Building bridges to fight fire: the role of informal social interactions in six Colorado wildland–urban interface communities

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Abstract.   Property owners in fire-prone communities have been identified as key stakeholders in the wildfire dilemma. Although past research has examined stakeholder characteristics and their behaviours, less is known about how small-scale social processes among stakeholders might shape mitigation decision-making and related actions. This manuscript highlights the role informal social interactions play in building bridges among full-time and part-time residents that facilitate the spread of wildfire information and galvanise small-scale cooperative efforts to reduce wildfire risk. Data from in-depth interviews conducted with residents in six fire-prone Colorado communities indicate that these interactions create bridging capital that links those who are not likely to be the direct recipients of wildfire outreach efforts to those who are.

Introduction

As the wildland–urban interface (WUI) population continues to grow, making further incursions into wildfire-prone areas, expenditures associated with wildland fire continue to increase. In recent years, almost half the US Forest Service's annual budget (up to US$2 billion per year) has been used to suppress fires (United States Senate Committee on Energy and Natural Resources 2009). As the WUI footprint expands along the borders of public lands, efforts continue to help understand factors that facilitate the adoption of risk-reduction strategies by private landowners.

Community outreach and education began in earnest in the 1990s as the Forest Service began to focus on human dimensions of forest management (Frentz *et al.* 2000). Since that time, community-based wildfire planning has become an important strategy in wildfire risk management intended to reduce risks and improve community capacity and response to wildfire risk and fire events. Community Wildfire Protection Plans (CWPPs), for example, are intended to reduce risks to firefighters, communities and the environment, along with reducing costs associated with firefighting (Senate Hearing 2007). In 2006, over 600 CWPPs had been established (Rey and Cason 2008). By 2008, spurred by ongoing calls for community interventions (Senate Hearing 2007), education and outreach efforts facilitated the establishment of 1500 CWPPs in the USA, incorporating over 4700 communities (Rey and Cason 2008). The establishment of community-based efforts, such as CWPPs, across fire-prone areas is evidence of increasing wildfire risk awareness and response. It is still unclear, however, what social mechanisms facilitate or prevent the active involvement of residents in these processes.

This article highlights informal social dynamics in six Front Range Colorado communities. It is apparent from this study that informal interactions serve as social mechanisms that often reach community members who are not active in community activities or are not the direct recipients of outreach efforts. Further, these interactions create relationships between residents at opposite ends of the spectrum of community involvement, that is, between active and inactive community members.

Literature review

Ideally, forest management goals that incorporate surrounding communities connect people, communities, and their landscapes in order to define and reach mutually sustainable goals (Gray *et al.* 2001). Community-based forestry efforts have sought to make community members stakeholders in the management process (Burns *et al.* 2003) in order to reduce conflict and increase the likelihood of successfully reaching management goals.

Consistent with outreach efforts that seek to increase community capacity needed to respond to wildfire risk, recent trends in wildfire research highlight the roles and characteristics of community leaders (Lang *et al.* 2006) and the importance of neighbourhood organisations (Shiralipour *et al.* 2006). Further, work has begun to stress the necessity of recognising, fostering and increasing human, social and cultural capital that promotes community adoption of wildfire mitigation actions (Jakes *et al.* 2002; Kruger *et al.* 2003; Agrawal and Monroe 2006). By examining the characteristics of communities and their organisations, wildfire researchers have begun to focus on what Putnam (2000) refers to as 'bonding' capital – those relationships built among people who have similar ideas or concerns. Indeed, people who join community groups and organisations often do so out of shared interests and ideas and in these processes, bonding capital contributes to in-group loyalty and cohesiveness.

In this article, however, I focus on the importance of the informal social interactions that contribute to 'bridging' capital – the creation of links among people or groups with less in common (Putnam 2000). Certainly, Granovetter's (1973, 1983) 'strength of weak ties' argument suggests that informal social processes are important mechanisms for the spread of information. It has been well established in the hazards field, however, that the provision of information does not necessarily lead to the adoption of hazards adjustments (Tierney 1993; McCaffrey 2008). And although community outreach programs such as Firewise Communities/USA, Fire Safe Councils, and FireFree function under the assumption that interactions among neighbours facilitate the adoption of fuel reduction 'innovations' (Rogers 2003; Sturtevant and McCaffrey 2006), little research exists corroborating this assumption in the hazards field.

Research on disasters has established the importance of informal social processes in shaping disaster response. However, the role informal social processes play in the adoption of hazards adjustments during times of relative normalcy has yet to be fully investigated (Lindell 1997; Tierney *et al*. 2001). At the household level, decisions to take action to reduce hazards-related risks can be considered as products of multiple interactions over time. Community interactions, extent of community participation, and identification with groups of individuals who share or jointly create similar risk perceptions can influence decision-making (Scherer and Cho 2003). Bridging relationships that emerge through informal social interactions facilitate the development of social networks that are based on notions of reciprocity and mutual obligation (Putnam 2000). They link those with less in common and can foster the development of shared norms and expectations.

Informal sources of influence, including friends, relatives and coworkers can inform hazard-related decisions (Short 1984; Lion *et al*. 2002). Neighbours' disapproval or approval has been found to influence likelihood of taking action to reduce risk (Monroe *et al*. 2006). Informal interactions with these sources of influence provide the opportunity for people to test their perspectives and the 'appropriateness' of their actions with community members who have varying levels of importance and expertise in their social setting (Fishbein and Ajzen 1975; Turner *et al*. 1981). In the wildfire context, research indicates that increasing social interactions may be advantageous because it can help make mitigation normative (Sturtevant and McCaffrey 2006). Indeed, these sources of influence become stakeholders, invested in the promotion and adoption of hazard adjustments (Lindell 1997). This may be particularly true in the WUI, in which household adjustments in the form of fuel reductions can have effects beyond the private property of the homeowner by altering wildfire risk levels for neighbours or even at the community-level – what economists refer to as interdependent security (Kunreuther and Heal 2003).

Thus, rather than performing an inventory of community characteristics that may indicate community amenability to the provision of wildfire risk information or capacity to mobilise resources based on concerns (Kruger *et al*. 2003), the present paper examines the processes through which informal interactions contribute to bridging capital, specifically among part-time and full-time residents, and shape wildfire risk decision-making and behavioural outcomes.

Methods

Study area

To understand the social dimensions of wildfire mitigation decision-making, residents in six communities facing high fire risk were targeted for in-depth interviews (Brenkert-Smith 2008). With guidance from County wildfire experts, two primary communities were selected through purposive sampling (Strauss and Corbin 1998; Berg 2004) based on two dimensions: community composition (percentages full-time *v*. part-time or seasonal residents) and the extent of community infrastructure. Strong social infrastructure was characterised by the presence of community organisations and boards (e.g. road, water, fire). Weak social infrastructure was characterised by the absence of such collective efforts. Four secondary communities were selected according to the original selection criteria as well as other factors that emerged as criteria for consideration during interviews in the primary communities, including wildfire history, topography, and proximity to urban areas.

Among the communities with a high percentage of full-time residents, two communities had weak infrastructure (Rocky Way Pines and Pine Lodge) and one had strong infrastructure (High Ground). Among the communities with a high percentage of part-time residents, two communities had strong infrastructure (Lake Clear and Ever Wild) and one had weak infrastructure (Pine Ascent) (see Fig. 1).

In the three communities composed primarily of full-time residents, Rocky Way Pines, Pine Lodge and High Ground, part-time residents are few and far between. In these communities, undeveloped parcels tend to be owned by adjacent full-time residents, purchased to create social or fire buffers by expanding their property or to increase their investment.

Like many high-amenity areas, the other study communities (Lake Clear, Pine Ascent, and Ever Wild) are composed of a high number of dwellings that are occupied part-time or seasonally. Two of these communities also include large numbers of undeveloped parcels. Although these communities have high percentages of part-time residents, part-time status takes multiple forms. Some part-timers are weekenders who visit their WUI properties on a regular basis whereas others are seasonal residents. Some owners live outside the state, making their presence within their community, usually during summer, even less frequent. Reflecting this pattern, many of the participants' WUI homes are not winterised for year-round use. In Lake Clear and Pine Ascent in particular, part-time residences may stand empty from fall well into spring.

Data collection and analysis

To explore social dimensions of wildfire mitigation decision-making fully, in-depth interviews were conducted in the six target communities. The sample was collected using a combination of random sampling and purposive sampling. In all, 250 letters of invitation were sent to households randomly selected from target communities using the County Assessor's databases. The 178 successfully delivered letters yielded 60 interviews (34% response rate). Random sampling led to an under-representation of community leaders, part-time residents, and absentee owners. Purposive sampling (Patton 1990) was used to increase representation of these groups. Subsequent mailings
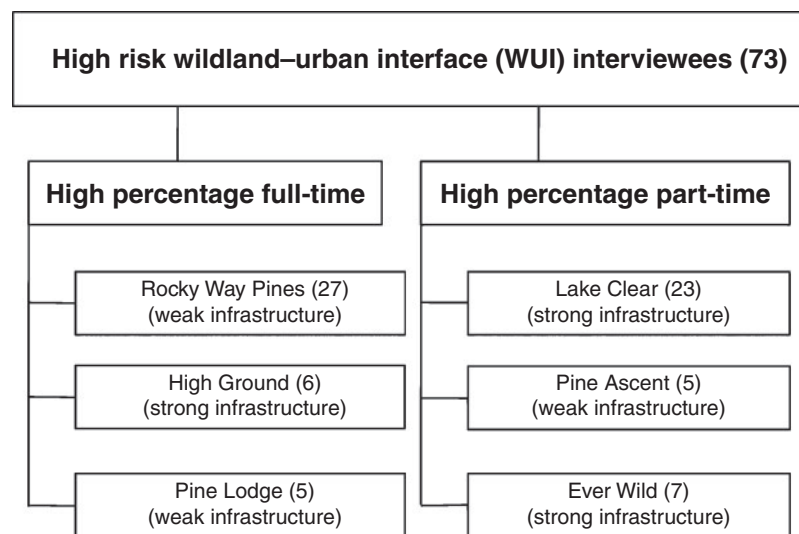
Fig. 1. High fire risk wildland–urban interface (WUI) interviewees by community.

targeting part-time residents and community leaders identified by County informants provided the remainder of the interviews. In total, 73 participants were interviewed, representing 62 WUI households[A] and 76 fire-prone mountain parcels.[B] Among the 62 households, 31 (50%) owned parcels that were occupied full-time, 17 (27.4%) owned parcels occupied part-time, 2 (3.2%) owned undeveloped parcels, and 12 (19.4%) participants owned multiple types of parcels.

In-depth interviews were conducted with all 73 participants. Forty-six of the participants were interviewed in person and on site. When participants were unable or unwilling to accommodate on-site visits, arrangements were made for interview over the phone (26) or in person off site (1). All interviews were digitally recorded. Contextual notes were taken during the interviews and inserted into the verbatim transcripts (see Auerbach and Silverstein 2003). *NVivo* (QSR International, Melbourne), a software program for qualitative data analysis, was used to code and analyse the data. Open coding was used for initial data analysis (Lofland and Lofland 1995; Strauss and Corbin 1998). Iterative and recursive processes were used to identify major themes and to tease out dimensions and nuances of subthemes. Once major themes and subthemes were identified and clearly articulated, focussed coding was used to re-evaluate the data.

The findings discussed below follow from analysis of one of the major themes identified from the text of the interviews: social interactions. This theme included data pertaining to the dynamics of informal interactions, such as with whom participants were likely to interact, the tone and purpose of the interactions, the meanings associated with the interactions, and the potential wildfire-related behavioural outcomes linked to these interactions, as described by study participants.

All participants and communities have been given pseudonyms to protect their identities. Quotes are verbatim unless they

were edited for space and ease of reading; any omissions are indicated by ellipses.

Findings

The intention of this paper is to highlight the role informal social interactions play in the formation of important bridging relationships among residents that facilitate wildfire risk reduction efforts. In the following sections, I begin by describing the role residential status has on social interactions as well as challenges presented by part-time ownership status. Next, I explore how informal social interactions, particularly among owners of different residential status, create bridging capital. Specifically, I examine how bridging capital fosters the exchange of information and ideas relevant to wildfire risk management *and* the instigation of small-scale collaborative wildfire risk reduction efforts. Finally, I explore the gaps and ruptures in bridging relationships due to part-time and absentee ownership.

Residential status

Residential status was the most important factor shaping the amount of time study participants spent in their WUI community. More importantly, perhaps, residential status was the most important factor shaping how they intended to shape their time and the types of experiences they sought during their time there. It is not surprising that full-time residents spent the most time in their WUI communities, because their primary residence is in the community. These residents were more active in formal community activities and informal social activities. Just over one-third of all participants were active in community activities; among owners of parcels occupied full-time, 48% reported community participation. Further, full-timers were more likely

[A]As household mitigation decisions are not typically made by one sole decision-maker, interviews were conducted with more than one member of the household whenever possible. In 11 of the 62 households represented in this study, two household decision-makers were interviewed.
[B]Several residents held more than one parcel.

to know other community members regardless of the location of their property within the community landscape.

In contrast, part-time residents spent less time in their WUI communities and were less likely to participate in formal community activities or informal social interactions than full-time residents. Only 17% of owners of part-time parcels reported participating in community activities. In terms of informal social interactions, they were more likely to interact with their immediate neighbours than with non-neighbouring community members. In fact, if part-timers were acquainted with any community members, it was likely to be a proximate neighbour.

Part-time residents face several challenges that can serve as obstacles to undertaking fuels reduction. Often juggling the upkeep of multiple homes, part-time participants consistently reported that finding time to mitigate was challenging. Virtually all of the part-time participants stressed that time and effort required to implement mitigation measures were the most significant challenge preventing or limiting their risk reduction efforts. The work required implementing fuel reductions depends on parcel size, fuel load and topography, and can require significant investment of time, labour, or the ability to hire others to perform the work. Although Colorado's vegetation and climate do not lead to fast-growing forests, fuel reduction is an on-going process that requires maintenance.

In other research, seasonal residents have been found to perceive mitigation measures as time-consuming and feel negatively about the amount of time required (Bright and Burtz 2006). Indeed, it is not particularly surprising that for a seasonal resident, who may spend a week a year at their WUI property, the time and effort required to cut trees and haul slash to meet general mitigation guidelines may be seen as negative.

In this study, part-time residents were less likely than full-time residents to have the necessary equipment to undertake mitigation efforts. This was particularly true for seasonal owners living out of state. A lack of appropriate equipment may be reflected in the differences in the types of risk reduction measures undertaken between different types of owners (see Table 1). For example, 26.2% of full-time participants reporting removing fuels within a 30-foot (~9-m) perimeter of their homes compared with only 11.1% of part-time participants. Lower input measures such as trimming low-hanging branches off trees (a technique that involves the removal of ladder fuels often referred to as 'limbing') were adopted at similar levels (69% of full-timers and 66.7% of part-timers) and thinning or clearing underbrush that may only require hedge trimmers or a

shovel was more commonly implemented by part-timers than by full-timers. Though the sample does not lend itself to statistical analyses comparing groups, there appear to be important differences in the types of measures each group chooses to implement.

As WUI settings are not the primary residence for part-time residents, there were also differences in what was at stake if a serious wildfire event were to occur. For example, all part-time study participants reported having different magnitudes of investments at stake for wildfire damage or loss. The majority of part-time dwellings in this study were non-winterised cabins intended for seasonal use and presumably had lower assessed values. These study participants also reported having less valuable contents in the dwellings. Items such as important papers, personal mementos and other valuable items such as electronics and computers were more likely to be located in their primary residences.

All part-time participants also revealed that their primary interest in spending time in their WUI communities was for the outdoor or recreational opportunities afforded by the landscape. They simply did not want to spend their limited time mitigating wildfire risk. This is consistent with a recent study that found that place attachment among part-time residents tends to be related to the experience of that place as an escape (Stedman 2006). Emily Beton (50s, married, part-time owner since 1998) of Lake Clear described her interactions with other part-time residents:

> We know a lot of people who are [also] weekenders. So a lot of times we will get together and have a barbeque or we go over. [Emily]
>
> And how have you gotten to know them? Are they your immediate neighbours or do you know them from participating in community social activities? [Interviewer]
>
> We met them when we were fishing…they are close by and they will drive up, you know, and they wave and then they start coming to visit. And we do the same. [Emily]

Emily Beton reflected on her enjoyment of her time in Lake Clear as a time to relax and get away. Certainly, full-time participants were just as likely to reflect on their enjoyment of the recreational opportunities of their WUI settings but they also were much more likely to stress the important social ties that make their community 'home'.

Neighbours building bridges

The primary social interactions study participants reported having were informal social interactions with neighbours. Across a fence or at the mailbox, these interactions were strongly shaped by residential status and served to create bridging relationships among community members. The development of relationships among full-time and part-time residents emerged as a central component of the social fabric of the study communities. Importantly, the relationships formed during these interactions served three functions central to wildfire risk management. First, bridging relationships created the opportunity for information exchange among owners with shared fire risk. Second, they led to collaborative wildfire-related action among neighbours to address shared risk. And finally, these interactions contributed to the creation of social attachments. I will detail these findings below.

Table 1. Percentage of part-time and full-time owners reporting implementing mitigation measure

	Full-time	Part-time
Comprehensive fuel removal within 30′ (~9 m) of home	26.2%	11.1%
Limbing (removing ladder fuels)	69%	66.7%
Thinning (tree removal)	50%	33.3%
Thinning (clearing underbrush)	78.6%	94.4%
Removal of slash from property	21.4%	11.1%

Information exchange

Social interactions among neighbours were primarily informal interactions, ranging from casual encounters while gathering mail and discussions over the fence about community events and affairs, to conversations addressing the challenges associated with rural living including road conditions, wildfire and weather. Whereas sometimes these interactions laid the foundation for friendships, more often they were neighbourly chats that occurred during brief visits, leaning on fence posts or when pausing while passing each other on the road.

Interview data reveal, however, the importance of these interactions in linking part-time residents to full-time residents. For all but two part-time study participants, these informal interactions were the only regular social interactions they had within their WUI communities. These interactions built bridges among neighbours and connected part-time residents to their communities as full-time neighbours served as a conduit of information and influence.

Emily Beton, a part-time resident in Lake Clear, explained that despite not participating in any community activities, she was able to remain informed because of interactions with a neighbour. When asked if she participates in any of the community activities, she explained:

> No. I really don't because, you know, I learned most of the things [about wildfire mitigation] from one of our neighbours. He is a full-time resident and he kind of keeps an eye on our place. And I think last year, there was a fire close by and he called us and we drove up right away. So, you know, he just keeps us informed.

Emily Beton's informal interactions with her full-time neighbour provided a link to the community. Her connections to a full-time property owner also made her feel more confident and secure in her mitigation decision-making.

Despite the fact that part-time participants lauded these valuable relationships, only a small portion of the full-time participants were aware of the vital community role they were playing while engaging in these interactions. In fact, many full-time study participants complained about the obstacles to communicating with part-time and absentee landowners. In contrast, most part-time participants reported that besides media reports, these informal interactions were their primary source of wildfire-related information. Part-timers explained that the information they received through these interactions were particularly valuable because of it specificity to their WUI community. Only three of the part-timers actively participated in community activities. Among those who did not participate in any community activities, their full-time neighbours were often the lifelines for community and tailored wildfire information.

Research has found that perceptions of knowledge of a hazard are linked to the adoption of protective measures (Lindell and Whitney 2000). Part-time study participants reported that they were able to test their knowledge in these informal interactions. For example, part-time Lake Clear owner, Richard Earl (50s, married, currently building home) highlighted the importance of interactions with his now full-time neighbour when he was deciding to purchase land. His neighbour was familiar with the landscape and the challenges associated with rural living. He

provided information to Richard about risk-reduction measures and helped assuage Richard's concerns about wildfire risk by making specific recommendations for his parcel. Richard explains:

> …[A]nother thing the neighbours knew about was all the wild junipers. There was [sic] a lot of them on the property and they have the highest fire danger. So we, basically, cleared all those off before we started building the cabin. And trimmed the trees up, hauled all the dead stuff or most of it and so we've done a lot. Raked up all the pine needles. That was probably, that was probably like three pick-up loads of pine needles alone. So, you know, there's [sic] things you can do to help yourself.
>
> Did you feel like their information was trustworthy and accurate? [Interviewer]
>
> Oh yeah. [Richard]

Richard reflected on the fact that while he was looking to buy WUI property, he was concerned about all of the uncertainty associated with WUI living. His neighbour filled the role of a valuable and reliable source of information that helped him feel confident about the prospect of living in the WUI safely. Indeed, other studies have found that those who do not consider themselves knowledgeable about wildfire risk are likely to emulate a neighbour's behaviour (Martin *et al*. 2007). Richard's neighbour also provided information about fauna and flora that helped him feel familiar with his new surroundings.

The fuel reduction work on the properties of full-time residents served as demonstration plots for other community members as they considered how their parcel's appearance might change with the implementation of fire mitigation measures. Sara Hale (40s, married, full-time owner since 1996) of Lake Clear addressed the challenges to reducing wildfire risk:

> We have watched some people right up above us who have totally cleared their properties and just done magnificent jobs and my goal is to do as well as they have. [Sara]
>
> And have you ever talked with their neighbours about what they have done? [Interviewer]
>
> Yeah. They are very friendly. They came down and talked about what they did and we went up and walked around and talked about it. [Sara]

According to Sara Hale, neighbours provided specific information about what she could do to reduce her risk. Their actions simultaneously served as examples of what final results might look like on her property if she followed her neighbours' lead. This finding supports other research that indicates that adoption of risk-reduction measures increases with the provision of specific hazard and hazard-mitigation information (McCaffrey 2004) and that the extent of neighbours' actions can shape interest in and likelihood of undertaking risk-reduction actions (Steelman 2008). Further, this finding supports research indicating that demonstration areas play an important role in providing concrete examples of how prescribed techniques may look on the local landscape (Monroe *et al*. 2006; Sturtevant and McCaffrey 2006). In Sara Hale's case, it was the repeated informal interactions between neighbours that allowed Sara to consider her options and test the 'appropriateness' of her (in)

actions (Fishbein and Ajzen 1975; Turner *et al.* 1981) with her neighbours – those most affected by her decision-making.

Because of the dynamics of fire behaviour, adjacent properties share levels of wildfire risk. Although proximity among neighbours leads to shared risk, it also provides the opportunity for informal social interactions. For part-time residents, informal social interactions with neighbours were the primary social interactions with other WUI community members. Because of their casual nature, part-timers didn't feel that they were obliged to agree with the perspectives being presented, but rather saw the interactions as the opportunity for friendly neighbourly rapport and to find out about community events. If household mitigation decisions are the product of multiple interactions over time, it stands to reason that these interactions play a role in part-time owner wildfire mitigation decision-making. Indeed, part-time participants reported having made specific mitigation decisions as a result of these informal interactions, particularly those with full-time neighbours.

Collaborative efforts among neighbours

Data from the study interviews revealed that in addition to facilitating the exchange of relevant and specific wildfire risk and mitigation information, bridging relationships, particularly among neighbours, fostered small-scale wildfire-related collaborative action. Over half of the study participants reported pursuing small-scale wildfire mitigation projects with neighbours in order to reduce shared risk. Efforts planned and implemented by study participants included fuel reduction efforts along shared property boundaries, often targeting specific topographical features that put both properties at risk.

In Lodge Pine, a community with weak social infrastructure, study participants reported engaging in collaborative efforts with neighbours on small-scale efforts primarily targeting areas along property lines as a way of creating small fuel breaks between properties. Although these acts were short-term, isolated and focussed on specific tasks, they fostered a sense of community. Other efforts in this community were more substantial and allowed neighbours to assist others who were unable to perform the physical labour but had shared concerns. Joshua Oland (50s, married, full-time owner since 1996) was recruited by a neighbour who felt threatened by a large adjacent lot laden with dry fuels. Joshua explained:

> We actually all banded together and helped a neighbour… they had a fairly large piece of property – about 40 acres and we helped them clear off a whole bunch of wood – most of which was mostly rotting. But mostly it was a lot of fun because it was a big neighbourly thing.

In addition to fuel reduction efforts, many participants reported having emergency preparedness and response plans that involved intentions to assist the elderly, families with children, and neighbours with evacuation of pets or livestock in the event of a fire.

Building bridges

Neighbours who worked together to tackle the challenges of shared fire risk not only shared resources, but built relationships and networks. For example, Lake Clear owner Jack Walters (60s, married, owner of full-time (1999) and undeveloped (1995) parcels) approached a neighbour about whose property he had concerns. The neighbour offered to pay Jack to undertake some thinning on his property. Jack explained, 'Oh yeah. He realises as thick as that was in there, it endangered everybody'. By approaching his neighbour, Jack learned that his neighbour was not intentionally neglecting the fuels on his property, but was unable to perform the work himself and didn't know where to find help. Not only did these interactions bring some relief to Jack's concerns but fostered the beginning of a bridging relationship that had not previously existed.

For others, like full-time Rocky Way Pines owner Rae James (60s, widowed, full-time since 1988), approaching her downhill neighbour about fuel conditions not only led to fuel reduction collaborations but it also eventually led to an entirely new perspective on her neighbours and her WUI experience. She explained that one of the things that attracted her to Rocky Way Pines was the lack of community organisations or associations. Through efforts with her neighbours, however, a sense of community had evolved along her road. When asked if she anticipated having the types of social interactions and relationships she described, she replied:

> No. In fact, most of the people that live up here…we all moved up here for the privacy and the beauty of living up here, but we found that we had that commonality, that we liked our privacy, so that is the whole thing that is shared here … I know most of the people on this road and a good half on that road…

Further, the trust developed in the bridging relationships among part-time and full-time neighbours described by study participants indicates that education and information need not come from experts. In fact, when looking at specific shared sources of risk, such as a ravine, the actions taken by a knowledgeable neighbour provided definitive templates for available mitigation options that were obviously possible to implement.

Although participants recognised that wildfire risk management, particularly in terms of fuels management, is not a one-time effort, they did not feel that their collaborative actions with neighbours obligated them to future commitment unless they determined it would be useful in the future. Consistently with the cultural norms of many WUI communities, the high regard for privacy and solitude shaped these bridging relationships. As Putnam (2000) notes, networks and associated norms of reciprocity 'come in many different shapes and sizes with many different uses' (21). Indeed, participants asserted their on-going desire for independence even in light of the new relationships they had forged.

Gaps in bridges

As noted in the previous section, residential status was the most important factor shaping the amount of time owners spent on in their communities and played a vital role in shaping informal social interactions. The previous sections highlighted the role of informal social interactions as mechanisms that successfully spread information and influence from full-time to part-time residents. In this study, it is apparent that informal social interactions play an important role in the spread of wildfire

information and in galvanising small-scale fuel-reduction efforts. These interactions are only possible, however, when neighbours and community members interact. High percentages of part-time, seasonal or absentee landowners create gaps and ruptures in community social fabrics, hampering the opportunities for informal social interactions. Part-time and absentee owners were not only more difficult to contact for this study, but were reportedly difficult for community members to get to know or even meet.

The ruptures in the social fabric caused by these absences became particularly apparent in relation to wildfire risk concerns. Study participants stressed concerns about the absence of their part-time and absentee neighbours, particularly when they felt that the fuel conditions on those properties presented risk to themselves and the community. When asked if neighbouring properties cause concern because of the fuel conditions, Ray Paully (50s, married, part-time owner since 1996) of Lake Clear explained:

> Oh yeah, the lots on either side of us, both of them have a lot of dead wood on them. We have never seen anybody on the lots, using them, so you know, I don't know if they are out-of-state people on them that just never come or what. The one to the west of us particularly has lots [of dead wood], it has probably never been cleared out, I would say.

Neil Conners (40s, single, full-time owner of developed (1982) and undeveloped (2000) parcels), a full-time resident of Pine Ascent, shared this concern. He confirmed that with part-time neighbours, he rarely has had an opportunity to interact, let alone communicate his concerns regarding the properties' conditions. When asked about whether or not he has shared his concerns with his neighbours he explains, 'They have only been up here once or twice a year, so no, I have not … [My neighbours are] mostly just people who come up a weekend once or twice a year'.

Most study participants simply complained about the absence of their neighbours whereas some participants in communities with formal infrastructure tried to use those resources to establish contact or facilitate interaction. Emily Beton (50s, married, owner since 1998), a part-time owner who frequents her property weekly, for example, found that despite the extensive community infrastructure and resources in Lake Clear, neither formal nor informal channels have made it possible to communicate with her neighbours. When asked about her concerns about her neighbour's property, she explains:

> …his lot is right next to ours and we have talked to the [homeowners'] association to please send some letters and they haven't done anything and that is our concern. To make sure that some of these people clean up their dead trees. [Emily]
>
> And have you ever talked with any of these neighbours yourselves? [Interviewer]
>
> Well, they are from California. So I don't, you know, I don't know how to get a hold of them and neither does our [other] neighbour. [Emily]

Another Lake Clear owner, Kathryn Kingston (60s, retired, full-time resident since 2002) bemoaned the inability to interact with the residents of the neighbouring properties because of their absence:

> You rarely see them. I mean, let's see, we've been here 4 years. We never, we met the people that used to own it once, but never met the new people. The people down there, those people, there is a house immediately down from us, we met them once.

In these cases, despite the fact that residents wanted to engage with neighbours in order to address wildfire risk, residential status limited opportunities for informal social interactions and the creation of bridging relationships.

Discussion

Although it has been well established that informal social processes shape disaster response (Lindell 1997; Tierney *et al.* 2001), it is apparent from the findings described above that informal social processes also play an important role in pre-impact hazard adjustments. Weak ties bridge the more isolated part-time residents to full-time neighbours, who are more likely to be 'bonded' to the community. In doing so, they link those less likely to be aware of community events and activities to community members who are more likely to have this awareness and more likely to participate or play a role in organisations targeted for wildfire outreach and education efforts.

Further, the role these bridging relationships play among part-time and full-time neighbours suggests that education and information need not come from experts. Indeed, these informal interactions fostered trust and helped facilitate the spread of expert knowledge from those who had interacted with wildfire experts through education and outreach efforts to those who had not. In fact, when looking at specific shared sources of risk, such as a ravine, the actions taken by a knowledgeable neighbour can provide a definitive template for available mitigation options. Part-time participants reported that the wildfire information they received from neighbours was usually very specific and detailed and immediately applicable to their property and the surrounding area. Full-time neighbours served as interpreters and consolidators of information, tailoring the information for the specific interaction. Certainly, active and informed full-time residents were perceived by part-time study participants as having sufficient expertise to garner the confidence of those who are less informed. Hazards research indicates that people facing risk want specific and definitive information to help the 'personal relevance of the risk facing them' (Lion *et al.* 2002, p. 765). These findings indicate ongoing support within wildfire research that personalised contact and one-on-one interactions are important approaches to educating homeowners about available mitigation options (McCaffrey 2004).

Informal interactions also linked part-time residents to community discourses and resources. The knowledge full-time residents extended to part-time neighbours regarding mitigation options as well as their confidence regarding the efficacy and importance of implementation was often the link that led part-time residents to action. Study participants valued information that directly related to the unique physical dimensions of their parcel provided by neighbour and community interactions.

Conclusions and implications

Like decision-making in the face of other hazards (Short 1984; Lion *et al.* 2002), the current study highlights the importance of neighbours in shaping residents' wildfire mitigation decisions. Regardless of whether the collaborative actions were intended to reduce the risk of wildfire through mitigation action or constituted plans among neighbours in the event of the fire, they highlighted the importance of informal social interactions in wildfire-related decision-making. Across all the study communities, from those with the strongest infrastructure to those with the weakest, participants reported taking action with neighbours to deal with shared fuel problems.

Importantly, this article focusses on the importance of residential status in shaping opportunities for informal social interactions that fostering bridging relationships among those most and those least likely to be the direct recipients of wildfire information. Important to wildfire risk management, these interactions not only facilitated the flow of wildfire information from full-time to part-time residents, but fostered relationships that galvanised small-scale mitigation efforts to combat shared risk. Although the interactions described above did not require on-going commitments, they did contribute to meaningful connections among residents. Neighbour interactions between full-time and part-time residents often served as the only link between part-time residents and their communities. These social connections expanded participants' understandings of their environmental settings into important social places where meaningful interactions enrich WUI experiences.

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