HAZARD NOTE

bushfire&natural HAZARDSCRC

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TOPICS IN THIS EDITION | EXPOSURE | FRAMEWORK | RESILIENCE | INFRASTRUCTURE

THE AUSTRALIAN EXPOSURE INFORMATION PLATFORM: UNCOVERING NATIONAL EXPOSURE

ABOUT THIS PROJECT

This project builds on research from the Natural Hazard Exposure Information Modelling Framework, conducted by the Bushfire and Natural Hazards CRC as part of the *Natural hazard exposure information modelling framework* project.

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SUMMARY

Understanding what is exposed during hazard events is a highly valuable starting point for a variety of sectors. Within a web-based platform that was designed with, and specifically for, emergency management, this project aligns Geoscience Australia's National Exposure Information System (NEXIS) and spatial data capabilities with a range of key elements from the Natural Hazard Exposure Information Modelling Framework. The new Australian Exposure Information Platform (AEIP) quickly and easily allows users to generate exposure reports needed for decision making before, during and after hazard events anywhere in Australia. The customised reports provide a detailed statistical summary of the number of people, dwellings, other buildings and structures, businesses, agricultural and environmental assets, within a user-defined area. Since the beta version was launched in 2018, the AEIP has been used regularly by more than 240 users, from agencies such as emergency management and local government, to produce thousands of reports each month.

▲ Above: THE AUSTRALIAN EXPOSURE INFORMATION PLATFORM HELPS GOVERNMENT, INDUSTRY AND RESEARCH AGENCIES UNDERSTAND WHAT IS EXPOSED IN AN AREA, TO INFORM BETTER DECISIONS BEFORE, DURING AND AFTER EMERGENCIES.

CONTEXT

The Australian Exposure Information Platform (AEIP) can be used to help estimate the potential impacts of natural or human-induced hazards or critical infrastructural failures on Australian communities. An understanding of what is exposed at any location can be used for mitigation and operational decision making for any hazard within a defined area. Decision makers now have easy 24/7 access to nationally consistent exposure information anywhere in Australia.

BACKGROUND

In 2002, Geoscience Australia began the development of the NEXIS project, in response to the Council of Australian Governments reform commitment on Australia's ability to manage natural disasters and other emergencies.

NEXIS provides comprehensive and nationally consistent exposure information to enable users to understand the elements at risk. Exposure information is produced by sourcing the best publicly available information, including statistics, spatial and survey data, such as demographics, building, business, agriculture, institutions, infrastructure and environmental elements. Public access to NEXIS has been limited to products based on Local Government Areas or Australian Bureau of Statistics (ABS) Statistical Areas.

Since 2012, Geoscience Australia has been providing support and advice to the insurance sector, as well as local, state and government agencies, industries and universities. In 2013, the Bushfire and Natural Hazard CRC and Geoscience Australia led a three-year research project in collaboration with the University of Melbourne and the University of Canberra to create a comprehensive Natural Hazard Exposure Information Framework. The objective was to fully describe and categorise exposure information elements into a consistent framework, specifically to meet the needs of the emergency management sector.

With further support from the CRC in 2018, the project began development of a nationally consistent exposure information platform – one that provided easy access to a robust, reliable and operational system. The platform and underlying system could be used to understand what is exposed for disaster preparedness, planning, response and recovery, at all levels of government, industry and research.

BUSHFIRE AND NATURAL HAZARDS CRC RESEARCH

After consulting with stakeholders, the main need identified was the ability to quickly gain a holistic understanding of what is potentially exposed within a hazard event area or any area of interest. In response, Geoscience Australia designed the exposure report, comprising a collation of selected key exposure information elements, presented in a clear and consistent layout enabling timely emergency response and recovery decision making.

Prior to this project, the ability to generate exposure reports, although largely automated, still relied on manual intervention and was only accessible via Emergency Management Australia's Crisis Coordination Centre. The AEIP allows anyone to generate a report for any area of Australia at any time, combining the extensive work from the NEXIS and exposure reports with the comprehensive Natural Hazard Exposure Information Framework. For the first time, users have direct access to nationally consistent exposure information through a user driven, on-demand interface.

Web mapping application and API

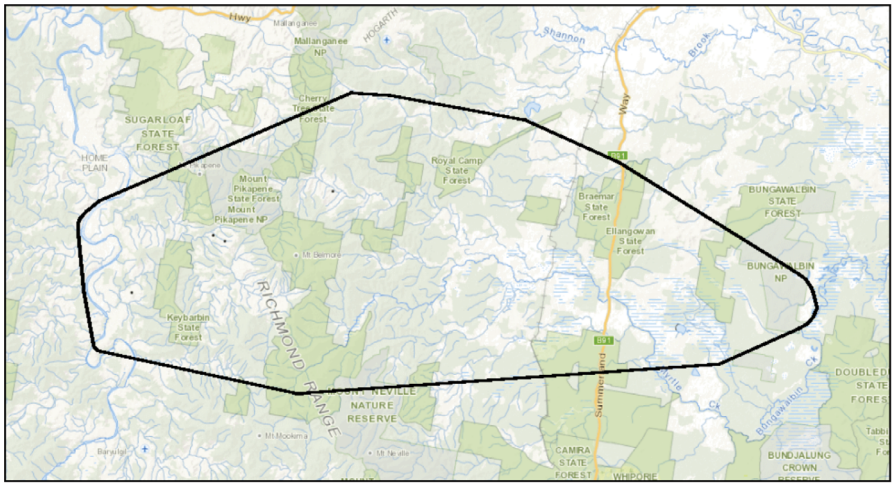
The web platform includes an interactive map for area selection and report request, and an Application Programming Interface (API) to allow requests to be sent from other web-mapping applications. The mapping application enables users to upload or draw an area of interest, select the type of exposure data themes they would like, and provide contextual information (such as report title). They are then delivered the resulting report via email within five to ten minutes depending on the size and complexity of the areas of interest. The API is a key feature of the platform. It allows external users to integrate the platform into their own existing or new applications. Users can request reports without having to leave their system (such as those being used by New South Wales Rural Fire Service).

Geoscience Australia - Exposure Report

Event name: 350684
Event type: Bushfire
Report Date: 29-11-2019 11:44:13 (AEST)

Australian Government
Geoscience Australia

LGAs within the event footprint: Richmond Valley (A), Clarence Valley (A), Kyogle (A)
Localities within the event footprint:
Footprint data source: Sapphire database



Building Exposure, V10 January 2019	
Residential	**Event**
Population count	305
Dwelling count*	153
Building count	153
Pre 1980 construction count	4
Pre 1990 probable asbestos containing products**	47
Reconstruction value	$84,590,000
Contents value	$11,800,000
Commercial	
Building count	-
Reconstruction value	$-
Industrial	
Building count	8
Reconstruction value	$60,740,000
2016 SEIFA IRSAD*	
Dwellings in area with a SEIFA decline 10 score (most advantaged)	-
Dwellings in area with a SEIFA decile 9 score	-
Dwellings in area with a SEIFA decile 8 score	-
Dwellings in area with a SEIFA decile 7 score	-
Dwellings in area with a SEIFA decile 6 score	-
Dwellings in area with a SEIFA decile 5 score	-
Dwellings in area with a SEIFA decile 4 score	4
Dwellings in area with a SEIFA decile 3 score	-
Dwellings in area with a SEIFA decile 2 score	6
Dwellings in area with a SEIFA decile 1 score (most disadvantaged)	143
Dwellings in area without a SEIFA score	-

Dwelling estimates where residents:		
Demographic*	**Event**	**NSW(Av)**
Are all aged 65 or over	16.3%	18.7%
Includes persons aged 14 years and under	14.8%	26.4%
Includes an Indigenous person	12.8%	4.5%
Are a single parent family	6.2%	6.5%
Are in need of assistance for self-care activities	22.3%	11.5%
Include persons not proficient in English	0%	1.9%
Do not have access to a motor vehicle	2.7%	11.5%
No one has completed Year 12 or higher	38.3%	16.6%
Moved to the region in the last 1 year	6.4%	12.1%
Moved to the region in the last 5 years	19.6%	31.1%
Top 5 employing industry*:		
Agricultre Forestry Fishing, Manufacturing, Health Care Social Assistance, Consultation, Administrative Supportive Services		
Economic*	**Event**	**NSW(Av)**
Are low income ($1-$499/week)	51.2%	24.9%
Are medium income ($500-$1,499/week)	43.2%	52.2%
Are high income ($1,500+/week)	3.7%	24.5%
Are in public housing	5.2%	7.9%
Are all unemployed	3.3%	1.6%

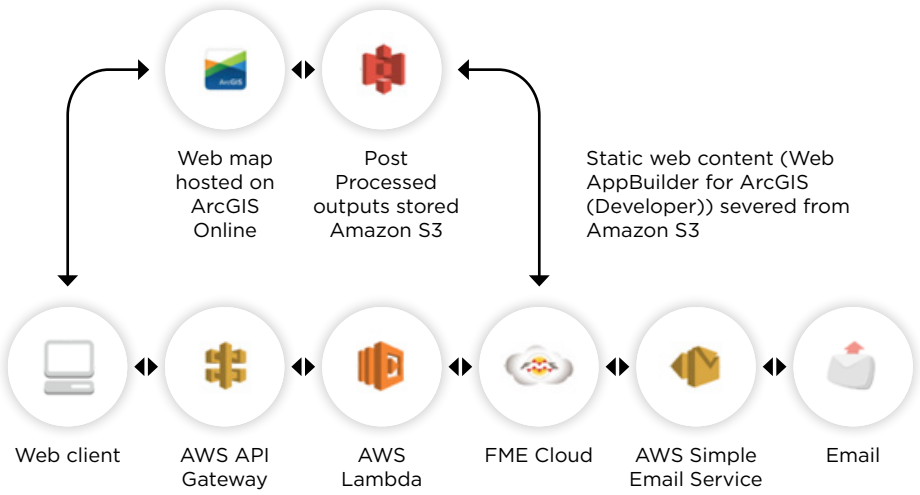
** Demographic information is based on 2016 Census. Residential demographic and economic information is not provided for dwelling counts less than 20 or when the population count is zero*

*** Buildings may contain asbestos cement materials, especially in the eaves, internal and external wall cladding, ceilings (particularly in wet areas such as bathrooms and laundries), corrugated products (roofing and cladding) and fences*

Institution Exposure			
Education	**Event**	**Government Facilities**	**Event**
School - Pre/Primary	1	Federal Court	-
School - Secondary	-	Medicare Office	-
School - Tertiary	-	Centrelink Office	
School - Other (Combined, Special)	-	Diplomatic Facility	-
Health and Welfare		Consulate Facility	-
Hospital - Public	-	Major Defence Facility	-
Hospital - Private	-	Correctional Facility	-
Nursing Home	-	Immigration Detention Facility	-
Retiremnet Home	-	Local Government Offices	-
Emergency Services			
Police Station	-		
Fire Station	3		
Ambulance Station	-		
SES Facility	-		
Emergency Management Facilities	-		

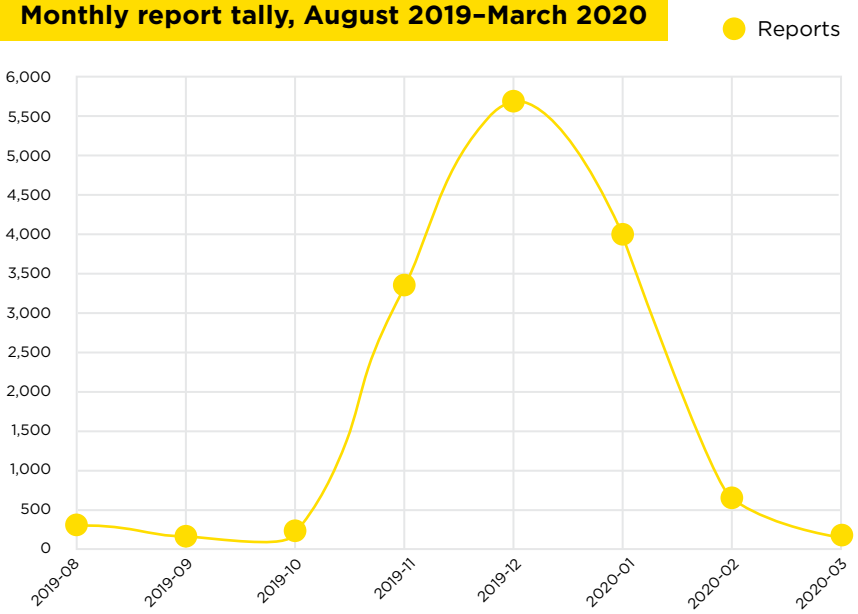
Infrastructure Exposure			
Utility/Energy	**Event**	**Transport**	**Event**
Power Station - Major Renewable	-	Airport - Major Areas	-

▲ Figure 1: EXAMPLE OF AN EXPOSURE REPORT GENERATED BY NSW RURAL FIRE SERVICE CERBERUS ENSEMBLE FIRE SIMULATOR DURING THE 2019/20 BUSHFIRE SEASON, USING THE AEIP API.



▲ Figure 2: OVERALL WORKFLOW FROM THE AEIP RECEIVING A REQUEST TO USER NOTIFICATION OF COMPLETED REPORT.

Monthly report tally, August 2019–March 2020



Large requests by separate server

700,000 reports

generated for Western Power

15,000 reports

generated for Queensland Fire and Emergency Services.

▲ Figure 3: NUMBER OF EXPOSURE REPORTS PRODUCED VIA AEIP BY MONTH, FROM AUGUST 2019–MARCH 2020, REFLECTING SEASONAL VALUE

END-USER STATEMENT

"The Australian Exposure Information Platform (AEIP) Application Programming Interface (API) was integrated into the NSW RFS Cerberus Ensemble Fire Simulator workflow during the 2019/20 bushfire season. Cerberus is able to simulate where a fire is likely to move in the next 24 hours and the simulation polygon extent generated can now be automatically consumed by the AEIP API to generate an exposure report. This capability allows NSW RFS to quickly assess what is in the path if the fire is not controlled and therefore helps to plan and prioritise emergency responses. The ability to integrate AEIP into Cerberus provides an excellent triage capability to support decision makers in times of rapidly changing events as experienced in the unprecedented bushfire season of 2019/20."

– Stuart Matthews, Principal Project Officer, Operational Services/Planning and Predictive Services, NSW Rural Fire Service

"During *Cyclone Veronica* (March 2019), we were able to use AEIP to understand exposures in the towns in the Pilbara that were under threat. This enabled us to determine vulnerabilities in structures and populations. It enabled recovery coordination to have an appreciation of the reconstruction values if *Cyclone Veronica* had impacted any of these coastal communities. It has also been very useful with conducting risks assessment for multiple hazards and assisting with long-term capability analysis. Our Community Preparedness Branch now uses AEIP for identifying vulnerable communities and to consider broader demographics towards tailoring the type of community engagement they apply."

– Steve Gray, A/Manager, Hazard Intelligence and Risk Reduction, Department of Fire and Emergency Services, WA

When a request is sent to the API, Amazon Web Services (AWS) and Feature Manipulation Engine (FME) services are utilised to process, extract and aggregate information, and provide a download location for the final tabular data and html report. When the results are ready for download, the AWS email service notifies the end-user that the job is completed and where the results can be found.

RESEARCH FINDINGS

Before the AEIP, during an emergency, users had to wait for Geoscience Australia to manually create exposure reports during an emergency. Geoscience Australia guaranteed a two-hour turnaround per report request during business hours. With the AEIP, users can now quickly and easily make their own customised exposure reports by using the web mapping application or the API. With exposure information now easily accessible and available at any time, it is possible for decision makers to readily utilise exposure information as a key piece of intel for critical pre-planning, or on-the-fly scenario event assessments, anywhere across Australia.

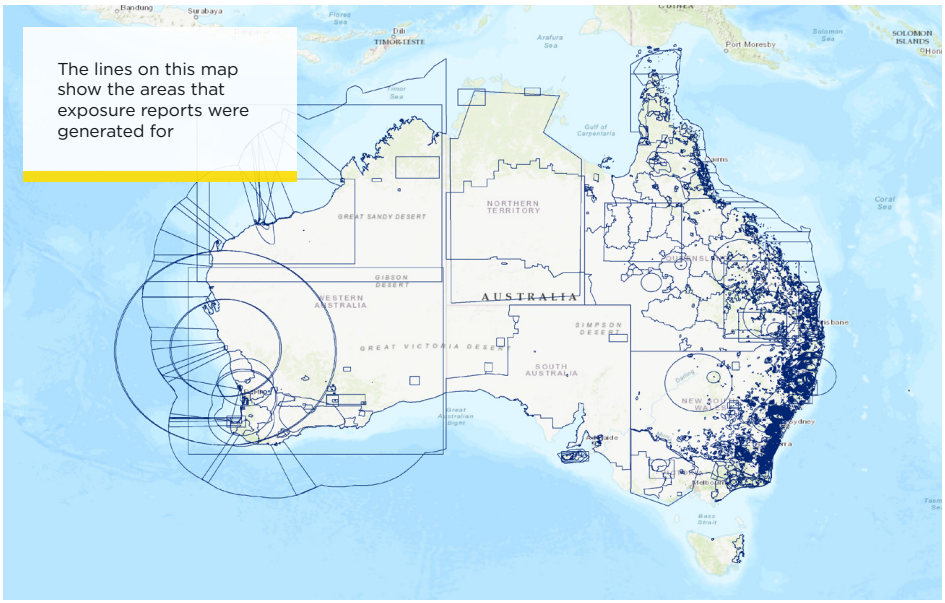


Figure 4: END-USER AREAS OF INTEREST (MORE THAN 14,000) FOR DECEMBER 2019 TO MARCH 2020. THIS MAP SHOWS THAT EXPOSURE REPORTS WERE GENERATED FOR BOTH SMALL AND LARGE AREAS, COVERING ALL STATES AND TERRITORIES. DARK-BLUE AREAS SHOW MULTIPLE AEIP QUERIES, CORRELATING WITH EXTREME WEATHER EVENTS E.G. 2019/20 BUSHFIRES.

FURTHER READING

Power L, Charalambou C, Orr K, Dunford M & Hay R (2017) Australia exposed: exposure information for ensuring Australia's community safety, FIG Working Week conference presentation (8883), FIG, 29 May – 2 June 2017.

Nadimpalli K, Mohanty I & Kalantari M (2014) Natural hazards exposure information modelling framework, Geoscience Australia, Canberra.

Nadimpalli K, Mohanty I, Vidyattama Y, Kalantari M & Rajabifard, A (2017) Australian natural hazards exposure information framework: guidelines for national consistency and comprehensive information, Bushfire and Natural Hazards CRC, Melbourne.

HOW IS THE RESEARCH BEING USED?

A beta version of the AEIP was released in August 2018 at the AFAC18 powered by INTERSCHUTZ conference in Perth, for use during the 2018/2019 fire season (October–March). During that season, more than 1,500 exposure reports were produced by more than 200 users, which may have taken up to four months to produce before AEIP (two hours per report), if these were submitted as individual requests. Based on user feedback, improvements were made to the AEIP before the platform went live at AFAC19 in August 2019.

During the north Queensland flooding in December 2018, more than 400 exposure reports were created in one week by government agencies – helping them make faster and smarter decisions to reduce loss of life and economic impact.

With an unprecedented early and dramatic start to the 2019/20 bushfire season, the number of exposure reports produced from the AEIP was in excess of 14,000 by more than 200 individual users (90+ domains; 1 August 2019–31 March 2020). Users such as NSW RFS have integrated the API with their own applications and have been producing thousands of valuable reports each month, particularly during the devastating 2019/20 fire season. Western Power, a WA-based energy provider, has recently utilised the platform to create 700,000 reports.

What these usage patterns show is that during a crisis, when demand for information to inform decisions is extremely high, the AEIP is invaluable. By speeding up the delivery of vital exposure information in an automated format, its nationally consistent and easily accessible approach to data ensures that information and decision making across jurisdictional borders can be done in a way that is comparable and quantifiable.

FUTURE DIRECTIONS

The tool is becoming an important part of planning for community preparedness and improving safety. To date, more than 300 users have been surveyed on their experience using the AEIP, and recommendations for future improvements are ongoing. Future suggestions will be considered to ensure AEIP continues to meet users' needs. Potential improvements may include (but are not restricted to):

- ongoing updates and maintenance of data
- the ability to create exposure reports across state and territory borders
- the addition of national comparative demographic statistics
- the ability for drawn areas of interest to receive the spatial data with the report, allowing users to repeat the request and/or distribute to other users
- the ability for users to select existing geographies, such as Local Government Areas, Bushfire Forecast Districts and the ABS Statistical Geographical Standard digital boundaries
- the ability to batch a number of areas of interest in a single process.

The Bushfire and Natural Hazards CRC is a national research centre funded by the Australian Government Cooperative Research Centre Program. It was formed in 2013 for an eight-year program to undertake end-user focused research for Australia and New Zealand.

Hazard Notes are prepared from available research at the time of publication to encourage discussion and debate. The contents of *Hazard Notes* do not necessarily represent the views, policies, practises or positions of any of the individual agencies or organisations who are stakeholders of the Bushfire and Natural Hazards CRC.

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