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## The art of learning: wildfire, amenity migration and local environmental knowledge

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## Abstract

Communicating the need to prepare well in advance of the wildfire season is a strategic priority for wildfire management agencies worldwide. However, there is considerable evidence to suggest that although these agencies invest significant effort towards this objective in the lead up to each wildfire season, landholders in at-risk locations often remain under-prepared. One reason for the poor translation of risk information materials into actual preparation may be attributed to the diversity of people now inhabiting wildfire-prone locations in peri-urban landscapes. These people hold widely varying experiences, beliefs, attitudes and values relating to wildfire, which influence their understanding and interpretation of risk messages doing so within the constraints of their individual contexts. This paper examines the diversity of types of local environmental knowledge (LEK) present within wildfire-prone landscapes affected by amenity-led in-migration in south-east Australia. It investigates the ways people learn and form LEK of wildfire, and how this affects the ability of at-risk individuals to interpret and act on risk communication messages. We propose a practical framework that complements existing risk education mechanisms with engagement and interaction techniques (agencycommunity and within community) that can utilise LEK most effectively and facilitate improved community-wide learning about wildfire and wildfire preparedness. C 2011 IAWF.

## Keywords

art, learning, wildfire, amenity, migration, local, environmental, knowledge

## Disciplines

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## **Abstract**

Communicating the need to prepare well in advance of the wildfire season is a strategic priority for wildfire management agencies worldwide. However, there is considerable evidence to suggest that although these agencies invest significant effort towards this objective in the lead-up to each wildfire season, landholders in at-risk locations often remain under-prepared. One reason for the poor translation of risk information materials into actual preparation may be attributed to the diversity of people now inhabiting wildfire-prone locations in peri-urban landscapes. These people hold widely varying experiences, beliefs, attitudes and values relating to wildfire, which influence their understanding and interpretation of risk messages – doing so within the constraints of their individual contexts. This paper examines the diversity of types of Local Environmental Knowledge (LEK) present within wildfire-prone landscapes affected by amenity-led in-migration in southeast Australia. It investigates the ways people learn and form LEK of wildfire, and how this affects the ability of at-risk individuals to interpret and act on risk communication messages. We propose a practical framework that complements existing risk education mechanisms with engagement and interaction techniques (agency-community *and* within community) that can utilise LEK most effectively and facilitate improved community-wide learning about wildfire and wildfire preparedness.

## **Keywords**

Amenity migration, Australia, wildfire, risk communication, experiential learning, local environmental knowledge, natural hazards, peri-urban landscapes.

## **Introduction**

The promotion of community engagement in wildfire risk management and prevention is a well-established necessity for wildfire management agencies (Carroll *et al.* 2004; McCaffrey 2004a; Paton and Wright 2008). Engagement means more than mere participation in risk management processes. It

also allows information sharing and problem solving within communities and between community members and agency representatives. However, its practical application is less well established, particularly at the local level where local players enact organisational programs. This paper seeks to understand the interplay between learning styles and local environmental knowledge (LEK), which refers to contextualised beliefs, attitudes and skills. We use this understanding to suggest better ways to undertake community engagement in localities where social diversity is growing (Gordon *et al.* 2010), and where traditional risk communication processes do not engender well-prepared and resilient peri-urban communities.

The diversity of people choosing to live in areas bordering natural vegetation poses significant difficulties for the emergency management agencies tasked with managing and mitigating wildfire risk (see, for example, Paveglio *et al.* 2009). Various terms have been used to describe the 'rural-urban interface' (Buxton *et al.* 2006:24-31), the 'wildland-urban interface' (Ewert 1993; Susan 2007), or "i-Zone" areas (Cottrell 2005), wildfire-prone 'peri-urban landscapes' are of particular importance when considering social vulnerability to wildfire. The ambiguous interface nature of these landscapes – partly 'urban', 'rural' and 'wildland', has resulted in these interface areas increasingly being populated by both amenity-led in-migrants as well as established longer-term residents. Amenity-led in-migration (popularly referred to in Australia as "tree- or sea-change") refers to the movement of people away from urban centres predicated on desires for lifestyle change, affordable property, and/or the attraction of natural environmental settings (Burnley and Murphy 2004; Hugo 2005). It has resulted not only in population growth but also a rapid demographic re-composition of these areas, as urban migrants purchase land, often subdivided farmland, whilst the more traditional rural population ages or declines.

The diverse backgrounds of residents living in peri-urban landscapes is evident in their varying levels of natural hazard-related knowledge (Paveglio *et al.* 2009; Prior 2009; Eriksen and Gill 2010).

Longer-term residents in wildfire-prone areas are more likely to have direct experience of wildfire into which other information sources are integrated. Many newer residents, on the other hand, have little or no experience of wildfire, either personally or in their families. They are therefore likely to establish knowledge, attitudes, beliefs and values relating to wildfire via second-hand information

from, for example, neighbours, friends, family, the media, environmental groups, or fire agencies. The different ways people establish their knowledge base invariably means their knowledge differs, being influenced by the way the individual learns and incorporates new information into existing knowledge. This influences peoples' ability to understand, interpret, and evaluate risk communication on wildfire awareness, preparedness and response (Barnett and Breakwell 2001; Gill 2005; Prior and Paton 2008).

The February 2009 wildfires in Victoria (Australia) and the August 2009 wildfires in California (USA), in areas strongly characterised by amenity-led in-migration, provide vivid examples of the potential for loss, and the critical need to engage with local communities in these areas. Highlighted in these wildfires and their aftermath has been the significance of the changing nature of peri-urban interface populations, and how these changes reflect shifts and variability in lifestyles, outlooks on, and expectations of, nature and life in the 'bush' (Robbins *et al.* 2009; Gill *et al.* 2010). These disastrous wildfires have once again highlighted concern about residents' insufficient wildfire preparedness and awareness, and their assumptions about personal ability to act in the event of a wildfire (BCRC 2009; Bowman *et al.* 2009; Teague *et al.* 2009). This lack of preparedness for wildfire is not a new issue. Summarising conclusions from Australian wildfire inquiries since 1939, a 2004 Commonwealth inquiry into the severe January 2003 Canberra (Australia) wildfires show low preparedness to be a persistent issue, noting that '...a level of community complacency appears to have existed before every major fire event' (Ellis *et al.* 2004:254). Research examining wildfire-associated human behaviour has made similar findings, suggesting that despite (or because of) awareness or experience of wildfire, landholder preparedness may fall short of the level deemed desirable by emergency management and other agencies (McCaffrey 2004b; Gill 2005; Brenkert-Smith *et al.* 2006; McCool *et al.* 2006; Pyne 2006; Paton 2008). It is therefore of concern that the interim report of the Commonwealth inquiry into the February 2009 wildfires in Victoria (Teague *et al.* 2009) focuses primarily on communication *during* the fires, rather than the need to improve community risk communication activities *well in advance* of the wildfire season, even though both issues were explored extensively during the inquiry.

80 These early risk communications are influenced by the amount and accuracy of wildfire-relevant LEK  
81 an individual possesses, including their ability to understand, interpret and effectively utilise such  
82 wildfire risk information. More than this though, LEK guides the way individuals assess and make  
83 sense of wildfire risk within their own contexts (Johnson-Laird 1983; Zaksek and Arvai 2004). There  
84 is no hard and fast definition of the term 'Local Environmental Knowledge' although most  
85 characterisations emphasise the dynamic, contextual, holistic, and conceptual nature of local  
86 knowledge systems (Fischer 2000; Indian 2008). LEK is ways of construing the world rather than an  
87 accumulation of facts (Studley 1998) and whether or not people have lived in an area for a long period  
88 of time, they will have some beliefs about, or attitudes concerning the surroundings in which they find  
89 themselves. As such, people are not 'empty vessels' awaiting information, but actively incorporate  
90 information and interpret it in relation to the values, attitudes and beliefs they have already established  
91 rather than any underlying science of a message (Agrawal 1995; Weber and Word 2001; Robbins  
92 2006). Consequently, predictable changes in behaviour do not necessarily result from increased  
93 knowledge or community education programs (Tierney *et al.* 2001; McCaffrey 2004b; Vanclay 2004;  
94 Pannell *et al.* 2006; Paton and Wright 2008; McGee *et al.* 2009; Eriksen and Gill 2010).

95 The changing social fabric within peri-urban landscapes (characterised by diverse landholders with  
96 varied and dynamic LEK) thus necessitates more appropriate policy and practical advice on managing  
97 wildfire risk. In this paper we specifically focus on the relevance of Kolb's (1984) experiential  
98 learning theory to improve two-way wildfire risk engagement with diverse landholders by comparing  
99 and integrating findings from our empirical research in peri-urban landscapes into the proposed  
100 theoretical learning models. Rather than discussing detailed research data and findings, the focus of  
101 the paper is the value of situating risk communication and LEK in the context of multiple learning  
102 styles and dynamic and relational notions of scale. We firstly give a brief outline of the empirical  
103 research methods and study areas from which the findings subsequently integrated into the learning  
104 models are derived. We then provide a detailed examination of learning styles, learning conditions  
105 and LEK contextualised by examples from peri-urban landscapes. Finally we propose a practical  
106 framework that complements existing risk education mechanisms with local, context specific, and

interactive engagement initiatives that can utilise LEK and learning styles most effectively. We thereby endeavour to assist emergency management authorities to develop more apt community outreach initiatives that increase mental and practical wildfire preparedness.

## **Methodology**

This paper is a trans-disciplinary collaboration that builds on two independent mixed-methods research projects in human geography (referred to as Study A) and social psychology (Study B). Although the studies were established and conducted independently of each other, they were both conducted in peri-urban landscapes with similar levels of wildfire risk in southeast Australia. They both focussed on residents' perceptions of wildfire and the significant factors that influence peoples' level of engagement with wildfire risk. Both studies also used postal surveys and semi-structured interviews that consisted of similar research questions (see below). Further, the findings of both studies display a remarkable consistency in the social issues that underpin awareness and preparedness amongst landholders in peri-urban landscapes. This paper does not attempt to blend the data of Studies A and B but instead triangulates results on topics covered by both research projects, clearly indicating in the following sections the source of any data used. It is the triangulation of research methods and findings across social science disciplines that provide this collaborative project with a strong foundation. Together the research projects provide important insights into deeper processes that underpin how people form LEK on wildfire and how risk information is used and interpreted.

Study A focussed on rural-urban interface areas in New South Wales (the Oakdale area in Wollondilly Shire, Kangaroo Valley in the Shoalhaven, and Windellama on the Southern Tablelands), whilst Study B carried out research in peri-urban landscapes of New South Wales (Upper North Shore and Sutherland Shire, Sydney) and Tasmania (Hobart) (Figure 1).

Figure 1: Map of peri-urban study areas in southeast Australia.

The study areas were chosen due to their commuting proximity of 90 minutes or less to national economic and political centres – Sydney, Canberra, and Hobart; extensive land use change and farm

subdivisions; the co-existence of activities traditionally classified as urban, rural or conservation; their high amenity value; and the close proximity (50m – 1km) to significant areas of naturally vegetated land, which heightens the risk of wildfire. Their character is a product of the demographic changes, lifestyle preferences, agricultural restructuring and the footloose working patterns of the internet age that have shaped amenity-led landscapes and communities across Australia, including many of the areas worst-hit by the wildfires in Victoria in February 2009 (Holmes 2006; Barr 2009; Clode 2010).

A mixed-methods research approach, consisting of postal-surveys and semi-structured interviews, was employed in both studies to integrate quantitative and qualitative methods and data in a way that the components mutually illuminated the research during fieldwork, analysis, interpretation, and write-up (Johnson and Onwuegbuzie 2004; Bryman 2006, 2007; for detailed descriptions of research methods see Prior 2009; Eriksen and Gill 2010; Eriksen *et al.* 2010). Both survey instruments explored topics such as landowners' experience of wildfire, the role of wildfire in their property management goals, involvement with local fire brigades or environmental groups, and perceptions of personal and community levels of wildfire risk, knowledge, and preparedness. All interviews followed six broad research themes: wildfire mitigation efforts, property management, landscape values, community engagement, understanding of risk messages, and ways of learning.

Study A surveyed 348 landholders between February and May 2008 (a 16% response rate). Study B surveyed a total of 431 households in Tasmania in October 2006 (a 28% response rate), 277 households in New South Wales in October 2007 (a 19% response rate), and 398 households in Tasmania in October 2007 (a response rate of 31%). Survey respondents could volunteer to be interviewed further on their opinions and experiences relating to wildfire. This formed the basis for the selection of purposive interview samples (Hay 2005; Creswell 2007; Bryman 2008). The interview participants were selected to give a balanced sample of gender, age, intention to prepare, main or secondary residence, local rural fire brigade membership, levels of wildfire experience, property size, asset protection zones (firebreaks), and wildfire action plans. On the basis of survey responses, 38 landholders in Study A were interviewed on their properties from October 2008 to April 2009 using an in-depth, interactive, semi-structured interview approach, while semi-structured



telephone interviews were conducted with 36 householders in Study B in January 2006 and April 2007. The interviews were audio recorded and transcribed verbatim before being coded and analysed using the Computer Assisted Qualitative Data Analysis Software NVivo v8. The direct interview quotes used in this paper have been chosen because they illustrate attitudes, beliefs and concerns shared by landholders in both studies. Empirical research results in the following sections are used specifically to demonstrate the use and value of learning models and experiential learning theory.

Given the annual threat of wildfire in southeast Australia it is worth mentioning that fieldwork took place both during and outside the statutory Bush Fire Danger Period, which generally runs from October to March in New South Wales and Tasmania depending on climatic conditions (RFS 2009; TFS 2009). During this period the public awareness of wildfire is usually heightened due to the increased media coverage of wildfire stories and the sense of wildfire danger related to hot and dry weather conditions and/or actual wildfires. In Study A postal surveys were distributed at the end of a wildfire season (2007-2008) with little wildfire activity. This may explain the fairly low (but nevertheless statistically acceptable (see Dillman, 2000; Groves et al., 2004)) response rate to the postal survey in Study A. The interviews, on the other hand, were carried out in the months leading up to, during and after the tragic “Black Saturday” wildfires in Victoria in February 2009. Study B was planned such that surveys were distributed to landowners in the lead-up to the wildfire season (during September and October 2006 and 2007). Interviews were conducted at the conclusion of these wildfire seasons, in order to capture information about what mitigation activities were actually undertaken in relation to the landholders’ stated intentions identified when they completed the survey. All data collection for Study B was conducted prior to the “Black Saturday” wildfires, though significant wildfires occurred around Hobart and on the East Coast of Tasmania (Prior and Paton, 2008) during the 2006-2007 wildfire season.

### **Ways of learning: Problematising wildfire risk communication**

Current wildfire community education initiatives tend to focus on the dissemination of fixed ideas (for example, keep gutters clear of leaves, prune or remove vegetation in close proximity to buildings),

rather than the actual process of learning and understanding the implications of these ideas. This follows prevailing notions in cognitive and behavioural learning theories where results are measured as the number of fixed ideas accumulated by an individual (Ajzen 1991; Barr 2008). This is inherently problematic in the context of the dynamic and constantly changing nature of local knowledge systems. It results in a disparity between the official rationality of wildfire management and landholders' everyday life (Eriksen and Gill 2010). Such disparity has important implications if landholders' assessments of wildfire hazard as acceptable (or not) do not correspond with official discourse on wildfire management and mitigation. How can policy and community outreach programs address disparity if individual notions of preparedness do not align with the official intent? Gill (2005) and Prior (2009), for example, highlight that individuals' perceptions of 'capable and prepared' can differ significantly from that of fire authorities. Problems are therefore inevitable when authorities advocate landholders to stay and defend their property if they are 'capable and prepared' without further local and context specific risk engagement that clarify what 'capable and prepared' actually is. These problems escalate when recipients of this message have no or little wildfire experience with which to interpret the practical and mental levels of preparedness this message implies.

To demonstrate the value of situating risk communication and LEK in the context of multiple learning styles and dynamic and relational notions of scale, we turn to Kolb's (1984) experiential learning theory. Kolb (1984, 38) defines learning as '...the process whereby knowledge is created through the transformation of experience'. To Kolb (1984), knowing is a process, not a product and the emphasis is therefore placed on adapting and learning rather than content or outcomes. Knowledge is seen as a transformation process rather than a commodity to be acquired or transmitted, and learning therefore transforms experience in both its objective and subjective forms – a notion conveyed in the quote below.

*It's the training and the experience at fires that have helped me understand how bushfire works and understanding the landscape and the vegetation. So overall it certainly isn't a couple of dot points. It's a complicated thing to understand, so your understanding of it*

*sort of grows rather than you just completely understand it. You just understand it a little bit more than you did before. (Tree-changer, Windellama, October 2008)*

Critical to Kolb's experiential learning theory, and to the focus of this paper, is the view that '...to understand learning, we must understand the nature of knowledge, and *vice versa*' (Kolb 1984:38). New knowledge, skills, or attitudes are achieved, according to Kolb, through two primary dimensions of the learning process in a cyclical manner (Figure 2). One dimension represents concrete experience of events at one end and abstract conceptualisation at the other. The other dimension has active experimentation at one extreme and reflective observation at the other. '[I]n the process of learning, one moves in varying degrees from actor to observer, and from specific involvement to general analytic detachment' (Kolb 1984:31). Kolb's experiential learning theory holistically conceptualises how individuals adapt to their social and physical environment through the dialectic and simultaneous functioning of thoughts, feelings, perceptions, and behaviour. It also alludes to the necessity of actors, observers and teachers interacting to realise beneficial outcomes.

Figure 2: The structural dimensions of Kolb's experiential learning theory and the resulting basic knowledge forms (adapted from Kolb 1984).

Kolb's learning cycle presents wildfire education initiatives with promising prospects because, if followed in sequence, the stages ensure that the learning process provides feedback through the evaluation of the consequences of an action and thus provides a basis for new action, further evaluation, and so on (Healey and Jenkins 2000). Additionally, the cycle can be entered at any point, allowing people with different knowledge or learning styles to benefit from the same process in different ways. Placed within the theory's learning sequence are four practical training methodologies that can be used by education initiatives to take people through the cycle systematically in the course of a program: planning for experience, increased awareness, reviewing and reflecting on experience, and providing substitute experiences (Gibbs 1988; Healey and Jenkins 2000). Furthermore, Kolb (1984) acknowledges that different learning stages are associated with distinct learning styles (Table 1). Table 1 demonstrates how these learning styles are reflected in the variety of ways research

participants in Studies A and B identify and reflect on learning about wildfire.

Table 1: Kolb's learning styles and learning conditions contextualised with ways of learning in the southeast Australian wildfire-prone peri-urban study areas (expanded from Kolb 1984; Healey and Jenkins 2000).

Learning Styles	Behaviour	Characteristics	Optimum Learning Conditions	Identified learning styles by research participants in Study A and B.
<b>Diverger</b>	Feel and watch	Views situations from many perspectives. Relies heavily upon brainstorming and generating ideas.	When allowed to observe and gather a wide range of information.	'By observing my land'. The public media. Talking to other rural residents.
<b>Assimilator</b>	Think and watch	Uses inductive reasoning. Has the ability to create theoretical models.	When presented with sound logical theories to consider.	Talking to long-term residents. Talking to local bushfire brigade members. Reading information from fire agencies.
<b>Converger</b>	Think and do	Relies heavily on hypothetical deductive reasoning.	When provided with practical applications of concepts and theories.	Attending bushfire management training. Attending community meetings.
<b>Accommodator</b>	Feel and do	Carries out plans and experiments and adapts to immediate circumstances.	When allowed to gain hand-on experience.	Active member of local bushfire brigade. Personal bushfire experience.

#### Local environmental knowledge and learning in wildfire-prone peri-urban landscapes

Peri-urban landscapes are increasingly sought-after places in which to live. In addition to amenity-led in-migration, the proportion of homes in bushland fringe areas is increasing as towns and cities expand (Burnley and Murphy 2004; Gill 2005). The Commonwealth inquiry (Ellis *et al.* 2004) and the McLeod report (McLeod 2003) following the 2003 Canberra wildfires identified specific issues in relation to living in peri-urban landscapes that directly influence wildfire preparation, primarily because these interface areas are attractive to different people for different reasons. Whilst some

people move seeking to be closer to nature, others are seeking cheaper living that is still relatively close to urban amenities and employment (Paton *et al.* 2008).

Social disconnection within a locality has been shown to be more likely where amenity-led in-migration and high resident turnover characterise communities (Weber and Word 2001; Graffy and Booth 2008). The high turnover of property owners in amenity-led communities can lead to an erosion of intra-community familiarity and trust, where the local knowledge concerning, for example, wildfire and wildfire preparedness is slowly lost, or held by long-term residents with little reason to share their knowledge with the ‘blow-ins’ (Forrest and Kearns 2001; Morrison 2003; Cocklin and Dibden 2005).

*One of the neighbours that was here before, he was the head ranger for the Water Board for 20 or 30 years. So he had a lot of local knowledge on different things. He’d tell you all about bushfire. But that’s all gone now and no one took any notice of his experience and now it’s lost. I think people like [him], all their knowledge is lost. (Tree-changer, Oakdale, January 2009)*

However, both newer and longer-term residents in Studies A and B stressed the importance of local knowledge sharing in learning, and sense of community (a construct that describes connections within a community, such as individuals’ identity and actions as part of a community (McMillan and Chavis 1986)) was identified as a key factor influencing effective preparedness among interview participants (see quotes below and Table 1). This highlights that social and demographic dynamism in peri-urban landscapes does not automatically equate to a loss or degradation of useful wildfire LEK from these communities.

*I stupidly asked him ‘You don’t know anything about fencing, do ya?’ Not knowing that he’s a generational sheep farmer! Afterwards you find out that the bloke lives on a thousand acres, he knows everything! He came on and we did one fence and then after that because of what I learnt with him, we did everything else. (Weekender, Windellama, November 2008)*

*We live in a pretty active community and word of mouth is probably the best way to find out about [preparing]. It's only our street, and there's not a great changeover of people here, like most of the people have been here for 20-25 years. They were very welcoming and really, as a street, very proactive and community orientated I guess. (Tree-changer, Fern Tree, April 2007)*

Turnover in peri-urban communities (as evident in Table 2 for the southeast Australian study areas) certainly leads to a constantly changing quantum of LEK, as well as a growing variety in landholder categories (Table 3) (see also Mendham and Curtis 2010). However, whether established long-term resident, or new arrival into a wildfire risk area, all people have developed perceptions regarding wildfire. These perceptions are developed after receiving risk information, through associations with wildfire in the media, through social interactions (friends, family, neighbours, etc.), or through experience. People learn about wildfire (correctly or incorrectly) from these associations, which consequently influence the development of their wildfire LEK. As such, all people living in, or moving to wildfire risk areas hold more or less articulate and preconceived ideas and knowledge about how wildfire may, or may not affect them and others within their community.

Table 2: Turnover of property occupancy in the southeast Australian study areas (% of respondents).

		Study A: NSW (n=348)	Study B: NSW (n=277)	Study B: TAS (n=431)	Study B: TAS (n=398)
<i>Year sampling conducted</i>		2008	2007	2006	2007
<b>Year of move to property</b>	<b>&lt; 1969</b>	4	10	9	7
	<b>1970s</b>	8	13	11	9
	<b>1980s</b>	18	33	16	19
	<b>1990s</b>	28	17	24	25
	<b>2000s</b>	42	27	40	41

Table 3: Landholder categories in the southeast Australian study areas (adapted from Klepeis, et al. 2009)

<b>Landholder Types</b>	<b>Characteristics</b>
Full-time Graziers Full-time Dairy / Beef Cattle Full-time Livestock / Market Gardening	Full-time residents; off-farm income important but their objective is to earn a living from the land.
Full-time Tourism	Full-time residents; off-farm income important but

	their objective is to earn a living from their property through tourism related activities.
Full-time Lifestylers (amenity buyers): Commuters Hobby farmers Retirees Seekers of a rural retreat	Full-time residents ('Tree-changers'); many have a secondary residence elsewhere; main or only source of income is off-farm; amenity use; a minority seek to generate profit from farming activities.
Part-time Lifestylers (amenity buyers): Hobby farmers Land investors Recreationalists Seekers of a rural retreat	'Weekenders' or occasional visitors; primary residence is elsewhere; rely on off-farm income; amenity use; a minority seek to generate profit from farming activities.

296

297 Study B found that longer-term residents, and people with direct experience of wildfire are  
 298 significantly more likely to make substantial preparations for wildfire, and think critically about  
 299 how their behaviour might mitigate the impacts of wildfire on their lifestyles (for a detailed  
 300 description of the statistical analyses applied, see Prior, 2009). Survey data from Study A  
 301 further identified that landholders tend to lean either towards a stance that emphasises the  
 302 benefits of wildfire and hazard reduction burns (generally people who have lived and/or worked  
 303 on the land for more than 10 years, and with direct experience of wildfire), or a stance that  
 304 stresses concern for the environmental impact of burning (often newer landowners or  
 305 weekenders who are less likely to have personal wildfire experience) (for a detailed description  
 306 of the statistical analyses applied, see Eriksen and Gill 2010). This conforms to popular ideas  
 307 that new landholders are *the* problem: that they are ignorant about wildfire and need to be  
 308 educated – a notion conveyed in the quote below.

309 *A lot of the people who move out here are just naïve. They could potentially be in a lot of*  
 310 *trouble. Like the neighbours down here – how that never burnt down, I'll never know.*  
 311 *Look where the house is! They put that house right next to the bush. Like, God help me*  
 312 *what a silly place to build a house! They wanted to take advantage of the view, so*  
 313 *obviously no comprehension of the danger. (Long-established tree-changer, Oakdale,*  
 314 *January 2009)*

315 Yet, as a 'tree-changer', the interviewee above also moved "out here" initially but has learned and  
 316 grown more knowledgeable 'on location'. Furthermore, whilst the interviewee was confounded by the

desire of the new arrival to “take advantage of the view”, the interviewee was uninformed of the wildfire-related decision-making processes the new arrival went through in planning and building, and possibly preparing to live “right next to the bush”. This highlights that whether or not the knowledge a new or established resident has about wildfire is accurate and useful depends largely on where that information has come from, how it overlays existing knowledge, and the perceptions the individual holds concerning the role wildfire might play in their peri-urban life.

Importantly, narrative analysis of interview data revealed that dualistic stances towards wildfire management are often not mutually exclusive. Decisions regarding hazard reduction that involve altering the landscape in particular, appear to be negotiated outcomes amongst household members and wider networks with diverse values and backgrounds. The quotes below illustrate how many residents are unwilling to compromise certain landscape characteristics because of their attachment to landscape and lifestyles, despite being able to identify the inherent wildfire risks presented by these landscapes (see also McCaffrey 2004b; Brenkert-Smith *et al.* 2006; Paton *et al.* 2008; McGee *et al.* 2009).

*If any tree is to be cut down we have to have a conference about it. There's no such thing as just going and cutting a tree down, you know. It's got to be really discussed, thought about, do we really need to do it, you know. (Tree-change couple, Kangaroo Valley, January 2009)*

*I think a lot of bush gets destroyed that way, by people moving into the bush and then getting scared of fires, and chopping it all down. I live in the bush because I like the bush, so I don't want to surround my house with you know, 40 metres of lawn, that's just ridiculous. (Tree-changer, Hobart, March 2007)*

Triangulation of the quantitative and, in particular, the qualitative research results of Studies A and B highlights that the demographic and structural changes associated with amenity-led in-migration do not translate into straight forward cultural change reflected in ready distinctions between newcomers and longer term landholders (see also Gosnell and Abrams 2009; Robbins, *et al.* 2009; Gill, *et al.*



2010). For example, while the broad groups (and their vernacular refinements, “locals”, “tree-changers”, “weekend warriors”, “fire fighters”, “greenies”, and “rednecks”) at times appeared internally unified and externally opposed to each other, the situation is more complex than that. There are often characteristic differences between those who make a living off the land and those who are simply residential landowners; long-term and newer tree-changers; weekenders who are actively involved in the local community and those who are not.

This suggests that other types of social distinctions or processes may be of similar or greater relevance when pitching community engagement programs. Newer landholders may truly be unaware of the threat from wildfire because they have no history of fire within their families or have always lived in urban environments. People who choose to live in peri-urban landscapes for purely economic reasons may similarly be unlikely to consider wildfire threat when making this choice (Paton *et al.* 2006; Whittaker 2008). However, many people appear to wilfully ignore the threat from wildfire to avoid having to confront uncomfortable truths about everyday tradeoffs, as these truths would result in decisions that require undesirable investment in time allocation, money, or landscape changes (Prior 2009; Eriksen and Gill 2010; see also McGee and Russell 2003; Brenkert-Smith *et al.* 2006; McGee *et al.* 2009). This highlights the need for a greater emphasis on how LEK within communities varies, community dynamics, and learning styles in order to improve education and engagement processes about wildfire risk.

The incorporation of empirical data (extracted from Study A) into Figure 3 illustrates how Kolb’s (1984) theoretical structure can be employed to understand relational and dynamic notions of wildfire knowledge. In highlighting different knowledge dimensions, Figure 3 demonstrates how people may be situated differently on the figure’s axes because of experiences, attitudes, beliefs, values, or preferred learning styles, rather than as a result of landholder categories. Other factors, such as gender, may further affect landholders’ placement on the different axes (Eriksen *et al.* 2010).

Figure 3: Relational and dynamic notions of wildfire knowledge (building on the structural dimensions of Kolb’s (1984) experiential learning theory (included in grey writing)).

Figure 3 emphasises that the challenge for community outreach programs is to find the best ways to build on existing local knowledge whilst simultaneously adapting to better reflect changing social, cultural, environmental and economic needs (as highlighted in the quote below). The relevance of Kolb's experiential learning theory to meet this challenge is that it stresses the value of interactive learning. 'If the education process begins by bringing out the learner's beliefs and theories, examining and testing them, and then integrating the new, more refined ideas into the person's belief systems, the learning process will be facilitated' (Kolb 1984:28). Such interactive learning processes provide more scope for local barriers to be identified, trust to be built, and opportunity for questions to be raised and clarified. It also promotes networks of communication and interaction between diverse types of residents, resource managers and emergency services in peri-urban landscapes. Above all, it provides an avenue to complement awareness raising mass-communication methodologies, which alone generate inconsistent results (Paton *et al.* 2006).

*The knowledge is there but it's not disseminated. You can get books about fire essentials but you don't necessarily relate it to local conditions. The knowledge that's been gained about, you know, how fire acts in the Valley, not how fire acts generally. So [we need] some more interactive community focus and interplay between the experts and the keen amateurs. (Weekender, Kangaroo Valley, November 2008)*

#### **Turning theory into practice: Ways of knowing**

Figure 4 provides a new framework in which to establish more effective learning about wildfire. This framework is based on an integration of Kolb's (1984) learning styles and optimum learning conditions, the existing means of wildfire risk communication, and research that examines the socio-cognitive processes individuals engage in when deciding whether or not to prepare their properties for wildfire (Paton and Wright 2008; Prior 2009; Eriksen and Gill 2010; Eriksen *et al.* 2010). Integrating these components, which have each been used to inform risk management processes to date, should focus and increase the effectiveness of future wildfire risk communication and education programs. Figure 4 connects current wildfire education mechanisms with the stages in the learning cycle where

they may be most effectively applied. It relates education mechanisms and learning styles to the theoretical process individuals pass through in reaching the point where a decision to prepare for wildfire is made – from motivating people to engage, to facilitating the intention to prepare, and to the promotion of action (Paton et al. 2008). It identifies the important factors that influence the stages of this process – stages that can be addressed by knowledge of the individual learning style, and the education mechanism appropriate to that stage in the learning cycle.

Figure 4: A framework for targeting particular wildfire risk information to particular learning styles and learning stages (adapted from Kolb 1984; Gibbs 1988; Healey and Jenkins 2000; Paton et al. 2008; Delaine et al. 2008; Paton and Wright 2008).

It is useful to understand the operation of this framework using the February 2009 wildfires in Victoria as an example. In this instance many people with no personal wildfire experience were forced to enter the learning cycle when unexpectedly faced with a severe wildfire on their doorstep. Without experience people feel and watch, and are likely to make last-minute decisions about how to act. The aftermath of the wildfire prompts reflection, which often results in the search for information that individuals evaluate against their new experience. As awareness and understanding of the local wildfire risk increases, the process of conceptualising ways to mitigate the risk is initiated. If inhibiting factors, such as hazard anxiety, ‘self-efficacy’ (Bandura 1986), and complacency, are overcome, these steps are followed by experimentation, the implementation of preparation measures, further reflection and so on. At each of these stages there is a need for information, guidance and tools to assist the learning process. The more interactive, local and context specific the information, guidance and learning tools are, the more likely they are to be successful in improving individual and community preparedness for wildfire. This process is supported with conscious and subconscious sharing of experiences, fears, motivation, skills, and other factors that influence people’s level of engagement with wildfire. In this context, sharing spreads the burden associated with learning how to prepare and helps to build a shared, collective knowledge about how to address wildfire threat ensures a more resilient community. Interactions concerning wildfire preparedness also increase people’s capacity to understand and address the uncertainty and challenging nature of events

associated with wildfire activity.

It is important to stress that Figure 4 is a simplification of a complex process that can be used to understand learning in people with or without wildfire experience. Its pertinence for future community outreach initiatives lies in the emphasis it places on the relationship between the process of learning and the way people make decisions about preparing for wildfire in the context of existing education/communication processes: do people *know* how best to mitigate wildfire risk? It thereby addresses the influential factors, such as LEK, learning styles, demographics, environmental beliefs, and lifestyle, among many other context and situation specific factors, at each of the three preparedness steps. This highlights an important aspect of wildfire risk management and education: the need to develop a good understanding of the characteristics of the community, for example through ‘community profiling’ (Cottrell 2008), before beginning a dialogue about wildfire risk mitigation (Prior and Paton 2008; Eriksen and Gill 2010; Eriksen *et al.* 2010).

## **Conclusion**

This paper has considered how diverse landholders in wildfire-prone peri-urban landscapes learn and form LEK of wildfire, and how this affects the ability of at-risk individuals to interpret and act on risk communication messages. In doing so we have drawn on Kolb’s (1984) theory of experiential learning. We acknowledge that much effort has been directed at developing engagement processes in wildfire risk communication in recent years, but suggest these processes are still dominated by traditional paradigms of unidirectional risk communication, which limit the effectiveness of engagement.

We demonstrate that one of the key difficulties associated with communicating wildfire risk information to a diverse population is anticipating the extent to which this information is incorporated into the individual’s existing knowledge, which is created through dynamic relationships and interaction with land, nature, events, and people. Understanding how people learn and how wildfire LEK changes with time and in context must therefore be an important component in effective wildfire risk communication through engagement.

The paper underlines how community members' local connections play a key role in fostering and transmitting social, human, and cultural capital, such as intergenerational knowledge, local ties, and information sharing, which can promote or add value to wildfire preparedness. This demonstrates a need to make the link between learning processes and the way people make decisions about preparing for wildfire, and the information they use in these decisions, more explicit. To be successful, community outreach programs need to build on the existing local knowledge of diverse types of landholders whilst simultaneously adapting to better reflect changing social, cultural, environmental and economic needs. The promotion of networks of communication and interaction between diverse types of landholders is a valuable tool in achieving these goals. This could involve quarterly or half-yearly engagement sessions that particularly address the concerns of women; interactive family 'fun-days' at local bushfire brigade stations where children and parents together can learn basic wildfire safety facts; risk assessments of local properties that other community members are invited to attend; or 'story telling' evenings where local wildfire (and other) stories are shared to deepen peoples' sense of belonging and contextualise information for both newer and older residents. Importantly, wildfire managers should consider themselves as members of these communication networks.

Such community outreach initiatives are capable of providing residents with enough 'experience' to be able to act. Importantly, these initiatives must be interactive and locally and socially contextualised, so they both appeal to a heterogeneous set of landholders with diverse learning styles and address *local* barriers and motivations for action. Developing more effective processes for two-way risk engagement can modify, dispose of, and/or accommodate the environmental beliefs, lifestyles, social pressures, and trust issues that affect the development of LEK on wildfire. Risk engagement should not be competing with cultural, environmental and economic procedures, tradeoffs, and dilemmas in everyday life but instead acknowledge them and work with them to generate better outcomes for agencies and landholders alike. For example, it should be made clear what the tangible benefits are of having a transparent wildfire action plan that has been discussed and rehearsed with all household members regardless of age and gender; why such plans should be communicated to neighbours, friends and family; and why decisions to 'leave early' also require

planning and rehearsals. Actions that yield everyday benefits for the landholder, but with opportunistic wildfire risk mitigation outcomes should be promoted repeatedly. For example, these include mowing the lawn, installing a rainwater tank, having long hoses, purchasing a fuel-driven water pump, double-glazed windows, and establishing local 'telephone trees'.

Establishing mechanisms that bring context to wildfire management and thus 'experience' to non-experienced individuals is important in enhancing the cultural capacity of peri-urban communities to manage wildfire risk. The framework presented in this paper can overcome some of the risk communication difficulties faced by wildfire management agencies. It provides a foundation for more reflective and thus more effective two-way risk engagement that fosters shared information and shared learning, rather than unidirectional, top-down communication that relies on the ability of diverse individuals to recognise, understand and use such information. Providing experience through local, context specific and interactive initiatives and engagement can provide people with the mechanisms needed to better understand and interpret risk information. This framework allows people to understand how the knowledge they have can be used, how it might be improved, and who can improve it. The framework also signifies the work emergency services need to accomplish prior to engagement initiatives in order to understand and incorporate the needs of specific communities. It thus provides a positive feedback loop that will ultimately contribute to more widespread community preparedness for wildfire at a time when a growing number of people internationally choose to live in wildfire-prone peri-urban landscapes.

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