

Trial by fire: Community Wildfire Protection Plans put to the test

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Abstract. Research has found that community wildfire protection planning can make significant contributions to wildfire mitigation and preparedness, but can the planning process and resulting Community Wildfire Protection Plans make a difference to wildfire response and recovery? In case studies conducted in four USA communities with Community Wildfire Protection Plans in place when wildfires occurred, we saw a range of Community Wildfire Protection Plan projects designed to change the path and intensity of the wildfires. In most of our communities, the Community Wildfire Protection Plan and planning process improved relationships among firefighting agencies, clarified responsibilities and improved communication systems, contributing to fire response efficiency and effectiveness. We found that social learning resulting from the wildfire experience motivated communities to revisit and implement their Community Wildfire Protection Plans, changing the planning frame and scale and increasing the plan's relevance for response and recovery. We conclude that Community Wildfire Protection Plans and experience with wildfire can also result in greater community capacity that builds resilience and increases adaptive capacity for future environmental changes and disasters.

Received 22 September 2012, accepted 30 April 2013, published online 13 August 2013

Introduction

Since 2003, community-based collaborative planning for wildfire in the USA has been promoted by the *Healthy Forest Restoration Act* (HFRA) and its call for community wildfire protection plans (CWPPs)^A (Steelman and Burke 2007; Fleeger 2008; Jakes *et al.* 2011). With a focus on hazardous fuels treatment and reducing structural ignitability, CWPPs address the need for wildfire readiness (mitigation and preparedness). Emergency managers have long stressed the importance of hazard mitigation as a component of the three Rs of emergency management: readiness, response and recovery (Godschalk *et al.* 1999; Britton 2001; McCool *et al.* 2006). The broader promise of emergency management is that steps to strengthen the three Rs will contribute to community resilience and adaptive capacity for living with disasters such as those arising from wildland fire. Resilience is the ability of ecological and social systems to absorb disturbance without changing system structure (Gunderson and Holling 2002; Berkes *et al.* 2003). The more resilient a community is to disturbances such as wildfire, the less likely it is to experience catastrophic losses as a result of these events (Gunderson 2009; Tierney 2009). Adaptive capacity refers to the ability of a community to mobilise resources with a goal of adjusting or adapting to environmental

change (Nelson *et al.* 2007). Although resilience is considered to be a short-term response to an environmental stressor, adaptation is a longer-term response that requires the capacity to learn from the event and to develop significant corrections and adjustments (Brooks and Adger 2004).

Community capacity contributes to disaster readiness and therefore resilience and adaptive capacity (Allen 2006; Norris *et al.* 2008). Community capacity is 'the interaction of human capital, organisational resources and social capital existing within a given community that can be leveraged to solve collective problems and improve or maintain the well-being of a given community' (Chaskin 2001, p. 295). In an earlier study of 13 communities becoming more fire-adapted through community wildfire protection planning (Jakes *et al.* 2007; Grayzeck-Souter *et al.* 2009; Brummel *et al.* 2010; Jakes *et al.* 2011, 2012), we found that CWPP processes and projects built community capacity, including the development of new skills, improved relationships, expanded networks, social learning and civic norms, and the identification of additional resources (Fig. 1).

Whereas our earlier research confirmed that CWPPs contribute to wildfire readiness, one emergency manager asked our research team, 'Does it make a difference if a community has

^AA community wildfire protection plan (CWPP) is created by an at-risk community in collaboration with emergency management and land-management agencies and other stakeholders to help manage the local wildland fire risk. At a minimum, a CWPP maps the community's wildland-urban interface, prioritises areas requiring hazardous fuels treatments and develops recommendations for reducing structural ignitability.

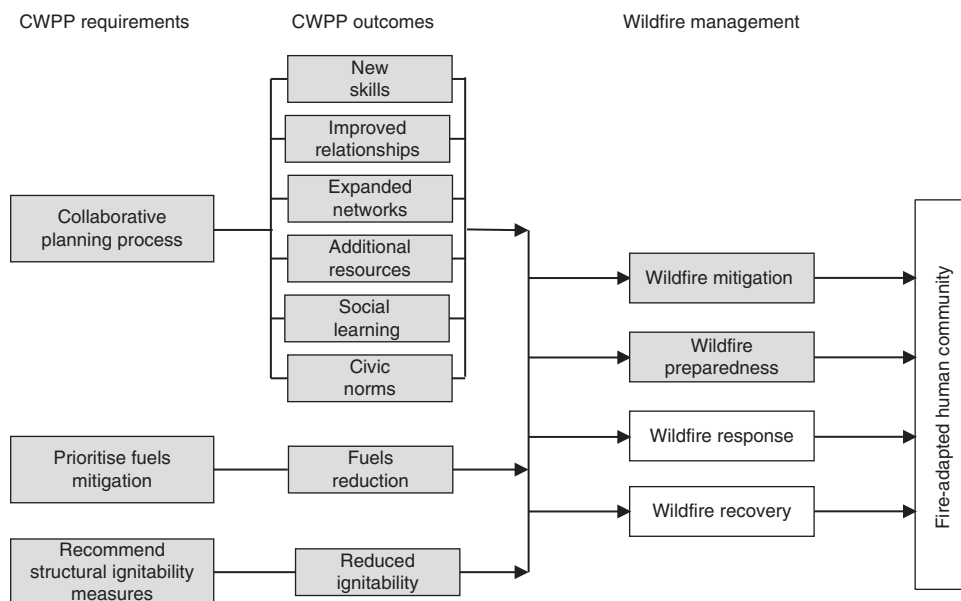


Fig. 1. Community wildfire protection planning (CWPP) requirements: that a collaborative process be used to prioritise areas for fuels mitigation and to recommend measures to reduce structural ignitability, produce outcomes that contribute to wildfire management and a community being adapted for wildfire. Research supporting the relationships indicated by the shaded boxes is found in [Jakes *et al.* \(2007, 2011\)](#).

a CWPP in place when the fire comes?’ We conducted research to begin to answer this question, investigating the benefits of having a CWPP during wildfire response and recovery.

Methods

We conducted case studies in four communities that had developed and implemented (to some degree) a CWPP before a wildfire burned into their area – Cook County, Minnesota; Taylor, Florida; Trinity County, California; and Valley County, Idaho. Case-study research is used by social scientists to investigate the who, what, how and why of contemporary events ([Yin 2003](#)).

Because there has been no research addressing the benefits of having a CWPP in place to wildfire response and recovery, we conducted exploratory research using a qualitative inductive approach ([Corbin and Strauss 2008](#); [Saldana 2009](#)). Study participants were selected using purposeful sampling, with individuals chosen because of their knowledge or experience with the CWPP process and the wildfires of interest ([Lindlof and Taylor 2002](#)). Starting in spring 2009 through spring 2010, we talked to 42 individuals including local emergency managers and firefighters, elected officials, representatives of governmental agencies and non-governmental organisations, independent contractors, members of the CWPP committee and residents. Most of our data were collected using interviews; however, in Taylor and Valley County, members of the CWPP committees preferred to talk to us as a group, which we did using the interview questions as the focus group discussion guide. Focus groups ran for 2 h, interviews ran approximately 1 h.

We gathered data until we agreed that emergent themes or responses had stabilised and no new information would be forthcoming from additional discussions. Except for two interviews, we were both present for all discussions. All discussions

but one were audio-recorded and transcribed. In the one exception, the interviewee felt that she could speak more openly if not recorded, so both authors kept detailed interview notes.

Each author coded all transcripts, identifying themes related to the CWPP process, the benefits of having a CWPP in place when the fire arrived and any modifications to the CWPP as a result of the fire for all discussions in each community. We then compared themes, reconciled any apparent contradictions and identified a final set of themes emerging from each community. Working across communities, we identified a set of themes that reflected findings in all communities. As a final step, we selected the most representative quotes for the cross-community themes. This coding strategy provided a systematic way to identify salient themes based on their reoccurrence in the data ([Boyatzis 1998](#); [Silverman 2001](#)).

We also reviewed the CWPPs and newspaper articles, official reports and other memoranda related to the fire. These documents allowed us to expand on our findings by filling in details that were difficult for interviewees to remember.

Our unit of analysis was determined by the scope of the CWPP – the county in three cases and a town in one. We refer to these units as communities but recognise that they consist of various sub-communities and governance structures.

Results

Cook County, Minnesota

Cook County is located in the Arrowhead Region of north-eastern Minnesota, and fire has been a frequent visitor to the area’s boreal forests ([Table 1](#)). In 1999, a blowdown event levelled trees on more than 1500 km² of forestland in the region, and a fuels risk assessment found that the storm had significantly increased fire risk in the area ([Fites *et al.* 2007](#)). An interagency storm-recovery strategy was developed that focussed on fuels

Table 1. Demographics, forest types, community wildfire protection plan (CWPP) characteristics and fire attributes for case study communities

Characteristics	Case study communities			
	Cook County, Minnesota	Taylor, Baker County, Florida	Trinity County, California	Valley County, Idaho
Demographics (county statistics)				
• Population (2011 estimate)	• 52 18	• 27 154	• 13 723	• 9638
• Land area (km ²) [square miles] (2010)	• 3761 [1452]	• 1515 [585]	• 8234 [3179]	• 9492 [3665]
• Density (persons per square kilometre)	• 9.3 [3.6]	• 119.9 [46.3]	• 11.1 [4.3]	• 7.0 [2.7]
• [persons per square mile] (2010)				
• Median household income (US\$) (2006–10)	• 49 162	• 47 276	• 38 725	• 50 851
• Median owner-occupied home value (US\$) (2006–10)	• 247 100	• 137 900	• 268 200	• 287 100
Forests				
• Boreal forest of pine, spruce and a highly flammable balsam component		Pine flatwoods and cypress–hardwood swamps	Ponderosa pine, Douglas-fir, subalpine to Trinity Alps montane chaparral	Douglas-fir, lodgepole pine, subalpine and dry forests
CWPP				
• Date signed	• 2005	• 2006	• 2005	• 2004
• Scale	• County	• Town of Taylor	• County with nested community plans	• County
• Initiated and led by	• Superior National Forest staff	• Florida Forest Service staff	• Trinity County Fire Safe Council	• Idaho State Forester, private consultant
Fire attributes				
• Fire	• Cavity Lake Fire	• Georgia Bay Complex	• Iron and Alps Complex	• Cascade Complex Fires
• Estimated area burned (ha) [acres]	• 13 000 [32 000]	• 243 000 [600 000]	• 81 000 [200 000]	• 121 000 [300 000]
• Month started	• July 2006	• April 2007	• July 2008	• August 2007
• Cause of start	• Lightning	• Lightning	• Lightning	• Lightning
• Fire	• Ham Lake Fire			
• Estimated area burned (ha) [acres]	• 14 700 [36 443] in US, 30 300 total [75 000]			
• Month started	• May 2007			
• Cause of start	• Campsite fire escape			

reduction, fire prevention, fire suppression and emergency response preparedness (Superior National Forest 2006).

The CWPP

The Cook County CWPP was signed in 2005, and was seen as one of several initiatives responding to the blowdown – ‘one more piece of the puzzle’ [National Forest staff]. The CWPP contributed to a countywide strategy to address wildfire risk that also included an ongoing Firewise^B program and a biomass initiative.

The CWPP, initiated by Superior National Forest staff, was described by a member of the CWPP committee as a plan for ‘the pros – the sheriff, the Forest Service, the [Department of Natural Resources]’. The Firewise program was described as addressing the needs of local residents, providing them with information about reducing their wildfire risk. The Firewise and CWPP committees come together in the design and implementation of projects, promoting the mitigation of wildfire risk across ownerships. The biomass initiative focuses on bringing businesses to the area to utilise the small-diameter woody material being removed during fuels reduction projects. To ensure coordination and cooperation among the three groups, the committees have overlapping membership and meet consecutively on the same day of the month.

Study participants identified several benefits from developing and implementing the Cook County CWPP. The CWPP helped identify and define differences between disaster management resources on the east side and west side of the county and encouraged efforts to bring the entire county up to the same standards. The CWPP mapped the wildland–urban interface and identified gaps in emergency coverage; steps were taken to eliminate ‘no-service’ zones. The CWPP mapped wildfire risk and provided evidence of the need for mitigation activities across the county, thus helping link fuels mitigation projects across ownerships. Finally, study participants felt that having the CWPP and implementing its projects helped the county compete for grants.

The fire

In July 2006, the Cavity Lake Fire burned nearly 13 000 ha in Cook County, making it the largest fire in the area in more than a century. Less than 1 year later, the Ham Lake Fire burned more than 14 700 ha in Cook County. Fuels treatments carried out as part of the storm-recovery strategy helped moderate the effects of both fires and provided areas the firefighters could use to anchor burnouts and other fire-response activities (McDaniel 2006; Fites *et al.* 2007). Sprinkler systems, many installed after the blowdown, saved several homes and businesses and provided safety zones for firefighters (Johnson *et al.* 2008).

Did the CWPP have an effect on wildfire response and recovery?

Most of the natural resource and wildfire professionals we interviewed found it difficult to tease out wildfire response and recovery effects of the CWPP versus all the other fire-management initiatives going on in Cook County, and when pressed for an opinion, felt that the CWPP made very little

difference. Individuals not regularly involved in forest and wildfire management generally felt that the networks and relationships developed as a result of the CWPP made it easier to communicate during and after the fire. A lakeshore owner association member shared how he was able to contact wildfire managers met during the CWPP process to obtain up-to-date information during the fire, which informed resident decisions about evacuation. A local government employee said that because of relationships developed during the CWPP process, decisions related to recovery, including identifying where to dispose of debris from the fires, were made more quickly and had wider support.

Did the fire have an effect on the CWPP and the community's capacity to live with wildfire?

At the time of this study, the 2005 CWPP was being rewritten to take advantage of lessons learned during the fires. The fires affirmed the importance of being prepared for evacuation; the updated CWPP focuses on planning for and practising evacuations. The fires identified problems with communication systems critical during the wildfires; the updated CWPP identifies necessary improvements. The fires demonstrated that the effectiveness of the sprinkler systems for reducing structural ignitability and protecting firefighters was enhanced when coupled with vegetation management. Finally, the fires demonstrated the effectiveness of prescribed burning, forest thinning and defensible space actions for reducing the effects of wildland fire, increasing support for additional collaborative treatments, including those identified in the CWPP.

Taylor, Florida

Residents of Taylor, in north-eastern Florida's Baker County, regularly experience wildland fires (Winter *et al.* 2006) and long-time residents generally understand wildfire risks. However, Taylor has recently seen an influx of new residents; industrial forests are increasingly being sold to developers, resulting in an expanding wildland–urban interface (Brummel *et al.* 2008). New residents are described as less aware of wildfire but have shown that they are willing to learn.

The CWPP

The Florida Forest Service (FFS) was already working with towns on becoming nationally recognised Firewise Communities when the Florida State Forester added CWPPs to the list of priorities for state mitigation specialists. The Taylor CWPP was written by a committee composed of FFS and National Forest staffers, the county fire chief, a representative from the local timber company and a local pastor. The pastor was seen as the link to local residents and the Sunday church bulletin became a tool for community wildfire education.

The CWPP defined and clarified responsibilities for local wildfire readiness, response and recovery, identified resources available for wildfire management and developed alternative evacuation routes. Early in the CWPP process, committee members teamed up to walk through high-risk neighbourhoods, noting the location of homes in relation to public land boundaries, identifying hazards present in each home ignition zone and

^BThe use of the term Firewise in this manuscript generally refers to a state's adaptation of the national Firewise Communities program (www.firewise.org, accessed 26 June 2013). When referring to the national program, we use the phrase ‘Firewise Communities’.

mapping wildfire risk. This activity was undertaken because the committee recognised that 'local knowledge was very important' to wildfire management [National Forest staff]. Community education priorities were also identified in the CWPP.

The first CWPP project undertaken was a fuel break around Taylor, and an existing break was re-established and new areas cleared to make the break continuous around the community. This project depended on support from the US Forest Service, FFS, forest industry and private landowners, and its completion demonstrated their commitment to the CWPP (Jakes *et al.* 2011). Additional benefits from developing and implementing the CWPP included joint training among the US Forest Service, FFS and county fire teams, qualifying many county firefighters for wildland firefighting. Maps showing the location of community infrastructure and firefighting resources were also produced. Members of the CWPP committee believe that the plan enabled them to obtain grants to fund mitigation work; they also stressed the importance of collaboration and relationships built during the planning process.

The fire

In April 2007, fires burning on the Georgia side of the Okefenokee Wildlife Refuge merged and ran more than 32 km into Florida (Georgia Forestry Commission 2007). The fire threatened Taylor and all residents were told to evacuate. For 3 days, teams of firefighters from the US Forest Service, FFS, Georgia Fire Commission and the Baker County Fire Department battled the fire on the outskirts of Taylor. The turning point came when the CWPP fuel break was used to anchor a backburn, widening the protection zone and allowing firefighters to save Taylor. In the end, what were known as the Georgia Bay Complex fires burned nearly 243 000 ha in Florida and Georgia.

Did the CWPP have an effect on wildfire response and recovery?

The fire chief articulated what we heard during many interviews, that because of the CWPP 'when the fire came, we were ready'. In terms of response, CWPP-sponsored training qualified county firefighters to work on wildland fire, expanding the pool of local firefighters. The CWPP fuel break was used to anchor the backburn that saved the town. New evacuation routes mapped in the CWPP were employed during the fire. Additional CWPP maps showed the location of residents at risk and high-value infrastructure and resources, and were used by the incident command team during response.

Did the fire have an effect on the CWPP and the community's capacity to live with wildfire?

We were told that the fire raised residents' awareness of the completed fuelbreak and its importance to the response effort: 'We didn't realise that they had ... made fire lines [as part of the CWPP]. And that's probably the most important thing that kept the fire off of us' [Taylor resident]. As a result of the fire, CWPP projects have expanded to private home sites; grants have been obtained to cover the costs of some mechanical treatments around homes and yard signs call attention to the work. Briefings held after the fire and residents' experiences during the fire encouraged the community to take the steps necessary to become a recognised Firewise Community.

Trinity County, California

Over the past 25 years, the ecological, economic and health costs of catastrophic wildfires have become particularly evident to residents and visitors to north-western California's Trinity County – nearly 28 000 ha burned in the county in 1987 and over 400 000 ha in both 1999 and 2006. These fires galvanised the county to support fire planning efforts: 'Because of past fires, communities felt a sense of urgency – this [CWPP] was a way for them to start' [National Forest manager].

The CWPP

The Trinity County Fire Plan was initiated in 1998 and completed in 2000, before federal guidelines for CWPPs were in place. In 2005, the Trinity County Fire Safe Council coordinated an effort to modify the Trinity County Fire Plan and obtain the necessary signatures to meet CWPP requirements. CWPPs for smaller communities were nested in the county CWPP.

The CWPP identified assets at risk from wildfire, coordinated forest restoration projects, proposed projects to reduce hazardous fuels and construct fire breaks across private and public land, provided outreach to residents, gathered information about public values, developed alternative evacuation routes and identified steps to increase firefighter safety. In a county with small communities scattered across such a large area, it was a challenge to meet each community's expectations. A process for ranking federal fuel-reduction projects was modified by the CWPP committee, ensuring the needs of isolated small communities were not forgotten and that the highest-priority projects for each community were undertaken first. The promise of federal fuels management funding for counties with CWPPs was a major incentive for engaging in the process.

The fire

On 20 June 2008, a series of thunderstorms produced more than 3000 lightning strikes that ignited over 100 wildfires in Trinity County. Although many of these fires were quickly extinguished by firefighters or died out on their own, two clusters of wildfires on the Shasta-Trinity National Forest burned for 3 months, causing locals to refer to that time as 'the lost summer' (Davis *et al.* 2011). By the end of the summer of 2008, more than 101 000 ha had burned in Trinity County, with Forest Service suppression costs exceeding US\$150 million (Nielsen-Pincus *et al.* 2011).

Did the CWPP have an effect on wildfire response and recovery?

Many of the people interviewed in Trinity County identified the collaboration and organisational capacity built during the CWPP process as the major benefit for wildfire response. However, they felt that recovery after the fire did not benefit from the CWPP projects, partly because responders did not utilise CWPP projects completed or in place that could have minimised damage.

'Around Hayfork, the fire burned up two places where we had done community wildfire protection work. I think I can safely say that because of the [CWPP] work, they were safer places for direct attack, you know. But when it came down to it and the fire event was happening, [the responders] didn't rely on those' [National Forest staff].

The CWPP was generally seen as having more effect on wildfire response and recovery by individuals not involved in natural resource and wildfire management, such as local government officials, business people and local residents, than by those who were involved. Benefits were generally described in terms of the relationships developed that made it easier for those not directly involved with the fire to gather and distribute information during the fire.

Did the fire have an effect on the CWPP and the community's capacity to live with wildfire?

As we have seen in our other communities, the fire had a larger effect on the CWPP than the CWPP had on the fire:

'So what [the fire] brought to light for us is that our plan needed to really think a lot more about how we are affected in an incident and how [the CWPP] could be useful in an incident.' [Community-based forestry organisation staff]

An extensive CWPP revision process was undertaken. Numerous community meetings were held to update the maps and newer geographic information system (GIS) software was used to ensure that the map format would be accessible for incident command teams and emergency responders.

The fires helped build public support for projects identified in the CWPP that will facilitate future response and recovery. Federal forest managers are helping local residents understand what it means to reside in a fire-dependent ecosystem and the CWPP will continue to play a role in helping people build self-sufficiency:

'People have to learn how to take care of themselves... people have to rethink how they're going to survive in a fire-adapted ecology and particularly one that's ... out of sync. So the CWPP has a pretty strong role in doing that.' [National Forest staff]

Valley County, Idaho

Valley County, less than a 2-h drive due north of Boise, Idaho, is known as 'Boise's playground'. Nearly 90% of the county is in federal ownership and past land-use practices and a century of fire suppression have altered forest structure so that it has become more susceptible to large-scale, high-intensity fires (Schlosser *et al.* 2004).

The CWPP

The Idaho State Forester determined that CWPPs would be developed at the county scale, and, after a competitive process, the Valley County Commissioners hired a consulting firm in Moscow, Idaho, to develop the Valley County CWPP, one among many created by this firm. Managers and emergency responders interviewed described the 2004 CWPP as a template-driven plan that was irrelevant to community efforts to address wildfire management issues: 'I was part of the group that tried to put this together a bit, but I don't think it was really worth the money [that was spent] on it' [Idaho Department of Lands staff].

Idaho Department of Lands (IDL) requested that counties update their CWPPs and in the fall (autumn) of 2006, one of their local foresters volunteered to chair the Valley County CWPP

Working Group. He expanded CWPP committee membership and formed subcommittees to better address local community concerns (Valley County Fire Working Group 2010). These subcommittees were not fully mobilised when the fires arrived.

The fire

On 17 July 2007, a series of thunderstorms ignited more than 25 fires in central Idaho. Although firefighters were able to control the majority of these fires, several escaped suppression efforts and merged to become the Cascade Complex of wildfires, burning more than 121 000 ha (Graham *et al.* 2009).

Did the CWPP have an effect on wildfire response and recovery?

Individuals interviewed told us that the CWPP made little difference to the response or recovery from the 2007 fires, largely because few if any projects in the 2004 CWPP were implemented and the updating process was still in its infancy.

Did the fire have an effect on the CWPP and the community's capacity to live with wildfire?

The fires were credited with 'waking us up' and making the community more aware of wildfire risk and the need for action. The CWPP Working Group and subcommittees increased efforts to revisit and revise the plan:

'All of a sudden it was like, we need to get out there. We need to educate the people... So, it's because of the fire, we've moved up faster than I ever anticipated we would.'

Funding was sought to carry out mitigation projects, and calls for collaboration as part of the grant application processes encouraged people to work together. The CWPP Lands Subcommittee worked to ensure that there was more coordination between fuels mitigation on public and private land. Trust began to improve between the Forest Service and residents of local communities. Local residents, fire professionals and land managers were optimistic that these new efforts will help reduce wildfire risk:

'I think this new plan, the revisions we're going through now ... I see it as a huge step. I mean, there are so many disasters down here on the valley floor waiting to happen. It's just a matter of time. But this is a good effort... I mean, it's going to make a difference sooner or later.' [National Forest staff]

Discussion and conclusion

In this exploratory study, we have begun to document the benefits of community wildfire protection planning to wildland fire response and recovery. The direct benefits of CWPP outcomes to wildfire response and recovery were obvious only to study participants in Taylor, Florida; there are reasons that CWPP benefits were not as obvious in other communities. In Cook County, Minnesota, and Trinity County, California, actions to manage wildfire risk have been going on for many years and people do not necessarily distinguish who initiated or championed any one effort; rather, the different initiatives are seen as an overall approach to living with wildfire. This abundance and joint sponsorship of activities made it difficult for individuals to identify benefits from any one program. In Valley County,

Table 2. The effect of outcomes from developing and implementing a community wildfire protection plan (CWPP) on fire response and recovery and effects of the fire on CWPP outcomes

CWPP outcomes		CWPPs			
	Cook County, Minnesota	Taylor, Florida	Trinity County, California	Valley County, Idaho	
Effect of CWPP outcomes on fire response and recovery					
1. Community capacity					
• Better relationships	Contributed to better communication during response and recovery	Contributed to better communication during response and recovery	Contributed to better communication during response and recovery		
• Better collaboration or coordination	Contributed to finding ways to dispose of debris after the fires	Expanded firefighter pool			
• Training or new skills		• Maps of evacuation routes			
• New resources or maps		• Maps of residents and resources at risk			
2. Fuels reduction or treatments		Fuel break provided anchor for back-burns, redirected fire			
3. Decreased structural ignitability					
Effect of the fire on the CWPP outcomes					
1. Community capacity					
• Increased community awareness of wildfire risk	• Broader community support for more fuel treatments on public and private land	Community supported and worked for Firewise designation	• Broader community support for more fuel treatments on public and private land	Increased community awareness of wildfire risk	
	• Fire districts across the county working on evacuation planning		• Group organising to liaise between community and incident command teams during next fire		
			• Group organising to improve local wildfire response capabilities		
• Improved or expanded wildfire planning	Community revising CWPP	Community revising CWPP	Community revising CWPP	Community revising CWPP	
• Better communication	Have identified need for improvement and working to make those improvements				
• More resources	Obtained funding for additional sprinklers	Funding sought to expand treatment on public and private land	New maps of values at risk	• Funding sought for mitigation projects	
				• Funding for new equipment	
2. Fuels reduction or treatments	Encouraged linking fuels treatment on public and private land	More treatments planned on public and private land		• More mitigation projects planned	
				• Working to link project on public and private land	
3. Decreased structural ignitability	More sprinklers being installed				

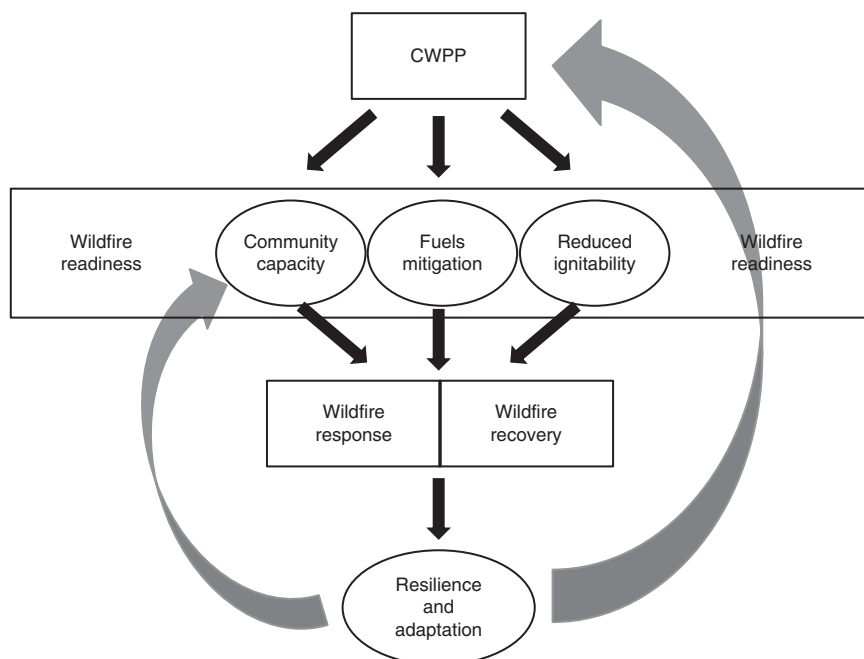


Fig. 2. Model illustrating that community wildfire protection plans (CWPPs) have outcomes related to wildfire readiness (including building community capacity, fuels mitigation and reduced structural ignitability) that affect wildfire response and recovery. During a wildfire event, communities mobilise these capacities, resulting in increased resilience and adaptation, further building community capacity and revising the CWPP to improve readiness for the next event.

Idaho, local initiatives to engage the public in wildfire management were relatively new at the time of this study, so awareness to the CWPP effort was just beginning to grow. Nevertheless, analysis of data from all four communities found that CWPPs contribute to building community capacity, improving resilience and building community adaptive capacity to live with wildfire (Table 2).

Our research suggests linkages between CWPP outcomes and community adaptive capacity as illustrated in Fig. 2. The model begins with findings from this and earlier research (Jakes *et al.* 2007, 2011) that found CWPPs produced outcomes that contribute to wildfire readiness by building community capacity, mitigating fuels and reducing structural ignitability (incorporating relationships highlighted in Fig. 1). Analysis of new data from our four case studies allows us to suggest that individual, organisational and community capacities built during the readiness stage are mobilised during and immediately after a wildfire to meet the challenges of response and recovery – demonstrating a community’s resilience. The social learning that occurs during response and recovery further builds community capacity and improves planning for future events, contributing to a community’s resilience and fostering adaptation. In our model, the larger up-arrows represents findings from the four case studies that mobilisation of capacities builds further community capacity, particularly as they all revisited their CWPPs.

Three themes emerged from this research. The strongest theme emerging from our analysis was the interviewees’ belief in the value of community-based collaborative wildfire planning, as evidenced by their commitment to revising and implementing their CWPPs following the fires. In Cook County, the

fire pointed out the need to expand the CWPP focus on evacuation, communication system improvements and linking the installation of sprinkler systems to the reduction of hazards in the home ignition zone, all of which are being addressed in the plan revision. In Taylor, the fire caught the attention of local homeowners and has encouraged the CWPP committee to expand projects that address fuels mitigation and structural ignitability on home sites. In Valley County, the fire convinced the County Commissioners of the need to provide resources to support a CWPP-revision subcommittee. In Trinity County, the fire spurred a series of meetings to revisit CWPP mapping of local knowledge for emergency response and public values for project prioritisation. CWPPs have been characterised as living documents (Williams *et al.* 2012) and the commitment of our case-study communities to revising their plans highlights the truth of this characterisation.

A second theme is that the CWPP process created a framework that allowed communities to mobilise community interest generated by the fires in structured venues for dialogue that encouraged social learning not only about wildfire management, but about forest health and community wellbeing. For instance, Cook County’s CWPP is integrated with other local institutions, contributing to efforts to expand utilisation of material produced during fuel reduction projects and diversify the local economy. The CWPP Working Group in Valley County addressed escalating growth of subdivisions with guidelines for covenants and regulations. In Trinity County, an organisation with expanded capacity from CWPP activities trained workers for forest restoration and created a regional network to support prescribed burning.

A third theme from our data analysis was how the social learning that can occur during and immediately after a wildfire creates the potential to build community capacity and contribute to adaptive capacity and resilience for future events. For example, the wildfires in Cook County spurred the CWPP committee to draw on and further develop the leadership skills and technical knowledge of local residents to address fire protection needs, expanding awareness and support for future wildfire management activities. In Taylor, the fire highlighted the benefits of relationships built between the county fire district and US Forest Service, which has encouraged more collaboration to reduce wildfire risk. The Cascade Complex fires helped the Valley County CWPP committee engage a wealthy resort neighbourhood that funded new suppression equipment and improved preparedness. In Trinity County, the fires pointed out institutional changes needed to increase local community involvement in future fire events. For example, the Trinity County Board of Supervisors has selected local residents to serve as 'Local Area Advisors' who will function as local liaisons to future incident command teams under the supervision of the Trinity County Office of Emergency Services. In addition, the newly organised Concerned Citizens for Responsible Fire Management, made up of retired fire professionals, is investigating ways to restore local capacity for initial attack during large fire events. This new community capacity in all four communities will facilitate long-term adaptation to wildfire.

In all our communities, actions taken in creating or implementing the CWPP increased the communities' resilience and adaptive capacity, particularly after their wildfire event. Residents increased their understanding of the reality of living in fire-dependent ecosystems, how they can take responsibility for reducing risk to their property and ways they can participate in or support collective action for wildfire management, all contributing to the adaptive capacity of their communities. Residents also became aware of the steps local community organisations and state and federal agencies have taken to mitigate their risk and many have become more supportive of wildland fire and forest management. CWPP mapping exercises allowed communities to identify residents at risk and also those local, state and federal agencies who could provide assistance. Accordingly, CWPPs contributed to communities being better able to assess and address their vulnerabilities to wildfires and other natural disasters and better equipped to take responsibility for addressing them.

This research has described the effects of the CWPP process and implementation not only on wildfire readiness but also on response and recovery. The model emerging from the data reinforces the supposition that a community's CWPP and wildfire experience (1) build community capacity and (2) mobilise the community to take steps for adaptation based on their learning. In addition, the model highlights the benefits of community wildfire protection planning and provides support for continuing and expanding planning initiatives. The model has the potential to guide researchers in formulating hypotheses and questions that will produce findings to help local decision-makers, emergency and resource managers and local residents increase the capacity of their communities to not only be resilient in the event of wildfires, but to learn from these events and build

community adaptive capacity for future environmental risks and disasters.

Acknowledgements

This research was supported by the National Fire Plan through the Northern Research Station and by the Station's 'People and their Environment' research work unit. Special thanks to Gwyneth Myer who helped with data collection and analysis. Thanks also to the individuals interviewed for this study – their shared experiences provided the data that were the foundation for this research.

References

- Allen K (2006) Community-based disaster preparedness and climate adaptation: local capacity building in the Philippines. *Disasters* **30**(1), 81–101. doi:10.1111/J.1467-9523.2006.00308.X
- Berkes F, Colding J, Folke C (2003) 'Navigating Social–Ecological Systems: Building Resilience for Complexity and Change.' (Cambridge University Press: Cambridge, UK)
- Boyatzis RE (1998) 'Transforming Qualitative Information: Thematic Analysis and Code Development.' (Sage: Thousand Oaks, CA)
- Britton NR (2001) A new emergency management for the new millennium? *Australian Journal of Emergency Management* **Summer**, 44–54.
- Brooks N, Adger WN (2004) Assessing and enhancing adaptive capacity. Technical Paper number 7. In 'Adaptation Policy Framework'. (Ed. LM Lim) (United Nations Development Programme: New York) Available at http://content.undp.org/go/cms-service/stream/asset/?asset_id=2200854 [Verified 18 July 2012]
- Brummel R, Grayzeck-Souter S, Nelson K (2008) Community profile: Taylor, Florida. Community Wildfire Protection Plans: enhancing collaboration and building community capacity. (Fort Lewis College: Durango, CO) Available at <http://jfsp.fortlewis.edu/Profiles/TaylorFL.asp> [Verified 26 June 2012]
- Brummel RF, Nelson KC, Souter SG, Jakes PJ, Williams DR (2010) Social learning in a policy-mandated collaboration: community wildfire protection planning in the eastern United States. *Journal of Environmental Planning and Management* **53**(6), 681–699. doi:10.1080/09640568.2010.488090
- Chaskin R (2001) Building community capacity: a definitional framework and case studies from a comprehensive community initiative. *Urban Affairs Review* **36**, 291–323. doi:10.1177/10780870122184876
- Corbin J, Strauss A (2008) 'Basics of Qualitative Research', 3rd edn. (Sage Publications: Los Angeles, CA)
- Davis EJ, Moseley C, Jakes P, Nielsen-Pincus M (2011) The lost summer: community experiences of large wildfires in Trinity County, California. University of Oregon Institute for a Sustainable Environment, working paper number 30. (Eugene, OR) Available at http://www.nrs.fs.fed.us/pubs/jrnl/2011/nrs_2011_davis_001.pdf [Verified 19 July 2012]
- Fites JA, Reiner A, Campbell M, Taylor Z (2007) Fire behavior and effects: suppression, and fuel treatments on the Ham Lake and Cavity Lake fires. (Superior National Forest, Eastern Region, US Forest Service: Duluth, MN) Available at http://www.fs.fed.us/adaptivemanagement/projects/FBAT/docs/HamLake07_22_08.pdf [Verified 22 June 2012]
- Fleeger WE (2008) Collaborating for success: community wildfire protection planning in the Arizona White Mountains. *Journal of Forestry* **106**(2), 78–82.
- Georgia Forestry Commission (2007) The historic 2007 Georgia wildfires: learning from the past – planning for the future. (Georgia Forestry Commission: Macon, GA) Available at http://www.wildfirelessons.net/documents/historic_2007_ga_wildfires.pdf [Verified 19 July 2012]
- Godschalk DR, Beatley T, Berke P, Brower DJ, Kaiser EJ, Bohl C, Goebel C, Matther R (1999) 'Natural Hazard Mitigation: Recasting Disaster Policy and Planning.' (Island Press: Washington, DC)
- Graham RT, Jain TB, Loseke M (2009) Fuel treatments, fire suppression, and their interactions with wildfire and its effects: the Warm Lake

- experience during the Cascade Complex of wildfires in Central Idaho, 2007. USDA Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-229. (Fort Collins, CO)
- Grayzeck-Souter SA, Nelson KC, Brummel RF, Jakes P, Williams D (2009) Interpreting federal policy at the local level: the wildland–urban interface concept in wildfire protection planning in the eastern United States. *International Journal of Wildland Fire* **18**(3), 278–289. doi:10.1071/WF08081
- Gunderson L (2009) Comparing ecological and human community resilience. CARRI Research Report 5. (Community and Regional Resilience Institute: Oak Ridge, TN) Available at http://www.resilientus.org/library/Final_Gunderson_1-12-09_1231774754.pdf [Verified 15 June 2009]
- Gunderson LH, Holling CS (Eds) (2002) 'Panarchy: Understanding Transformations in Human and Natural Systems.' (Island Press: Washington, DC)
- Jakes P, Burns S, Cheng A, Saeli E, Nelson K, Brummel R, Grayzeck S, Sturtevant V, Williams D (2007) Critical elements in the development and implementation of community wildfire protection plans (CWPPs). In 'The Fire Environment – Innovations, Management, and Policy: Conference Proceedings', March 2007, Destin, FL. (Eds BW Butler, W Cook) USDA Forest Service, Rocky Mountain Research Station, RMRS-P-46CD, pp. 613–625. (Fort Collins, CO)
- Jakes P, Esposito C, Burns S, Cheng A, Nelson KC, Brummel R, Sturtevant VE, Williams DR (2012) Best management practices for creating a Community Wildfire Protection Plan. USDA Forest Service, Northern Research Station, General Technical Report NRS-GTR-89. (Newtown Square, PA)
- Jakes PJ, Nelson KC, Enzler SA, Burns S, Cheng AS, Sturtevant V, Williams DR, Bujak A, Brummel RF, Grayzeck-Souter S, Staychock E (2011) Community wildfire protection planning: is the Healthy Forests Restoration Act's vagueness genius? *International Journal of Wildland Fire* **20**, 350–363. doi:10.1071/WF10038
- Johnson JF, Downing T, Nelson KC (2008) External sprinkler systems and defensible space: lessons learned from the Ham Lake fire and the Gunflint Trail. A report prepared for the Firewise Program, Minnesota Department of Natural Resources. (University of Minnesota Department of Forest Resources: St Paul, MN) Available at http://www.forestry.umn.edu/prod/groups/cfans/@pub/@cfans/@forestry/documents/asset/cfans_asset_183520.pdf [Verified 5 September 2012]
- Lindlof TR, Taylor BC (2002) 'Qualitative Communication Research Methods', 2nd edn. (Sage Publications: Thousand Oaks, CA)
- McCool SF, Burchfield JA, Williams DR, Carroll MS (2006) An event-based approach for examining the effects of wildland fire decisions on communities. *Environmental Management* **37**, 437–450. doi:10.1007/S00267-005-0054-0
- McDaniel J (2006) 'That thing was rolling': the Cavity Lake Fire. Advances in Fire Practice. (Wildland Fire Lessons Learned Center: Tucson, AZ) Available at <http://wildfirelessons.net/SearchResults.aspx?q=Cavity%20Lake> [Verified 22 June 2012]
- Nelson DR, Adger WN, Brown K (2007) Adaptation to environmental change: contributions of a resilience framework. *Annual Review of Environment and Resources* **32**, 395–419. doi:10.1146/ANNUREV.ENERGY.32.051807.090348
- Nielsen-Pincus M, Moseley CA, Davis EJ (2011) Fire suppression costs and impacts of the 2008 wildfires in Trinity County, California. University of Oregon Institute for a Sustainable Environment, working paper number 31. (Eugene, OR) Available at http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/WP_31.pdf [Verified 19 July 2012].
- Norris F, Stevens S, Pfefferbaum B, Wyche K, Pfefferbaum R (2008) Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology* **41**, 127–150. doi:10.1007/S10464-007-9156-6
- Saldana J (2009) 'The Coding Manual for Qualitative Researchers.' (Sage: Los Angeles, CA)
- Schlosser WE, Corrao VP, Duman T (2004) Valley County, Idaho wildland–urban interface wildfire mitigation plan. (Valley County Commissioners: Cascade, ID) Available at http://www.idl.idaho.gov/nat_fire_plan/county_wui_plans/valley/valley.pdf [Verified 9 January 2013]
- Silverman D (2001) 'Interpreting Qualitative Data: Methods for Analyzing Talk, Text and Interaction.' (Sage: Thousand Oaks, CA)
- Steelman TA, Burke CA (2007) Is wildfire policy in the United States sustainable? *Journal of Forestry* **105**(2), 67–72.
- Superior National Forest (2006) Wind and fire. (US Forest Service Northern Region: Milwaukee, WI) Available at <http://www.wilderness.net/toolboxes/documents/education/Boundary%20WatersSNFFweb.pdf> [Verified 5 September 2012]
- Tierney K (2009) Disaster response: research findings and their implications for resilience measures. CARRI (Community and Regional Resilience Institute), Research Report 6. (Oak Ridge, TN) Available at http://www.resilientus.org/library/Final_Tierney2_dpsbjs_1238179110.pdf [Verified 18 July 2012]
- Valley County Fire Working Group (2010) Appendix A: Community Wildfire Protection Plan addendum 2010. (Valley County Commissioners: Cascade, ID) Available at http://www.idl.idaho.gov/nat_fire_plan/county_wui_plans/valley/Valley-County-2010-CWPP-Addendum-11-22-10.pdf [Verified 28 June 2012]
- Williams DR, Jakes PJ, Burns S, Cheng A, Nelson KC, Sturtevant V, Brummel RF, Saeli E, Souter SG (2012) Community wildfire protection planning: the importance of framing, scale, and building sustainable capacity. *Journal of Forestry* **110**, 415–420.
- Winter A, Holman S, Kett S, Dolan R (2006) Taylor Community Wildfire Protection Plan. (Florida Forest Service: Perry, FL) Available at: http://www.iafc.org/associations/4685/files/downloads/CONFERENCES/WUI/WUI08/wui08ppt_103.pdf [Verified 26 June 2012]
- Yin RK (2003) 'Case Study Research: Design and Methods', 3rd edn. (Sage Publications: Thousand Oaks, CA)