



THE UNIVERSITY OF
SYDNEY

Complex Civil Systems Research Group (CCSRG)
Faculty of Engineering & IT (FEIT)
A Compilation Submission to
The Productivity Commission

RISK, RECOVERY & RESILIENCE

A compilation of research and studies into Natural Disaster Funding arising from work by research staff and PM undergraduate students in collaboration with the Blue Mountains City Council, The Lions Club of Winmalee, NRMA Insurance and RHoK (Sydney) into an Ecological Fire Risk Register for the Blue Mountains, Nov 2013-June 2014

NATURAL DISASTER FUNDING ARRANGEMENTS PUBLIC ENQUIRY

(Prepared by: Associate Professor Doctor Simon Reay Atkinson)

The views expressed in this compilation submission are entirely and solely those of the authors and contributors and do not necessarily reflect official thinking, research outputs and policy of the University of Sydney, its collaboration partners (BMCC, The Lions Club of Winmalee, RHoK and NRMA Insurance), researchers or students.

JUNE 2014

RISK, RECOVERY & CREATING RESILIENCE

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1	Risk Recovery, Resilience Poster – University of Sydney
2	Paper: Classifying and Systemising Uncertainty and Instability – a Dynamic social Network approach to Risk
3	First Stop Release Press Notice
4	Resilience and First Stop Press Release – Future Work
5-25	BPM Undergraduate Student Posters

Risk Recovery and Resilience

1.1 Introduction

This compilation overview provides details of results emerging from five strands of work undertaken by the Complex Civil Systems Group at the University of Sydney (FEIT) and arising from the Blue Mountain Fires in October 2013:

1. Work examining what may be meant by *Instability* and *Uncertainty* and how the two might interconnect to create complex instabilities which, in some cases, may lead to disasters (Reay Atkinson, 2014).
2. Work examining political sûreté economies (Reay Atkinson, 2013) and how these can relate to complex instabilities.
3. Work examining synthetic ecologies (Reay Atkinson et al 2013b) and how these may relate to fire ecologies, such as are evident in the Blue Mountains and elsewhere in Australia.
4. Course Work Research undertaken by University of Sydney third year undergraduate Bachelor of Project Management resulting in an ecological examination, presentation and individual posters addressing risk, recovery and resilience in the Blue Mountains.
5. Resultant work by Random Hack of Kindness (Sydney Branch) resulting in an innovative Personal Information Exchange (PIE) known as First Stop.

2.1 Definitions

As part of this work, see 'Classifying and Systemising Uncertainty and Instability – a Dynamic social Network approach to Risk' by Reay Atkinson et al, (Attachment 2), the following definitions were developed / provided:

- *Uncertainty* applies to probabilities, as in a Risk Register and to physical measurements that are already made, or to *known-unknowns*, *unknown-knowns* and *unknown-unknowns*. Specifically Uncertainty is considered to:
 - 'Arise in partially observable, opaque, stochastic environments / non-ergodic (complex) ecologies, overly prescribed, ruled or controlled regimes as well as due to lack of assurance, *instability*, ignorance and / or lack of caring and shared awareness; including indolence':
- Instability can create Uncertainty and Uncertainty can create Instability but they are not the same thing. Instability may be:
 - 'the quality or state of being unstable and / or the tendency to behave in an unpredictable, changeable, *uncertain*, or erratic manner'.

We considered the Freedman-Morgan¹ (Freedman, 2009) understanding of 'Prevent' being about preventing a hostile act / damaging event in the first instance through all other means short of the use of force, including the use of meaningful inducements and encouragement (influence, policies, laws and rules). Our *simpler* model considers the management of three phases: **Prevention**; **Engagement** and **Recovery** (PER). Other four stage models exist, including Mitigate, Preparedness, Response & Recovery (MPRR) and Prevent, Prepare, Respond & Recover (P2R2). However, we consider that **Engagement** incorporates Response and that *mitigation* and *preparedness* are elements of **Recovery** and **Prevention**. Moreover, we also suggested that the ability to prevent, engage and recover is indicative of *Resilience*, where we see:

¹Distinction credited to P.M. Morgan, Deterrence: A Conceptual Analysis, Beverly Hills, CA: Sage Publications, 1977, ch. 2.

- ‘Resilience to be the *ability* [encompassing both *capability* and *capacity*] of an ecology or system to *adapt*, transform, redesign, renew, and recover [*bounce back*] in a timely *response* [as opposed to react] to events’ (after Bryant, 2012, see Reay Atkinson et al, 2014a).

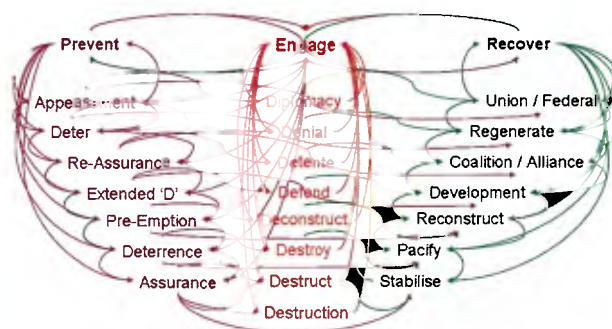


Figure 1: Prevent-Engage-Recover Model – ‘The Rose Bowl’ developed for considering humanitarian and stability type operations (Hemlock, 2012)

The aim of the **PER** Model is to move *agents* as quickly towards the Recovery phase as is possible, ideally without having to enforce and / or enact new laws. Yet having formal enforcement and legislative bodies available as an option to enable the recovery and prevention processes.

Table 1 Some Causes or Sources of Uncertainty in the Performance Measurement of Risk during the Prevention, Engagement and Recovery Phases, from (Sousa et al., 2013)

Phase	Factor	Description
Prevention	Physical	Changes to Vegetation
	Human	Changing Land Use, Human Error, Politicking
	Technological	Building Types
	Complex	Climate Change, extreme weather
Engagement with Fire	Physical	Communication Routes
	Human	Formal-Informal Networks (Federal State / Council / Rural Fire Service) Operational Response Time
	Technological	Media & Medium (IT, Cyber Communications, Twitter etc.)
	Complex	Safe Messaging, Water Availability
Recovery	Physical	Location / Extent of Damage
	Human	Rules, Regulations, Insurance, Politics, Lack of Competencies, Health, Knowledge Networks
	Technological	Building Designs & Classes
	Complex	Governance, Political Layers

According to Lopes et al. (2013), the performance measurement (PM) process, involves three different activities: measurement, data record/transmission and performance measure determination. Each of these three activities can be made automatically (for example by a computer application), it can be made manually (i.e. it may depend on human tasks), or it may be a combination of both. All these activities can influence the results or values of any PM. Thus an

unknown error or *uncertainty* is present in any PM (Sousa et al., 2013). This uncertainty can be induced by several factors (Lopes et al, 2013), some of which are described in Table 2. Applying the 'cause-and-effect, Ishikawa or fishbone diagrams' (developed in 1950 by the late Professor Kaoru Ishikawa) for providing a 'a force-field analysis' to provide 'a diagram combining the restraining and driving forces...to assist in [system] diagnosis' (Juran and Godfrey, 1999), we classified *Instabilities* into four major types, see Table 1:

- **Physical:** e.g. fire, earthquake, tsunami;
- **Human:** e.g. war, politics, Global Financial Crisis; famine, social change etc;
- **Technological:** e.g. Cyber, ICT and, potentially disruptive technologies such as nanotechnology;
- **Complex:** some combination of Physical; Human, Social or Technological,(socio-info/techno or info/techno-socio) e.g. Morwell town disabled by the Brown Coal Fire.

Building on previous work, Reay Atkinson et al defined a Synthetic Ecology to be:

'a system (being or entity) that adapts, over time, by combining, through design and by natural processes, two or more dynamically interacting networks, including organisms, the communities they make up, and the non-living (physical and technological) mechanical components of their environment' (Reay Atkinson et al, 2014b).

Noting Bill Gammage's (2011) research showing that in 1778, when British and European settlers first *colonised* Australia, there existed a *synthetic ecology* adapted to fire and managed accordingly we considered a Fire Ecology to be one part of the Synthetic Ecology that represents the 'Blue Mountains Region' (or Greater Blue Mountains Area). We applied research² undertaken (March-July 2014) by undergraduate students taking the ENGG 3853 Risk Management Tools and Techniques course at the University of Sydney. The second half of the course involved the students researching and developing an *Ecological Fire Risk Register of the Blue Mountains*. The study was based on the fires that occurred in the region of the Blue Mountains from 17 to 28 October 2013. The area called the 'Blue Mountains Region' is called so because, as temperatures rise, the oils of the different Eucalyptus species evaporate to create an aerosol haze or mist that appears blue to human eyes. It is also these oils contained within eucalyptus that create the fire ecology of the region and the Flammable Ecosystems identified by Bond and Keeley (2005) to include boreal forests, eucalyptus woodlands, shrub lands, grasslands and savannahs. We considered, from the Pacific Biodiversity Institute³, the Blue Mountains also to incorporate a Fire Ecology:

'A branch of ecology that focuses on the origins of wild-land fire and its relationship to the environment that surrounds it, both living and non-living'.

The fires that occurred in the Blue Mountains were identified as being a Major Fire and a complex instability combining the physical environment (including changes to global and local climates and vegetation management / types), human designs, building, businesses and the political *sûreté* economy. To further identify and classify these types of fires we noted that a Major Fire lasted more than 10-15 days and, while occurring in one identifiable geographic location, e.g. the Blue Mountains Region, could have multiple sources and resultant fire fronts.

² This is a new concept for research as part of a course and undertaken at the undergraduate level – taking research into the wider ecology and considering it as a dynamic.

³ http://www.pacificbio.org/initiatives/fire/fire_ecology.html

3.1 Some Emerging Results

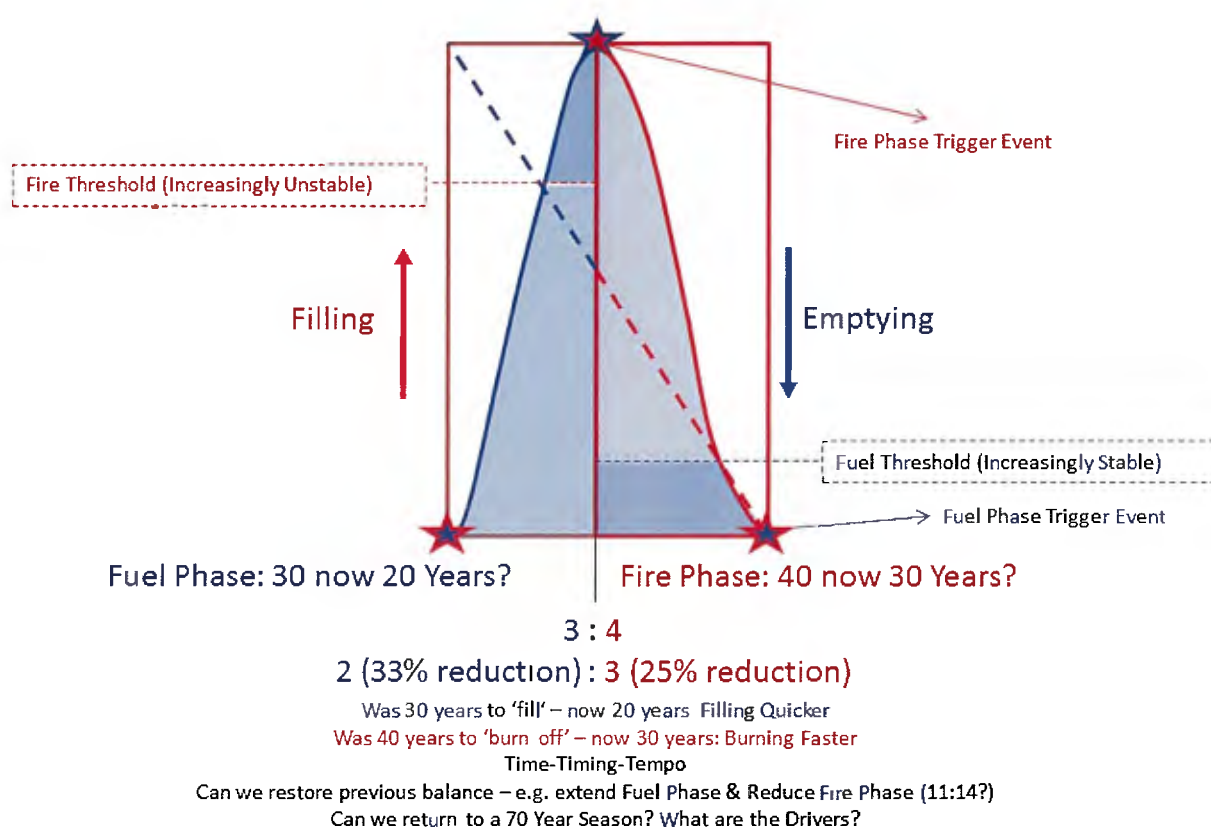


Figure 2: Possible Changing Fire Seasons and Fire-Fuel Phases in the Blue Mountains 1914-2014

From Figure 2, and as a result of the Research undertaken by University of Sydney undergraduate BPM students and research staff / lecturers, it was suggested that:

1. Previous **Fire Seasons** may have been as long as 70 years and appear to have reduced to 50 years (for reasons, it was suggested, of global and local climate change; changes in vegetation management and land usage);
2. **Fire Seasons** previously incorporating a 30 year **Fuel Phase** (during which time the regions fuel levels increased to a potentially unstable threshold level) and a 40 year **Fire Phase** during which time this fuel was burned off (in a number of major fires, until it had reached a stable threshold level, before the cycle began again) had reduced to potentially 20 and 30 years respectively;
3. During a **Fuel Phase** one might now go 20-25 years between major fires (and potentially reducing);
4. The longest one could go between major fires during a **Fire Phase** was 5-8 years, and the frequency may be increasing.
5. That given the sheer size of region, see Table 2, it was *probable* that Back-Burning⁴ may have only limited impact on the fuel levels in the region as a whole and that it would take a number of Major Fires to reduce this level to a manageable, sub-critical threshold level – when essentially the whole process would begin again.

⁴ This is not to argue that Back-Burning is not important but rather a recognition that given the sheer scale and size of the region and the amount of fuel involved and the fact that we are probably locked into a Fire Season (of between 50-70 years), there is only ever so much that Back-Burning may achieve.

Table 2: Synthetic Ecology of the Blue Mountains-Sydney Region (Reay Atkinson et al, 2014a)

6.

Physical-Socio Ecology	Approx. Area (MHa)	Approx. %
Maritime / Rivers / Lakes	0.9	20%
Urban	0.45	10%
Forested / National Parks (Blue Mountains Region)	2.0	45%
(Blue Mountains National Park)	(0.7)	(15%)
	(0.27)	(6%)
(Blue Mountains City Council)	(0.143)	(3.2%)
Rural / Agricultural	1.1	25%
	4.45MHa	

The more significant conclusion – which was not a fatalistic one – was that ‘when living in the Blue Mountains or regions classified as being Fire Ecologies (such as in California and Spain) one was only ever between Major Fires’. The problem became, not so much to do with managing the **Fire Phase** – since it was concluded that a) we are pretty good at engaging with Major Fires and b) they occur frequently enough (every 5-8 years) that we remember the lessons learned – but during the **Fuel Phase**, when we tend to forget the lessons we have learned and our insurance, housing policies, organisations (including volunteer networks) and precautionary rules and ordinances are forgotten or based upon something that occurred ‘generations ago’⁵. The more dangerous of the two phases may, in actual fact, may be the Fuel Phase when the collective memory of what to do and how to survive safely in a Fuel Ecology – in other words our Resilience – fades.

3.1.1 Some Analytical Data

From work undertaken by students to examine potential costs in terms of Prevent – Engage – and Recover, realistic Estimate Monetary Values (EMVs) for the different financial risks were calculated. Based upon figures tested with the community, with insurance experts and with local volunteer networks and other facts and figures relating to the Blue Mountains community, the following EMV for a Major Fire was calculated:

Table 3: Estimated Monetary Value Costs for Engaging a Major Fire in the Blue Mountains Region

Major Costs	\$ Major Fire
RFS	15750000
SFS	23625000
Housing	0
Insurance	2680000
Health	10940000
One-Off Support Funding	1400000
Culture & Tourism	6526238
Litigation	3400000
Media & Reputation	1332624
Volunteers	
Total	65653862

⁵ Where we consider a generation to be 14 years.

Costing Notes:

- The costs of the RFS were based upon this being a volunteer fire service and that all would be engaged during a major fire supported by the state fire service (SFS) and SES. The costs were based upon having fire fighters engaged for 15 days, continuously and obviously include the overhead costs of retaining such services over the year.
- Health factored in two major costs: 1) the cost of estimated numbers of fatalities from actuarial figures⁶ and b) an estimate of the related costs of injuries (at the time) and subsequently (including PTSD) during the Recovery and Prevention phases.
- Insurance reflected a number of perspectives, including the fact that a significant number of properties (for a number of different reasons) are underinsured, and so this gave rise to a cost on the region as a whole following a major fire.
- Although Housing was shown as a zero cost during a major fire, the location of housing and housing designs to resist fires / prevent fire spread, as related to existing building codes and regulations, was very much part of the wider research undertaken. Properties built to be Fire Resistant could significantly reduce the costs of the Prevent and Recovery phases while also reducing the numbers of fatalities and injuries – and improving Resilience.
- The cost of underinsurance, including potential national, state and local changes to policies and implementation and the potential for subsequent litigation, gave rise to costs being attributed to litigation (based loosely on the current class action) and so potentially upon media and reputation assessed as a combination of a percentage of legal costs and potential impact on culture and tourism.

Note 1: while some comment is made as to the impact of litigation on resilience below, this compilation overview submissions and costing neither endorses nor contests the current class action.

- The cost on Culture and Tourism, which was seen also to represent history, the local communities and the, often, volunteer networks that support this industry – was based upon a percentage loss during and after a Major Fire using BMCC annual income figures, see <http://www.economicprofile.com.au/bluemountains/tourism/output>.
- A proportion of the Mayor's Fund was allocated and seen as being an opportunity cost on the region – since funds invariably have to be provided from elsewhere, see <http://www.mpes.nsw.gov.au/publications/bushfires/bluemountains2013/booklet>.

The overall EMV of a Major Fire in the Blue Mountains – which falls upon individuals, the state, insurers; at the Federal level and also on the BMCC and local volunteer groups – was suggested to be in the region of \$66M. It is understood that other estimates have suggested a cost in the region of \$45M, so this may not be an unreasonable gross figure.

3.1.2 Social Impact Factors

The identification of the importance of culture and heritage and also the recognition that, in a Fire Ecology, one is only ever 'between Major Fires', led to a reappraisal of the priorities that may need to apply in a Major Fire. A key component of ecological risk management was determined to be Resilience, in which the role of culture (including tourism) in nurturing volunteer networks (such as

⁶ During the Blue Mountain Fires of October 2014 it is generally accepted that because the fires occurred during a working week and at day time the number of potential fatalities and injuries was much reduced than for an event occurring / beginning overnight.

the Lions and RFS) is fundamental to Recovery and Prevention. This, taken with the EMV costs (Table 3), suggested a new prioritisation for **Major Fires**:

1. Life;
2. Culture and Heritage;
3. Environment; and
4. Property.

Note 2: This prioritisation for **Major Fires** may be different to fires occurring in the Prevent and Recovery stages, where the priority is normally Life and then Property. In a major fire, we concluded that it may not be possible to save property and, therefore, people needed to be able to walk away from their properties – possibly in as little as 10 minutes, from which we conclude:

In a Major Fire, your survival may be based upon the '**10 Minute Rule – being able to walk away**'. Could you walk away from your property in 10 minutes – what do you need to do to be prepared to do so in a Major Fire?

Sensitivity Analysis for the Recover and Prevent stages suggested that, while more could be done to reduce the length of the Recovery stage from 5 years (as currently estimated for the 2009 Victorian Black Saturday Fires) to 3 years, say, this did not substantially reduce the costs of the Recovery and Prevention stages. Working with FEMA and as advised from other agencies, it was determined that the major impact on cost reduction following an emergency, e.g. in the Recovery and Prevent stages, came from activating, mobilising and retaining volunteer networks and their supporting regional frameworks – including government and insurance companies. Cost analysis suggested, that for every dollar spent to support volunteer engagement, could provide up to \$10 in return – in other words, the costs that would otherwise fall on the public or private sector to provide the same.

Table 4: Table 2: Generational Classification Matrix, 1900-2019, after Reay Atkinson et al (2013c)

Epoch	Generation	Current Age 2014
1900-1914	Centennials	100 to 114
1915-1929	Great Generation	85 to 99
1930-1944	Depressionals	70 to 84
1945-1959	Baby Boomers	55 to 69
1960-1974	Generation X	40 to 54
1975-1989	Generation Y	25 to 39
1990-2004	Millennials	10 to 24
2005-2019	Recessionals	0 to 9

Annual EMV costs (falling on all parties, private and public, state, Federal, local and individual) of the Prevent and Recover stages were considered to be in the region of \$15M and might be reduced by 4% if the Recovery (post Major Fire) was reduced from 5 to 3 years, yet:

If one can engage with the volunteer networks more effectively and enable a 1:10 investment return, it may be possible to reduce the annual Prevent and Recover EMV from \$15M by 30%, to about \$10.5M per annum.

This observation and the reprioritisation of major fires (1 to 4), suggested above, increased the emphasis on engaging with volunteer networks. At the same time, some research and anecdotal

evidence is suggesting that volunteer groups – such as the Lions – are struggling to engage with the younger generations (see Table 4). As a result, many volunteer networks are ageing (54+) and younger generations (younger Gen X and older Gen Y) may not be being energised. Although RHoC stands in contrast with most volunteers drawn from Generations X and Y. Student course work research, shown in some of the posters attached, identifies volunteering as an issue and looks to ways for re-engaging with younger volunteers and keeping them involved – *stickability*.

3.1.3 On Resilience

Returning to the definition provided earlier for resilience being: ‘the *ability* of an ecology or system to *adapt*, transform, redesign, renew, and recover in a timely *response* to events’ (after Bryant, 2012; see Reay Atkinson et al, 2014a), Resilience is significantly a social phenomenon / attribute for dealing with events – specifically those uncertain events which can give rise to complex instabilities and, in some cases, disasters. This is essentially what our initial research concluded – that without Resilience, our communities will be vulnerable to unforeseen events and may be unable to do anything other than react rather than respond to them. This extended to an understanding of PTSD (see Reay Atkinson et al, 2014b) and how close social networks can assist both in reducing the numbers impacted by PTSD and aiding and abetting recovery. These factors then played strongly into recommendations to prioritise Major Fires in terms of ‘Life, Culture and Heritage, Environment and Property’ as a way of re-energising volunteer networks and keeping them involved (stickability).

Our work revealed that litigation may have an adverse impact upon resilience. It does this essentially by placing people’s lives on hold – while costly legal processes, judgements and awards are made – and creating a form of *Planning* or *Resilience Blight*. In other words, while these actions are under way the trusts necessary for collaboration and so Resilience are eroded and people put their lives on hold. There are also often legal reasons why people and / or companies and institutions can no longer collaborate for *fear* of being the subject of secondary litigation and / or because they are named as respondents or appellants. An example may be that, two of the six fires contributing to the Major Fires in the Blue Mountains were allegedly attributed to sparks from overhead power lines. In other cases of this type, the result has been that power has been isolated (or turned off) at times of high fire risk. This appears sensible but, in some cases, appears to have led to increases in heat strokes and injuries / deaths through heat stress. Finally, the reaction of many people on learning of a class action being brought (and indeed of Government and NGOs and Private Companies) is that they no longer need to contribute charitably or provide other support functions, set up following a disaster. In other words, local, international and national sympathy – so essential for learning lessons; preventing future occurrences and ‘telling the story’ – is also adversely impacted.

In examining funding costs of Natural Disaster, the Public Service Commission may wish to examine the litigation financial industry that has arisen to fund such class actions – and to take a punt on people’s misfortune. Whereas in the past laws of ‘maintenance and champerty’ existed to prevent / reduce non-criminal actions against the public purse / interests, this is no longer the case. It is possible, in the event of Major Fires occurring in a region susceptible to such events – for example in a Fire Ecology – that emphasis should be placed on ‘no-fault found compensation’ with a view to enabling collaboration, learning and resilience and applying lessons learned. The key lesson learned from the Blue Mountains Major Fires of 2013 is the lack of awareness of housing regulations, preparedness and, above all, under insurance had a major impact on Recovery and therefore Resilience. Litigation too often comes at the cost, it would appear, of Resilience and Recovery.

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RISK, RECOVERY AND RESILIENCE

ECOLOGICAL FIRE RISK REGISTER – A PROJECT CONDUCTED BY THE UNIVERSITY OF SYDNEY IN COLLABORATION WITH THE BLUE MOUNTAINS CITY COUNCIL, THE LIONS CLUB OF WINMALEE, NRMA INSURANCE, AND RHOK SYDNEY.



As part of our world-first Bachelor of Project Management degree students undertake unique research as part of their coursework program. This enables these students to apply their newly learned skills to a real world problem – risk, recovery and resilience in bushfire management.

RESEARCH INTO RISK MANAGEMENT IN RELATION TO BUSHFIRES IN THE BLUE MOUNTAINS

Our research suggests that the Blue Mountains region is what would be described as a Synthetic Ecology: 'a system (being or entity) that adapts, over time, combining through design and/or by natural processes, two or more dynamically interacting networks, including organisms, the communities they make up, and the non-living (physical and technological) mechanical components of their environment'.

The Blue Mountains incorporates a fire ecology: a branch of ecology that focuses on the origins of wild-land fire and its relationship to the environment that surrounds it – both living and non-living.

The Fire Season: our sense is what was once a Fire Season of 70 years (comprising a fuel phase and a fire phase) may now be reduced to 50 years. It includes two phases:

- The fuel phase: may now be 20 years and
- The fire phase (as the fuel is burnt off) 30 years.

During the fuel phase, we may have 20 years or more between Major Fires and when in the Fire Phase no more than 8 years.

Major fires will happen – 'we are only ever between fires'. Part of our understanding is accepting this and so building our resilience or the ability of an ecology or system to adapt, transform, redesign, renew, and recover in a timely response to events.

OUR EMERGING THOUGHTS

Resilience is based on shared awareness; recognising that 'we live in a fire ecology and major fires will happen'.

We have identified the importance of culture and history (including tourism) in nurturing volunteer networks (such as the Lions and RFS) – fundamental to our Recovery and Prevention.

All this suggests a new prioritisation for Major Fires described by:

1. Life;
2. Culture and Heritage;
3. Environment; and
4. Property.

This being the case, in a major fire your survival is based upon 'being able to walk away' – for which we suggest the '10 Minute Rule': 'could you walk away from your house in 10 minutes – what do you need to do to be prepared to do so in a Major Fire?'

If you would like to find out more about what we do, you can contact us at the following:

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Classifying and Systemising Uncertainty and Instability – a Dynamic social Network approach to Risk

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The narrow and probabilistic, ergodic approach to risk, to date, has potentially not fully understood or incorporated the dynamical synthetic ecology in which our systems actually operate. A dynamic synthetic ecology made even more complex and potentially uncertain and unstable through the degrees of socio-info/techno connectivity we now enjoy compared to 30 years ago. This means our decisions and solutions are often deeply entangled in ways that it is almost impossible to measure. Yet Risk Management continues to call for measured certainty based upon a potentially increasingly narrow and frozen understanding of Risk – usually ‘taken’ at the unit / operational but not the systems level. In this paper, we look at uncertainty and instability as being connected but not necessarily synonymous indicators of risk. In terms of instability, we look to classify different types of instability that a system may face including, for example, technical risks introduced through disruptive technologies.

Keywords: *ergodic, synthetic ecology, instability, uncertainty, socio-info/techno, instrumentation.*

1. INTRODUCTION

Fire scientists and managers recognized that *fire-adapted ecosystems* had been harmed by overzealous suppression, that growing fuel loads were exacerbating wildfire problems, and that restoring natural fire regimes should be a priority in fire management policy and practice. Nonetheless, despite changes in agency rhetoric and fire management policy over the last several decades, fire suppression continues to be reinforced through incentive structures, agency budgets, and professional practice (Arno and Allison-Bunnell 2002). Instead of making ecological restoration the core of fire management practice, land management agencies are devoting ever greater resources to suppressing fires that continue to grow in extent and intensity (Butler and Goldstein, 2010).

In this paper, we consider *classification* and *ecological* [system] *identification* (what are the systems we are looking at?) as being essential precursors to making and taking robust decisions regarding Risk, its measurement, instrumentation and management. *Instabilities* can lead to *uncertainty* – sometimes through shocks to the system, for example a *Physical Instability* such as an earth quake or Tsunami. These more *Complex Instabilities* (connecting a Tsunami with the siting of a Nuclear Power Reactor for example) need to be understood and factored into any adequate measurements of risk, so that the *uncertainties* (in any measure of risk) can be properly and adequately understood. This, in itself, provides for a more dynamical and resilient understanding of risk than potentially has been the case hitherto – and so may act as an *aid* to improved decision making and taking.

From classification and identification of the systems we are seeking to address we consider how, rather than measuring and *metricating* risk as a static singular No., we may *instrument* risk and devise models that can provide a dynamical (non-ergodic) and *non-obtrusive* means of assessing risk. By *instrument*, we mean creating network models of the system that can act like a petrol gauge in a car, to give managers good *indicators* and *warnings* of system health and therefore its ability to identify and manage risks over time, not simply in time, in which we consider, after ATL (2007); Ford et al (2009) and Reay Atkinson (2011a), instrumentation to be:

'The ontological modelling of dynamic system ecologies so as to identify what has occurred at different combinations and scales in order to synthesise, analyse, influence and / or control future socio-info/techno and info/techno-socio phenomenon, strategies and processes'

The *instruments* we propose are Dynamic social Networks (DsN) (Uddin et al, 2012) that represent a model – imperfect as it may be – of the *socio-info/techno* (Reay Atkinson et al, 2012) and *info/techno-socio* (Reay Atkinson et al, 2011b) systems we are often addressing, be they in the physical or cyber / virtual worlds in which increasingly we work, design, engineer and solve more complex problems. We also distinguish between *decision making* and *decision taking* (DMT) (Reay Atkinson et al, 2014b) and consider an alternative model for dynamically arriving at decisions that differentiates between *strong* control type signals and the *weaker* social signals of innovation, change and adaptation (Ansoff, 1975; Coffman, 1997; Granovetter, 1973; Hansen, 1999; Hiltunen, 2010; Hiltunen, 2008). Weaker signals often drowned out by the control measures put in place to minimise risk (Reay Atkinson, 2011a)! Instrumentation may also allow a company or organisation to understand the impact of uncertainty and instability on risk and so guide, steer or influence the organisation towards alternative equilibriums.

In this paper, we first introduce the concepts of instability and uncertainty we will be examining. We then develop the concepts for the synthetic ecology, as applied to political, economic assurance and instability models. We then suggest how these concepts and models may and will be applied as part of a wider informal investigation into the Blue Mountains Region in support of the Blue Mountains City Council, the people it represents and the wider region.

2. SYNTHETIC ECOLOGY AND IDENTIFICATION

'In 1770 Lieutenant James Cook, HMS Endeavour, saw something remarkable along Australia's east coast: the trees had "no underwood". On 1 May he "made an excursion into the country which we found diversified with woods, lawns and marshes; the woods are free from underwood of every kind and the trees are at such a distance from one another that the whole country or at least a great part of it might be cultivated without being obliged to cut down a single tree".' James Cook quoted in Bill Gammage (2011).

Bill Gammage's point is that in 1788, when British and European settlers first *colonised* Australia, there existed a *synthetic ecology* adapted to fire and managed accordingly, where we consider a synthetic ecology to be:

'a system (being or entity) that adapts, over time, by combining, through design and by natural processes, two or more dynamically interacting networks, including organisms, the communities they make up, and the non-living (physical and technological) mechanical components of their environment' (Reay Atkinson et al, 2014a).

Similarly, the Pacific Biodiversity Institute¹ considers a *Fire Ecology* to be:

'A branch of ecology that focuses on the origins of wild-land fire and it's relationship to the environment that surrounds it, both living and non-living'.

Today, 'the parks have gone...1788's controlled fire [undertaken by Aboriginal / Indigenous peoples] stopped when Europeans arrived. Today's bushfires devastate, and decimate species which

¹ http://www.pacificbio.org/initiatives/fire/fire_ecology.html

flourished during millennia of Aboriginal burning. In heath near Kiama (NSW), ground parrots needed fire every 3–7 years to balance food and shelter. In 1788 they got this, but after 1788 they got infrequent hot fires, and by 1968 had died out. ...since 1788 at least 23 mammal species have become extinct, and since about 1940 almost a third of world mammal extinctions have been in Australia. Recognising how extensive such changes have been, to plants, animals and the land, is crucial to understanding how constant and purposeful 1788 management was' (Gammage, 2011).

In our research, we consider the Fire Ecology to be one part of the Synthetic Ecology that represents the 'Blue Mountains Region' (or Greater Blue Mountains Area) that forms the basis of this paper and its area of research. We use, by way of example, research² currently being undertaken (March-July 2014) by undergraduate students taking the ENGG 3853 Risk Management Tools and Techniques course at the University of Sydney. The second half of the course involves the students researching and developing an Ecological Fire Risk Register of the Blue Mountains. The study is based on the fires that occurred in the region of the Blue Mountains from 17 to 28 October 2013. The area called the 'Blue Mountains Region' is called so because, as temperatures rise, the oils of the different Eucalyptus species evaporate to create an aerosol haze or mist that appears blue to human eyes. It is also these oils contained within eucalyptus that create the fire ecology of the region and the Flammable Ecosystems identified by Bond and Keeley (2005) to include boreal forests, eucalyptus woodlands, shrub lands, grasslands and savannas.

The Blue Mountains National Park constitutes one part of the area traditionally considered as belonging to the 'Blue Mountains Region' and including also the Kanangra-Boyd, Wollemi and Nattai National Parks, see Figure 1. As seen by Figures 1 and 2, reproduced from Google Maps, the fires occurred both inside and outside the Blue Mountains National Park and the wider Blue Mountains Region, somewhat adding to the perceptual confusion at the time and during recovery. Considering the roughly 44,500 square kilometres / 4.45 Mega Hectares (MHa) – or 16,864 square miles / 10.9 Million Acres – shown by Figure 1, about 2 MHa (45%) is forested / National Park of which approximately one third (0.7 MHa / 15% of the Map) constitutes the Blue Mountains Region, see Table 1. Put in perspective, the area covered by the map shown in Figure 1 is over twice the size of Wales and the forested / rural areas are about the same size as Belgium.

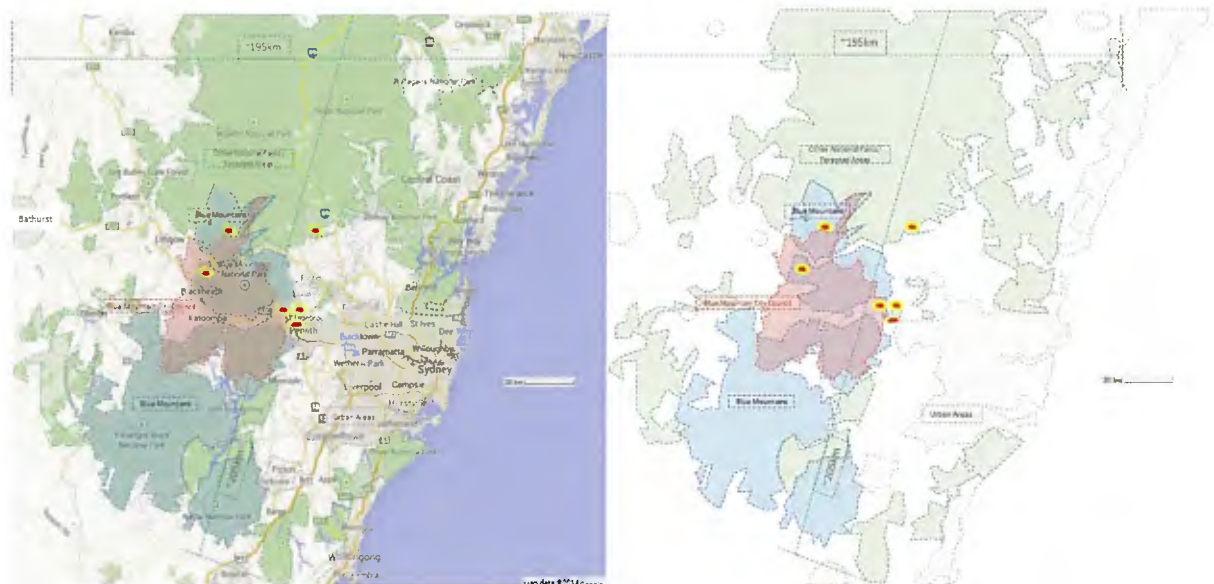


Figure 1 – (LHS) Map of the Region showing major seats of Fire (*Map Data @ 2014 Google*)
 Figure 2 – (RHS) System Ecological Map of the Region showing National Parks / Forested; Urban and Rural / Agricultural Areas in addition to the Blue Mountains City Council.

From the main seats of the fires, shown in Figure 1, it will be seen that while two fires were within the Blue Mountains National Park; one was in the Wollemi National Park and three were in the Penrith region. Similarly, three of the fires were within the area covered by the Blue Mountains City Council,

² This is a new concept for research as part of a course and undertaken at the undergraduate level – taking research into the wider ecology and considering it as a dynamic.

two of them were in adjacent urban council areas and one was outside both the Blue Mountain Region and City Council. Yet the perception from news coverage of the event was that the Blue Mountains, as a whole, were 'up in flames' and, consequently, 'not open for business'. Although important for minimising traffic to the fires (and so-called disaster tourism), it was a bit like closing the countries of Wales or Belgium as a result of five or six relatively well identified and located fires! As a result, the economy of the whole region suffered as bonified tourists stopped coming.

Table 1 Synthetic Ecology of the Blue Mountains-Sydney Region

Physical-Socio Ecology	Approx. Area (MHa)	Approx. %
Maritime / Rivers / Lakes	0.9	20%
Urban	0.45	10%
Forested / National Parks (Blue Mountains Region)	2.0	45%
(Blue Mountains National Park)	(0.7)	(15%)
(Blue Mountains City Council)	(0.27)	(6%)
(Blue Mountains City Council)	(0.143)	(3.2%)
Rural / Agricultural	1.1	25%
	4.45MHa	

Note 1: The Blue Mountains National Park, itself, covers about .27 MHa (6% of the Map); whereas the 'Blue Mountains Region', identified above, incorporates other adjacent National Parks to describe the area as a whole.

Note 2: The Blue Mountains City Council incorporates parts of the Blue Mountains National Park and essentially runs East-West along the famous vehicular routes that first opened up the hinterland of New South Wales to European settlers, early in the 19th Century.

3. UNCERTAINTIES AND INSTABILITIES: PREVENTION & RECOVERY

In this paper we consider *Instability* to be 'the quality or state of being *unstable* and / or the tendency to behave in an *unpredictable*, changeable, or erratic manner'. We further suggest that there are four different classes of instability that need to be understood when managing risk and which we consider to be the Physical, Human, Technological and Complex:

- **Physical:** e.g. fire, earthquake, tsunami;
- **Human:** e.g. war, politics, Global Financial Crisis; famine, social change etc;
- **Technological:** e.g. Cyber, ICT and, potentially disruptive technologies such as nanotechnology;
- **Complex:** some combination of Physical; Human, Social or Technological, (socio-info/techno or info/techno-socio) e.g. Morwell town disabled by the Brown Coal Fire.

Situating 'risk' in terms of an economy is clearly an imperative as has been seen when *recovering* shattered countries such as in Bosnia or Sierra-Leone. If people do not feel secure and safe – *assured* – they will not invest their time in the local ecology and will endeavour, naturally, to go somewhere else where they may be rewarded, see Gilpin (2000). We conclude, therefore, that the same applies to recovering local economies and regions from physical / human instabilities such as fire. 'Decision making and taking can be considered as the political element necessary to create the context in which decisions can be taken: politicking' (Reay Atkinson *et al*, 2011c, 2012, 2014b). This was coupled to the economy by Keohane and Nye (1972) who considered the 'Political Economy' and then extended to the 'International Political Economy (IPE)' by Gilpin (2000). Rather than the IPE, the more coupled Political Sûreté³ Economy (PSE) acting at both a Global and Local (glocal) levels or GPSE⁴ (pronounced gypsy) is suggested.

³Encompassing safety, security, assuredness (including insurance) and trust.

In this paper we consider the Freedman-Morgan⁵ (Freedman, 2009) understanding of 'Prevent' being about preventing a hostile act / damaging event in the first instance through all other means short of the use of force, including the use of meaningful inducements and encouragement (influence, policies, laws and rules). Our model considers the management of three phases: Prevention; Engagement and Recovery (PER). Other four stage models exist, including Mitigate, Preparedness, Response & Recovery (MPRR) and Prevent, Prepare, Respond & Recover (P2R2). However, we consider that *engagement* incorporate response and that *mitigation* and *preparedness* are elements of recovery and prevention. Moreover, we also suggest that the ability to prevent, engage and recover is indicative of resilience, where we see: 'Resilience to be the ability of the *system* to transform, renew, and *recover* in a timely response to events' (Bryant, 2012). The aim of the PER Model is to move *agents* as quickly towards the Recovery phase as is possible, ideally without having to enforce and / or enact new laws. Yet having formal enforcement and legislative bodies available as an option to enable the recovery and prevention processes.

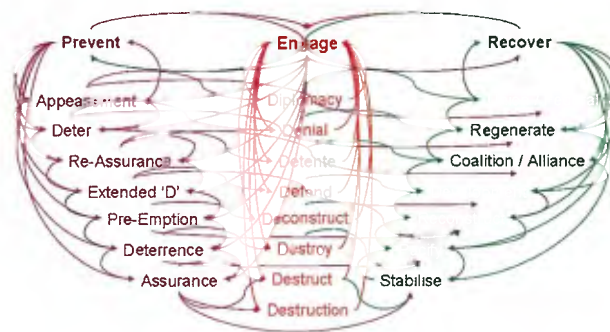


Figure 3: Prevent-Engage-Recover Model – 'The Rose Bowl' (Hemlock, 2012)

The Prevent-Engage⁶-Recover model, Figure 3, is not exhaustive and considers political options relating more to defence and security. It attempts to identify alternative connected-strategies that might be available to diffuse complex situations. There is no 'one size fits all' but there are elements within the model that may be applied to recovery from complex instabilities. Specifically, the PER model recognises work by Gray (2003) and Luttwak (2001) 'that placed emphasis on the importance of strategic culture in *networked social processes* and which underpin planning, *decision-making* and so *decision-taking*: good decisions are not capability driven' (Reay Atkinson and Goodman, 2008). Frequently we are presented with situations where decisions need to be taken and yet when there is *uncertainty* as to how best to proceed. In other words, there is more than one solution and we are dealing, potentially, with a complex problem. Uncertainty applies to probabilities, as in a Risk Register and to physical measurements that are already made, or to *known-unknowns*, *unknown-knowns* and *unknown-unknowns*. Specifically, we consider uncertainty to 'arise in partially observable, opaque, stochastic environments / non-ergodic (complex) ecologies, overly prescribed, ruled or controlled regimes as well as due to ignorance and / or lack of caring and shared awareness (or indolence)':

In the formulation of a traditional Performance Assessment System (PAS) in the Occupational Health & Safety (OHS) area, most Performance Indicators (PIs) are affected by non-probabilistic *uncertainty* like the imprecision, the indefiniteness or the ambiguity, however, they are usually represented by deterministic values. This is mainly due to the inability of current PASs to adequately represent this kind of uncertainty. It is considered, however, that a good PAS must be able to deal with the uncertainty since this uncertainty is part of the models used to obtain the PIs and also part of data that support them. Generally, each PI is represented by a

⁴Ascribed to Dr Jamie MacIntosh and Dr Simon Reay Atkinson, Advanced Research Assessment Group (ARAG), UK Defence Academy, 2007. ARAG is under Hansard's Parliamentary record as being the only UK Public organisation to have identified the potential of the Global Financial Crisis; its depth and duration some years beforehand.

⁵Distinction credited to P.M. Morgan, *Deterrence: A Conceptual Analysis*, Beverly Hills, CA: Sage Publications, 1977, ch. 2.

⁶This model, considered during the UK Strategic Security and Defence Review (SDSR) is implicitly referred to by General Sir David Richards, then Chief of General Staff in his letter to all [British] Army Commanding Officers, dated 29 Oct 09, in which he states inter-alia: 'Prevention will be a key element of British foreign policy in the years ahead and we in the Army will have a critical role to play in this. Whether we are training indigenous security forces to build their capacity to cope with violence and terrorism overseas or merely reassuring our allies that we are there to support them, we must be *prepared* to be *deployed* and *engaged* in *prevention* operations across the globe'.

number that is not able to represent uncertainty. The problem is how to overcome this situation or how to deal with data uncertainty (*Cavallare, 2013*).

According to Lopes et al. (2013), the performance measurement (PM) process, involves three different activities: measurement, data record/transmission and performance measure determination. Each of these three activities can be made automatically (for example by a computer application), it can be made manually (i.e. it may depend on human tasks), or it may be a combination of both. All these activities can influence the results or values of any PM. Thus an unknown error or uncertainty is present in any PM (*Sousa et al., 2013*). This uncertainty can be induced by several factors (Lopes et al, 2013), some of which are described in Table 2.

Table 2 Some Causes or Sources of Uncertainty in the Performance Measurement of Risk during the Prevention, Engagement and Recovery Phases, from (*Sousa et al., 2013*)

Phase	Factor	Description
Prevention	Physical	Changes to Vegetation
	Human	Changing Land Use, Human Error, Politicking
	Technological	Building Types
	Complex	Climate Change, extreme weather
Engagement with Fire	Physical	Communication Routes
	Human	Formal-Informal Networks (Federal State / Council / Rural Fire Service) Operational Response Time
	Technological	Media & Medium (IT, Cyber Communications, Twitter etc.)
	Complex	Safe Messaging, Water Availability
Recovery	Physical	Location / Extent of Damage
	Human	Rules, Regulations, Insurance, Politics, Lack of Competencies, Health, Knowledge Networks
	Technological	Building Designs & Classes
	Complex	Governance, Political Layers

To support this classification and systems analysis, we will apply 'cause-and-effect, Ishikawa or fishbone diagrams' developed in 1950 by the late Professor Kaoru Ishikawa, 'with a force-field analysis' to provide 'a diagram combining the restraining and driving forces...to assist in [system] diagnosis' (*Juran and Godfrey, 1999*).

4. HIC SUNT DRACONES (HERE BE DRAGONS)

The dragon-crocodile⁷ possessed fire sticks. The rainbow bird would ask for fire, but was knocked back every time. The dragon had fire. No man made it. The dragon had had fire from a long time ago. Then the rainbow bird took the fire and put it everywhere. Every tree has fire inside now (*Isaacs, 1980*).

⁷ The Dream Time Story is of the crocodile itself a form of 'terrible lizard' or dinosaur which we might, in this regard, think of as the dragon in European or Chinese mythology. This story is paraphrased from Jennifer Isaacs (1980) compilation of stories under the title 'Crocodile took the Firestick', see also Fire and Rescue NSW, <http://www.fire.nsw.gov.au/page.php?id=647> visited February 2014

We may, in some respects, be better thinking of the ecology of the region in terms not simply of its blue azure but also in terms of fire. Rather than simply being the Blue Mountains, the region might also be described as the 'Blue Dragon Mountains' (*montes puteulanus dracones*). The Blue Mountains ecology represents an *ecosystem* composed of dynamically interacting networks, hence our work to create a dynamical ecological fire risk register. The output will be a register designed and intended to scope these interacting organisms, and communities and their associated physical and technological networks and to provide an instrument for assessing them and thereby the future resilience of the region as a whole to cope with fire, recover from fire and prevent the excesses of fire in the future.

To undertake this research, we intend to take a *systems* level approach, looking at the whole *ecology* (of the Blue Mountains) and identifying the different types of networks interacting within it. This leads to *System Classification*, necessary as a first step to *identifying* the types of tools and techniques one will apply to manage the whole system. We have begun this process by developing some of the classifications in terms of instabilities and uncertainties we will be seeking to identify (assess and measure) as part of our research.

Building on the identified causes or sources of uncertainty, we intend to quantify them in different means for example applying probability or fuzzy theories to deal with subjectivity and Likert-type scales to allow experts or users to express their degree of importance/agreement of a given subject' (*Sousa et al., 2013*). We intend then, by applying graph theory showing interconnected uncertainty sources and their dependencies, to convert this into a matrix. From this matrix, we can then develop individual levels of uncertainty about particular identified risks to the Blue Mountains Ecology. Our intention is to create a dynamic risk register and one that we can *instrument* – and so to show changing levels of risks and the uncertainties associated with their measurements. From these uncertainties, we can then examine reasons for them and potentially advise on actions that are increasing uncertainties – for example climate change leading to reduced opportunities for back burning leading to increased growth and fuel for fires – and so *instrument* the ecology.

Our aim is to create an *instrument* that enables us to better manage in particular the recovery and prevention phases so as to improve the resilience of the region as a whole and its ability to engage and recover from fires. Such an instrument would be an aid to better management – but may have considerable impact upon future governance arrangements and the way we do our business and politics. In other words, the instrument itself and the potential opportunities for industry it creates may enable a resilient future Knowledge Enterprise Economy (KEE) and export opportunities on a national and regional basis.

ACKNOWLEDGMENTS

The Blue Mountains City Council, the peoples of the region and the Recovery from Fire Programme, 2013- and the international and local charities from many different Australian cultures and religions who responded and gave so magnificently during and after the fires.

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First Stop

Working with John Donohoe (Winmalee Lions Club) and under the lead of Ian Wahlet (a tutor on the Project Management and Leadership programs at the University of Sydney) and with a remarkable group of young professionals from Random Hacks of Kindness (RHoK) we all came together over the weekend of 30 May / 1 June to create **First Stop**. First Stop is a QR (Quick Response code) and trust based personalised information exchange (PIE) that will allow for the rapid / trusted transfer of personal details in an emergency, through recognised providers. It becomes an Emergency Register Information Hub (ERIH) at the front-end of an emergency shelter / HQ / gathering space.

RHoK, under an exceptional group of volunteer hackers (Roz, Stephen, Andreas, John, Sol, Anabel, Ian, Nikita, David and Simon – no surnames; no pack drill!), have taken forward the development of open access coding to allow the First Stop concept to be developed and taken up by any and all first responders (charities, NGOs, emergency services etc.) We recognise that this is essential to building trusts and confidences in the new social map following an emergency – when so much of the old maps have been changed by fire, flood, mudslides etc.. The concept of post emergency, Dynamic Social Mapping (DSM) is one being taken forward by the Complex Civil Systems Research Group at the University of Sydney. We acknowledge, in doing so, the remarkable work and kindness of RHoK Sydney in listening to the people of the Blue Mountains and others experiencing emergency to help us develop First Stop for humanity – the logo is shown below:



Emergency Register Information Hub



Random Hacks of Kindness

Hacking for Humanity

As part of the University of Sydney's world-first Bachelor of Project Management degree, students undertook a unique research program into the Fire Ecology of the Blue Mountains. This involved students working with the Blue Mountains City Council; The Lions Club of Winmalee, NRMA Insurance and Random Hacks of Kindness (RHoK), Sydney. The lab became their classroom; the lecture theatre their lab. Their research confirmed the Blue Mountains region as a synthetic fire ecology, synthesising wild-land fire and its relationship to the environment that surrounds it – living, non-living (physical and technological) and mechanical. From research led by Professor Simon Reay Atkinson and Ms Aminah Wehbe, students identified a key component of ecological risk management to be Resilience, in which the role of culture (including tourism) in nurturing volunteer networks (such as the Lions and RFS) is fundamental to Recovery and Prevention. This suggested a new prioritisation for **Major Fires**:

1. Life;
2. Culture and Heritage;
3. Environment; and
4. Property.

In a Major Fire, they concluded, your survival is based upon the '10 Minute Rule – being able to walk away'. Could you walk away from your property in 10 minutes – what do you need to do to be prepared to do so in a Major Fire?

Working with RHoK, John Donohoe (Winmalee Lions Club), Ian Wahlet, Roz, Stephen, Andreas, Sol, Anabel, Nikita and David conceptualised **First Stop**, a QR (Quick Response code), trust based personalised information exchange (PIE). First Stop allows for the rapid / trusted transfer of personal details in an emergency, through recognised providers. It becomes an Emergency Register Information Hub (ERIH) at the front-end of an emergency shelter / HQ / gathering space and is part of the Dynamic Social Mapping (DSM) project being taken forward by the University of Sydney. For more information contact John at johnandtrishd@gmail.com.



Emergency Register Information Hub

Remi Bell

School of Civil Engineering, Complex Civil Systems Group & Project Management
FACULTY OF ENGINEERING & INFORMATION TECHNOLOGIES

Supervisors: Associate Professor Dr Simon Reay Atkinson and Ms Aminah Wehbe

Education Through Insurance

As a fire's intensity increases, firefighters' capabilities decrease, as does the capacity of community to receive and act on triggers. Therefore before a disaster strikes, citizens need to understand the risks to themselves and their environment, to give them the best chance to prepare for and survive a natural disaster.

I propose that this warning should be given by insurance companies, by calculating insurance based on the level of property risk associated, using a **National Natural Disaster Risk Map**. This calls for the collaboration of the Government, the insurance industry and possibly a third party, like Google. If the Government was to focus more on mitigation and building resilience, recovery costs would be lower because there would be less loss.

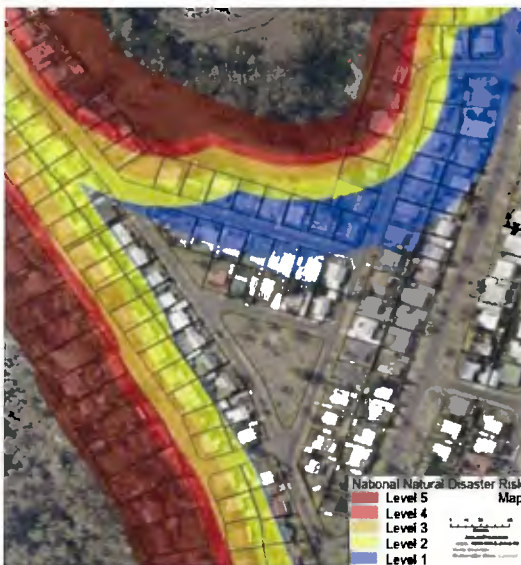
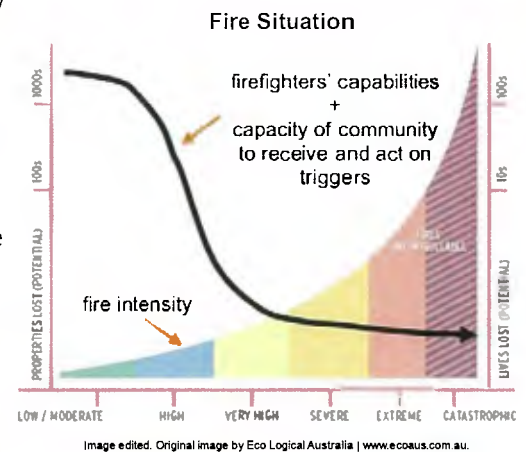
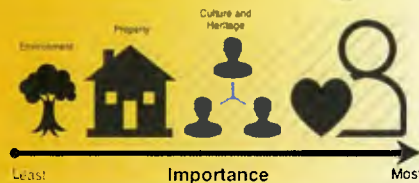


Image edited. Original image by Eco Logical Australia | www.ecoaus.com.au.

What Needs To Be Done...

The government needs to use policies to provide legitimacy to this initiative, as well as support the operational capabilities of someone like Google.org, and the insurance industry, to create public value through maximum awareness. The Government can support the insurance industry by helping change public view of insurance; this can be done through stopping the assistance of those who choose not to insure.

A single **National Natural Disaster Risk Map**, to be used by all property insurers, is required to reduce confusion, providing the greatest benefit. The Government and the insurance industry could work along side Google.org to create a high quality product that could withstand considerable online traffic, be widely compatible and easily accessible by all. By having this map open to the public, greater overall risk understanding can be obtained. An existing example of Google.org helping Australia with natural disasters is their Crisis Response product, which helps citizens find important information when a natural disaster strikes.

How Prepared Are You?

With this initiative increasing situational awareness, you will be encouraged to think about and plan how to be best protected. By being made aware of the dangers, you are given the opportunity to put in place plans to save as many things as possible. By knowing you have done the best that you can, you will be more resilient, thus helping to retain your community's culture and heritage.

Just 10 minutes can be the difference between life and death.

Make sure you plan ahead so that you are your most prepared in the event of a natural disaster. An **Emergency Life Support Apparatus** is a very simple to use breathing apparatus that comes in 10 and 15 minute versions, it provides clean breathable air and it is rechargeable and reusable. If you are at risk of fires, having one at your residence could save your life.



Sabre ELSA |
Emergency Life
Support Apparatus

www.sabreh2s.com/h2s-safety-equipment



Hypothesis:

'Altering social behaviour to seek out potential risks associated with property location, and building positive associations with the insurance industry, should increase natural disaster preparedness, therefore reducing associated risks and increasing resilience.'

Aim



THE UNIVERSITY OF
SYDNEY

The Blue Mountains Fires: Constructability for fire resilience

Ludmila Costa de Aguiar, University of Sydney, Civil Engineering Major

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FACULTY OF ENGINEERING & INFORMATION TECHNOLOGIES

Supervisors: Associate Professor Dr Simon Reay Atkinson and Ms Aminah Wehbe

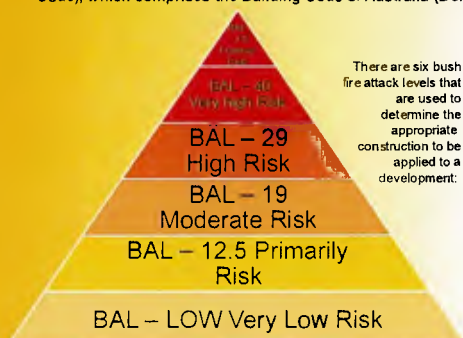
Constructability



Government spending on reconstruction significantly outweighs investment in pre-disaster resilience. What actions can be taken to make the constructions more resilient to fire? What needs to be done to, on top of saving lives, keep the properties safe and with the least damage possible?

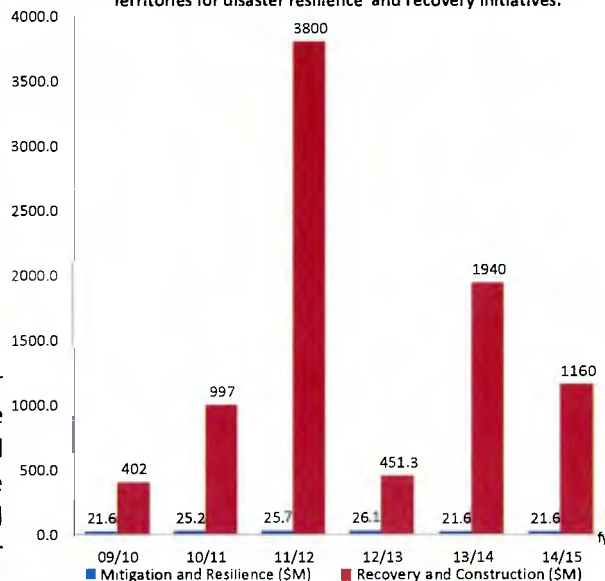
www.abcb.gov.au & www.nfma.com.au

New buildings are subject to follow the NCC (National Construction Code), which comprises the Building Code of Australia (BCA).

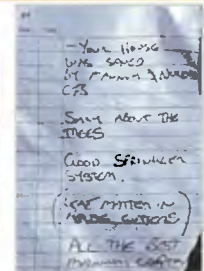


The Australian Government made over \$166m in Recovery Payments in 2013. The traditional official reaction after a substantial loss of houses has been to create/impose tougher levels of protection. But first of all they must consider the update of older houses to the current standards.

Discrepancy between the Funding provided to States and Territories for disaster resilience and recovery initiatives.

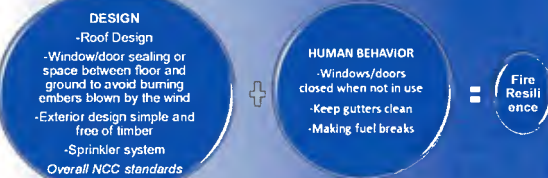


Fuel Break on Las Almohallas at the back of Los Gazquez



Note left for homeowners from Mannum CFS Captain, Peter Wilkinson.

There is no such thing as a fireproof building, but the more it adheres to the standards (of the NCC) the better. There is also the behaviour factor that needs to be considered in order to have a combined course of action that will create the best situation in case of a fire.



Technical x Human behaviour

Sources of uncertainty in the performance measure of risk

Phase	Factor	Description
Prevention	Technological	Building Types
	Human	Land Use, Human Error
Recovery	Technological	Building Design and classes

Design Solution:

- Roof
- Simple outside design
- Reinforced concrete slab
- Avoid decorative timber work

The greatest threat to your home will come from ember attack.
NSW Rural Fire Service, Fire Safety Information

Human actions:

- Cleaning roof and gutters/debris, such as leaves and twigs can get trapped on the roof, against the walls or under the floor
- Turn off air conditioning in case of fire

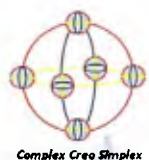
Increasing Resilience Factors



Pre-disaster resilience action is cost beneficial for Australia. But there is also the need to make sure people with properly sited and built houses do not negate the protective measures for which they paid good money in the first place. It is advised that more funds are applied to the increase of the number of houses following the standards, and stronger campaigns made about the importance of people's own actions, so that the number of lost houses is decreased. Investment in reducing vulnerability reduces the cost of recovery and reconstruction, so investment in pre-disaster mitigation will ultimately provide savings over the long term.



Catherine Hubbard and daughter Amy stand in front of the burnt ruins of their home in Winmalee, in the Blue Mountains. www.theage.com.au



To consider the hypothesis:

'Is it possible to develop an Ecological Fire Risk Register of the Blue Mountains Region that will improve Resilience by enabling actors to understand, live with and know the right applicable actions and so better aid Prevention for Major Fires?

A Safer Blue Mountains housing



THE UNIVERSITY OF
SYDNEY

Complex Civil Systems Research Group (CCSRG)
Faculty of Engineering & IT (FEIT)
A Compilation Submission to
The Productivity Commission

RISK, RECOVERY & RESILIENCE

A compilation of research and studies into Natural Disaster Funding arising from work by research staff and PM undergraduate students in collaboration with the Blue Mountains City Council, The Lions Club of Winmalee, NRMA Insurance and RHoK (Sydney) into an Ecological Fire Risk Register for the Blue Mountains, Nov 2013-June 2014

NATURAL DISASTER FUNDING ARRANGEMENTS PUBLIC ENQUIRY

(Prepared by: Associate Professor Doctor Simon Reay Atkinson)

The views expressed in this compilation submission are entirely and solely those of the authors and contributors and do not necessarily reflect official thinking, research outputs and policy of the University of Sydney, its collaboration partners (BMCC, The Lions Club of Winmalee, RHoK and NRMA Insurance) , researchers or students.

JUNE 2014

Importance of Awareness

Ability to predict and mitigate a possible risk and to react correctly in the event of that happening, in this case a Fire or Major Fire

De Briganti

Awareness of fire procedures and prevention methods can be effective in the prevention of major fires and so in the recovery efficiency of those natural disasters. It does so by enhancing the knowledge of fires in the inhabitants of the exposed communities providing different points of views on the problem and on the possible aspects of this disaster.



For communities living in a high fire risk area such as the Blue Mountains it should be natural for its members to have appropriate knowledge of risks that could affect them and the possible ways to mitigate them.

We believe this knowledge should be provided by the introduction of compulsory Health and Safety induction sessions held by experts involved with the prevention of fire disasters, such as firefighters, geologists, paramedics etc. Those experts will fill the gaps the population has in the understanding of fires and provide them with escape options.

Health and Safety Induction Session (HSIS)



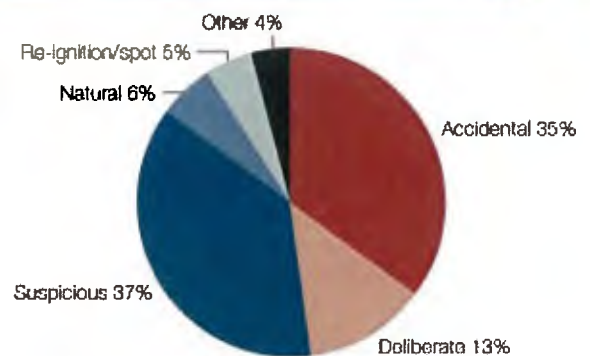
Importance for the Community

As local communities are the main stakeholders in the events of a fire their active involvement in the prevention and recovery phase is natural and essential

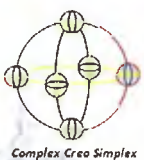
This introduction of HSIS will help prevent accidental fires and keep the community updated over time on changes in risk and procedures.

The creation of individual and tailored sessions for each precinct will address different risks the communities are subject to and adapt to specific requirements of each area.

Besides all of the above, this proposal explains only one step of keeping the community safe, and in the case of a major fire they will still be required to abandon everything and leave in 10 minutes, having a contingency plan ready.



Pie chart showing the causes of known vegetation fire for 2008.
Causes of known vegetation fires, Australian Institute of Criminology, 2008



Complex Creo Simplex

Logos

To consider the hypothesis:

'Delivery of *regular* and *compulsory* Health and Safety Induction Sessions will improve community awareness of major fires and so increase resilience through our ability to prevent and recover from them.'

Aim

What happened?

"Natural disasters have been ravaging human dwellings for as long as they've been built. It doesn't matter if they are caused by water, wind, or fire, natural disasters can devastate both homes and residents' lives"

(http://www.abc.net.au/1radio/news/stories/2013/10/20131020_natural_disasters_devastate_homes_and_lives)

In 2013, New South Wales experienced a series of bushfires, the worst of its kind since the 1960s. First sign of fires were reported to have begun burning on the 13th of October, 2013; followed by the worst of beginning in the Greater Blue Mountains Area on the 16th and 17th of October, 2013.

Fires and dangerous conditions were fuelled by high fuel loads, as well as warm, dry and windy weather. The fires peaked on the morning of October 18, 2013, where over 100 fires were burning across NSW.

(Murphy Damien (26 October 2013). "Lucky country" The Sydney Morning Herald Retrieved 26 October 2013)

Don't Let This Happen To YOU!



The Application

Each resident living in a bushfire prone area is living between bushfire sessions, whether it be 1 year or 8 years between each fire they are still constantly at risk and need to be adequately prepared.

There has been recent research which has resulted in the development of a smartphone application to help residents in bushfire prone areas to engage more actively in bushfire preparedness.

It aims at helping people within effected areas follow through on their intentions to undertake bushfire preparedness work. The application is designed to train the person's selective attentional response which is related to the threat of a fire.

(Nati en Muldock (2012). EMOTIONAL BUSHFIRE PREPAREDNESS IN YOUR POCKET, Fire Australia magazine)

"The [smartphone] application will assist people who want to do something to reduce their individual bushfire risk, but who find themselves procrastinating enhance their safety,"

- Professor Colin MacLeod



Are You Prepared For This?

Being well prepared for a fire is not just about cleaning up around the house and or having a plan in case of a fire...It's about making sure you are prepared mentally, physically and emotionally to face this fire and protect your family.

Bush fires are extremely terrifying and detrimental experiences. They come with gusty winds, intense heat and flames that will fatigue you quite quickly.

(<http://www.bluemountains.rfs.nsw.gov.au/>)

How does it Work?

The application is designed to work by measuring the response of the user to words that will progressively appear on the screen. Many of these words relate to bushfires and are aimed at influencing emotion. The user must react to these words, as they appear, by pressing the appropriate prompt. The quicker the response, the higher they score. Attentional bias is indicated by the response time. The process which this app uses is known as cognitive bias modification.

(Nati en Muldock (2012). EMOTIONAL BUSHFIRE PREPAREDNESS IN YOUR POCKET, Fire Australia magazine)



Fire-fighters do not protect your home, they focus on getting you out and to safety as quickly as possible. During a fire, they rank importance as follows:

1. Life
2. Culture and Heritage
3. Property
4. Environment



Conclusion

Therefore, we can see how mental preparedness is just as important as physical preparedness during a bushfire. People are mentally attached to their possessions and if you can channel that attachment to better prepare for a disaster beforehand, life you be much simpler during a fire.

More research into this application and helpful hint may be found at The University of Western Australia online library.



Complex Creio Simplex

Logos

Your hypothesis:

If residents were better prepared and more preventative measures had been taken, there would be a significantly less number of destruction and disappointment.

Aim



The Community as a frontline defence for Bushfires

Dallas Michael Blitvic

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Supervisors: Associate Professor Dr Simon Reay Atkinson and Ms Aminah Wehbe

First on scene:



A core objective of bushfire management is to help individuals and communities to regain the capacity to function again after a bushfire. An important part of this capacity is how prepared people are to deal with their exposure to the adverse consequences of a hazard. With respect to a major fire, it involves the degree of community education in fire management, the interpretations of warning signs, the level of planning and preparation and also decision making in which to either stay and defend or leave.

Successful synchronisation of the community and these objectives allow them to respond swiftly in possible circumstances and therefore act as a frontline in the management of major fires.

Non Profit Organisation

- Provides financial support through fund raising or donations
- Primarily focuses on Transformability stage
- Provide outside volunteers

Government

- Responsible for majority of resources used in the prevention, preparation and control of major fires
- Significant costs
- Delayed response compared to community

Community

- Passion and eagerness for involvement
- Man power
- Wide range of abilities and experience
- Resourcefulness
- Prompt reactions

Individual

- Response time
- Geographical knowledge of area
- Personal attachment
- Informal networks
- High priority
- Compassionate



What is needed?

- Government or external funding/ allocation of resources
- Development of relationships amongst the community
- Effective communication and collaboration
- Quick response/ communication times
- Cultural and community awareness
- Bushfire management committees



NSW RURAL FIRE SERVICE

"A Bushfire Management Committee (BFMC) provides a forum for cooperative and coordinated bushfire management in a local area. It also provides community involvement in the Bush Fire Risk Management process and assists the Bush Fire Coordinating Committee to consider issues relevant to the protection of life, property and the environment from bushfires. BFMCs are responsible for preparing, coordinating, reviewing and monitoring the Plan of Operations and Bush Fire Risk Management Plan for their area." - NSW Rural Fire Service

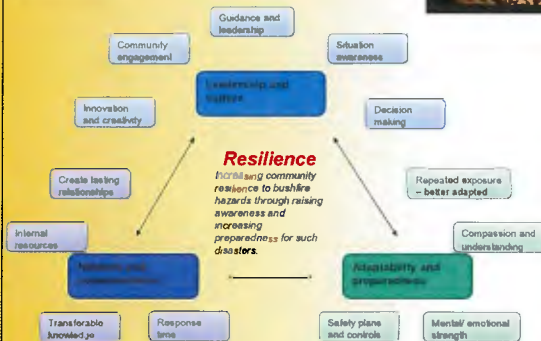


Why?

- Results from The Australian Journal of Emergency Management, Vol.22 No. 2, May 2007, illustrates how responsibility for bush fire maintenance activities primarily rely on property owners and the local council (community) This Creates an incentive to further encourage community members to act and respond as a cohesive team in bushfire management

	RFR (%)	Property owner (%)	Local council (%)	Partners and other services (%)
Firebreaks around properties	9.7	83.1	7.2	0.0
Keep overgrown bushland and creek beds clear	11.9	12.4	54.1	22.5
Clear overgrown properties	0.4	81.8	18.2	0.4
Remove rubbish from public areas	0.4	0.0	95.6	0.0
Maintain property access for the fire brigade	4.9	73.1	19.8	7.8

How?



"Targeting community resilience to the bushfire hazard has the potential to significantly reduce the impact of a bushfire event" - The Australian journal of disaster management.

RISKS

Safety of individuals

- What or who provides safety equipment
- Are community members trained/educated to act safely?

Resource use

- Individuals must be appropriately qualified or experienced
- Ensure resources (machinery) are safe for operation

Who is responsible

- Managers/ leaders need to be in place to ensure correct guidance
- Community will need to co-operate efficiently



Utilise community members/ volunteers more effectively to be used as a frontline in the prevention, preparation and control of major fires.

Aim

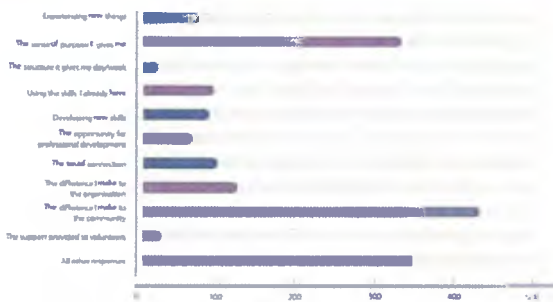
Introduction

References:

Bellon, R. R. 1991. Permanent Disaster Volunteers: Where do they fit. *Nonprofit and Voluntary Sector Quarterly*.
Tomoko Haroka, T. O. C. M. S. H. H. R. B. 2012. Factors Influencing Collaborative Activities between Non-Professional Disaster Volunteers and Victims of Earthquake Disasters. *PLG.Sone*

Increasing the number of people involved in volunteering services in the Blue Mountains in societies such as the RFS or SES will have many positive follow on effects throughout the community. This increase in activity will lead to an increase in:

- The capability to fight fires
- Informal communication channels
- Awareness
- The ability to manage evacuation procedures safely and effectively.



http://www.volunteeringaustralia.org/wp-content/files_mf/1377045635VANSVI2011.pdf



http://www.volunteeringaustralia.org/wp-content/files_mf/1377045635VANSVI2011.pdf

Post disaster, victims are less likely to work collaboratively with newly formed volunteers (Haroka, et al., 2012). Therefore having long serving volunteers in place automatically allows the community to involve themselves better.

Having well organised, and well trained volunteers is a key component of reducing the overall impact of the bushfires (Britton, 1991). This also increases the likelihood of achieving the Governments "no lives lost" metric. Greater volunteer presence allows for better pre-disaster awareness events (Haroka, et al., 2012), which can lead to greater knowledge in the local community and potentially reduce the total number of houses and lives lost.

Detail



Conclusion

The key area for improvement in volunteering numbers is in people under 35; in particular people under 18. However motivating people under 18 can be difficult as they are more focused on their schooling and sporting requirements. Some of the methods that may help improve the local community's involvement are listed below.

- Minimum volunteer programs in schools, working in parallel with the RFS volunteering program.
- Focusing campaigns on key reasons as to why people want to volunteer
- Talks within local businesses by working firefighters which highlight the need for more help.
- Government sponsored work programs.



Reducing Financial Burden of bushfire victims through the use of compulsory insurance.

Daisy E. Muljono

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Supervisors: Associate Professor Dr Simon Reay Atkinson and Ms Aminah Wehbe

Aim & Hypothesis.

Who is financially responsible for recovery phase of Bushfires? Should we have home insurance legally imposed on homeowners, especially in high risk areas to reduce the financial and emotional burden of rebuilding of homes on bushfire victims as well as the government.

Underinsured property is a great burden to residents who are already in an emotional state of loss. Although, we can not prevent natural disasters (floods, cyclones, bushfires), compulsory insurance would reduce the financial impact of those affected.



Picture 1. Source: <http://www.intmagazine.com/news/australia-news/mum-of-fives-miracle-escape-from-blue-mountain-bushfires>

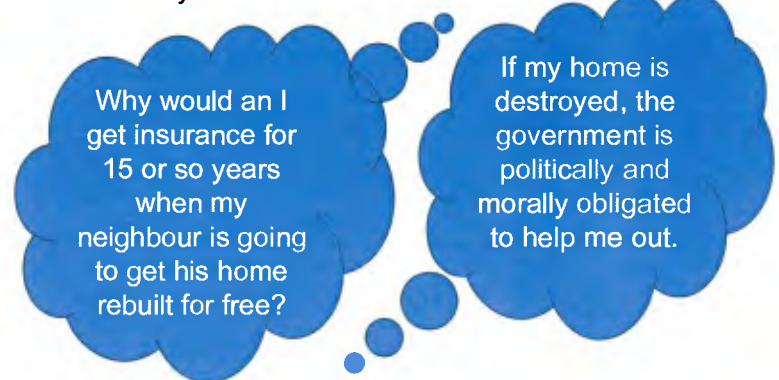
Table 1: Factors the encompass the Recovery Phase of the bushfire cycle.

Factors of the Recovery Phase	
Physical	Inspection of location and extent of damage
Human	Emotional and Physical Health, Finances
Technological	Fire-proof building designs, BAL Rating
Complex	Interactions with one or more of the above factors, Government, Political layers

Total cost to rebuilding insured property > **Maximum amount payable under an insurance contract**

The Blue Mountains bushfires destroyed more than 200 homes and severely damaged a further approximately 110. 80% of homes destroyed in the 2013 Blue Mountains bushfires were underinsured (Insurance Council of Australia).

Victim Mentality:



"Everyone for Themselves"

VS

Government Funded Approach

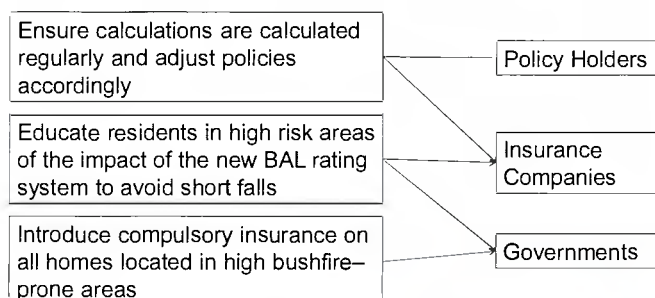
New building regulations force residents to downsize or relocate as rebuilding costs exceed insurance coverage

The new national building standards (3959 *Construction of buildings in bushfire-prone areas 2009* (AS3959)) contributes to the extra costs required to rebuild and exceeds their insurance coverage, which can increase the rebuilding costs by \$80,000-\$120,000 on average.

Table 2: Definition BAL Rating Categories.

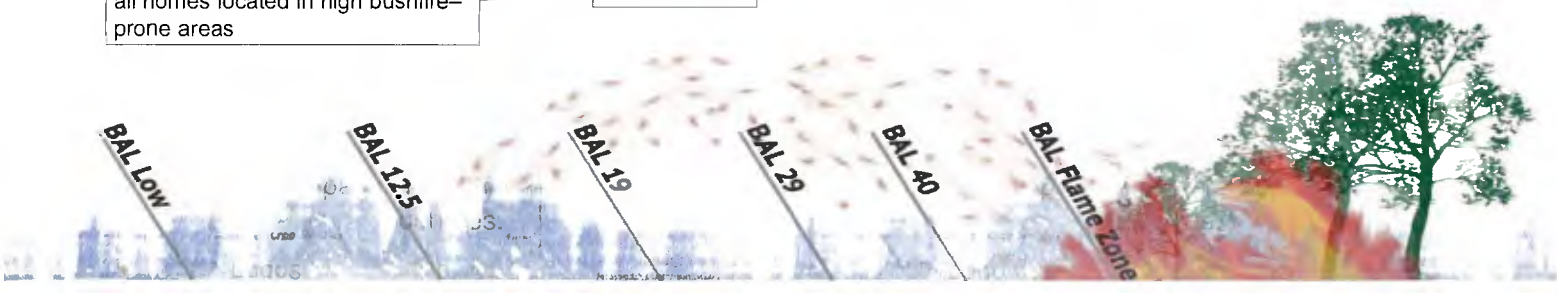
Bushfire Attack Level Ratings	
BAL-Flame Zone	Radiant levels of heat and flame attack significant enough to threaten building integrity and pose significant risk to residents. Buildings must be constructed to withstand extreme heat and flame contact.

Who is responsible for the recovery phase of a bushfire?



Conclusion & Recommendation

Compulsory insurance will increase the costs of living in the area. Thus, it may deter families/individuals from buying property in the area, thus reducing the intrinsic cultural value of the Blue Mountains. In conclusion, better information on the risks and consequences of natural disasters and ways of protecting and reducing the risk of damage to property in high risk areas would better benefit the community as a whole, eliminate the negative mentality, as well as reducing the government financial expenditure in the even of such disasters.



Introduction

Description – An insight into the effect that reducing indecision in fire ecologies will have on preventing major complex instabilities

References:

Boulat, M., Lau, X., Lee, J.-R., Lee, J., Lee, K., Lim, A., Ng, R., Ruvananthara, R., Sun, R., Tan, N., Tedasepu, A., Voon, N., Vo, S., & Wang, W. (2011). *Australian Bushfires - A Burning Issue*. University of Tasmania.
Handmer, J., O'Neil, S., & Kilalea, D. (2010). *Review of fatalities in the February 7, 2009 bushfires*.
Whittaker, J., Haynes, K., McLennan, J., Handmer, J., & Towers, B. (2010). *Victorian 2009 bushfire research response: Household mail survey*. Melbourne: Bushfire Cooperative Research Centre

A major root cause of bushfire fatalities is the indecisiveness of residents in the area (Handmer et al., 2010). This document will look at how raising the number of people that are adequately prepared to both defend (*fight*) or leave (*flight*) their homes can reduce indecisiveness and mortality. The key issue with bushfires is their unpredictability and uniqueness. Every fire is different in nature and danger and hence it is important to be prepared for all eventualities. In risk management terms this is often referred to as contingency planning.

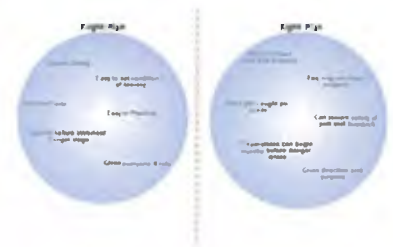


Figure 1 – Benefits of Flight or Fight Plans. © S Woods

Danger of Only Having One Form of Fire Management Plan

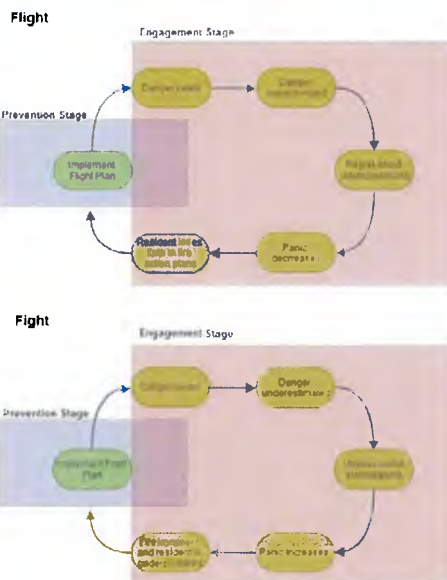
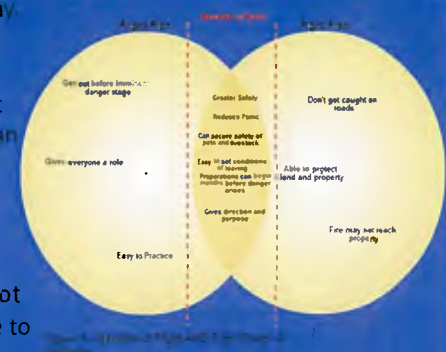


Figure 2 – Danger of relying on a single Fire Action Plan. © S Woods

Analysis

There is a serious problem with only being prepared for a bushfire in one way. Figure 2 shows how sticking to a single plan can result in severe consequences (Boulat et al., 2011). This danger might be (a) loss of faith in your fire action plan or (b) serious danger to one's safety. Obviously neither of these outcomes is advisable and Figure 3 shows how a combination of both plans leads to residents being much better off. The root of the issue is that often people choose to take a 'Wait and See' policy which endangers you more than taking decisive action (Whittaker, Haynes, McLennan, Handmer, & Towers, 2010). The intention of this document is not only to increase the need for a dual fire plan but also to

Discussion



reduce the number of people who are not effectively sticking to their original plans. This inaction can be considered one of the biggest dangers in fire-afflicted ecologies.

Conclusion

The continued running of awareness programs and the production of materials to help people develop numerous fire action plans is paramount to this programs success.

References

Rohrmann, B. *Critical Assessment of Information on Bushfire Preparedness for Residents*. Australian Journal of Emergency Management, Vol. 15 No. 1 Autumn 2000: 14-19. <<http://search.informit.com.au/ezproxy2.library.usyd.edu.au/doi/curent/Summary/doi/10.224185217714.res=IELHSS>> ISSN: 1324-1540. [cited 23 May 14].
Figure 4 – NSW RFS (2007). *Bush Fire Action Plans*. http://www.bluemountains.rfs.nsw.gov.au/dsp_content_archive.cfm?CAT_ID=708
Figure 5 – NSW RFS Community Engagement, (2012). *Building Community Resilience*. <<http://buildingcommunityresilience.blogspot.com.au/2012/12/phone-trees.html>>

Recommendations

For fire ecologies, being prepared is half the battle. By taking preventative action, fatalities should reduce and residents should feel more decisive in dealing with a complex instability such as a bushfire. To ensure residents are prepared for all eventualities it is recommended that the RFS take a two pronged approach. For starters awareness must be gathered and this would be most effectively done through the continued distribution of leaflets in fire ecology regions and running advertisements on local television and radio stations (Rohrmann, 2000). This awareness however must be backed by the availability of fire action plan templates. This refers to the production of documents that outline what actions you should take if you plan to 'Fight' or 'Flight' as well as an easy to use template with spaces so that you can 'fill in the blanks' to personal the plan for yourself.



Figures 4 & 5: Examples of existing advertising that emphasises the importance of Fire Action Plans.

Your hypothesis:

By increasing the awareness of the need for both a fight *and* flight plan in fire affected ecologies overall fatalities will drop. This increase in awareness should result in an increase in preparation by residents.

Aim – To reduce fire-related fatalities

Nikhil Nimmagadda

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Supervisors: Associate Professor Dr Simon Reay Atkinson and Ms Aminah Wehbe

Hypothesis:

Reshaping resident's interaction with bush fire during the Fuel Phase to be more emotive and omnipresent in the Blue Mountains region, with the use of art and humanities would result in a population better equipped to act and cope with fires.

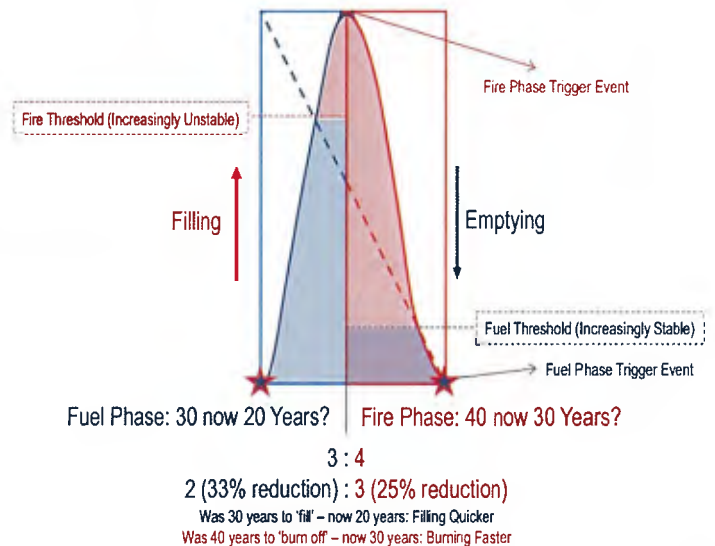
Don't Unlearn Lessons during Fuel Phase

Fire Ecology is More Unstable Now

Historical 70 years fire cycles have reduced to a shorter 50 year cycle – a 20 year Fuel Phase and 30 year Fire Phase.

With a significantly long fuel phase it is important to foster fire education and preparedness to new members of the community who might not have ever experienced a fire disaster in the Blue Mountains during their lifetime.

Veterans of fire disasters in the region need reinforcement of past lessons learnt and experiences.

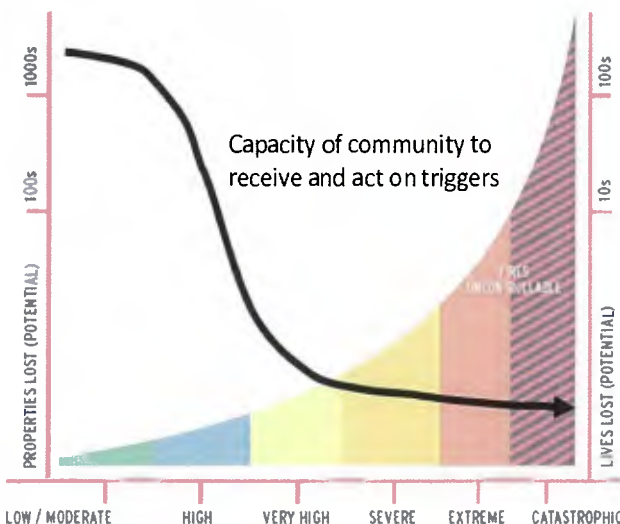


Reshaping Bush Fire Interaction

Capacity of community to receive and act on information triggers, decreases as the severity of fire increases. Early preparation and emotive conditioning of what to expect in a fire disaster is critical.

Fundamentally change how newer generations and residents understand and interact with the community's past experiences of dealing with bush fires – to identify with it at a more personal level.

Introduce local, organic, and grassroots level initiatives in addition to current state based top-down initiatives. Fire shouldn't be something that is merely confined to a 'fire awareness week' every year.



Bringing the Arts and Humanities into Fire Resilience

Transform fire preparation from passive activities to interactive actives.

Introduce permanent art installations dedicated to bush fire history in the Blue Mountains region.

Build a cultural narrative by erecting a public wall of testimonies from residents who have been through past fire disasters in the region.

Help preserve past experiences of fire disasters and connect them to newer generation of residents.





Providing information of *options prior to leaving*

Guo, ruibing

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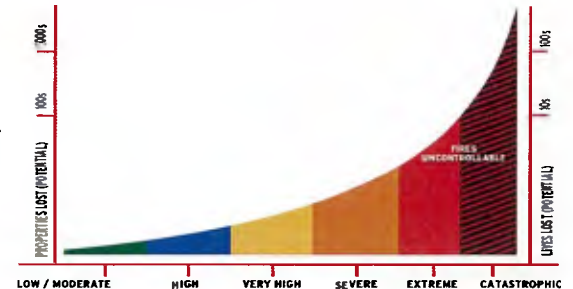
Supervisors: Associate Professor Dr Simon Reay Atkinson and Ms Aminah Wehbe

Did you know?

In the Blue Mountains area, **197** houses were destroyed.

The blue mountain region is highly prone to a bush fire, which is a major threat to tourism and the surrounding community. In the past years, there have been a notable number of victims, both tourists and people from local communities whereby the fire burns homes. Large numbers of people who remain unprepared in fire occurrence tend to make vital decisions and evacuate too late. The more severe of a fire disaster, the more casualty and property loss. A majority of casualty is due to smoke inhalation instead of burn. Prompt escapes avoid casualty.

Property loss versus Lives loss



As the fire danger rating increases, the loss of life and property increases.



The picture above is a snapshot of the impact of the bushfire on the blue mountain. In the background are buildings that could be a home, factory, or an industrial place which is just inside the charred remains of plants.

The more severe of a fire disaster, the less prompt information the victims could acquire at scene. Due to insufficient immediate at-scene information, victims normally feel hopeless and have a tendency to evacuate improperly such as appropriate timing and direction of evacuation, which results in massive casualty and property loss. Hence, this fire evacuation precaution poster could effectively educate potential victims with proper evacuation actions and concepts, leading to less casualty.

Challenge: Acquire sufficient at-scene information in time!

Insufficient information prior to leaving results in increased risks associated with death, injuries and damage costs to property.



Be Prepared
Be Aware
Be Ready

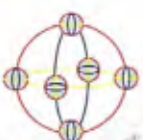
If you spot a fire, do not panic, panicking disables your ability in figuring out the direct and proper evacuation route. Try to work out the source of fire (where smoke comes out). If the fire is too close to you, make yourself a wet towel to avoid inhalation of smoke. Do not use a lift, door bells, phones, and electronics. Get into a vehicle asap and drive to the opposite direction of the fire source. Do not bring along too much belongings which might slow you down. Telecommunication advertisement such as radio broadcast, television, leaflet, poster are effective in arousing people's evacuation strategy.

KEY to staying safe: practice YOUR fire escape plan

- Try to find two ways out from your home, and remember the locations of the nearest hospitals.
- Before opening any doors in a fire, feel the door first to see if it's hot. (a hot door means there may be a fire on the other side.)
- Stay low to the floor.
- Find the nearest evacuation points after you get out.
- Don't go back for *ANYTHING*!

Evaluation tips

Don't get burnt!



Complex Creo Simplex

To consider the hypothesis:

Synthetic ecology in fire evacuation guidelines (evacuation manner, assembly points, locations of hospitals) prior to evacuation may increase the probability of survival.

Aim

Communication

Crisis communication strategies involve:

- "Before crisis – preparing for the worst;
- During crisis – minimising damage in crisis
- Recovery – restoring visitor confidence."

Crisis Communications Handbook for Regional and Local Tourism. (Tourism Victoria)

In a bushfire, communication is vital for survival.

More and more it has occurred via social media because:

- It warns individuals in danger directly on their personal devices;
- Is a quick way of communicating urgent information, etc.

Providing information about the risks involved in a fire might not be enough if the population doesn't understand the consequences of that fire's level.

Social media

RFS apps:



Fires Near Me



Fires Near Me NSW



NSW RFS Firefighters' Pocketbook

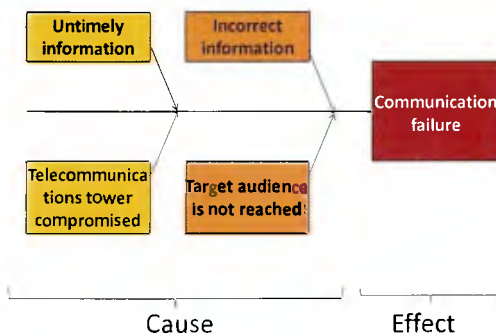


My FirePlan

Available for download at:
http://www.rfs.nsw.gov.au/dsp_content.cfm?ca_t_id=131251

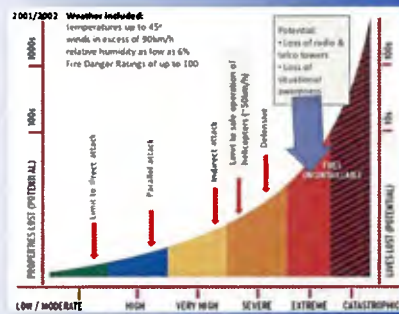
Communication might fail if some risks are triggered such as the ones represented below:

Ishikawa (Cause and Effect) Diagram:



If one of these fails to occur, it might have tragic consequences.

These risks need to be assessed and avoided as much as possible.



Different levels of fire require different responses and actions!

Communication Risks



New Ways of Communicating

One of the lessons learned after Black Saturday (2009) was that the most important communication was not only to provide enough information about the risks involved in a crisis, but rather "instructive information that tells people what to do" (Coombs, 2007).

Source: Case Studies in Crisis Communication: International Perspectives on Hits and Misses. GEORGE, A. M. and PRATT, C. B. (2012)

Crisis communication includes:

- Pre-crisis guidance;
- Crisis event guidance and
- Post-crisis guidance.

However, communication should also include guidelines of what to do for each one of those levels or risk.

Knowing exactly when evacuation is the only option left might be what separates bushfire survivors from victims.



Hypothesis:

Preparing the population for the case of a fire is not enough if they haven't been prepared on how to act in this crisis. Giving instructions to the population at risk can help prioritize actions and save lives.

Aim



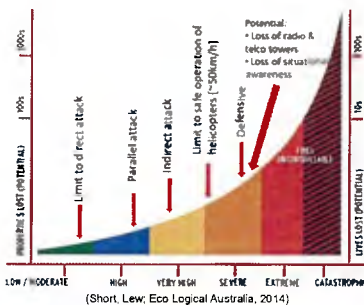
Characteristics of information provided

Need for quality and continuous information to affected communities before, during and after fires

Information is one of the most important factors in people's decision taking during an catastrophic event. This way, different channels of communication must be open to local community.

These channels must deliver information fully comprehensive before, easily accessible during, and complete after a disaster.

In order to ensure quality of such information, the information must come from a trustworthy source.



Considering a daily schedule of one average citizen, the information about a disaster has to be transmitted through different medias during the day.

During the night, a sound alarm installed at every house in the community can be effective. During the day, SMS messages informing about eventualities must be a channel.

In conjunction with SMS messages, GPS installed on residents cars can advice about potentially risky ways, saving crucial time in decision taking.

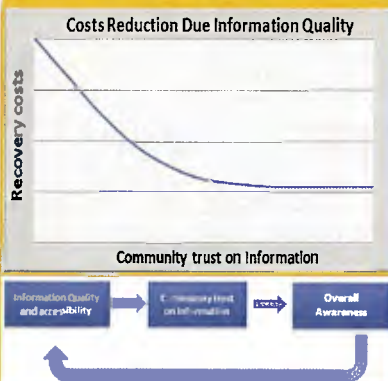
All these methods must be used in conjunction, and the responsibility for who is delivering this information must be defined upfront, in agreement with community.

All these medias work even in extreme level disasters, through underground wiring and satellite communications.

Synergy of different medias



Conclusion



Concluding Remarks / Recommendations

The ability of response of a community decreases depending on the intensity of a disaster. However, its resiliency can greatly increase if the correct information is delivered on time by a reliable source.

The creation of different channels of communication increases the flexibility with which the information is distributed, allowing a more adequate response and in consequence reducing the losses caused by a disaster.

This have positive implications on property damaged in the event of disaster, casualties and therefore on resources spent in recovery phase.

In order to gain community trust, it is necessary to keep continuously delivering qualified information. In the medium to long term, the result is an increased level of awareness by the residents, reducing decision taking time and improving response time and quality in the event of disaster.

Most important of all: the community is not only the target of the information, but an important source of it. If well managed, the community itself can greatly improve the information quality.

Your hypothesis:

Information is a valuable asset in decision taking in emergency situation;
The use of various channels to communicate to the community is a relevant strategy to increase awareness, reducing overall impacts of bushfires.

Increase awareness



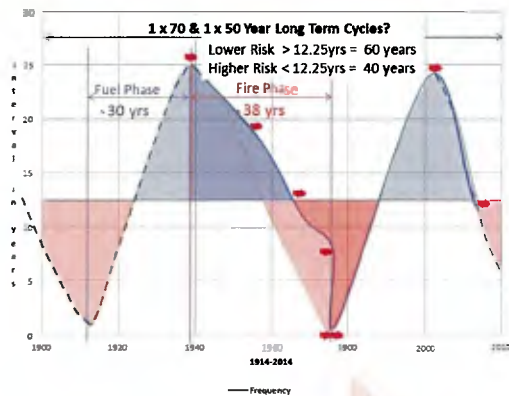
Complex Crea Simplex

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1

BACKGROUND

Historical Fire Frequency Blue Mountains



Awareness of the risk of fires fluctuates in line with the frequency of catastrophic fires. The mentality of society shifts from 'when' to 'if'.

The problem is, in Australia, we are **ONLY EVER BETWEEN FIRES**

The ideal state would be to maintain a continual awareness of the risk posed by bushfires in the Blue Mountains.

A **Synthetic Ecology** is defined as "a system that adapts...through design and by natural process, two or more dynamically interacting networks..." (SRA, 2014)

Risk is a function of both the likelihood of an adverse event occurring, and a systems ability to respond.

The **Fire Ecology** considered in this study is an emergent synthetic ecology at the interface of the human and wildfire networks.

The desired outcome is to influence that interface area in such a way that the risk, or the system's ability to adapt, is improved through both design and natural processes.

2

DOMAIN OF STUDY

The Author proposes a solution based on the interaction of a cultural narrative and the grassroots concept of '10 Minutes'.

A **Cultural Narrative** both expresses and shapes the collective experiences, customs and tangible artefacts of a society. Catastrophic natural disasters have considerable influence on the cultural narrative of a community, and in many ways provide an insight as to how a society will react to circumstantial pressure.

Influencing the cultural narrative is a powerful means by which to alter collective behavior.

Councillor Mick Fell, when asked what metric could define bushfires for the next generation said "**10 more minutes**".

Just 10 Minutes can have a tremendous impact during a natural disaster. You could use those minutes to save your life, your neighbor's life, a house or even communicate a vital piece of information. 10 minutes can make all the difference.

Whether used for yourself, or the community, 10 minutes presents a **wealth of opportunities** with which to influence the scope of a tragedy.

3

SOLUTION

The Cultural Narrative is a powerful tool to manipulate group behavior.

The notion of 10 minutes can literally shape the scale of disaster.

When considered in concert, these two concepts enable a unique way in which to conceptualise responses to a catastrophic bushfire.

Rather than express a technical or material solution, the author suggests an anthropocentric model through which to influence the cultural narrative of communities living in a Fire Ecology. By working the notion of 10 minutes into the cultural narrative, the risk posed by bushfires is reduced as the human network component of the system improves its ability to respond.

The question is **HOW?**

Imagine watching TV one night, and the screen turns black. Gradually flames flicker up and build to a crescendo. In the ashes appears the question "What Could You Do With 10 Minutes?"

The power of **EMOTIVE MEDIA** to shape a cultural narrative is well known, and should be utilised to enable the desired change in that narrative. That is to say, articulate to a community the influence that its own cultural narrative can have on the scope of tragedy resulting from a natural disaster.

One possible solution is to offer a generous award for the most effective media campaign.

A hypothetical sensitivity analysis of the EFRR developed by SRA (2014) - assuming that a successful media campaign would **reduce the impact of a major fire** by 20% - suggests that this approach could save the community **\$400,000**.

This amount, or a portion of, would be used to fund the award with the view that the same process be recycled for every catastrophic fire. The effect of this would be two-fold:

- Media would be actively engaging with the Fire Ecology to enable an improved ability to respond (thereby reducing risk), and;
- The perpetual nature of the award would work to maintain an awareness of the Fire Ecology and the importance of reducing risk through an increased ability to respond (What Impact Can You Have With 10 Minutes?).

4

END STATE

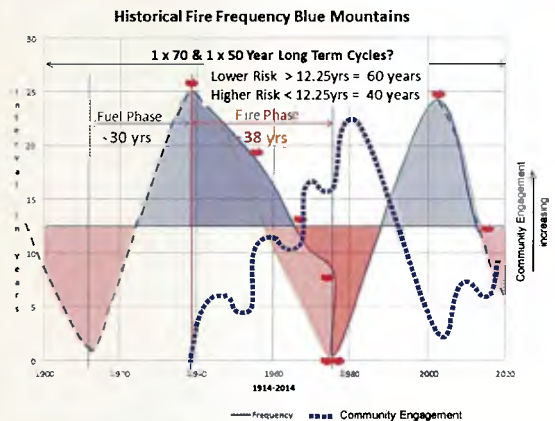
It is suggested that, by employing emotive media to weave the notion of 10 minutes into the cultural narrative, the human dimension of the Blue Mountains Fire Ecology will work to reduce the risk posed by fire by improving the system's ability to respond.



Understanding the Synthetic Ecology

The collision of the fire ecology and the community of the Blue Mountains has created a complex network of interwoven relationships. As outlined by Reay Atkinson et al. (2014) there appears to be a cyclic pattern to the bush fire events as displayed in the graph. The current phases appear to be a fuel phase of approximately 30 years and a fire phase of 38 years.

Overlaid on the graph is a community engagement factor that displays the level of engagement increasing with each new fire in the fire phase. The fuel phase then causes a serve drop in awareness and engagement due to the lack of media attention and fires. This reduction in awareness greatly affects the community's resilience and capability to handle the first fire of the next fire stage. The ideal resilient community, that is the focus of this study would be able to successfully limit the impact of the first fire disaster of the phase and all subsequent events after. Through the methods detailed below the serve drop in awareness and engagement can be reduced ensuring the Blue Mountains community survives and thrives for many more fire seasons.



Cyclic Delay in Community Engagement & Resilience
(adapted from Reay Atkinson S. 2014)

The Web of Resilience

Community resilience is defined by the Wellington Region Emergency Management Office as a community with the 'capability to anticipate risk, limit impact, and bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change.' The key aspects outlined are that you must be ready and capable at any instant.

Unfortunately there is no silver bullet that creates a resilient community, capable of preparedness across the fuel phase. It is only through a 'web of community resilience' and awareness that the interwoven relationships and capabilities required to adapt to a change in phase may be possible.

All stakeholders are key to community resilience and with proper systems in place they can effectively be leveraged to 'limit impact and bounce back rapidly.' The key areas identified are; connected communities, empowered individuals and social groups, clear and respected channels of communication, realistic expectations, quick response mechanisms, roles and responsibility defined and lastly honesty amongst the community.

Through the web and key areas mentioned above a resilient community will emerge, capable of dealing with all disaster situations that present themselves.



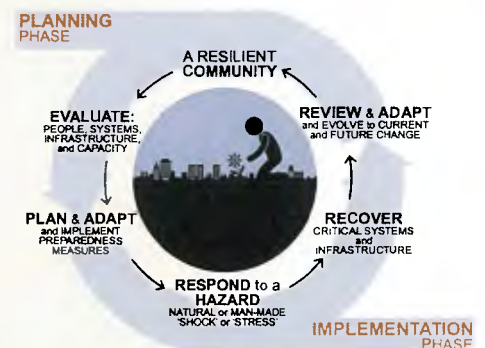
Web of Community Resilience
(Wellington Region Emergency Management Office 2012)

The Resilient Community

By leveraging the current community's social capital, the future of the Blue Mountains Region as the picturesque location will be secure. As L.J. HaniFan (1916) said when talking about school communities, 'The community as a whole will benefit by the cooperation of all its parts, while the individual will find in his associations the advantages of the help, the sympathy, and the fellowship of his neighbours.'

Selling the idea of the individual support is paramount in realising the potential of the community before the disaster strikes. Increasing awareness through art programs, informative bush trails and similar culture drives, will ensure that generations into the future learn from the past and create a continuum of lessons learnt.

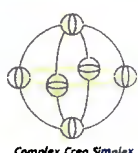
As Robert Burns famously wrote 'The best laid schemes of mice and men, often go astray.' And this begs the question, are we not better equipping ourselves by investing in the people and the community? The resultant community will require a combination of both education and planning thus enabling the Blue Mountains Region to become a resilient community, capable of 'growth in the face of turbulent change.' As further studies take place it is vital that the information be retained in the community sphere, as this is the key to resilience.



Planning Resilient Communities
(Gomez-Palacio A., (2014) 'Urban Ecology'. Presentation Notes, dated 3 April 2014)

'It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change.' Charles Darwin 1859

The community that is resilient and able to adaptable to turbulent changes survives.



References
Reay Atkinson S, M. Mitchell, H. Answorth, M. Harré, S. Sousa (2014) Classifying and Systemising Uncertainty and Instability - a Dynamic social Network approach to Risk in EAD (ed) RISK 2014 Conference
Brisbane, 28-30 May. Engineer Australia (draft submitted)
Reay Atkinson S (2014) ENG 3853 Ecological Fire Risk Register of the Blue Mountains' In: Quesio ppt. Presentation Notes arising from Fire Ecology Risk Research, dated 2 May 2014
Wellington Region Emergency Management Office © (2012) Community Resilience Strategy: <http://www.getprepared.org.nz>, accessed 27 May 2014.

TEN MINUTES MAY NOT BE A LONG TIME, BUT MAY BE ENOUGH TO SAVE YOUR LIFE

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Placement Supervisor: Associate Professor Simon Reay Atkinson

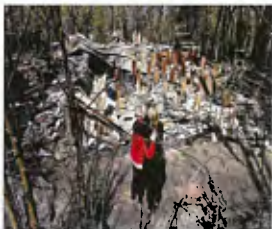
Blue Mountains Ecology

The Blue Mountains region is a fire prone environment.

PREPARE. ACT. SURVIVE.

Fire, fundamentally is a vital ecosystem process, in which native plants and animals of the Blue Mountains have adapted to. In fact many native plants and animals strive and survive on the regular occurrence of fires. Although fires are detrimental for the local ecosystem, more often than not they cause dismay and panic for the individuals living within this ecology.

The residence of the Blue Mountains must understand, that attempting to prevent naturally occurring fires is not reasonable as that would result in attempting to manage the local environment. Rather residence must continue to integrate a culture of resilience and adaptability within the community, as this will aid in the immediate response to as well as during the recovery phase once a fire has occurred.



VS



The ability to buy yourself an extra 10 minutes when faced with a catastrophic fire can possibly result in the difference between life or death. The resilience comes from the vital idea that individuals are capable of ensuring they have enough time to gather any important belongings before fleeing.

By constantly maintaining your home, you are significantly increasing the chances of your home surviving as well as decreasing the threat to neighbouring properties. Simple things such as

- Keeping gutters and roofs clean,
- Regular landscaping of property,
- Planting non ignitable vegetation and
- Keeping grass under 10 cm long.

Regardless of whether or not residents choose to escape or defend, these four strategies can ensure that residents are able to save themselves enough time to put their plan/response into motion.

Preparing Your Home

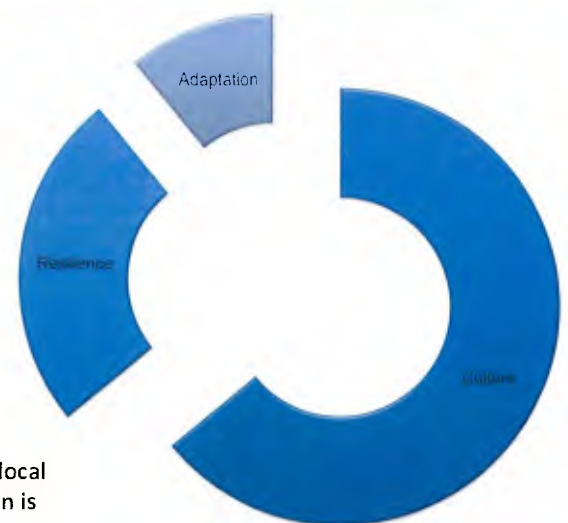


Culture, Resilience & Adaptation

The hypothesis suggests that developing a culture of resilience can aid in the adaptability and recovery of the community of the Blue Mountains after an occurrence of a natural fire.

This poster mainly focuses on how to ensure you have an extra ten minutes once such occurrences transpire through the maintenance of your home. This in itself can dramatically aid in the immediate response strategies adopted by the locals, therefore not only developing but cultivating resilience within the community.

The hypothesis puts forward a strong argument, however for this to occur, the local community must embrace the vital idea that adaptability rather than prevention is much more sufficient and valuable in such ecologies.



Preparation and effective recovery measures from major fires creates a culture of resilience.

Hypothesis

Ecological Fire Risk Register to improve community resilience and social recovery

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Sub-Ordinate Research Question 3:

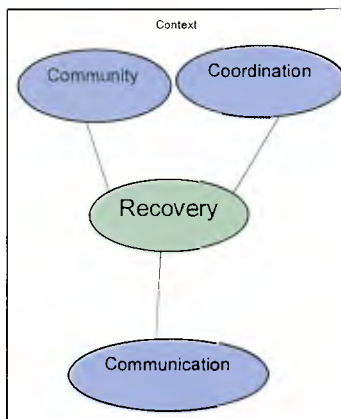
Can an Ecological Fire Risk Register be used to improve Resilience in the Blue Mountains, 'in time' (engaging with Major Fires) and also 'over time' (Recovering from and Preventing Major Fires).

A *systematic ecological* fire risk register developed to improve the community resilience in the Blue Mountains during the Fire and Recovery Phase to reduce and improve the ability to recover from future bushfires.

The development of an ongoing lifecycle model within the health sector is needed to address the current risk of concentrating on emergency responses as apposed to community recovery and future preventions. This will further allow the recovery of post-bushfire incidents to support the wellbeing of people and communities.



Community resilience approach



Contextual Communication Recovery Model

Though a systems thinking approach, creating an ongoing lifecycle model will strengthen the relationships across sectors and groups within the community to focus on the psychosocial recovery of the bush fires. The interconnected experiences and networks composed of multiple communities, service providers, organisations and government need to be established to create community resilience and social connectedness. This will build resilience in overcoming trauma, past adversities to avert mental health problems.

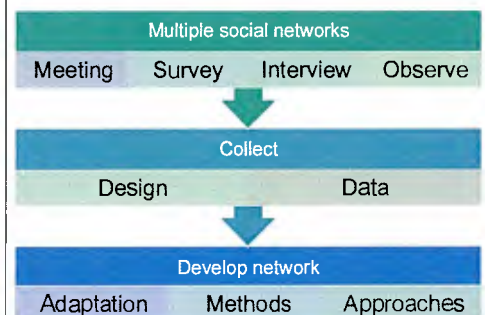
The *Contextual Community Recovery* model visually represents the four major aspects needed to foster community resilience, where context is a major element towards understanding and applying the community engagement, communication and the coordination within the re-construction and recovery of Major Fires.

To understand and identify the context, administration of focus group discussions, social network surveys, community and government meetings, and qualitative interviews should be administered to provide a basic measurement of community resilience and further establish a connection between multiple social networks. The *Data and Network Analysis* model provides a framework to create existential linkages between data collection and future approaches and methods.

Conclusion

In developing a dynamic ecological Fire Risk Register for the Blue Mountains to improve community resilience, an emphasis towards psychosocial recovery is needed to improve social connectedness and community awareness.

Though multiple methodologies and multisectoral teams, communities and organisations must interstitially interact with one another to form an effective recovery and preventative measures. The conduct of community studies, interviews and measures will allow the understanding and identification of current and future risks to improve community resilience. Therefore, adapting the 'organisational health' concept towards community networks will provide long term Major Fire recovery and future preventions.



Data and Network Analysis model



To consider the hypothesis:

An adaptation of the 'organisational health' concept (Warren and Warren 1977) may enable identification, interstitial interaction and existential linkages within a community, so as to improve the capacity of community resilience, social connectedness and well-being.

Hypothesis

YOU MAY NOT BE ABLE TO CHANGE YOUR LIFE IN TEN MINUTES, HOWEVER YOU CAN SAVE IT

School of Civil Engineering, Complex Civil Systems Group & Project Management
FACULTY OF ENGINEERING & INFORMATION TECHNOLOGIES
Supervisors: Associate Professor Dr Simon Reay Atkinson and Ms Aminah Wehbe

The Blue Mountains region is a fire ecology in which the ecosystem relies on the effects of the seasonal fires. The prevention of fires is not beneficial nor plausible however resilience can be improved.

The region known as the Blue Mountains is part of a fire ecology in which many native plants and animals depend on the effects and outcomes of such fires. As this region is inhabited by humans the impacts of such fires on these inhabitants can be detrimental with the loss of assets as well as in extreme cases the loss of life. The prevention of fires within this fire ecology is not possible nor of benefit to the ecosystem. However, the resilience and recovery of such inhabitants can be improved through the development of risk registers in which mitigation techniques can provide inhabitants with an extra ten minutes.



Through the development of a dynamic fire risk register the resilience of the inhabitants who live within this fire ecology can be improved. It is not plausible to prevent fires however an extra ten minutes can be provided.

EXAMPLE SOLUTION

- Implementation of fire trails, (such as seen in the image on the right), of which inhabitants can use during a fire. This implementation of a clear, safe passage can provide direction and safety to those affected by this unpreventable occurrence, as well as direct access for emergency vehicles such as fire-fighters and SES. regularly maintained to ensure there is no overhanging vegetation that will aid in the spread of fire to these trails.

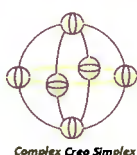
An Extra Ten Minutes



Conclusion

The given hypothesis is a valid hypothesis. Risk registers do provide excellent resilience and recovery measures, however the prevention of fires is not plausible. This concept and understanding that fires cannot be prevented, will provide a strong platform for the development of mitigation, resilience and recovery techniques.

The Blue Mountains region is a fire ecology and the development of a fire risk register will improve resilience and ability to recover. The hypothesis stating that major fires within the area is unpreventable is a valid argument as the prevention of such a variable occurrence is impossible. The prevention of the outbreak of fires within this fire ecology is not plausible nor beneficial to the ecosystem. Instead of wasting valuable time attempting to prevent the unpreventable, resilience measures such as the fire trails (mentioned above) should be developed as these will provide inhabitants with irreplaceable and invaluable time. **You may not be able to change your life in ten minutes, but it is possible to save it.**



Complex Cre Simple

Logos

Your hypothesis:

Considering the Blue Mountains Region as a fire ecology in which the ecosystem relies on the seasonal occurrence, it is possible to develop a dynamic fire risk register to improve resilience in terms of the ability to adapt and recover from unpreventable occurrences such as major fires.

Aim

Information and Knowledge

Aim to provide free information and knowledge to the residents of the Blue Mountains through the use of periodic seminars and training facilities.



Information transfer is vital in many projects, and the communication of ideas and thoughts may very well be an approach worth studying in regard to the mitigation of bushfires.

What we are experiencing to a degree is Black-Box syndrome, where vital information can be held up involuntarily by higher departments or personnel.

We aim to blend information into a mixture, and allow the residents to easily digest, learn and organise this knowledge. Seminars and meetings are the efficient way of passing on relative information to the residents of the Blue Mountains in the hope that the residents themselves can practice in the event of disaster.

A lack of knowledge can turn a bushfires into a disaster. Information should be at the forefront of bushfire defence.



Flame Movement Diagram

First and foremost we aim to convey what can be done to prevent fires. A general understanding of natural disasters has shown that for a single dollar spent in mitigation echoes to a ten dollar recovery action.

New strategies to approach fires that have emerged, including smoke alarms, fire tracking and back burning.

Residence would also be given advice regarding the defense of their property, in regard to the factors to take on board in their judgment of staying in their homes. They will be given information on different evacuation plans and routes, and how to react to the alarm sirens

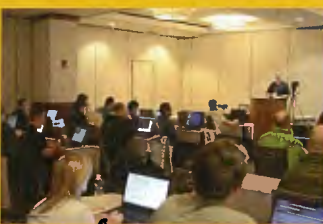
In the months of Spring and Summer the seminars will also cover danger ratings in coming weeks, and any other conditions or events that residents would need to be aware of.

Sharing The Necessities



Fire Extinguisher Information

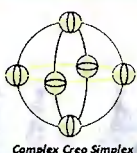
Conclusion



The seminars should be mandatory for the residents. As an incentive to be present, the council will cater dinner and tea.

Those who are not present will be sent extra pamphlets, and phone calls and newsletters both to remind the resident that the seminars are gravely important, and also as a information medium.

Our seminars and training centres support an information hot-spot, and a social centre for optimum knowledge transfer.



To consider the hypothesis:

Awareness and information is highly efficient and effective in the fight against Bushfires. Knowledge should be the first line of defence, and the difference between a Bushfire and a Disaster.

Aim

Fatigue

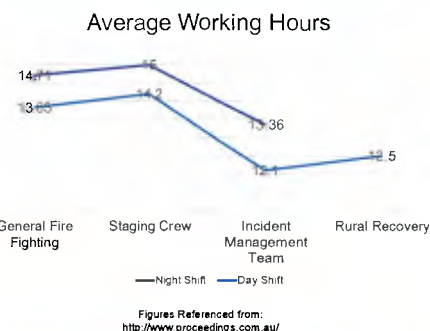
Fatigue impacts heavily upon Rural Fire Service Workers. In an event of a disaster, shifts may end up becoming 16-18 hours, with over 24 hours of no sleep.



The common effects of fatigue include; **lack of concentration, poor judgement, irritability, reduced hand-eye coordination, reduced vigilance, slower reaction times and reduced capacity to assess risks.**

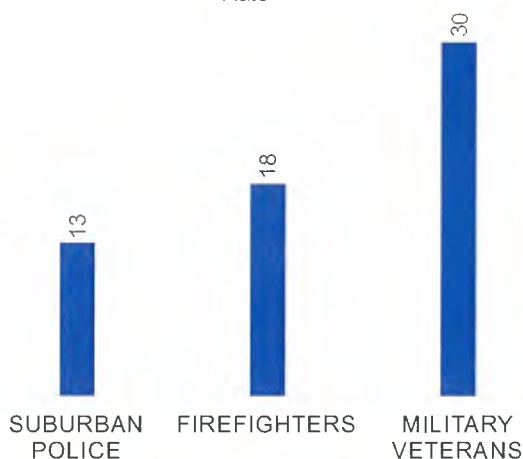
During a disaster, Fire crews are required to make efficient decisions as well as work effectively with others to minimise the impacts associated with bush fires.

Fatigue management is vital to the success of Fire Fighting Efforts.



RATE OF PTSD

■ Percentage Rate



Figures Referenced from:
<http://www.traumeline1.com>

Post-traumatic stress disorder is a psychiatric disorder that may occur after an individual experiences a **traumatic experience.**

Some symptoms include; re-experiencing the traumatic event, numbing and avoidance and **increased anxiety and emotional arousal.**

If not addressed appropriately, PTSD will affect team work and work efficiency, leading to increased risks of safety for the individual as well as the crew.

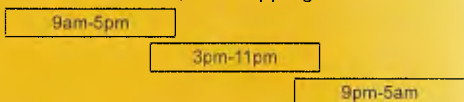
PTSD

Due to the chaotic nature of disasters, Rural Fire Fighters may experience PTSD, which will affect all other aspects of their lives.

It is imperative to monitor and support the mental health of Emergency crews, to ensure constant and reliable performance, as well as securing the wellbeing of crews.



Shorter, Overlapping Shifts



Reduce Fatigue Through

Ensure Fire Fighters are not in direct contact with High Risk Environments



Higher Quality Accommodation for Better Quality Sleep

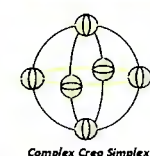


Reduce PTSD Through

Regular Group meetings and Mental health checks



Create a working environment that is supportive of mental health



To consider the hypothesis:

By reducing and monitoring the fatigue and mental wellbeing of Emergency Fire Fighters, we will be able to reduce operational risks such as Financial and Safety Risks, as well as increase the efficiency and reliability of efforts.

Aim



THE UNIVERSITY OF
SYDNEY

Indecisive? Stay and defend or Leave early!

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Wait and See plan

Aim to reduce the indecisiveness by steering the general community away from the "wait and see plan"

"Indecisiveness breeds confusion"

The Wait and see plan is a course of action by residents that are in bushfire where they remain observant of the situation, acting only when necessary or seeing an opportunity. However bushfires could be unpredictable and also dangerous, many citizens that experience a major bushfire may be affected by the lost of communication, hindering their ability to receive crucial information on the level of fire. It is statistically addressed through the Rural fire service that many deaths are correlation with residents 'waiting and seeing' rather than taking a specific course of action. It is imperative that you should watch for signs of bushfire, and act immediately. "Last minute evacuations are often fatal and not supported in law"(bushfirecr,2007)



Where's my cat? Many people during bushfire are without plans, this means that they would often hesitate and act significantly slower, leaving themselves and their house vulnerable.

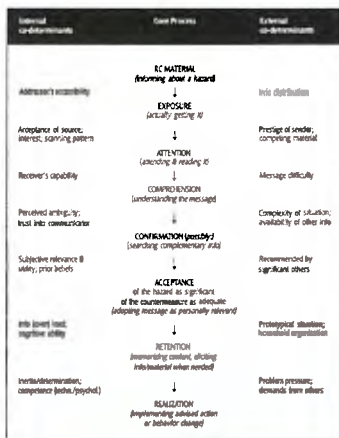
Stay and defend or Leave Early Plan

The Stay and defend or Leave early plan is the approach to eliminating indecisiveness. It includes two components:

- You stay and defend your housing if you understand the bushfire severity ("putting out embers that may be invading to their home")
- Or you leave early because the home owner is unable to defend the fire either from their own impairments, or receiving information that the fire would be uncontrollable.

Core purpose of the ads that educate the community includes information such as:

- Buildings are more likely to survive if someone extinguishes the ignition from small bush sparks
- People are to create defendable spaces for themselves to protect against ember and radiant heat
- Understand that some building due to their "construction methods, located on high unmanageable fuel loads may not be able to defend high intensity bushfires"(royalcomission,2005) Therefore deploy the Leave Early plan
- Make sure that the occupants research and understand their house(plan before hand) and determine whether its defendable to take the 'leave early option'.
- "Last minute evacuation is the most dangerous option of all"(Brown.M, royalcommission,2009)

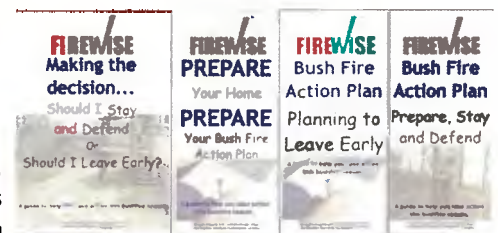


Rohrman, Bernd's model

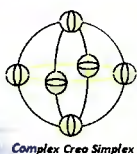
Conclusion



It is important to understand that during bushfire, indecisiveness could lead to dangerous incidents as the community would have less time to react to unpredictable events. In order to sustain the best outcome of a bushfire, increasing decisiveness through educated planning and procedures could potentially allow you to protect many residential homes while reducing fatality.



BluemountainsRFS



Logos

Your hypothesis:

The education of "Stay and defend or Leave early" plan through the use of educational ads on TV and social networking can reduce the indecisiveness(the wait and see plan) of local community in bushfire.

Aim