The CRC Research Program update

Dr John Bates / Research Director

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bushfire&natural HAZARDSCRC

Australian Government
Department of Industry, Innovation and Science

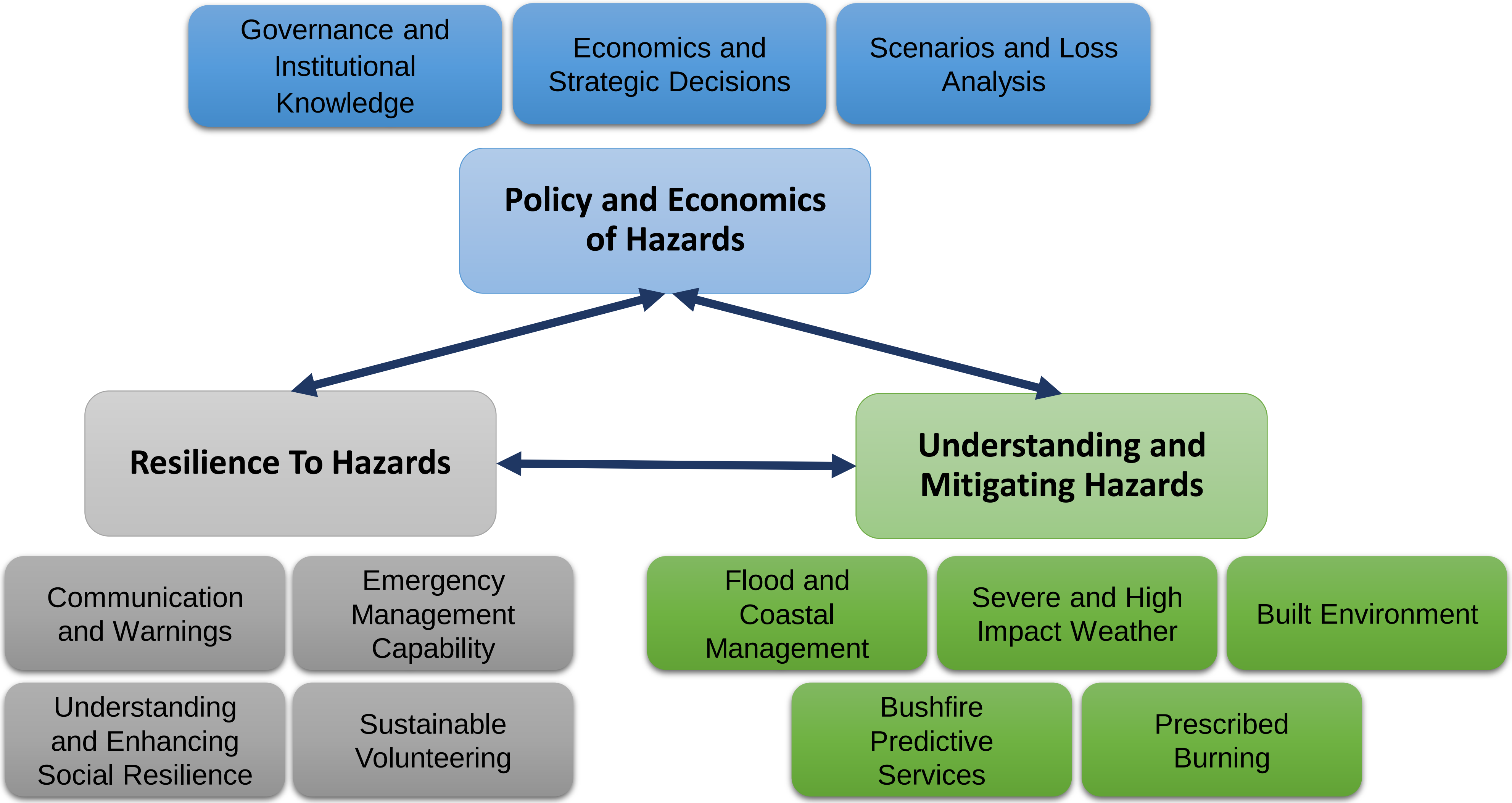
Business Cooperative Research Centres Programme

BUSHFIRE
AND NATURAL
HAZARDS
COOPERATIVE
RESEARCH
CENTRE

A forum of knowledge

The CRC is the research hub for an active, engaged knowledge network

CRC Research Program 2013 - 2021



Governance and Institutional Knowledge

Economics and Strategic Decisions

Scenarios and Loss Analysis

Policy and Economics of Hazards

Resilience To Hazards

Understanding and Mitigating Hazards

Communication and Warnings

Emergency Management Capability

Understanding and Enhancing Social Resilience

Sustainable Volunteering

Flood and Coastal Management

Severe and High Impact Weather

Built Environment

Bushfire Predictive Services

Prescribed Burning

CRC Research Program 2013 - 2021

Research Utilisation Forums

- Northern Australia
- Managing the landscape
- Workforce 2030
- Policy, economics and mitigation
- Extreme weather
- Communications, education and communities
- Fire predictive services

ronment

Volunteers

IMPROVING VOLUNTEER RETENTION AND LEADERSHIP

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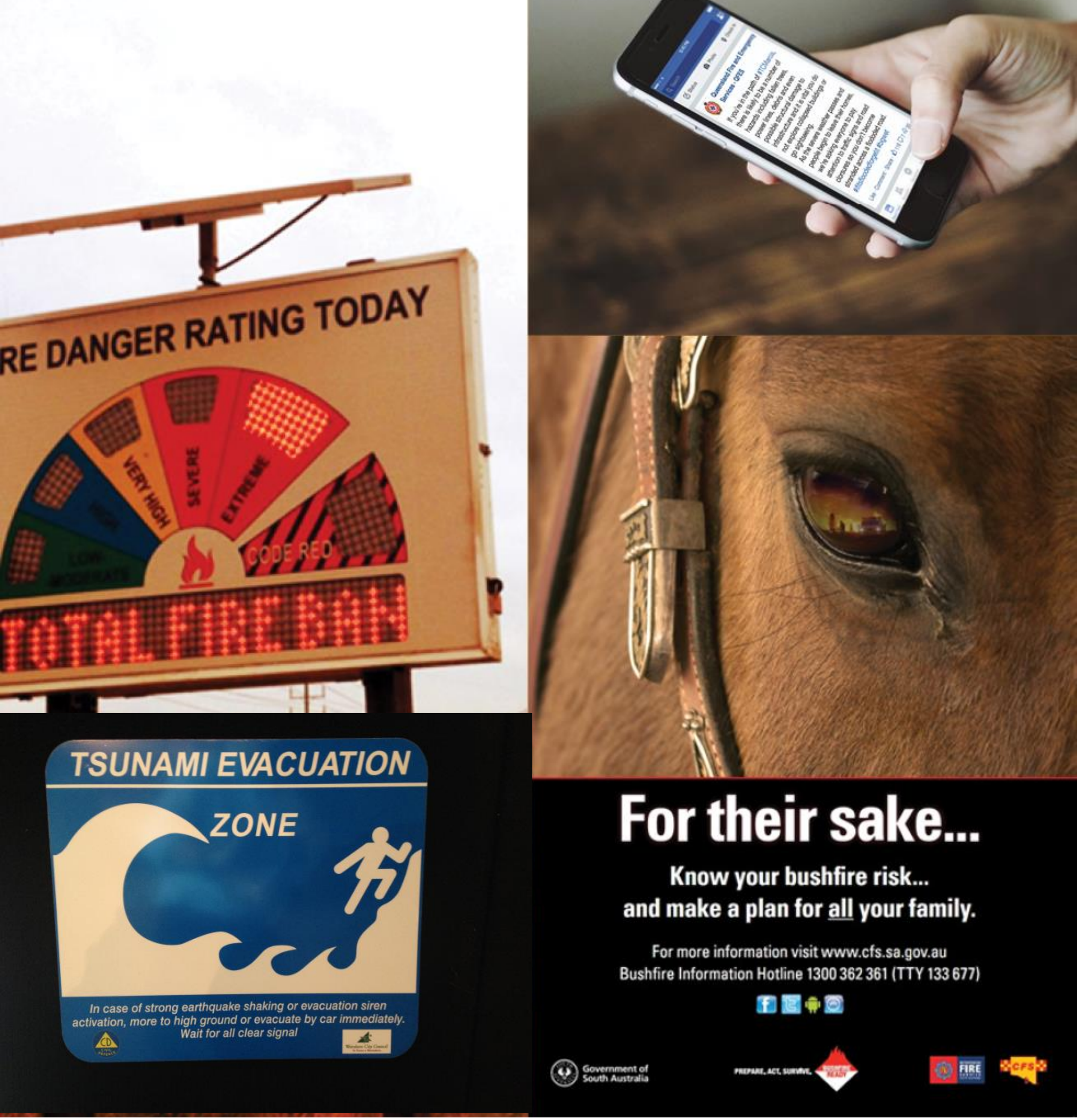
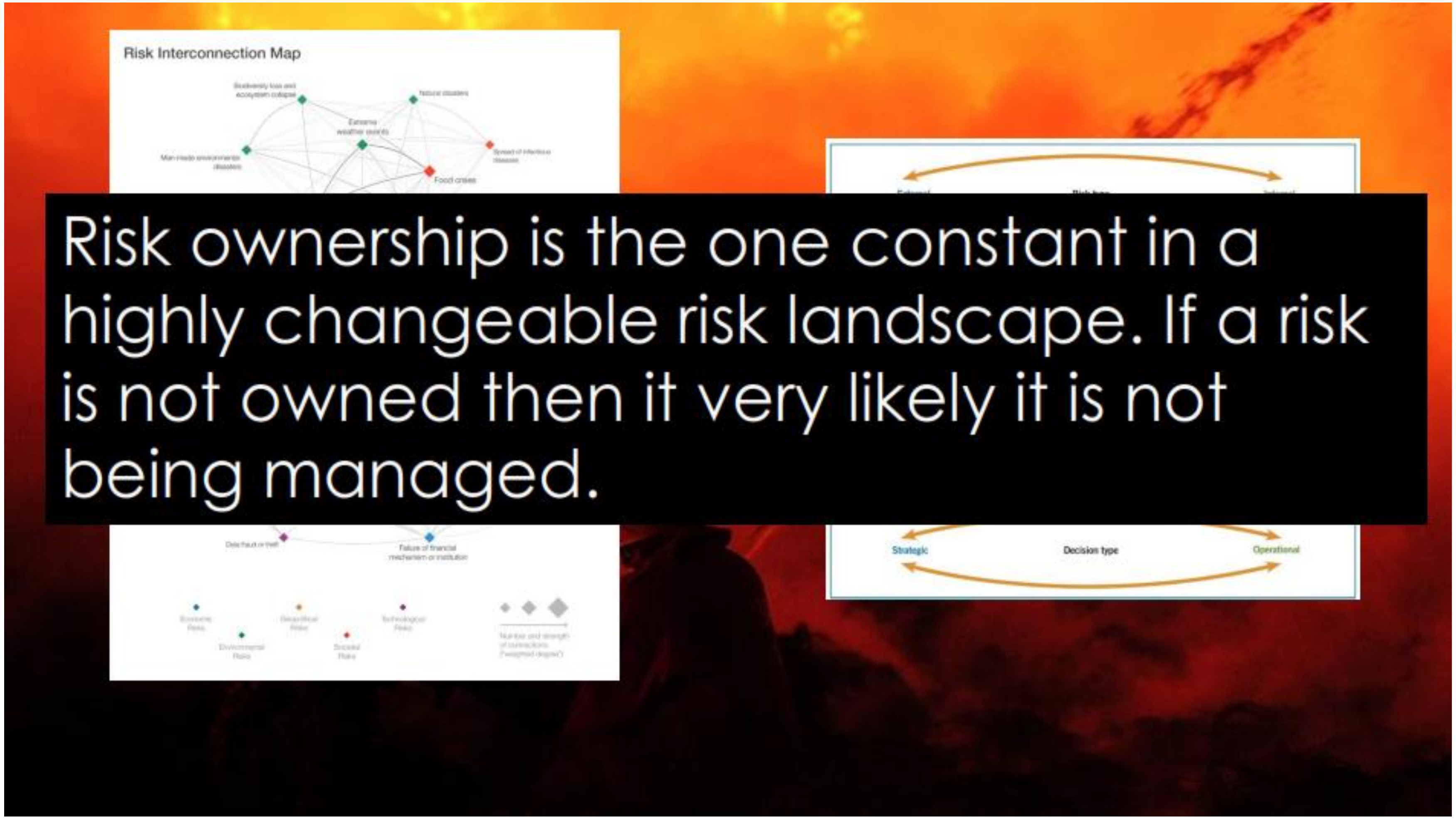

RE DANGER RATING TODAY
LOW-MODERATE
HIGH
VERY HIGH
SEVERE
EXTREME
CODE RED
TOTAL FIRE BAN
TSUNAMI EVACUATION
ZONE
In case of strong earthquake shaking or evacuation siren activation, move to high ground or evacuate by car immediately.
Wait for all clear signal
For their sake...
Know your bushfire risk...
and make a plan for all your family.
For more information visit www.cfs.sa.gov.au
Bushfire Information Hotline 1300 362 361 (TTY 133 677)
Government of South Australia
PREPARE, ACT, SURVIVE.
BUSHFIRE READY
FIRE
CFS

Emergency warnings

ENHANCING EMERGENCY WARNINGS

Risk and mitigation



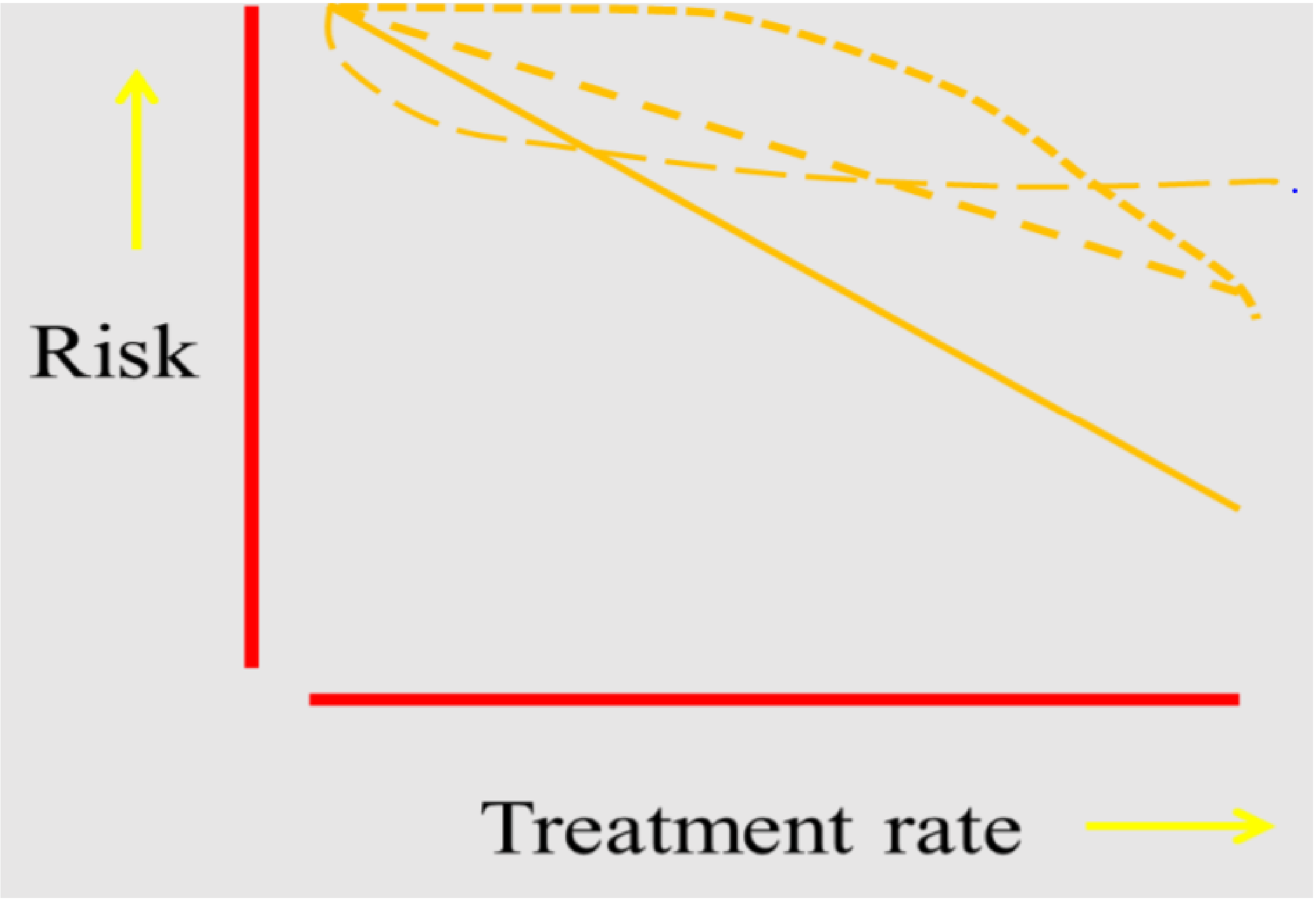
Risk ownership is the one constant in a highly changeable risk landscape. If a risk is not owned then it very likely it is not being managed.

Risk Interconnection Map
Extreme weather events
Food crises
Strategic
Decision type
Operational

Prescribed Burning Atlas

Comparative performance of differing prescribed burning strategies in reducing risk to multiple values.

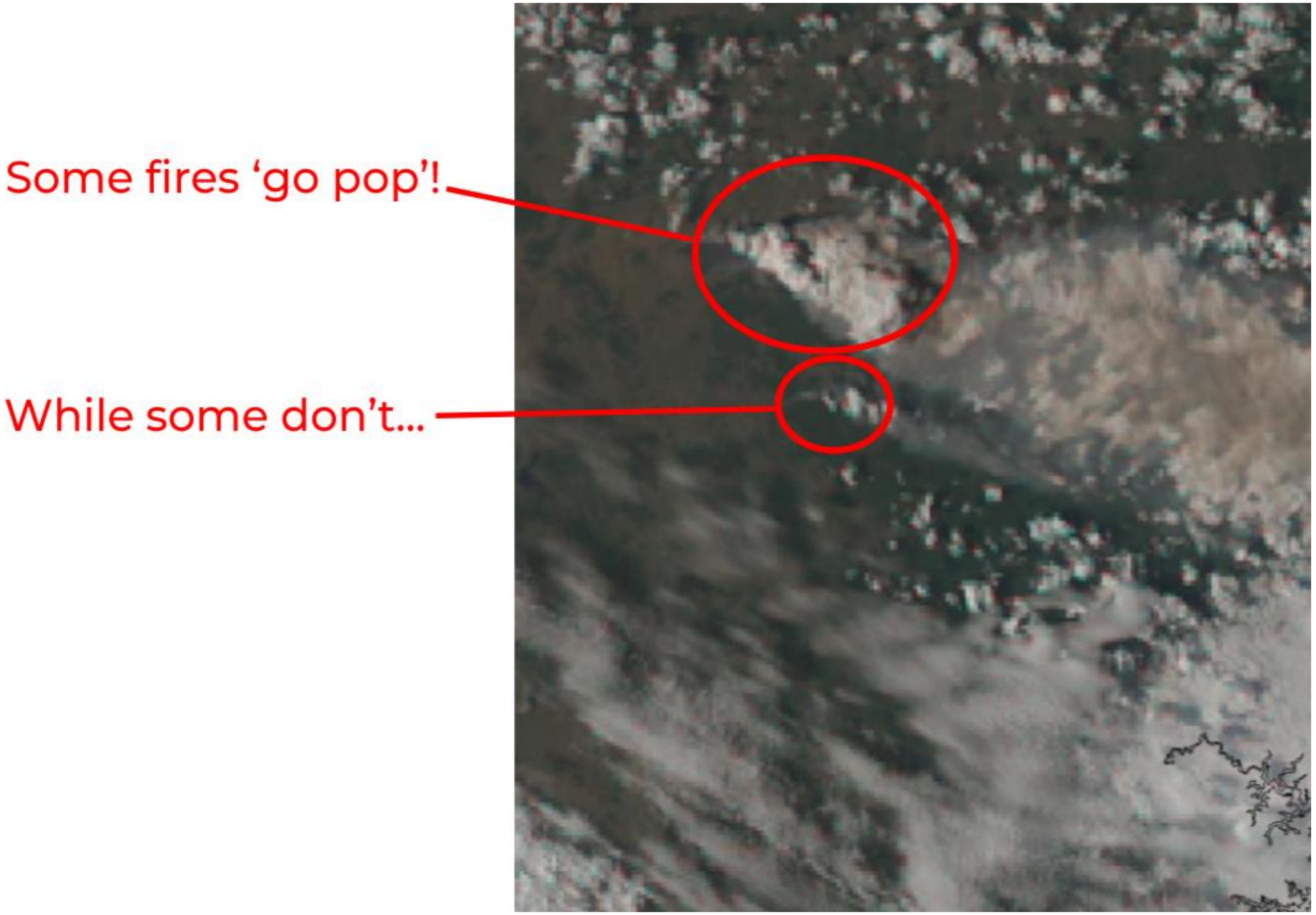
- Phoenix models
- 0 – 10% treatments
- Edge vs Landscape
- 13 case study regions



The physics, ecology and social science of bushfires

Modelling dynamic fire behaviour

- Coalescence & mass spotfire dynamics (Sharples)
- Thresholds for extreme fire behaviours (Penman)
- Grassfire RoS validation (inc grass height)

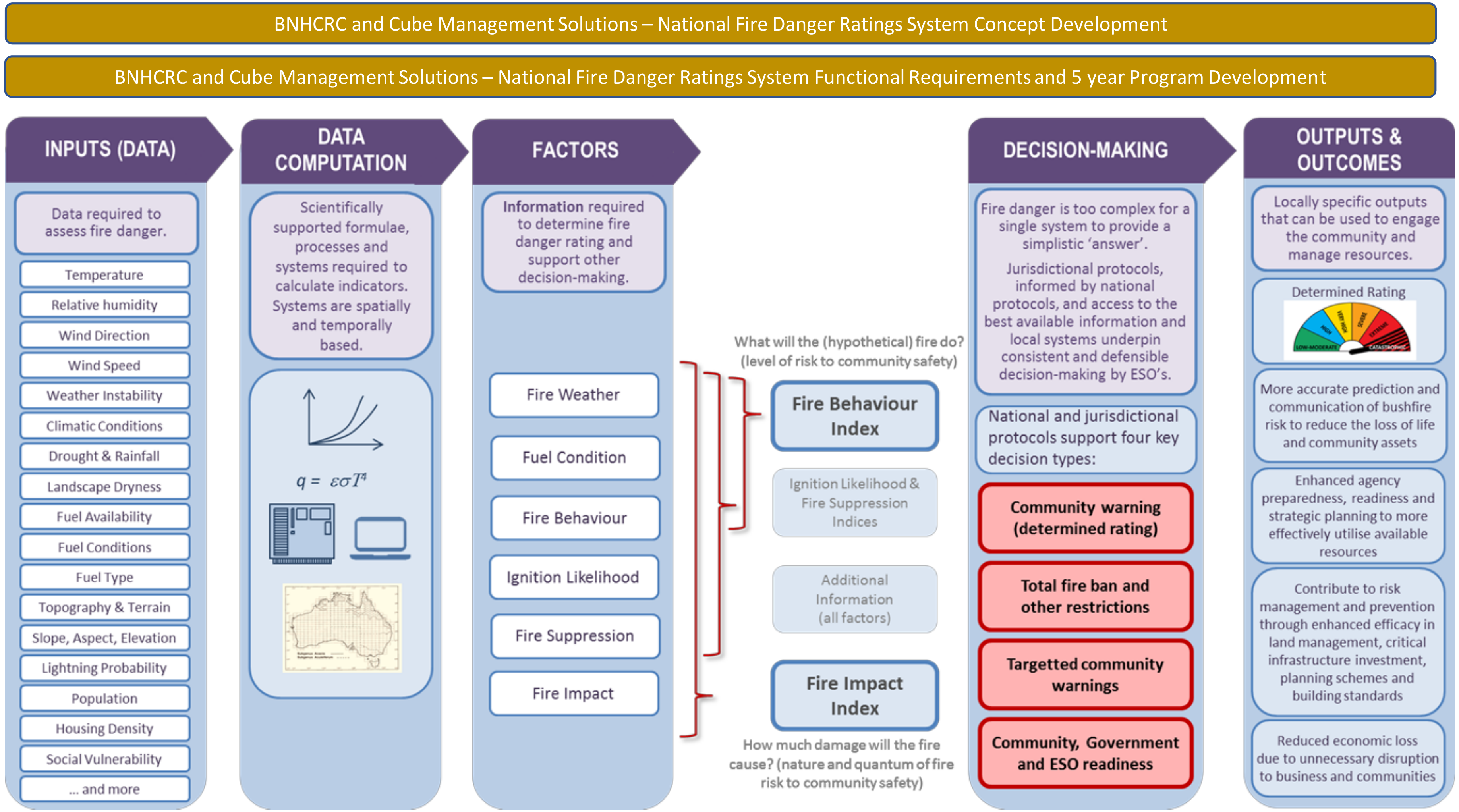


Some fires 'go pop'!

While some don't...

Yes, fires really do influence weather

A national fire danger rating system



BNHCRC and Cube Management Solutions – National Fire Danger Ratings System Concept Development

BNHCRC and Cube Management Solutions – National Fire Danger Ratings System Functional Requirements and 5 year Program Development

INPUTS (DATA)

Data required to assess fire danger.

- Temperature
- Relative humidity
- Wind Direction
- Wind Speed
- Weather Instability
- Climatic Conditions
- Drought & Rainfall
- Landscape Dryness
- Fuel Availability
- Fuel Conditions
- Fuel Type
- Topography & Terrain
- Slope, Aspect, Elevation
- Lightning Probability
- Population
- Housing Density
- Social Vulnerability
- ... and more

DATA COMPUTATION

Scientifically supported formulae, processes and systems required to calculate indicators. Systems are spatially and temporally based.

$q = \varepsilon\sigma T^4$

FACTORS

Information required to determine fire danger rating and support other decision-making.

- Fire Weather
- Fuel Condition
- Fire Behaviour
- Ignition Likelihood
- Fire Suppression
- Fire Impact

What will the (hypothetical) fire do? (level of risk to community safety)

Fire Behaviour Index

Ignition Likelihood & Fire Suppression Indices

Additional Information (all factors)

Fire Impact Index

How much damage will the fire cause? (nature and quantum of fire risk to community safety)

DECISION-MAKING

Fire danger is too complex for a single system to provide a simplistic 'answer'.

Jurisdictional protocols, informed by national protocols, and access to the best available information and local systems underpin consistent and defensible decision-making by ESO's.

National and jurisdictional protocols support four key decision types:

- **Community warning (determined rating)**
- **Total fire ban and other restrictions**
- **Targetted community warnings**
- **Community, Government and ESO readiness**

OUTPUTS & OUTCOMES

Locally specific outputs that can be used to engage the community and manage resources.

Determined Rating

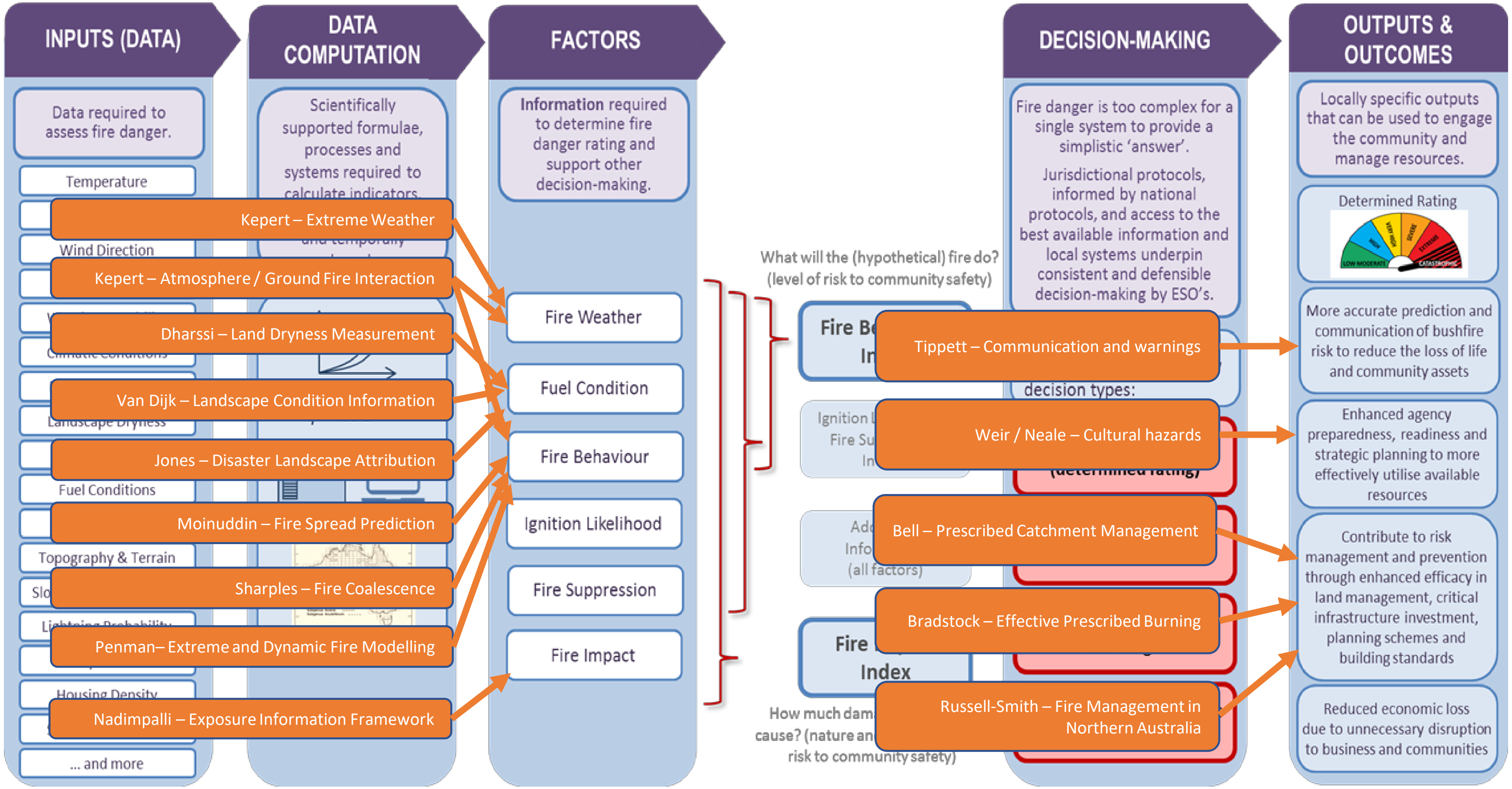
More accurate prediction and communication of bushfire risk to reduce the loss of life and community assets

Enhanced agency preparedness, readiness and strategic planning to more effectively utilise available resources

Contribute to risk management and prevention through enhanced efficacy in land management, critical infrastructure investment, planning schemes and building standards

Reduced economic loss due to unnecessary disruption to business and communities

Enriched by research



INPUTS (DATA)

Data required to assess fire danger.

- Temperature
- Wind Direction
- Fuel Conditions
- Topography & Terrain
- Slo
- … and more

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- Fuel Condition
- Fire Behaviour
- Ignition Likelihood
- Fire Suppression
- Fire Impact

What will the (hypothetical) fire do? (level of risk to community safety)

Fire Be
In

Ignition
Fire Su
In

Add
Info
(all factors)

Fire
Index

How much dam
cause? (nature an
risk to community safety)

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decision types:

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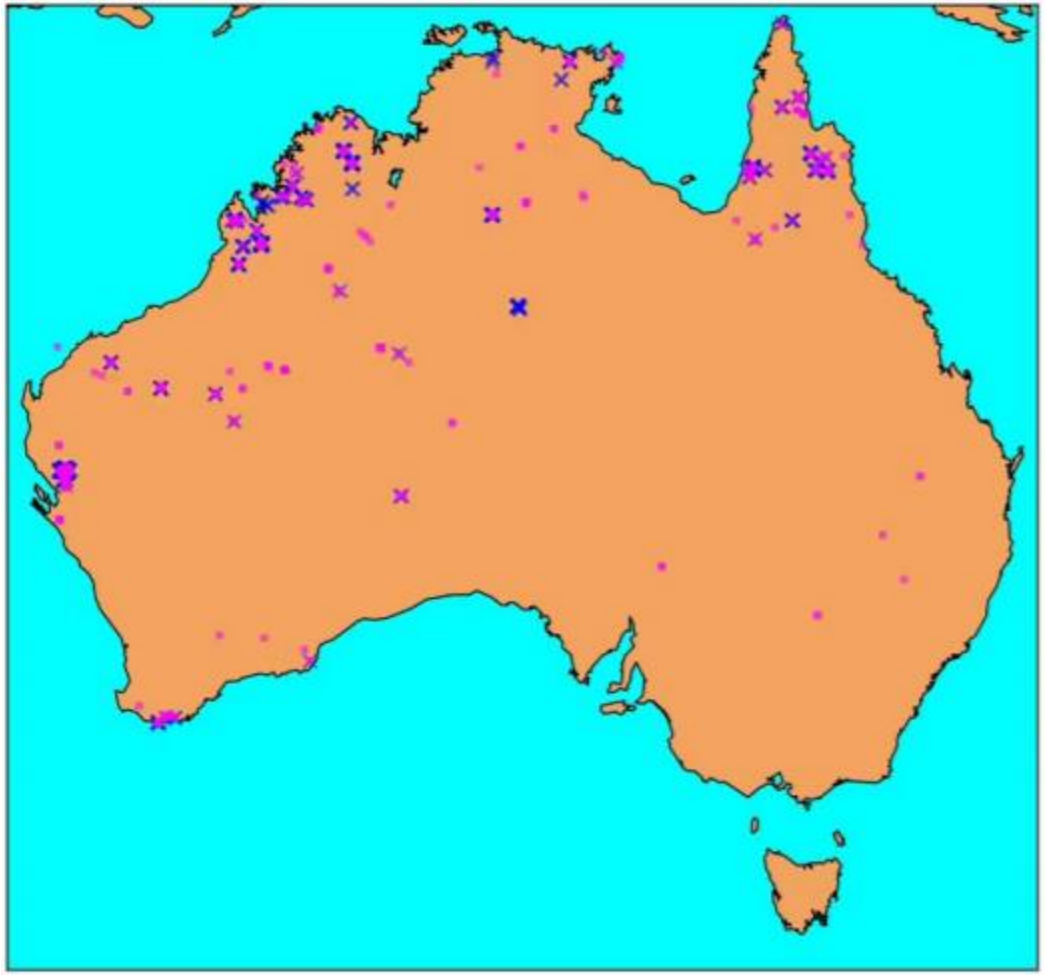
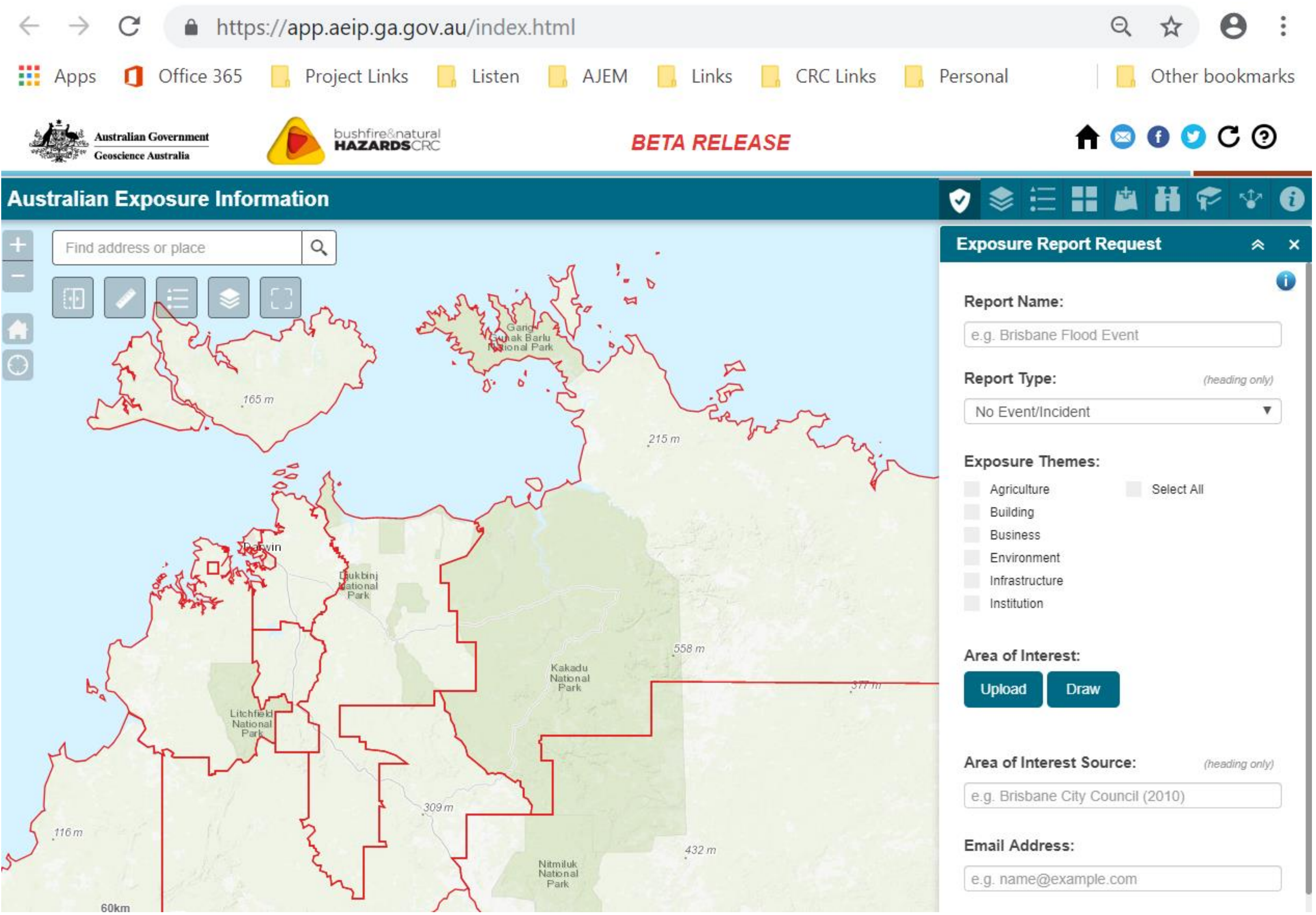
- Kepert – Extreme Weather
- Kepert – Atmosphere / Ground Fire Interaction
- Dharssi – Land Dryness Measurement
- Van Dijk – Landscape Condition Information
- Jones – Disaster Landscape Attribution
- Moinuddin – Fire Spread Prediction
- Sharples – Fire Coalescence
- Penman– Extreme and Dynamic Fire Modelling
- Nadimpalli – Exposure Information Framework
- Tippett – Communication and warnings
- Weir / Neale – Cultural hazards
- Bell – Prescribed Catchment Management
- Bradstock – Effective Prescribed Burning
- Russell-Smith – Fire Management in Northern Australia



Fire surveillance

Near real-time fire detection using Himawari-8 data feeds


https://app.aeip.ga.gov.au/index.html
Apps
Office 365
Project Links
Listen
AJEM
Links
CRC Links
Personal
Other bookmarks
Australian Government
Geoscience Australia
bushfire&natural HAZARDS CRC
BETA RELEASE
Australian Exposure Information
Find address or place
Garig Gunak Barlu National Park
165 m
215 m
Darwin
Djukbinj National Park
Kakadu National Park
558 m
377 m
Litchfield National Park
309 m
116 m
432 m
Nitmiluk National Park
60km

Exposure Report Request

Report Name: e.g. Brisbane Flood Event

Report Type: *(heading only)* No Event/Incident

Exposure Themes:

☐ Agriculture ☐ Select All
☐ Building
☐ Business
☐ Environment
☐ Infrastructure
☐ Institution

Area of Interest:

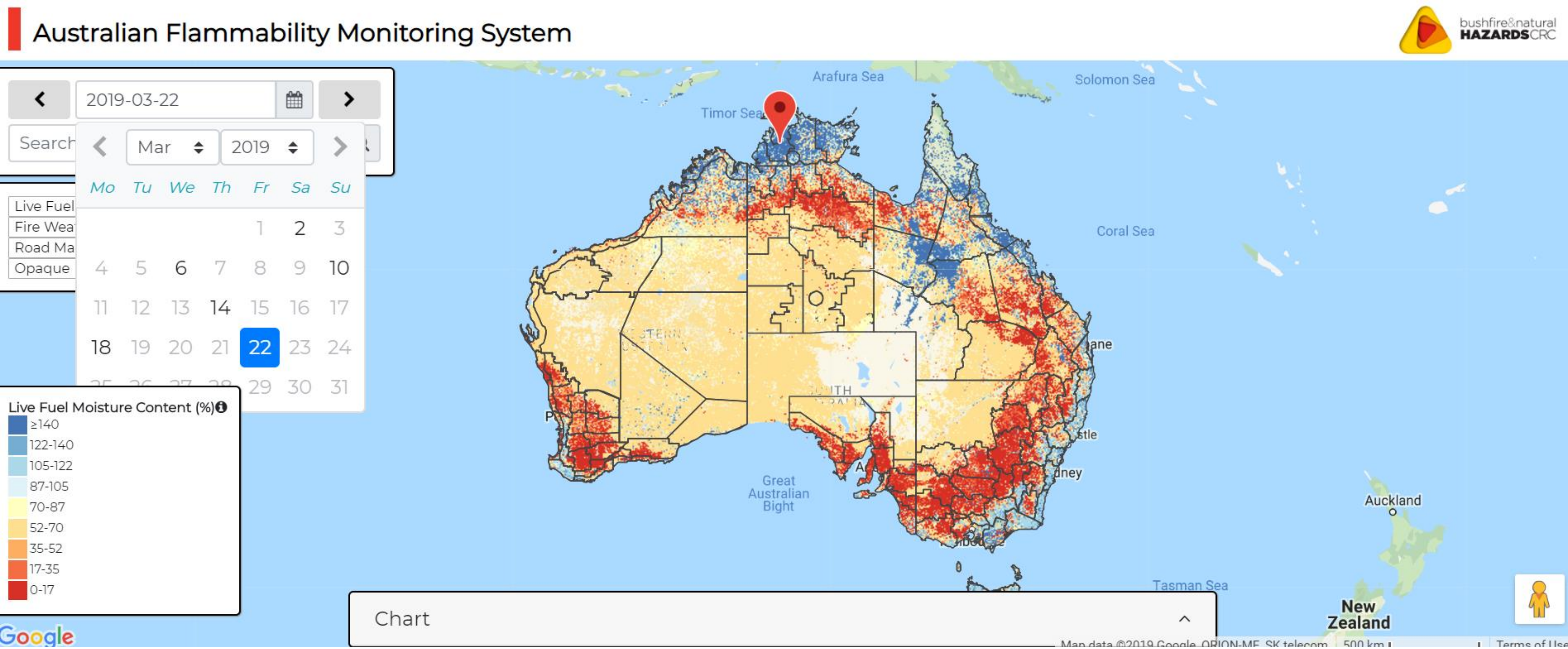
Upload
Draw

Area of Interest Source: *(heading only)* e.g. Brisbane City Council (2010)

Email Address: e.g. name@example.com

Aus. Exposure Information

Estimating what is at risk
www.info.aeip.ga.gov.au



Australian Flammability Monitoring System

2019-03-22

Live Fuel Moisture Content (%)

🟦	≥140
🟦	122-140
🟦	105-122
⬜	87-105
🟨	70-87
🟨	52-70
🟧	35-52
🟥	17-35
🟥	0-17

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Search
Mar
2019
Mo Tu We Th Fr Sa Su
1 2 3
4 5 6 7 8 9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
29 30 31
Live Fuel
Fire Wea
Road Ma
Opaque
Arafura Sea
Timor Sea
Solomon Sea
Coral Sea
Great Australian Bight
Tasman Sea
Auckland
New Zealand
Chart
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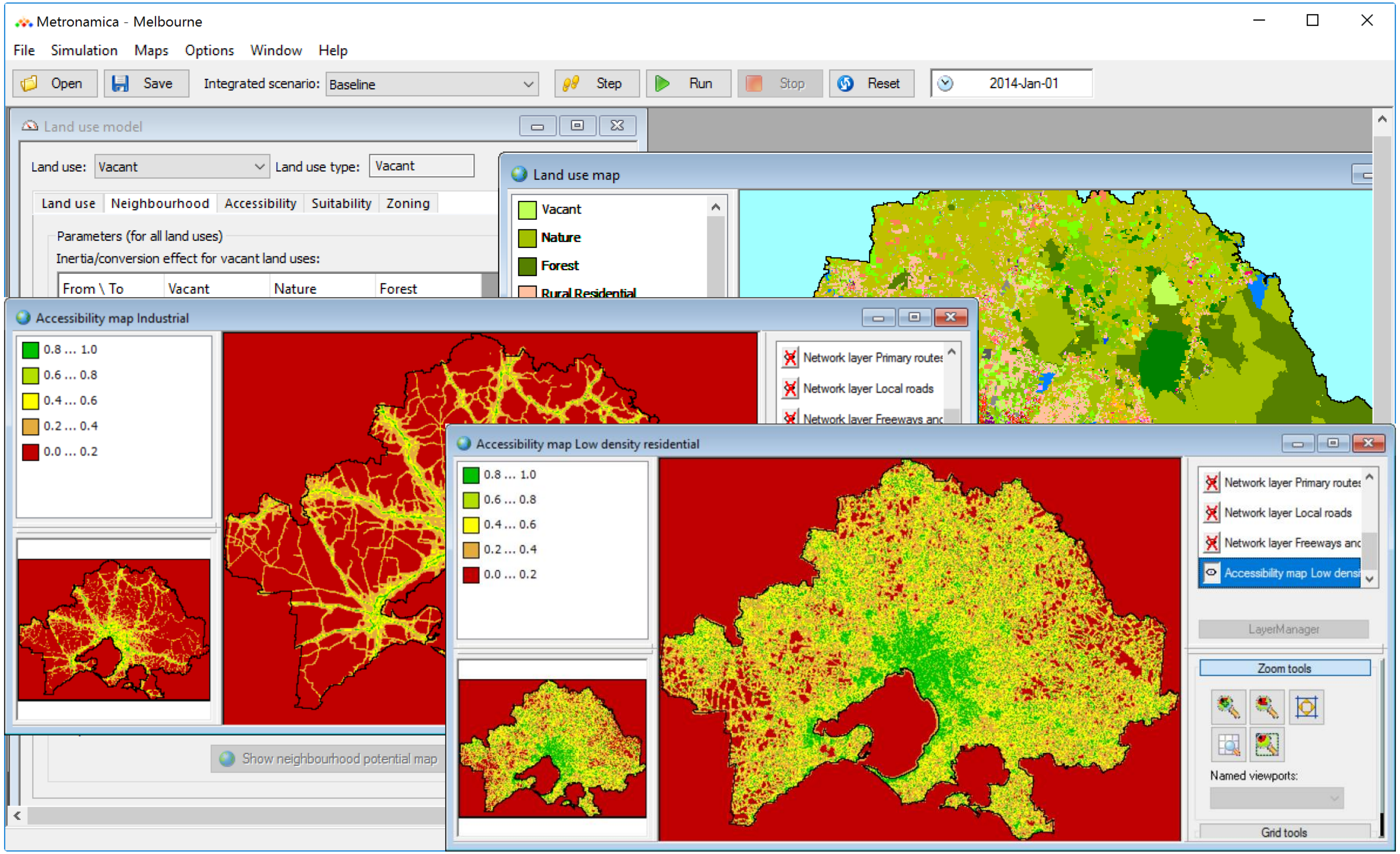
Map data ©2019 Google, ORION-ME, SK telecom
500 km
Terms of Use

Live fuel moisture

http://wenfo.org/afms/

Supporting investment decisions


Metronamica - Melbourne
File
Simulation
Maps
Options
Window
Help
Open
Save
Step
Run
Stop
Reset
Land use model
Land use
Neighbourhood
Accessibility
Suitability
Zoning
Land use map
Accessibility map Industrial
Accessibility map Low density residential
Network layer Primary routes
Network layer Local roads
Network layer Freeways anc
Accessibility map Low densi
LayerManager
Zoom tools
Named viewports:
Grid tools
Show neighbourhood potential map

Integrated scenario: Baseline

2014-Jan-01

Land use: Vacant
Land use type: Vacant

Parameters (for all land uses)
Inertia/conversion effect for vacant land uses:

From \ To	Vacant	Nature	Forest

- 🟩 Vacant
- 🟩 Nature
- 🟩 Forest
- 🟧 Rural Residential

Accessibility map Industrial:

- 🟩 0.8 … 1.0
- 🟩 0.6 … 0.8
- 🟨 0.4 … 0.6
- 🟧 0.2 … 0.4
- 🟥 0.0 … 0.2

Accessibility map Low density residential:

- 🟩 0.8 … 1.0
- 🟩 0.6 … 0.8
- 🟨 0.4 … 0.6
- 🟧 0.2 … 0.4
- 🟥 0.0 … 0.2

Towards 2021

Measures of success, opportunities for the future

Stay in touch

Online and in person

www.bnhcrc.com.au/showcase2017

Showcase 2017 – Research Driving Change
4-5 July 2017, Adelaide
Presentations, case studies, audio and video.

Publications from Projects
Journal articles, reports, conference papers
and more.

www.bnhcrc.com.au/publications/overview

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News, Research, Discussion
Hazard Notes, Hazard News
Australian Journal of Emergency Management