3rd HLF on UNGGIM, 22-24 October 2014, Beijing, China

Next Generation of Disaster Management and Public Safety-

Delivering a Resilient Future

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Head, Department of Infrastructure Engineering
The University of Melbourne

CENTRE FOR DISASTER MANAGEMENT AND PUBLIC SAFETY

GSDI Global Spatial Data Infrastructure Association

THE UNIVERSITY OF MELBOURNE

Supporting Public Safety
by spatial information
Enabling disaster management & evidence-based
decision making

MESSAGE

To create a richer and smarter platform to support timely and effective decision making for disaster management

...a platform for ALL hazards, ALL agencies, and the community

A Worldwide Problem

Disaster events are increasing in frequency and severity

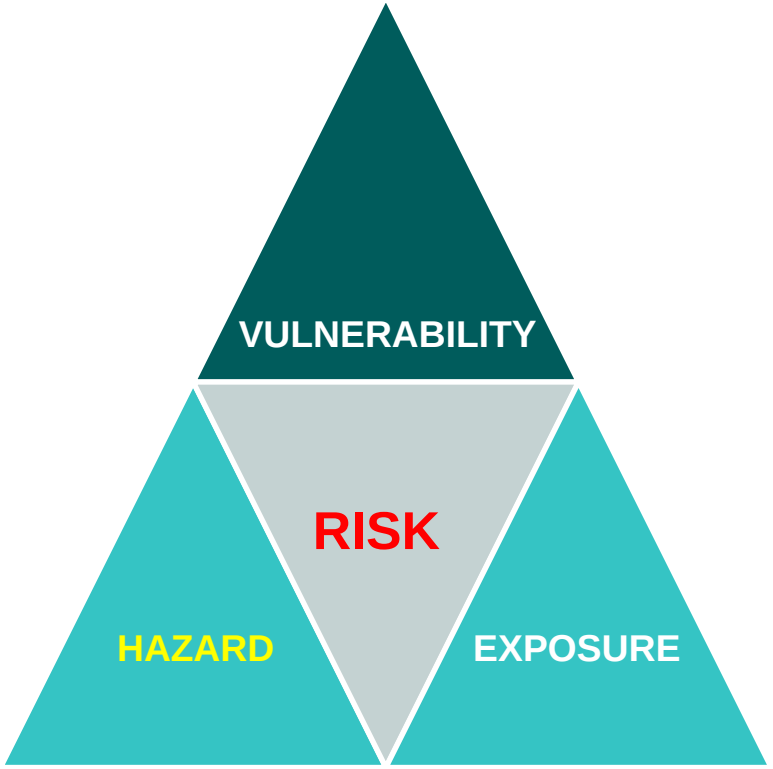
Images: www.bigstockphoto.com; twitter

Disaster Management Trends

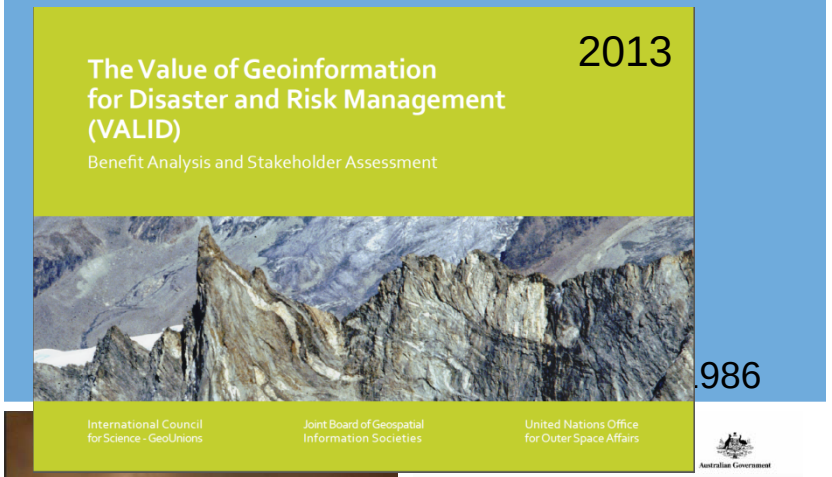
Disaster management is **evolving** and **expanding**

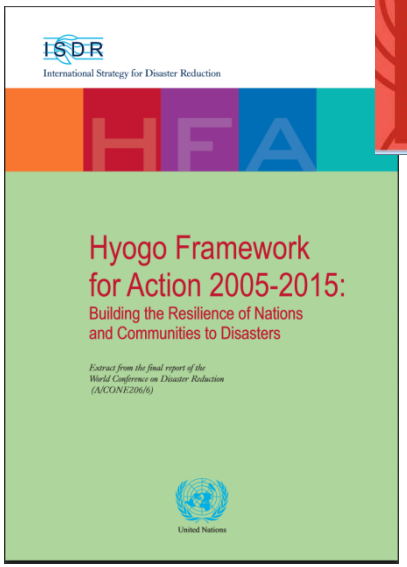
driven by **policy changes** and the implementation of **strategic frameworks**

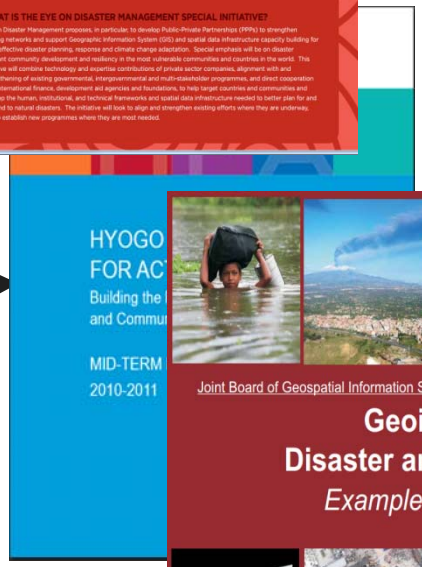
to address the **vulnerability**, **exposure** and **resilience** of communities.

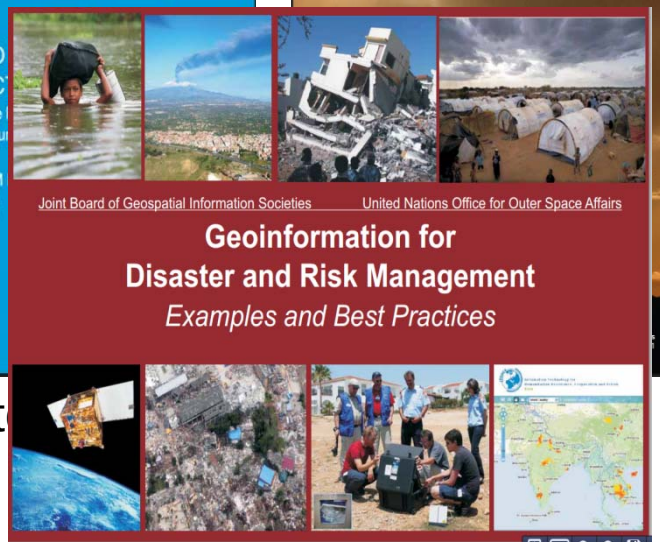


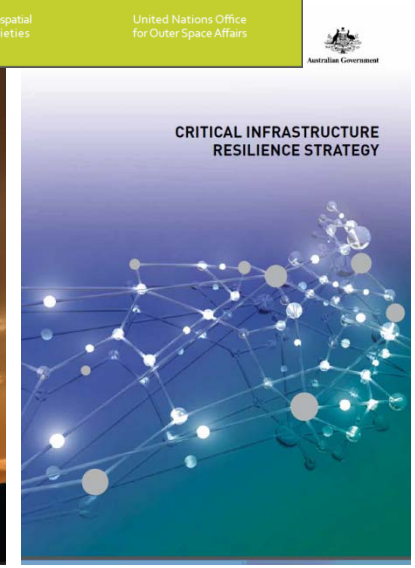
International and National Policy





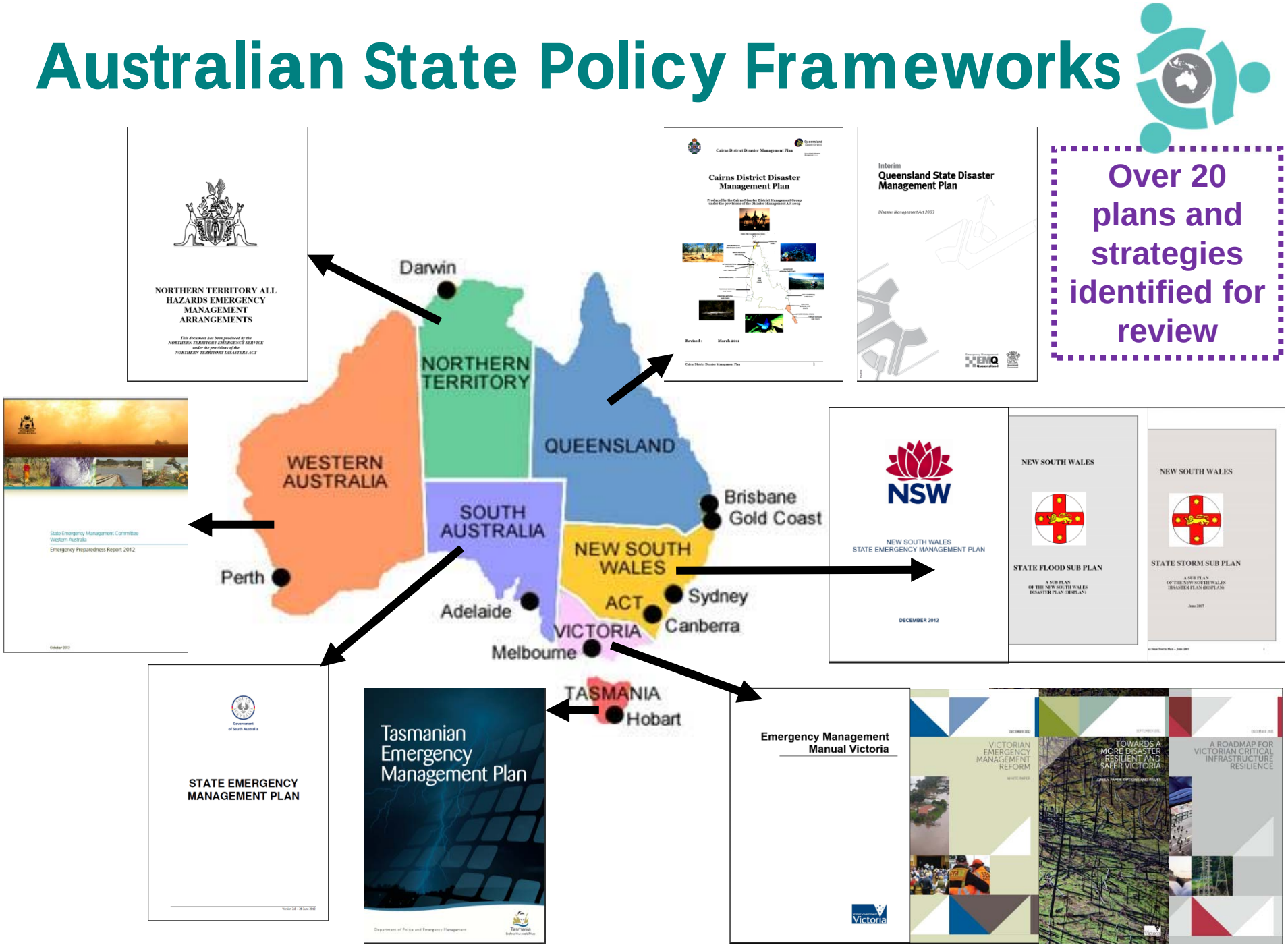






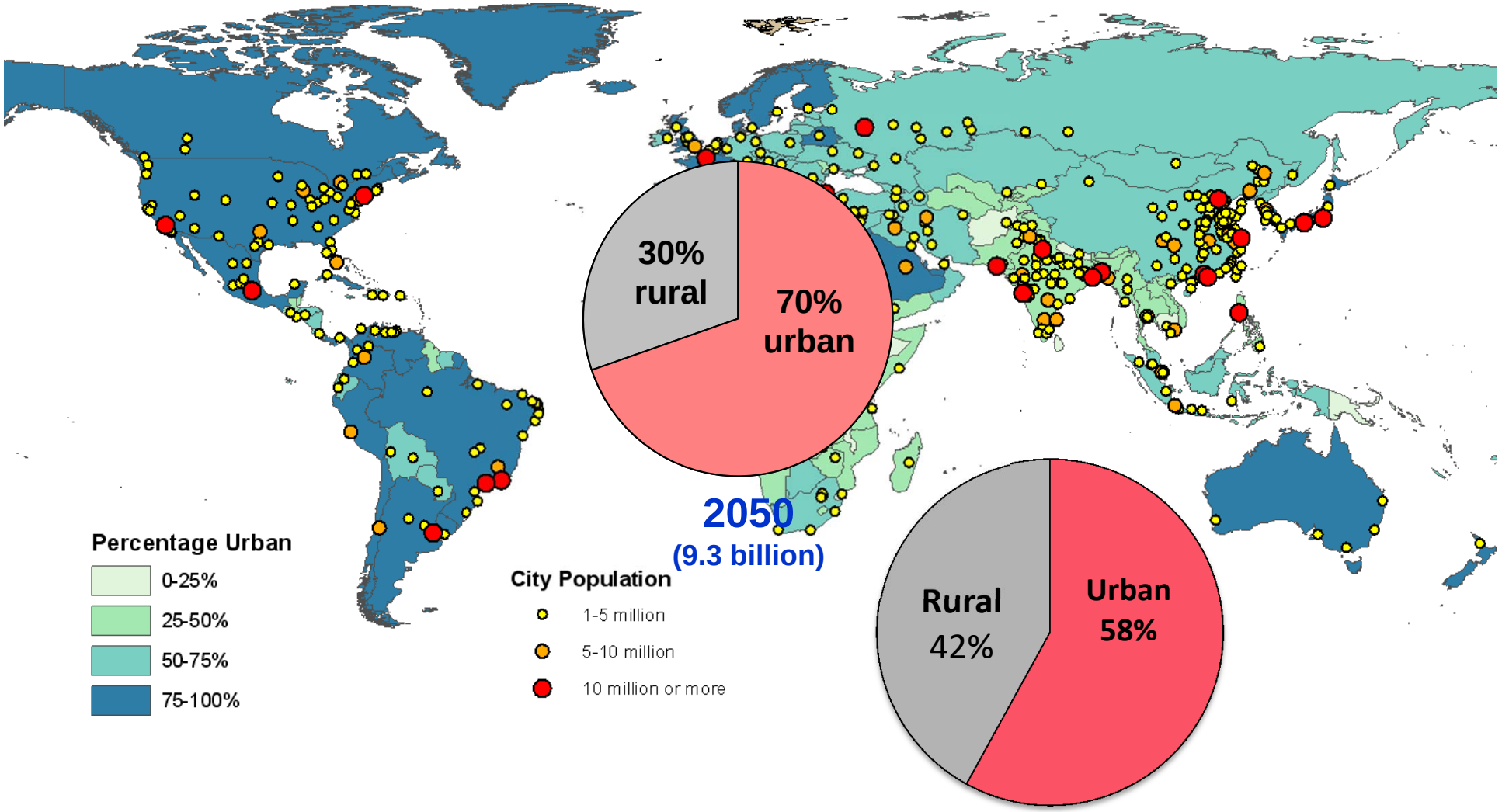
The HFA is a 10-year plan t
world safer from natural

Australian State Policy Frameworks



Over 20 plans and strategies identified for review

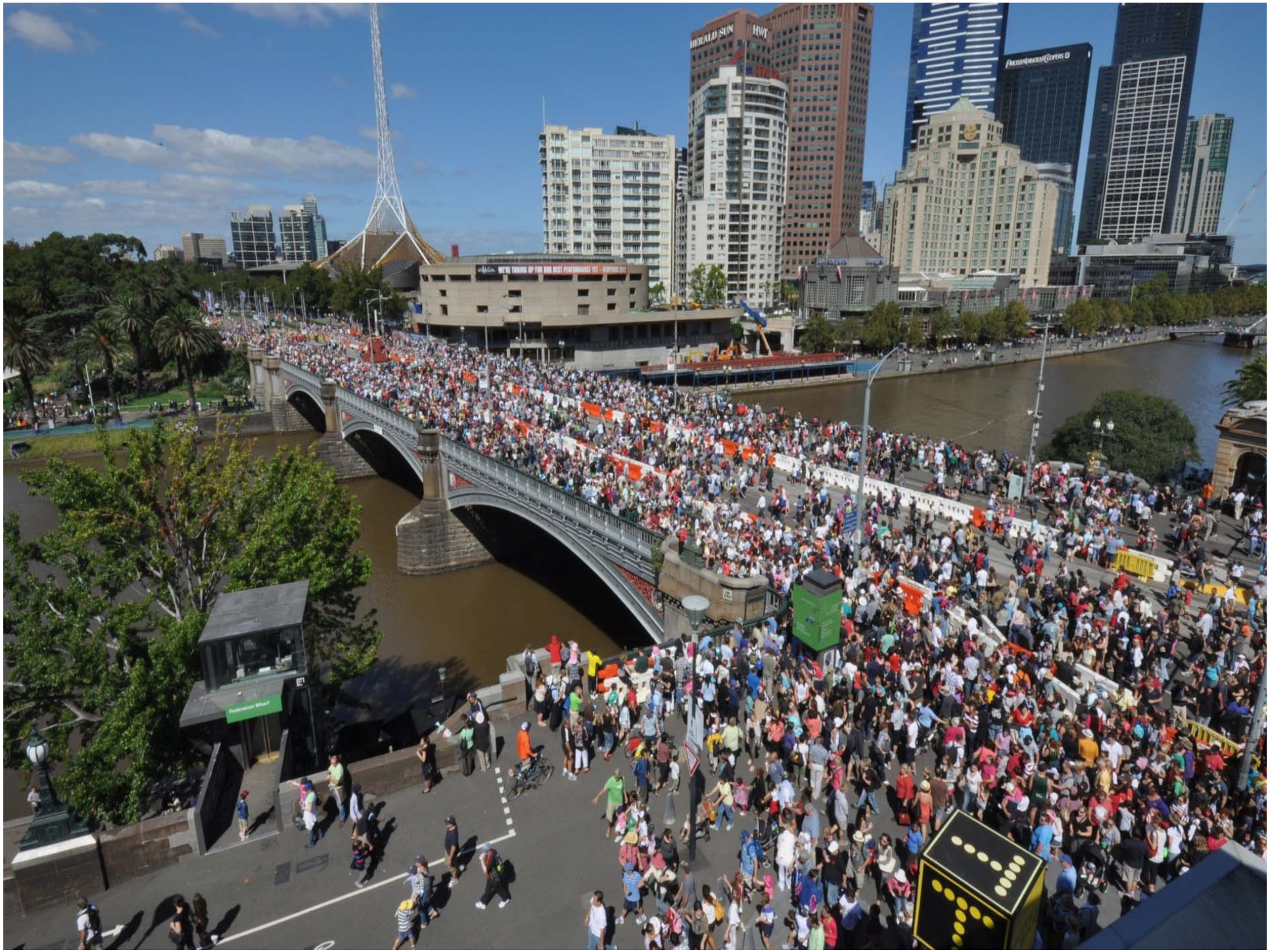
Percentage of Urban Population and Agglomeration by Size Class 2025-2050



Source: United Nations, Department of Economic and Social Affairs, Population Division (2011): World Urbanization Prospects, the 2011 Revision

Urbanisation Trend will Continue

Complex Structures


HERALD SUN
HWT
Federation Wharf

Jollibee
AVON

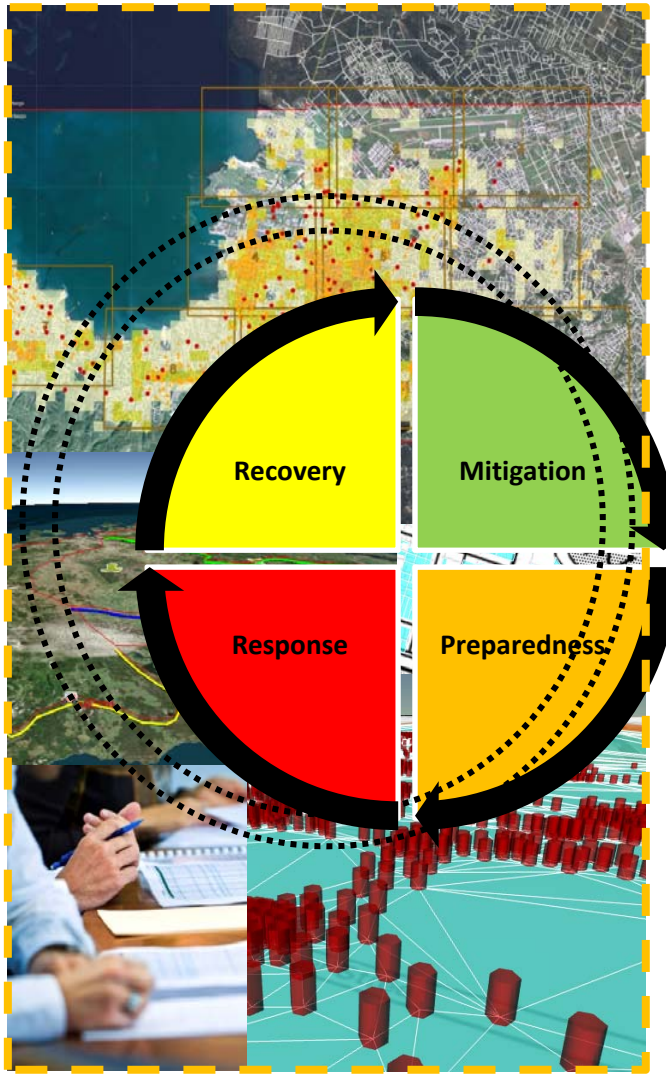
Summary of Issues

These predictions of **increased** global population and **urbanisation..**

..along with **increased extreme weather** events

is **prompting response** from researchers around the world to tackle:

Next-Generation Disaster Management



DISASTER MANAGEMENT
REQUIREMENTS

An Integrated Approach

Governance

Multi-sourced data

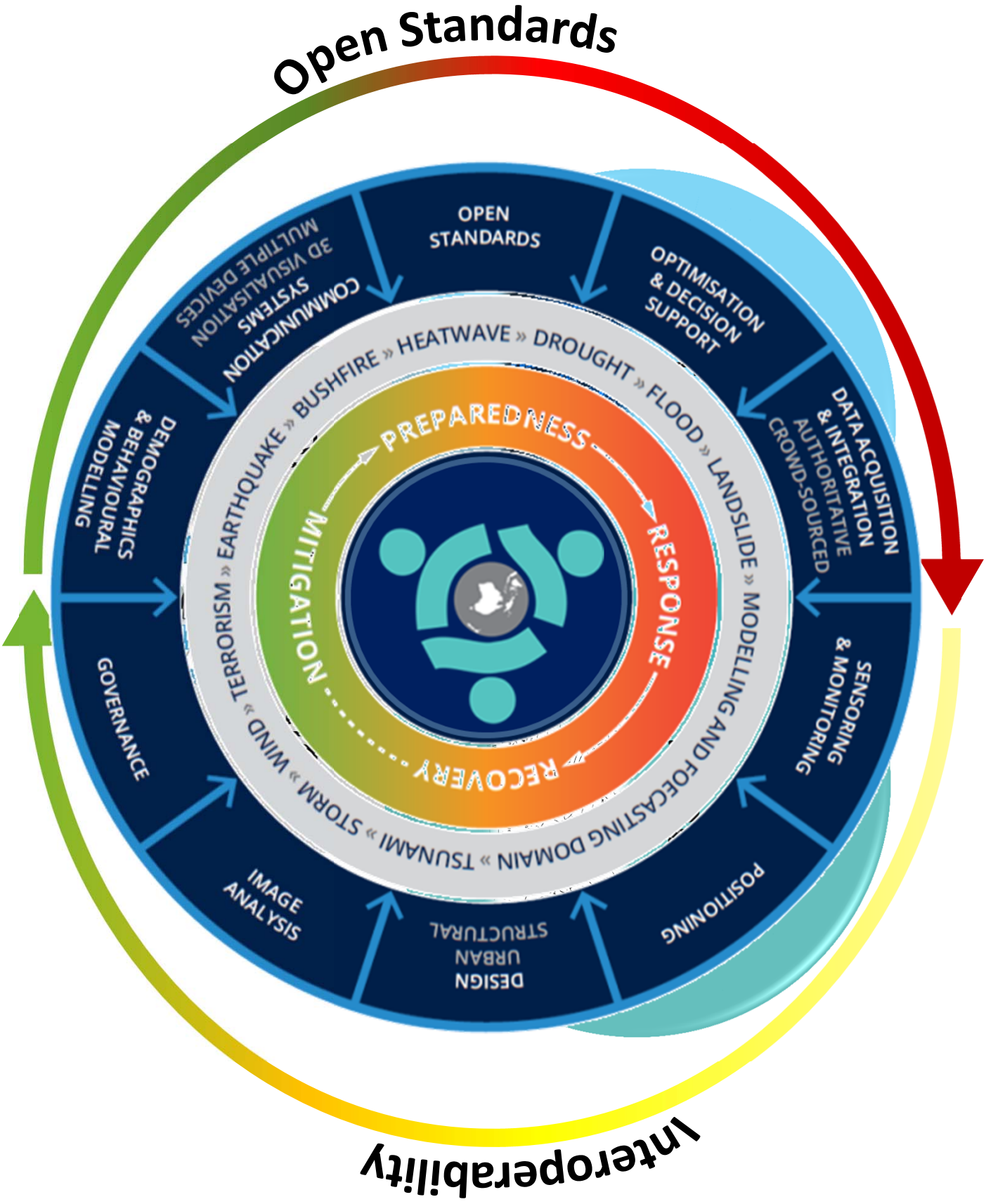
Open Standards

Collaboration

Effective Communication

Interoperability

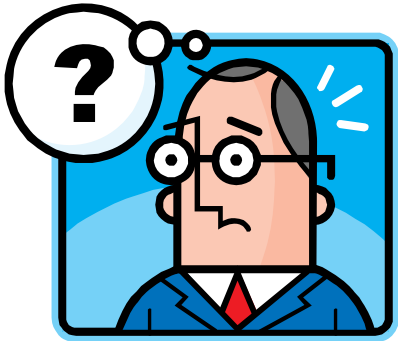
A culture change in disaster management;
"Asking and Listening" vs. "Telling and Talking"

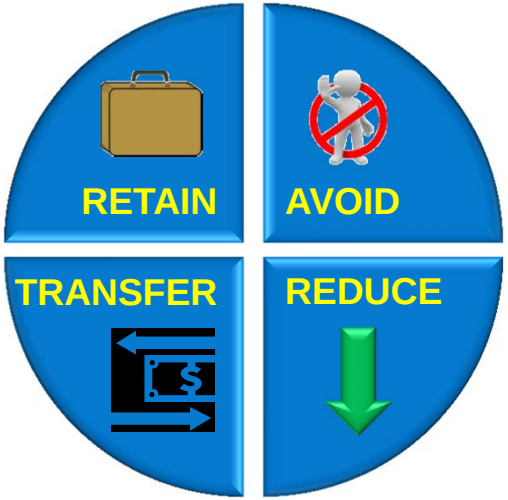

Open Standards
OPEN STANDARDS
OPTIMISATION & DECISION SUPPORT
DATA ACQUISITION & INTEGRATION AUTHORITATIVE CROWD-SOURCED
SENSORING & MONITORING
POSITIONING
DESIGN URBAN STRUCTURAL
IMAGE ANALYSIS
GOVERNANCE
DEMOGRAPHICS & BEHAVIOURAL MODELLING
COMMUNICATION SYSTEMS 3D VISUALISATION MULTIPLE DEVICES
TERRORISM » EARTHQUAKE » BUSHFIRE » HEATWAVE » DROUGHT » FLOOD » LANDSLIDE » MODELLING AND FORECASTING DOMAIN » TSUNAMI » STORM » WIND »
PREPAREDNESS
RESPONSE
RECOVERY
MITIGATION
Interoperability

Good Information is Needed

Informing decision about "**Where** and **When**";

- In order to decide which **risk** management choice is appropriate, stakeholders require **good information.**





- Without **good information** these decisions are difficult.

Volunteered Geographic Information & Crowdsourcing

User-generated content that contains either **implicit** or **explicit** locational

Collaborative mapping activities of users and contribution of geographic data

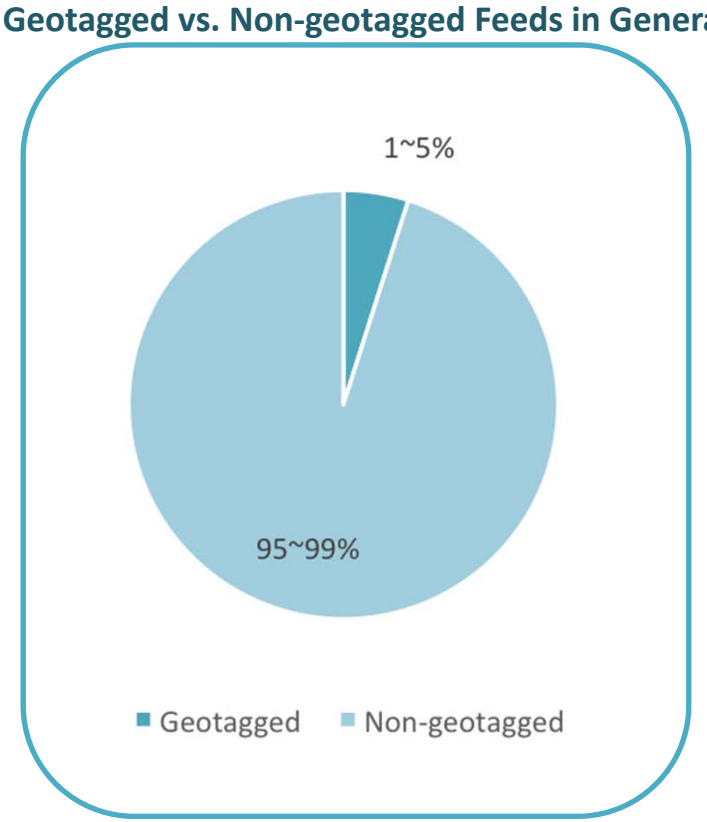
Source of collective intelligence and relying on the idea that a group can solve a problem more effectively than an expert, even though the group has a lack of relevant expertise

Opportunities of accessing and exploring the vast repository of potentially useful, cost-effective and spatio-temporal data

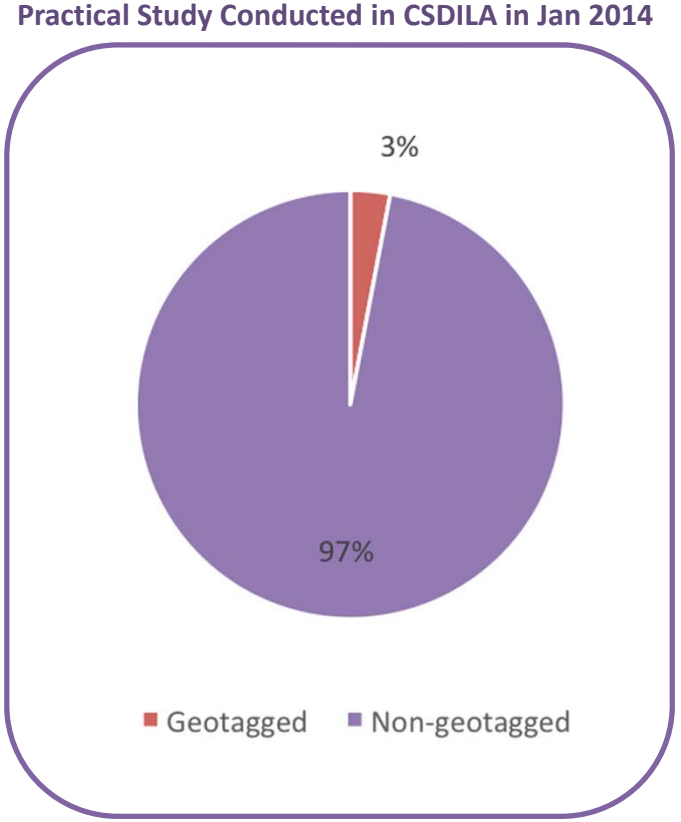
A natural fit for use in a variety of applications, especially for time-sensitive contexts like **emergency response that real-time geospatial data can be of great value**

Issues and challenges in the quality and credibility of crowdsourced data, cited by a number of studies.

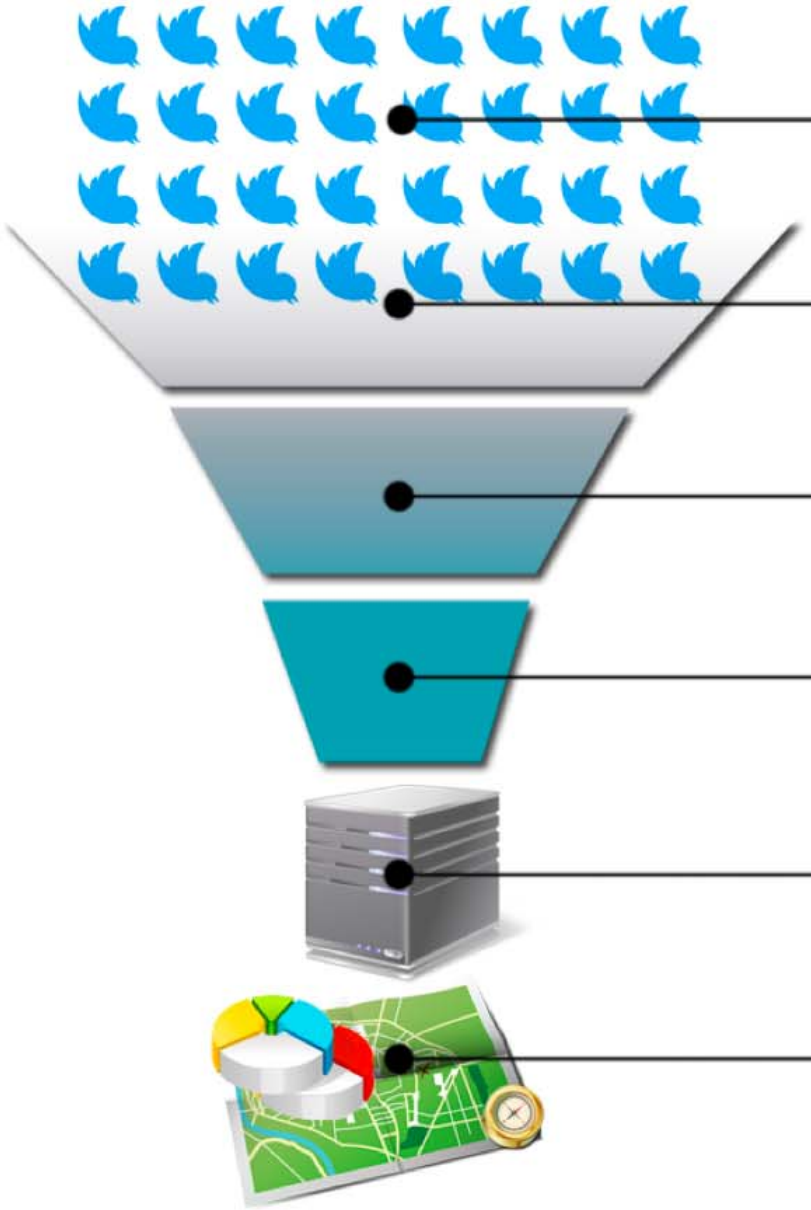
Geotagged vs. Non-geotagged Tweets



(Birregah et al, 2012)



Methodology and Architecture of the crowdsource Platform



Data Collection
From the Twitter Streaming API

Keyword Filtering
Earthquake, Storm and Flood

Duplicate Elimination
Eliminating Multiple & Identical Entries

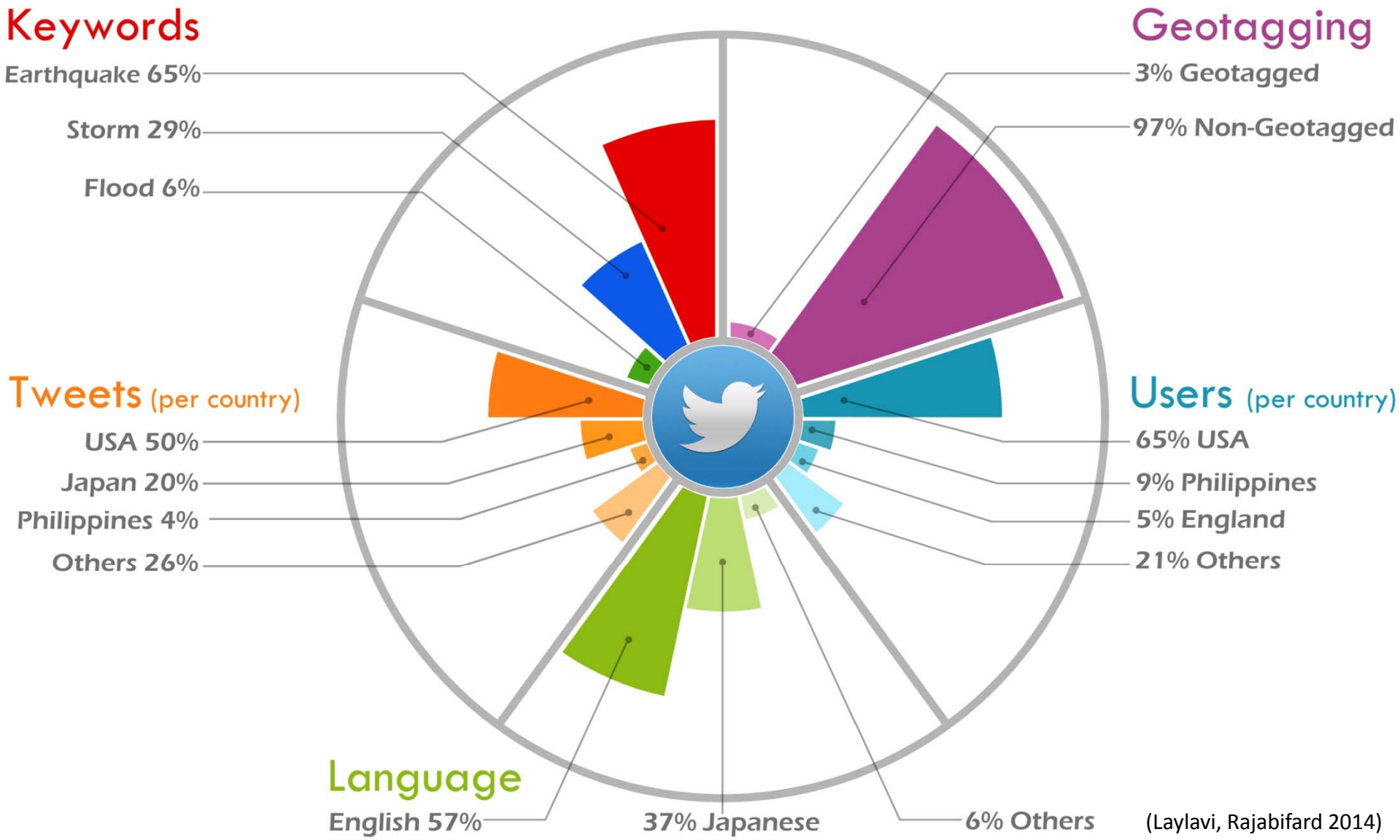
Geotagging Analysis
Filtering the Non-geotagged Tweets

Storing and Structuring Data
Storing in PostgreSQL and making it GIS-ready

Mapping, Analysis and Visualisation
Using ArcGIS

(Laylavi, Rajabifard 2014)

Statistical overview of the disaster-related tweeter data Effective



(Laylavi, Rajabifard 2014)

Effective Disaster Management

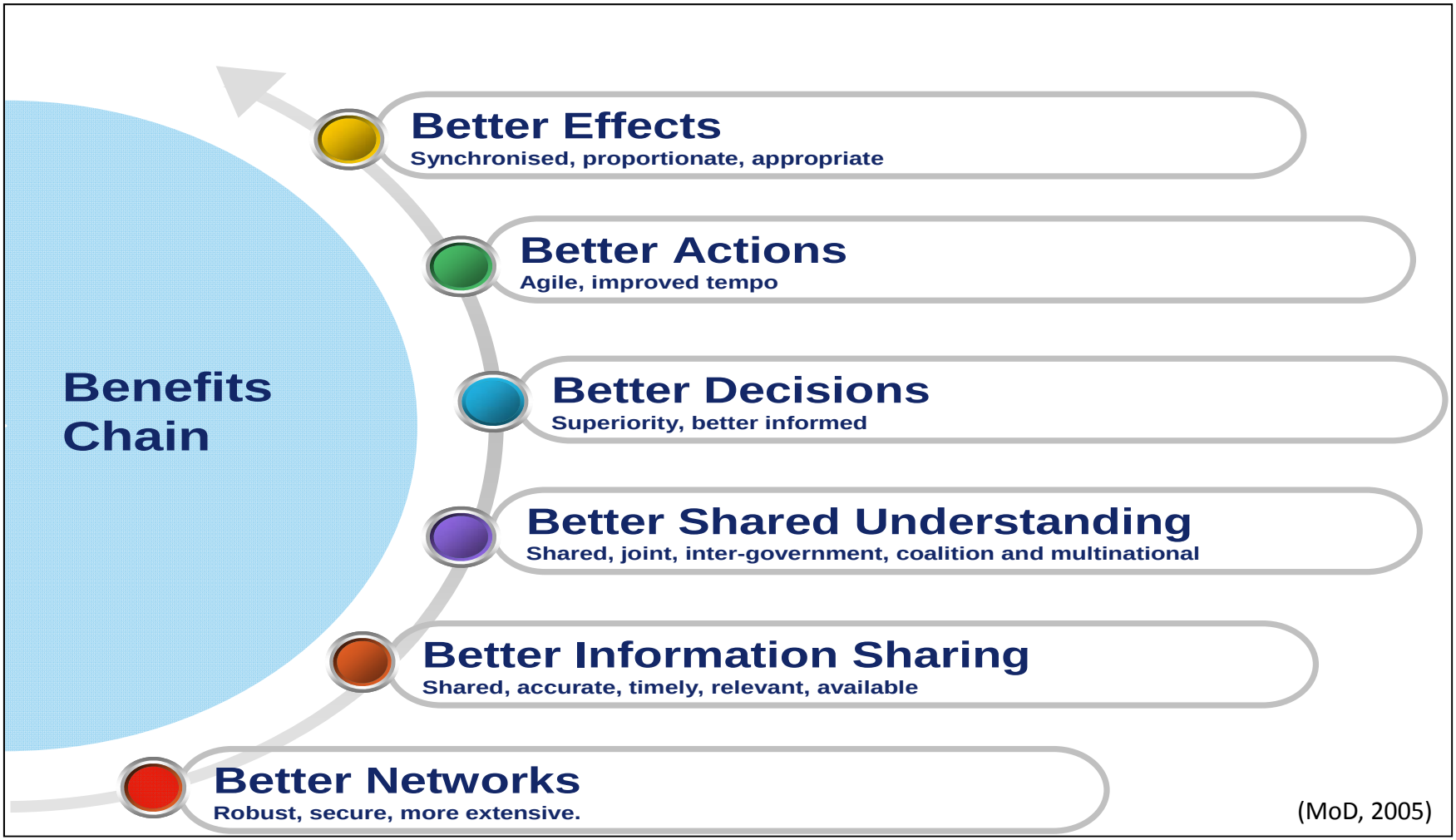
- **Overarching challenges for an effective Disaster Management:**

  Connecting and building relationships; establishing principles for sharing; reliability and performance; and legislation.

- **Proposing a Framework comprises a foundation and four pillars:**

  Governance and Leadership, Capability, Assurance and Community.

Challenges for Effective Disaster Management



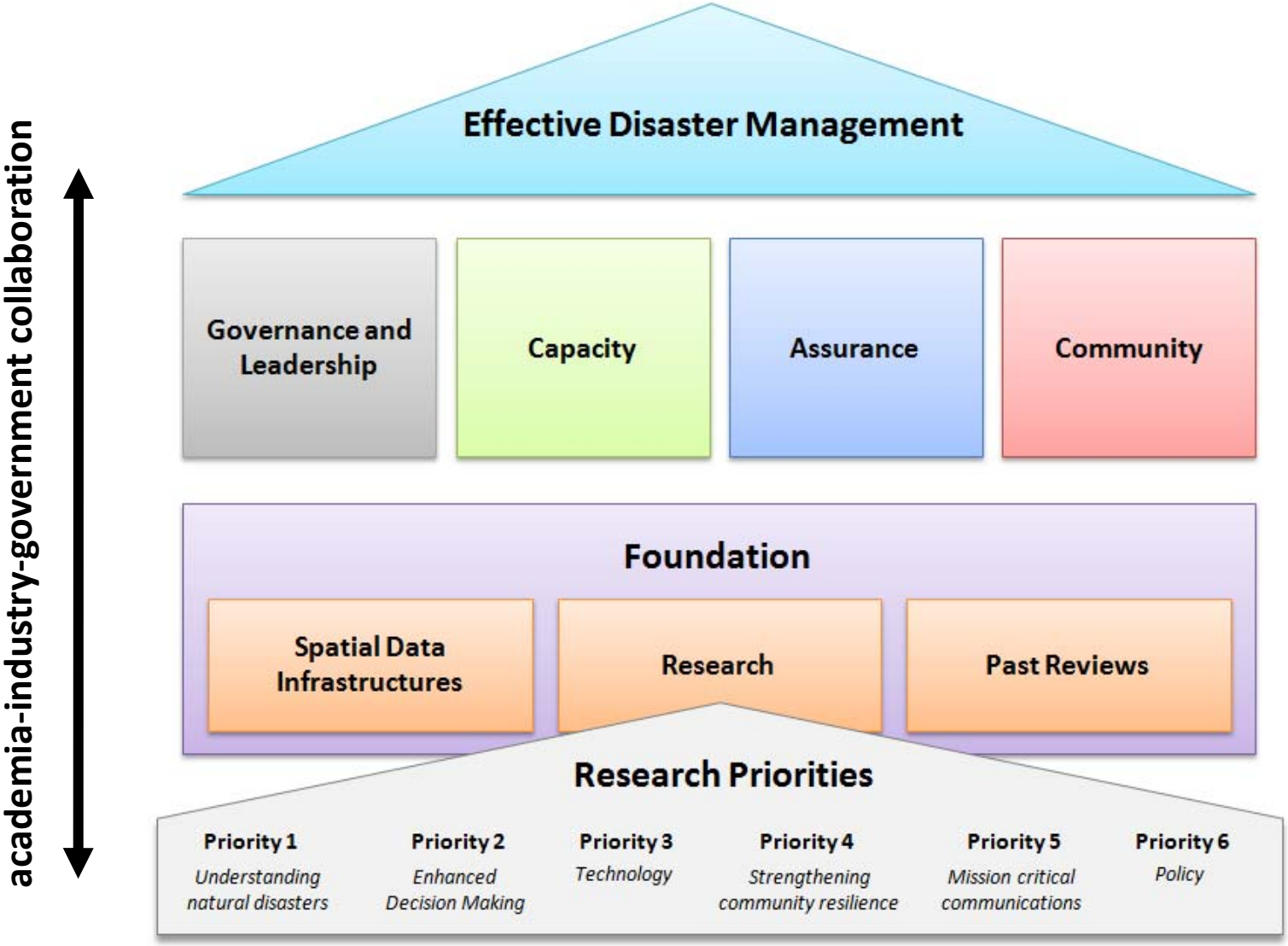
Challenges for Effective Disaster Management

3. **Reliability and performance**

   Ensuring what's in place actually perform effectively in managing the disaster

4. **Legislative support for the developed strategies and activities.**

Framework for effective disaster management



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CENTRE FOR

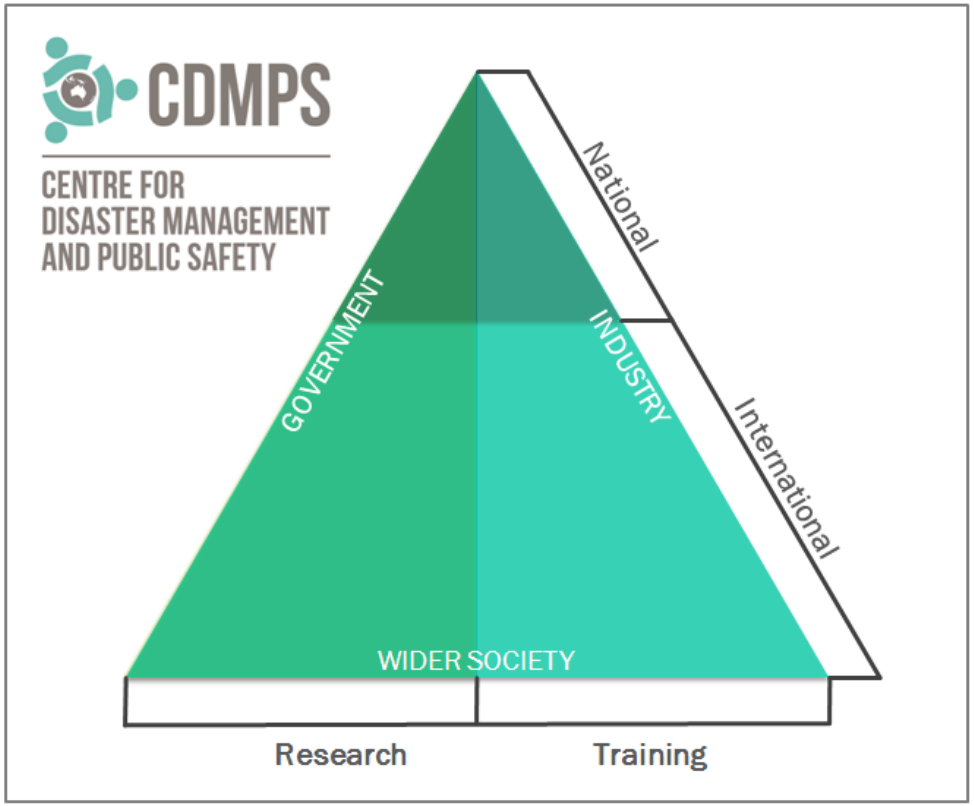
DISASTER MANAGEMENT

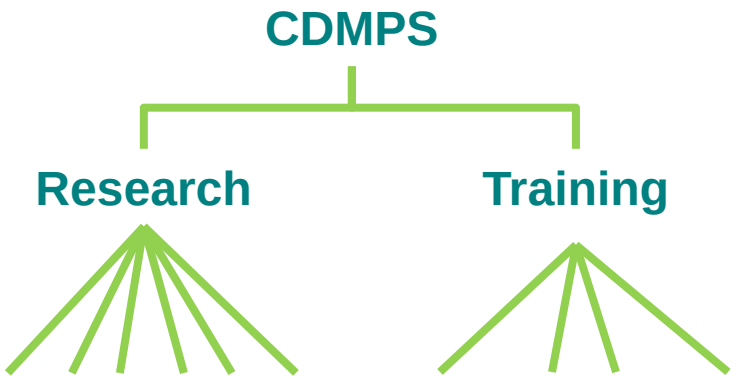
AND PUBLIC SAFETY

THE UNIVERSITY OF MELBOURNE

Centre Focus

- Multi-disciplinary
- All hazard and all phases of disaster management
- Global themes and engagement





Research Priorities

Research Priorities

- ***Priority Area 1:*** Understanding Natural Disasters
- ***Priority Area 2:*** Enhanced Decision Making
- ***Priority Area 3:*** Technology
- ***Priority Area 4:*** Strengthening Community Resilience
- ***Priority Area 5:*** Mission Critical Communications
- ***Priority Area 6:*** Policy

Training

- **Community** Education
- **Intensive** Training
- **Executive** Training
- **Short Courses**
- **Online** Training
- Formal Training: **Masters** level

ENGAGEMENT INITIATIVE

CDMPS

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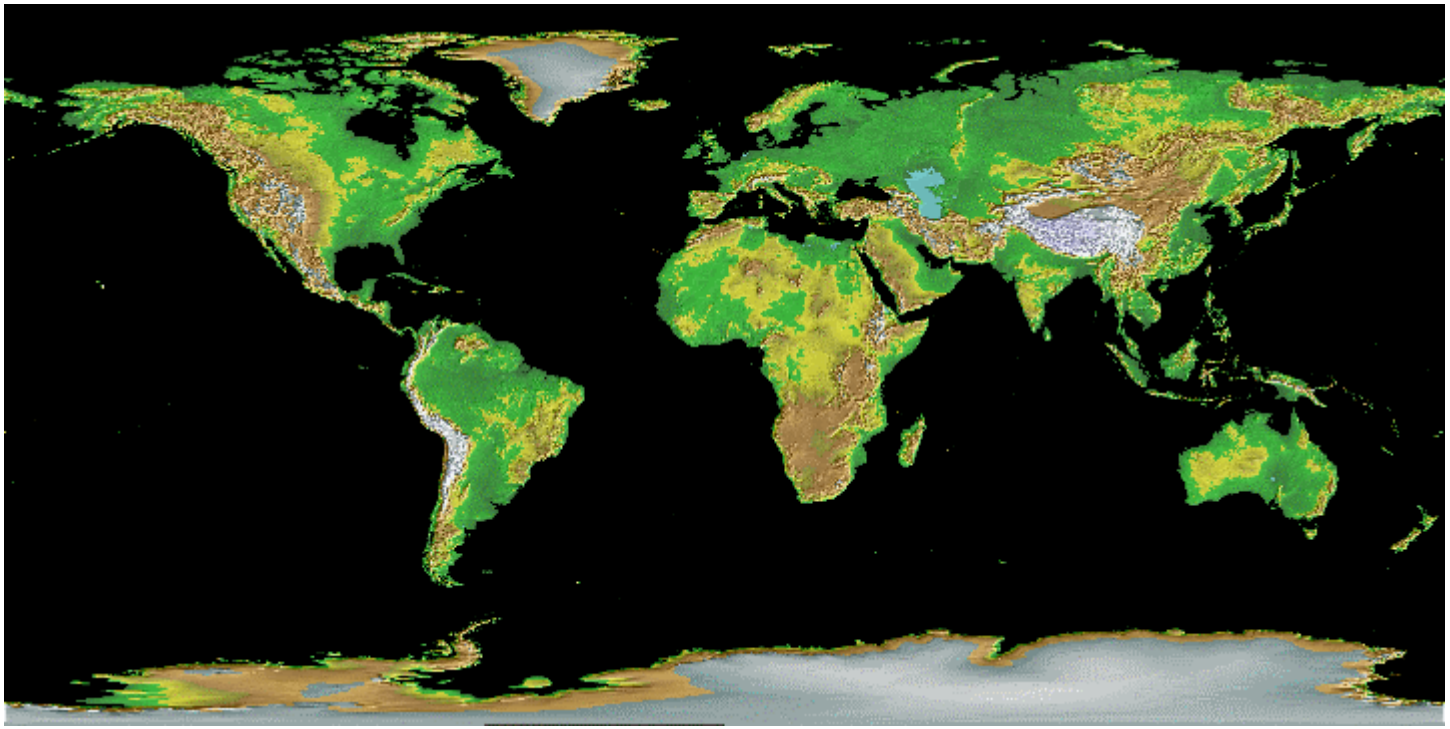
External Interest

Over 20 countries and 40 organisations and 15 universities have expressed their interest in being involved.



WITHIN THE UNIVERSITY OF MELBOURNE

- Over 50 researcher from:

Melbourne School of Engineering

- Infrastructure Engineering
- Computer Science and Software Engineering
- Mechanical Engineering
- Electrical and Electronic Engineering

Melbourne Law School

Faculty of Education

Faculty of Science

- Department of Mathematics and Statistics
- Department of Information Systems
- School of Earth Sciences

Faculty of Architecture, Building and Planning

School of Government

Faculty of Medicine, Dentistry and Health Sciences

- School of Population and Global Health
- Social Work

Melbourne School of Land and Environment

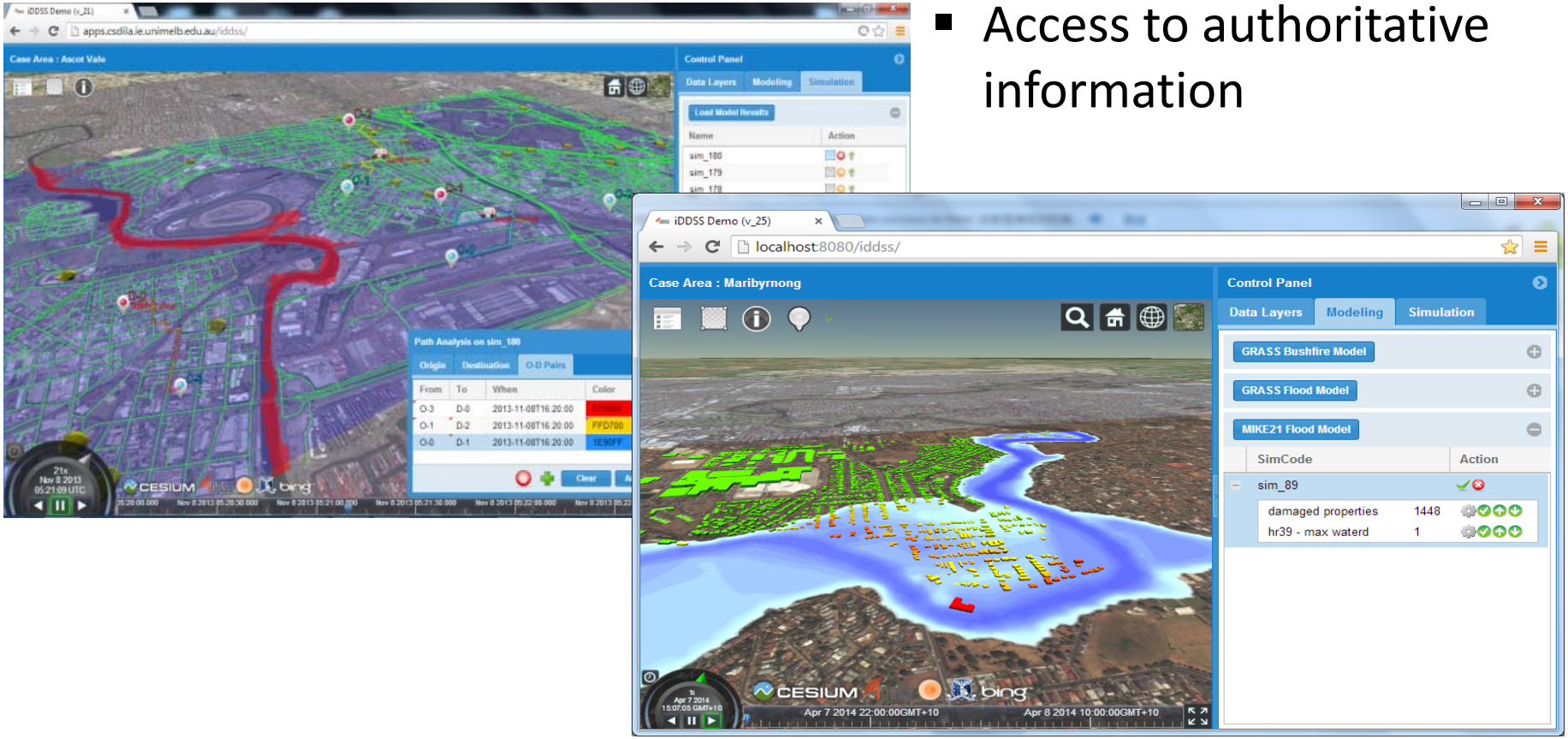
- Forest and Ecosystem Science
- Resource Management and Geography

INTELLIGENT DISASTER DECISION SUPPORT SYSTEM

Features of the IDDSS SYSTEM

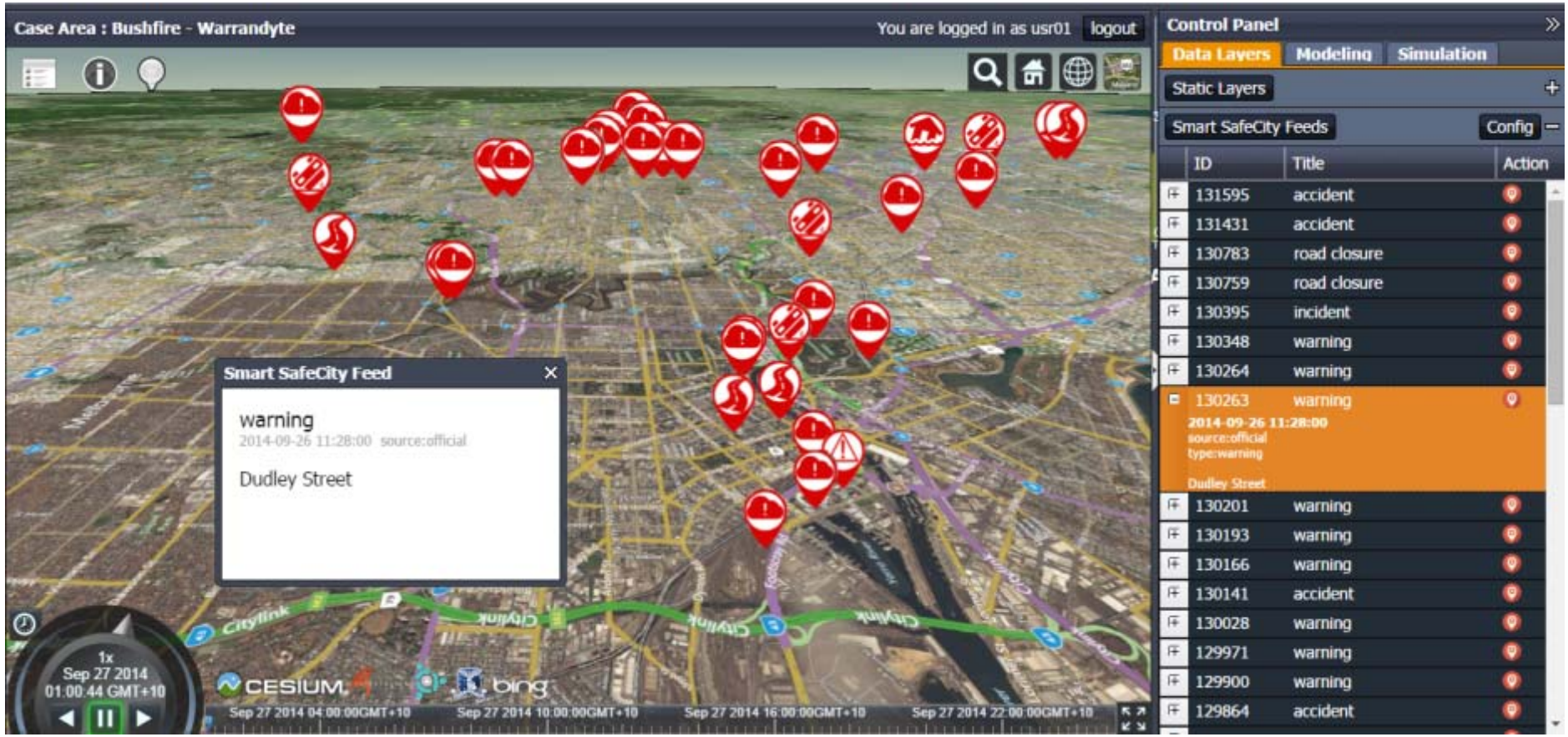
The technical aspects of the system include:

- Webmapping component
- Crowd sourcing component
- Modelling component
- Optimisation component
- Access to authoritative information



The system is current and interactive:

- Live emergency feeds **aggregated from official sources** and the crowd
- “Smart Safe City” mobile app will enable the **two-way communication** between the community and decision makers in a disaster context.



To assist in your evaluation, you can:

- **Load** and **visualize** infrastructure **layers** in IDDSS
- **Query** attribute **data** on map

The system has a number of analysis options:

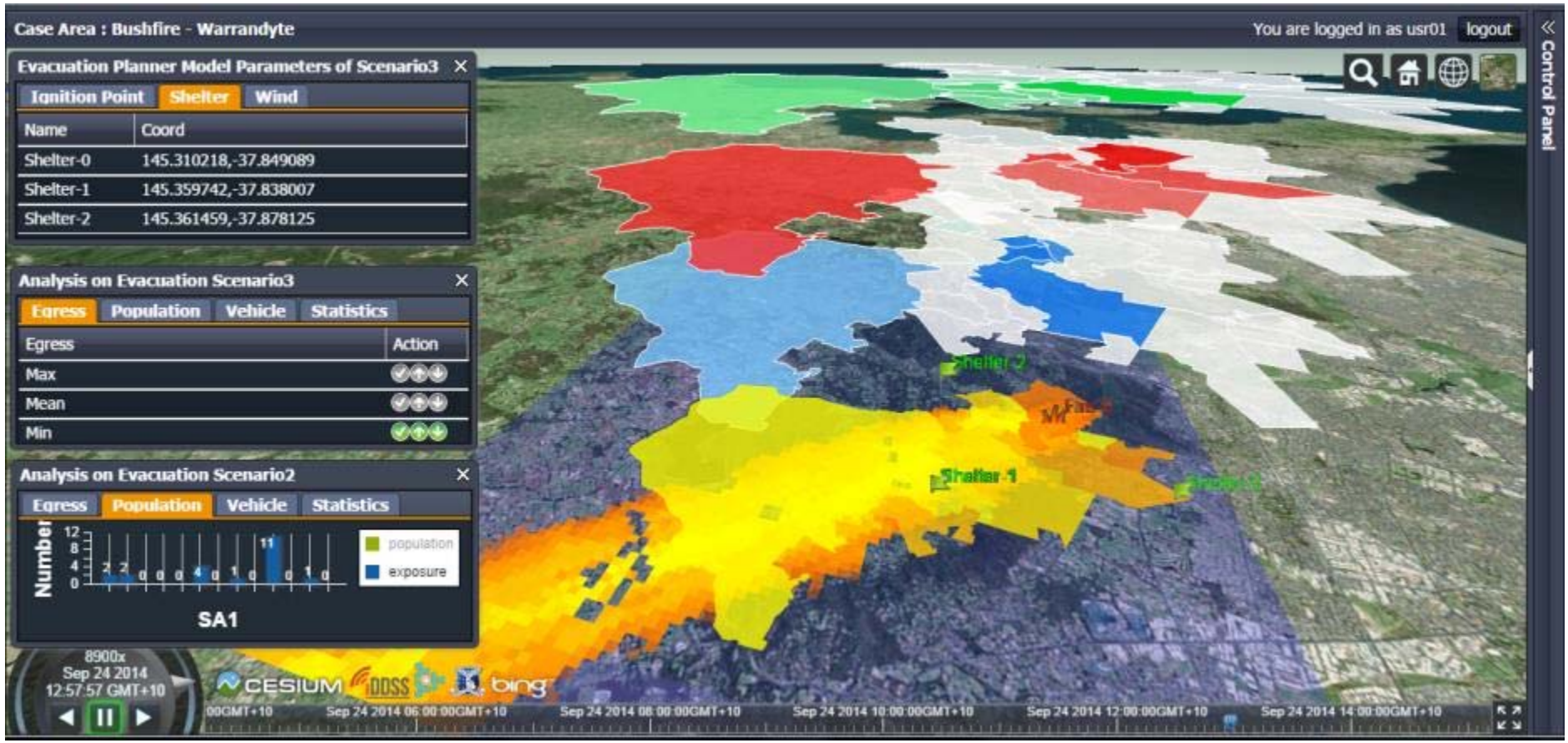
- **Flood simulation** and **water depth** calculations
- **Property damage assessments** using various damage curves
- Total damage **cost statistics** of flood affected area

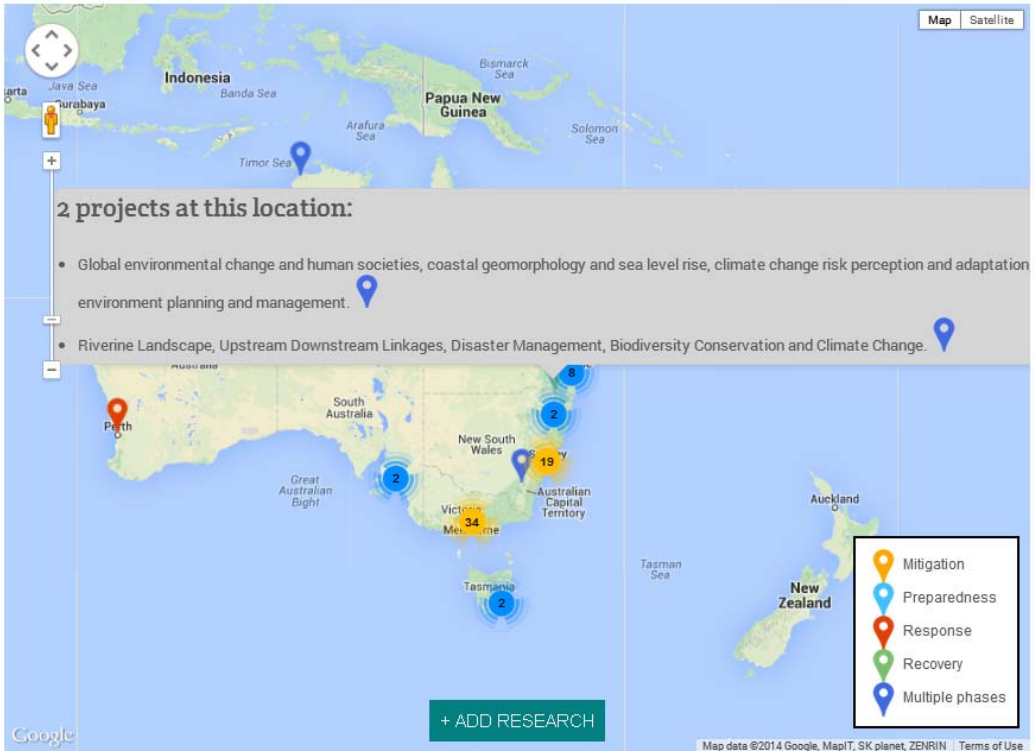
The system allows you to:

- Conduct a **bushfire propagation simulation**
- Carry out a **risk area analysis** using buffer rings and statistics
- Determine most the effective **resource assignment** through analysis
- Generate routing over **damaged road network**

Through integration with the Eva Planner:

- Animate **fire spread** and regional **evacuation** sequence
- Egress **time comparison** among 3 different scenarios (blue, red, green)
- **Generate statistics** (exposure population, affected vehicles) on both local and global levels





A tool to bridge disaster management research gaps:

DISASTER MANAGEMENT RESEARCH REGISTER (DMRR)

www.cdmps.org.au/dmrr

Disaster Management Research Register

CDMPS
CENTRE FOR DISASTER MANAGEMENT AND PUBLIC SAFETY

Disaster Management Research Register

Home | Projects | My profile | Researchers | Organizations | Key centers | About us

Welcome to the Disaster Management Research Register

This website is a repository of disaster management research worldwide. Within the website is a map of disaster management research worldwide, details relating to specific projects, and resources for finding relevant disaster management projects for you.

Find related disaster management research – worldwide!

Welcome to the Disaster Management Research Register (DMRR). The Register is a repository of disaster management related research worldwide. The Disaster Management Research Register (DMRR) provides a forum for researchers to share and become aware of different disaster related research taking place – no matter the hazard, the disaster phase under focus, or the country being studied. Researchers from ALL countries and ALL organizations can list information about their research projects and view information about other research projects taking place. **To view the current disaster management research listed, view the map below.**

Lessons Learnt

We are facing unprecedented challenges…

Interoperability at the **data level** in an unrestricted manner;

Seamless integration and **free flow of data** and information exchange.

Thank You

abbas.r@unimelb.edu.au

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