The Australian Journal of
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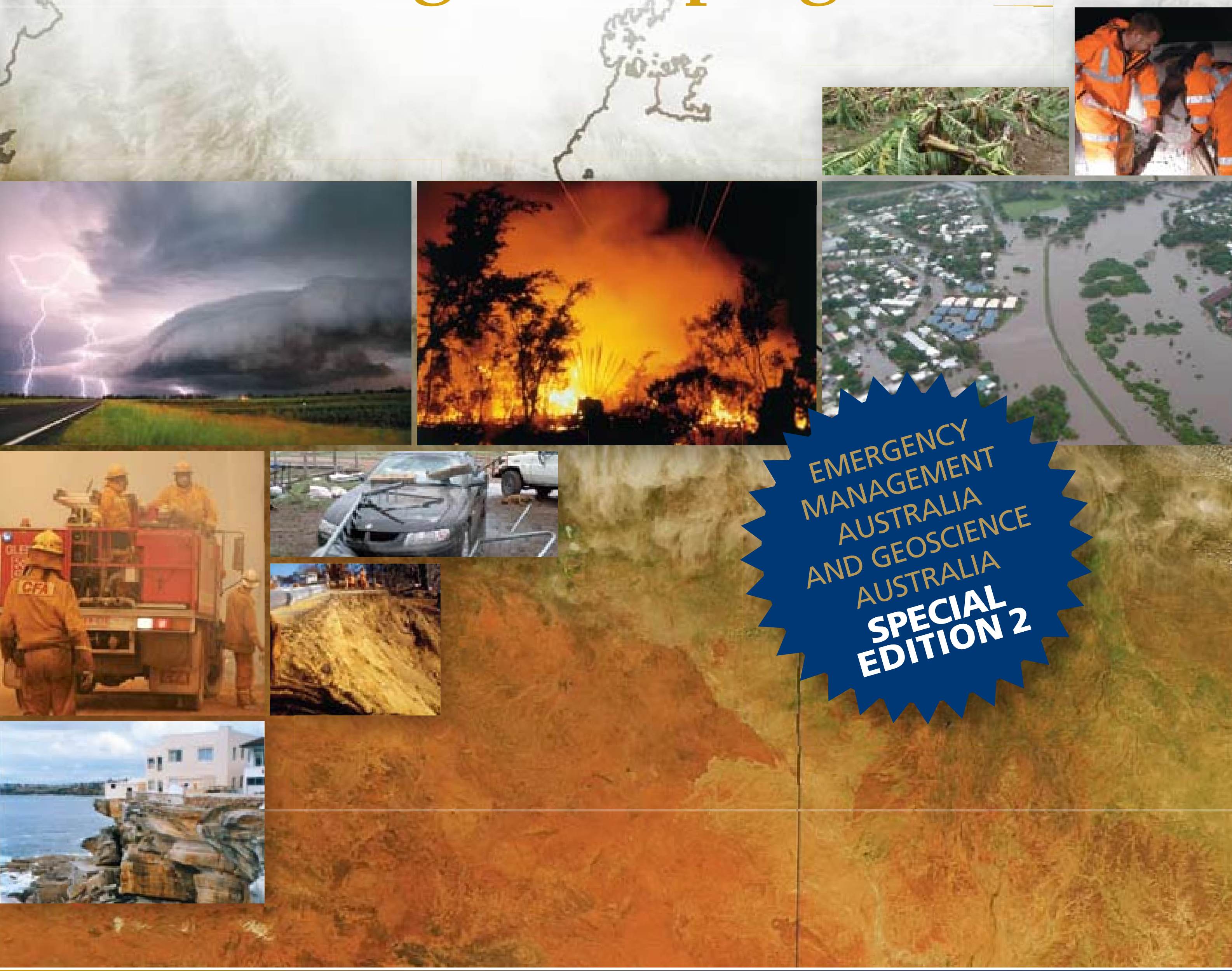
Risk assessment in risk management programs

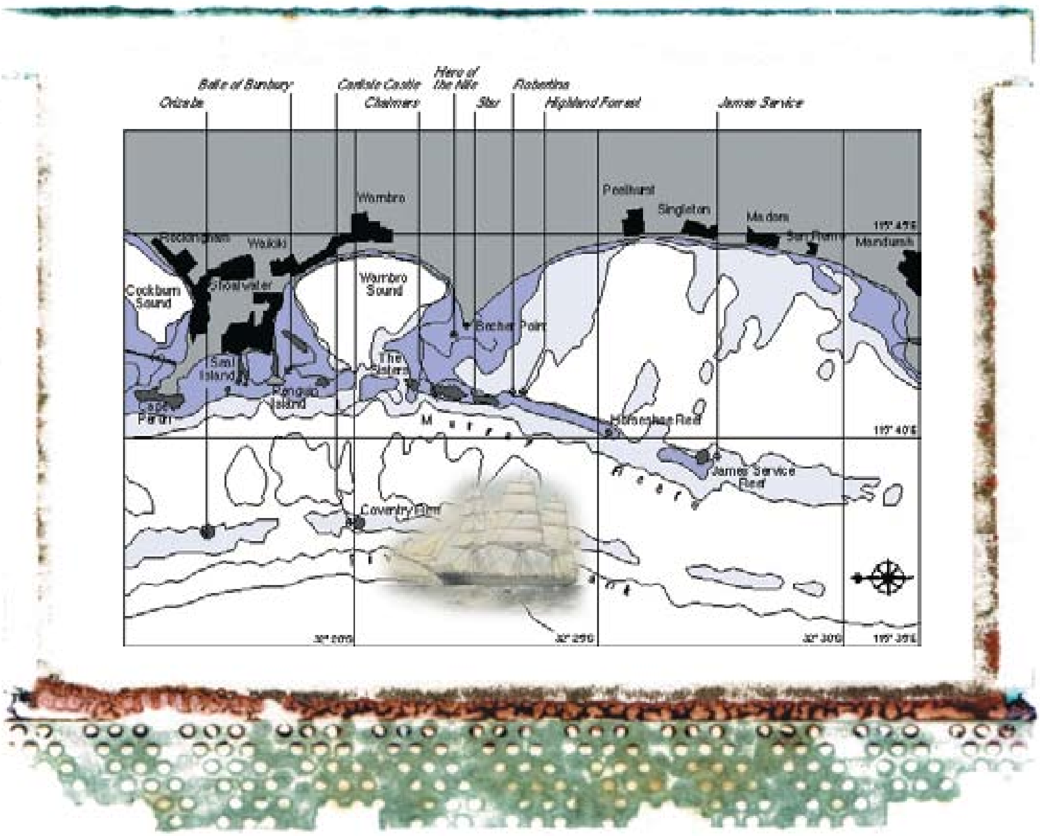


World's top landslide risk management guidelines

New risk assessment method for Victoria

Are our households prepared for disasters? Survey Results

historical snapshot



19th Century shipwrecks in southwest Western Australia

In the 19th Century, scores of shipwrecks occurred in the shallow waters off the southwest Western Australia coastline. Some of the most disastrous shipwrecks in the area were caused by winter storms accompanied by strong westerly winds and driving rain. These included the renowned wrecking of the James Service in 1878 off Rockingham-Mandurah with loss of all 20 crew and passengers, and two ships that were wrecked in the same force ten winter storm in July 1899. These were the Carlisle Castle, shipwrecked off Rockingham with loss of all hands (est. 24-26 persons) and cargo (est. £40,000 – £50,000), and the City of York, wrecked off Rottnest Island with loss of 11 hands.

The impacts on local communities from these events near Perth reflect the changing nature of community vulnerability to severe storms over time. In these 19th Century events, loss of life was significant.

The Rottnest Island tragedy led to a major upgrading of communications following a Parliamentary review of the harbour and pilot services of the colony. Since then, vast improvements in meteorological forecasting and communications, as well as many other advances, have dramatically reduced the likelihood of storm-related major shipping accidents in these waters. The winter storms continue to cause significant environmental damage, widespread community disruption and insurance costs but loss of life from these events in the past 50 years has been low.

Cover: (L-R, top to bottom)
Crop damage from Cyclone Larry, QLD, 2006. Bureau of Meteorology. SES volunteers filling sandbags, QLD State Emergency Service. Lightning near Ruthven, NSW, 2008. NSW Storms (Dave Ellem, www.nswstorms.com/). Bushfires in the Blue Mountains, NSW, 1994. Bureau of Meteorology. Flooding in North Mackay, QLD, 2008. RACQ - CQ RESCUE, Mackay. CFA fire fighters, VIC. Country Fire Authority. Debris damage from a Queensland storm. QLD State Emergency Service. Landslide at Thredbo, NSW, 1997. Geoscience Australia (Trevor Jones). Residential development in 2005 along a coastal cliff subject to ongoing erosion, North Bondi, NSW. (Greg Kotze).

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Please note that contributions to the *Australian Journal of Emergency Management* are reviewed. Academic papers (denoted by Ⓡ) are peer reviewed to appropriate academic standards by independent, qualified experts.

Foreword

By Dr Neil Williams PSM; CEO, Geoscience Australia

Dr Neil Williams, Chief Executive Officer, Geoscience Australia.

Australia has suffered overwhelming loss and heartbreak through the impact of the recent Victorian bushfire tragedy. This event, the worst natural disaster ever experienced in Australia, again challenges all involved in emergency management to redouble efforts to improve the future safety of Australian communities by reducing disaster risk and increasing disaster resilience.

To be successful, we will need to do work on all aspects of natural disasters to better understand how they develop and how best to lessen their impact. To help achieve this, we need reliable and valid information on hazards, society, infrastructure and the environment. Using this information we can develop an evidence-base of the risks that we face and therefore target our management of risk.

Most hazard events cannot be averted, but their consequences can be minimised by implementing mitigation strategies and reducing the potential impacts to those communities that are most at risk.

As part of its extensive work on all-hazard risk research, Geoscience Australia monitors and assesses earth-surface processes which pose a risk to Australia. We gather data and develop tools for use by governments and other authorities to help them make Australia as safe as possible from natural and human-caused hazards.

Proactive risk assessment steps against hazards include:

- Recognising areas with the greatest hazard potential;
- Measuring the likelihood of various hazard events that could occur in these priority areas;
- Modelling the impact of these events and estimating potential losses to communities; and
- Making consistent information on risk, and risk assessment tools, easily available to risk managers in government and industry.

Geoscience Australia develops models and innovative approaches with the help of our expert partner organisations EMA, the Bureau of Meteorology, CSIRO and State and Territory governments to assess potential losses to Australian communities from a range of sudden impact natural hazards including earthquakes; landslides; floods; tsunami; severe winds; tropical cyclones; severe storms and bushfires.

This innovative approach to natural hazard management will soon be implemented internationally following the announcement from Prime Minister Kevin Rudd of a joint Australian/Indonesian Facility for Disaster Reduction to be established in Jakarta. This AusAID project will see Geoscience Australia working closely with the Indonesian Government to share our knowledge of risk and impact analysis to create a sustained, self-reliant approach to community safety from natural hazards.

The November 2008 special edition of AJEM gave many examples of methods that are used to produce risk assessment tools and information. This second special edition presents state of the art applications of these approaches by emergency managers, planners and technical specialists in risk management projects to achieve long-term risk reduction.

Dr Neil Williams PSM
CEO, Geoscience Australia

First National Security Statement to the Australian Parliament

The Prime Minister of Australia
The Hon. Kevin Rudd MP, 4 December 2008

Prime Minister Kevin Rudd presented Australia's inaugural National Security Statement (NSS) to Federal Parliament on 4 December, 2008, outlining initiatives to improve national security policy advice, coordination and governance.

The NSS is a key part of the Government's reform agenda to build a more secure Australia, and addresses some of the emerging challenges Australia may face in the 21st Century.

The NSS will become a regular statement to the parliament on the state of Australia's national security and the new and emerging challenges we face. It announces that the Government will appoint a National Security Adviser, Mr Duncan Lewis AO*, to provide a new level of leadership, direction and coordination to our national security agencies.

The Government believes it is essential to engage with the Australian people on the threats we face and the role the wider community can play in responding to those threats.

Australia's national security community is highly effective and has proven highly adaptable. But in an increasingly complex and interconnected security environment, we need a more integrated national security structure that enhances national security policy coordination.

The NSS sets out the Australian Government's strategic direction on national security. It articulates Australia's national security interests and organising principles and describes the Government's comprehensive view of security challenges facing Australia.

The government's comprehensive concept of national security recognises that Australia has particular circumstances and interests that differ from other nations.

The strategic environment is increasingly complex and inter-connected, and the boundaries between international and domestic security issues are increasingly blurred.

The NSS also addresses the recommendations of Mr Ric Smith, AO, PSM, in his Homeland and Border Security Review.

Mr Rudd commissioned Mr Smith, the former Secretary of the Department of Defence, to report on the best and most efficient way to coordinate overall national security arrangements.

Mr Smith has now finished his work. The Government has considered his report and strongly agrees with its recommendations. Mr Smith's advice is that big departments risk becoming less accountable, less agile, less adaptable and more inward-looking.

The Government has therefore decided that the best solution for Australia is not another agency, but a new level of leadership, direction and coordination among the agencies we already have.

The Government has also decided that an enhanced Customs and Border Protection Command is the preferable structure for Australia to meet the complex border security challenges of the future.

In addition to the appointment of a National Security Adviser, our national security structure will be improved by the creation of a strategic policy framework, a National Intelligence and Coordination Committee and enhancing our national crisis management arrangements.

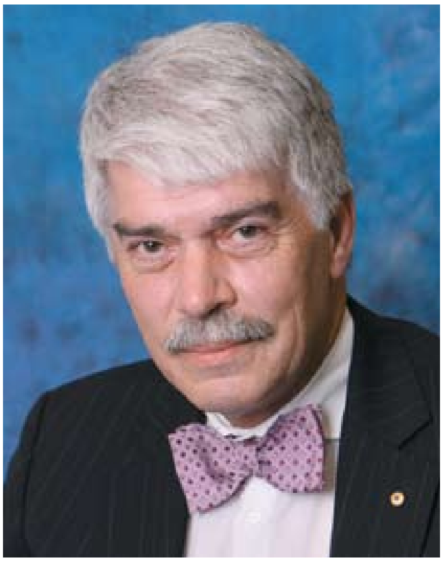
The National Intelligence Coordination Committee will have responsibility for foreign, defence, security and law enforcement intelligence.

Our national crisis management arrangements will be improved through the establishment of a Crisis Coordination Centre, following consideration in the Budget context.

To access the full National Security Statement visit http://www.pm.gov.au/docs/20081204_national_security_statement.rtf

* A profile of Mr Duncan Lewis AO is scheduled for the May 2009 edition of this journal.

New Secretary for Attorney-General's Department



Mr Roger Wilkins AO is Secretary of the Attorney-General's Department, a position he has held since September 2008.

Prior to his appointment as Secretary of the Department, he was Head of the Government and Public Sector Group Australia and New Zealand with Citi and was Citi's global public sector leader on climate change from 2006-2008.

From 1992-2006, Mr Wilkins was the Director-General of The Cabinet Office in New South Wales where he played a leading role in areas of reform in administration and law, corporatisation and micro-economic reform. Other areas included Commonwealth-State relations, negotiation of agreements on competition policy, international treaties, mutual recognition, electricity, the environment, and health reform.

Mr Wilkins has chaired a number of national taskforces and committees dealing with public sector reform, including the Council of Australian Government Committee on Regulatory Reform, the National Health Taskforce on Mental Health and the National Emissions Trading Taskforce. He was New South Wales' representative on the Senior Officials Committee for the Council of Australian Governments.

Mr Wilkins was responsible for the Greenhouse Office, the introduction of an emissions trading scheme in New South Wales and design of a national emissions trading scheme for Australia as chair of a national taskforce. He has recently led the strategic review of climate change programs for the Commonwealth Government.

He is a member of the Board of the International Forum of Federations and advises different federal systems especially on fiscal issues.

Mr Wilkins was the Director-General of the Ministry of Arts from 2001-2006. He was appointed an Officer of the Order of Australia in 2007 for service to public administration in New South Wales, particularly as a contributor to a range of policy initiatives, and to arts administration.

Letter to the Editor

Dear Editor,
Australian Journal of Emergency Management, Vol. 19, No. 1, March, 2004.
Journal Entry: 'Integration of emergency risk management into West Australian indigenous communities' by Moya Newman and Scott Andrew Smith.

I have been reading the above journal entry and have noticed an item which may need looking at. It states "Between April and November, the coastline is subjected to tropical weather conditions".

Should this be November to April?

Regards,
Nicholas Preston
Hodge+Collard Architects, Perth, WA

We have checked with the Authors and the Bureau of Meteorology and indeed both confirm the coastline of Western Australia is subjected to tropical weather conditions from November to April. We have made a note of this on our website for future reference.

Victoria's state-level emergency risk assessment method

Gabriel examines a new logarithmic method for initial comparative assessment of emergency-related risks at state level.

Abstract

Victoria's State Emergency Mitigation Committee has developed a method for initial comparative assessment of emergency-related risks at state level. Adapting existing municipal-level models, a method has been developed and successfully implemented. The main adaptations have been the use of a curve to represent the risk rating, the placement of coloured risk zones on the graph, the recalibration of consequence descriptors to the state-level context, and the use of logarithmic scales.

Introduction

The application of risk management to the emergency management sector commenced about a decade ago and has been implemented in a variety of contexts, most notably at local/municipal level or in relation to specific risks and/or localities. More recently, consideration has been given to application of the same approach at a state or even national level.

The importance of emergency risk assessment at state level arises from the fact that most expenditure on emergency risk reduction is either made by state governments, or is mandated by them through regulatory instruments often enforced by local government, and is made by the private sector. Communities expect governments to be active in monitoring risks and in implementing strategies to reduce the likelihood and/or consequences of emergencies. Emergency-related expenditure can have a number of drivers, the most obvious one being actual experience of major emergencies. It is a common phenomenon that increased investment in response resources follows major emergencies or disasters. This may be accompanied, later, when the reviews, inquests, reports and the like are issued, by an increased emphasis on mitigation (i.e. risk reduction) often expressed in the form of new or enhanced regulations or other control mechanisms.

As an expression of contemporary management practice, the application of risk management to emergency-related risks is a natural fit. However, the High Level Group that reported to COAG on natural disaster management in Australia several years ago identified the 'lack of independent and comprehensive systematic natural disaster risk assessments' as one of the main weaknesses in Australia's current emergency management arrangements. It also perceived 'a focus on response and reaction at the expense of prevention, mitigation and recovery of affected communities'. It then proposed that disaster management activities should be driven by better knowledge, including systematic risk assessments, in order to shift 'management arrangements further towards proactivity, from the more reactive approach of the past'. It went on to propose 'a stronger focus on anticipation, mitigation, and recovery and resilience in order to achieve safer, more sustainable communities, and a better balance compared with the effort and resources traditionally applied to disaster relief' (DOTARS, 2004).

It recommended 'that all Australian levels of Government commit to, and announce, 'a … programme of systematic and rigorous disaster risk assessments' and a 'system of data collection, research and analysis to ensure a sound knowledge base on natural disasters and disaster mitigation' (DOTARS, 2004).

In Victoria, the State Emergency Mitigation Committee (SEMC) was established in 2004, partly as a state response to the COAG report and its recommendations. The Committee's charter includes conducting a state-level risk assessment for Victoria, although not limited to the natural disaster risks that the High Level Group emphasised. When the committee looked for tools with which to undertake this task, it found no extant methodology, as the published guides in Australia were mainly geared to either community risks at municipal level or corporate risk perspective and process – strongly biased to risks in the engineering, manufacturing or insurance industry contexts.

Consequently, SEMC's first project was the adaptation of existing risk assessment models to the task of performing a state-level emergency risk assessment.

Existing models

The primary documents referenced for the development of the state level model were those of Victoria State Emergency Service (VICSES, 1999), Emergency Management Australia (EMA, 2004), and the Tasmania State Emergency Service's Tasmanian Emergency Risk Management project (Gilmour, 2003).

The report of the Tasmanian project contained maps of the locations of highest risk of flood, wildfire, storm and others. It was essentially an amalgamation of many local/regional level risk assessments. The SEMC considered that the output of each assessment was too complex and detailed to be practical as a state-level approach. The emergency risks to the State of Tasmania as a single geopolitical entity were not identified.
In summary, while it was a statewide risk assessment, it was not state-level.

Both the VICSES and EMA models are focused at municipal-level risk assessments. In each case there is a focus on local level consequences, expressed in fairly detailed and very local terms, for example 'There is a risk that a bushfire within the municipal reserve will cause significant damage to the College of Advanced Education timber buildings' (EMA, 2004).

However, their overall process and methodology were a useful starting point to adapt to a state-level model, and were sufficiently aligned to AS/NZS 4360:2004 to fulfil that particular criterion.

Needs specified for the state-level methodology

The state level risk assessment methodology was required to:

- enable an assessment of different risk types on a common basis;
- be able to incorporate qualitative as well as quantitative information;
- be able to incorporate as much verified data as is available;
- be relatively simple to enable understanding and use by a wide range of people;
- be consistent with accepted risk assessment methodologies; and
- cater for a range of event sizes/impacts and likelihood.

As a developmental project, it was considered important to be able to derive some useful results from an early stage, and to improve and refine the model progressively through later iterations.

In terms of a risk assessment process, the normal sequence as published in the Australian Standard is applied, using the stages of Identify Risks, Analyse Risks and Evaluate Risks, preceded by the stage of Establish the Context (AS/NZS 4360:2004).

It was clear that the consequence descriptors, as well as the risk evaluation criteria and the presentation of the results of the risk assessments all needed to be adapted to meet the needs of the state-level context.

Context

The first step in the process was the development of the context statement. The key elements are that the assessment covers the whole state – treating it as a homogeneous entity. In other words, the fact that risks vary by location is not considered. It also means that only major risk events will be visible. This serves the purpose of the state-level risk assessment in providing a big-picture result.

While stakeholders include the community, the private sector and non-government organisations, the primary audience for the risk assessment is the state government. This emphasises one of the primary purposes of the exercise – to make a systematic high level contribution to the government's decisions about investment in mitigation. Those decisions can be driven by a range of factors; one of them should be the outputs of a reliable and systematic assessment of a range of emergency risks. Risk assessments offer us an improved basis for understanding risks, as distinct from events, and evaluating whether the high priority risks are receiving a proportionate commitment to mitigation, to guide expenditure priorities.

Risk has been defined as 'the chance of something happening that will have an impact on objectives'. (AS/NZS 4360:2004) In this context, the objective is the continued, safe functioning of the state, its communities and people. As is well understood, emergencies large and small can impact on the achievement of that general objective, and there is huge commitment to safety across all elements of our society.

In this assessment, it is clear that residual risk is being assessed, as distinct from inherent or raw risk, i.e. risk as it exists prior to or without the imposition of any controls. SEMC recognises that there are already controls in place modifying most or all of the risks assessed to some extent, and that it would be far beyond the scope of the exercise to assess the inherent risk.

Type of analysis

Noting that the risk assessment spans a number of emergency risk types, the information available about them is quite variable, and for some there is inadequate reliable data. The primary input is drawn from experts with detailed knowledge of the risk and the history of events, pooling their knowledge and opinions in a workshop process. A fully quantitative risk assessment/analysis has not been possible within the resources available. Therefore the approach can be classified as semi-quantitative, in that some numerical data are used. Experts' estimates of consequence and likelihood in relation to a number of potential emergency events are expressed numerically and the results are plotted on a standard risk matrix, with a graphical representation.

Statistical confidence levels are acknowledged as being not high, but this level of precision is appropriate for a screening or first-pass risk assessment, in that it provides little detail about each risk, but can identify, very broadly, a hierarchy of risks, specifically highlighting those that may warrant further attention by way of more rigorous and specific assessment.

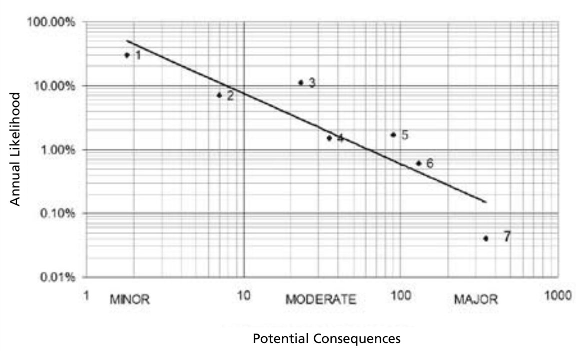
Outputs of risk assessments

One of the first customisations of the community-level risk model to state level was the decision to express each risk graphically as a curve located on a standard risk matrix of likelihood and consequence ranges. Each curve is a visual representation of a particular emergency risk, which makes it easier to appreciate the risk level, and expresses the fact that risks can manifest at a variety of scales. For example, a curve expresses the nature of many of the natural phenomena that can generate emergencies. There can be many small-scale natural hazard events that cause minor or moderate damage, and there are a few large natural hazard events that cause the most damage.

Use of curves also assists in enabling a comparison of disparate risks, by comparing the positions of the risk curves.

The curve is generated by the placement on a standard risk matrix of points representing a number of emergencies (risk events) that are either historical and adjusted to current values, or entirely synthetic but realistic. A spreadsheet tool is used to locate the points and generate the regression line, a sample of which is shown in Figure 1.

Figure 1 Sample risk curve overlaid on the log-log risk matrix.



The position and angle of the line can change over time, in response to such factors as climate change, where there may be fewer but more damaging emergencies such as floods or storms that move the curve to the right, or an improvement in mitigation, which would shift the curve to the left. While the precision of each curve's derivation may not be high, if frequency increases, some curves cluster closer to the more 'extreme' part of the matrix (towards the top right corner), thus allowing conclusions to be drawn as to the highest risks to the state.

As both the likelihood and consequence scales are logarithmic (as explained further below), the line is straight. This acts to reduce the sensitivity of the curve's position to small variations in the positions of the points representing events.

The consequence scale and descriptors

The consequence scale is built on five domains of consequence, derived from the recovery environments identified in Victoria's State Emergency Recovery Arrangements.

At the state level, the domains used for evaluating consequence are:

- personal: Capacity pressure on the hospital/health system, or the systems for supporting people who are displaced from home or otherwise seriously affected by an emergency;
- infrastructure: Interruption to supply of essential services or continued functionality of critical infrastructure;
- public Administration: Threat to or loss of public confidence in the State's ability to provide public services and govern;
- environment: Level and duration of impairment to environmental systems; and

- $ Economy: Significant economic losses or major disruption to one or more industry sectors.

One attribute that excites discussion with participants who are used to risk assessment in the engineering or hazardous materials disciplines is that human injuries or fatalities are not explicitly considered. In explanation, SEMC considered that, in the context of a State-level risk assessment method, the meaning and impact of the number of human fatalities may vary when applied to disparate emergency risks. The community's tolerance for human fatalities is inconsistent across the range of emergency risks, e.g. the community is likely to react differently to the same number of deaths occurring from bushfires as compared with road crashes. The number of injuries is, however, indirectly incorporated through the capacity pressure on the hospital/health system.

Figure 2 shows three levels of consequence to reflect the low-complexity model in use. The differences between the levels reflect order of magnitude steps. This is intended to simplify the primary differentiation between levels, noting that there is still a factor of 10 difference between the lowest and highest values within each level. This logarithmic scale is used because it suits the analysis of data where scales vary greatly. In particular, it allows practitioners to appreciate variations that occur when smaller values are used. On the risk matrix, levels of consequence are given an index value of 1 to 1000.

Figure 2: Consequence domains, levels and descriptors.

Level	Order of Magnitude	Description: Impacts on the State across 5 key sectors – People (P), Infrastructure (I), Public Administration (P), Environment (E) and Economy ($)	
3	Major	P	Health system unable to cope. General displacement of people beyond capacity of the State. State personal support system unable to cope.
		I	Critical failure impacts on community's functioning over a large area for an extended period.
		P	Loss of public confidence in the State's ability to manage. State's inability to manage the event causes serious public outcry. Policy goal or program abandoned.
		E	Very serious long term impairment or loss of ecosystem functions.
		$	Economic costs and losses exceed $1B. Significant widespread disruption to at least one industry sector.
2	Moderate	P	Health system operating at surge capacity; under severe pressure. Displacement of people within capacity of the State to cope. State personal support system operating at maximum capacity.
		I	Critical failure impacts on community's functioning over a medium to large area for a medium period.
		P	The State's capacity for normal activity is perceived as impaired. Significant diversion from public policy goal/s or program/s.
		E	Serious medium term impairment of ecosystem functions.
		$	Economic costs and losses exceed $100M. Disruption to at least one industry sector.
1	Minor	P	Health system operating at optimum capacity levels. Displacement of people within regional capacity to cope. Personal support needs being met.
		I	Critical failure impacts on community's functioning over a small area for a short period.
		P	The State perceived as able to continue business despite disruptions.
		E	Minor to moderate short term impairment of ecosystem functions.
		$	Economic costs and losses <$100M. Generally managed within standard financial provisions.

In applying the table, the highest level of consequence for a specific event across the five frequency domains is taken as the overall level of consequence. Future versions of the model could include weightings, or means, or some other mathematical refinement.

The likelihood scale

The likelihood scale shown in Figure 3 is similar to a community-level scale. Note that this scale is also logarithmic, so that each level is ten times more likely than the next lower level. There are also qualitative descriptors to differentiate between the levels.

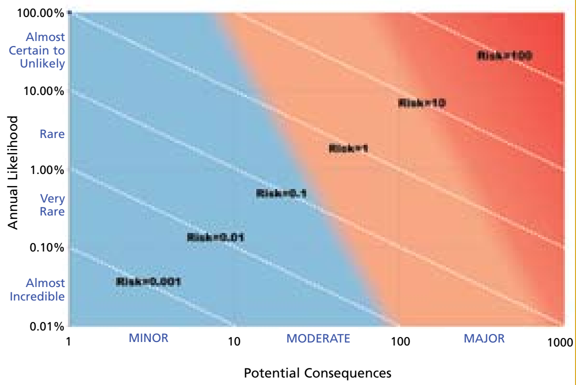
Figure 3: Likelihood scale and criteria.

Level	Descriptor	Description: In any one year, the likelihood of the event occurring is:
A	Almost Certain to Unlikely	>10% Many recorded events Many events in comparable jurisdictions Great opportunity, reason, or means to occur
B	Rare	>1% – 10% Some recorded events Some events in comparable jurisdictions Some opportunity, reason, or means to occur
C	Very Rare	0.1 – 1% Few recorded events or little indicative evidence Some similiar events in comparable jurisdictions Little opportunity, reason or means to occur
D	Almost Incredible	<0.1% No recorded events or any indicative evidence No recent events in comparable jurisdictions Minuscule opportunity, reason or means to occur

Risk evaluation – evaluation zones

It is probably not possible for a committee of public servants to finally determine the risk evaluation criteria on behalf of the community's elected representatives. However, ANZS 4360:2004 requires risk evaluation criteria to be developed. This has been done, in a way consistent with the expression of risk using curves, by overlaying coloured zones on the risk matrix.

Figure 4: Risk rating zones.



There are thee zones of risk identified by their colour. The boundaries between these zones are steeper than the lines of constant risk (shown as white dashed lines), reflecting societal intolerance of higher consequence events.

Blue: Most risk should be in this zone. The risks identified in this zone are effectively controlled by systems across government, industry and the community. Emergencies that do occur are mostly handled within the routine operations of emergency response and recovery agencies.

Expenditure on additional risk reduction may not achieve proportional reduction in risk for resources invested; there are higher priorities for such expenditure.

Orange: This is a smaller zone than the blue zone. In this zone, the consequences of emergencies will be higher than for the blue zone. This is an area in which active steps and financial investment in risk reduction are likely to be taking place because:

- a positive cost/benefit ratio for investment in risk reduction is expected; and
- the level of residual risk may be a matter of some public controversy.

Should further risk reduction for a particular hazard be impractical or unaffordable, the residual risk may be higher than is desired.

Red: This is the smallest zone and identifies that the risk is an alert for the state. Risks in this zone are generally associated with high consequence and low to very low likelihood of occurrence, which allows communities to operate in the presence of such risk. However, where likelihood is higher, risks in the red zone should be a stimulus to action to reduce the level of risk to more acceptable levels. One of the purposes of this project is to identify inadequately treated risks in the red zone.

Process of risk assessments

The risk methodology was pilot tested in 2006 on about twenty risks. For each risk assessed, a lead agency was appointed whose nominated contact person arranged and facilitated a workshop involving experts from the range of relevant agencies. While this proved generally effective, the results clearly demonstrated that different groups had applied a range of different assumptions about the project and varied in their interpretation of the instructions. The outcome was a reduced level of comparability of the results.

During 2008, a formal state emergency risk assessment was undertaken, again using the workshop process to assess 18 risks, with consultants MWH Australia facilitating each one. This did result in a higher level of consistency and comparability across the assessments.

The consultants also introduced some enhancements to the method, particularly in clarifying the relationships between hazards, risks and emergencies for the purposes of risk assessment. This is necessary as many hazards can generate a variety of types of emergency, and some emergencies can generate others which need to be recognised as possible consequences.

Assessment of controls

In addition, the consultants introduced in 2008 the concept of an analysis of the relative importance of current mitigation controls, the effectiveness of those controls and the prioritisation of options for future enhancement of controls.

This element was moderately successful and will be refined for future rounds of the assessment.

Validity of the methodology

The 2008 assessment engaged many people from state departments and agencies, plus a few academic experts, who engaged enthusiastically with the process and delivered a confirmation of its validity for the state-level emergency management context.

The confidence in the specific results is lower than would be desirable; this can be addressed for future rounds by developing more detailed instructions for participants as well as the facilitators, and encouraging participants to gather relevant data prior to attending workshops.

Conclusion

Work done to date in Victoria has shown that a viable state risk assessment method has been derived by fairly simple adaptations of the risk assessment component of the EMA Emergency Risk Management model (EMA, 2004). The introduction of a risk curve overlaid on the risk matrix, recalibration of the consequence descriptors and determination of risk zones, together with a model for assessing mitigation controls, have produced a method that has been well regarded at state level in Victoria across a variety of agencies with responsibility for emergency risk management.

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About the author

Paul Gabriel has been engaged in emergency management policy since 1986, prior to that working in the ambulance unit of the then Health Department. He has been a part of the Office of the Emergency Services Commissioner and its predecessors and has worked on a wide range of projects, including the production and maintenance of the Emergency Management Manual Victoria. Paul is a member of Victoria's State Emergency Mitigation Committee and is Victoria's representative on the National Risk Assessment Advisory Group. He may be contacted on Paul.Gabriel@justice.vic.gov.au

A fresh approach to development assessment in Bushfire Protection Areas

Meryl Sherrah describes the on-line website tools developed by the Department of Planning and Local Government in South Australia to assist with development assessment in Bushfire Protection Areas.

Abstract

In late 2006 and 2007, changes were made to the planning and building requirements for new dwellings to be built in certain identified bushfire risk areas of South Australia.

The changes affected 39 councils located throughout SA, including Eyre Peninsula, Yorke Peninsula, Kangaroo Island, the South-East, the Riverland, Murray Bridge, mid-North, Mt Lofty Ranges and parts of the metropolitan Adelaide region.

Under the changes, parts of these councils have now been designated as Bushfire Protection Areas. Each of these Areas has been thoroughly assessed and categorised into one of three bushfire risk levels – high bushfire risk, medium bushfire risk or general bushfire risk. There are also areas which are 'excluded'.

Different planning and building requirements now apply depending on the designated level of bushfire risk. The Department of Planning and Local Government has prepared an online search tool to assist people in identifying whether a particular property in the 39 councils is in a Bushfire Protection Area and the property's assigned bushfire risk.

A web mapping application to assist in development assessment in Bushfire Protection Areas has also been produced for Country Fire Service and council staff involved in development assessment.

The development of the online search tool and the web mapping application was funded under the Natural Disaster Mitigation Programme and has received Australian and State Government financial support.

Introduction

Following the serious bushfires in Eastern Australia in the Summer of 2002 / 2003, the South Australian Premier convened a Bushfire Summit which recommended, amongst other things, that there be: *"A review of bushfire policy framework and development plans (including land use and infrastructure) to update Development Controls in designated Bushfire Prone Areas and to consider extending the number of Bushfire Prone Areas."*

A Ministerial Planning Amendment report was introduced in three stages between December 2006 and December 2007 which established consistent Bushfire Protection Areas (formerly known as Bushfire Prone Areas) and policies across South Australia. Previously the Bushfire Protection Areas had been confined to the Mount Lofty Ranges. Extension of the Bushfire Protection Areas was based on calculations of the potential bushfire hazard which used a spatially based implementation of the McArthur Grassland and Forest Fire Danger Meters. These changes affected 39 councils located throughout SA, including Eyre Peninsula, Yorke Peninsula, Kangaroo Island, the South-East, the Riverland, Murray Bridge, mid-North, Mount Lofty Ranges and parts of the Metropolitan Adelaide region.

Under the new Bushfire Planning conditions, all proposed new habitable buildings in the defined Bushfire Protection Areas must be assessed to determine the level of bushfire risk as part of the development application. In High and Medium Risk Bushfire Protection Areas this will help to determine the appropriate construction standard. The assessment is based on Australian Standard "AS3959 – Construction of Buildings in Bushfire-Prone Areas" which sets out the minimum construction requirements for each of four levels of defined Bushfire Hazard and the methodology required to undertake the site assessment. The actual hazard for the building site is determined by completing a threat matrix that considers a combination of the classification of vegetation type, its proximity to the building and the slope leading to the building.

The Department of Planning and Local Government Bushfire Protection Areas website includes a Bushfire Risk Level Online Search tool which allows people to identify bushfire risk for any property in Bushfire Protection Areas. A web mapping application allowing development assessment in Bushfire Protection Areas has also been developed. This has been made available to the Country Fire Service (CFS) and local councils to assist them in undertaking the site assessments. The application enables the user to investigate a proposed building site for the presence and proximity of vegetation to a proposed building site and the slope and aspect of the land relative to the building site. The information supplied will enable the user to quickly undertake the assessments and ascertain whether a more detailed site assessment will be required. It enables all those involved with the assessment process to view and share a consistent set of information regardless of their individual locations.

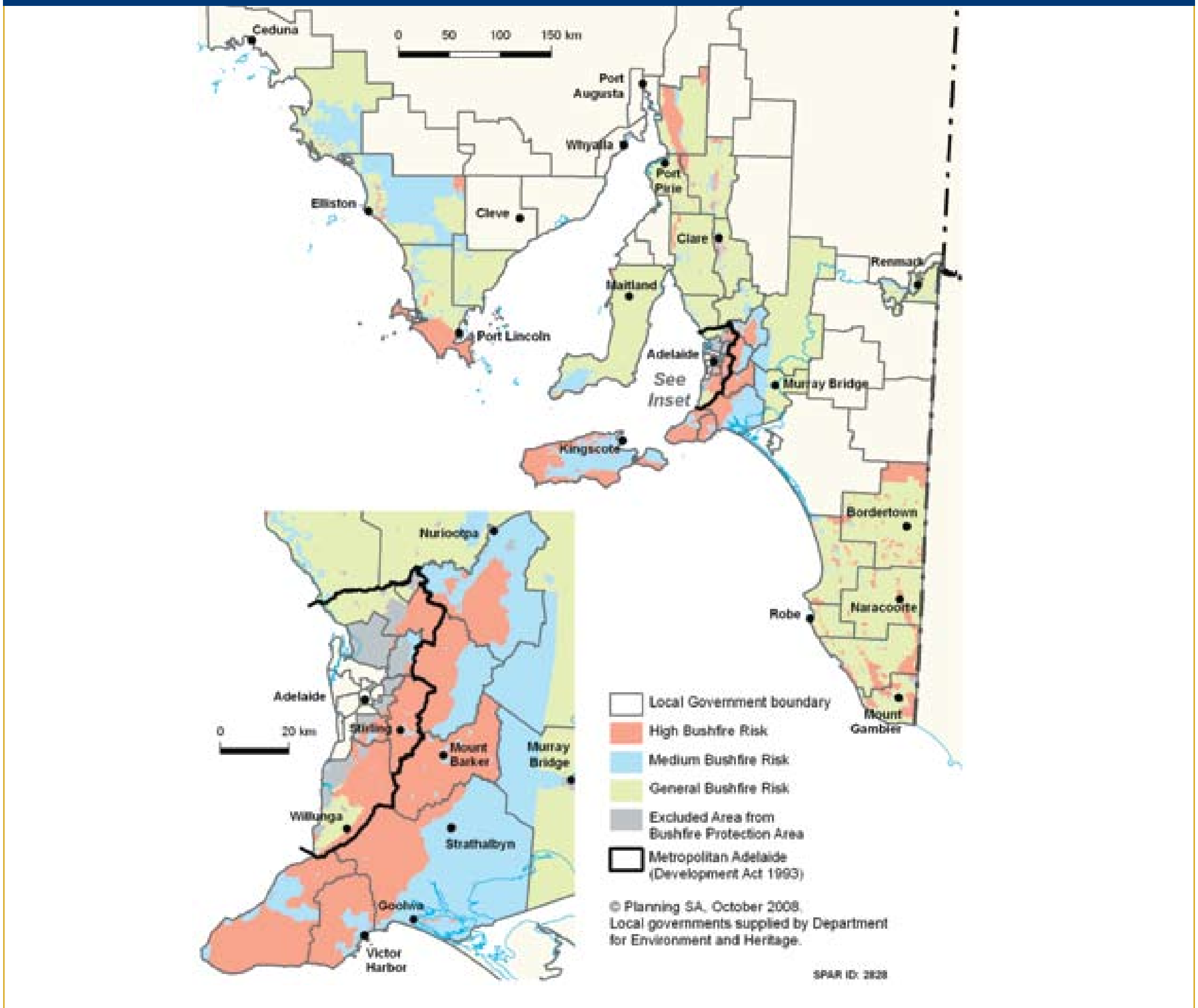
The Development Assessment in Bushfire Protection Area web application has been funded under the Natural Disaster Mitigation Programme by the Commonwealth and South Australian governments.

Bushfire Protection Areas – planning requirements

The Ministerial Plan Amendment established Bushfire Protection Areas in some parts of the 39 Councils mentioned above. Each of these Areas has been thoroughly assessed and categorised into one of three bushfire risk levels – high bushfire risk, medium bushfire risk or general bushfire risk. There are also areas which are 'excluded'. Figure 1 shows the extent of the Bushfire Protection Areas in South Australia.

Different planning and building requirements now apply depending on the designated level of bushfire risk. The requirements may include features such as having dedicated water supplies for fire fighting; buffer zones between homes and flammable or combustible vegetation; appropriate access roads; and building features which increase bushfire protection (e.g. spark and ember protection).

Figure 1: Bushfire Protection Areas in South Australia.



Requirements for high bushfire risk areas

Where the selected property falls within an area described as high bushfire risk, all new habitable buildings (e.g. a dwelling or tourist accommodation) will be assessed for compliance with the following criteria:

- have a dedicated fire fighting water supply of at least 22,000 litres;
- ensure that gaps between the dwelling floor and the ground are enclosed to prevent burning debris from entering;
- be set back 20 metres from flammable/combustible vegetation;
- Be located and designed to minimise risk from bushfires; and
- have access roads and tracks that are appropriately designed and built for entry and exit of vehicles, including fire fighting vehicles, during a fire.

In addition, proposed new habitable buildings in *High Bushfire Risk Areas* are assessed against the bushfire protection requirements in the **Building Code of Australia** and the **South Australian Housing Code**, and Minister's Specification SA78. The building must be designed to provide protection from sparks and embers. The determination of the level of protection required will require a site assessment of the bushfire hazard as part of the application for building rules consent. From this site assessment, the appropriate construction standard will be determined in accordance with Australian Standard AS 3959-1999 - for High and Extreme categories of bushfire hazard.

Requirements for medium bushfire risk areas

Dwellings proposed for properties within medium bushfire risk areas must meet the following criteria:

- have a dedicated fire fighting water supply of at least 5,000 litres;
- ensure that gaps between the dwelling floor and the ground are enclosed to prevent burning debris from entering;
- be set back 20 metres from flammable/combustible vegetation;
- be located and designed to minimise risk from bushfires; and
- have access roads and tracks that are appropriately designed and built for entry and exit of vehicles, including fire fighting vehicles, during a fire.

In addition, new habitable buildings in *Medium Bushfire Risk Areas* are assessed against the bushfire protection requirements in the **Building Code of Australia** and the **South Australian Housing Code**, and Minister's Specification SA78. The building must be designed to provide protection from sparks and embers, including such measures as covers under eaves, metal fly wire screens and steel shoes for posts (as required by Australian Standard AS 3959-1999 – for Medium Construction). No specific assessment of the bushfire hazard for the site is required in these areas.

Requirements for general bushfire risk areas

The criteria for dwellings proposed for properties within general bushfire risk areas are the same as those for medium bushfire risk areas. There are no mandatory construction requirements for new buildings in these areas.

Requirements for excluded bushfire risk areas

'Excluded' areas generally include existing townships and other settlements that have an adequate water supply for fighting fires and suitable emergency vehicle access and egress.

The need to have regard to matters that specifically seek to reduce risk to life or property from bushfires in such areas is generally considered lower than other areas which have been assigned to a Bushfire Risk category, and where considerations about the siting of buildings, vehicles access and availability of a dedicated fire fighting water supply are more important. As such, proposals to construct a house or to subdivide land for residential purposes within an 'excluded' area are not assessed against the Bushfire Protection provisions of the Development Plan.

There are, however, other requirements that need to be taken into account when applying to develop land in 'excluded' areas. This includes the need to ensure the layout and design of land division proposals takes into account the Bushfire Risk assigned to adjoining land.

There are no mandatory construction requirements for new buildings in these areas.

Bushfire risk level online search tool

Department of Planning and Local Government has prepared an online search tool to assist people in identifying whether a particular property in the 39 councils:

- is located within a Bushfire Protection Area;
- the property's assigned level of bushfire risk (high, medium or general risk); and
- what minimum bushfire-related planning and building requirements may apply.

Users are able to identify bushfire risk level by using a map to navigate to the area in question. Alternatively they can enter a plan parcel, certificate of title or assessment number to locate the property. Users are then able to view a map showing the property boundary and the surrounding bushfire risk level. A link to the relevant council's development plan is also provided.

The Bushfire Risk Level Online Search Tool can be accessed via the following URL:

http://www.planning.sa.gov.au/go/development-plans/bushfire-protection-areas/bushfire-risk-level-online-search-tool/

Web mapping application – Development Assessment in Bushfire Protection Areas

This application was designed to assist the Country Fire Service and Councils to undertake the assessments required for proposed developments in Bushfire Protection Areas. It is only available to Council and CFS staff who must supply a login and password to access the site.

A range of information and factors relevant to the assessment of the potential bushfire risk for a specific site are provided to enable users to undertake a desktop investigation of a particular development application. This information, both spatial and textual, should be useful in evaluating and documenting risks at proposed development sites prior to an on-site inspection.

Users of the web site are also encouraged to read the Department of Planning and Local Government Guide titled "Undertaking development in Bushfire Protection Areas" which outlines the planning and building requirements in areas of bushfire risk in conjunction with the Council's Development Plan.

This application was developed using ESRI's ArcIMS web mapping software.

Search Tools

The application has several search options which allow bushfire risk areas be identified by searching on property details or suburb or alternatively to browse bushfire risk areas via a map.

The property details search option is recommended if you know any property identifying information such as plan parcel, certificate of title or valuation assessment number. Property details may be obtained via an address search of the Property Location Browser on the Land Services Group (Department for Transport Energy and Infrastructure) website.

It is also possible to search for bushfire risk areas via a map interface which allows searching by using the pan and zoom tools. A pull down list of local councils can be used to restrict the search to a council area. A separate option exists to search by suburb in a similar manner.

An example of a Plan Parcel search is shown below:

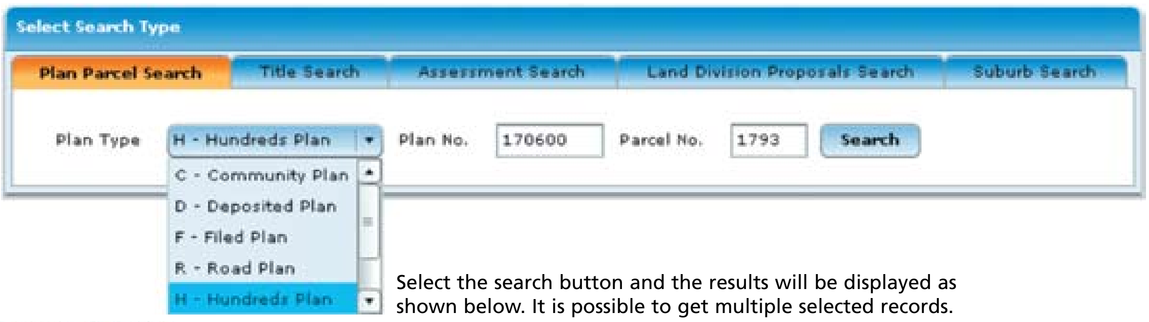
Sample Plan Parcel Search.

A plan parcel identifier is defined by a letter/number sequence, for example:
H170600 S1793

This sequence is made up of three parts:

Plan Type (H)	Choices of plan type are available in the drop down list in the search tool.
Plan Number (170600)	User will need to enter this number.
Parcel Number (1793)	User does not need to enter the letter next to this number (S in the example above), just the number.

Select the Plan Type from the drop down list and type the Plan Number and Parcel Number in the appropriate boxes as shown below.



Select the search button and the results will be displayed as shown below. It is possible to get multiple selected records.

2 Records Found

Map	Plan Parcel	Title	Assessment Number	Bushfire Risk Level	Development Plan Name
Show Map	H170600 S1793	CT 5210/36	5832672005	High	Mount Barker (DC)
Show Map	H170600 S1793	CT 5210/37	5832672005	High	Mount Barker (DC)

Upon making a successful Plan Parcel search, selecting "Show Map" will display a map zoomed in to the selected land parcel. The selected land parcel is identified on the map by a red cross-hatch ( ). Clicking on the relevant Council under the Development Plan Name Heading will display the Development Plan for that Council.

Data Layers

A wide range of data, sourced from a number of State Government Departments is available for display in maps on the Bushfire Protection Area's web mapping application.

Administrative data layers include place names, suburbs, local government areas, digital cadastral database, reserves, National Parks and Wildlife SA (NPWSA) reserves, CFS stations, roads and railways.

Topographic data consists of contours, spot heights, water bodies and water courses. These are available at 1:10,000 capture scale in the Mount Lofty Ranges, River Murray and large country towns and at 1:50,000 in other areas. There is also raster data of elevation, slope and aspect with a 25m cell resolution.

There is a vegetation structure dataset which combines all the regional vegetation mapping datasets produced as part of the Biological Survey of SA program within the Department of Environment and Heritage that contributes to the National Vegetation Information System (NVIS). Vegetation mapping descriptions follow NVIS standards and an attribute vegetation_class has been added that equates to the relevant vegetation class in the "Picture Key to the Forms of Australian Vegetation", Figure 2.1, and Table 2.1 in the Australian Standard AS3959-1999.

Bushfire data includes the Bushfire Protection Areas dataset showing the spatial extent of the bushfire protection provisions brought in under the Ministerial Bushfire Plan Amendment in 2006/2007. Other fire data includes the date of last fire, number of fires and fire history. This mapping is for major fires that have burnt largely within or adjacent to NPWSA reserves. A raster dataset of calculated bushfire hazard with 50m cell size is also provided. This was calculated from a model based on the McArthur Forest and Grassland meters using the worst case scenarios for fuel loads, winds, humidity and temperature. The major inputs to the model included slope, aspect and estimated fuel loads base on the native vegetation dataset mentioned above.

Aerial Photography available on the website currently covers the Mt Lofty Ranges and Fleurieu Peninsula also Yorke Peninsula, the Mid North and South East regions of South Australia. Pixel resolution ranges from 35 to 90 cm.

Maps on the website have raster data (which includes aerial photography) at the bottom of the table of contents, then polygon layers and finally line and point layers (e.g. roads and localities) at the top.

The draw order (bottom to top) then ensures that the polygon, line and point data is not overdrawn by the solid-fill raster layers. Users must be aware of which layers are checked on in the table of contents otherwise it is possible to accidentally over draw data, for example the Bushfire Protection Areas are checked on by default and hence may draw over any checked aerial photography which is lower down in the table of contents.

To reduce the time taken to draw maps, the aerial photography will only draw at scales less than 1:500,000. Scale dependencies have also been set for some other layers, in particular the cadastre.

Using the web application as part of the Assessment Process

To undertake a typical site assessment for a proposed new development in Bushfire Protection Areas, the user must first locate the property in question using one of the search methods outlined above.

It is suggested the user then displays the following layers for the assessment – land parcel labels, contours, spot heights, lakes, reservoirs and dams, watercourses and native vegetation structure. Any vegetation areas close to the proposed development can then be identified by selecting the identify tool and clicking on this area. A pop-up window will appear and display the attributes of the vegetation selected.

The measure tool can be used to indicate distances from a proposed development to a vegetated area or a road.

Slope gradient and site aspect can also be investigated by displaying these layers.

Further information about the site can be obtained by progressively displaying other data layers such as fire history, and aerial photography. The actual calculated bushfire hazard for the site can be determined from the "Calculated Bushfire Hazard – 50m Cells" layer. This layer contains the results of the original calculations of the bushfire hazard based on slope, aspect and predicted fuel loads from the vegetation mapping.

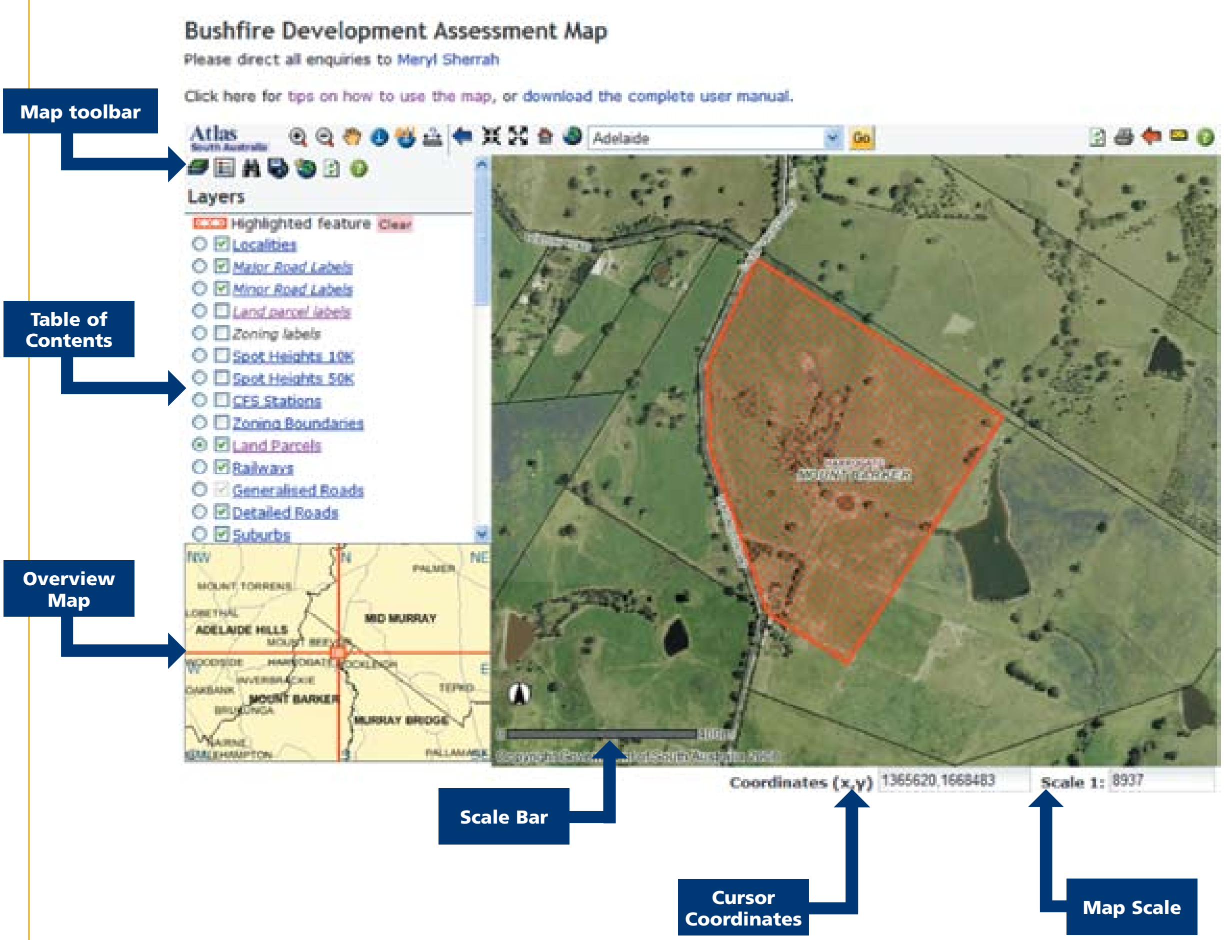
At any stage of the assessment the user can create a PDF image of the map, including a legend. This can then be saved or printed.

The layout of a typical Bushfire Development Assessment Map is shown over the page.

User system requirements

A minimum monitor size of 17" with a minimum resolution of 1024 by 768 is recommended to run this application. Users must have Microsoft Internet Explorer 6 or 7 or Mozilla Firefox installed as their web browser. Adobe Acrobat Reader is also required to allow printing and to read the User Manual. Finally, to display the selection boxes that are used for the Plan Parcel, Certificate of Title and other selection options, Adobe Flash Player must be installed and enabled.

Figure 2: Bushfire Development Assessment Map.



Conclusions

The development of a website for bushfire hazard and development planning information, including planning and building assessment tools has helped to streamline the development assessment process for Councils in Bushfire Protection Areas in South Australia. As well as detailing Bushfire Risk Areas and the appropriate planning and building controls, it has allowed Council and CFS officers to examine proposed developments at the land parcel level through a web mapping application, including contributory factors to bushfire hazard such as vegetation type, slope and aspect.

Acknowledgements

The development of this website was funded under the Natural Disaster Mitigation Programme and was made possible by the very generous financial support received from the Australian and South Australian Governments.

I would like to acknowledge Peter Brooke-Smith for his contribution to the Bushfire Mitigation and Development Control GIS Project from its initiation, including the establishment of the Bushfire Protection Areas website.

Thanks also to Jason Phillips for producing the maps and diagrams in this paper.

About the author

Meryl Sherrah is a GIS Analyst in the Department of Planning and Local Government, South Australia. She has been working with Geographical Information Systems since 1991.

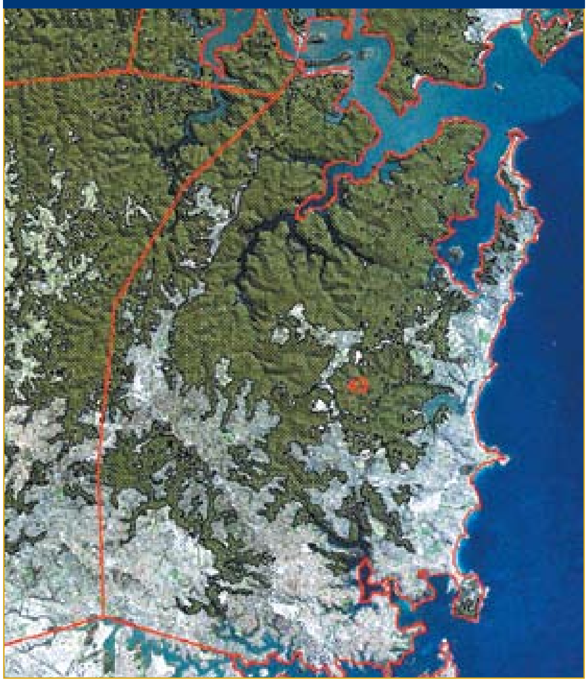
I-Zone planning: Supporting frontline firefighters

Byrne outlines the NSW Fire Brigade's I-Zone planning system designed to manage the effects of urban interface engagements.

"I observed fire travel through urban bush corridors, igniting areas of grass and bush and then spread into vegetation located around the structures, leading to the ignition and destruction of numerous houses. These types of vegetation features acted as a funnel, drawing the fire deeper into the suburbs. I observed this funnelling first hand on numerous occasions."

Darryl Thornthwaite
ACT Fire Brigade 18th Jan 2003

Image 1. Aerial view of Sydney's bushland urban interface showing the complexity of the urban vegetation mix. (Chen and McAneney, 2005 in Lowe, 2008).



Introduction

The focus of this paper is bushfires that impact on the built environment in the bushland urban interface or I-Zone. These fires are transitional by nature with the fuel source of the fire changing from vegetation to structural, as the fire travels from a bushfire prone area to an urban area. It is this transitional nature that causes the greatest challenges for a largely urban fire service such as the NSW Fire Brigades. A simple definition of an interface area is "Any area where structures (whether residential, industrial, recreational or agricultural) are located adjacent to or among combustible (bushland) fuels" (Cottrell, 2005:110). NSW Fire Brigades use I-Zone as an abbreviated term for any bushland urban interface.

During an 'I-Zone' type of emergency, fire commanders are required to make instant judgments regarding firefighter and civilian safety, appropriate firefighting strategies, resource placement, and values at risk, due mainly to the dynamic nature of these fires. Often these judgments are made with the acceptance of resulting property losses, due to the magnitude and speed of the fire and the often limited resources available. It is the dynamic nature of these fires and the time critical nature of decision-making that causes the greatest challenges for on ground commanders within the fire services. Therefore the greater the planning undertaken by the NSW Fire Brigades the greater the likelihood of mitigating the effects of these events.

As a result of internal investigation it was evident that NSW Fire Brigades could further improve its operational and risk management procedures in I-Zone emergencies. It was identified that the development of a robust method of supporting critical decision making by command officers, in the form of I-Zone Planning, was critical to successfully mitigating the effects of these emergencies. This decision support tool has the safety of firefighters, operating in these volatile high risk environments, as its key objective. I-Zone planning enhances the NSW Fire Brigades performance to mitigate the effects of I-Zone emergencies, and support the Rural Fire Service (RFS), the lead combat agency for bushfire in New South Wales.

I-Zone planning has three main goals:

1. firefighter safety;
2. improved emergency management; and
3. community education.

Key stages of I-Zone planning include:

Macro risk assessment

- a risk assessment of the target area (NSWFB Station Area) by the Bushland Urban Interface (BUI) Section's I-Zone Officer using High Resolution Aerial Photography;
- additional assessment using FireAus[1] data in Arc View;
- inclusion of known fire history and fuel assessments through information provided by local Bushfire Management Committees Risk Plans; and
- I-Zone (macro) plan developed electronically.

Micro Risk Assessment

- identification of highest risk area within station boundaries. This includes analysis of Australian Incident Reporting System Data;
- ground truthing of I-Zone plan by firefighters at local station. This includes data collection by local crews in target location;
- development of hardcopy and electronic mapping including identification of sectors as per Incident Command System; and
- resulting data linked to the NSW Fire Brigades Computer Aided Dispatch System.

As described above, this information will be linked to the Computer Aided Dispatch system allowing the NSW Fire Brigades to dispatch the correct resources in key locations, as part of an increased weight of attack strategy, in a time critical environment. I-Zone planning is also available to all fire agencies through Section 52 (NSW Rural Fires Act 1997)[1] planning process through Local Bushfire Management Committees in New South Wales. This planning will assist all fire agencies in the event of major bushfires in urban areas.

Defining the issue - NSW Fire Brigades

Broadly speaking there are three major issues that have elevated I-Zone fires as a priority for the NSW Fire Brigades they are:

- climate change;
- population migration; and
- operational Command and Firefighter Safety.

1. Climate Change

Climate change projections indicate that Victoria and NSW are likely to become hotter and drier in future (Hennessy et al, 2005; Suppiah et al, 2005). Hennessy and Suppiah evidence that since 1950 Australia has warmed by 0.85 C. Rainfall has also decreased in the south-east and droughts have become hotter as the number of extremely hot days has risen. Southern Australia has the reputation of being one of the three most fire-prone areas in the world, along with southern California and southern France. The CSIRO and Bureau of Meteorology report, "an increase in fire weather risk at most sites in 2020 and 2050, including the average number of days when the FFDI rating are high or extreme. The combined frequencies of days with very high and extreme FFDI readings are likely to increase 4-25% by 2020 and 15-70% by 2050" (Hennessy et al, 2005). Interestingly, the study also concluded that the window available for prescribed burning may shift and narrow, thus adding a further constraint to the ability of agencies and land managers to mitigate the effects of bushfires. The recent Lucas & Hennessy et. al (2007) report prepared for the Climate Institute also confirms these trends.

The above scenario is already affecting the organisation with many bushfires impacting on, or originating in NSW Fire Brigades areas of operations. Statistics from the NSW Fire Brigades Annual Report, 2006/07, indicate that 25% of the 138,021 responses by NSW Fire Brigades units annually are bush or grass fire related, that translates to a total of 34,505 incidents, annually. These statistics illustrate the significance of grass and bushfires to the operational capacity of the NSW Fire Brigades.

2. Population migration

The majority of NSW's population resides in the Greater Sydney Area, defined as an area of land from Port Stephens in the north, west to the Blue Mountains, and south to Kiama. Within this area there has been a growing trend of people migrating to more rural locations. This has been driven by a number of issues including lack of available cost effective land in city locations, lifestyle considerations, decentralizing

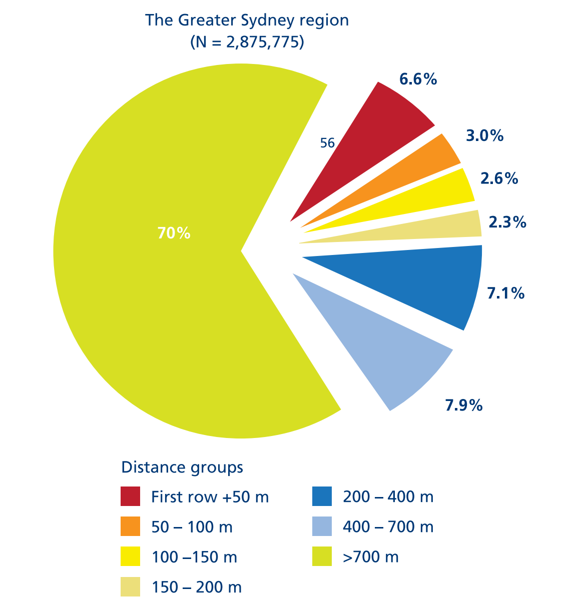
1. Section 52 of the NSW Rural Fires Act 1997 requires each bush fire management committee to develop a plan of operations and a bush fire risk management plan.

of workplaces, and greater availability of internet connections in rural locations. "The population in Sydney and the Central Coast is tipped to grow from the current level of 4.1 million to 5 million by 2022. The Illawarra and the Lower Hunter are home to another 750,000 people - and growing strongly too" (Sydney Metropolitan Strategy (2004), Minister's Message).

There are many similarities between the urban growth and subsequent fire regimes in California and New South Wales. In the United States a number of studies blame urban sprawl as the primary source of increasing ignition and a leading factor for increasing severity of urban interface fire in southern California (Goldstein, Candau, & Moritz, 2000; Keeley et al 1999).

The Californian Department of Forestry and Fire Protection suggest that for every 600 homes or 700 people, there will be one more ignition per year per 1,000 acres (California Department of Forestry and Fire Protection, 1995, p2). This is based on the linear regression data from 1921 to 1993 for California Sierra Nevada foothills and similar data from California's Riverside County suggesting with 95% confidence that the addition to former wildlands of 1 housing unit per square mile means an additional 0.001733 ignitions per year per 1,000 acres and an addition of an additional 1 person per square mile will lead to an additional 0.001438 ignitions per year per 1,000 acres. This suggests a strong correlation between expanding populations in I-Zone areas and increased fire activity.

Image 2. FireAus pie chart showing properties and distance from vegetative fuel edge in meters and subsequent risk category Red - Very High , Orange - High etc. Note 9.6% of structures are in the very high/high risk category. (Chen and McAnene, 2005 in Lowe, 2008).



3. Key issues in Command and fire safety

a. Command

The NSW Fire Brigades undertakes a number of emergency response roles:

- structure fires;
- hazardous Materials (Hazmat);
- bushfire;
- rescue;
- Urban Search and Rescue (USAR); and
- Chemical Biological Radiation (CBR).

As a largely urban-based fire service, bushfire response is just one component of the organisations role. Within this context, the challenge for the NSW Fire Brigades is how best to prepare its command level officers for I-Zone type events, given the overall training demands of a multi emergency response organisation.

Not all command officers will have sufficient experience of I-Zone fires to have developed the required mental schemata enabling them to make effective decisions in a time critical manner. What can the NSW Fire Brigades do to support these officers in this environment? The implementation of a decision support system through planning for I-Zone events is a solution offered in the I-Zone planning system.

I-Zone fires are problematic for fire services as they have a number of characteristics that are difficult to manage operationally:

1. they are fast moving, dynamic fires that pose serious safety risks for firefighters;
2. they impact on numerous structures simultaneously;
3. property losses can occur within a short time frame;
4. a large number of resources are frequently required to combat these events;
5. consistent inter-agency cooperation and understanding is required;
6. communications technology overload often occurs; and
7. large civilian populations are frequently affected.

b. Ember attack

Impact in the context of this paper is defined by Leonard and Blanchi as "the parameters that can describe the magnitude or persistence of the attack mechanism" (Leonard, J. Blanchi R., 2005). In the right conditions, embers will cause mass ignitions in the urban interface. These embers can travel large distances from fuel beds and, borne by strong winds, impact on urban vegetation or buildings with devastating effect. It is the sheer volume of these embers that is the issue.

Ember attack takes place over a long period of time, before the fire front hits, during the fire front, and for considerable hours after the fire has passed. The risk from these embers is a complex issue and many factors are involved. The atmospheric conditions, type and mass of vegetation, building construction, and building surrounds.

Dowling argues that ember attack is responsible for 90% of all houses destroyed by bushfires and that radiation and direct flame play a relatively minor role in fire propagation (Dowling, 2008). Human activity plays a significant part in mitigating these ember attacks, prevention and suppression activities, before during and after ember attack are critical (Ramsay 1996). Consequently, any capability to reduce the effect of these ember storms is invaluable. The introduction of Community Fire Units Program by the NSW Fire Brigades in these urban areas is critical. “The CFU approach is intended to empower community members to be proactive in the defence of their own properties” (Lowe, Haynes, Byrne, 2007)”.

c. House to house fire spread

A key factor in the spread of fire in the urban interface is house to house fire spread. Studies conducted by Leonard, CSIRO, conclude that a significant percentage of fire damage was caused by structure to structure fire spread. This is caused principally by direct flame attack. In many urban and suburban areas houses are built in close proximity to each other, often with common structural elements such as garaging, pergolas, and fencing, facilitating the spread of fire from one structure to another. This is further exacerbated by the trend to build larger houses on relatively small blocks of land in many of these areas. When structures are less than 15 metres apart, they are considered by the NSW Fire Brigades as a mutual exposure. That is, a fire commencing in one of these structures has the ability to spread to all other structures if there is no human intervention, either from fire services or local residents.

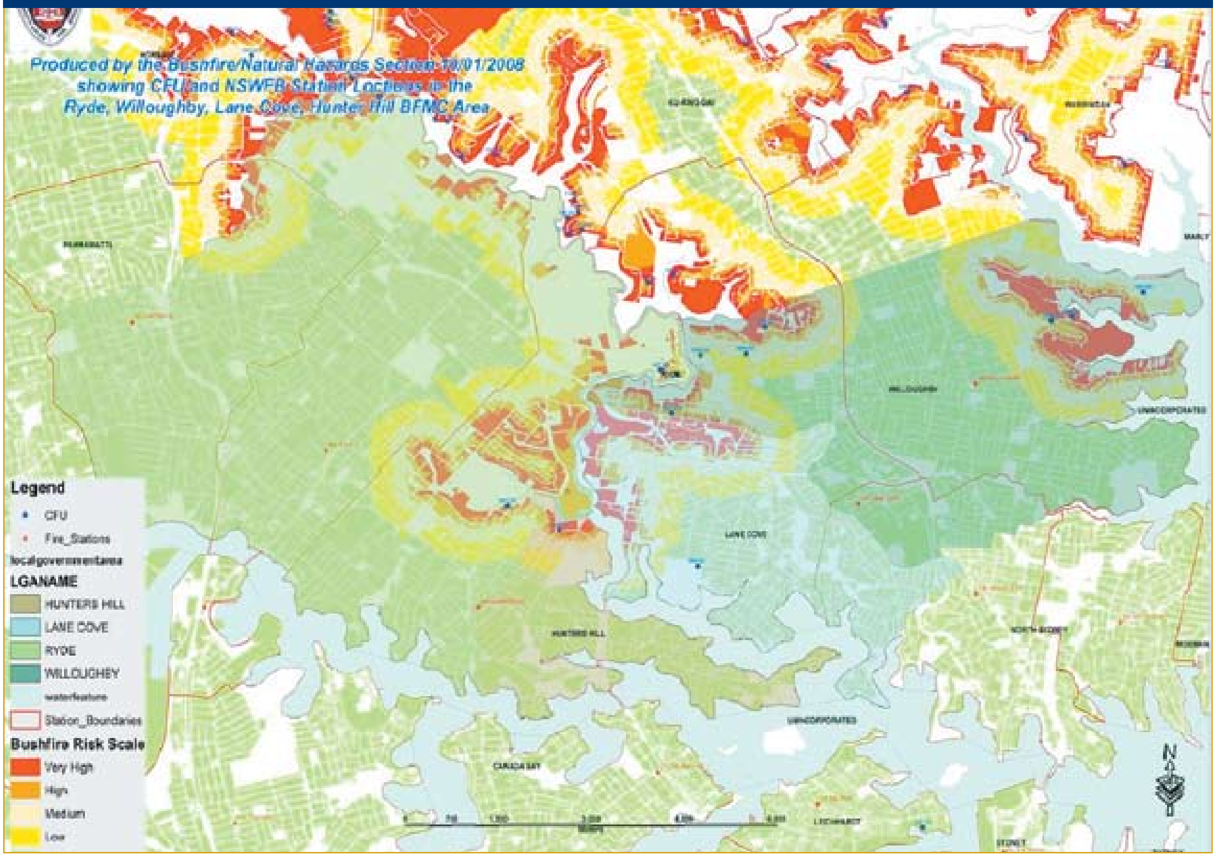
d. Defendable space

The defendable space is defined as “a home’s characteristics, its exterior material and design, in relation to the immediate area around a home within 30 metres, principally determine the home ignition

Image 3. FireAus Risk Rating Thurlgano Rd. Engadine, southern Sydney.
NSWFB Bushland Urban Interface Section.

Image 4. Thurlgano Rd Engadine - actual structures lost in Bushland Urban Interface fire in October 2002. Note the properties lost are identified as Very High risk as in previous, Figure 3.
NSWFB Bushland Urban Interface Section.

Image 5. NSW Fire Brigades Macro Planning Tool using Fire Aus layer in ArcView, Lane Cove valley Sydney 2008. Areas denoted in red represent locations of very high to high risk.
NSWFB Bushland Urban Interface Section.



potential" (Jack Cohen, USDA Forest Service Missoula MT, 2003). Cohen further argues that a home's location does not necessarily determine its vulnerability to bushfire; the condition of the home ignition zone determines its vulnerability to fire. This introduces the concept of defendable space around a home that is threatened by bushfire. Therefore if there is sufficient defendable space around such a structure, despite its location and the severity of the fire, it may be deemed defendable by either occupants or fire services.

Identifying such defendable spaces is intrinsic to developing an effective structure triage capability. This becomes critical for fire commanders as it enables them to effectively and efficiently allocate resources at the fire front.

e. Structure triage

No discussion of the bushland urban interface would be complete without discussing structure triage. The overarching operational doctrine in combating these fires is maximizing the often limited available resources for maximum effect. Therefore a system for deciding on which assets to concentrate on saving is essential. If for example, a fire commander arrives at a location where a major fire is running and multiple houses are alight, how would he or she decide which properties to concentrate the efforts of their resources on Structure triage identifies, through a series of criteria, the defendability of individual structures. In broad terms there are three types of structures:

1. structures that are quite safe and therefore require little or no resources;
2. structures that will require resources to save; and
3. structures that, despite allocating resources, cannot be saved.

This logic demands of Incident Controllers a decision not to save particular structures. The principle here is to use the available resources for the greatest good. By applying the above classification an incident controller can make rapid decisions on which structures to which they will allocate resources. This helps greatly in clarifying and justifying fireground decision-making. The same logic can be applied in the risk assessment phase of the I-Zone project, and in terms of planning it is an invaluable tool for local fire crews.

Implications for I-Zone planning

The primary responsibility for any fireground commander is the safety of personnel. I-Zone fires provide significant challenges to urban fire services. Therefore the primary aim of I-Zone planning is to provide critical information to firefighters in relation to the risk in these bushland urban interface communities.

The generic information contained in each I-Zone Plan includes the following:

1. aerial view of target area;
2. roads (primary and secondary);
3. fuel sources;
4. hydrants;
5. static Water Supplies; and
6. property boundaries

Additional information that is sourced by the NSW Fire Brigades Bushland Urban Interface Officers in cooperation with local fire crews include:

1. divisional and Sector boundaries;
2. safe refuge areas;
3. helicopter landing points;
4. assembly/Staging areas; and
5. areas of High Medium and Low Risk.

Point 5 above refers to the identification of areas of high risk etc. The author has modified the Californian Risk Assessment Matrix (RAM), developed by Battalion Chiefs Mike Rohde (Orange County Fire Authority) and Bill Clayton (CDFF San Diego) for use in I-Zone planning. This RAM was developed by the military for use by military personnel when deployed into unfamiliar territory. The RAM provides a quick visual display of the risk to firefighter safety at a specific geographical location. This type of system is invaluable when fast briefings are required for field operations.

The below sample I-Zone Plan illustrates the volume of information available on these documents and the value of this information to fire ground commanders. The plans are available in hardcopy to Station Commanders for their local area. Higher command ranks within the organisation will also have both micro and macro plans available as incidents develop exponentially.

Conclusion

The NSW Fire Brigades I-Zone planning system represents a sophisticated, integrated approach to managing or mitigating the effects of bushland urban interface emergencies on communities within a specific geographical location i.e. the Bushland Urban Interface. The I-Zone Planning system is a winner of the Emergency Management Australia Safer Communities Award for Pre-Disaster Planning, 2007. The system continues to be developed and improved for the benefit of at risk communities and fire services alike. Importantly, I-Zone planning is a very useful tool to educate communities in these high risk bushland urban interface communities. The NSW Fire Brigades is making this planning tool available to the volunteers in their Community Fire Unit Program.

Image 6. NSW Fire Brigades I-Zone Plan – Macro. The map shows the South Katoomba area west of Sydney. Note the areas denoted as high risk in red are largely found on the urban fuel edge.
NSWFB Bushland Urban Interface Section.

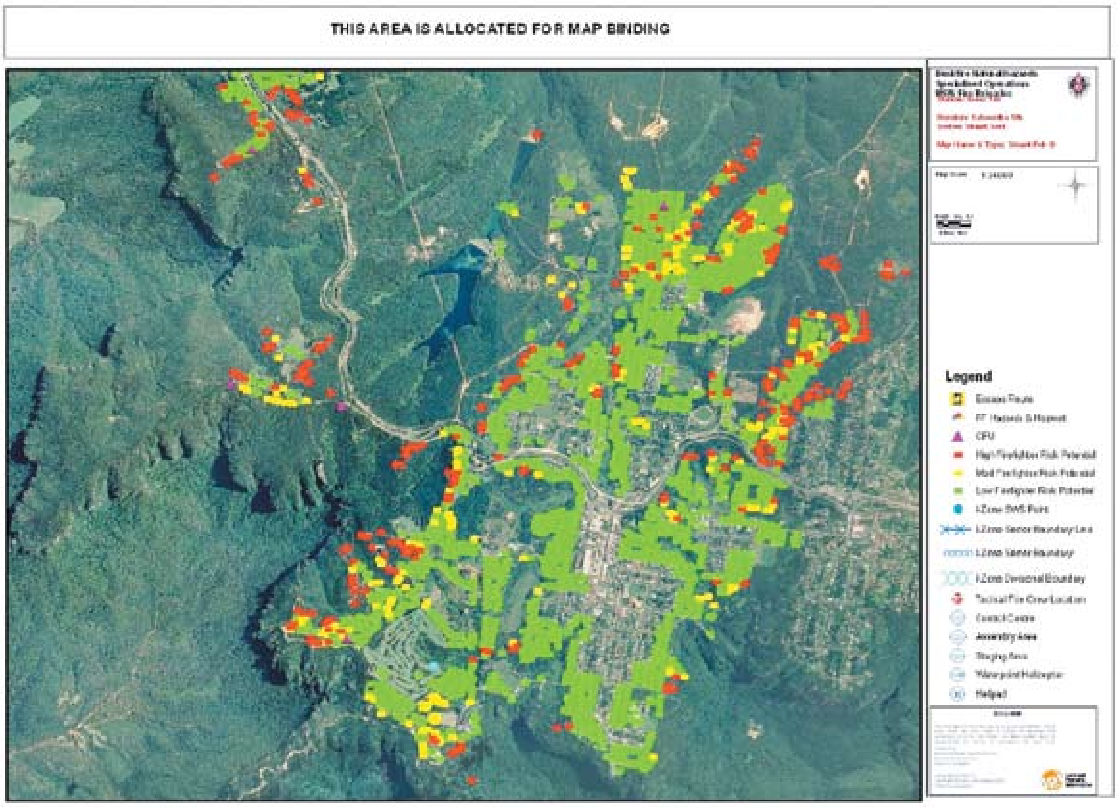
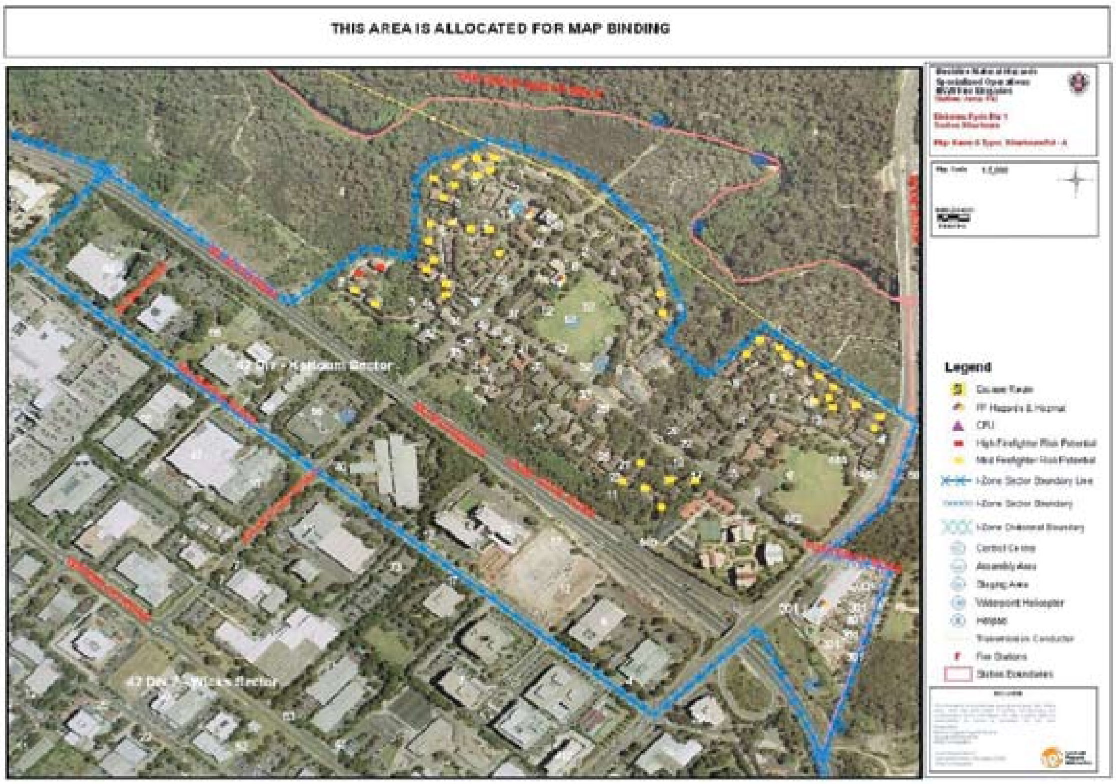


Image 7. I-Zone Plan – A Decision support tool. The legend on the right hand side provides key information for operational decision making.
NSWFB Bushland Urban Interface Section.



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The Wildfire Project: An integrated spatial application to protect Victoria's assets from wildfire

Flett, Hine and Stephens describe the Victorian Identification and Consequence Evaluation (Wildfire) Project that draws upon statewide data sets to support integrated fire management planning.

Abstract

This paper provides an overview of the Wildfire Project undertaken by Victoria's Office of the Emergency Services Commissioner (OESC) in collaboration with Spatial Vision Innovations Pty Ltd, the Country Fire Authority (CFA), the Department of Sustainability and Environment (DSE) and the Municipal Association of Victoria (MAV).

The Wildfire Project provides an opportunity to bring together the best quality statewide datasets to identify, classify, quantify and value the state's economic, environmental and social assets to assist fire management planners to enhance their capability to plan for, respond to and recover from wildfire, using a standard set of online statewide spatial information products.

Introduction

Geographic information systems (GIS) play a major role in emergency management, by providing the capability to rapidly gather and summarise data about geographic features and locations. By combining spatial data with asset related information in a modern, service-oriented architecture, a particularly powerful geospatial solution can be created—one that provides shared understanding and enables decision-makers across a range of stakeholders to make better-informed decisions (IBM, 2007).

The Wildfire Project products will enable fire management planners to view assets in a geospatial context, so they can more easily visualise the spatial relationships between managed assets and other mapped features around them, enabling levels of awareness and insight not provided by figures in tables. Consolidation of a wide range of asset-related data will support both GIS specialists and non-GIS users in their decision-making. Duplication of data will be avoided via this unified view of asset and geospatial data.

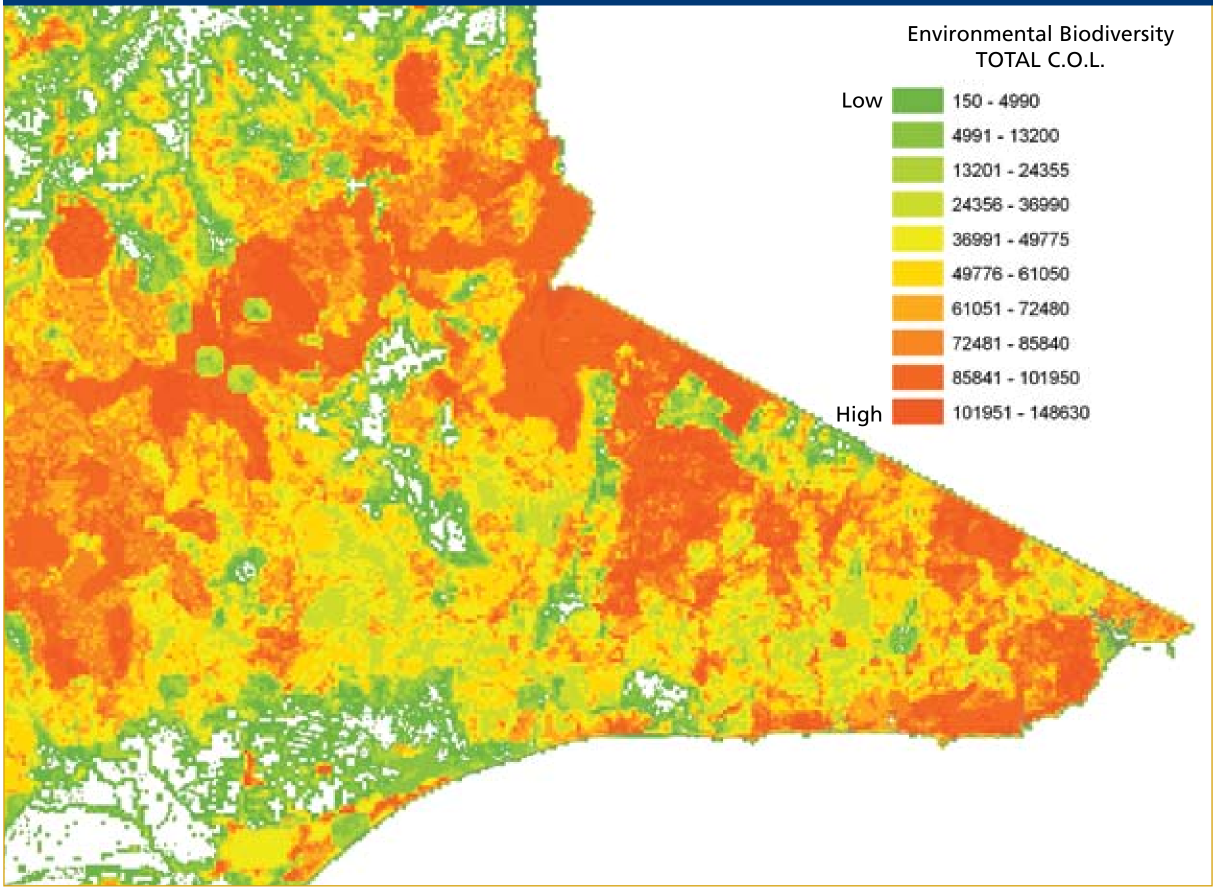
Improving our knowledge of where assets are located improves and supports integrated strategic planning and decision-making. Visualisation through mapping enables planners to view and understand the landscape more holistically. Maps provide an intuitive, visual framework, allowing people to conceptualise and understand the environment, and make more informed and considered decisions regarding wildfire risk (IBM, 2007). Figure 1 provides an example of the spatial representation of the Wildfire Project consequence of loss in relation to environmental biodiversity assets.

Context of Wildfire Project

Emergency services have long been recognised for their ability to respond to rapid impact events that threaten human safety, often under extreme circumstances. The traditional approach is to deliver action based treatments, what Crondstedt (2002) describes as a focus on hazard rather than vulnerability. Salter (1998) identified the emergence of a shift in emergency management from the traditional internal agency (response) focus to a community centred (risk management) focus. He described this as the emergency management community reinventing itself, to better meet the needs of communities. In Salter's view, such a paradigm shift would be evidenced by focusing on vulnerability via proactive multidisciplinary approaches in collaboration with communities. This trend has also been identified by Gabriel (2002) which he described as reconceptualising emergency management.

The emergency riskscape is changing and there is an increasing expectation that emergency managers are preparing for the impacts of urbanisation, climate change, pandemics, terrorism and energy, fuel and water security. Such preparedness requires much more than the traditional focus on competent rapid response. Success will ultimately depend upon long term integrated community planning (Handmer & Dovers, 2008). Ten years after Salter published his observations, emergency management in Victoria still has some way to go in developing the integrated, community based strategic planning capability to adequately fulfil this essential future requirement.

Figure1. Spatial Representation of consequence of loss in relation to environmental biodiversity assets.



The Victorian Department of Justice's strategic priorities include a commitment to developing an integrated long term strategic plan for the state's emergency services sector. The Future Horizons Discussion Paper (OESC, 2007) identifies a certain lack of imagination in emergency management planning, which has traditionally been based upon historical events. The paper indicates that such an approach is inadequate for future challenges and proposes a new approach based upon the following layers of thinking:

- strategic: There is significant potential within Victoria's emergency management arrangements to adopt sector-wide, whole of government approaches across a range of strategic outcomes. The main constraints to this are the complexity of the existing administrative arrangements and the lack of capacity to initiate change within these;
- imaginative: The need to anticipate previously unanticipated hazards has been underscored by the emergency management experience of the past decade;
- flexible: Changing scenarios and threats will continue to demand a more flexible approach within the sector to delivering outcomes. Some of the traditional constraints may demand to be revisited; and
- community-focused: The need to engage the community across a range of outcomes in emergency management – including service delivery – will continue to inform all processes within the sector.

The Wildfire Project is a practical step down the path of this new approach. The project is part of Victoria's fire safety strategy, Fire Safety Victoria (FSV) which provides the framework for a whole of government approach to fire safety. It is based upon comprehensive triple bottom line considerations that incorporate local knowledge and adopts a risk management approach to improving local planning and coordination. The strategy's objectives are based around community engagement and understanding (OESC, 2006).

Wildfire planning

The role wildfire plays on public land is complex. As well as being a potential seasonal threat to life and property, fire also plays an integral role in the maintenance of much of Victoria's environmental biodiversity. Considerable work is required to improve understanding of wildfire and develop integrated approaches which can be applied uniformly across the state.

Planning for the management of wildfire involves an analysis of wildfire risk. The Wildfire Project develops approaches, principles and tools (in the form of both spatial and aspatial data) to develop a shared statewide understanding of the consequences of wildfire in relation to assets. It does not produce a range of products encompassing the full risk management spectrum, but rather focuses on the 'consequence' as opposed to the likelihood characteristic of the risk management equation.

To assess vulnerable elements within communities effectively, planners need to understand the community and the assets potentially at risk from the impact of wildfire. Commonly a subjective approach, it is predominantly focussed on the elements of 'life and property' which is not sufficiently comprehensive to ensure that communities are well prepared and resilient.

How can we understand what the consequences would be in terms of economic, environmental and social impacts to local communities and in fact, Victoria as a whole? Without fully understanding these triple bottom line consequences, how can we effectively plan asset protection regimes based upon identified vulnerability rather than potential hazards?

The Wildfire Project aims to establish an evidence-based product to support a consistent statewide approach to wildfire planning and decision-making. It enables the consequences of wildfire on assets to be classified, quantified and mapped in a uniform way across the state, meeting the needs of a range of stakeholders involved in wildfire planning, irrespective of organisational or geographical boundaries.

Project scope

In Victoria, responsibility for wildfire planning and response correlates to public (DSE/Parks Victoria), private; and CFA and Metropolitan Fire and Emergency Services Board (MFESB) land boundaries. The interests of people living in wildfire prone areas of Victoria can be assessed in the context of the economic, environmental and social wellbeing on both public and private land. The need to develop integrated management approaches across administrative, organisational and land tenure boundaries, is increasingly recognised.

The Wildfire Project was developed with two primary objectives:

- *to develop a methodology that identifies, classifies, quantifies, evaluates and summarises the consequences of wildfire on assets throughout Victoria; and*
- *to develop statewide wildfire consequence maps and datasets derived from existing primary source datasets, presented in a uniform and accessible format that supports integrated wildfire planning and decision making across DSE, CFA and Local Government.*

The Wildfire Project is 'tenure blind' and makes no distinction between public and private land in wildfire planning. It has developed integrated spatial products that identify assets at risk from wildfire on both public and private land and attempts to demonstrate the significance of the consequence of asset loss on both.

The project focuses on community assets that are typically static - those that do not alter frequently. The products can be used not just for wildfire, but applied to a range of emergencies such as floods, major landslides or earthquakes.

Methodology framework

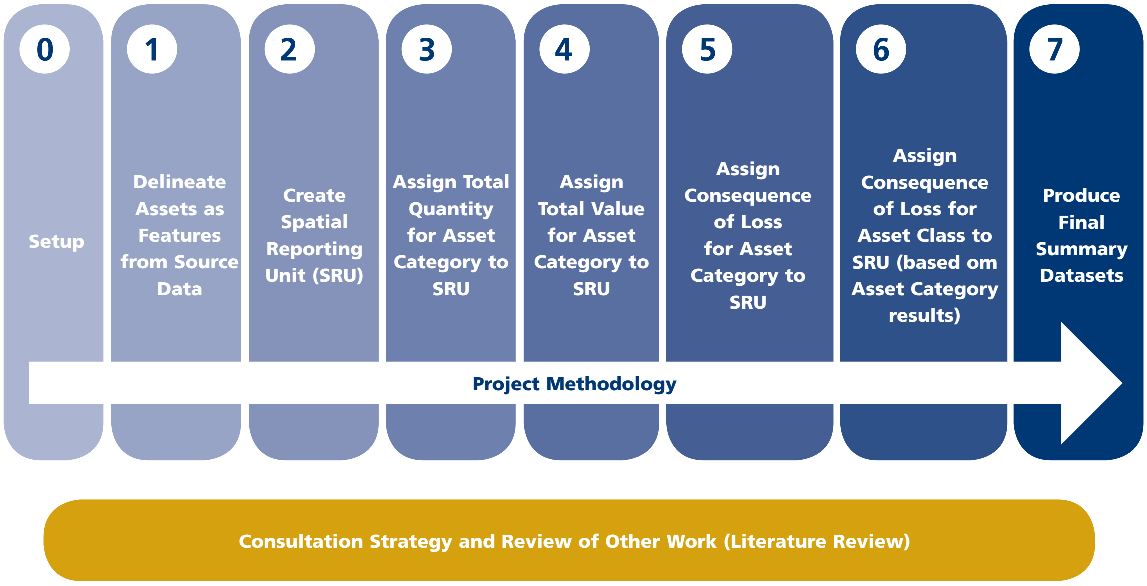
OESC engaged geospatial and information technology company, Spatial Vision and its team comprising Beca, RMIT Centre for Risk & Community Safety and Ecology Australia, to undertake the project and develop the project methodology.

To provide a robust framework for the methodology, a process logic was developed for the methodology. In its simplest form, this involved:

- identifying and defining the assets - identifying existing, suitable spatial datasets that describe the asset;
- obtaining and incorporating the primary (source) spatial dataset(s) and supporting classification schema to represent the asset, into the methodology;
- assigning the primary spatial dataset (in which the asset is represented as a point, line, or area) to a 'reporting unit' (where the "amount" of the asset within the reporting unit is used to determine the quantity of the asset);
- translating the asset quantities into an asset value for each 'reporting unit';
- translating the asset value into an asset consequence of loss rating for the loss of the asset, or loss of the function the asset provides; and
- aggregating the Asset Category results for each Asset Class.

Seven key stages underpin the methodology and the approach to assessing the consequence of losing assets from a wildfire event, as shown in Figure 2.

Figure 2. Diagrammatic representation of the key steps in identifying, classifying and quantifying assets at risk from wildfire, and evaluating the consequences of their loss by wildfire.



Classification of assets

To classify the diverse range of assets, a three tier hierarchy was applied comprising asset groups, classes and categories.

Asset Groups: Three groups represent the contextual or thematic levels of environmental, economic and social. This comprises a triple bottom line approach in accordance with Government policy.

Asset Classes: Ten classes represent the level at which asset categories are summarised and reported on for the purposes of key project outputs. Eight of the ten classes have been applied as insufficient relevant data is currently available for two of the classes.

Asset Categories: 173 categories represent the level at which assets are defined for the purpose of assigning values, measures of disruption, and consequence of loss. They represent the lowest level of asset classification. This level of asset classification is required to accommodate the varied representations of assets in existing spatial datasets and to be able to classify types of assets (for example power stations of a certain size, or roads of a certain type).

A breakdown of the 173 Asset Categories implemented on the basis of the eight Asset Classes for which a consequence of loss rating was assigned, is presented in Table 1.

Table 1. Representation of the asset classification system.

Asset group (TBL Theme)	Asset Class	Number of Asset Categories
Environmental	Biodiversity	29
	Land	NIL
	Water	2
	Air	NIL
Economic	Economic production	24
	Infrastructure	37
	Property	19
Social	Cultural Heritage	12
	Social Infrastructure	40
	Human Life	10
Total		173

Many spatial datasets have an existing classification schema or attributes on which a classification of the asset types can be made. For example, many environmental assets are classified by a conservation rating, while for infrastructure the asset category may be based on physical parameters, like road surface, school or hospital type. Other assets may have a value related to production capacity (for example, agricultural capacity or power station capacity), which may be used as the basis for grouping assets for the purpose of assigning asset value. Other assets (for example land value, or gross timber value produced) have a dollar value that can be used to group assets.

Reporting construct

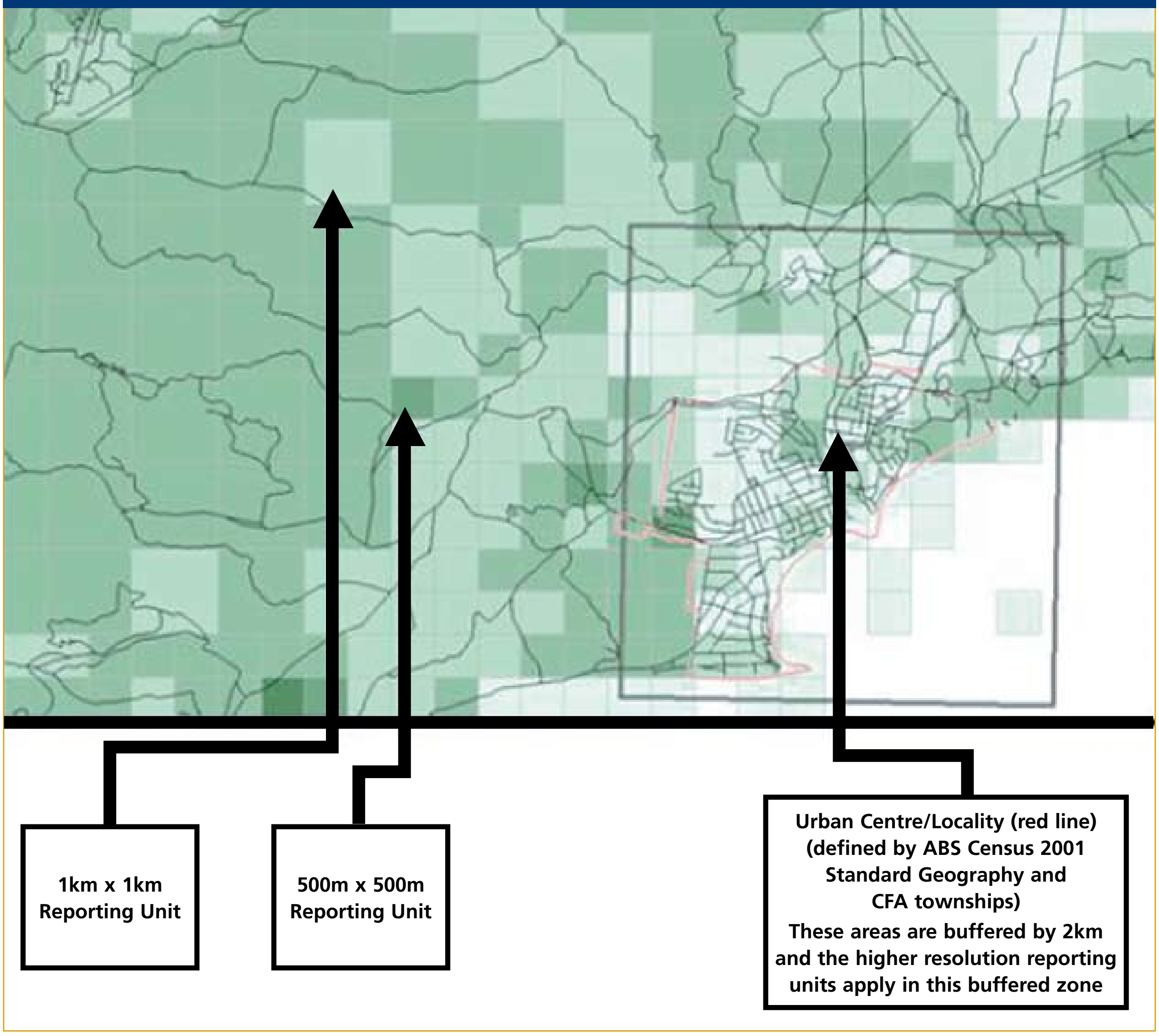
A key requirement of the project was to provide a tool for planners that take a large number of assets represented in a variety of ways (as spatial datasets) and create an informative and focused summary.

This is achieved by aggregating the assigned consequence of loss for individual assets on an area-based reporting unit. This can be thought of as the "reporting" resolution of the database containing asset information in summary form. The spatial reporting unit enables the aggregation of summary information related to a diverse range of physical features represented as lines, points and areas.

This approach provides planners with a concise summary of the consequences of asset loss in any particular area of interest. A key issue in deciding the appropriate resolution for the reporting unit is identifying at what resolution the information 'adds value' from a strategic perspective.

A reporting unit of 1km by 1km is adopted for the State and a reporting unit of 500m by 500m was adopted for towns and urban areas as represented in Figure 3. Spatially, this is represented by statewide grids for each asset class.

Figure 3. An example area of the statewide multi-resolution reporting unit template dataset.



Valuing assets

All assets are valued from a statewide perspective and in a strategic planning context. It was determined that assigning a 'relative value' to the assets was the most appropriate approach to valuing the assets. Understandably, there are many complexities involved in valuing all assets with an 'absolute' dollar value, particularly with respect to the environmental and social groups.

Environmental assets incorporate a number of statewide datasets that apply existing classification systems. Independent valuations are not readily available for assets. To overcome this, all assets for a particular Asset Category are assigned a relative statewide value between 1 and 100, where 1 is assigned to the asset type of least value and 100 to the asset type of most value.

Using biodiversity assets as an example, the value of 100 may be assigned to those assets of greatest value from a statewide viewpoint. For this project every hectare of old-growth forest is assigned a value of 100 and every rare and threatened species site a value of 100 per count (or site). In the case of native vegetation that has no conservation status rating, a value of 25 is assigned, based on it having a lower value. A cleared area may be assigned a value of 0 in relation to its contribution to biodiversity.

Consequence of loss

Consequence of asset loss is represented spatially using a colour ramp to indicate the level of consequence. The methodology assigns the consequence of loss to an Asset Category (for example, power stations of a certain size, or roads of a certain type). The underlying premise is that the consequence of loss of an asset is a combination of the damage to the asset and the potential disruption (or flow on effect) that occurs as a result of losing the function or service provided by the asset.

Consequence of loss is calculated as follows:

Consequence of Loss = DAMAGE + DISRUPTION

Where:

DAMAGE = total loss of asset value (based on replacement value and/or intrinsic value); and

DISRUPTION = impact from the loss of an asset (based on the loss of a function and/or service provided by the asset across disruption elements).

Although the two components are generally seen as closely related, in a wildfire context, they can be independent of each other. In the project methodology, it is assumed that the components are independent - for example, a power station or road may not be damaged by a wildfire, but the function or service it provides may be significantly disrupted by such an event.

Disruption

Disruption impacts arising from the loss of the service or function provided by an asset are often significantly greater than the replacement or intrinsic value of the asset itself. The approach taken in classifying assets accounts for this issue. Hence, the classification of power stations, or hospitals, or agricultural production capacity, for example, should include consideration of the level of disruption that their loss, or loss of service and/or function will cause, and not just their value.

In many cases, the classification of assets is not suitable for rating local disruption impacts such as in the case of certain roads. For example, a single road to an isolated township will have the same road type classification as many other roads in the state with the same basic parameters (sealed, single lane, major road). However, the disruption impacts caused if this only form of access was severely damaged or closed as a result of fire, would be significant to the community.

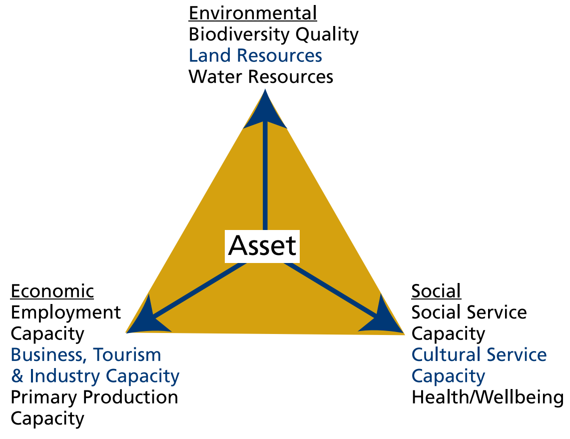
This is an example of where the classification available for statewide spatial data cannot always be used to assign meaningful disruption element ratings from a local perspective. It illustrates the limitations of what can be undertaken centrally through the Wildfire Project, and what must be undertaken at a regional or local level through the provision of local user interaction and the incorporation of local knowledge.

Disruption elements

Disruption is 'measured' using a set of elements that describe a range of disruptive impacts that can occur due to the loss of an asset type. Those that are relevant to an asset category are used in assigning a disruption rating or measure.

Nine disruption elements are identified and used in the methodology (Figure 4). The use of disruption elements allows the potential multiplicity of flow-on impacts associated with the loss of an asset to be clearly identified. It also provides planners with useful information on the drivers for the consequence of loss associated with particular asset types; and thereby it assists in planning treatments to minimise that consequence.

Figure 4. Disruption Elements (that relate to the loss of service or function of an asset), grouped on the basis of Asset Groups.



Project trial and delivery

The Wildfire Project underwent an evaluation trial by field users who applied the project methodology and spatial products in a number of areas throughout Victoria. This involved a range of agencies and local government areas across Victoria. Participants were able to share their experiences in using the outputs of the project.

The trial sought to validate and further refine the methodology and products. The methodology and format of the outputs delivered have been reviewed based on the feedback and key refinements implemented into the development of an application to make the final project outputs available to stakeholders.

To deliver the Wildfire Project outputs, OESC has partnered with the Cooperative Research Centre for Spatial Information (CRC SI) and other organisations in the National Data Grid (NDG) Project. The NDG project is a data access and modelling support tool being undertaken by the CRC SI as a research project. The NDG Project will provide a platform for updating, hosting and providing interactive access to identified use cases. A delivery application for the Wildfire Project will be developed as part of the NDG project.

Conclusion

In the planning context, the Wildfire Project will enable fire management planners to make shared decisions with the community - people who have not traditionally had a say in the decision making – people who are not necessarily fire or GIS specialists.

The ability to factor in local community knowledge is an important and unique feature of the project. This is important not only in appropriately determining likelihood, but also in considering the impact of disruption downstream. Disruption can only be realistically understood with the benefit of local knowledge. This approach empowers communities in this important decision making process.

The application of products from the Wildfire Project will enable a comprehensive, evidence based assessment of identified assets and the consequence of their loss resulting from wildfire. The Wildfire Project application will enable fire management planners to make better decisions about risk priorities in their planning and response strategies when facing wildfire threat.

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Taking a risk-based approach for landslide planning: An outline of the New Zealand landslide guidelines

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In December 2007, GNS Science released the publication 'Guidelines for assessing planning policy and consent requirements for landslide prone land' (Saunders & Glassey, 2007). Primarily for land use planners, the guidelines provide non-prescriptive guidance on how the landslide hazard can be incorporated into risk-based planning policy and consent requirements. Use of the guidelines is not a regulatory requirement, but is recommended as good, evidence-based practice.

The guidelines propose a risk-based approach to land use planning and consenting, based on the Australian/New Zealand Risk Management Standard AS/NZS 4360:2004. This approach considers landslide recurrence interval, and a Building Importance Category of the building proposed for a site. This approach does not guarantee that a building will not suffer damage from a landslide, but it does establish if the risk of damage is sufficiently low to be generally accepted.

This paper is based on four planning principles:
1) gather accurate landslide hazard information;
2) plan to avoid landslide hazards before development and subdivision occurs;
3) take a risk-based approach in areas already developed or subdivided; and
4) communicate the risk of landslides in built-up areas.

This paper provides an overview of this risk management process presented in the guidelines, and how it can be utilised by land use planners, based on the above four overarching planning principles.

The landslide risk management process

Where a level of landslide risk has been identified, there are a number of options available to manage that risk, including:

- **ignore the risk** - generally not considered as an appropriate option;
- **mitigate the risk –** undertake engineering works to reduce the likelihood of failure, and/or the consequences of failure;
- **accept the risk –** if the risk is accepted, emergency plans should be made to manage the consequences of an event and/or any residual risk;
- **avoid the risk –** avoid putting life and property at risk by not placing either in the risk situation; and
- **transfer the risk –** insure against any risk, however the intrinsic value of life and treasures can not be compensated by insuring against the risk. This is not generally an option where a landslide could result in loss of life.

Natural processes, as well as human activities, affect the stability of slopes and formation of landslides. Both natural processes and the effects of development on slope instability must be understood when assessing landslide risk. It is critical for a planner to appreciate these issues early in the planning process to enable them to decide whether the risk posed by the natural hazard is acceptable, treatable, or unacceptable, and therefore whether a development should proceed as planned. Mitigation strategies can often be designed to reduce risk from landslides but in some cases this might not be possible. The risk-based planning approach, adapted from the AS/NZS Risk Management Standard 4360:2004 (summarised in Figure 1), involves risk analysis, risk assessment and risk treatment, and is discussed in the following sections.

Past planning and development decisions have not always taken this risk-based approach. The risk-based approach recognises that a different planning approach is needed for an area that has not been developed (i.e. a greenfield site) and for an area that has been developed or subdivided, or where there exists an expectation to build. Each local authority will need to determine the definition of a greenfield site for their own city/district. It may be an area where there is currently no expectation to build (e.g. no zoning for intensive development), or it may be an undeveloped area of certain defined size (e.g. < 20 acres).

Figure 1. Risk-based planning approach (modified after AS/NZS Risk Management Standard 4360:2004).

RISK ANALYSIS

Step One: Identify landslides in your district or region

Where are the landslides in the district or region?

Step Two: Identify the nature of the landslide hazard

What is the likelihood of a landslide in the district? *(landslide AEP)*

What is the nature of the landslide? *(type, size, mechanism, complexity)*

Step Three: Identify the consequences of the landslide hazard

What are the elements at risk at the proposed development site? *(people/assets)*

What is the construction type? *(building importance category)*

Step Four: Estimate the risk to a subdivision or development

Likelihood of a Hazard x Consequences?

RISK EVALUATION

Step Five: Assess and evaluate the level of the risk to a subdivision or development

How does the risk compare with other hazards?

Is the risk acceptable?

Are there alternatives or options?

RISK TREATMENT

Step Six: Treat the risk

What action should be taken to avoid or mitigate the risk within the landslide hazard areas?

Regulatory planning methods

Non-regulatory methods

Limiting the risk posed by the building

Step Seven: Monitor and review

Are our outcomes being achieved?

Is new information available?

Does the district plan need to be updated?

Risk analysis

Risk analysis involves acquiring information on landslide hazards, as well as considering any consequences if people and property are affected by landslides. Firstly, a thorough assessment of the types, characteristics and frequency of landslides in the area of interest should be carried out as part of the hazard identification. Secondly, a consequence analysis establishes the elements at risk (people/property/assets).

Elements at risk

Different levels of landslide risk can be acceptable, depending on the consequences of a landslide occurring at a particular site. For example, the overtopping of a dam by a wave caused by a landslide may have significantly greater consequences than a minor landslide affecting a single dwelling. However, in any one year, a small landslide is far more likely to occur than a large landslide into a lake.

Table 1. Building Importance Categories: a modified version of New Zealand Loading Standard classifications (AS/NZS 1170.0.2002).

Building Importance Category (BIC)	Description	Examples
1	Low consequence for loss of human life, or small or moderate economic, social, or environmental consequence.	Structures with a total floor area of less than 30m^2 Farm buildings, isolated structures, towers in rural situations Fences, masts, walls, in-ground swimming pools
2a	Medium consequence for loss of human life, or considerable economic, social, or environmental consequences	Timber framed single-storey dwellings
2b	(As above)	Timber framed houses of plan area more than 300m^2 Houses outside the scope of NZS3604 "Timber Framed Buildings" Multi-occupancy residential, commercial (including shops), industrial, office and retailing buildings designed to accommodate less than 5,000 people and also those less than 10,000m^2 gross area. Public assembly buildings, theatres and cinemas of less than 1000m^2 Car parking buildings
3	High consequence for loss of human life, or very great economic, social, or environmental consequences (affecting crowds)	Emergency medical and other emergency facilities not designated as post disaster facilities Buildings where more than 300 people can congregate in one area Buildings and facilities with primary school, secondary school or day care facilities with capacity greater than 250 Buildings and facilities with capacity greater than 500 for colleges or adult education facilities Health care facilities with a capacity of 50 or more residents but not having surgery or emergency treatment facilities Airport terminals, principal railway stations, with a capacity of more than 250 people Any occupancy with an occupancy load greater than 5,000 Power generating facilities, water treatment and waste water treatment facilities and other public utilities not included in Building Importance Category (BIC) 4 Buildings and facilities not included in BIC 4 containing hazardous materials capable of causing hazardous conditions that do not extend beyond the property boundaries
4	High consequence for loss of human life, or very great economic, social, or environmental consequences (post disaster functions)	Buildings and facilities designated as essential facilities Buildings and facilities with special post-disaster function Medical emergency or surgical facilities Emergency service facilities such as fire, police stations and emergency vehicle garages Utilities required as backup for buildings and facilities of importance level 4 Designated emergency shelters Designated emergency centres and ancillary facilities Buildings and facilities containing hazardous materials capable of causing hazardous conditions that extend beyond the property boundaries
5	Circumstances where reliability must be set on a case by case basis	Large dams, extreme hazard facilities

To classify building elements at risk, a Building Importance Category (BIC) can be used, although it is recognised that there are other approaches to classifying elements at risk. An example of the use of BICs are the Australia/New Zealand Standard for Structural Design Actions, Part 0 General Principles (AS/NZS 1170.0:2002). The BIC indicates the relative importance of a building, or proposed building, where an identified landslide hazard exists. Different risk levels for building damage (collapse, burial, etc.) would need to be determined according to the building type, use and occupancy, and the size and type of landslide that could affect the site.

This classification does not cover roads, bridges and other developments that do not necessarily involve buildings, but such elements could be included, based on importance of the road or land being developed. The BIC does not directly classify people within the elements at risk, but does recognise that certain types of buildings have different numbers of people or vulnerability (e.g. many children in schools, and many infirm people in hospitals and care facilities).

Measures of consequence

The consequences of a landslide are commonly described in terms of the cost of damage, and the numbers of deaths and injuries (casualties). The Australian Geomechanics Society (AGS) landslide risk method defines measures of consequence to property (depending on the damage to a building) using terms such as: insignificant, minor, medium, major and catastrophic. The AS/NZS Loadings Standards 1170:2002 defines building damage in terms of serviceability (serviceability limit state) and life safety (ultimate limit state).

Irrespective of the measure of consequence used, the design life of the building, infrastructure or development must be taken into account when assessing the risk. AS/NZS 1170.0:2002 considers the expected lifetimes of various classes of buildings. Most common buildings of BIC 2 and 3 (see Table 1) have an expected lifetime of 50 years. The probability of landslides causing irreparable damage to a building, or threat to life, should be within acceptable limits. Riddolls and Grocott (1999) provide guidance on risk to life from landslide, but acceptability of risk is subjective and varies from person to person, and from organisation to organisation.

Risk estimation

A landslide hazard may be assessed as “extreme”, but if there are no vulnerable elements then there are no consequences, and therefore no or minimal risk. Landslide risk analysis is an iterative process, whereby initially a broad appreciation of the hazard and the resulting consequences is developed (i.e. risk = hazard x consequence (or vulnerability)). This will assist in determining which aspects need more in-depth investigation.

In determining the landslide hazard, the magnitude (size) and frequency of past events, along with the probability of possible triggering events should be considered. The probability of triggering events, such as rainfall and earthquake shaking, are assessed separately. The likely soil moisture conditions also need to be considered.

Annual Exceedance Probabilities (AEPs) are suggested for design landslide hazard events for various building classes, as per AS/NZS 1170.0:2002, to assess the risk. This defines design events in terms of the Ultimate Limit State (the design event where the structure will fail),

Table 2. Annual probability of exceedance for Building Importance Categories for a 50 year design life based on AS/NZS 1170.0:2002.

Building Importance class	Annual probability of exceedance for ultimate limit state	Annual probability of exceedance for serviceability limit state
1	1/100	-
2	1/500	1/25
3	1/1000	1/25
4	1/2500	1/500
5	Determined on a case-by-case basis	

Note: AEP = 1/average return period (years) and the Serviceability Limit State, where the structure can continue to be used following the event. For a design working life of 50 years the following AEP would apply for BIC 1 to 4 as per Table 2.

The assumptions and uncertainties associated with the probability should be clearly stated. Probabilities are usually based on long-term averages of known landslide events and potentially triggering events, but can also consider changes in preparatory factors. For any landslide hazard assessment the following should be defined to qualify the limitations of the assessment:

- the extent of the site and its features;
- geological and historical evidence of landsliding at the site and within the general area;
- geographic limits of the processes that may affect the site;
- the type of analysis carried out;
- the basis for the hazard assessment; and
- the numerical uncertainty in the probability assessment (if this can be determined with any confidence).

Risk assessment

Risk assessment involves evaluating risks, making judgements on the acceptability of the risks and evaluating remedial options and mitigation measures. Such assessments depend on the hazard and consequences of the landslide event being considered, the societal acceptance of certain risk levels and the uncertainty of the hazard assessment. This is where policy decision-makers overlap with geological and geotechnical professionals in making decisions about acceptable risk and appropriate development options.

In assessing the landslide hazard and risk, a local authority should also take account of:

- community values and expectations (what the community wants and what it does not want);
- which areas of the district are, or are likely to be, under pressure for development;
- what infrastructure already exists near a landslide hazard (buildings, network utilities etc.) and the value of that infrastructure;
- what level of risk the community is prepared to accept or not accept (in practice, it is easier to define what the community will not accept using community reactions to past events as a guide); and
- consideration of the feasibility (effectiveness versus cost) of possible engineering solutions or other risk reducing mitigation works.

Landslide risk assessment requires an understanding of the likely consequences of different types of landslide events, such as injury or loss of life and damage to property and investment. It also requires consideration of the cost of clean-up, or repair or replacement of damaged property and services after the event. Riddolls and Grocott (1999), describe a methodology for quantitative risk assessment for determining slope stability risk in the building industry aimed at New Zealand geotechnical practitioners. However, there is also a need to consider the geotechnical risks in the current framework of New Zealand legislation and accepted codes of engineering practice. For example, it is ineffective to design a building to withstand earthquake ground shaking of 1/500 AEP if the land on which it is to be built is in the likely path of a large, possibly rainfall-induced landslide with a higher AEP.

Planners should take opportunities to plan to avoid landslide hazards before development and subdivisions are approved. However, in areas already developed or subdivided, approval for development at a location deemed to have a landslide hazard involves evaluating the risk of landslide, alongside the level of risk the community is prepared to accept.

Taking a risk-based approach to resource consents

Determining consent categories

The Resource Management Act 1991 (RMA) is the principal environmental legislation in New Zealand, and provides for the classification of land use activities as permitted, controlled, restricted discretionary, discretionary, and non-complying. The status of a resource consent determines those matters the local authority can consider when deciding on an application and the conditions that may be imposed. Different types of buildings can be placed into different resource consent activity categories, based upon the level of landslide risk.

Table 3 provides an example of one way that different consent status could be applied to activities in areas where landslide hazard has been identified. The BIC has been used as the key activity category, and the AEP as the trigger for a resource consent status. This table is presented as a guide only, and may require refinement as it is applied and tested. The table can only be a guide if sufficient information to define the AEP is available.

Table 3. Recommended resource-consent activity status for proposed land-use based on the probability of land slippage, falling debris or subsidence[1] causing severe building damage or life-safety risk at a specific site, based on proposed uses for buildings of different importance categories as outlined in Table 4.1.

Range of annual exceedence probability[2] (AEP)	<1/24	1/25—1/99	1/100—1/499	1/500—1/999	1/1000—1/2499	>1/2500
Qualitative acceptability of risk	Never acceptable	Seldom acceptable	Sometimes acceptable	Generally acceptable	Seldom unacceptable	Always acceptable
Building importance category (BIC)	Recommended activity consent status[3] based on proposed use and probability of severe damage or life-safety risk from the hazards of landslip, falling debris or subsidence as defined in the RMA					
BIC 1 Low consequences (temporary or uninhabited buildings)	Non-compliant	Discretionary	Permitted	Permitted	Permitted	Permitted
BIC 2 Medium consequences (normal occupancy)	Non-compliant	Non-compliant	Discretionary	Permitted	Permitted	Permitted
BIC 3 High consequences (crowds affected)	Non-compliant	Non-compliant	Non-compliant	Discretionary	Discretionary	Permitted
BIC 4 High consequences (post-disaster functions)	Non-compliant	Non-compliant	Non-compliant	Non-compliant	Discretionary	Permitted
BIC 5[3] Structures of special importance	Non-compliant	Non-compliant	Non-compliant	Discretionary (special studies)	Discretionary (special studies)	Discretionary (special studies)

1. Annual exceedence probability is 1/(return period in years).
2. Well engineered mitigation works may be used to reduce the probability of damage or life-safety risk to acceptable levels on some otherwise "non-compliant" or "discretionary" sites. This should be taken into consideration when preparing the application for consent, with an assessment of residual risk.
3. BIC 5 buildings are those where the consequences of loss or damage can be expected to have regional or national impact. As such they should be subjected to special consideration and are expected to be subjected to special studies and specific planning restraints. The term 'Special Studies' is used in the New Zealand Loading Standard classifications (AS/NZS 1170.0.2002), and requires justifying any departure from the Standard, or for determining information not covered by the Standard.

The consent categories have been determined using the annual exceedance probability for ultimate limit state as shown in Table 2. The stated AEP for ultimate limit state is deemed to be the point at which the local authority should exercise some control over the activity. At this point the activity requires resource consent to allow the local authority to assess the risk and potential effects of the activity on the hazard. For higher AEPs (i.e. more likely) the local authority should exercise greater control. This allows the local authority to decline an application where either the risk or the potential effects of the hazard are significant. This approach recognises that up until the AEP for the ultimate limit state is reached (lower risk), it is appropriate that the activity is permitted.

The BIC categories in Table 3 are directly applicable to the construction or alteration of structures, but the table can also be applied to the subdivision and earthworks associated with such developments. Where subdivision or earthworks are required for residential structures, then the BIC 2 consent categories can be applied; where earthworks are proposed for a dam, then the BIC 5 consent categories are relevant; and so forth. Similarly, the categories could be applied during the rezoning of land for particular purposes.

While it takes time and resources to undertake a plan change to incorporate these planning principles into an existing operative plan, principles from the guidelines can be integrated into existing internal council planning processes. For example, as a result of the guidelines, the Hutt City Council based in Lower Hutt has stated:

'Council now has a geotechnical engineer which we refer applications to where planners have concerns about slope stability. This engineer peer reviews the application and advises as to whether further information is required, whether the proposed stability measures are acceptable and provides suggested conditions of consent. This has turned out to be very successful with several applications having fundamental changes to their design as a result of his comments. Other changes which have been implemented include the development of checklists to help new planners as well as ongoing education from our geotechnical engineer who gives seminars on relevant stability matters (i.e. what is a geotechnical engineer and when should we request a geotechnical report etc …)'. (Beban, pers com, 28 November 2008).

Second generation planning offers the best time to incorporate the principles of the guidelines into planning policy. In New Zealand, second generation planning processes are underway in many districts, and provides an opportunity for these principles to be included, or to strengthen existing policies which may be in place.

Conclusion

This paper is based on the guidelines by Saunders & Glassey (2007), and has provided an overview of the risk management process used in the guidelines. The guidelines are based on four overarching planning principles: 1) gather accurate hazard information; 2) plan to avoid hazards before development and subdivision occurs; 3) take a risk-based approach in areas likely to be developed or subdivided; and 4) communicate the risk of hazards.

Risk analysis involves assessing the hazard as well as considering the consequences if people and property are affected by these hazards. To classify building elements at risk, a Building Importance Category (BIC) is used. Risk assessment involves evaluating risks, making judgements on the acceptability of the risks and evaluating remedial options and mitigation measures. Such assessments depend on the hazards and the risk posed by them and societal acceptance of certain risk levels. Risk assessment can then be linked to land use development applications and used in determining the resource consent categories and conditions.

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Wendy Saunders is a full member of the New Zealand Planning Institute. Wendy recently won the Zonta/Building Research Award for PhD study, where she is researching innovative land use planning for natural hazard risk reduction.

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Landslide risk management for Australia

Andrew Leventhal and Geoff Withycombe overview Australia's world-class landslide risk management guidelines.

Abstract

The Australian Geomechanics Society published a suite of guidelines in 2007 that are recognised nationally and internationally as world-leading practice. The three documents are supplemented by two commentaries to collectively provide advice to the Australian public, government regulators responsible for the management of landslide risk, and geotechnical practitioners who conduct assessments of landslide risk. As a consequence, these contribute to safer communities and therefore a reduction in the costs of disasters.

This paper discusses the development of the guidelines and their applications in land use planning, risk assessment, risk management and the transfer of knowledge to practitioners, regulators and the broader Australian public. The paper also provides a brief overview of the status of Landslide Risk Management in Australia.

The Landslide Zoning guideline for land use planning has been the template for an international version which was published in late 2008 jointly by the three international technical societies representing geomechanics interests worldwide.

Introduction

The application of Landslide Risk Management in Australia has advanced in several significant ways over the last two and a half decades and is now embedded in regulation in New South Wales and Victoria in a number of Local Government Areas (these particular areas being where residential development is susceptible to landslides) and State Government instrumentalities in each state.

Background to landslide activities

The Australian Geomechanics Society (AGS) (Walker et al., 1985) introduced the concept of risk into hillside residential development. Indeed, it is fair to say that this was the introduction of the concept of risk into the residential development (through the building approval process) within Australia. Pleasingly, it was rapidly accepted and adopted by Local Government Areas within critical metropolitan areas of Sydney and Melbourne.

Fell (1995) presented a keynote address on the style, mechanics and distribution of landslides within southeastern Australia. Excluding mining activity, he concluded that: most landslides in Australia are in soil and weathered rock reflecting the deeply weathered profile over much of the country; most landsliding is restricted to a few geological environments; the vast majority of sliding is reactivation of existing natural instability; many soils are fissured, and shear strengths between residual and fully softened are appropriate; many sedimentary rock and tertiary sediment slides occur where low residual strength soils and rocks are present; much instability is rainfall related, and landslide activity has increased through clearing of vegetation.

Cyclic weather patterns can produce much of the landslide activity. For example, principally as a result of a La Nina-driven extended period of rainfall, from 1988 to 1990 widespread instability affected significant lengths of the Main Northern Rail Line and over 100 sites on the South Coast Rail Line in NSW - these latter requiring closure of the Line in 1989 to affect treatment of landslide issues. In addition, precedent rainfall of 0.5m to 0.6m depths over periods of 3 to 6 months have been recognised by many researchers and practitioners as triggers for deep-seated landsliding, particularly in the NSW coastal Illawarra region, and presumably similarly elsewhere throughout the nation. On the other hand, short intense rainfall events tend to produce surface erosion and debris flow landslides, as was the case in Wollongong in 1998.

In terms of awareness, most of the Australian populace would be familiar with the landslide in the Kosciusko ski resort village of Thredbo in 1997 that demolished two accommodation lodges and resulted in the death of 18 people. The landslide involved the rapid collapse of a fill embankment that had previously supported the Alpine Way above the village. The fatalities were the subject of a Coronial Inquiry (Hand, 2000) who determined that the failure was intimately linked to saturation of the failed mass through rupture of a water supply pipeline.

Photo courtesy of NSW Police.

This landslide of 30 July 1997 at Thredbo claimed 18 lives as a consequence of the destruction of two ski lodges by a failure of the road embankment fill of the Alipne Way.

In 2000, the AGS published a technical paper on landslide risk management concepts and guidelines (AGS, 2000). Since it had been recognized that the 1985 advice (Walker et al., 1985) had become outdated through improvements within the practice of risk assessment and risk management, both within Australia and internationally. Updated advice to geotechnical practitioners and regulators was provided in AGS (2000). Within his determination of the Thredbo Inquiry, Coroner Hand (*ibid*) recommended "that the Building Code of Australia and any local code dealing with planning, development and building approval procedures, be reviewed and, if necessary, amended to include directions which require relevant consent authorities to take into account and to consider the application of proper hillside building practices and geotechnical considerations when assessing and planning urban communities in hillside environments". He further recommended that "AGS (2000) be taken into account in undertaking this exercise".

An outline of the framework for landslide risk management process is provided in Figure 1.

Most landslide risk assessments for domestic development could be conducted then in accordance with the principles and guidelines within AGS (2000). Such assessments were frequently performed as qualitative assessments for risk to property, with a quantitative (or perhaps more correctly, semi-quantitative) assessment of risk to life. Some Local Government Councils operate with acceptable risk levels of "Moderate" for property and 1×10^{-5} per annum (alternatively, using scientific notation, as 1E-5pa) for risk to life within the domestic development setting, whilst others set acceptable risk levels of "Low" or "Very Low" for property and 1E-6pa for risk to life.

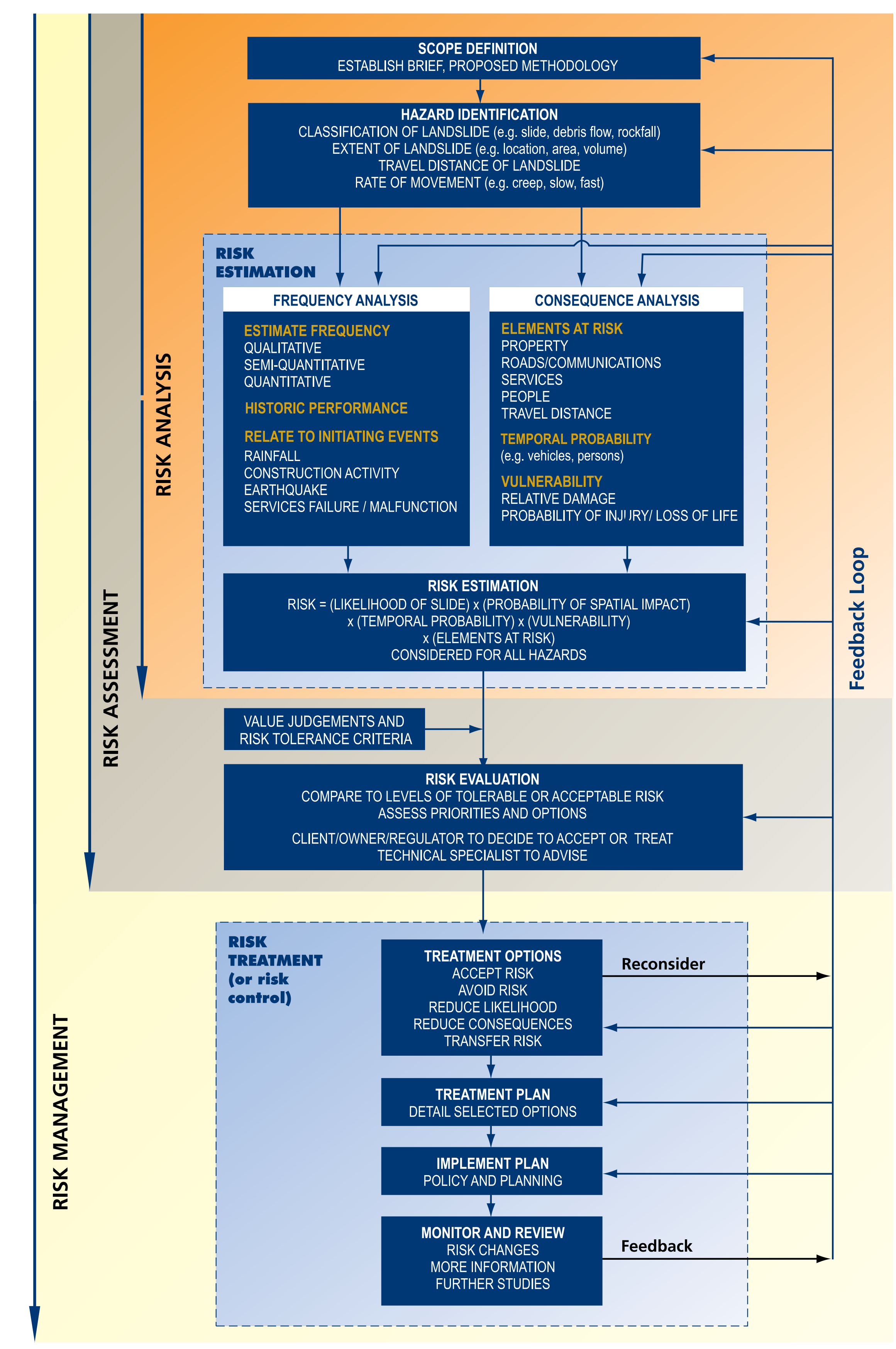
AGS (2000) has been integrated within planning instruments by Local Government Areas such as: Pittwater Council (in the northern beaches area of metropolitan Sydney), Wollongong City Council (in the Illawarra area on the south coast of NSW), Shire of Yarra Ranges (outer metropolitan Melbourne in Victoria); Colac-Otway (in rural Victoria); and State Government instrumentalities such as the NSW Dept of Planning for Kosciuszko National Park (which covers the alpine ski resorts of New South Wales – including Thredbo) and the Victorian Alpine Resorts.

A discussion of the status of adoption of Landslide Risk Management around the Australian Governments is provided within the appendix of Leventhal & Kotze (2008). Therein, it is noted that:

(a) Nationally. For residential development, the Building Code of Australia requires every site to be classified in accordance with AS2870, which is an Australian Standard that deals with the identification and management of reactive clays – not landslide risk. AS2870 permits classification of a site as Class P for circumstances not covered by identified reactive clay scenarios. Such Class P situations, whilst perhaps mainly intended for sites with a significant presence of fill or soft soils, could also include landslide hazard and/or landslide risk. This classification to cover the presence of landslide hazard, however, is perhaps relatively tenuous, and to the authors' knowledge has not been tested.

The guideline for landslide hazards (ABCB, 2006), developed by AGS for the Australian Building Codes Board (ABCB), is a companion document to the Building Code of Australia and has introduced the concept of risk management for landslide issues. Currently, this guideline is an advisory (rather than mandatory) document.

Figure 1. Landslide Risk Assessment and Management. Flowchart demonstrating the Landslide Risk Management Process.



(b) The regulations for each State and Territory are quite varied, few recognise the issue of Landslide Risk Management and there is intermittent reference only to AGS (2000).

Quantitative landslide risk assessments have been conducted for particular major infrastructure projects - such as the Bethungra Spiral on the Main Southern Rail Line between Sydney and Melbourne (Moon et al. 1996) and for Lawrence Hargrave Drive (Wilson et al., 2005). The scale of the projects has permitted undertaking of these quantitative studies. A study by MacGregor et al. (2007) provided data to assist performance of quantitative assessments at a domestic residential development scale for geomorphic settings comparable to Pittwater Local Government Area.

In 1998, a major storm event led to 140 separate landslide events (fortunately with no attributed fatalities) throughout the Illawarra Region on the South Coast of NSW - i.e. within the Local Government Area of Wollongong City Council. The commendable actions during this emergency were recognised by an award from Emergency Management Australia. An outcome of the actions undertaken during the event was the development of a Landslide Action Plan (Wollongong City Council, 1999).

Key Points:

- The Thredbo landslide, with its unfortunate loss of life, led to a wide appreciation throughout Australia of the hazards to both life and property posed by landslides.
- Regulators were put on notice by the Coroner of the Thredbo landslide of the desirability to include assessment of landslide hazards in the building development process in hillside areas prone to instability.
- Tools such as the guidelines produced by the Australian Geomechanics Society exist to assist regulators and practitioners in this process.

Landslide risk management guidelines and commentaries

The development of three guidelines and their commentaries was funded under the 2004-2005 funding round of the National Disaster Mitigation Program. The application was sponsored by the Sydney Coastal Councils Group. The outcomes were three guidelines and two commentaries on Landslide Risk Management (See Table 1).

Table 1: List of guidelines and commentaries in Australian Geomechanics V42(1).

Guideline Title	Abbreviated Title	Reference	Intended Users
"Guideline for landslide susceptibility, hazard and risk zoning for land use planning", Australian Geomechanics, Vol 42 No 1, March 2007.	Landslide Zoning Guideline	AGS (2007a)	Regulators, Geotechnical Practitioners
"Commentary on guideline for landslide susceptibility, hazard and risk zoning for land use planning", Australian Geomechanics, Vol 42 No 1, March 2007.	Commentary on Landslide Zoning Guideline	AGS (2007b)	As above
"Practice Note guidelines for landslide risk management", Australian Geomechanics, Vol 42 No 1, March 2007.	Practice Note 2007	AGS (2007c)	Geotechnical Practitioners, Regulators
"Commentary on Practice Note guidelines for landslide risk management', Australian Geomechanics, Vol 42 No 1, March 2007.	Practice Note Commentary	AGS (2007d)	As above
"Australian GeoGuides for slope management and maintenance", Australian Geomechanics, Vol 42 No 1, March 2007.	Australian GeoGuides	AGS (2007e).	General Public, Regulators, Geotechnical Practitioners

The Australian Geomechanics Journal.

Copies of the guidelines and commentaries are available for download from the Australian Geomechanics Society's website: www.australiangeomechanics.org [from the home page use the link "Download the Landslide Risk Management documents", and then download from AGS (2007)]. Note that copies of AGS (2000) are also downloadable from the same webpage.

The **Landslide Zoning Guideline** provides guidance in the methods of Landslide Zoning to government regulators (officers of local government and state government instrumentalities) and geotechnical practitioners. Such characterisation contributes to the planning process in areas of landslide hazard. The associated **Commentary** provides background to the guideline.

The **Practice Note Guideline** and **Commentary** provide guidance both to practitioners in the performance of project specific landslide risk assessment and management, and also to government officers in interpretation of the reports they receive. The Practice Note can be used an external reference document for legislative requirements and supersedes the recognised industry "standard" on Landslide Risk Management in Australia – AGS (2000). AGS (2000) remains as a complementary commentary and reference document. The Practice Note provides a means for uniformity in the quality of assessment and reporting and, as such, will promote confidence in the planning and risk management process regarding landslide hazards.

The Practice Note provides:

i. a revised risk to property matrix to address shortcomings identified in usage – see Appendices B, C and D herein;

ii. recommendation for the adoption of criteria for tolerable risk to life;

iii. the introduction of Importance Levels and linked criteria for tolerable risk to property – see Appendices A and C herein;

iv. the introduction of a suite of model sign-off forms, linked to recommendations from risk assessments, to improve the linkages between assessment, design and construction. This provides a management tool in the Landslide Risk Management process;

v. further explanation of the risk equation and method of calculation, together with further examples and references; and

vi. guidance on the contents of a Landslide Risk Management report.

The **Australian GeoGuides** for slope management and maintenance provide owners, occupiers and the broader public with guidance on management and maintenance of properties subject to landslide hazard.

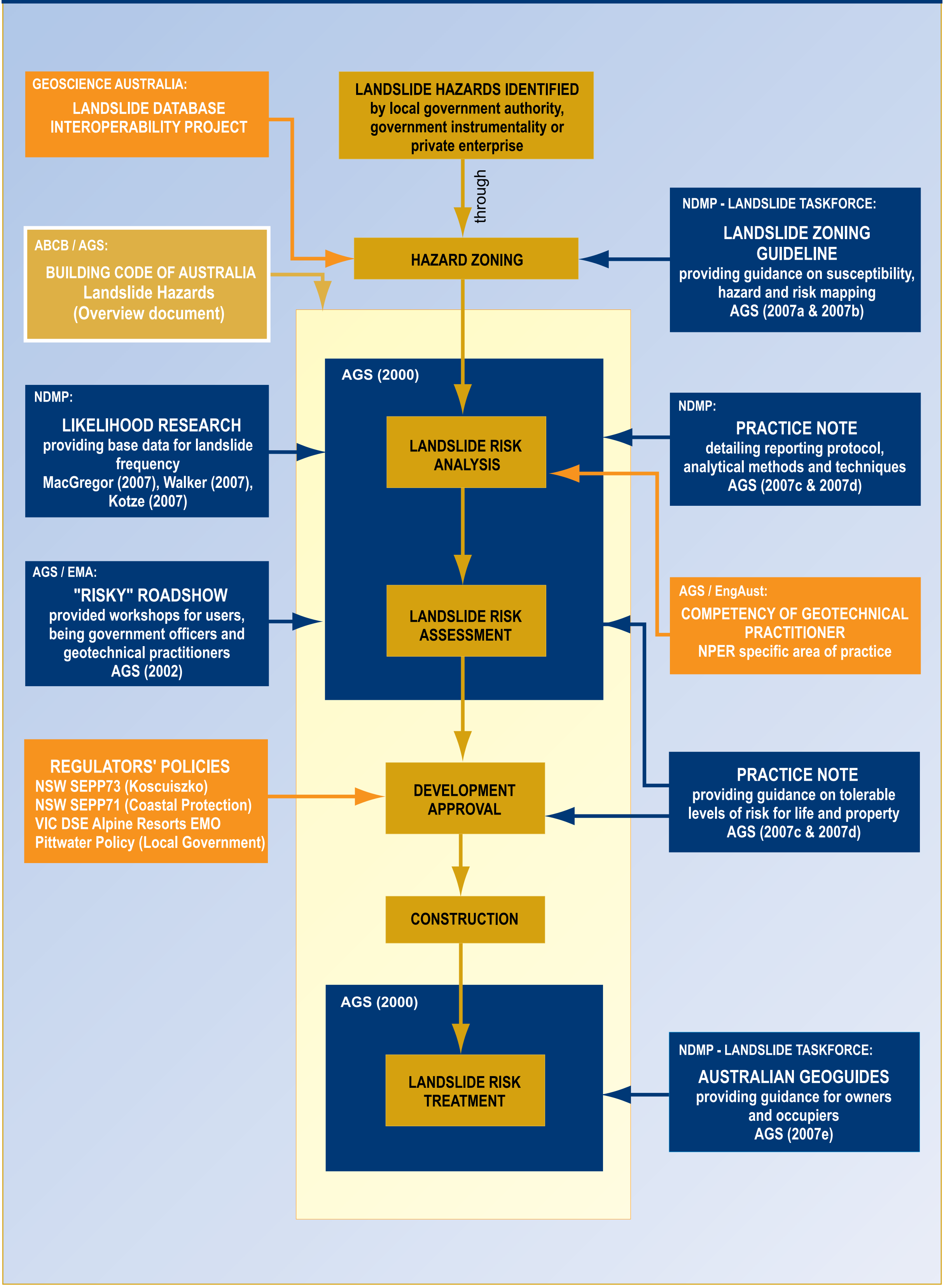
Project Outcomes

The suite of guidelines and the Australian GeoGuides benefit the general community and Local Government regulators through achieving safer, more sustainable, communities in relation to their exposure to landslide risk. The guidelines also reduce risk to the community through improved planning and slope management practices – key requisites of the Natural Disaster Mitigation Program funding. These guidelines link with the risk management practices presented in AGS (2000) [as enhanced by the Practice Note], and the Building Code of Australia Guideline (ABCB, 2006).

This suite of aforementioned guidelines contributes significantly to completion of the Landslide Risk Management framework for Australia described in Leventhal (2007) and Leventhal et al. (2007). A diagram depicting the Landslide Risk Management framework, and the manner that the suite of project outcomes interacts with the framework is provided at Figure 2. A project sheet that briefly explains this National Disaster Mitigation Program-funded project and its outcomes is available from the Sydney Coastal Councils Group.

As part of an undertaking to notify relevant parties of the outcomes of the project, CD ROMs containing copies of the guidelines and commentaries were distributed to each Local Government Council throughout Australia.

Figure 2. Development of systematic and defensible landslide risk management process.



It is noted that the use of Importance Levels, as defined in the Building Code of Australia, has enabled a move from strictly residential domestic development to a wider range of structures - e.g. from buildings which need to withstand a rapid onset natural emergency (such as cyclone shelters) to those that do not (perhaps such as farmyard structures). An explanation of Importance Levels and a copy of the discussion contained within the Practice Note Commentary (AGS 2007d) are provided herein in Appendix A.

Target risk levels

Philosophically, there are a number of parties involved in setting acceptable or tolerable risk levels – namely: the owner of the property in question; the occupier of the property; members of the public that may be impacted in the event of a landslide; and the regulator responsible for approval of the development. Pragmatically, however, the regulator is the party who must determine the risk levels given its responsibility to manage hazards at the local community level. In most instances, that will be the Council of a Local Government Area or a State instrumentality.

In AGS (2007c & 2007d), adoption of *tolerable risk* criteria was recommended.

The AGS suggests that for most development in existing urban areas criteria based on Tolerable Risks levels are applicable because of the trade-off between the risks, the benefits of development and the cost of risk mitigation. Tolerable risk levels for property are one class higher than provided in Appendix C (e.g. *Moderate* where *Low* is acceptable). Consideration should be given by regulators to adopting Tolerable risk to property for *Existing Slope* and *Existing Development* situations in a similar vein to the recommended differentiation for risk to life. The recommended *Tolerable loss of life* risk values for the person *most at risk* for different situations are shown in Table 1 of the Practice Note (and are included in Appendix D herein).

It is recommended in AGS (2007d) that risks be assessed only for the *person most at risk*, and not for the *average person* as suggested in AGS (2000). ANCOLD (2003) reported that the *person most at risk* is always controlled, and that *average risks* were difficult to define and determine.

The recommended values are higher for *existing slopes* than for *new slopes*. This is in keeping with ANCOLD (2003) and general literature on risk tolerability which indicates that persons tolerate risks from existing hazards more than for newly constructed ones. Where development modifies an existing slope, the *new slope* criteria should be applied in accordance with the definitions given for the situation in Table 1 of the Practice Note.

Regulators may decide to apply *acceptable risk* criteria for high consequence cases, such as schools, hospitals and emergency services in recognition of the importance of these structures and as a way of covering societal risk concerns. This is also reflected in the recommended criteria for property loss for different Importance Levels of structures.

The community may tolerate higher risks from natural hazards than man-made hazards (IUGS 1997).
Such a consideration by the regulator may result in some natural hazards being tolerated in the face of exceptional expenditure to reduce the risk to tolerable levels.
An example of this may be the risks associated with boulder falls from natural cliff lines in a bush reserve adjacent to existing residential development.
If the regulator and potentially affected owners were not aware of the circumstances, then prior to the landslide risk assessment they would have been *uninformed*. Adoption of such tolerable risks should be made on the basis of an appropriate landslide risk assessment and appraisal of the risk mitigation options.

It is recognised in AGS (2007d) that the recommended criteria are higher than required by NSW Department of Planning (2002). However, those criteria apply to development such as chemical plants which can be sited in locations where the low risks can be achieved. Urban development is within designated areas, the land owner has no option but to develop at the nominated site (if practical) so the trade-off between risk levels, cost of development and risk mitigation have to be considered. This is a similar situation to dams and is part of the reason ANCOLD have adopted tolerable risk criteria.

Societal Risk may be measured against the ANCOLD (2003) recommended values as given in Figure 4 of Leroi et al. (2005). Reference should be made to ANCOLD (2003) when carrying out such assessments.

International activities

The Landslide Zoning guideline and its Commentary provided the template for international versions. Published in the *International Journal of Engineering Geology*, the international guideline and commentary were modified from the AGS version under the aegis of the Joint Technical Committee JTC-1 on Landslides and Engineered Slopes (Fell et al., 2008 & 2008a, on behalf of JTC-1). JTC-1 exists through the collaboration of the three international bodies within the geotechnical arena - the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), the International Society for Rock Mechanics (ISRM) and the International Association of Engineering Geologist (IAEG). The international adoption of the Australian-developed guideline and commentary reflects well upon the pedigree of the documents.

Other current activities in Australia

The Department of Mineral Resources, Tasmania, is one of the few, if not the only, state government instrumentalities in Australia involved in landslide susceptibility mapping on a regional scale (1:25,000). (The mapping program of Wollongong City is a Local Government undertaking). Mineral Resources Tasmania, in its undertaking to provide an assessment of landslide susceptibility of major urban areas, has continued its mapping programme with the publishing of susceptibility mapping for Launceston, which complements earlier work around Hobart. Deterministic GIS modeling techniques were employed to produce predictive susceptibility maps. Mazengarb (2007) reported the status of this work, which aligns with the guideline AGS (2007a). The outcomes are being used by relevant Councils, to identify the need for detailed assessment in response to development applications.

Mapping of landslide susceptibility and hazard mapping has continued within the Wollongong city boundaries through a combination of support from the Wollongong City Council (local government) and university sponsored research. This undertaking previously was also supported by NSW State Government road and rail transport instrumentalities. Flentje (2007) reports trialling an extension of the program into the broader Sydney Basin through the use of GIS methods.

Landslide hazard and susceptibility mapping was completed for Local Government land use planning within Pittwater Council's area of responsibility in the northern beaches area of metropolitan Sydney in 2007 (Leventhal & Kotze, 2007). Landslide likelihood is one of the most important input parameters to Landslide Risk Analysis, and research into this in the Pittwater area was also reported this year (MacGregor et al., 2007). This was supported by the work on rainfall analysis (Walker, 2007) and on recorded rockfall frequency (Kotze, 2007).

Geoscience Australia (2007) undertook an assessment of risk analysis requirements for natural hazards throughout Australia. The study was conducted for the Council of Australian Governments and covers tropical cyclones, flood, severe storm, bushfire, earthquake, tsunami and landslide hazards. As a consequence of the development of the practice of landslide risk management within Australia, a significant contribution was made to the landslide chapter by members of the AGS Landslide Taskforce. The landslide chapter deals with: hazard identification; costs of landslides; potential influence of climate change; roles and responsibilities; and discusses information gaps. The information gaps identified include: the development of landslide inventories (a matter being addressed by Geoscience Australia through its Landslide Inventory Interoperability Project); support for regional susceptibility mapping; and support of the need for systematic and standardized landslide risk assessments throughout the nation (as is now possible through AGS 2007c for example). The "Natural Hazards in Australia" project (Geoscience Australia, *ibid.*) promotes the AGS (2007) suite to government at all levels throughout Australia.

Key Points:

- A framework for landslide risk management which can be adopted throughout Australia has been developed by the Australian Geomechanics Society.
- Regulators such as the Councils of local government areas are the bodies appropriate to manage the landslide risk management process, with policy and resource support from other levels of government.
- The determination of acceptable or tolerable risk to life and risk to property must reside with the regulator, who acts in the best interests of its local community.
- There is an overall national benefit for a universal approach to landslide risk management, thereby providing surety to all those involved in the process that best practice is in operation.

Recognition of the contribution by AGS to landslide risk management

The value of the guidelines to the Australian populace has been recognised by the Civil College of Engineers Australia through the award of the Warren Medal in 2007 to the principal authors of the guidelines. [The Warren Medal is awarded annually by the Civil College of Engineers Australia for the best paper in the discipline of civil engineering.]

In November 2008, the suite of guidelines was recognised with High Commendation in the Australian Safer Communities Awards 2008. These Awards are sponsored by Emergency Management Australia (EMA).

The judges noted that:

> "The award is for a suite of six world-leading papers on landslide risk management published in March 2007 and for the development of a framework for Landslide Risk Management in Australia. The papers are intended to be of value to regulators, geotechnical

practitioners and the general public interested in land use planning. Copies of the papers have been widely distributed to local government authorities and state and territory instrumentalities across the country. The two specific elements of the national disaster mitigation project were Landslide Hazard Zoning and Slope Management. The framework is anticipated to have significant implications for national disaster mitigation, as recognised by state and federal governments."

Key Point:

- The landslide risk management framework and guidelines developed by the Australian Geomechanics Society has been recognised both nationally and internationally as world-leading practice.

Future work

Future tasks include:

(i) Modifications to regulations within existing legislation are required to incorporate the AGS (2007) suite. This will initially involve Pittwater Council, Wollongong City Council, Kosciuszko National Park, Victorian Alpine resorts erosion management plan (under which landslide risk management is covered) and the Shire of Yarra Ranges and Shire of Colac-Otway in Victoria. Both Pittwater and Yarra Ranges are in the process of implementation.

(ii) Formulation of a Development Control Plan-format for the performance of Landslide Risk Management within the building approval process, and particularly for it to be suited to the NSW Planning standard template which is under government consideration.

(iii) Introduction of an Australia-wide / state-wide profroma for conducting Landslide Risk Management for the advantage of both regulators and practitioners, and hence of benefit to the general public. Whilst recognizing that there are landslide hazards of one form or the other in virtually every local government area of Australia, the aim is for one process rather than several hundred variations.

(iv) Continued transfer of information through education empowerment of landslide risk management to regulators and pracftitioners, involving workshops and teaching materials (pending funding).

(v) Developments of landslide inventory, susceptibility and hazard zoning through demonstration projects to determine the viability of these tools to assist regulators (pending funding).

Conclusions

A major initiative completed in 2007 was to develop a suite of guidelines and commentaries (AGS 2007). The generation of these risk management tools provides the means for the understanding and application of landslide risk management throughout the nation for the benefit of the Australia populace.

This paper provides the summary of the state of Landslide Risk Management within Australia.

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Appendix A
IMPORTANCE LEVEL

Extract from Building Code of Australia (as reported in Appendix A of AGS 2007c)

Importance Level – of a building or structure is directly related to the societal requirements for its use, particularly during or following extreme events. The consequences with respect to life safety of the occupants of buildings are indirectly related to the Importance Level, being a result of the societal requirement for the structure rather than the reason per se of the Importance Level.

Importance Level of Structure	Explanation	Examples (Regulatory authorities may designate any structure to any classification type when local conditions make such desirable)
1	Buildings or structures generally presenting a low risk to life and property (including other property).	Farm buildings. Isolated minor storage facilities. Minor temporary facilities. Towers in rural situations.
2	Buildings and structures not covered by Importance Levels 1, 3 or 4.	Low-rise residential construction. Buildings and facilities below the limits set for Importance Level 3.
3	Buildings or structures that as a whole may contain people in crowds, or contents of high value to the community, or that pose hazards to people in crowds.	Buildings and facilities where more than 300 people can congregate in one area. Buildings and facilities with primary school, secondary school or day-care facilities with capacity greater than 250. Buildings and facilities for colleges or adult education facilities with a capacity greater than 500. Health care facilities with a capacity of 50 or more residents but no having surgery or emergency treatment facilities. Jails and detention facilities. Any occupancy with an occupant load greater than 5,000. Power generating facilities, water treatment and waste water treatment facilities, any other public utilities not included in Importance Level 4. Buildings and facilities not included in Importance Level 4 containing hazardous materials capable of causing hazardous conditions that do not extend beyond property boundaries.
4	Buildings or structures that are essential to post-disaster recovery, or with significant post-disaster functions, or that contain hazardous materials.	Buildings and facilities designated as essential facilities. Buildings and facilities with special post-disaster functions. Medical emergency or surgery facilities. Emergency service facilities: fire, rescue, police station and emergency vehicle garages. Utilities required as back-up for buildings and facilities of Importance Level 4. Designated emergency shelters. Designated emergency centres and ancillary facilities. Buildings and facilities containing hazardous (toxic or explosive) materials in sufficient quantities capable of causing hazardous conditions that extend beyond property boundaries.

(from BCA Guidelines)

Appendix B

Extract from AGS (2007c, Appendix C) –
An example of qualitative landslide risk assessment matrix.

See Appendix C of AGS (2007c) for details of the assessment of likelihood and consequence for landslide hazards, together with description of the risk levels.

Qualitative Risk Analysis Matrix – Level of Risk to Property.

LIKELIHOOD			**CONSEQUENCES TO PROPERTY (with indicative approximate cost of proportional damage)**				
DESCRIPTOR		Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A	ALMOST CERTAIN	10^{-1}	VH	VH	VH	H	M or L (5)
B	LIKELY	10^{-2}	VH	VH	H	M	L
C	POSSIBLE	10^{-3}	VH	H	M	M	VL
D	UNLIKELY	10^{-4}	H	M	L	L	VL
E	RARE	10^{-5}	M	L	L	VL	VL
F	BARELY CREDIBLE	10^{-6}	L	VL	VL	VL	VL

Notes:

1. Refer to Appendix C (AGS, 2007c) for examples of qualitative measures of likelihood and consequences which contribute to that table, and descriptions of risk level implications that are outputs of the table.
2. Cell A5 may be subdivided such that a consequence of less than 0.1% is Low Risk.
3. When considering a risk assessment, it must be clearly stated whether it is for existing conditions or with risk control measures (that may not necessarily be implemented at the time of assessment).

Appendix C

Extract from AGS (2007d)

Copy of Table C10 from Commentary to AGS LRM Practice Note 2007

AGS suggested Acceptable Qualitative Risk to Property Criteria.		
Importance Level of Structure (Note 1)	**Suggested Upper Limit of Acceptable Qualitative Risk to Property (Note 2)**	
	Existing Slope (Note 3) / Existing Development (Note 4)	New Constructed Slope (Note 5) / New Development (Note 6) / Existing Landslide (Note 7)
1	Moderate	Moderate
2	Low	Low
3	Low	Low
4	Very Low	Very Low

Notes:

1. Refer to Appendix A, Practice Note (AGS 2007c)
2. Based on Appendix C, Practice Note (AGS 2007c)
3. "Existing Slopes" in this context are slopes that are not part of a recognizable landslide and have demonstrated non-failure performance over at least several seasons or events of extended adverse weather, usually being a period of at least 10 to 20 years.
4. "Existing Development" includes existing structures, and slopes that have been modified by cut and fill, that are not located on or part of a recognizable landslide and have demonstrated non-failure performance over at least several seasons or events of extended adverse weather, usually being a period of at least 10 to 20 years.
5. "New Constructed Slope" includes any change to existing slopes by cut or fill or changes to existing slopes by new stabilisation works (including replacement of existing retaining walls or replacement of existing stabilisation measures, such as rock bolts or catch fences).
6. "New Development" includes any new structure or change to an existing slope or structure. Where changes to an existing structure or slope result in any cut or fill of less than 1.0 m vertical height from the toe to the crest and this change does not increase the risk, then the Existing Slope / Existing Structure criterion may be adopted. Where changes to an existing structure do not increase the building footprint or do not result in an overall change in footing loads, then the Existing Development criterion may be adopted.
7. "Existing Landslides" have been considered likely to require remedial works and hence would become a New Constructed Slope and require the lower risk. Even where remedial works are not required per se, it would be reasonable expectation of the public for a known landslide to be assessed to the lower risk category as a matter of "public safety".

Appendix D

Recommendations for acceptable and tolerable risk in AGS (2007c) and AGS (2007d) for importance Level 2 Structures and for the person-most-at-risk.

Situation	Acceptable Risk		Tolerable Risk	
	Risk to Property	Risk to Life	Risk to Property	Risk to Life
New slopes, new development or existing landslide	LOW or VERY LOW	10^{-6} per annum	MODERATE, LOW or VERY LOW	10^{-5} per annum
Existing slopes or existing development	LOW or VERY LOW	10^{-5} per annum	MODERATE, LOW or VERY LOW	10^{-4} per annum

Note 1: AGS (2007c) Table 1 for risk to life, AGS (2007d) Table C10 for risk to property.

Note 2: For other than single residential dwellings of Importance Level 2, societal risk criteria may apply.

This table combines recommendations from AGS (2007c) and AGS (2007d). The table refers to structures of Importance Level 2 potentially at risk from landslides related to both (i) new slopes or new development and (ii) existing landslides.

Risk values identified as "tolerable" include an implication of an order of magnitude higher risk than an "acceptable" level, this being a trade-off between the risks, the benefits of development and the cost of risk mitigation borne by society.

About the authors

Andrew Leventhal was National Chairman of the Australian Geomechanics Society (AGS) in 2002 & 2003 and is currently responsible to the AGS National Committee for matters associated with landslide risk management. This is in the context of a voluntary position in the professional society. He held the office of President of the Sydney Division of Engineers Australia in 200 & also 2001. He is a Senior Principal Geotechnical Engineer with GHD Geotechnics.

Geoff Withycombe is the Executive Officer of the Sydney Coastal Council Group (SCCG). The Sydney Coastal Councils Group was established in 1989 to promote co-ordination between member councils on environmental and natural resource management issues relating to the sustainable management of the urban coastal environment. The Group consists of 15 councils adjacent to Sydney marine and estuarine environments and associated waterways.

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Bringing information management practices to natural disaster risk reduction

Monica Osuchowski argues that the concepts behind the existing multi-organisational virtual information database on landslides can be applied to the all hazards environment to provide sound hazard knowledge and disaster risk reduction.

Abstract

The important role of information management in improving baseline data for natural hazards has been demonstrated through a collaborative pilot project between Geoscience Australia, Mineral Resources Tasmania and the University of Wollongong. The result is a 'virtual' landslide database that makes full use of diverse data across three levels of government and has enabled landslide data to be collated and accessed from a single source.

Such a system establishes the foundation for a very powerful and coordinated information resource in Australia and provides a suitable basis for greater investment in data collection. This paper highlights the capacity to extend the methodology across all hazards and describes one solution in facilitating a sound knowledge base on natural disasters and disaster risk reduction.

Introduction

It is generally acknowledged that effective disaster risk reduction requires a systematic understanding of the history of natural hazard events. At the core of this lies a fundamental need for data as acknowledged in the Council of Australian Government (COAG) report on natural disasters. The report through Reform Commitment 2 (RC2) called for the establishment of a 'nationally consistent system of data collection, research and analysis to ensure a sound knowledge base on natural disasters and disaster mitigation' (COAG 2004).

Developing consistent data across a single hazard is challenging enough, but developing consistency across a broad range of hazards is significantly more complex. Recent advances in information management methodologies have provided the opportunity to pursue a new approach in data management, which has the capability to meet RC2. The approach utilises interoperability techniques and was successfully tested and implemented in a pilot project to facilitate consistent landslide data.

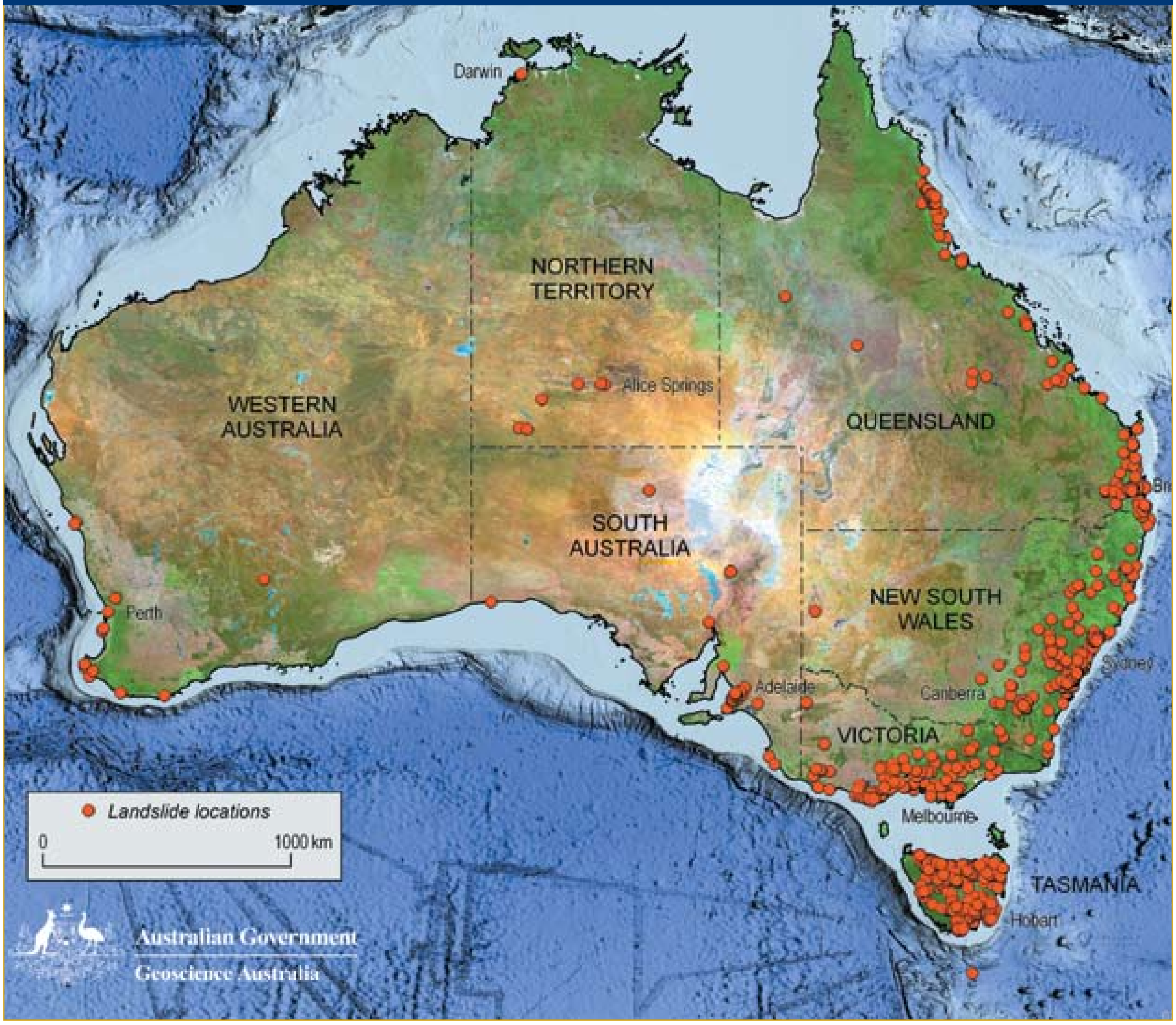
Drivers for coordinated landslide data

Despite the frequent and ongoing occurrence of landslides across the most populated regions of the Australian coastline (Figure 1) the cost of landslides in Australia is unknown. It is believed the annual average cumulative cost may be comparable to other higher profile natural hazards. However, challenges in data collection and the absence of cost measures commonly used for reporting on cyclone, hail or bushfire for example, such as either the amount of insured loss or relief funding, means it is difficult to estimate the cost of landslides. A single landslide event rarely meets the threshold levels required for relief funding, and insurance for landslide damage is not provided. This means costs are absorbed directly by the local government, private home-owners or infrastructure authorities.

Capturing landslide data and making this information available to those who need it was identified as an underpinning requirement in susceptibility, hazard and risk mapping and also for risk analyses, research and land-use decisions (AGS, 2007).

Therefore, improving our collective knowledge of landslides in Australia is essential.

Figure 1. The distribution of landslide events in Australia recorded since 1842.



Challenges in landslide data collection

Landslides are perhaps one of the most difficult hazards in terms of obtaining and collating data due to the localised responsibility of individual impacts. This means there are a wide variety of approaches that individuals use in managing information, and subsequently data generally is:

- widely dispersed;
- in different formats;
- of varying levels of detail;
- difficult to access; or
- not reported.

Implications are that data cannot readily be collated across different sources, compared or aggregated. This presents difficulties to others needing access to information for decision making, such as geotechnical practitioners or other levels of government.

There are two conventional solutions for achieving consistency in data collection:

1. responsibility falls directly to a single organisation; or,
2. responsibility is shared by everyone collecting data to an agreed standard.

However, the challenges in developing consistent landslide data collection using the aforementioned solutions lie within the following:

- while Geoscience Australia (GA) maintains a national landslide database in an internally consistent format, it only captures those events reported in the media. Consequently, the database severely underestimates the true occurrence of landslides and this is shown in Figure 2;
- trying to physically incorporate landslide data from a large number of sources and maintain it in a central database is impractical and resource intensive given the diverse approaches utilised;

- in considering the nature of landslide occurrence and the size of the country, it would be expensive and inefficient for a single agency to collect data in a consistent way that was useful to those needing it across all levels; and
- imposing a standard for a consistent approach among many individuals is also not feasible due to the number of individuals collecting data and because their existing data capture systems meet their needs.

Figure 2. Comparison of the number of landslides available in the national database managed by GA in comparison to the actual number of landslides available at local scale.

Locality	GA database	Local database
Tasmania	69	2074
Wollongong	72	402
Pittwater Council	6	193
TOTAL	147	2669

Our aim

GA's aim, as a technical advisor in the implementation of RC2, was to find a way to achieve national consistency in data collection while acknowledging existing data collection efforts. Due to some of the aforementioned challenges in landslide data capture, it was important to think beyond traditional solutions and consider innovative alternatives. A vision was needed to encapsulate what the most efficient way would be to collect and manage data and what the future of data management might look like.

The vision

An effective way of managing and utilising landslide and other natural hazard datasets across all levels (eg: local, regional and national levels) is embedded in a few simple concepts:

- it should be possible to collect data once and maintain it at the most effective and appropriate level;
- it should be possible to combine spatial information and share it between many users and applications; and
- it should be possible for information at one level to be shared at all levels.

These concepts are analogous to several of the stated visions of the INSPIRE initiative underway in the European Union (INSPIRE, 2008).

A solution

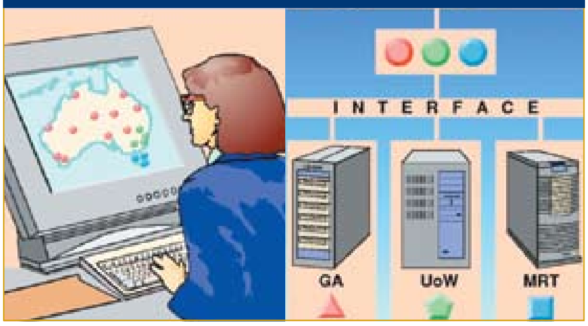
An information management methodology known as "network service-oriented interoperability" was identified by GA as one solution to overcome the challenges described across data capture within the landslide domain.

Interoperability, in the way that GA decided to implement it, acts like an information portal. The idea is that information located in physically separate databases can be viewed through a portal as one consistent virtual dataset. The virtualisation is achieved through the ability to collate and characterise large volumes of information over the internet regardless of how individual database custodians decided to manage and describe their data. It does this through mapping or translating unique data into a common format via a web interface. This interface essentially acts like a buffer between a user searching for data and each database provider, translating information back and forth as required (Figure 3).

Implementing an interoperable approach by using available databases as they means that existing data collection efforts are acknowledged and that full value is made of captured data. It is important to emphasise that database custodians retain complete responsibility for their own data. Each continues to collect, manage and maintain data as they always have, and in which ever way best meets their needs.

This means it is possible to collate a variety of data from different organisations without imposing change on individuals or agencies (i.e. developing consistency using a 'bottom-up' approach). The outcome is that such data not only continues to serve the needs of individual database custodians, but also serves a broader need.

Figure 3. Concept underlying the common interface into one 'virtual' database.



A pilot project

GA worked in partnership with Mineral Resources Tasmania (MRT) and the University of Wollongong (UoW) to demonstrate a way of establishing consistency across national, regional and local scale landslide data and to showcase some of the benefits and functionality of adopting such an approach. This pilot project is referred to as the Landslide Database Interoperability Project (LDIP). Each landslide database forming part of the LDIP contained different amounts of data, expressed details differently and was created in a different format including Oracle (GA), Microsoft Access (MRT) and Microsoft Excel (UoW).

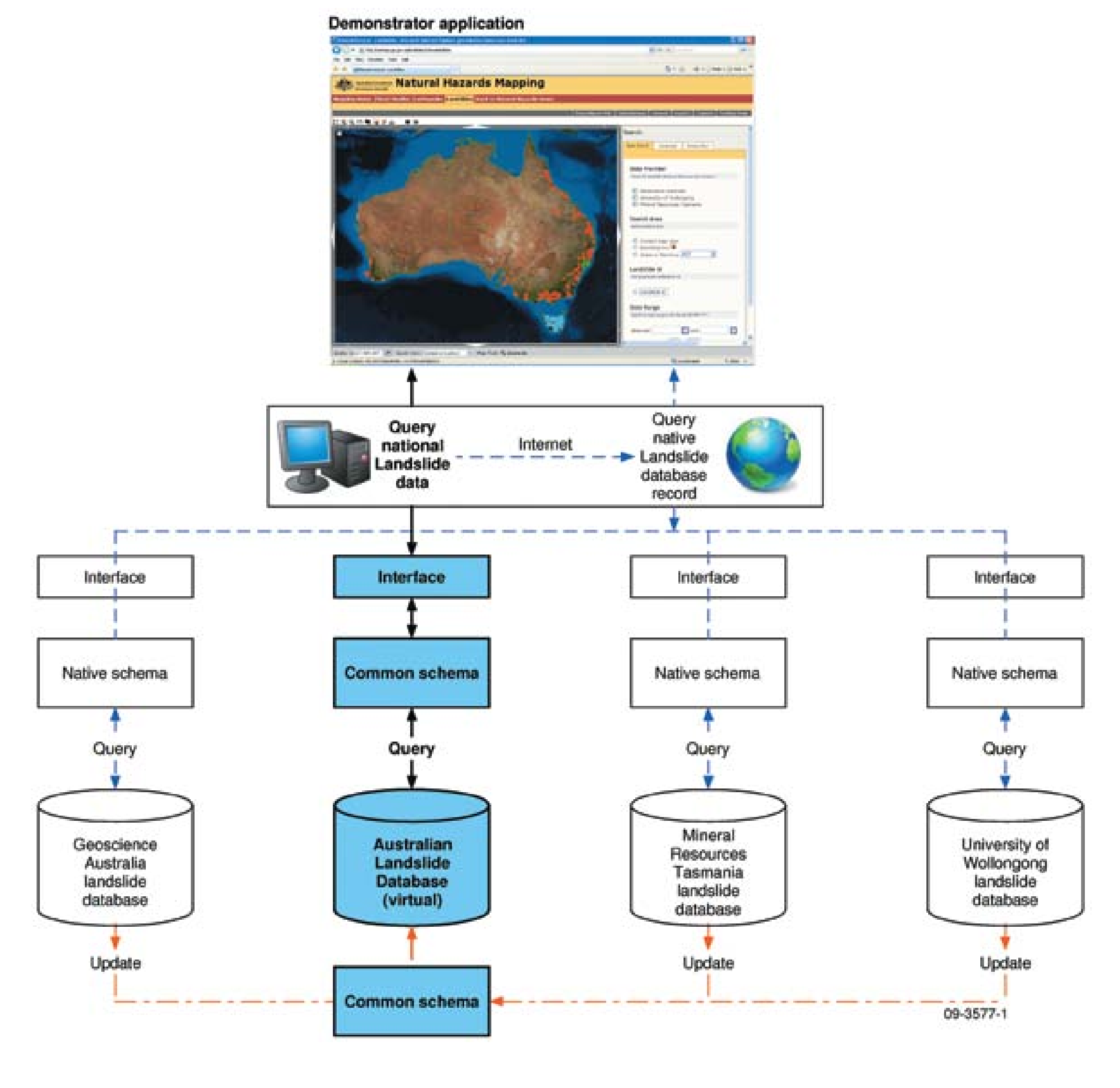
The LDIP sought to gain experience in applying new techniques and ascertaining their effectiveness as a way of potentially meeting RC2 for all hazards. Technical components were developed between Social Change Online, CSIRO and GA's Information Services Branch. The project was explicitly designed to exercise and consolidate an emerging methodology for designing such data services. Therefore, many important aspects required for ongoing sustainable use were beyond the scope of the pilot.

It is important to emphasise that the LDIP does not encompass all of the "data collection, research and analysis" issues which need to be addressed under RC2. However, it provides a simple means to highlight the complexity of data and information management for natural disaster mitigation and provides a new perspective in the way such challenges can be overcome.

Key to an all-hazard approach

The key to the all hazard approach adopted by GA were the strategic decisions to adopt common vocabularies and establish the system upon a common conceptual data model. The significance of how and why these components were established and the importance in relation to extending the approach across a range of natural hazards are the focus here. The project methodology is described in Osuchowski & Atkinson (2008).

Figure 4. A conceptual overview of the interoperable database.



Common vocabularies

An application schema is a set of definitions which describes how data is structured and expressed. It determines how data is related to other domains such as rainfall or geology. It also describes how a user will search and query data, and the way results are presented to them. As such, the schema forms a crucial part of the 'interface' alluded to earlier.

In order to create an application schema for landslides and thereby present diverse landslide data in a consistent way to users, many specific landslide models (or native schemas) needed to be synthesised into one common 'rich' schema (Figure 4).

This synthesis was achieved through reaching agreement within the science community on a set of common vocabularies to describe landslide events. It was necessary to find common ground for describing analogous information. An example can be shown in that all landslide databases typically capture information about the cause of landslides, but each has its own way of describing this (e.g.: rainfall events, precipitation, flood conditions, blocked drainage, fill failure, weak materials, excessive loading). Landslide causes are limited and it is possible to agree on what these causes are. For example we can separate 'cause' into contributing and/or trigger factors, which are either natural or man-made. Natural factors can be broken down into themes like 'ground conditions', 'geomorphological' or 'physical' with a series of terms used to provide more detail within each theme. In many cases where international conventions were available they were adopted more explicitly. Popescu (1994) was adopted to describe the cause of landslides in the landslide application schema. It is important to reiterate here that each database custodian retains own original data descriptions (native schemas) and the common schema referred to here simply is a veneer overlaid upon each database which maps data into the common format via the web.

As part of developing an application schema, it was important to be conscious of the different users of landslide data and the type of information they need, because the way in which information is recorded, has implications for how useful it is to users.

A common conceptual data model

The common vocabularies are a key part of the data model used for the interface. The data model contains the instructions for the transfer and exchange of data. For an all hazards approach, a common conceptual data model and the use of standards were essential. These are what can ultimately enable data to be collated and shared across multiple natural hazard databases in the future.

Consider for example the nature of landslides and landslide investigations. Landslides typically have a strong geospatial component and, as a result, landslide data is often displayed and managed with databases and GIS technology. It is important to realise that these components are not specific to landslide databases, but are also true for other natural hazards, and are in fact also generic with regards to the way any spatial data is captured. Therefore, it is efficient to leverage off international developments in geospatial standards which define how this data is exchanged (Cox & Richard, 2005). By doing this, it provides us with the ability to directly link and incorporate data from related domains as they are developed in future. For example, we could query relationships between landslide data with detailed datasets on earthquake, rainfall, soil, geomorphology and geology, which could further aid more consistent susceptibility, hazard and risk assessments.

In many cases the type of information described or required in landslide inventories is also analogous to information described or required in other natural hazard databases. Consider for example the damage following an event such as number of buildings damaged or destroyed, type of direct or indirect damage, remediation costs, etc. It is important to be able to collate this type of data across all hazards. Therefore, it makes sense for a generic damage/impact model to be developed and applied across all hazards in future. Customisations for specific hazards if they are required could be undertaken from this common point. Adoption of such an approach would allow for information to be easily aggregated across all hazard databases (or all other domains that deal with a component of damage, such as biological or technological hazards).

To reflect such possibilities, the landslide model was developed in 'packages' (a way of compartmentalising information) so that an individual package such as 'damage' for example, can be easily extracted and shared with damage information across other natural hazards.

Therefore, best practices codified by the International Standards Organisation (ISO) and the Open Geospatial Consortium (OGC) were adopted. Further information is available within Osuchowski and Atkinson (2008) and Atkinson et al. (2007).

Process

In order to map content from each database provider to the common schema, we needed to develop a series of rules or commands for the translation of data. This proved to be difficult due to the large number of free text descriptions in the databases. The entire contents of a free-text description needed to be mapped to a single term or number of terms in the interface. The use of free text fields also meant similar information was described differently within a single database. Consider for example: debris flow, debris-flow, debris/earth flow, or complex debris flow-earth slide. Each separate instance needed to be manually mapped to the common schema.

While a 'bottom up approach' enables data to be produced to a nationally consistent format from existing data, a 'top down' approach that encourages the use of standards in the development of new databases would provide greater functionality and also allow direct mapping from new database providers to the interface in future.

The result

Successful implementation of the methodology is demonstrated in connecting three physically separate and unique landslide databases via the web (www.ga.gov.au/landslide).

The most important advantage of adopting such an approach is the increased volume of information it facilitates. The database now has over 3630 entries detailing landslides and sets of landslides throughout Australia. Over 2074 landslides are being reported from MRT, over 1000 are reported from GA and 402 are reported from UoW.

Time and resource constraints dictated the level of functionality enabled as part of the pilot. The current LDIP is a demonstrator and further work is still needed to achieve a 'stable' system. These are further described in Osuchowski & Atkinson (2008). Examples include:

- a governance framework is required to manage changes to vocabularies. If new free-text descriptions are developed by custodians, the interface cannot map to this data;
- rules are also required to specify how the system behaves. For example if a connection to one of the three databases is temporarily unavailable, the search is aborted. Rules can specify the return of all data available, with a message indicating which database is unavailable; and
- performance optimisation of the application is needed as it can presently take up to one minute to execute a search.

Current benefits include:

- the system collates and characterises information from different sources in real time, providing an automatically updated single point of access to landslide information. New information is immediately available online. There is no need to wait for manual updates;
- data is presented consistently to enable the comparison and aggregation of data across databases;
- users are able to simultaneously search and query remote databases regardless of where they are hosted or differences in format, providing greater availability, accessibility and discoverability of data;
- detailed information can be accessed for specific requirements or generic information can be aggregated for strategic purposes. Drill-down functionality means different users can access the level of information they require from the same, single information-rich source;
- the need to locate, access and interrogate isolated databases or to separately identify and contact a number of individuals when information is needed is removed;
- the system provides an ability to export data in a range of formats, such as kml (Google Earth) or display results as reports, tables, maps and potentially as graphs and statistics;
- users can access multi-media such as photographs, videos, published papers, articles etc.;
- database custodians have greater flexibility and functionality in searching for their own data, and in comparing landslides occurring under similar conditions in other parts of the country for example. Custodians also select which fields of data they would like to share;
- databases can be connected to the interface whether or not they are available in an online capacity. For example, MRT and UoW do not have their landslide databases available separately online; and
- there is no limit to the number of landslide databases that can be linked into the virtual database since the interface neither stores or records data.

Discussion

At a minimum this demonstrator initiative provides Australia with a framework for a centralised national landslide inventory, which with further work could connect other available landslide databases in Australia. However, there is also considerable capacity for this approach to provide State Governments with a simple way to compile and maintain their own state-wide databases.

Interoperability is becoming increasingly relevant to federal government decision makers and research groups, all of whom need to access data and information across Australia through one system. This is especially the case in the research and management of natural hazards in Australia.

Implementing RC2 effectively and sustainably is a challenging task, but it is possible. The methodology of the LDIP has the capacity to be applied across to other hazards, such as flood, earthquake, tropical cyclone and bushfire. This would require a greater policy and governance framework, balanced with a greater technical capacity. The coordinated development of common vocabularies targeting requirements across all user groups would also be needed, but the benefits would be significant. Land-use planners, emergency managers, town planners, policy officers and researchers would be able to:

- access up-to-date information;
- access the same source data;
- share and compare methodologies;
- compare and contrast data within and between hazards; and
- engage in greater discussion on how to better reduce the risk to Australian communities from natural hazards.

Conclusions

The interoperable approach described here establishes a platform to support improved risk assessments and informed mitigation decisions through its ability to collate and characterise large volumes of information. In using a common data modelling methodology, the landslide domain model provides the capacity to extend the approach across other natural hazard databases and integrate data from other domains, leading to gains by all levels of government as well as academia and insurance organisations.

It is impractical and expensive for a single agency to maintain an up-to-date central database by collating and physically integrating data from different sources. An interoperable approach ensures that full value is made of available information, and that responsibility for collecting and maintaining this data is shared across all agencies. Specific-purpose data can not only continue to serve the needs of individual database custodians, but can also now serve a broader need. By sharing and exchanging data more efficiently we can also build more effectively on previous knowledge and reduce duplications in effort.

Such a system establishes the foundation for a very powerful and coordinated information resource in Australia and provides a suitable basis for greater investment in data collection, facilitating a sound knowledge base on natural disasters and disaster risk reduction.

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How well prepared are Australian communities for natural disasters and fire emergencies?

Nicolopoulos and Hansen examine ABS statistics and published research to determine the level of preparedness for household emergencies.

Abstract

Results from the Australian Bureau of Statistics surveys on household and community preparedness for natural disasters and fire emergencies are presented within the context of published research into factors that influence preparedness. The results provide a better understanding of the characteristics of householders who prepare for natural disasters and fire emergencies, and how prepared householders are in the event of an emergency.

Introduction

Natural disasters such as bushfires, floods, storms and tropical cyclones occur regularly across the Australian continent. They cause more than $1.14 billion damage each year to homes, businesses and the nation's infrastructure, along with serious disruption to communities (Department of Transport and Regional Services, 2002). The Commonwealth Scientific and Industrial Research Organisation (CSIRO) submission to the Review of Natural Disaster Relief and Mitigation Arrangements points out that that more extreme weather events, and large-scale single events with severe cyclones, storms and floods, are expected in the future (Department of Transport and Regional Services, 2002). The CSIRO also points out the influence of the greenhouse effect on climatic conditions is expected to increase the severity and/or frequency of cyclones, storms, bushfires and floods in certain regions of the country. As well, CSIRO highlights the prospect of shifting hazard zones, including movement of the cyclone belt further south and flooding of rivers and coastal zones previously immune to flooding (Department of Transport and Regional Services, 2002). These changes could have dramatic effects, as the traditional strategies for dealing with severe events may not be able to cope with the new patterns of impact (Department of Transport and Regional Services, 2002).

In communities susceptible to experiencing adverse impacts from natural disasters and fire emergencies, the active pursuit of strategies to manage the associated risk is essential.

A primary aim of governments is to dramatically reduce death and injury, and the social, economic and environmental impacts of natural disasters and fire emergencies. In some cases a well established response system can limit the consequential damage and reduce the number of casualties from natural disasters and fire emergencies such as structure fires and bushfire. However, in the case of floods, coastal inundation, cyclones and storms, response measures are not sufficient to assist the economic and social recovery of communities. There is consensus within the emergency management community, governments and those in policy-making areas for an increased focus on proactive, effective and value for money emergency management measures. The aim of these emergency management measures is to increase community safety and reduce costs and impacts of natural disasters and emergencies. An increased focus on proactive emergency management measures would ensure better management of demand for the relevant services, to the greatest extent possible given the many variables that lead to emergencies. More recently the focus of disaster management has shifted towards disaster risk assessments, community preparedness, disaster mitigation measures and, in some jurisdictions, recovery management.

Being prepared reduces the risk of injury and damage within a household, and facilitates a capability for coping with the temporary disruption associated with hazard activity.

About the ABS surveys

The Australian Bureau of Statistics (ABS) survey on *Household Preparedness for Emergencies, October 2007* was conducted throughout New South Wales (NSW), Victoria (Vic), Queensland (Qld) and the Australian Capital Territory (ACT). The ABS survey on *Community Preparedness for Emergencies, October 2007* was run throughout Western Australia (WA). Both surveys were conducted during the two weeks commencing Monday 8 October 2007. As with the *Household Preparedness for Emergencies, October 2007* survey, the *Community Preparedness for Emergencies, October 2007* survey was conducted as a supplement to the ABS Monthly Population Survey (MPS).

The *Household Preparedness for Emergencies, October 2007* survey examined the steps households had taken in preparing for emergencies. These steps included safety precautions such as installing smoke alarms, ensuring emergency phone numbers were accessible and having an emergency plan. Where households had experienced an emergency in the last two years, the survey investigated how they responded during the emergency and whether any changes were made to ensure better preparedness in the future.

The *Community Preparedness for Emergencies, October 2007* survey included topics on: emergency action plans such as pre-arranged exit plans from residences and alternative accommodation arrangements in event of an emergency; transportation needs during evacuation; householders who have caring responsibilities for non-household members; members of households who do not understand English; and the availability of stored drinking water and emergency food stores.

For both surveys, information was collected by either face-to-face or telephone interview from one responsible adult per household. The respondent answered questions on behalf of the household.

Key survey findings

Some selected highlights of the *Household Preparedness for Emergencies, October 2007* survey (Tables 1, 2 and 4) are:

- In the two years prior to the survey, the ACT had the highest percentage of households (18%) who had experienced an emergency followed by NSW (12%), Qld (10%) and Vic. (8%).
- Around one in five households who experienced an emergency contacted emergency services (Vic. 24%, NSW 21%, ACT 17% and Qld 15%).
- Approximately half of Qld, NSW and Vic. households and over a third of ACT households who experienced an emergency implemented changes for better emergency preparedness.
- Smoke alarms were the most common safety precaution. Over 90% of homes had a smoke alarm installed (Vic. 97%, NSW 94%, Qld 94% and the ACT 90%).
- A written or rehearsed emergency plan was the least common safety precaution implemented by households in Vic. (15%), ACT (15%) and NSW (13%). In Qld the two least implemented precautions in homes were fire blankets (19%) and a written or rehearsed emergency plan (20%).
- One in three households did not keep emergency phone numbers in a location for ease of use (Qld 39%, ACT 38%, NSW 36% and Vic. 30%).
- Nearly one-fifth of all households in NSW, Vic., Qld and the ACT had at least one household member who would have difficulties evacuating the home without help in an emergency.

Table 1. Presence of selected safety precautions.

		NSW			VIC			QLD			ACT		
		Capital city	Balance of state	Total	Capital city	Balance of state	Total	Capital city	Balance of state	Total	Capital city	Balance of state	Total
Smoke alarms/ detectors	%	93.3	95.4	94.1	97.1	97.3	97.2	93.6	93.9	93.8	na	na	89.7
Tested smoke alarms/detectors	%	73.2	79.7	75.7	80.6	86.1	82.2	77.7	79.7	78.8	na	na	69.6
Fire blankets	%	17.1	20.5	18.4	21.1	23.5	21.8	17.3	19.6	18.5	na	na	19.4
Fire extinguishers	%	24.5	31.8	27.4	29.8	32.3	30.5	31.5	33.0	32.3	na	na	30.3
Electrical safety switches or circuit breakers	%	75.7	76.2	75.9	75.6	73.3	75.0	88.0	90.8	89.5	na	na	78.5
Written or rehearsed emergency plan	%	11.2	16.6	13.3	14.0	17.9	15.1	16.8	22.2	19.7	na	na	14.7
Portable first aid kit	%	53.6	62.7	57.1	53.9	60.4	55.8	61.5	64.0	62.8	na	na	59.0
First aid qualification	%	28.5	34.2	30.7	28.1	32.6	29.4	35.2	34.8	35.0	na	na	31.0
Total households	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	na	na	100.0

Table 2. Type of most recent emergency by whether changes made as a result.

		NSW		VIC		QLD		ACT	
		Changes made as a result of an emergency		Changes made as a result of an emergency		Changes made as a result of an emergency		Changes made as a result of an emergency	
		Yes	No	Yes	No	Yes	No	Yes	No
House fire	%	49.9	50.1	55.7	44.3	56.1	43.9	44.5	55.5
Bushfire	%	55.9	44.1	50.6	49.4	50.7	49.3	np	np
Storm, wind or hail	%	40.8	59.2	36.6	63.4	49.0	51.0	32.8	67.2
Flood	%	56.9	43.1	62.8	37.2	67.3	32.7	43.7	56.3
Other emergency	%	57.2	42.8	42.5	57.5	63.7	36.3	np	np
Total households that had an emergency	%	45.6	54.4	46.4	53.6	52.5	47.5	37.1	62.9

Table 4. Emergency plan by whether household has a perceived risk and difficulty evacuating in an emergency.

		Perceived risk of bushfire	Perceived risk of flooding	At least one household member would need help	No household member(s) would need help
NSW					
Has emergency plan, written or rehearsed	%	23.3	19.4	18.0	12.3
Has emergency plan, but not written or rehearsed	%	17.2	17.3	10.7	14.0
Has no emergency plan	%	59.5	63.3	71.3	73.7
Total households	%	100.0	100.0	100.0	100.0
VIC					
Has emergency plan, written or rehearsed	%	33.7	18.2	19.7	14.2
Has emergency plan, but not written or rehearsed	%	19.9	11.6	10.4	14.7
Has no emergency plan	%	46.4	70.2	69.9	71.2
Total households	%	100.0	100.0	100.0	100.0
QLD					
Has emergency plan, written or rehearsed	%	23.8	24.3	23.7	18.8
Has emergency plan, but not written or rehearsed	%	17.0	17.4	13.5	19.1
Has no emergency plan	%	59.2	58.3	62.7	62.1
Total households	%	100.0	100.0	100.0	100.0
ACT					
Has emergency plan, written or rehearsed	%	18.0	14.5	18.8	13.9
Has emergency plan, but not written or rehearsed	%	17.2	14.8	11.3	16.1
Has no emergency plan	%	64.8	70.8	69.9	70.1
Total households	%	100.0	100.0	100.0	100.0

Some selected findings from the *Community Preparedness for Emergencies, October 2007* survey (Table 3) include:

- almost 8% of WA households have experienced a major emergency; one third of these said they would prefer to remain with their home in the event of another emergency. Of the WA households that had never experienced an emergency, this proportion declined to one in ten;
- one in ten WA households have an agreed place to meet in the event of becoming separated during a major emergency;
- in households in areas outside of Perth 16% had someone with a role either in the emergency services, medical profession or defence force - that may be called on to assist in an emergency - compared to 7% of Perth households;
- half of WA households had someone with a first aid qualification; and
- nearly a third (30%) of all WA households lacked stored drinking water.
- seven days' worth of food (not needing refrigeration or cooking) was available in 30% of Perth households and in 42% of households in areas outside of Perth;
- the majority of WA households had access to a phone: 90% had at least one mobile and 89% had a landline;
- almost one third (32%) of WA households did not have internet access; this was highest among people living alone (58%);
- nearly a quarter of WA households reported that they would need transportation assistance if they were required to evacuate; and
- in a major emergency (such as a bushfire, flood or cyclone) one in five WA households would need some form of assistance to evacuate their homes. The most common reason for this was that the household included people with limited mobility - such as young children or the elderly,

Table 3. Community preparedness for emergencies, Western Australia.

		Perth	Balance of state	Total
Exit plan from dwelling	%	44.9	51.5	46.5
Agreed meeting place	%	10.2	11.3	10.5
No stored drinking water	%	33.0	21.2	30.1
No food that does not need cooking or refrigeration	%	8.3	3.8	7.2
No portable radio with working batteries	%	47.5	48.4	47.7
No mobile phones	%	9.2	12.3	10.0
No landline telephone connection	%	9.8	13.4	10.7
No internet access	%	30.6	37.6	32.3
First aid qualification	%	50.3	54.7	51.4
Keeps medication together	%	39.4	43.8	40.5
Keep important documents together	%	81.1	83.7	81.8
No torch for ready use	%	12.5	6.5	11.0

Discussion

The results suggest that legislation, regulations and building codes significantly influence the level of household preparedness. Smoke alarms and electrical safety switches or circuit breakers were reported as the most common safety precaution measures implemented by households. Non mandatory precautions such as written and rehearsed emergency plan and fire blankets were the least common safety precaution implemented by households. The *Household Preparedness for Emergencies, October 2007* survey results showed that:

- the most common safety precaution that households had taken was to have smoke alarms or detectors installed in their homes. In each jurisdiction, 90% or more of homes had a smoke alarm installed (Vic. 97%, NSW 94%, Qld 94% and the ACT 90%);
- electrical safety switches or circuit breakers were the second most common safety precaution. These were present in over three quarters of homes in the ACT (79%), NSW (76%) and Vic. (75%) and in 90% of homes in Qld; and
- a written or rehearsed emergency plan was the least common safety precaution implemented by households in Vic. (15%), ACT (15%) and NSW

(13%). In Qld the two least implemented precautions were fire blankets (19%) and a written or rehearsed emergency plan (20%).

Numerous studies have identified socio-economic and demographic factors associated with levels of household preparedness for emergencies and adaptive action, and systematic differences among population segments with respect to the likelihood of adopting preparedness measures and precautions (Dooley et al., 1992; Russell et al., 1995; Tierney et al., 2001; Paton & Burgett, 2005). Correlations of socio-economic and demographic variables with levels of preparedness and adoption of measures provide useful information. This is because they allow emergency managers to target populations segments that are least predisposed to adopt preparedness measures. The ABS results indicate that levels of preparedness are associated with age, home ownership, household type, and the ability to understand English.

Age was associated with the implementation of safety precautions and preparedness measures. In WA households with at least one person aged 60 years and over, 57% had an exit plan compared to 42% of households with at least one person under 15 years age. However, 64% of households with at least one person under 15 years had a first aid qualification, compared to 29% households with at least one person aged 60 years and over.

Home ownership was a factor associated with a household having the safety precautions to extinguish house fires, compared to homes that were rented. In particular, NSW, Vic., Qld and ACT households who owned or were paying off their home were approximately twice as likely to have fire blankets and fire extinguishers. This is when compared to NSW, Vic., Qld and ACT households who rented. In WA home ownership also increased the likelihood of a household being better prepared for an emergency, compared to homes that were rented. A greater proportion of WA households living in dwellings that were fully owned or being purchased had an exit plan, an agreed meeting place, first aid qualification, kept medication and important documents together so they could be easily taken in an event of an emergency and had stored drinking water of 20 litres or more compared with WA households who rented. They also had higher levels of access to communication.

Household type was associated with the implementation of safety precautions and preparedness measures. The results from the *Household Preparedness for Emergencies Survey, October 2007* survey suggest that couples with children were more likely than other household types to implement safety precautions and preparedness. Households consisting of a person living alone were generally less likely than other household types to implement safety precautions and preparedness measures. In Qld, NSW and Vic. households consisting of a couple with children were more likely than other household types to have a household member with a first aid qualification (Qld 53%, NSW 45%, Vic. 43%). These households were around 3 times more likely than lone person households to have a first aid qualification (16% in Qld, 15% in both NSW and Vic.). In Qld and Vic. portable first aid kits were most commonly found in couple with children households (74% and 66% respectively). In NSW couple with children households (66%) and couple households (64%) were the household types most likely to have portable first aid kits.

However, the WA results suggest that levels of preparedness for emergencies were not necessarily associated with a particular household type. Although the WA survey also showed that two-thirds (68%) of the couple with children households had someone with a first aid qualification compared to 49% of lone parent with children households having a first aid qualification, having an exit plan was highest among person living alone households (62%). Of the remaining WA household types, the proportion with an exit plan ranged from 39% for couple with children households to 43% for couple only households.

Fluency in the English language was associated with the implementation of safety precautions and preparedness measures in WA. In WA households where all members understood English, 47% had an exit plan, 93% had at least one day's supply of emergency food, 52% had a first aid qualification and 41% kept medications together. In contrast, among WA households where at least one member did not understand English, the proportions were 36% had an exit plan, 77% had at least one day's supply of emergency food, 28% had a first aid qualification and 38% kept medicines together.

However a review of research by Lindell & Perry (2000) has concluded that the correlations of demographic variables with the adoption of preparedness measures and precautions are very small. Moreover, a number of researchers argue that information on demographic variables is not very useful to those interested in trying to increase household preparedness, because demographic attributes are difficult or impossible to alter (Lindell & Perry, 2000; Paton, 2006). Furthermore, Paton argues that focus on these factors may conceal the dynamic processes that underpin how people, irrespective of their specific demographic make-up, make decisions about whether to prepare or not. Russell et al. (1995) acknowledged socio-economic and demographic factors associated with levels of preparedness, but argue that a different set of factors influence preparedness in the pre and post hazard environments. A close examination of socio-economic, psychological, and situational variables that influence the propensity to prepare for disasters revealed a tendency for socio-economic factors to be significant in the pre-impact period, and for socio-economic, psychological and situational variables to influence post impact preparedness.

The results for both surveys show that the majority of safety precautions and preparedness measures were taken by households outside capital cities. In NSW and Vic. the biggest difference was in the proportion of homes with a portable first aid kit. While in both Melbourne and Sydney 54% of homes had a portable first aid kit, areas outside the capital cities for both jurisdictions reported higher proportions of homes with a portable first aid kit for NSW (63%) and Vic. (60%). In WA, 52% of households outside Perth had a plan on how to get out of their dwelling if there was an evacuation, and 11% had an agreed meeting place compared to the 45% and 10% respectively for Perth. The WA survey results also indicate that the areas outside Perth have a higher proportion of households with a first aid qualification, and a higher proportion of households that keep medication and important documents together so they can be easily taken in an event of an emergency.

There could be a number of reasons for the differences in the levels of safety precautions and preparedness measures between capital cities and areas outside of capital cities. Larson & Dearmont (2002) argue that strong social cohesion and participation in community activities are features of agricultural communities and long term residents, and that these characteristics may influence preparedness. McGee & Russell (2003) support this argument. Their research showed residents involved in agriculture and with long standing association with the area appeared better prepared than those on small properties and newcomers. They argue that social networks, previous experiences with wildfires and grassfires, and involvement with the local fire brigade influence preparedness of long term residents of areas outside of capital cities.

Another explanation for the geographic differences in the uptake of safety precautions and preparedness levels could relate to households' experience of emergencies. A number of studies point to a positive relationship between experience with actual events and preparedness (Lindell & Prater, 2000; Russell et al., 1995). The results from *Household Preparedness for Emergencies Survey, October 2007* suggest households in areas outside capital cities experienced a higher proportion of emergencies compared to households in capital cities.

The survey results indicate that households who had experienced an emergency had higher levels of preparedness, and implemented safety precautions and changes for better preparedness. Approximately half of Qld, NSW and Vic. households who experienced emergencies implemented changes for improved safety and better preparedness. Over a third of ACT households who experienced an emergency (37%) made changes. Changes implemented include installing and regularly testing smoke alarms, implementing an emergency plan and putting emergency phone numbers in an easily accessible place. Among households in WA that had experienced a major emergency, when asked about a future emergency, 59% had an exit plan, 33% were unwilling to evacuate their home, 23% had a household member who may be called upon to assist in an emergency and 18% had an agreed place to meet. In contrast, among households that had not experienced a major emergency, the proportions were 45%, 10%, 8% and 10% respectively.

A number of studies confirm the trend that levels of preparedness peak immediately or shortly after a hazard event (Russell et al., 1995; Paton & Cittrell, Lindell & Whitney, 2000). Russell et al.'s (1995) study on preparedness and hazard mitigation actions before and after two earthquakes also revealed residents in the earthquake affected areas increased their level of preparedness. Survival activities such as storing water and food, having a torch, radio and first aid kit and acquiring first aid training improved, but progress in home hazard mitigation and family earthquake planning was generally constant and low.

Importantly, however, the ABS survey results suggest that a household's experience of an emergency is more of an influencing factor in increasing the likelihood of residents to install safety precautions and prepare for emergencies than a household's perception of risk of an emergency occurring. Of the households with a perceived risk of bushfire, a majority of the surveyed jurisdictions, except Vic., did not have an emergency plan. In Vic., 54% of households who perceived themselves at risk of bushfire had an emergency plan (compared to 41% in both NSW and Qld and 35% in the ACT). Of the households with a perceived risk of flooding, a majority of the surveyed jurisdictions did not have an emergency plan. In Qld, 42% of households who perceived themselves at risk of flooding had an emergency plan (compared to 37% in NSW, Vic. 30% and 29% in the ACT). A number of studies indicate that many residents living in hazard prone areas fail to personalise the risk and therefore have low levels of preparedness. These researchers have found that people who live in hazard prone areas are likely to take action, but only if they see the event as controllable, and tend to deny and minimise the seriousness of the risk when they believe that little can be done to reduce the danger (Turner et al. 1986; Duval & Mulilis, 1999; Lehman & Taylor, 1988; Heller et al., 2005). Other studies (e.g., Paton et al., 2001; Whitehead et al., 2001) found the opposite, with direct experience predicting reduced preparedness. One explanation for this has been framed in terms of the "gambler's fallacy", in that if people experience one event they believe they are less likely to experience a future event. They are, consequently, less inclined to prepare.

Conclusion

The results of ABS surveys have implications for emergency management practitioners, and reinforce that a one-size fits all approach to developing and delivering preparedness programs is not appropriate. The what, how, when, where and why pre hazard preparedness predictors may be different from post preparedness predictors. There is a need to tailor preparedness programs to targeted communities. The data suggests a window of opportunity post hazard in which focused initiatives are likely to be effective.

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REPORTS

Kiwirrkurra: the flood in the desert

Introduction

Many remote Indigenous communities in Australia are located in areas most at risk of 'natural' disasters. One such remote Western Desert community, Kiwirrkurra, was devastated by a flood in March 2001. A project recently completely by Emergency Management Australia, in consultation with the Fire and Emergency Services Authority of WA, (FESA) has documented the communities stories from the Kiwirrkurra flood to identify the lessons learned, so that other communities and emergency managers can benefit.

A brief history of the settlement of Kiwirrkurra and its current administrative arrangements is included as background, as well as some information on the devastating flood and the key lessons learned by both the community and emergency managers. It is hoped that these lessons can inform future emergency management work with remote Indigenous communities, and help identify ways for Indigenous communities and emergency managers to work together better.

The Kiwirrkurra stories demonstrate that through developing and maintaining good and trusted relationships, good communication channels and understanding and respecting relationships, culture and country even the most severe of emergencies can be managed and the community can survive.

Kiwirrkurra – the most remote community in Australia.

Kiwirrkurra in Western Australia is one of Australia's most remote Indigenous communities. It is located approximately 1200km to the east of Port Hedland in Western Australia and 850km to the west of Alice Springs in the Northern Territory. The Kiwirrkurra permanent community was established the early 1980s, as one of the 'Pintupi Homelands' outstations. By 1983 there were community residents living permanently around the bore, and in close proximity to their country. Members of the Kiwirrkurra people were among some of the last Indigenous groups to come into contact with non-Aboriginal Australia.

Although Kiwirrkurra falls within the boundaries of the East Pilbara Shire (administered from Newman in WA), the community has closer ties with, and is geographically closer to Alice Springs. Despite Kiwirrkurra lying officially beyond the area of the Ngaanyatjarra communities, the Ngaanyatjarra Council is active in supporting the Kiwirrkurra community, through the provision of services such as legal and anthropological advice, administrative support, commercial air transport and health services. The 'tyranny of distance' has meant that they are not necessarily supported to the same level as other communities.

What happened at Kiwirrkurra?

Flooding occurred in the Kiwirrkurra region in early 2000, cutting off road access to the community for a number of months and resulting in discussions regarding mitigation works and other possible solutions. Funding was provided for mitigation works following the 2000 floods. Flooding occurred the following year, however, before any mitigation strategies or broader solutions had been implemented.

Between March 3 and 5 2001 unusually heavy rainfall across the desert caused widespread flooding. The Kiwirrkurra area was one of the areas most seriously affected by the flooding which resulted from run-off being trapped in the low-lying basins with little or no drainage. The flooding was compounded by the unusually high watertable levels in the area which were the result of high rainfall the previous year - the ground was simply soaked. Towards the end of March 2001, shortly after contractors had begun to clean up the houses in Kiwirrkurra and grade the surrounding roads, another large rain event occurred. The water levels in the community rose again and the physical recovery works were unable to continue. For the Kiwirrkurra people there were significant cultural issues bound up with the cause of the extensive rainfall and the resulting flood, most of which were not able to be discussed with outsiders to the community.

In response to the March flooding, the entire Kiwirrkurra community (170 people) was evacuated to Kintore (although for various reasons the community didn't stay). From Kintore the community relocated to the Norforce Army Base at Alice Springs. The evacuation was carried out with the assistance of Defence Force helicopters, and was coordinated by Emergency Management Australia (EMA). The Norforce Army Base was only available for a period of 4 weeks and in this time an alternative site had to be found. After a range of options had been considered, it was decided to relocate the community temporarily at Morapoi Station in the Western Australian Goldfields, some 2000 km SSW of Kiwirrkurra, probably for about 12 months.

The time the Kiwirrkurra community spent in Morapoi, though short, is generally regarded as having resulted in a severe disruption to the social fabric of the community. Kiwirrkurra is normally a dry (alcohol free) community, but during their time at Morapoi and Alice Springs the community had access to alcohol. Many people reported problems such as drunken, violent and aggressive behaviour and domestic violence during the stay at Morapoi. Some community members commented that the community's separation from their country contributed to the social difficulties the community experienced. After a short time the community decided to leave Morapoi and began to move themselves closer to their homelands, staying in other communities and settlements where they could. It was nearly 18 months before the community was able to get back to their homes. Almost all residents had returned to Kiwirrkurra by late 2002.

Moya Newman (FESA) walking and talking with some of the Kiwirrkurra women elders.

FESA's Peter Cameron with Kiwirrkurra Elders.

Working with Indigenous communities – Lessons Learned

Every remote Indigenous community is different, and no one model of effective communication, emergency management or capacity building will work in every community. Within some general guidelines, emergency management and emergency services workers must build their own relationships with communities, and come to know, understand and respect the background and culture of community members. Only then can they focus together on how best to communicate, make decisions and build a self reliant community that knows initially what to do, and then who to call, in the event disaster strikes. Training and development opportunities (capacity building) for the community are in fact two way learning experiences for all involved.

Building trusted relationships enables two way communication and understanding

In Kiwirrkurra and other Western Australian remote communities one way in which relationships have been established and strengthened is through a program of pre wet season visits, with FESA personnel providing advice on risk management and mitigation strategies. By working with communities (in advance of the most likely period for a natural disaster to occur) trusted relationships are built, and understanding is developed on both sides. The importance of having appropriate emergency services personnel working with these communities is obvious when one considers the operational value of on the ground knowledge in the management of an incident. The importance of the trusted relationship is even more integral to an effective incident management response when swift and efficient decision making is enabled through quick and effective consultation between trusted emergency managers and the community. Community members in Kiwirrkurra have indicated that it important for them to stay in their own remote community, where their families are, and where they can maintain their links with the land e.g. go out hunting etc. They have developed a relationship with Peter, and feel they can give him a call should they need to move out of the community again.

Good, established communication channels and working within community decision making structures is vital

Since the flood in Kiwirrkurra good relationships have been established between senior Kiwirrkurra men and women and FESA staff such as Peter Cameron, District Manager Pilbara West, and Moya Newman, Manager of the FESA Indigenous Policy & Strategy Branch. Both are welcomed into the community. They are respected for the work they have done and the emergency plans and strategies they have put in place together with the community. Utilising their understanding of the structure of the community, the decision-making arrangements, and most importantly, who they needed to be speaking with, these emergency management staff have been able to establish two way lines of communication and understanding. Community members, likewise, know who to call and how to reach them. Having both men and women working with the community means that knowledge and understanding have developed with regard to both men's and women's business and decision making structures.

Kiwirrkurra community still flooded two weeks after peak.

Understanding and respecting country and culture can improve outcomes and recovery

It is important that emergency managers working with Indigenous communities understand the historical and current context of the community they are working with. This knowledge makes it easier to negotiate and communicate with community members. Additionally it can help avoid awkward misunderstandings and embarrassing trip ups over cultural and/or historical sensitivities and issues that may damage trusted relationships. After the Kiwirrkurra evacuation community members spoke of the difficulties associated with leaving their dogs behind. These animals were (and remain) an important cultural element of the community and it was devastating to leave them. There can also be broader cultural spiritual and custodial considerations in relation to events such as flooding, and it is important that emergency managers make themselves aware of these, if the community is able to share such information. It's also important that emergency management arrangements and procedures are flexible enough to accommodate the cultural and spiritual needs of the people.

Education and training offers benefits to community members and emergency managers.

Education and training in emergency planning, risk management and mitigation strategies and incident response are invaluable for both emergency management staff and community members. Education and training helps build community resilience and self reliance, improves emergency management planning and pre disaster preparations, and can aid effective incident response and community recovery. There can also be spin off benefits such as improved literacy and numeracy skills, better attendances at school and/or training and increased levels of community and individual self esteem. Ongoing cultural awareness and community engagement training for emergency management staff is beneficial in giving them the tools to work more effectively with, and make the most of, their interactions with Indigenous communities.

Self reliance, preparation and planning are important for communities, especially those remote and distant from emergency services

Current and past chairmen of the Kiwirrkurra community expressed their desire for continuing education, training and engagement with emergency management and services staff, to help them build a strong, healthy and vibrant community living in the bush, working together. Where communities, like Kiwirrkurra, are hundreds of kilometres away from the most basic of emergency services, they must be self reliant for as long it is likely to take to get emergency services there. First aid courses, community fire trailers, emergency kits with food, water and batteries etc can help communities ride out the initial stages of a disaster until help arrives.

Flooded Kiwirrkurra residences three weeks after the flood peak.

FESA's Peter Cameron discussing flood mitigation works with a community member.

Emergency managers and emergency service workers need to work with communities in the recovery process

The involvement of community members in the physical recovery of Kiwirrkurra was problematic given the physical distance between Morapoi, where the community was relocated to, and Kiwirrkurra. In the event of another disaster in the community, consideration may be given to involving community members in the clean up process, including decision-making around renovation and refurbishment of housing.. In discussions with Kiwirrkurra community members about their return home, many indicated that finding their personal belongings gone and their houses refitted with new furniture and whitegoods was profoundly disturbing. The involvement of community members in decision-making of this kind is likely to facilitate better community and individual recovery from such traumatic incidents.

Education and training session with the community.

Conclusion

The telling of stories is important to Indigenous people. Their stories have survived over generations, passed down from the elders to the children. People are connected to their own stories, which are a source of pride. One community's story can also be used to help others. The Kiwirrkurra community's flood and evacuation experience taught them much about managing in a time of adversity that tested them as families, individuals and a community. The stories coming from the Kiwirrkurra community and the emergency managers who worked with them contain lessons for us all. Using the most ancient of communication methods (story telling) and modern methods (the Internet and video pod casting), we are able to share the lessons across a vast range of audiences in different places and in different ways. A documentary about the flood and evacuation of Kiwirrkurra ('Worrying for Kiwirrkurra' has been filmed and is due for release in April this year, while more information about Kiwirrkurra and the flood that forever changed the community can be found on the EMA website www.ema.gov.au.

This article is based in part on research work done in 2004 by Ms Heidi Ellemor, formerly of EMA, and follow up research and interviews undertaken by the Kiwirrkurra Documentary Project Team.

Lessons Learned

- Building trusted relationships enables two way communication and understanding
- Good, established communication channels and working within community decision making structures is vital
- Understanding and respecting country and culture will improve outcomes and recovery
- Education and training offers benefits to community members and emergency managers in terms of building resilience, improving planning and preparations, assisting recovery and community development and capacity building
- Self reliance, preparation and planning are important for communities, especially those remote and distant from emergency services
- Emergency managers and emergency service worker need to work with communities in the recovery process.

The Comcover Awards for Excellence in Risk Management 2008

L – R: Gordon Cheyne, Dr Neil Williams, Len Hatch, Gary Foley, Rick Bailey, Carl Muller, Anthony Baldwin, Craig Tigwell, Ray Canteford, Prue Harley and Mark Sullivan.

On Friday 7 November the winners of the 2008 Comcover Awards for Excellence in Risk Management were announced at the National Convention Centre in Canberra. The Australian Tsunami Warning System project, developed in partnership between The Bureau of Meteorology (The Bureau), Geoscience Australia (GA) and Emergency Management Australia (EMA), were awarded 'Highly Commended' in the Risk Initiative category.

The awards are based on the demonstration of true leadership in the field of risk management, and highlight the substantial ongoing benefits of risk management in achieving the current and future outcomes of Australian Government agencies. They recognise exceptional and inspiring examples of risk management and demonstrate how essential risk management is to the success of Australian Government agencies.

The nominations received in this year's program indicate that agencies are demonstrating a greater focus on the accountability and responsibility for managing risk with governance structures for the managing of risk more apparent in agencies. The regular monitoring and review of agencies' risk systems and processes indicate a cycle of continuous improvement where risk management frameworks and programs are reviewed and updated regularly.

As a direct result of the December 26 2004 Tsunami, the Government pledged $68.9million over four years to establish a national tsunami warning system, to be jointly managed by the Bureau, GA and EMA. This initiative provides an around-the-clock tsunami monitoring and analysis capacity for Australia, integrated into our well-established hazard warning and emergency management arrangements throughout the Australian States and Territories.

In presenting the award to The Bureau, GA and EMA, it was found that the project objectives were clearly articulated and the implementation strategy plan formed the foundation of the project's risk management plan and risk register. Comcover also noted that "there was clear evidence of how risk management was used to monitor implementation challenges and how staff from the operational to executive levels of each of the three agencies was engaged in the risk process."

Risk management was used to monitor implementation challenges and the risk process. The experience that the three agencies gained has assisted in gaining and developing high levels of risk management expertise, whilst supporting the Government in meeting its commitment to establish a tsunami warnings system in Australia as well as supporting the development of tsunami warnings for the international community.

Director General at EMA goes on to say "this is but another example of the great work conducted by our organisation and more broadly to meeting our mission of contributing to 'Safer, Sustainable Communities".

EMA's Graduate Certificate in Emergency Management

In November 2008, EMA held its last graduation for the currently accredited Graduate Certificate in Emergency Management. The Graduate Certificate was first offered in May 2004 and 68 students have graduated to date.

This qualification was specifically designed to provide training for people working in the emergency management sector who required professional development at postgraduate level. Students examined their management skills especially managing relationships within the multi-agency context; were engaged in debate in relation to emergency management theory and practice; contributed to and analysed innovation and change in emergency management; and contributed to the national emergency management research agenda from a practice base. The Certificate comprised of four modules: Current issues and trends in emergency management, Relationships management in an emergency management context, Research methods and a Research project.

Abstracts from the students' research projects will be included in the next editions of the AJEM.

Assessing the level of understanding of emergency management responsibilities and performance expectations of selected DHHS staff who are involved in emergency management

By Steve Smith, submitted June, 2006

The Tasmanian Department of Health and Human Services (DHHS) is an Agency of approximately 9,800 full time equivalent staff. It has a broad range of responsibilities under the Tasmanian Emergency Management Plan with these being implemented by various Divisions of the Department. The Department's emergency management responsibilities fall into two broad categories - as either lead agency, or as a support agency to another lead agency. The Department currently has 16 lead agency tasks and 11 support agency tasks.

DHHS has traditionally discharged its emergency management responsibilities within discrete (specialist) operational areas and with any cross Divisional synergies arising from this process being as much coincidental, as they might be planned. There is also strong anecdotal evidence to suggest a poor level of awareness across the Department as to the context in which emergency management capability is generated and how the Department meets its various emergency management responsibilities. Factors that contribute to this are the relative size and structural complexity of the Department, continual staff movement and the traditional 'stove-pipes' in which emergency management responsibilities have been allocated and managed in the past.

This research project presents the findings from a survey of selected DHHS staff and provides an insight into their understanding of emergency management practices and related compliance issues. The benefit to be gained from this project is information that will inform processes to improve understanding of emergency management responsibilities, and in turn, improve emergency management capability within DHHS.

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Recruitment and retention of volunteers in a local SES unit

By Peter Willmott, submitted October, 2008

Volunteer emergency services place considerable effort into recruiting and retaining volunteers. Most State organisations have volunteer programs to assist local units to recruit and manage volunteers. The success of a local unit to recruit and retain volunteers lies as much in its abilities as in those of the organisation.

This research shows that most members join with a prior knowledge of the emergency services and leave due to increased work or family commitments, rather than disillusionment or interpersonal issues. Those who leave the district frequently continue to volunteer in their new location.

This study demonstrates that a volunteer's personal needs (self motivating factors) must be met at the local unit. The culture of the local unit needs to demonstrate that each volunteer is valued, ensure that everyone feels included in the life of the unit and provide opportunities for responsibility and personal development.

The successful unit demonstrates that it is focused on its role in the community and separates political issues with external groups or the greater organisation from unit life. The study shows that members are loyal to the unit first, and are prepared to overlook politics with the organisation, or substandard facilities and equipment provided by the organisation where there is a strong, positive unit culture.

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Effective local plans

By Kate Kosmala, submitted September, 2008

In Australia, State and Territory governments have responsibility for maintaining an environment that promotes community safety and prosperity. One way this is addressed is through a range of prevention, mitigation and preparedness activities for dealing with emergency situations. In general, all local governments have emergency management planning obligations and this work occurs in a context where limited resources and increasing public expectations mean that efficiencies are sought in all activities, including the maintenance of emergency plans. Despite the commonality of both obligations and resource constraints for maintaining local emergency plans there is limited guidance from the state level to clearly identify recommendations for content and document management of local emergency plans. This lack of guidance represents an opportunity for improvement and is the main theme of this report.

A number of research activities were undertaken with primary and secondary sources, including a literature review, analysis of local plans in Tasmania, workshops with local planners, and surveys of practices in other Australian jurisdictions related to standards for local emergency plans. This research showed that currently there is no accepted standard for content and document management of local emergency plans nationally.

In Tasmania at least this absence means plans are diverse in their presentation and quality, local resources are wasted, relationships can be unnecessarily tense, intelligence is lost and there is the potential for failures in engagement at the foundation layer of the emergency management system. A number of other Australian jurisdictions reported similar status and outcomes.

Development of standards for local plans is identified as one method to improve the efficiency of effort of local governments in emergency management and promote community resilience.

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How does the NSW Department of Water and Energy identify the emergency management roles, responsibilities, risks, functions and networks, and so attach priority and political significance to forming these functions

By Russell Wade, submitted December, 2008

This report provides an analysis of relevant aspects of the NSW Government's State Plan and the related planning framework, that influence the adoption of the planning framework within the Department of Water and Energy (the Department). The planning framework is taken to be the Department's 'raison d'être', without consideration of the core responsibilities that underpin the work of government agencies, particularly in the area of reduction of risk exposure.

The research addresses the question as to how does the Department identify the emergency management roles within the organisation, the emergency linkages to other organisations and the political significance of forming these functions. The research design took a two-pronged approach, namely to examine the deficiencies in the framework that underpins the current NSW State Plan and to balance risk relativities through a comprehensive and coherent approach to risk assessment. A review of the literature draws out the concepts of risk, perceptions and trends in emergency management; and the consequences of dismissing a holistic approach to emergency risk assessment.

The results include a conceptual model of a spatial spectrum of risk relativities, which depicts the risks relative to the NSW State Plan priorities that impact on the Department. A further landmark finding is that in a water and energy supply chain context with high political significance, existing emergency management roles, linkages and practices can also benefit from the application of emergent techniques in innovative organisational transformation. This report concludes that the research provides compelling evidence for identifying the functions, roles and significance of emergency management within the Department.

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Long term accommodation for evacuated residents of nursing homes

By Elaine Davey, submitted June, 2007

Rescue workers found a gruesome scene inside St Rita's Nursing Home. 'It's the worst thing I've ever seen, a 60-year-old rescuer said. The descriptions of what was inside the single storey football field size building horrified even the hardened disaster veterans'.

During and after Cyclone Katrina, there were many horror stories of nursing homes having no evacuation plans, or if they had them, they had either not been tested or they were not acted on.

What do we do in Australia? What plans are in place in our Nursing Homes and Aged Care Facilities?

During disasters, administrators of health care facilities are faced with decisions about how to operate and care for patients, including when and how to evacuate patients if the facility becomes unable to support adequate care, treatment, or services. Where do these residents go? Who is responsible? How is this organised?

Hospitals and Nursing homes are required to have plans in place, describing how they will operate during an emergency. However, there appears to be a lack of long term evacuation planning and long term re-location for Nursing Homes/Aged care Facilities.

Evacuation planning can be problematic. Many of the residents cannot walk, or they may need assistance to walk. Residents may have dementia and therefore require to be evacuated to a secure and safe place. This can limit the accommodation available.

How many Nursing homes in Australia have these plans in place? If Australia had a disaster of the same magnitude as Hurricane Katrina, would our Nursing homes have a better outcome than those in New Orleans? Is Australia prepared for disasters?

Do we in Australia have the answers to these questions?

This paper will open up discussion on long term relocation of residents from Aged Care Residents.

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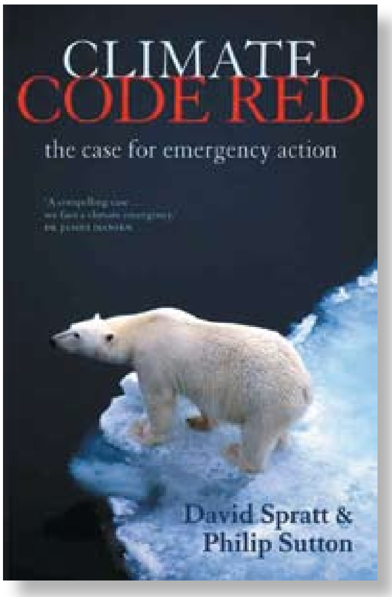
AJEM BOOK REVIEW



Climate Code Red:
the Case for Emergency Action

Reviewed by: Chas Keys

Authors: David Spratt and Philip Sutton

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The field of climate change, of late, has become a thicket of sharply opposing positions. Things have reached a point at which many people, emergency managers among them, have become highly confused as to what they should believe about something that might be just about the most serious emergency imaginable. The debate between the so-called 'climate change sceptics' and those who accept that climate change is real, important and to a significant degree humanly-induced is not merely complicated: in many instances it has become poisonous. At times the debate has degenerated into name-calling and other forms of personal denigration as the two sides accuse each other of dishonesty in their dealings with the science.

Which side of the fence the authors of Climate Code Red occupy in this argument is unambiguous. Spratt (a Melbourne businessman) and Sutton (an advisor to several Australian governments on sustainability issues) believe that the world's climate is changing, and dangerously, that the trend is very much due to human activity, and that we have already gone too far in increasing the level of greenhouse gases in the atmosphere and warming our planet. Their position is stated without seeking to denigrate (or indeed to counter) other opinions, and they develop a prescription for the solution of a problem which they describe as being truly of massive scale and consequence. The book's thesis is alarming, but its tone is sober and it is well documented. It begins with the empirical science, describing in detail the complex, feedback-rich processes involved in environmental change and concluding that the situation with regard to the summer melting of the Arctic sea-ice and the rise in sea levels is actually worse than the Intergovernmental Panel on Climate Change – a forum whose methods and conclusions are often derided by the sceptics has so far forecast. The conclusions are drawn that the pace of climate change is actually increasing, and that there is a real danger of 'run-on warming' that is, warming that is beyond human control if we do not quickly and effectively tackle the problem.

The book looks also at management that is, at what has been done so far to arrest the problem. It concludes that the answer is 'nowhere near enough'. The argument is put that most of the approaches that are currently being considered or are in the early stages of implementation ('clean' coal, carbon offsets and carbon trading schemes, for example) are ineffectual at best and, in practice, open to rorting and devious practice generally. One is left with the impression that current political mechanisms are simply incapable of dealing with the scale and urgency of the problem. 'Politics as usual' simply will not do the job, because it is geared to compromise and not to the radical action which the authors believe is urgently necessary if the planet is to escape disaster. Australia's enormous dependence on coal, both for power generation and export earnings, is a serious impediment to our making a strong effort: it means that there are strong lobbying interests in favour of fossil fuels, leading to governmental timidity in the adoption of emissions trading schemes. Spratt and Sutton argue for nothing less than a truly radical approach to the problem. Governments must switch quickly to emergency mode, they say, treating climate change as they would a problem of the scale of a world war. World War II saw several nations switch their economies rapidly to the point that expenditures on military outlays (as percentages of national incomes) reached or exceeded 50% and that from a base in some instances of less than 10% before 1939. An equivalent effort, it is argued, will be required to cut emissions quickly to zero (not by a certain percentage over the next few decades) and to radically reduce the processes responsible for warming. In essence this would mean a rapid shift towards renewable energy, the removal of fossil fuels from the transport sector, a rethinking of our methods of manufacturing, much more recycling, and many other things.

In 2009, as nations hesitantly debate the adoption of emissions trading schemes that may not halt the trend towards increasing the level of greenhouse gases in the atmosphere, such radical action seems far away. We had better hope that the future described by Spratt and Sutton is in error: if it is not, climate change will amount not simply to more frequent severe floods, increased risks of bush fire and more intense droughts, but to mass extinctions of species and the decline of the 'habitability' of the planet from a human point of view.

This is, to say the least, a challenging book. It is also genuinely frightening.

interesting websites

OzCoasts
Australian Online Coastal Information

http://www.ozcoasts.org.au/

OzCoasts provides comprehensive information about Australia's coast, including its estuaries and coastal waterways. This information helps to generate a better understanding of coastal environments, the complex process that occur in them, the potential environmental health issues and how to recognise and deal with these issues. The site has a number of datasets with a sophisticated data search capability; typology, geomorphic and scientific models (with the ability to build a model for your own community); coastal indicator fact sheets; habitat mapping tool kits; environmental management frameworks; and natural resource management reports.
This site is hosted by Geoscience Australia.

PreventionWebbeta

http://www.preventionweb.net/english/

Building the resilience of nations and communities to disasters

In support of the Hyogo Framework for Action, the International Strategy for Disaster Reduction (ISDR) secretariat has developed an information portal on disaster risk reduction (DRR) called PreventionWeb. The primary purpose is to facilitate the work of professionals involved in disaster risk reduction and promote an understanding of the subject by non-specialists.
PreventionWeb aims to provide a common platform for institutions to connect, exchange experiences and share information on DRR.
The system is designed to allow distributed data entry as well as provide options for content syndication to partner sites.
The site is updated daily, and contains news, DRR initiatives, event calendars, online discussions, contact directories, policy documents, reference documents, training events, jobs, terminology, country profiles, factsheets as well as audio and video content.

National Exposure Information System (NEXIS)

Geoscience Australia is developing the "National Exposure Information System (NEXIS)" to safeguard Australian communities from natural hazards, the consequences of terrorism and the impacts of infrastructure failures.

NEXIS is an operational capability to collect, collate and disseminate detailed exposure information about buildings and infrastructure:

- Residential (building and demographic – replacement value, people, income etc.)
- Business (buildings – CBD, non-CBD, industrial, replacement value, business type, employees, customers, turnover etc.)
- Institutional (hospitals, schools, community and emergency facilities – location, type, construction, replacement value, people etc.)
- Infrastructure (utilities, transportation, hazardous material etc.)
- Ancillary (vehicles)

The exposure information is derived from both a generic approach and from building (or asset) specific data. The development of coverage of institutions (educational, health, community, sports etc.) and alignment with activity models will further help emergency managers to estimate the consequences from rapid on-set events. This national initiative provides an opportunity for widespread community ownership through contributions by local authorities of community and building-specific information.

NEXIS provides information to emergency managers, researchers and decision makers.

NEXIS underpins government decision making in areas including climate change adaptation, emergency management planning and critical infrastructure.

Australian Government
Geoscience Australia

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