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2011

Trial by fire: natural hazards, mixed-methods and cultural research

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Publication Details

Eriksen, C., Gill, N. & Bradstock, R. (2011). Trial by fire: natural hazards, mixed-methods and cultural research. *Australian Geographer*, 42 (1), 19-40.

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Trial by fire: natural hazards, mixed-methods and cultural research

Abstract

This paper considers the issues of research 'relevance' and 'use' to reflect upon a cultural geography research project on bushfire that did not begin with any specific aim of being useful to policy makers but which has garnered considerable and ongoing interest from a broad audience. It provides an example of how the integration of quantitative and qualitative research methods and data can enhance research into cultural aspects of natural hazards whilst simultaneously playing a key role in ensuring that the research results are of interest to a wide range of groups. Using a mixed-methods research approach was found to provide insight into complex factors that influence attitudes and actions towards bushfire amongst diverse landholders in rural-urban interface areas in south-east Australia. We argue that mixed-methods research is a powerful tool in building and enhancing a cultural geography that has policy relevance, retains analytical depth, and is acceptable to risk managers. The ability of cultural geography through mixedmethods research to illuminate how socio-cultural processes are central to environmental attitudes and preparedness behaviour has direct relevance to recent international discussions of how to manage the vulnerability of the growing number of people living in bushfire-prone rural-urban interface areas. C 2011 Geographical Society of New South Wales Inc.

Keywords

Trial, fire, natural, hazards, mixed, methods, cultural, research, ERA2015

Disciplines

Life Sciences | Physical Sciences and Mathematics | Social and Behavioral Sciences

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ABSTRACT This paper considers the issues of research ‘relevance’ and ‘use’ to reflect upon a cultural geography research project on bushfire that did not begin with any specific aim of being useful to policymakers but which has garnered considerable and ongoing interest from a broad audience. It provides an example of how the integration of quantitative and qualitative research methods and data can enhance research into cultural aspects of natural hazards whilst simultaneously playing a key role in ensuring that the research results are of interest to a wide range of groups. Using a mixed-methods research approach was found to provide insight into complex factors that influence attitudes and actions towards bushfire amongst diverse landholders in rural-urban interface areas in southeast Australia. We argue that mixed-methods research is a powerful tool in building and enhancing a cultural geography that has policy relevance, retains analytical depth, and is acceptable to risk managers. The ability of cultural geography through mixed-methods research to illuminate how socio-cultural processes are central to environmental attitudes and preparedness behaviour has direct relevance to recent international discussions of how to manage the vulnerability of the growing number of people living in bushfire-prone rural-urban interface areas.

KEYWORDS Australia, mixed-methods research, cultural geography, bushfire, natural hazards, policy, applied research

Introduction

In Australia as elsewhere (Staeheli and Mitchell 2005; Ward 2005) academic researchers are expected to conduct research that will be relevant to non-academic ‘users’ in some way. For example applications for Australian Research Council grants are required to justify their proposed research in terms of ‘national benefit’ and contribution to a set of National Research Priorities (Australian Research Council 2009). Such requirements resonate with older (Harvey 1974) and more recent (Martin 2001; Hamnett 2003) debates within geography regarding criticisms of trends (such as the ‘cultural turn’) and the alleged consequent irrelevance of the discipline beyond academia. Responses to concerns about irrelevance have highlighted problems with uncritical use and characterisation of key concepts such as ‘use’ and ‘relevance’ (Staeheli and Mitchell 2005; Gill 2006), and with dualisms such as critical/applied research, high level/grassroots impact, and direct/diffuse influence (Pain 2006). ‘Relevance’ and ‘use’, for example, far from being one-dimensional concepts, have been shown to have various meanings and to be as much about social and political processes, including research-user relationships and the context of any particular research, as any readily

identifiable outcomes and application (Pawson 2006). Commenting on a career characterised by engagement with practitioners, Burgess (2005) argues that relevance is not given but is emergent. She also argues that ‘we...need to challenge policymakers, in that good research can change the definition of what is “relevant” and to whom’ (Burgess 2005, p. 277). Just as deliberative research that challenges key assumptions in practice may influence practitioner thinking, so too may the commissioned report languish on the shelves.

Policy analysis literature has shown that there are at least three different types of research ‘use’ (Beyer 1997; Amara, *et al.* 2004; Gill 2006). First, instrumental use is conceptualised as direct use of research to deal with specific issues or problems. Second, conceptual use refers to more indirect use, where for example research influences thinking or encourages people to see an issue in a different way. Thirdly, symbolic use refers to the use of research findings as ammunition to support existing positions. In general, research methods are not a good predictor of research utilisation although quantitative methods play a role in increasing use (Landry, *et al.* 2001; Amara, *et al.* 2004). Qualitative research, on the other hand, is influential in relation to conceptual and symbolic use (Amara, *et al.* 2004). Moreover, other research has shown that policymakers, while abstractly positivist, in fact draw upon a wide range of sources of information, being engaged in a profession that is as much art as science (Lynn 1999; Morcol 2001). The timing and context of research can thus be as significant as factors such as methods in determining the influence and ‘use’ of research. This includes the effort that researchers put into communicating their findings and the context of the research, such as the broader social, institutional, or political settings in which the research reaches groups such as policymakers (Gill 2006).

These findings suggest that there are many pathways to relevance and that there are never any guarantees that research will be of interest outside academia or ‘how’ it might be used. The relationship between research, evidence and policy is far from straight forward and is subject to negotiation, power, and shifting institutional landscapes (Fischer 2003; Hajer 2003; Juntti *et al.* 2009). Among other things this suggests that researchers need to actively position themselves for relevance, for example, through the use of research strategies to enhance the likelihood that research will be of interest to other groups (Pannell and Roberts 2009). Gill (2006) and McCaffrey and Kumagai (2007) argue that social science research, such as geography, influenced by critical perspectives and contemporary social theory has much to offer natural hazards and natural resource management policy and practice. In part, this requires following Burgess' injunction to challenge policymakers and others. However, it also suggests that cultural and critical geographers consider conducting research in such a way that is both theoretically informed and likely to be palatable to audiences outside academia, including policymakers.

In this paper we consider the issues of research ‘relevance’ and ‘use’ to reflect upon a cultural geography research project on bushfire that did not begin with any specific aim of being useful to policymakers but which has garnered considerable and ongoing interest from a broad range of groups. These groups have included bushfire policymakers and practitioners as well as the media and rural landholders. This has been achieved even as the project has maintained a critical perspective grounded in poststructuralist geography and in its analysis has challenged aspects of bushfire institutions and management. In this paper we consider what has made the research of such interest to broader audiences despite the fact it is grounded in a research paradigm that has been criticised as a key source of the irrelevance of much contemporary human geography. We particularly advance this reflection through arguing that a mixed-methods approach in cultural geography has much to contribute to natural hazards research. Building on James’ (2006, p. 290) argument that mixed-methods is one strategy by which cultural geography can be strengthened (see also Dunn, *et al.* 2007; Dunn 2008), we use mixed-methods as a tool for building and enhancing a cultural geography that has policy relevance, retains analytical depth, and has a role in hazards and natural resource management.

In this paper we firstly discuss the place of social science in natural hazards research. We then outline the underlying principles for carrying out mixed-methods research and contextualise this in the southeast Australian case study. This is followed by an examination of the applied relevance of the empirical outputs resulting from the cultural geography research project. We consider the nature of use or influence that we perceive is occurring and some contexts for the research that appear to be of importance. Finally, we consider the ability of cultural geography through mixed-methods research to assist the incorporation of social dynamics into official bushfire management policy and practice.

The place of social science in natural hazards research

There is growing recognition of the role of social science in bushfire research and management (Daniel, *et al.* 2007; Handmer and Haynes 2008). Characterised mainly by its absence until recently (Whittaker and Mercer 2004), a now growing body of Australian social science research on bushfire follows on from a long-standing critique that traditional natural hazards research, despite the influence of the work of Gilbert White (see, for example, White, *et al.* 2001), has been framed largely within biophysical science disciplines (Kates 1971; Emel and Peet 1989; Burton, *et al.* 1993; Handmer and Dovers 2008). Further, the behavioural approaches that have dominated social research on natural hazards have been shown to be problematic in their attempt to separate knowledge and action (Torry 1979; Watts 1983; Barr 2008). The past decade has also seen an increased interest in

poststructuralist perspectives on natural hazards and natural resource management that has shown that the dichotomy of nature and culture is implicit in biophysical and behavioural approaches to hazards (Rose 2001; Wisner, *et al.* 2004; Gill 2006; Suchet-Pearson and Howitt 2006; Griffiths 2007). As a result it is increasingly acknowledged that research and ultimately policy and practice responses need to be grounded in analysis that is sensitive to, for example, how people make sense of, and act towards, nature not only or simply in technical, biophysical, and behavioural approaches (see, for example, Robbins and Sharp 2003; Head, *et al.* 2005; Head and Muir 2006). Collectively, these critiques and advances in social science demand methodologies capable of addressing the challenges and issues that they pose.

In addition to these research imperatives to continually develop natural hazards research methodologies, there are pressing 'real world' issues that demand critical *and* constructive input from social scientists. The increasing frequency, for example, of bushfires, emphasizes the urgent need to engage more effectively with local communities (Daniel, *et al.* 2007; Ashe, *et al.* 2009; Eriksen and Prior In Press). The recent tragic bushfires in Australia, North America and Europe demonstrate a need not just to make local communities more aware of natural hazards such as bushfire but also a need to enable communities and individual landholders to take greater responsibility for their own safety through awareness, preparedness and response. The growing number of people living in bushfire-prone rural-urban interface areas and the predicted increase in high fire danger weather with climate change makes this a compelling issue internationally (CSIRO 2007; IPCC 2007; Bowman, *et al.* 2009), and poses significant difficulties for the emergency management agencies tasked with managing and mitigating bushfire risk (see, for example, McLennan and Birch 2005; Brenkert-Smith, *et al.* 2006; Paton and Wright 2008). Accordingly, the need to cross or integrate disciplines has become a dominant theme in discussions about bushfires and their management (Bradstock, *et al.* 2002; Ellis, *et al.* 2004; Gill 2005; Griffiths 2009). Part of this response does and undoubtedly will include an ongoing and possibly greater role for social science research in both broader public debates about bushfire and in development and evaluation of policy and practice (McCaffrey and Kumagai 2007; Handmer and Haynes 2008; Jensen and McPherson 2008). Innovative programs such as those of the Bushfire Cooperative Research Centre (www.bushfirecrc.com; Handmer and Haynes 2008) have helped social science to gain a far greater standing in bushfire institutions than in the past. Nonetheless, the history of social science in Australian natural resource management (Roughley 2005), perceptions of the role of social science more generally (Lewis 2003), and observations of the approach of emergency services to socio-economic issues (White, *et al.* 2001; Mercer, *et al.* 2008) suggest that social scientists are likely to continue to face challenges in being part of such processes. Both the detail and broader character of these challenges are elaborated in

Gill (2006). In the remainder of this paper we discuss and reflect on our mixed-methods research strategy and how it has facilitated a cultural geography that is critical and constructive, insofar as it has retained its theoretical groundings and generated interest beyond academia. We also discuss the undoubted importance of the temporal context of this research.

Principles of mixed-methods research

Mixed-methods research is an approach that combines quantitative and qualitative research techniques, methods and concepts within a single study. It thus builds on the strengths and weaknesses of both quantitative research characteristics (deduction, confirmation, theory/hypothesis testing, ability to generalise, explanation, prediction, standardised data collection, and statistical analysis) and qualitative research characteristics (induction, discovery, theory/hypothesis generation, depth, exploratory data collection, and qualitative analysis) (Johnson and Onwuegbuzie 2004; Bryman 2008). The debate about the worth of qualitative versus quantitative methods that lies at the heart of criticisms of the ‘cultural turn’ in geography is typically characterised by a series of dualisms (for more detail see: Philip 1998; Crang 2002; Hamnett 2003; Johnston, *et al.* 2003; Gill 2006; James 2006; Bryman 2007). The key strength of mixed-methods research, however, is the emphasis placed on methodological pluralism, diversity and integration. This strength is evident in the five underlying principles for carrying out mixed-methods research outlined in Table 1. It can, however, also be a disadvantage, mainly through the potentially time-consuming nature of mixed-method research (see Table 2).

INSERT TABLE 1 HERE

The mixed methodology used in our southeast Australian study demonstrate the diversity of methods that can be utilised in a cultural geography research project: postal surveys, archival newspaper analysis, semi-structured interviewing, photo-eliciting, property walk/drive throughs, informal and formal discussions, participatory observation, statistical analysis, narrative analysis, and qualitative content analysis (for a more comprehensive list and discussion of different types of methods, see Rocheleau 1995; Atkinson, *et al.* 2001; Bryman 2008). It is this methodological pluralism that makes mixed-methods research valuable for natural hazards policy and practice, as the approach provides the tools needed to gain a better understanding of the diverse social, economic, environmental and political parts that make up the whole of a natural hazard (Table 2).

INSERT TABLE 2 HERE

Study area and methods

The research presented in this paper was undertaken in three rural landscapes characterised by amenity-led in-migration in New South Wales, Australia: the Oakdale area in Wollondilly Shire, Kangaroo Valley in the Shoalhaven, and Windellama on the Southern Tablelands (Figure 1). Amenity-led migration refers to the increasing urban-to-rural movement of people predicated on desires for lifestyle change, affordable property, and/or the attraction of natural and/or coastal environmental settings (Burnley and Murphy 2004; Hugo 2005). It is popularly referred to in Australia as “tree- or sea-change”. Amenity-led migration has resulted not only in population growth but also a rapid re-composition of rural populations, as urban migrants purchase land, often subdivided farmland, whilst the more traditional rural population age or decline. The study areas were chosen due to their varying commuting proximity to two of Australia’s biggest economic and political centres – Sydney and Canberra; their varying degree of land use change and farm subdivision; their high amenity value; and the presence of significant areas of naturally vegetated land, which heightens the risk of bushfire. Their character is thus a product of the demographic changes, lifestyle preferences, agricultural restructuring and the footloose working patterns of the internet age that have shaped tree- and sea-change areas across Australia, including many of the areas worst-hit by the “Black Saturday” bushfires in Victoria in February 2009.

INSERT FIGURE 1 HERE

Figure 1: Map of study areas in southeast Australia

The aim of the project was to examine how experiences of place, culture, events and context mediate how landowners’ relate to bushfire in such socially dynamic areas. Initially the use of mixed methods was driven by two key considerations. First, were questions of how the influx of amenity migrants was influencing the reproduction and nature of knowledge about bushfire and whether distinctions relating to bushfire could be made between older and newer rural residents. Second, a central theoretical starting point was to conceptualise bushfire not just as a natural phenomenon but as simultaneously a product of ongoing associations and negotiations in everyday life (Eriksen and Gill 2010). Together these considerations required a research methodology that incorporated both survey and more intensive interview and fieldwork methods in order to elicit landholders’ attitudes, practices, decision-making, interactions, and beliefs.

To create a general overview of the context within which landholders’ narratives, knowledge, and behaviour are embedded, our research needed a quantitative data baseline from the outset. This was achieved through the postal survey and the examination of a broad range of

documents and policies. Archival research of local and State newspaper articles dating back to the mid 1960s provided historical insight into bushfire and land management changes in the study areas. In addition 'non-official' written sources such as novels and webpages were consulted to gain a sense of public awareness and attitudes towards bushfires. These were compared with official policy documents; academic research; and bushfire management brochures targeting the general public. This triangulation of diverse written sources highlighted historical trajectories of values and attitudes among different types of organisations and people that are important for understanding how values and attitudes are expressed at any given time.

The postal survey investigated the overall picture of landowners' type and level of engagement with bushfire management. It consisted of 43 questions that covered topics such as landowners' experience of bushfire, the role of bushfire in their land management aims, involvement with local fire brigades or environmental groups, and perceptions of personal and community levels of bushfire risk, knowledge, and preparedness. In the three study areas, all of the private dwellings identified in the Australian Bureau of Statistics 2006 Census (ABS 2007) were targeted by the postal survey (Groves, *et al.* 2004). 348 landholders (16% response rate) completed the survey from February to May 2008 at the end of a statutory bushfire danger period (October 1st to March 31st in New South Wales) with little bushfire activity (RFS 2009). This may explain the fairly low (but nevertheless statistically acceptable, see Dillman 2000; Groves, *et al.* 2004) survey response rate.

Two computer software programs were used to manage and analyse the quantitative data from the postal survey: FileMaker Pro 8.0v1 and SPSS 16.0. Factor analysis was first applied as a data reduction technique to summarise the large number of variables within the quantitative data into more meaningful, smaller sets of factors and to identify interrelationships between variables in the data set (Allen and Bennett 2008). The reliability of the consistency or dependability of findings over survey questions was verified by Cronbach's Alpha. Correlation and multiple regression analysis was then used to explore the extent to which variance within these factors could be accounted for by survey variables. Bivariate Pearson's correlation coefficients were calculated to assess the size and direction of the linear relationship between survey variables. Pearson's chi-squared tests of contingencies were furthermore used to evaluate whether survey components, such as levels of bushfire experience, preparedness, perceptions of threat and personal knowledge were related to gender. This statistical analysis identified patterns in the quantitative survey data of landholders' attitudes towards the use, role and risk of bushfire that was subsequently compared with narrative analysis results.

On the back page of the postal survey, respondents could volunteer to be interviewed further on their opinions and experiences relating to bushfire and natural resource management in changing rural landscapes. Of the 348 landholders who completed the survey 165 agreed to be interviewed further. On the basis of their replies, 38 landholders were interviewed on their properties from October 2008 to April 2009 – the months leading up to, during and after the “Black Saturday” bushfires. The 38 interview participants were selected to give a balanced sample of gender, age, place of upbringing, main or secondary residence, local rural fire brigade membership, levels of bushfire experience, property size, income generated on properties, asset protection zones (firebreaks), and personal bushfire action plans. This sampling strategy allowed interviewees to be selected purposively to meet criteria that were central to the main research topic (Creswell 2007; Bryman 2008).

The interviews followed five broad research themes: bushfire mitigation efforts, property management, landscape values, community engagement, and ways of learning. After “Black Saturday” interview participants were furthermore asked to reflect on their personal bushfire safety in relation to the tragic Victorian bushfires. An in-depth, interactive, semi-structured interview approach was used that included photo eliciting and property walk/drive-throughs. Each interview participant was provided with a disposable camera in advance of the interviews and instructed to take photographs of places, activities, people and things on their rural property and its surroundings that they consider important. The photographs were developed prior to the interview sessions and served as a starting point for many of the interviews. Both photography of and movement through the landscape being discussed elicited more in-depth details, as they acted as reference points through which interview participants could represent aspects of their individual reality to the interviewer and vice versa (Pink 2001). Embodied in the photographs were clues to landholders’ feelings about sense of belonging and identity. The interactive interviews thus provided perspective and insights into different ways of seeing (Bintz 1997; Riley and Harvey 2007; Riley 2010). The interviews were audio recorded and transcribed verbatim before being coded and analysed using the Computer Assisted Qualitative Data Analysis Software NVivo v8. The interview transcripts were coded using both *a priori* themes, such as community involvement, and emerging themes, such as emotional responses.

Rather than discussing detailed research data and findings, the focus of the following sections is the use of mixed-methods in cultural geography research to explore and discern a variety of themes in the research that connect with a range of bushfire policy and practitioner concerns evident in changing rural landscapes in southeast Australia.

Critical research, relevant research?

In this section we highlight three themes from our research that illustrate our argument that mixed-methods research can contribute to geographical research that is both critical and constructive in the sense of being broadly useful and relevant: 1) landowner types, 2) knowledge and learning, and 3) an examination of the awareness-preparedness ‘gap’ using concepts of everyday life and gender. These themes were both *a priori* and emergent in the research.

Landowner types

Attitudes towards bushfire and natural resource management elicited through the postal survey were found to influence if, how, and to what extent landowners prepare for bushfire, regardless of landholders’ risk awareness levels. In particular, two main stances towards bushfire management and preparedness were identified by the statistical analysis of the survey data. Landholders tend to lean either towards a stance that emphasises the benefits of bushfire and hazard reduction burns or a stance that stresses concern for the environmental impact of burning. The type of landholders who emphasise the benefits of using fire tends to be people who either have lived all their life on the land or work directly with the land; they have been landowners for more than 10 years; and they are more likely to be actively involved with their local rural fire brigade. The other group of people who tend to be concerned about the environmental impact of burning often are newer landowners or weekenders; they are likely to have higher levels of education, moving to rural areas after living in urban environments during their education and early career years, and are less likely to have personal bushfire experience. The mixed-methods approach allowed the affect of these stances on landholders’ level of engagement with bushfire management to be explored in greater detail through interviews. The relevance and applicability of the statistical results for policy development was thus verified through landholders narratives, as the two stances were evident not only in the context of property and bushfire management issues but also in narratives on community engagement and landscape values.

Despite the usefulness of this distinction between stances in both the survey and interview data, the interview data further facilitated critical analysis of this distinction. This has allowed the research to contribute to thinking beyond dualisms in amenity rural landscapes and to identify alternative and potentially more significant ways of thinking about the existence, erosion, or generation of social difference and connection. 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. For example, there are significant differences between those who make a living off the land and those who are

simply residential landowners; long-term and short-term tree-changers; weekenders who are actively involved in the local community and those who are not. This 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 (Gosnell and Abrams 2009; Robbins, *et al.* 2009; Eriksen, *et al.* 2010; Gill, *et al.* 2010). For bushfire agencies this has potential consequences for community engagement programs and for the nature of social capital and networks that they rely on for much regional and local bushfire training and management work. It also suggests that other types of social distinctions or processes may be of similar or greater relevance as canvassed in the next two sections.

Mixed-methods research enabled triangulation to be used both as a data and as a methodological validation and accuracy strategy. As Roe (1998, p. 87) underline ‘...instead of truth, what we get out of triangulation is confidence, i.e. convergence across multiple instruments enables us to be more assured we have in that convergence a point of departure which we feel is worth pursuing further’. Triangulation unveiled routes to additional knowledge through an enhancement of the richness of the data obtained. This highlighted how the embedded socio-linguistic everyday usage of concepts and terminology, such as ‘community’ or ‘landscape’, masks a large spectrum of difference that is important in bushfire management. The term ‘landscape’, for example, masks the diversity of landscape values that landholders are attached to. This diversity was only apparent in landholders’ narratives and highlighted that the two stances towards bushfire management identified through the quantitative data analysis (outlined above) are not mutually exclusive. Rather decisions regarding hazard reduction that involve altering the landscape are negotiated outcomes amongst household members and wider networks with diverse values and backgrounds. Many landholders appeared unwilling to compromise certain landscape characteristics due to attachment to landscape and lifestyle preferences despite being able to identify the inherent bushfire risks in these landscapes (see also McCaffrey 2004b; Vogt, *et al.* 2005; Brenkert-Smith, *et al.* 2006; McGee, *et al.* 2009).

Knowledge and learning

Examining the character and formation of local environmental knowledge in changing rural landscapes was a key objective in the research. Our starting point was that knowledge is not simply an accumulation of facts or a product, but a process and a way of construing the world. Analysing learning and knowledge production was greatly facilitated by the use of mixed methods. The survey data showed that key sources of information tend not to be official resources but local connections such as neighbours, friends, family, and bushfire

brigade volunteers. Triangulating this quantitative data against interview and other fieldwork material on learning, allowed us to flesh out exactly how learning occurred through such sources. When narrative and qualitative content analysis (Cortazzi 2001; Bazeley 2007; Bryman 2008; Riessman 2008) was applied to search for underlying themes in the interview transcripts it became clear, for example, that learning about bushfire takes place at both conscious and subconscious levels. When asked how landholders had learnt about particular bushfire management practices, many interview participants would shrug their shoulders and state “I don’t know. I just did”. Peoples’ learning styles were instead revealed indirectly during interviews when conversing about diverse life experiences: activities like home butchery, first aid skills, volunteer work for environmental groups, even artistic painting.

Interviewees interpretation of ‘facts’ conveyed experiential understandings and meanings given to events (Kolb 1984; Elliott 2006). This helped to make visible the cultural frameworks within which landholders operate as well as the content and form of individuals’ narratives. The narrative analysis revealed how landholders organise and forge connections between events and how they make sense of those connections – a key element in the processes of learning and knowledge production. The qualitative and quantitative data together clearly demonstrated that active, passive, as well as ‘spinoff’ ways of learning about bushfire takes place in landholders’ everyday life through doing, observing, listening, discussing, reading and thinking (McCaffrey 2004a; Fazey, *et al.* 2006; Eriksen and Prior In Press). This underlines the osmotic nature of local knowledge: gained with time, experience and place-based attachment, through the development of social, human, and cultural capital within local communities. It also emphasises the value of local networks in the dissemination of bushfire safety messages.

Preparedness and the ‘gap’: The relevance of everyday life and gender

The research approach facilitated analysis that goes beyond conventional axes of differentiation, such as those of newcomers and longer term landowners described above. This is important as the survey data on its own showed that longer term landholders tend to be better prepared for bushfire and more likely to be members of local bushfire brigades than newer landholders. This conforms to popular ideas that new landholders are *the* problem, that they are ignorant about bushfire, and need to be educated. However, the interview data revealed an alternative approach to interpreting the lack of preparedness among landholders across the board, considering that both the qualitative and quantitative data also showed a good awareness of the risks associated with bushfire. The interview data allowed us to explore the complexity and constitution of this apparent gap (Torry 1979; Watts 1983; Barr 2008). We applied de Certeau’s (1984) concept of everyday life to conceptualise bushfire as

an example of 'socio-nature' (Bakker and Bridge 2006) rather than only an external, disembodied force of nature. This analysis shows that official rationalities of bushfire management do not translate well into landholders' everyday life. Instead landholders bring their own agency to bushfire in the association of everyday procedures, dilemmas, and tradeoffs, effectively dissolving the gap even as they ostensibly demonstrate it (Eriksen and Gill 2010; see also McCaffrey 2004b). For example, whilst the post "Black Saturday" interview participants reflected on the tragic outcomes of these bushfires, there were no noticeable difference in attitudes and actions towards their personal bushfire safety. This aligns with the survey's identification of a lack of action despite a general awareness of, for example, the dangers associated with trees and bushes in close proximity to buildings. These 'gaps' elude the underlying practical and aesthetical reasons, such as shading from the sun, shelter from the wind, bird life, and natural beauty, for planting and maintaining this vegetation. Such agency was only evident through in-depth interviewing.

Gender is a further axis of analysis that was facilitated by triangulating the quantitative and qualitative data. Gender emerged strongly as an issue from the fieldwork and interview material and the survey data supported this significance. For example, there were statistically significant differences between men and women on the level of uncertainty regarding their plan of action during bushfire events (women were more uncertain) and on the level of membership of volunteer bushfire brigades (women were less likely to be members) (Eriksen, *et al.* 2010; see also Beatson and McLennan 2005; Haynes, *et al.* 2010). More generally, mapping out gendered experiences of bushfire revealed how conventional views of bushfire management as "men's business" are upheld despite the changing social circumstances associated with amenity-led in-migration (Eriksen, *et al.* 2010, see also Enarson and Morrow 1998; Proudley 2008). This gendered division of roles, for example, meant that many female interviewees did not know how to operate the fire fighting equipment on their properties, the responsibility for which was largely left to men. The burden of commuting associated with rural living further increased everyday commitments, making volunteer involvement in bushfire brigades difficult. The analysis clearly demonstrates that there is considerable work to be done in engaging and involving women in bushfire prevention and management. The role of women and the lack of engagement among women that our research found, strongly suggests that current strategies are not as effective as they might be with more gender sensitive frameworks. Arguably, a lack of engagement amongst women places them in a vulnerable position during bushfires.

Across these three themes, insight into complex, entrenched, subconscious, and at time paradoxical everyday issues that surround bushfire management was only provided through the integration of diverse data components during analysis and interpretation. By viewing

events and the social world through the eyes of the landholders in their survey responses, spoken narratives, visual photographic expressions, and the embodiment of their values through land management activities, thick descriptions of social settings, events and people were allowed to surface. These descriptions display the processes and meanings that simultaneously sustain and motivate social groups, vary across space, and are both place-bound and place-making (Geertz 2000; Head, *et al.* 2005). They are central to the social construction of natural hazards and have a place in bushfire debates, policy, and programs.

Interest beyond academia

The research is still relatively new and although policy-makers and practitioners played an important part as key informants and during participatory observation of training and workshop sessions, interviews were not carried out specifically with policymakers in order to determine their view of the research. Thus it is difficult to determine the exact nature of the influence of this research to date. It is possible that, as Burgess (2005, p. 277) highlights, '[w]e...found ourselves just ahead of a shift in policy-political thinking, so audiences are receptive, or at least curious enough to listen to what academics are saying'. However, the continual interest this research project has received from bushfire managers, landholders, community groups, and the media alike indicates that the topic and the findings are of relevance and interest beyond academia. Table 3 summarises key identifiable events and interest that have occurred over the course of the research.

This recognition was reinforced by the tragic February 2009 bushfires in Victoria. There was a noticeable increase in levels of concern and awareness of bushfire risks in the aftermath of the "Black Saturday" bushfires. This was evident in, for example, survey respondents requesting access to project findings on behalf of community FireWise groups established as a response to "Black Saturday". This increased awareness coupled with a ceaseless desire for controversial stories also resulted in the project, and in particular the findings on gendered dimensions of bushfire vulnerability, receiving interview requests from local, regional and national radio stations and newspapers (for example, Bird 2009; O'Keefe 2009; Trenwith 2009). Speaking up about gender issues also resulted in interest and project support from fire authorities (for example, Eriksen 2010b). The unspoken awareness observed amongst fire authority research participants of the need to address gender issues is arguably a sign of a gradual emergence of a new generation of staff within fire authorities who are more attuned to gender inequality. This certainly speaks to an issue that would bear further investigation. Research interest was furthermore received from Australian and British geographical societies for educational purposes, in an attempt to engage students with provocative case studies (for example, Eriksen 2009; Eriksen 2010a).

INSERT TABLE 3 HERE

The nature of the interest summarised in Table 3 indicates that direct (instrumental), conceptual and symbolic use or influence are likely if not already occurring to some extent. It is clear that the context of the research, particularly the timing of “Black Saturday”, which enabled the researchers to analyse the data in both a pre- and post-fire context, and the existence of programs aimed at landowners in areas such as our study areas, have been important in generating interest. The research has been timely both by chance under undesirable circumstances (the Victorian bushfires) and by dint of the research questions and design (urban-rural migration and bushfire agency interest in social issues) although this was a coincidence of interests rather than the result of prior engagement. As a result the researchers are now involved in collaborative research with the Hotspots Fire Project, a multi-partnership participatory engagement and education program run by the Nature Conservation Council of NSW (www.hotspotsfireproject.org.au). Furthermore, the insights gained from our research into intra-household negotiations, gender vulnerability and diverse local knowledge has, in line with the Victorian Bushfire Royal Commission (Teague, *et al.* 2010), been identified as a key area of research that requires further advancement. Funding has consequently been ensured for a continuation of the project through post-doctoral research. This continuation will include interviews with policymakers in order to determine their view of the research.

The research signifies the ability of cultural geography through mixed-methods research to provide insights and answers to a broad range of questions that are of interest to a diverse audience without necessarily sacrificing its critical dimension. It provides an outlet for multiple voices and complex narratives, whilst the breadth and depth of the research makes it more likely that the research findings will be of use to practitioners and others (Beyer 1997; Amara, *et al.* 2004; Gill 2006). Further, outside research circles where the validity of qualitative research is accepted, the credibility of the qualitative analysis is likely to be greater given its relationship with the quantitative survey data. Specifically, the research presented in this paper is ‘instrumental’ in the direct use of data to challenge, for example, traditional gender roles and masculine hegemony within emergency services. It is ‘conceptual’ in its ability to introduce new ideas, such as bushfire as a product of ongoing associations and negotiations in everyday life. Finally, the research is potentially ‘symbolic’ in its use as ammunition to sustain predetermined positions, such as the need to address the vulnerability of amenity-led communities to bushfires (while, we hope, tempering simplistic conceptualisations of the inhabitants of such areas). Cultural geography through mixed-methods research thus have direct relevance to bushfire management discussions

internationally, through the provision of valuable insights into the social dynamics that underpin the growing number of people living in bushfire-prone rural-urban interface areas.

Conclusion

This paper has demonstrated that cultural geography through mixed-methods research can make important contributions to natural hazards research, policy and practice. The case study shows how triangulation of qualitative and quantitative research methods and data can provide valuable insights into how people produce and disseminate particular ways of knowing and doing in changing rural landscapes in southeast Australia. The ability of cultural geography through mixed-methods research to unravel the complex social dynamics and rationalities that underpin landholders' attitudes and actions towards bushfire risk provides valuable insight that can be used to address the social, cultural, economic and environmental causes that heighten vulnerability to natural hazards such as bushfire. The multiple lines of evidence that emerge through the integration of quantitative and qualitative data provide powerful messages about everyday tradeoffs, diverse types of knowledge, intra-household negotiations and gender hegemony for official bushfire management policy and practice to act on through local, context specific and interactive initiatives.

The research process described in this paper confirms that 'relevance' is indeed emergent and a function of timing and context as much as the characteristics of the research itself. This research does, however, highlight four key reasons that in particular make mixed-methods research a powerful tool in building and enhancing a cultural geography that has policy relevance and acceptability for natural hazards and natural resource management in changing rural landscapes. Firstly, it demonstrates the limits of narrow empirical approaches by facilitating multi-faceted exploration of the diversity of landholders' and their varying attitudes and actions. Secondly, it connects research on natural resource management with conceptualisations of knowledge as flexible and dynamic with implications for the relationship between official policy and practice and the local environmental knowledge held and (re)produced by rural landholders. Rather than just providing information to be acted on, in-depth mixed-methods research results reveal that the starting point for community outreach programs should be to understand how bushfire (and the risk of other natural hazards) only exist for landholders in its association with other aspects of landholders' everyday life. It is therefore necessary to incorporate the social dynamics of local communities into official bushfire management policy and practice. Thirdly, in the specific context of bushfire policy, practice, and behaviour a mixed-methods approach facilitates critical assessment of underlying assumptions among land managers. The awareness-preparedness 'gap' provides a clear example of the complexity and contradictions that may be revealed. By contextualising

the rationalities that underlie official and local knowledge and actions through the use of diverse methods and data, the dissemination of research results can be crafted and targeted for various audiences. Mixed-methods research assists this process through our fourth and final point, namely in the varied ways diverse research data lends itself to simultaneous divergence, convergence, and corroboration that can be presented in different formats to diverse audiences. In this way we work towards realising our aim of undertaking a cultural geography that has, or develops, public and policy relevance while retaining analytical and critical depth.

REFERENCES

- ABS (2007) Australian Bureau of Statistics 2006 Census. www.abs.gov.au. Accessed 26 September 2007
- ALLEN, P. J. and BENNETT, K. (2008) *SPSS for the health & behavioural sciences*, Thomson, Australia
- AMARA, N., OUMET, M. and LANDRY, R. (2004) 'New evidence on instrumental, conceptual, and symbolic, utilization of university research in government agencies', *Science Communication*, 26, pp. 75-106.
- ASHE, B., MCANENEY, K. J. and PITMAN, A. J. (2009) 'Total cost of fire in Australia', *Journal of Risk Research*, 12(2), pp. 121 - 136.
- ATKINSON, P., *et al.* (eds), (2001) *Handbook of Ethnography*, Sage, London.
- AUSTRALIAN RESEARCH COUNCIL (2009) *Discovery Projects Funding Rules for funding commencing in 2011*, Australian Research Council, Canberra
- BAKKER, K. and BRIDGE, G. (2006) 'Material worlds? Resource geographies and the 'matter of nature'', *Progress in Human Geography*, 30(1), pp. 5-27.
- BARR, S. (2008) *Environment and society: sustainability, policy and the citizen*, Ashgate, Aldershot
- BAZELEY, P. (2007) *Qualitative Data Analysis with NVivo*, Sage, London
- BEATSON, R. and MCLENNAN, J. (2005) 'Australia's women volunteer firefighters: A literature review and research agenda', *Australian Journal on Volunteering*, 10(2), pp. 18-27.
- BEYER, J. M. (1997) 'Research utilization: bridging the gap between communities', *Journal of Management Inquiry*, 6, pp. 17-22.
- BINTZ, W. P. (1997) 'Seeing Through Different Eyes: Using Photography as a Research Tool', *Teacher Research*, 5(1), pp. 29-46.
- BOWMAN, D., *et al.* (2009) 'Fire in the Earth System', *Science*, 324(5926), pp. 481-484.
- BRADSTOCK, R. A., WILLIAMS, J. E. and GILL, A. M. (eds), (2002) *Flammable Australia: The Fire Regimes and Biodiversity of a Continent*, Cambridge University Press, Cambridge.
- BRENKERT-SMITH, H., CHAMP, P. A. and FLORES, N. (2006) 'Insights Into Wildfire Mitigation Decisions Among Wildland-Urban Interface Residents', *Society & Natural Resources*, 19(8), pp. 759 - 768.
- BRYMAN, A. (2007) 'Barriers to Integrating Quantitative and Qualitative Research', *Journal of Mixed Methods Research*, 1(1), pp. 8-22.
- BRYMAN, A. (2008) *Social Research Methods*, Oxford University Press, Oxford
- BURGESS, J. (2005) 'Follow the argument where it leads: some personal reflections on 'policy-relevant' research', *Transactions of the Institute of British Geographers*, pp. 273-281.
- BURNLEY, I. H. and MURPHY, P. (2004) *Sea change: movement from metropolitan to Arcadian Australia*, UNSW Press, Sydney
- BURTON, I., KATES, R. W. and WHITE, G. F. (1993) *The Environment as Hazard*, Guildford Press, New York

- CERTEAU, M. D. (1984) *Arts de faire: The practice of everyday life*, University of California Press, Berkeley
- CORTAZZI, M. (2001) 'Narrative Analysis in Ethnography', In Atkinson, P., *et al.*, (eds) *Handbook of Ethnography*, Sage Publications, London, pp. 384-394.
- CRANG, M. (2002) 'Qualitative methods: the new orthodoxy?', *Progress in Human Geography*, 26(5), pp. 647-655.
- CRESWELL, J. W. (2007) *Designing and conducting mixed methods research*, SAGE Publications, Thousand Oaks, Calif.
- CSIRO (2007) *Climate Change in Australia*, CSIRO, Australian Bureau of Meteorology.
- DANIEL, T. C., *et al.* (eds), (2007) *People, Fire, and Forests: A Synthesis of Wildfire Social Science*, Oregon State University Press, Corvallis.
- DILLMAN, D. A. (2000) *Mail and Internet surveys: the tailored design method*, John Wiley, New York; Chichester.
- DUNN, K. (2008) 'Comparative Analyses of Transnationalism: a geographic contribution to the field', *Australian Geographer*, 39(1), pp. 1-7.
- DUNN, K. M., KLOCKER, N. and SALABAY, T. (2007) 'Contemporary racism and Islamophobia in Australia: Racializing religion', *Ethnicities*, 7(4), pp. 564-589.
- ELLIOTT, J. (2006) *Using narrative in social research: qualitative and quantitative approaches*, Sage, London
- ELLIS, S., KANOWSKI, P. and WHELAN, R. J. (2004) *National Inquiry on Bushfire Mitigation and Management*, Canberra, Council of Australian Governments.
- EMEL, J. and PEET, R. (1989) 'Resource management and natural hazards', In Peet, R. and Thrift, N., (eds) *New Models in Geography: the Political-Economy Perspective*, Unwin-Hyman, London, pp. 49-76.
- ENARSON, E. AND MORROW B. H. (eds), (1998) *The Gendered Terrain of Disaster: Through Women's Eyes*, Praeger, Westport.
- ERIKSEN, C. (2010a) 'Ask the Expert' about Bushfire Management, *Geography in the News*. Royal Geographical Society (with IBG), www.geographyinthenews.rgs.org. Accessed April 2010
- ERIKSEN, C. (2010b) "'It's not firewomen, it's firemen!'". *Wafa Newsletter*, Women and Firefighting Australasia Inc. 1/2010, p. 2
- ERIKSEN, C. (2009) 'Fired Up? Bushfire awareness and preparedness amongst diverse rural landowners', *South Australian Geographer*, 24(2), pp. 14-17.
- ERIKSEN, C. and GILL, N. (2010) 'Bushfire and Everyday Life: Examining the Awareness-Action 'Gap' in Changing Rural Landscapes', *Geoforum*, 41(5), pp. 814-825
- ERIKSEN, C., GILL, N. and HEAD, L. (2010) 'The Gendered Dimensions of Bushfire in 'New' Rural Landscapes', *Journal of Rural Studies*, DOI: 10.1016/j.jrurstud.2010.06.001
- ERIKSEN, C. and PRIOR, T. (In Press) 'The Art of Learning: Bushfire, Amenity Migration and Local Environmental Knowledge', *The International Journal of Wildland Fire*
- FAZEY, I., *et al.* (2006) 'The nature and role of experiential knowledge for environmental conservation', *Environmental Conservation*, 33(1), pp. 1-10.
- FISCHER, F. (2003) *Reframing Public Policy: Discursive Politics and Deliberative Practices*, Oxford University Press, Oxford
- GEERTZ, C. (2000) *The interpretation of cultures: selected essays*, Basic Books, New York
- GILL, A. M. (2005) 'Landscape fires as social disasters: An overview of 'the bushfire problem'', *Environmental Hazards*, 6, pp. 65-80.
- GILL, N. (2006) 'What is the Problem? Usefulness, the cultural turn, and social research for natural resource management', *Australian Geographer*, 37(1), pp. 5-17.
- GILL, N., KLEPEIS, P. and CHISHOLM, L. (2010) 'Stewardship among lifestyle oriented rural landowners', *Journal of Environmental Planning and Management*, 53(3), pp. 317-334.
- GOSNELL, H. and ABRAMS, J. (2009) 'Amenity migration: diverse conceptualizations of drivers, socioeconomic dimensions, and emerging challenges', *GeoJournal*, Published online 8 July 2009

- GREENE, J. C., CARACELLI, V. J. and GRAHAM, W. F. (1989) 'Toward a conceptual framework for mixed-method evaluation designs', *Educational Evaluation and Policy Analysis*, 11, pp. 255-274.
- GRIFFITHS, T. (2007) The Humanities and an Environmentally Sustainable Australia, *Eco-Humanities Corner*. www.australianhumanitiesreview.org/archive/Issue-December-2007/EcoHumanities/EcoGriffiths.html. Accessed 4 January 2008
- GRIFFITHS, T. (2009) We have still not lived long enough. <http://inside.org.au/we-have-still-not-lived-long-enough/>. Accessed 2 March 2009
- GROVES, R. M., *et al.* (2004) *Survey Methodology*, John Wiley & Sons, Hoboken, New Jersey
- HAJER, M. (2003) 'Policy without polity? Policy analysis and the institutional void', *Policy Sciences*, 36(2), pp. 175-195.
- HAMNETT, C. (2003) 'Contemporary human geography: fiddling while Rome burns?', *Geoforum*, 34(1), pp. 1-3.
- HANDMER, J. and DOVERS, S. (2008) *Handbook of Disaster and Emergency Policies and Institutions*, Earthscan, London
- HANDMER, J. and HAYNES, K. (eds), (2008) *Community Bushfire Safety*, CSIRO Publishing, Collingwood.
- HARVEY, D. (1974) 'What kind of geography for what kind of public policy', *Transactions of the Institute of British Geographers*, 63, pp. 18-24.
- HAYNES, K., *et al.* (2010) 'Australian bushfire fatalities 1900-2008: exploring trends in relation to the 'Prepare, stay and defend or leave early' policy', *Journal of Environmental Science and Policy*, 13(3), pp. 185-194.
- HEAD, L. and MUIR, P. (2006) 'Edges of Connection: reconceptualising the human role in urban biogeography', *Australian Geographer*, 37(1), pp. 87-101.
- HEAD, L., TRIGGER, D. and MULCOCK, J. (2005) 'Culture as Concept and Influence in Environmental Research and Management', *Conservation and Society*, 3(2), pp. 251-264.
- HUGO, G. (2005) 'The State of Rural Populations', In Cocklin, C. and Dibden, J., (eds) *Sustainability and change in rural Australia*, University of New South Wales, Sydney, pp. 56-79.
- IPCC (2007) *Climate Change 2007: The Physical Science Basis. Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, Cambridge University Press.
- JAMES, A. (2006) 'Critical moments in the production of 'rigorous' and 'relevant' cultural economic geographies', *Progress in Human Geography*, 30(3), pp. 289-308.
- JENSEN, S. E. and MCPHERSON, G. R. (2008) *Living with Fire: Fire Ecology and Policy for the Twenty-first Century*, University of California Press, Berkeley
- JOHNSON, R. B. and ONWUEGBUZIE, A. J. (2004) 'Mixed Methods Research: A Research Paradigm Whose Time Has Come', *Educational Researcher*, 33(7), pp. 14-26.
- JOHNSTON, R., *et al.* (2003) 'Contemporary fiddling in human geography while Rome burns: has quantitative analysis been largely abandoned - and should it be?', *Geoforum*, 34(2), pp. 157-161.
- JUNTTI, M., RUSSEL, D. and TURNPENNY, J. (2009) 'Evidence, politics and power in public policy for the environment', *Environmental Science & Policy*, 12(3), pp. 207-215.
- KATES, R. W. (1971) 'Natural hazard in human ecological perspective: hypotheses and models', *Economic Geography*, 47, pp. 438-451.
- KOLB, D. A. (1984) *Experiential Learning: Experience as The Source of Learning and Development*, Prentice-Hall Inc., Englewoods Cliffs, New Jersey
- LANDRY, R., AMARA, N. and LAMARI, M. (2001) 'Utilization of social science research knowledge in Canada', *Research Policy*, 20, pp. 333-349.
- LEWIS, J. (2003) 'How useful are the social sciences?', *Political Quarterly*, 74(2), pp. 193-201.
- LYNN, L. E. (1999) 'A place at the table: Policy analysis, its postpositive critics, and the future of practice', *Journal of Policy Analysis and Management*, 18(3), pp. 411-425.
- MARTIN, R. (2001) 'Geography and public policy: the case of the missing agenda', *Progress in Human Geography*, 25(2), pp. 189-210.

- MCCAFFREY, S. (2004a) 'Fighting Fire with Education: What Is the Best Way to Reach Out to Homeowners?', *Journal of Forestry*, 102(5), pp. 12-19.
- MCCAFFREY, S. (2004b) 'Thinking of Wildfire as a Natural Hazard', *Society and Natural Resources*, 17(6), pp. 509 - 516.
- MCCAFFREY, S. and KUMAGAI, Y. (2007) 'No Need to Reinvent the Wheel: Applying Existing Social Science Theories to Wildfire', In Daniel, T. C., *et al.*, (eds) *People, Fire and Forests: A Synthesis of Wildfire Social Science*, Oregon State University Press, Corvallis, pp. 12-36.
- MCGEE, T. K., MCFARLANE, B. L. and VARGHESE, J. (2009) 'An Examination of the Influence of Hazard Experience on Wildfire Risk Perceptions and Adoption of Mitigation Measures', *Society & Natural Resources*, 22(4), pp. 308-323.
- MCLENNAN, J. and BIRCH, A. (2005) 'A potential crisis in wildfire emergency response capability? Australia's volunteer firefighters', *Global Environmental Change Part B: Environmental Hazards*, 6(2), pp. 101-107.
- MERCER, J., *et al.* (2008) 'Reflection on use of participatory research for disaster risk reduction', *Area*, 40(2), pp. 172-183.
- MORCOL, G. (2001) 'Positivist beliefs among policy professionals: An empirical investigation', *Policy Sciences*, 34(3-4), pp. 381-401.
- PAIN, R. (2006) 'Social geography: seven deadly myths in policy research', *Progress in Human Geography*, 30(2), pp. 250-259.
- PANNELL, D. J. and ROBERTS, A. M. (2009) 'Conducting and delivering integrated research to influence land-use policy: salinity policy in Australia', *Environmental Science & Policy*, 12(8), pp. 1088-1098.
- PATON, D. and WRIGHT, L. (2008) 'Preparing for bushfires: the public education challenges facing fire agencies', In Handmer, J. and Haynes, K., (eds) *Community Bushfire Safety*, CSIRO Publishing, Collingwood, pp. 117-126.
- PAWSON, R. (2006) *Evidence-based Policy: a Realist Perspective*, Sage Publications, London
- PHILIP, L. J. (1998) 'Combining quantitative and qualitative approaches to social research in human geography—an impossible mixture?', *Environment and Planning A*, 30(2), pp. 261-276.
- PINK, S. (2001) *Doing visual ethnography: images, media and representation in research*, SAGE, London
- PROUDLEY, M. (2008) 'Fire, families and decisions', *The Australian Journal of Emergency Management*, 23(1), pp. 37-43.
- RFS (2009) New South Wales Rural Fire Service, *New South Wales Rural Fire Service*. www.rfs.nsw.gov.au. Accessed 23 November 2009
- RIESSMAN, C. K. (2008) *Narrative methods for the human sciences*, Sage Publications, Thousand Oaks
- RILEY, M. (2010) 'Emplacing the Research Encounter: Exploring Farm Life Histories', *Qualitative Inquiry*, 16(8), pp. 651-662.
- RILEY, M. and HARVEY, D. (2007) 'Oral histories, farm practice and uncovering meaning in the countryside', *Social & Cultural Geography*, 8(3), pp. 391 - 415.
- ROBBINS, P., *et al.* (2009) 'Writing the New West: A Critical Review', *Rural Sociology*, 74(3), pp. 356-382.
- ROBBINS, P. and SHARP, J. (2003) 'The lawn-chemical economy and its discontents', *Antipode*, 35, pp. 955-979.
- ROCHELEAU, D. (1995) 'Maps, Numbers, Text, and Context: Mixing Methods in Feminist Political Ecology', *Professional Geographer*, 47(4), pp. 458-466.
- ROE, E. (1998) *Taking Complexity Seriously: Policy Analysis, Triangulation and Sustainable Development*, Kluwer Academic Publishers, Boston
- ROSE, D. B. (2001) *Connecting with Ecological Futures*, The National Humanities and Social Sciences Summit, Canberra
- ROUGHLEY, A. (2005) *Knowing People: Reflections on Integrating Social Science in Five Natural Resource Management Organisations 1978-2002*, Land and Water Australia, Canberra

- STAEHELI, L. A. and MITCHELL, D. (2005) 'The Complex Politics of Relevance in Geography', *Annals of the Association of American Geographers*, 95(2), pp. 357 - 372.
- SUCHET-PEARSON, S. and HOWITT, R. (2006) 'On Teaching and Learning Resource and Environmental Management: reframing capacity building in multicultural settings', *Australian Geographer*, 37(1), pp. 117-128.
- TEAGUE, B., MCLEOD, R. and PASCOE, S. (2010) *2009 Victorian Bushfires Royal Commission Final Report*, Parliament of Victoria, Government Printer for the State of Victoria.
- TORRY, W. I. (1979) 'Hazards, hazes, holes: a critique of the environment as hazard and general reflections on hazards research', *Canadian Geographer*, 23, pp. 368-383.
- VOGT, C. A., WINTER, G. and FRIED, J. S. (2005) 'Predicting Homeowners' Approval of Fuel Management at the Wildland-Urban Interface Using the Theory of Reasoned Action', *Society & Natural Resources*, 18(4), pp. 337 - 354.
- WARD, K. (2005) 'Geography and public policy: a recent history of 'policy relevance'', *Progress in Human Geography*, 29(3), pp. 310-319.
- WATTS, M. (1983) 'On the poverty of theory: natural hazards research in context', In Hewitt, K., (ed.) *Interpretations of Calamity*, Allen and Unwin, Massachusetts, pp. 231-262.
- WHITE, G. F., KATES, R. W. and BURTON, I. (2001) 'Knowing better and losing even more: the use of knowledge in hazards management', *Global Environmental Change Part B: Environmental Hazards*, 3(3-4), pp. 81-92.
- WHITTAKER, J. and MERCER, D. (2004) 'The Victorian Bushfires of 2002-03 and the politics of blame: A discourse analysis', *Australian Geographer*, 35(3), pp. 259-287.
- WISNER, B., *et al.* (2004) *At Risk: Natural Hazards, People's Vulnerability and Disasters*, Routledge, London

TABLE 1. Principles for carrying out mixed-methods research (adapted from Greene *et al.* 1989)

Triangulation	Seeking convergence and corroboration of results from different methods and designs, studying the same phenomenon
Complementarity	Seeking elaboration, enhancement, illustration, and clarification of the results from one method with results from the other method
Initiation	Discovering paradoxes and contradictions that lead to a re-framing of the research question
Development	Using the findings from one method to help inform the other method
Expansion	Seeking to expand the breadth and range of research by using different methods for different inquiry components

TABLE 2. The strengths, weaknesses and observed utility of mixed-methods research for natural hazards policy and practice (adapted from Johnson and Onwuegbuzie 2004)

Mixed-methods research characteristics (strengths and weaknesses)	Observed manifestation of strengths and weaknesses in the south-east Australian case study	Utility of observations for natural hazards policy and practice
Words, pictures, and narrative can be used to add meaning to numbers and vice versa. The strengths of an additional method can be used to overcome the weaknesses in another method by using both in a single study	Triangulation of data provided insights into experiential understandings and ways of learning. Collaborative sense making. Data enrichment. Narratives and emerging themes were backed-up by statistics. Statistical findings backed up and expanded by in-depth explanations	Written, visual and oral insights that explain and/or expand statistical predictions. Insights into attitudes, actions, everyday priorities and how to address these. Scope for cross-disciplinary research and collaboration. Opens up alternative ways of seeing. Incorporation of diverse knowledge types can strengthen management practices
Researcher can generate and test a grounded theory	Nature-culture dichotomy shown to be problematic. Clear distinction between official and local knowledge shown to be problematic	Insights with which to critically reflect on dominant theories and practices. Importance of evaluating findings within local settings. One model seldom fits all. Flexible approach needed
Can answer a broader and more complete range of research questions	Established overall picture of issues that could be used as a baseline. Research methodologies were modified as the project evolved	Diverse findings that are of interest to diverse end-users. Provides tools needed to gain insight into micro- and macro-level issues
Can provide stronger evidence for a conclusion through convergence and corroboration of findings	Thick descriptions of social settings, events and people surfaced	Multiple lines of evidence to support change and development. Illuminates how socio-cultural processes are central to environmental attitudes.
Can add insights and understanding that might be missed when using mono-methods	Gendered dimensions of bushfire, and subconscious and indirect ways of learning and knowing were explicit in interviews but implicit in the surveys	Ability to target implicit but significant factors that affect behaviour. Ability to unravel and address problematic interpretations/opinions.
Qualitative and quantitative research used together provides verification of applicability and produces a more complete knowledge necessary to inform theory and practice	Provided insights into alternative, personalised, non-scientific and subversive strands of knowledge. Diverse learning styles and ways of knowing were revealed. Contrast revealed between what landholders and authorities assess as acceptable bushfire hazards and why.	Solid base on which to address social, economic, and cultural causes of environmental problems. Creates tools for community engagement and ways of incorporating social dynamics into official policy and practice. Insights into why increased knowledge does not always result in behavioural changes.
It can be difficult for a single researcher to carry out both qualitative and quantitative research, and understand how to mix them appropriately	Production of large amounts of data, not all of which were relevant to the study. Fieldwork took longer than planned. Multi-disciplinary teamwork needed to draw on multiple skills and knowledge pools. Dependency on external expertise	Necessity of filtering through and evaluating what is relevant in policy and practical terms. Waiting period before research results are available.

TABLE 3. Key identifiable events, interest, and audiences reached during the course of the research

Communication mediums	How	When	Why	Audience(s) reached
AFAC/Bushfire CRC conferences	Posters	Aug. 2008 Sept. 2009	Opportunity to share research findings and network	Bushfire risk managers and practitioners, academics; nationally
<i>The Guardian Weekly</i> newspaper	Written opinion piece on learning from bushfires	27 Feb. 2009	Reaction to the politics of blame that followed 'Black Saturday'	Diverse community members internationally
Community FireWise Groups	Request for project findings. Follow on from completing postal survey	Mar. 2009	Increased awareness of local bushfire hazards in the aftermath of 'Black Saturday'	Local community members in study areas/private landholders
NSW Rural Fire Service HQ, Sydney. RFS Illawarra Community Safety Brigade meeting	Presentations on project findings followed by interactive discussions	May 2009 Sept. 2009	Recognition that project findings provide insights that can help disseminate bushfire safety messages to residents in at-risk areas	Official bushfire risk managers, practitioners and volunteers at State and regional level
<i>Illawarra Mercury</i> newspaper. <i>Your Times</i> , NSW Southern Highlands	Articles about project findings written by the media after telephone interviews	1 Jun. 2009 Jul. 2009	Increased awareness of bushfire vulnerability in the aftermath of 'Black Saturday'	Diverse community members regionally
ABC Radio Illawarra ABC Radio Newcastle	One recorded and two live radio interviews	2, 4, 9 Jun. 2009	Increased awareness of bushfire vulnerability in the aftermath of 'Black Saturday'	Diverse community members locally and regionally
<i>South Australian Geographer</i> (Journal of the Geography Teachers' Assoc. of SA). Royal Geographical Society (with IBG) 'Geography in the News' website	Written case studies plus interactive 'Ask the Expert' web session with students	Jul. 2009 May 2010	Increased bushfire awareness in the aftermath of 'Black Saturday' International interest on the effect of climate change on natural hazards	Students, teachers, academics, geographers, regionally and internationally
Hotspots Fire Project, Kangaroo Valley	Consultant on community profile and attitudes towards bushfire	Aug. 2009 Mar. 2010	Recognition of importance of incorporating social issues into ecologically sound fire use/management	Official bushfire risk managers, private landholders locally
<i>The Australian</i> newspaper: Higher Education section	Article about project findings written by <i>The Australian</i> after telephone interview	4 Nov. 2009	Start of official bushfire season. Continuing interest in bushfire risk in the aftermath of 'Black Saturday'	Diverse community members, academics, research departments, nationally
<i>WFAA Newsletter</i> (Women and Firefighting Australasia)	Short case study by researchers on gendered dimensions of bushfire	Jan. 2010	Use of project findings fosters organisational change within fire authorities	Fire authorities and bushfire risk managers nationally

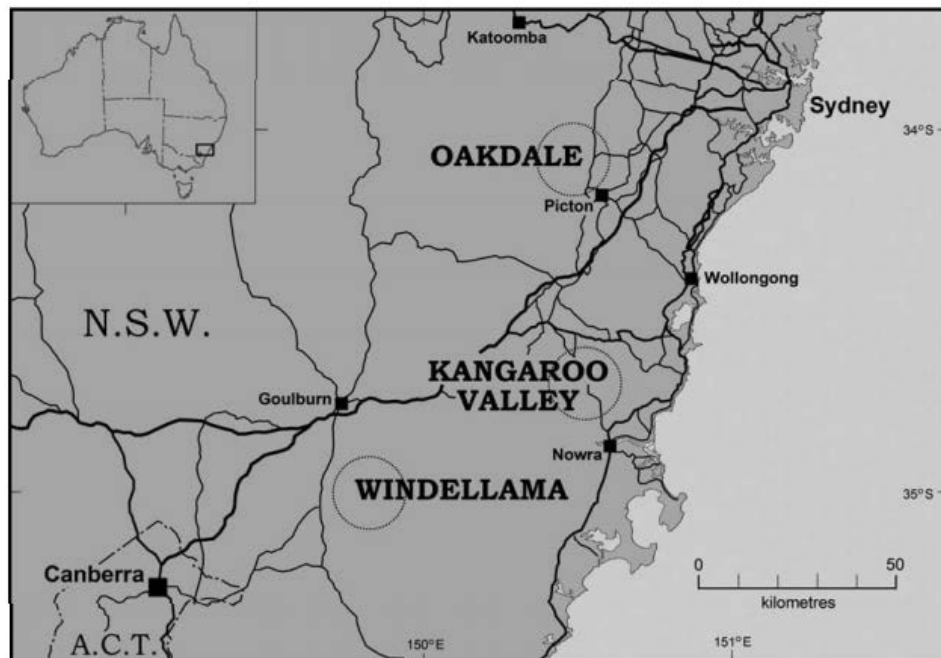


FIGURE 1. Map of study areas in south-east Australia.