communities can address wildfire risk through a case study of two communities affected by the same wildfire.

Community archetypes

Formal suburban WUI communities

Formal suburban WUI communities often consist of a collection of homes and subdivisions constructed by one or a few individual developers. These communities may or may not be gated, and they are typically inhabited by an affluent population. Formal suburban WUI communities are often "bedroom communities" within commuting distance of an urban area. They tend to have high proportions of professional and specialized technical workers with fewer manual skills, and limited knowledge of natural resource management. Place attachment and collective identity in these communities often focuses on the quality of the immediate residential environment and more "developed" amenities such as restaurants and playgrounds for children. Residents are generally familiar with subdivision covenants relating to amenities and restrictions on certain kinds of building and development in residential areas. To the extent that there is a collective identity in such areas, it generally focuses on the exclusivity and built amenities of a particular neighborhood. Residents often view the "wildfire problem" in terms of fuel and fuel reduction.

Residents also tend to be more trusting and willing to work with government agencies compared



to residents of other community archetypes, and often have less detailed knowledge or direct experience with wildfire. They are generally less likely, due to time, skill, and equipment constraints, to perform their own fuel reduction activities or other residential modifications for fire preparedness, and are instead more willing and able to pay for contracted services to do this work.

High amenity, high resource WUI communities

High amenity, high resource WUI communities tend to be less suburbanized than formal suburban communities, with high housing density and low residential sprawl. They are typically found in areas with many cultural amenities (e.g., arts, night life, and restaurants) in addition to natural amenities and outdoor recreation opportunities. They tend to match their suburban counterparts in terms of financial resources, general trust in government, and willingness to collaborate with formal organizations in reducing wildfire risk.

Table 1 Adaptive capacity characteristics*

Conceptual category	Adaptive capacity characteristic	Sub themes 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, or 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
	Local understanding of fire suppression responsibilities and limitations	Personal responsibility for fire protections vs. 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 vs. privacy or conservation as barrier to forest treatments
	Local 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; existing 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 and 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 or county supervisors/commissioners
	Risk reduction initiatives among agencies and locals	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

* This table reproduced from Paveglio et al. (in press)

Collective identity is often at the community and landscape scale and linked to recreation and natural amenities, including landscape conservation. Skill sets tend to be primarily professional but with a greater presence of emergency service experience and the skills and equipment to manage local landscapes (e.g., tree felling and brush removal) than formal suburban communities. Residents are generally as likely to turn to informal social networks such as friends and associates as they are to formal programs to learn about fire risk reduction for their homes and properties. Typically, they are more likely to hire contractors to carry out fuel mitigation activities than to perform it themselves.

Rural lifestyle WUI communities

Rural lifestyle WUI communities tend to be characterized by low-density housing and more problematic ingress and egress during wildfire emergencies. Residents' place attachment generally focuses on the rural and more rugged nature of where they live and the wildlands within which they are interspersed. Collective identity in rural lifestyle communities often revolves around facing common challenges that come with living a rural way of life (e.g., poor winter roads, or the need to maintain personal property and machinery). One author labels this as a focus on "country competence." [5] Professional skills are common and tend to occur in equal measure with emergency services and land management experience. As a result, residents tend to have a greater collective stock of practical local ecological knowledge in general, and fire knowledge in particular, than residents in the prior two archetypes. However, they often lack the financial resources or ability to command local attention that distinguishes the prior two categories.

Rural lifestyle residents are generally more likely to rely on social networks and local knowledge than public agency programs to deal with fire risk. While they are not as mistrustful of government regulations as residents in the working landscape archetype (below), they often have a greater tendency and ability than formal suburban and high amenity communities to tackle local problems such as reducing fuel loads themselves. For those reasons they tend to resist what they might see as micromanaging from the outside.

Working landscape/resource dependent WUI communities

Working landscape WUI communities are located furthest along the "rural" end of the urban-rural continuum. Development in these communities is generally low density and influenced by landscape features. These communities often have an historic local economies based on resource extraction and primary production; current economy may or may not be extraction-based. They tend to have intergenerational links to "working the land" that affect the culture and views of residents. This culture generally engenders a mistrust of government regulations, particularly at the federal level, and a strong desire for local independence and freedom from what they might see as excessive outside interference. Thus, there is often an abundance of manual skills, local ecological knowledge, and "country competence," but fewer professional backgrounds and skill sets. There is a general tendency to have greater respect for knowledge derived from hands-on experience rather than knowledge transmitted through public agency programs or academic sources. For these reasons, residents in these areas often spread knowledge and experience through informal social networks.

While there is great variability, many working landscape communities have not prospered financially in the globalized economy. Many do have well-developed local capacity and organization for dealing with small- to medium-sized fire events, but relatively little tolerance for the highly-structured, command-and-control approach to firefighting that characterizes high-level federal fire fighting teams responsible for larger fires. There is a strong tendency in these communities to eschew formalized programs related to reducing fire risk, mirrored by a corresponding emphasis on the application of local knowledge to community-based efforts.

Influence of community characteristics

The adaptive capacity of communities to wildfire can emerge differently in unique settings depending on which characteristics are at play in those areas. In some cases, the differences between communities results from differential access to resources or knowledge of how to solve natural resource problems. In others, it relates to residents' willingness and ability to work together or with local offices of federal and state agencies. The archetypes begin to organize more consistent lessons about the expression of adaptive capacity characteristics across communities.

Analysis of cases revealed, for instance, that efforts in formal suburban communities were often institutionalized into enforceable local regulations. Residents of formal suburban communities tended to put more trust in federal and state agencies working on wildfire mitigation and were more willing to collaborate with them on those efforts. In communities near Rancho Santa Fe, California, this meant providing the local fire protection district the authority to forcibly remove high fire risk material from private property and determine whether residents could shelter in their homes during wildfires.[6]

Trust in agencies diminished while progressing to the other end of the WUI archetype continuum. Working landscape/resource dependent communities often featured distrust of government agencies (especially higher levels of government) and demonstrated an unwillingness or inability to collaborate with agencies on resource management. In Linden, Arizona and Hayfork and Weaverville, California, this mistrust was grounded in local frustration about the reduction in timber harvesting on National Forests and anger about the ways previous wildfires had been handled by federal fire teams.[7] Instead, working landscape/resource dependent communities were more likely to use information from trusted local sources (e.g., firefighters, select agency professionals) to organize efforts aligned with traditional skills and practices of landscape management.

Also relevant is the tendency for formal suburban and high amenity, high resource communities to use outside services and non-local businesses for fuels reduction efforts. For instance, amenity migrants in Whitefish, Montana often used contractors for fuel reduction work due to a dearth of knowledge, equipment, and skills among residents in the area. In comparison, rural lifestyle or working landscape communities often include residents who prefer to conduct fuel reduction work themselves, or who can help their neighbors perform it. In Wilderness Ranch, Idaho, this meant that some residents removed brush and trees themselves and organized through the volunteer fire protection district to help reduce fuels on properties of those who could not.[8]

Additional characteristics related to fire adaptation differ among archetypes, but they are more difficult to characterize in terms of a particular continuum. Place-based attachment and community attachment were important across archetypes, and both influenced collective action and wildfire mitigation planning in the communities analyzed. But the basis for place-based or community attachments varied among archetypes.

Place-based attachment in high amenity, high resource communities such as Leavenworth, Washington, and Whitefish, Montana were often heavily tied to exceptional outdoor recreation or natural resource amenities[9] while place-based attachment in rural lifestyle communities such as Woodland Park, Colorado, and Grizzly Flats, California were linked to the rural character of a place, lack of development, and nearby wildlands.[10] Place-based attachment in working landscape/resource dependent communities such as Hayfork, California and Entiat, Washington, was tied predominantly to "working the land" or intergenerational ties to an area.[11] In formal suburban communities, place-based attachment was often linked to recreational opportunities or was not a prominent feature of local life.

Community attachment in formal suburban communities such as Auburn Lake Trails and Rancho Santa Fe, California was often tied to the exclusivity of living in the community and the in-group/out-group dynamics it engendered.[12] Community attachment in rural lifestyle communities such as North Fork, Montana and Weaverville, California was based on the desire of residents to work together to solve common problems (e.g., road maintenance, chores, and erosion) and support each other financially after wildfires.[13]

Among working landscape/resource dependent communities, strong, often intergenerational ties among family and friends motivated community attachment. Rural lifestyle community attachment was similar to working landscape/resource dependent communities with respect to views on property rights and ecosystem management. For instance, in Pinetop and Show Low, Arizona[14] and Roundup, Montana, residents were resistant to provisions that would infringe on individuals' freedom to manage private property as they chose. In fact, many residents made it clear that they had moved to or enjoyed living in the area because they did not feel as regulated by government as they would in a different type of setting.

These examples from the case studies analyzed in Paveglio et al. (in press) show how some of the adaptive capacity characteristics (see table 1, page 6) in communities from different archetypes affected approaches to wildfire risk mitigation efforts. They also show the importance of local social context in wildfire planning processes, and how diversity among WUI communities can lead to efforts that work differently across communities.

The expression of adaptive capacity characteristics that define each archetype is the result of unique historic and current capabilities, social interactions, and cultures of representative communities. Communities can also evolve in ways that allow them to change archetypes. For instance, rural lifestyle communities can arise from working landscape communities as resource- or timber-based economies shift and amenity migrants with different perspectives about uses of the landscape move to the area. In some cases, these influences led to different approaches to wildfire management such as increased focus on neighborhood-level fuels reduction strategies and a focus on landscape conservation.[15]

Examples from a case study

In June of 2011, the Track Fire burned near Raton Pass on the New Mexico/Colorado border, affecting the city of Raton, New Mexico and threatening the community of Santa Fe Trail Ranch, Colorado. The two very different communities in this case study highlight differences in how communities can prepare for, respond to, and recover from wildfire risk. It also illustrates how local social context affects communities' perception and response to wildfire risk, as well as some challenges and opportunities for wildfire adaptation that different communities face.

Community context and wildfire preparation

Raton, NM

Raton, New Mexico (population 7,000) is a traditionally working landscape/resource dependent community with ties to the mining and ranching industries. Most of the city's developed area is on sparsely vegetated flatlands between two mesas, but the fringes of town and some unincorporated developments are on wooded slopes. Raton sits close to the Colorado border in northeastern New Mexico in a rural setting. The nearest large urban centers are Denver and Albuquerque, each roughly a three hour drive away. Trinidad, Colorado (population 9,000) is about 25 miles away. Although many of the working landscape jobs that played a foundational role in creating the town have since left the area, the resulting depressed economic condition of the city exemplifies the dependence on these types of jobs, and the culture remains strongly tied to the mining, ranching, and horse racing industries that were historically important to the community. The community has resisted potential business developments in recent years that are at odds with these activities (e.g., call centers and distribution warehouses) despite the overall need for economic development. Residents describe these contradictory actions as longing for the "good old days." Some amenity migration to Raton has occurred but it has not been extensive. Many residents have family roots in the area that trace back multiple generations and contribute to their attachment to the area.

Typical of working landscape/resource dependent communities, Raton contains a relatively low level of formalized environmental governance institutions but strong informal networks among residents. This has led to wildfire preparation that is also centered on informal relationships and networks rather than organized programs. No formal city policies mandate defensible space around houses. Although there are several Firewise communities in Colfax County, there appears to be little interest among Raton landowners in establishing Firewise communities. Local government, while interested in Firewise designation, lacks the capacity for outreach to encourage landowner participation. A Community Wildfire Protection Plan (CWPP) was completed for Colfax County but its content is unknown to most officials in Raton involved in wildfire planning, and it does not appear to have materially influenced wildfire preparedness in the Raton area. Most homeowners on the fringes of town were cognizant of fire threats prior to the Track fire, and some had taken measures to create defensible space around their residences, but most landowners did not engage in extensive fuel modification outside their immediate residential areas. In a few notable exceptions, landowners not only completed comprehensive thinning projects across their properties, but also talked with surrounding neighbors about the benefits of wildfire mitigation work.

Local representatives of governmental entities and NGOs are also connected through informal networks. There has been a great deal of interest in forest and fire issues within Sugarite Canyon State Park, as it is one of the only parcels of public land in the area and is highly valued for activities such as hiking, camping, fishing, and hunting. It contains dense ponderosa pine and mixed conifer stands with higher risk of destructive wildfire than the surrounding pinyon-juniper terrain, and serves as the primary municipal watershed for Raton. In 2002, several key players from local- to national-level agencies responsible for various facets of natural resource management started working with each other and with relevant NGOs to discuss, plan, and implement vegetation management projects in the Sugarite Canyon State Park area. Thinning work in the park began in 2004. The group was awarded a federal Collaborative Forest Restoration Program[16] grant in 2006 to prepare a watershed stewardship plan (completed in 2008) and to plan and implement additional restoration projects on the New Mexico side of the border. Approximately 600 acres of dense forest were ultimately thinned within the state park from 2005 to 2007, and additional acres on the Colorado side brought the total area mechanically treated to around 2,700 acres by 2010. Outside of this collaborative work, few other mitigation projects were enacted in the area.

Santa Fe Trail Ranch, CO

The Santa Fe Trail Ranch (SFTR) community is markedly different from Raton and nearby Trinidad. It is carved out of the surrounding ponderosa pine and piñon-juniper/oak forest just over the Colorado state line north of Raton. Established in the early 1990s, it is a 17,000-acre subdivision that tends more toward the rural lifestyle community, but also has some high amenity, high resource characteristics. Housing is very low density, with 450 tracts of 35 acres each, and residences are accessed by a winding network of dirt roads with many internal connections but limited connections to outside travel routes. About one-third of the lots have residential development, and about one-fifth of them have year-round occupancy.

Homeowners at SFTR (both seasonal and year-round) are largely retirees from a variety of professional backgrounds, and most come from outside the local area. Many residents moved to SFTR for the rural nature, scenery, privacy, and wildlife combined with accessible amenities like shopping in nearby Trinidad. While residents are attached to the rural nature and forested wildlands characteristic of the area, they express little attachment to this place in particular, and most have insurance policies that would allow them to rebuild elsewhere in the event of a fire. Due to the diversity of the areas they have moved from, there is high variance in individual residents' knowledge about wildfire protection, their abilities to reduce wildfire risk, and perspectives about the

role of fire in the landscape. This diversity in backgrounds, knowledge, and perspectives has led to diversity in landowner willingness to participate in or support wildfire mitigation work. While some landowners are involved in wildfire planning and thinning projects across the Ranch, others are unwilling to invest in risk reduction work or remove any of the forested vegetation that drew them to the area, and note that they would rather move elsewhere if a fire were to burn the surrounding forest but not their house.

Wildfire preparation within SFTR is characterized by formal structures and funding that is accessed through a small group of local champions that actively pursues mitigation work. There is a formal network through the homeowners association (HOA) and various HOA committees, including a Forest Health and Wildfire Mitigation Committee. The subdivision was recognized as a Firewise community in 2006, but there are no building or fire protection standards or requirements of landowners. Through the mitigation committee, SFTR completed its own Community Wildfire Protection Plan in 2006 with help from local foresters and GIS consultants. Landowners involved in the committee are retired professionals that bring with them a wide variety of skills, including grant writing, fundraising, and project management, which has helped the committee be successful at obtaining grants for fuels reduction work through the state of Colorado. The grants have helped motivate some landowners to participate in fuels reduction efforts and the CWPP has been useful for planning and prioritization of projects, but there have also been considerable challenges in performing fuels reduction work that is integrated and connected. Such work is voluntary for property owners within SFTR, and many have left their properties untreated by choice or by default. The large proportion of absentee landowners has also presented challenges. In addition to landowners who do not support fuels reduction, many absentee landowners are unwilling to spend effort or time arranging for fuel reduction work, or even to give permission for treatments along the roadways near their properties in some cases.

The community has had mixed success in working constructively with surrounding landowners and communities. SFTR worked with the Vermejo Park Ranch, a 590,000-acre property owned by Ted Turner that borders SFTR on the southern side, to increase fire protection along the shared border. In 2007, Vermejo Park Ranch established a fuel break along this boundary to help protect the subdivision from fires that typically move from the Southwest to the Northeast. Residents of SFTR have since extended this fuel break northward around the western edge of the perimeter, and are working to obtain grants to perform maintenance work on the original break.

In some ways, however, the differing social contexts between the SFTR community and the surrounding landscape and communities has created cultural divides that affect wildfire preparation activities. Residents at SFTR are relatively affluent when compared to the nearby town of Trinidad, Colorado and the rest of Las Animas County, which is one of the poorest counties in the state. Las Animas County is generally rural and has a natural resource based economy, primarily centered on farming, ranching, and a history of mining, while SFTR residents are largely retired professionals. Subsurface energy extraction activities are abundant in the areas surrounding SFTR, but are not allowed within the ranch itself, further differentiating the SFTR landscape from the surrounding landscape. These differences have led to a cultural divide and somewhat strained relationship between the community and the local Fisher's Peak Fire Protection District. As a result, SFTR residents have largely dissociated from volunteer and support duties within the district, inciting calls for additional wildfire-preparedness training among some SFTR landowners. Among this group of landowners, informal trainings on how to identify and report local fire starts have been well attended.

Wildfire response

On June 12, 2011, the Track Fire ignited just west of Interstate 25 near Raton Pass, in between the city of Raton and Santa Fe Trail Ranch. The Raton Fire Department was the first to respond; fire

behavior was extreme and rapid expansion was facilitated by high winds, low humidity, and dry conditions following extended drought. Within hours, the fire jumped I-25 and moved northward toward Santa Fe Trail Ranch, instigating some residents to prepare for evacuation and others to prepare against spot fires by going to lookouts and laying out water hoses. Local leaders were able to pass GIS files created during the CWPP process on to emergency responders, which were reportedly very helpful in forming strategies for response based on fuel breaks, roads, and structures. A few hours after starting, the winds shifted and began to push the fire away from SFTR and back toward Raton. Although SFTR was ultimately spared from the oncoming fire, the distinct initial responses of residents to either prepare for spot fires or evacuate mirrors the distinct groups of resident involvement in wildfire risk reduction. While some residents had knowledge, resources, and will to deal with risks of the oncoming fire, other residents were terrified and evacuated with valuables even in the absence of an official evacuation order.

As the wind pushed the fire back toward Raton and up the steep slopes on the east side of Raton Pass to the top of Bartlett Mesa, neighborhoods on the north side of Raton and northeast of town near Highway 72 were evacuated. Local officials facilitated evacuation efforts, and accompanied homeowners to residences to retrieve valuable property if it was safe to do so. A few landowners with cattle refused to leave their property, but the majority of property owners left without incident. The fire eventually crossed the top of the mesa and spread eastward into Sugarite Canyon State Park. Due to the speed of the fire, severe conditions, and extreme fire behavior, local firefighting capacity was quickly overwhelmed despite response from many surrounding communities. A New Mexico state wildland fire crew arrived later that day, and as the fire continued to rapidly spread a federal Type II team was dispatched the following day. Within the first 24 hours, the fire had burned 22,000 acres, largely within Raton's municipal watershed in both Colorado and New Mexico. Much of the forested area burned as a crown fire, including both previously treated and untreated areas.

Although there was little that local response could do to contain the fire in the extreme conditions, the trust that was established between key local government and agency players during collaborative projects in Sugarite Canyon State Park promoted efficiency during local response and a smooth transition from local to state and federal responses. However, there were also interagency communication and coordination issues stemming from an outdated communications system used by the City of Raton, which handles

emergency dispatch for Colfax County. While the County's communication hardware and software had been updated, the City's had not, which led to disorganization between city and county communication. Overall, the response showed the strength of informal relationships among local players, but also a lack in formal communication system operations necessary in response.

Wildfire recovery

The fire was contained on June 27th after burning 27,792 acres (19,970 acres in New Mexico and 7,822 in Colorado). While both the City of Raton and the Santa Fe Trail Ranch subdivision were threatened, structural damage from the fire was relatively low, with eight homes and eleven outbuildings destroyed as the fire burned between the two communities. Suppression costs totaled approximately 7.5 million dollars, with additional costs for rehabilitation as well as economic impacts associated with closing I-25 and the Burlington Northern-Santa Fe rail line for several days. The fire also damaged a natural gas pipeline that runs through the watershed. The brunt of the fire's impacts, however, was borne by Raton's municipal watershed, where much of the terrain burned at moderate to high severity.

Although the Track Fire was a significant threat to residents of Santa Fe Trail Ranch, there were no rehabilitation needs for the immediate landscape or residences, and there have been few if any changes in wildfire planning or preparation efforts at SFTR. While wildfire mitigation work was still being completed at the time of our interviews, it was moving forward at the same pace as prior to the fire, and the fire did little to motivate landowners that were previously uninterested or opposed to fuels reduction. Risk-reduction work continues to be voluntary for property owners within SFTR, and among some, the Track Fire created less interest in such work—after they saw the intensity and speed at which the Track Fire burned, they saw less reason for preparation and had less interest in saving their homes if the landscape were to be burnt as severely as the landscape in Sugarite Canyon State Park. After the fire, some landowners also switched to insurance policies that allow a payout for rebuilding elsewhere.

For the City of Raton, recovery efforts were urgent and extensive. The severity of the burn, in addition to large rainfall events forecasted soon after the fire was contained, presented a significant threat to the municipal water supply that required immediate action. Although the fuels reduction efforts in the watershed did not alter fire behavior in such an extreme fire event, the cooperative relations built during these efforts helped greatly in local post-fire recovery. The previously established partnership facilitated quick decisions, action, and trust among partners to tackle rehabilitation efficiently.

The City of Raton Water Works Department had funds set aside through a special user fee; these funds were important in the immediate aftermath of the fire because they could immediately be used as required match for the Natural Resource Conservation Service (NRCS) Emergency Watershed Protection program. The local NRCS office quickly recognized the need and opportunity for program funds, contacted the Water Works Department for matching funds, and applied for the funding to get rehabilitation through seeding and contour logging started as soon as possible. Watershed engineering work began immediately upon fire containment, and practical skills, personnel, and equipment associated with Raton's mining industry were put to use in watershed rehabilitation to prevent the post-fire sedimentation from degrading the municipal water supply. In general, the post-fire watershed rehabilitation work was highly successful. Although one of the three reservoirs had to be sacrificed for use as a sediment basin, the recovery effort is broadly seen as providing the best possible outcome from a worst-case scenario in the watershed, and succeeded in protecting the municipal and recreational values associated with Lake Maloya, the largest reservoir and centerpiece of the state park.

Additional and ongoing efforts have attempted to correct some of the communication issues that were exposed during the Track Fire response

and better prepare Raton for wildfire risk. These efforts have generally been focused at the local government level. As a result of the Track Fire, Colfax County established a full-time Emergency Manager position responsible for overseeing and coordinating emergency preparedness and planning. The county Fire Marshall created a new volunteer fire district structured as a rapid-response unit capable of mobilizing quickly to locations in need. A new Raton Fire Chief has made it a priority to establish mutual and automatic aid agreements with other emergency response entities and to conduct joint training exercises. Work has also been done to clear vegetation lining the road that provides access to houses on the south side of Bartlett Mesa. While there is recognition among partners that the communication problems due to outdated equipment during the fire need to be addressed, that additional landowner outreach is needed, and that mutual aid agreements are more urgently needed, the economic constraints and limited capacity of planning personnel in the area continue to constrain additional progress.

Comparison and Discussion

The preparation, response, and recovery of the two communities described in the Track Fire case study show in greater detail how local social context affects actions and abilities in all stages of wildfire adaptation. While no approach can explain the full context of every community, the archetypes help to organizing communities at a broader scale and they provide a useful lens for understanding the unique challenges and opportunities in different kinds of communities.

In Raton, a working landscape and resource-dependent history have led to primarily informal communication networks, with formal programs like Firewise exciting little interest, and formal tools like a CWPP ultimately providing little value. The lack of formal programs or requirements led to modest wildfire preparation and grant funds for fuel reduction among landowners, and difficulties in formal communication between partners during the Track Fire response. The strength of informal relationships and trust built among local champions from agencies and NGOs during fuels reduction projects, however, facilitated efficient command hand-offs as the fire grew, and led to immediate recovery actions. The practical skills and equipment associated with the local mining history were also an accessible and invaluable asset in the emergency watershed engineering actions taken to avoid disastrous impacts on the municipal water supply.

At Santa Fe Trail Ranch, amenity migration and the diversity of people, skills, perspectives, and abilities typical in high amenity and rural lifestyle communities have led to distinct groups of residents with differing views on wildfire mitigation. A reliance on formal communication and programs like Firewise and fuel reduction grants has shown some success, and the CWPP process has been valuable in prioritizing projects and creating valuable electronic data that can help with wildfire response. Among landowners that are either absentee or opposed to fuels reduction work, however, no voluntary programs have thus far been able to induce action.

The archetypes and their associated adaptive capacity characteristics can also help us understand the types of actions most likely to be successful in facilitating additional wildfire adaptation in different settings. Efforts that recognize existing strengths and weaknesses of a community (as identified through the adaptive capacity characteristics) are more likely to succeed than efforts that try to elicit change through pre-designed methods. In Raton, it is unlikely that any attempt to increase the scale of fire adaptation will make substantial progress without utilizing the informal networks that characterize communication in the community. The power of relationship building in the community was demonstrated prior to, during, and after the Track fire, and there are possibilities to continue to expand the scope and scale of relationships to better prepare Raton residents for future fire events. Additional efforts will likely need to be built through individual relationships with support from local entities such as municipal and volunteer fire departments. While greater access to funding would benefit both communities, it would be a greater benefit to the economically depressed Raton. Funding that could make use of established priorities and partnerships at the local planning level would likely have the greatest leverage in Raton.

At Santa Fe Trail Ranch, the diversity of residents, formal communication networks, trust in government programs, and varying personal responsibility for fire protection dictate not just the types of preparation that have been successful, but also those that will likely continue to be successful in that community. Because of the distinct groups of residents with differing views on wildfire mitigation, outreach, education, and formal requirements for landowner action may have the greatest impact. Through the established homeowners association, SFTR has a central way of communicating outreach information as well as monitoring and enforcing fire-adapted requirements if adopted. Additional outreach and education efforts may help landowners that have moved from locations without wildfire risk to better understand the context of wildfire and its historic role in the SFTR landscape to spur more fire-

adapted residences and tracts. Even with greater education, however, the high amount of absentee landowners and the general preference to take insurance money rather than saving homes in a large wildfire event make it unlikely that wildfire risk reduction practices will be adopted at scale across SFTR without formal programs, requirements, and enforcements to do so.

This case study shows in greater the detail the types of characteristics that define local adaptive capacity and influence how WUI communities move toward greater fire adaptation. Case studies like this one were the basis for the original analysis of 18 communities that led to the development of the four archetypes, and additional investigations will continue to inform and support or adjust how we can understand the unique social contexts, opportunities, and challenges across communities.

Takeaways:

- No single approach is equally effective in all communities.
- The most effective investments and efforts will consider community context and characteristics.
- Key characteristics for consideration include:
  - Local communication modes and social networks
  - Community capacity for preparation, response, and recovery
  - Local knowledge, experience, skills, and financial capital
  - Community/agency relationships

Conclusion

The examples throughout this synthesis illustrate how the local social context of diverse communities influences different progressions toward fire adaptation. Understanding this diversity is an important step in advancing local adaptation to wildfire risk. Approaches for increasing wildfire adaptation in one community may not be appropriate in others, and informed efforts will need to consider the unique contexts of each community. Efforts in individual communities should take into account factors such as the community's modes of communication, levels of social capital, capacity and institutions for collective action, resources (such as knowledge, skills, experience, and financial capital), and relationships with governmental entities.

It is also important to consider that the social context of a community is not static. Rather, it is the result of historic and continued interactions among residents that have led to different approaches to wildfire management. Historic and ongoing interactions around wildfire management strategies, as well as the impacts of past wildfire events, also influence the current wildfire adaptation across archetypes.[17] In addition, 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." The goals and tactics of fire adaptation are constantly evolving, along with the populations exposed to changing wildfire risks.[18]

By considering the distinct features, assets, capacities, and challenges of different communities, the archetype approach can help organize our understanding of these contexts across the WUI. While the archetypes described here may well be added to and modified as research and experience in the WUI progresses, the approach we have suggested can be a template for both future research and policy development to help WUI communities deal with fire risk.

For more information on this research or a more detailed discussion of community archetypes, please see:

Paveglio, T.B., C. Moseley, M.S. Carroll, D.R. Williams, A.P. Fischer, and E.J. Davis. In press. Categorizing the social context of the Wildland Urban Interface: Adaptive capacity for wildfire and community "archetypes." Forest Science.

Endnotes

1 Fire Adapted Communities Coalition. 2013. "Guide to fire adapted communities." Available at: http://www.fireadapted.org. Last accessed: August 26th, 2014

2 Carroll, M.S., P.J. Cohn, and K.A. Blatner. 2004. "Private and Tribal Forest Landowners and Fire Risk: a Two-County Case Study in Washington State." Canadian Journal of Forest Research 34: 2148-2158.

Steelman, T.A., and S. McCaffrey. 2011. "What is Limiting More Flexible Fire Management—Public or agency pressure?" Journal of Forestry 109(8): 454-461.

Fischer, A.P., J.D. Kline, S. Charnley, and C. Olsen. 2012. "Identifying Policy Target Groups with Qualitative and Quantitative Methods: The Case of Wildfire Risk on Nonindustrial Private Forest Lands." Forest Policy and Economics 25: 62-71.

3 Paveglio, T.B., P.J. Jakes, M.S. Carroll, and D.R. Williams. 2009. "Understanding Social Complexity within the Wildland Urban Interface: A New Species of Human Habitation?" Environmental Management 43: 1085-1095.

Paveglio T.B., M.S. Carroll, and P.J. Jakes. 2010a. "Alternatives to Evacuation During Wildland Fire: Exploring Adaptive Capacity in One Idaho Community." Environmental Hazards: Human and Policy Dimensions 9(4): 379-394.

Paveglio, T.B., M.S. Carroll, P.J. Jakes, and T. Prato. 2012. "Exploring the Social Characteristics of Adaptive Capacity to Wildfire: Insights from Flathead County, Montana." Human Ecology Review 19(2): 110-124.

4 Boyatzis, R.E. 1998. Transforming Qualitative Information: Thematic Analysis and Code Development. California: Sage.

Charmaz, K. 2000. "Grounded Theory: Objectivist and Constructivist Methods." In Handbook of Qualitative Research: Second Edition, edited by N.K. Denzin, and Y.S. Lincoln, 509-535. California: Sage.

Titscher, S., M. Meyer, R. Wodak, and E. Vetter. 2002. Methods of text and discourse analysis. London: Sage.

5 Desmond, M. 2006. "Becoming a Firefighter." Ethnography 7(4): 387-421.

6 Paveglio, T.B., M.S. Carroll, and P.J. Jakes. 2010b. "Adoption and Perceptions of Shelter-In-Place in California's Rancho Santa Fe Fire Protection District." The International Journal of Wildland Fire 19(6): 677-688.

7 Carroll, M.S., P.J. Cohn, D.N. Seesholtz and L. Higgins. 2005. "Fire as a Galvanizing and Fragmenting Influence on Communities: The Case of the Rodeo-Chediski Fire." Society and Natural Resources 18(4): 301-320.

Davis, E.J., C. Moseley, M. Nielsen-Pincus, and P.J. Jakes. 2014. "The Community Economic Impacts of Large Wildfires: A Case Study from Trinity County, California." Society and Natural Resources 27(9): 983-993.

8 Paveglio et al. 2010a.

9 Rodriguez-Mendez, S., M.S. Carroll, K.A. Blatner, A.J. Findley, G.B. Walker, and S.E. Daniels. 2003. "Smoke on the Hill: A Comparative Study of Wildfire and Two Communities." Western Journal of Applied Forestry 18(1): 60-70.

Paveglio et al. 2012.

10 Jakes, P.J., L. Kruger, M. Monroe, K. Nelson, and V. Strurtevant. 2007. "Improving Wildfire Preparedness: Lessons from Communities across the U.S." Human Ecology Review 14(2): 188-197.

Jakes, P.J., C. Esposito, S. Burns, A.S. Cheng, K.C. Nelson, V.E. Sturtevant, and D.R. Williams. 2012. "Best Management Practices for Creating a Community Wildfire Protection Plan." U.S. Department of Agriculture, Forest Service, Northern Research Station: NRS-89, 27p. Available online at: http://www.nrs.fs.fed.us/pubs/gtr/gtr_nrs89.pdf.

11 Findley, A.J., M.S. Carroll, and K.A. Blatner. 2001. "Social Complexity and the Management of Small-Diameter Stands." Journal of Forestry 99(12): 18-27.

Davis et al. 2014.

12 Paveglio et al. 2009.; Paveglio et al. 2010b.

13 Davis, E.J., C. Moseley, P. Jakes, and M. Nielsen-Pincus. 2011. "The Lost Summer: Community Experiences of Large Wildfires in Trinity County, California." Ecosystem Workforce Program Working Paper #30, Institute for a Sustainable Environment, University of Oregon. Available at: http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_30.pdf.

Paveglio et al. 2012.

14 Carroll, M.S., T.B. Paveglio, P.J. Jakes, and L.L. Higgins. 2011. "Non-Tribal Community Recovery from Wildfire Five Years Later: The Case of the Rodeo-Chediski Fire." Society and Natural Resources 24(7): 672-687.

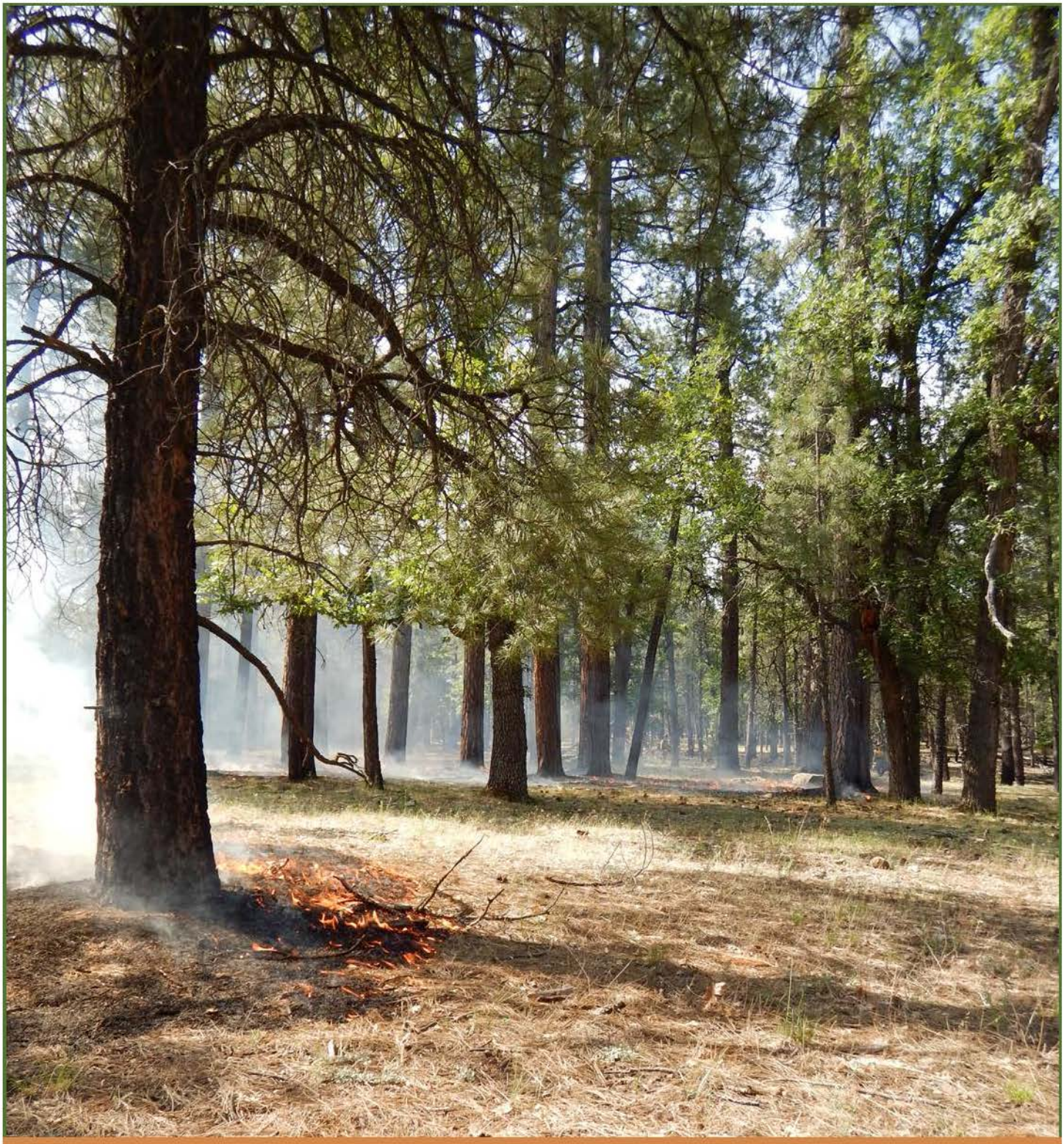
15 Carroll et al. 2004.; Paveglio et al. 2010a; Davis et al. 2014.

16 The Collaborative Forest Restoration Program (as opposed to the Collaborative Forest Landscape Restoration Program, a federal program for projects on national forest land) is unique to New Mexico, and is administered through the USDA Forest Service State and Private Forestry Program. For more information: http://www.fs.usda.gov/detail/r3/workingtogether/grants/?cid=fsbdev3_022022.

17 Eriksen, C., and N. Gill. 2010. "Bushfire and Everyday Life: Examining the Awareness-Action 'gap' in Changing Rural Landscapes." Geoforum 41: 814–825.

Carroll et al. 2011

18 Wildland Fire Executive Council. 2014. National cohesive wildland fire management strategy. Available online at: http://www.forestsandrangelands.gov/strategy/index.shtml; last accessed August 25th, 2014.



UNIVERSITY OF OREGON