



The role of data science in informing disaster mitigation and resilience policy

Simon Dunstall, Decision Sciences, CSIRO Data61
August 2018

www.csiro.au



Informing

**community understanding,
knowledge of environmental and
community vulnerability,
natural hazard impacts mitigation,
and regional development policy**

using data science, computational modelling, and
engagement between science and stakeholders

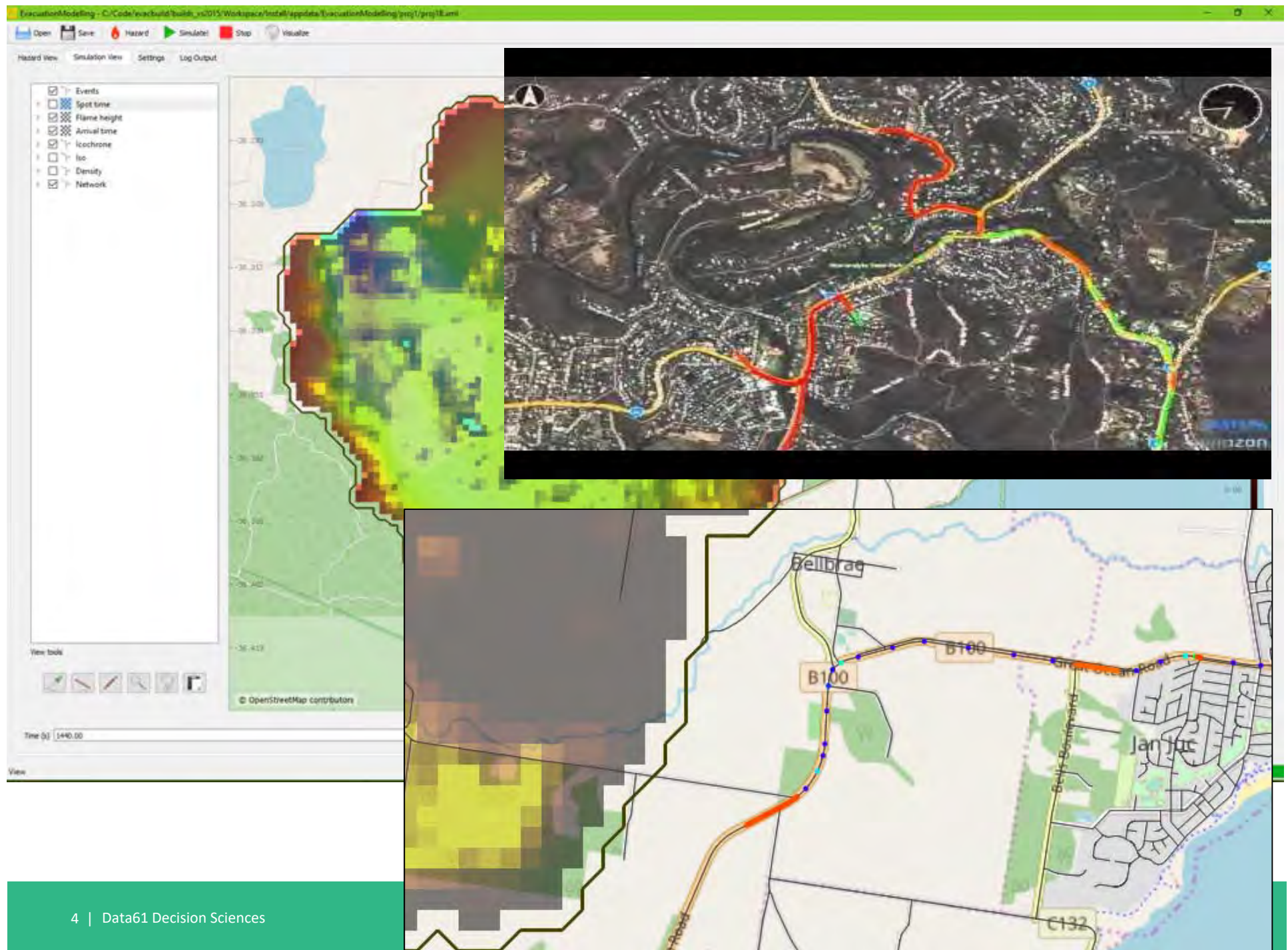
Understanding long-term MSL and storm surge impacts

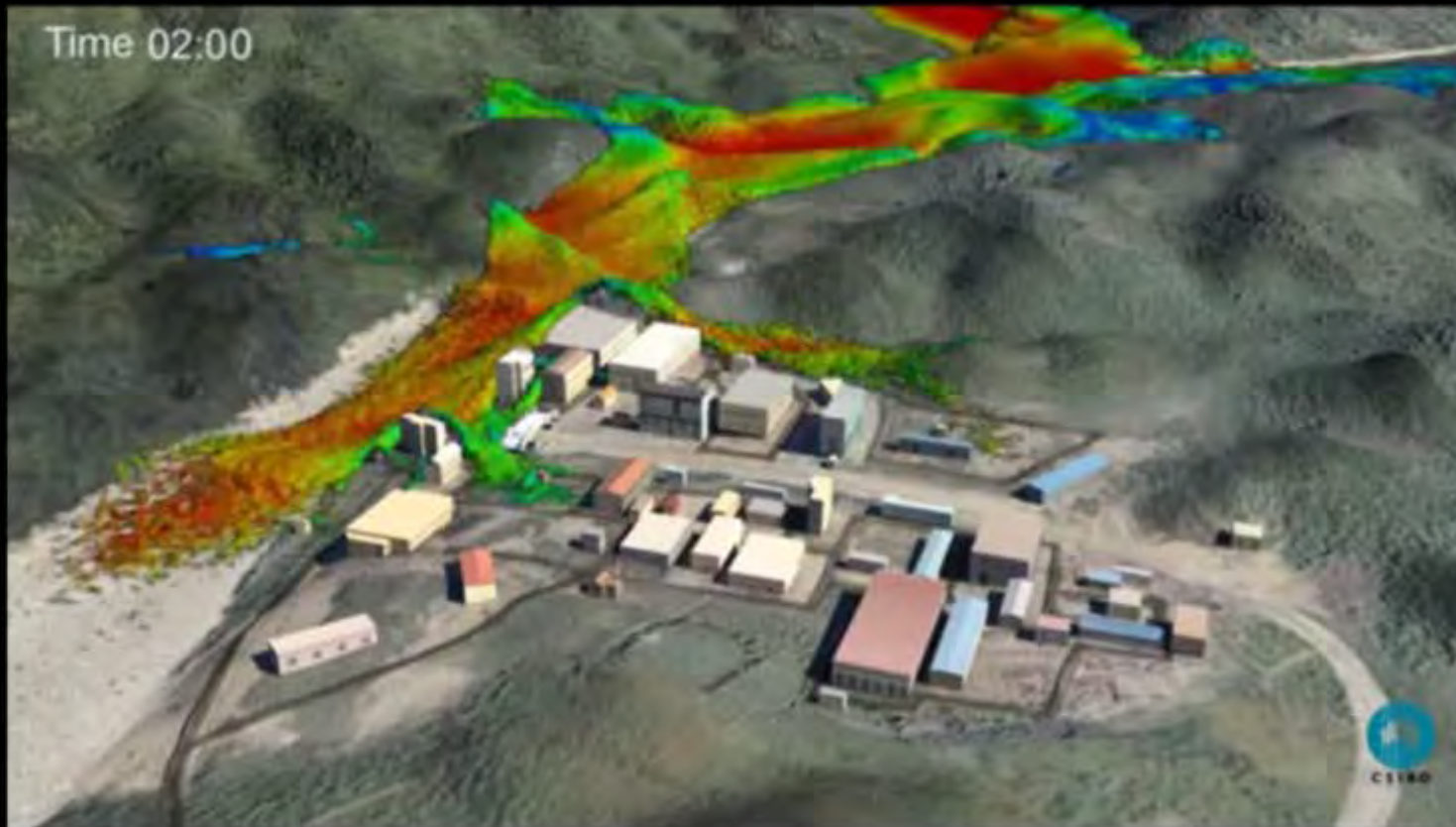
<https://www.youtube.com/watch?v=nIXM4luU-YA>



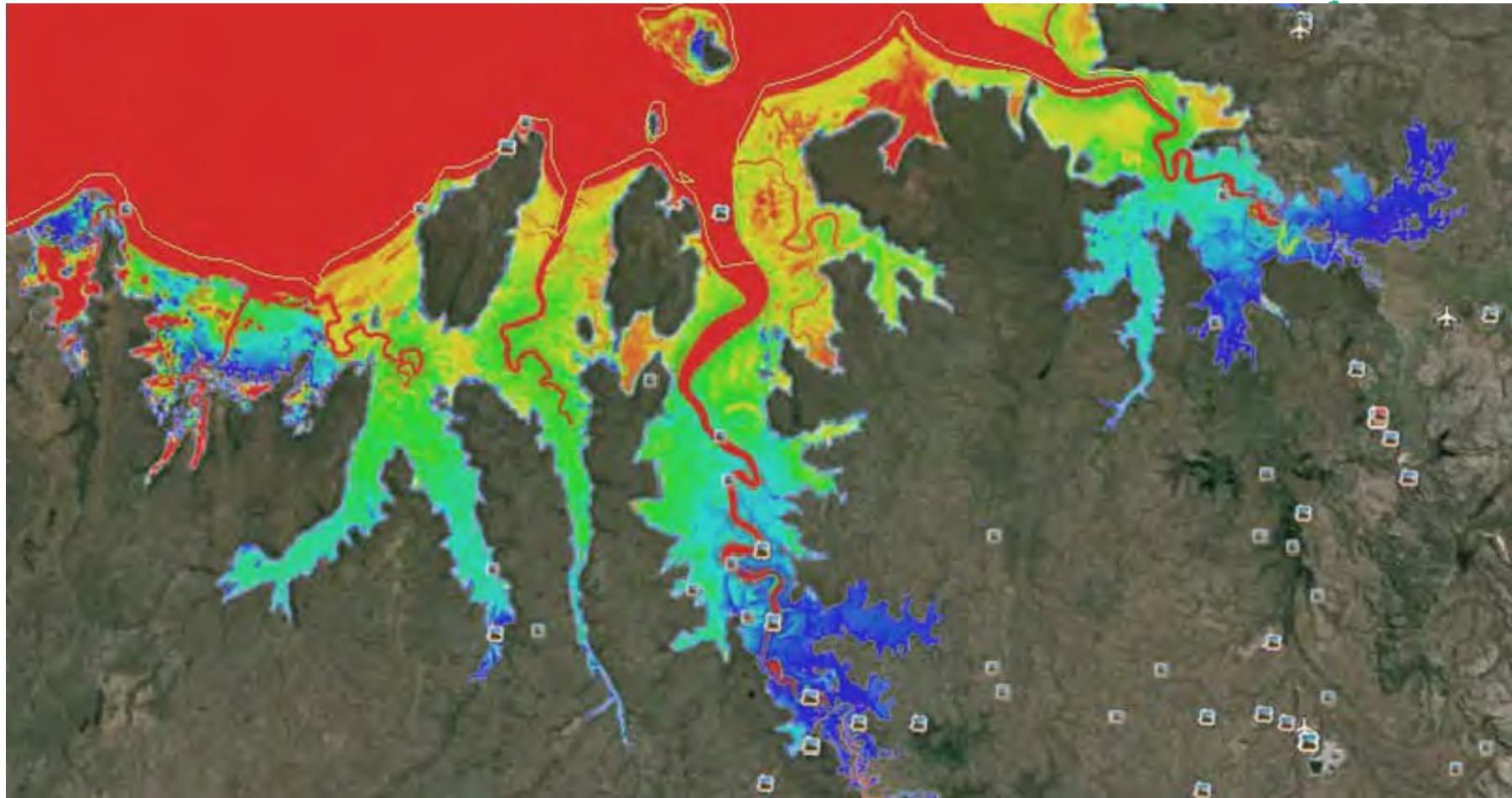
- Dynamic models incorporating localized rainfall, storm surge, sea-level rise, stormwater drainage, terrain interaction
- Effect of mitigations
- Limits of mitigations
- Building community understanding
- Basis for infrastructure and land-use policy







Satellite Surveying and Mapping Application Centre in China, CSIRO used SPH and DEM methods to test scenarios such as the hypothetical collapse of the massive Geheyan Dam in China



Environmental impact assessment of salinity intrusion in Kakadu national park



Development of Disaster Risk-Sensitive Shelter Plans (DR-SSP) from Community-Based Risk Analysis

Leorey Marquez, Sarah Redoblado, Maria Cheryl Prudente , Ernesto Serote, Nicasio De Rosas, Myrna Llanes, Jenifer Belarmino, Evelyn Sierra, Bernard Apuli

www.alterplan.org.ph
www.altriusa.com

20th Conference of IFORS
(International Federation of Operational Research Societies)
13-18 July 2014, Barcelona, Spain



Legazpi City – 9 Barangays

- Albay Province has active volcano, risks from frequent typhoons, heavy rainfall, flooding, mudslides, lahar flow



- Nine barangays - low risk from lahar, high risk from flooding and storm surge.

- Informal settlers – 50% of popn in nine barangays, 25% of popn of entire City.

Study Area Hazards



flooding



storm surge

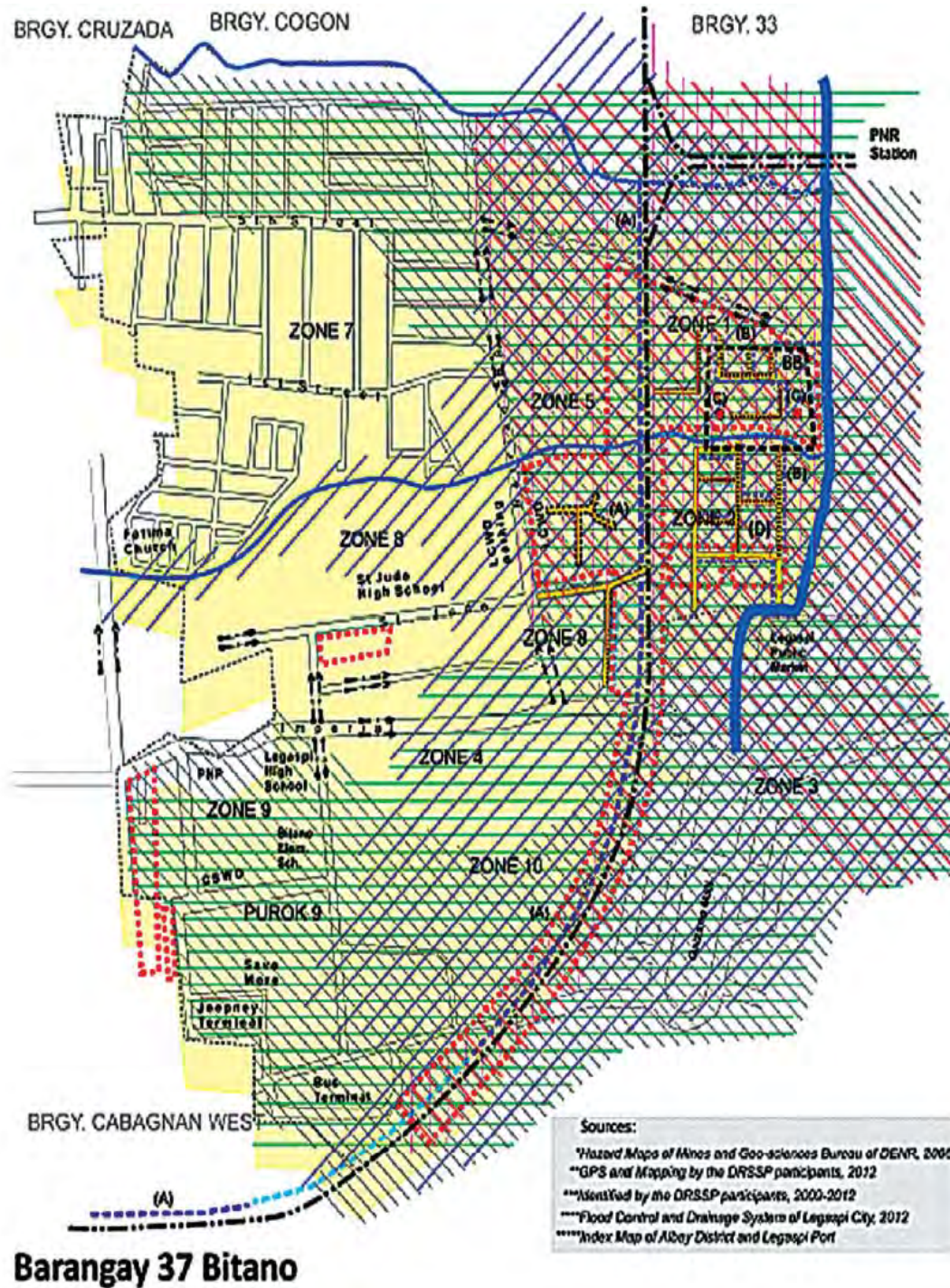
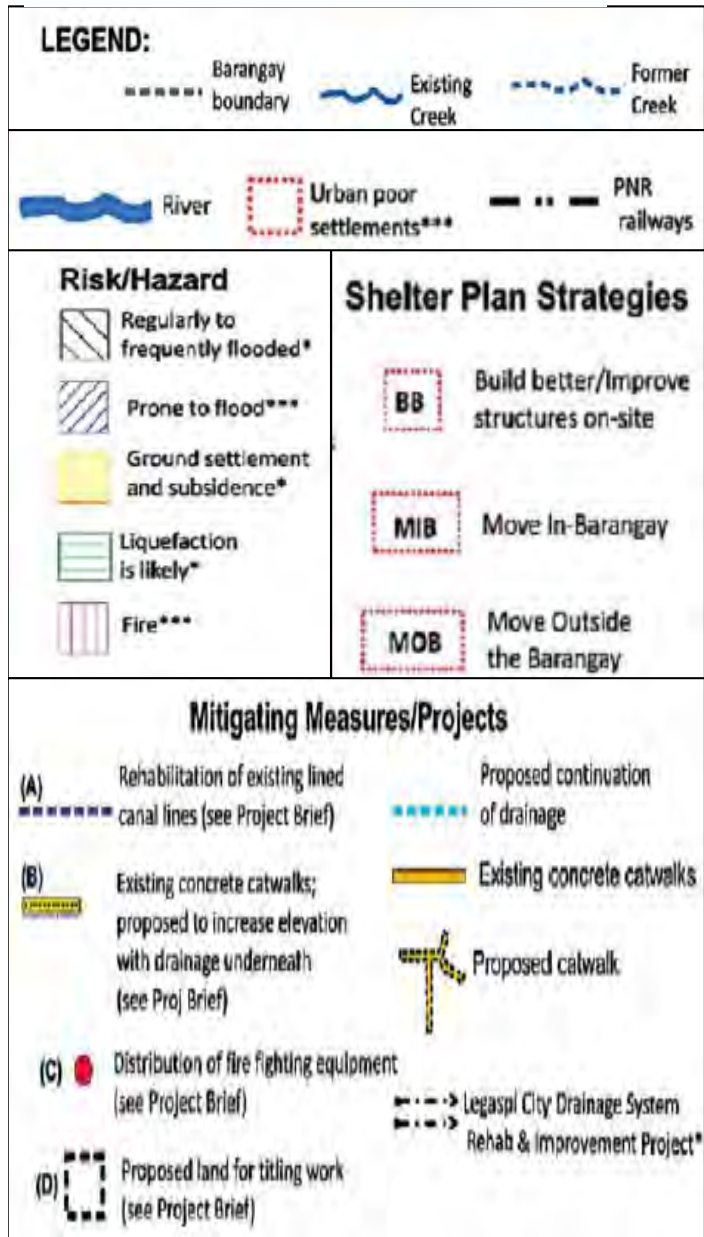


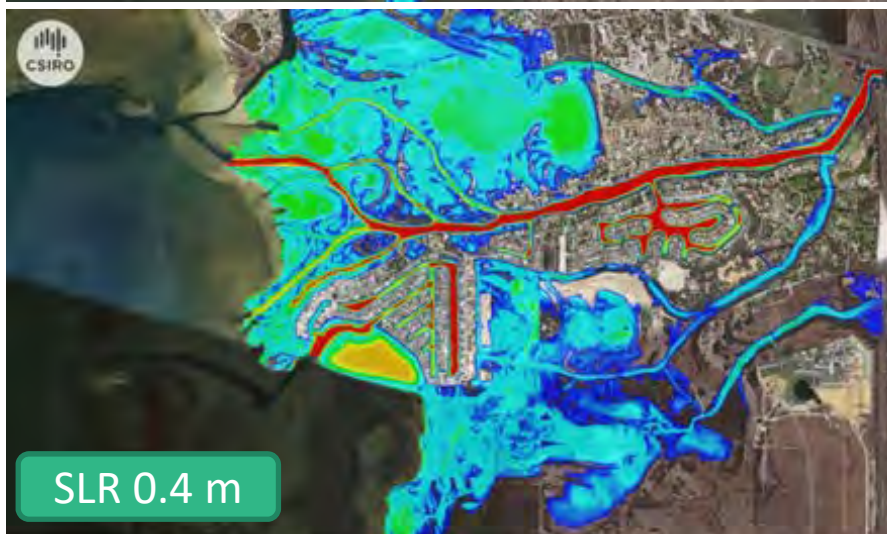
landslide

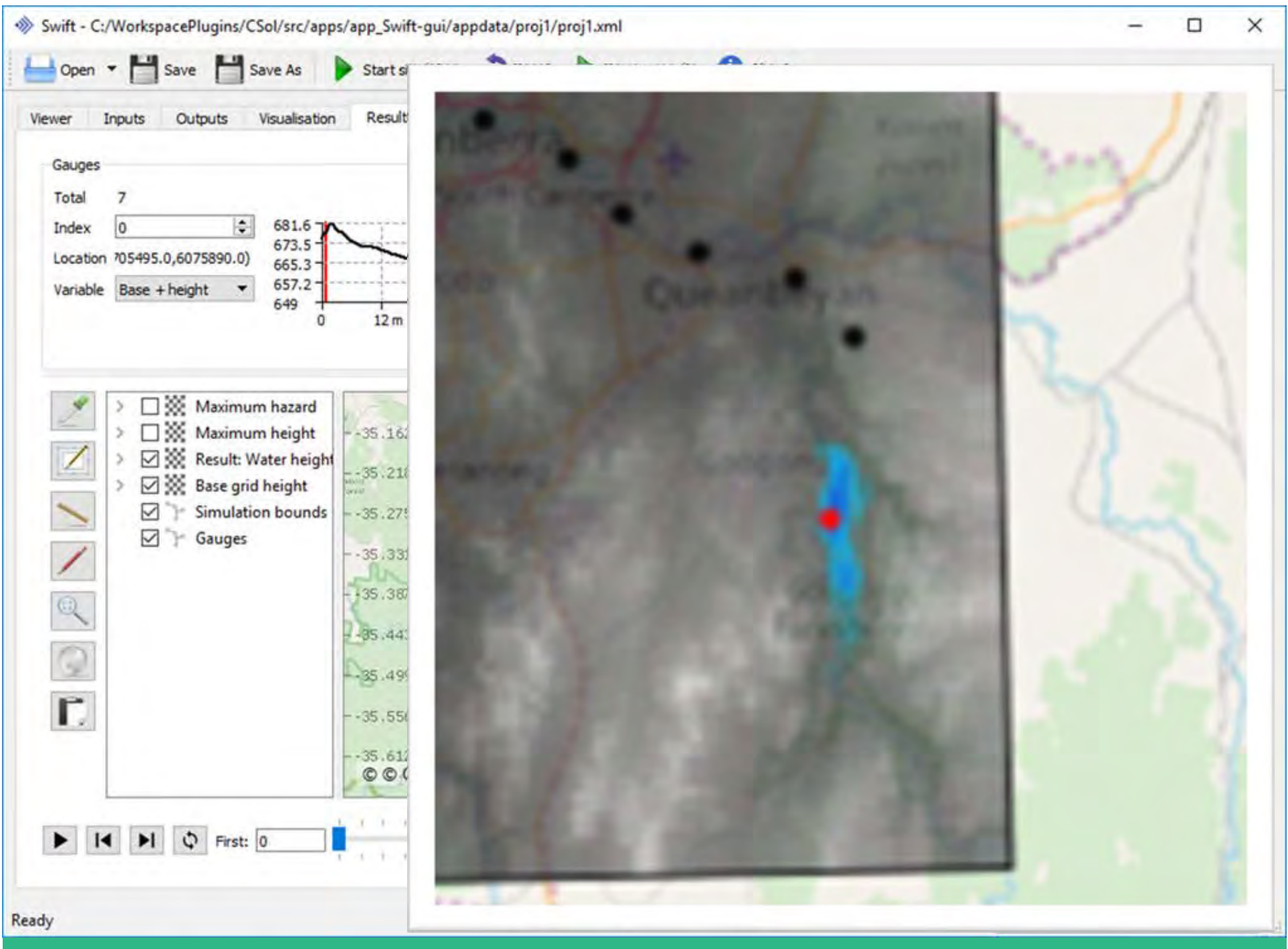


ground subsidence

DR-SSP Map – Bgy 37 (Bitano)







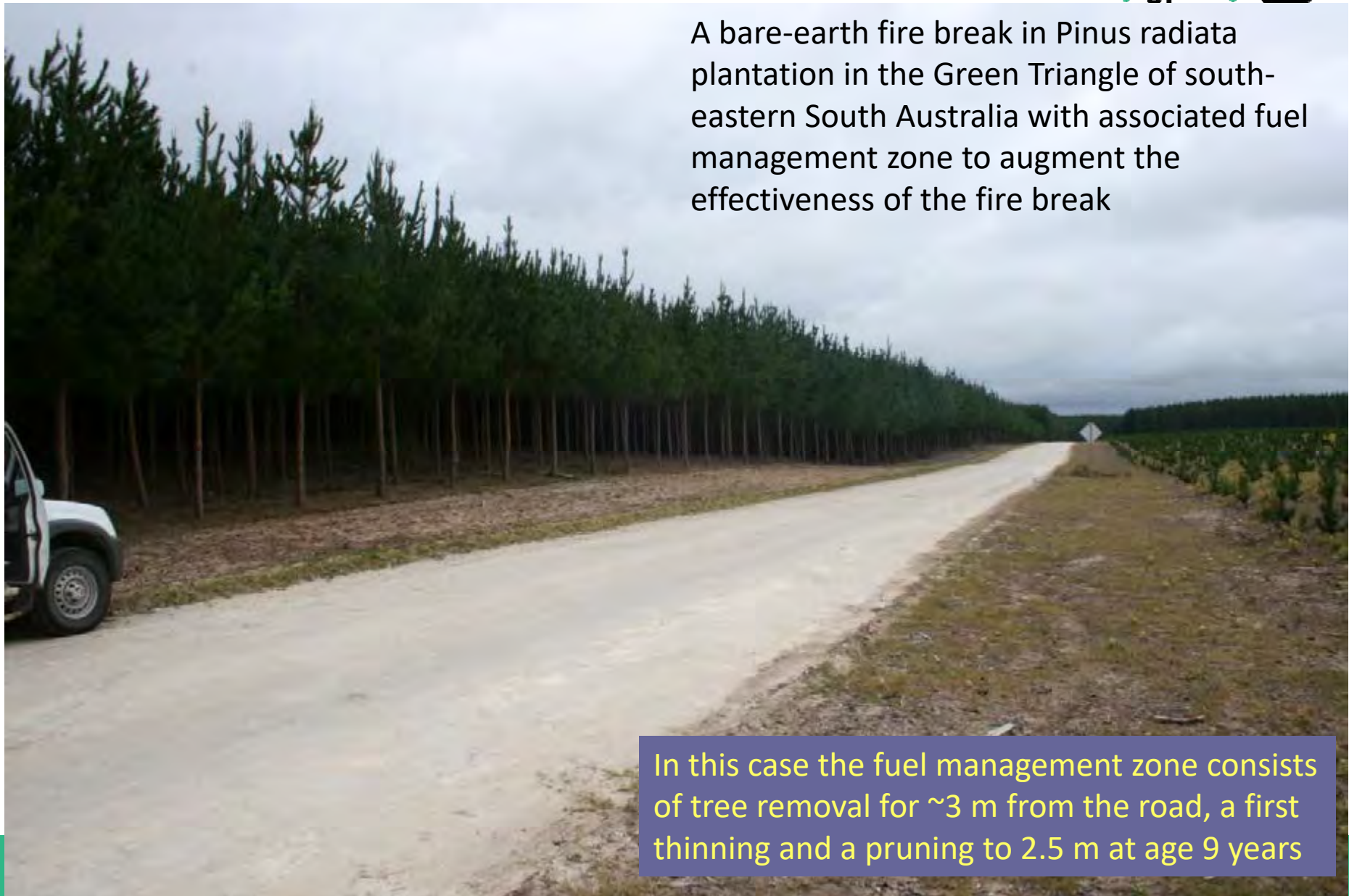
Informing and guiding

infrastructure change, industry practices, emergency response resourcing, and policy and regulatory change

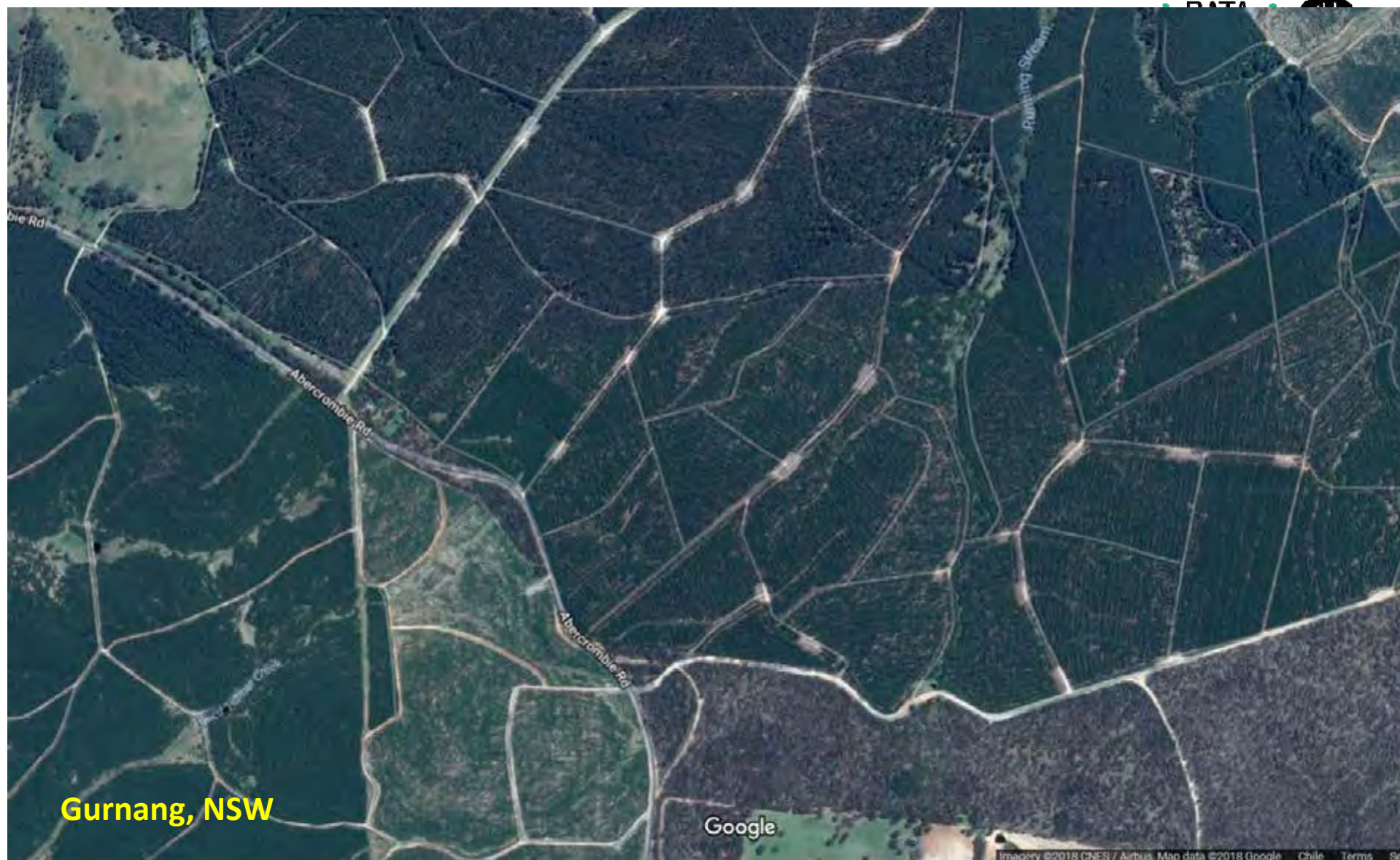
using data science, computational modelling, quantitative risk analytics, and science-government-industry engagement



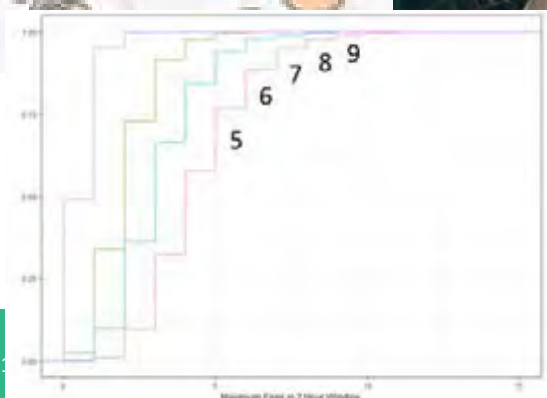
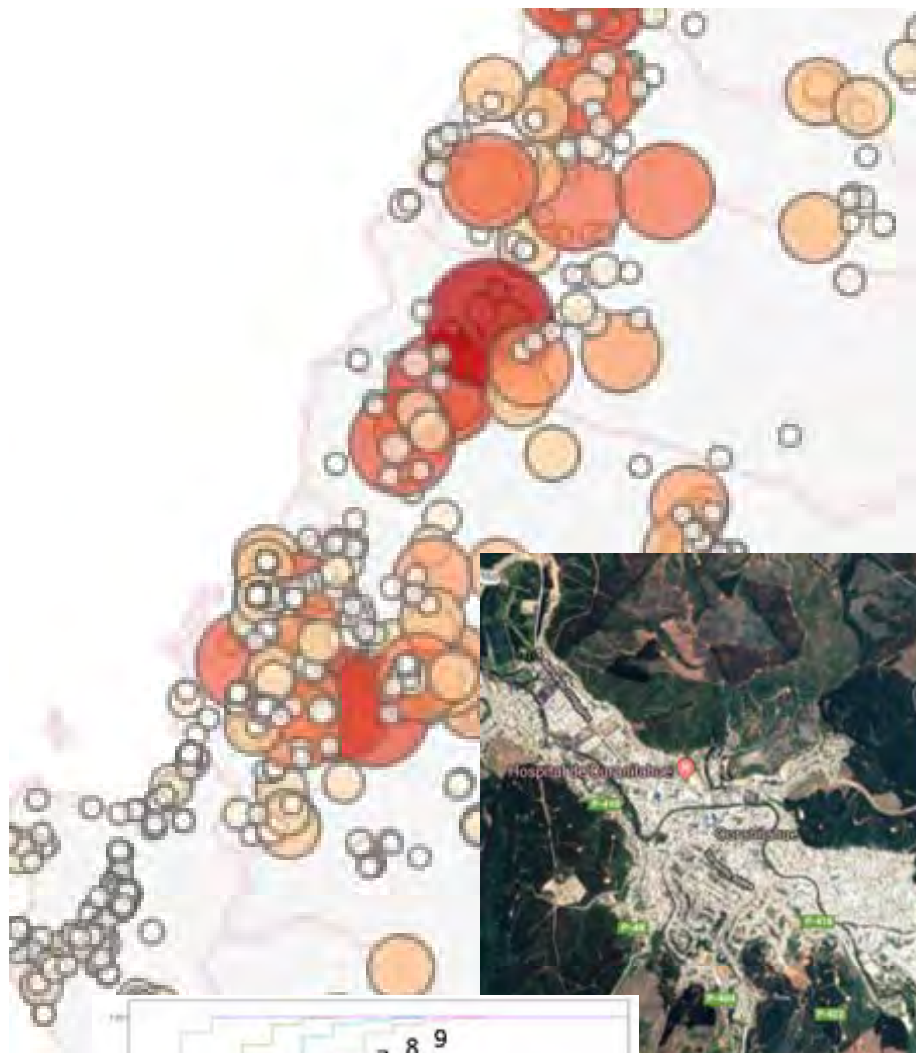
A bare-earth fire break in *Pinus radiata* plantation in the Green Triangle of south-eastern South Australia with associated fuel management zone to augment the effectiveness of the fire break



In this case the fuel management zone consists of tree removal for ~3 m from the road, a first thinning and a pruning to 2.5 m at age 9 years



Gurnang, NSW





Powerline Bushfire Safety Program



- The Powerline Bushfire Safety Program (PBSP) was established by the Victorian government in response to the 2009 Black Saturday bushfires
- Research supporting PBSP decision-making around electrically-caused bushfires:
 - Why electrically-caused bushfires account for over most bushfire-related deaths in Victoria since 1950
 - **Informing policy and regulatory change**
 - Estimating the performance of existing and future network technologies
 - **Providing comprehensive risk analyses, asset prioritisations and mapping products, to inform decision-makers about the highest-value locations to replace existing powerlines.**



Powerline Bushfire Safety Program - working to make communities safer

First phase of staged works across Victoria



MORE VIDEOS

Data SIO, NOAA, U.S. Navy, NGA GEBCO
©2015 Google
Imagery Landsat

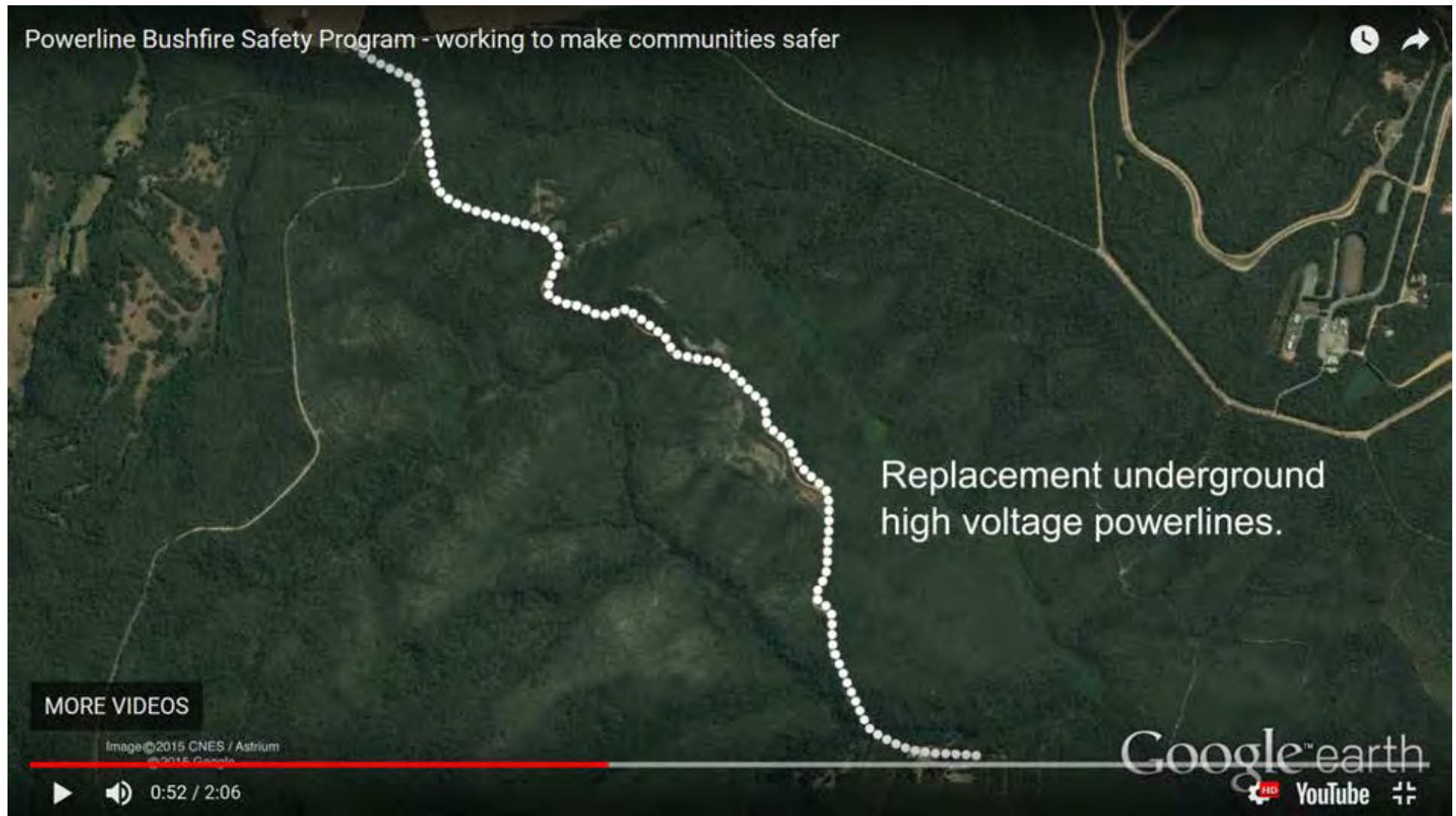
Data LDEO - Columbia, NSF, NOAA



0:43 / 2:06

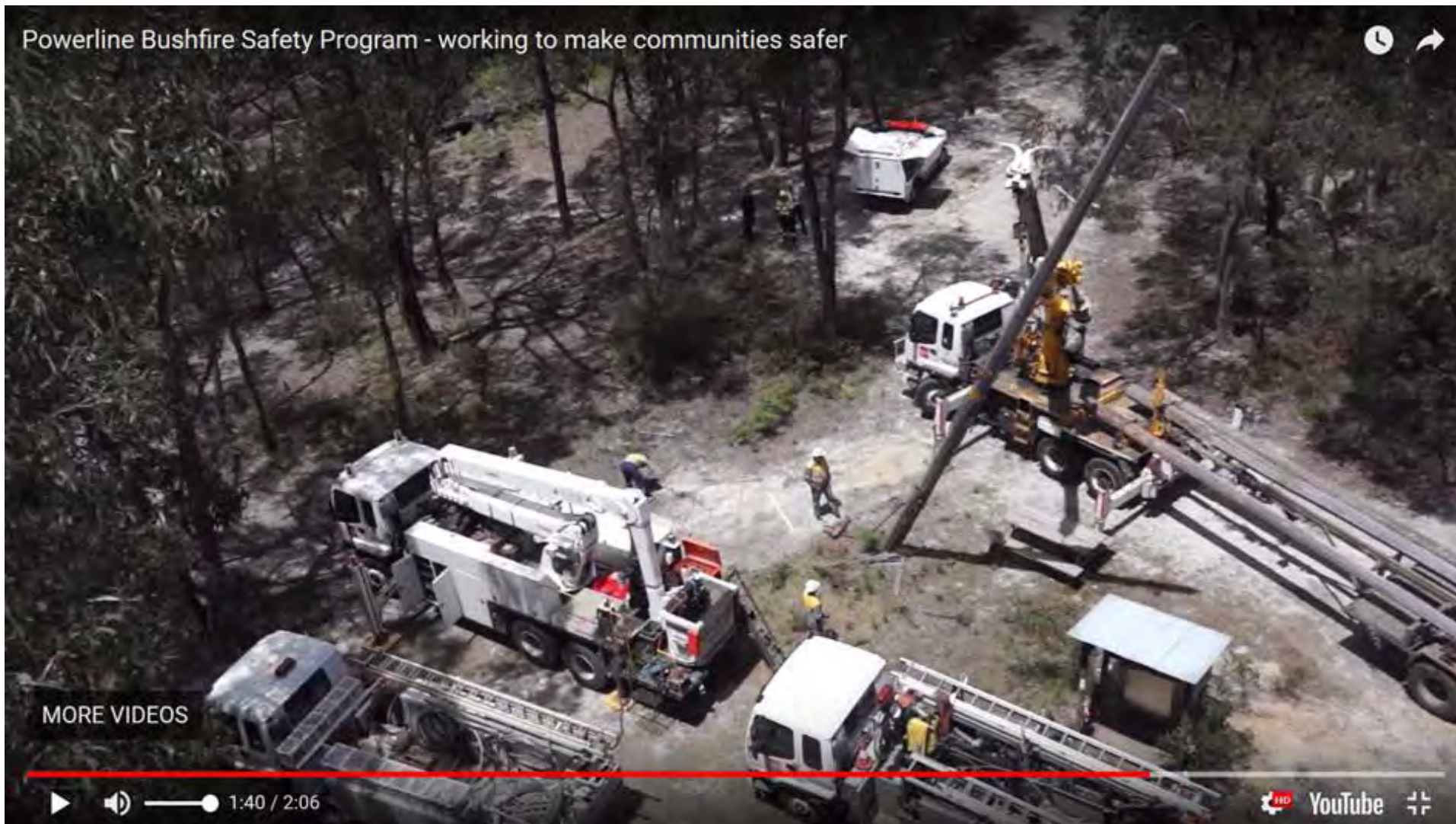
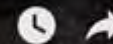
Google™ earth
YouTube

<https://youtu.be/JZVYTkYY2u4>



<https://youtu.be/JZVYTkYY2u4>

Powerline Bushfire Safety Program - working to make communities safer



MORE VIDEOS

1:40 / 2:06

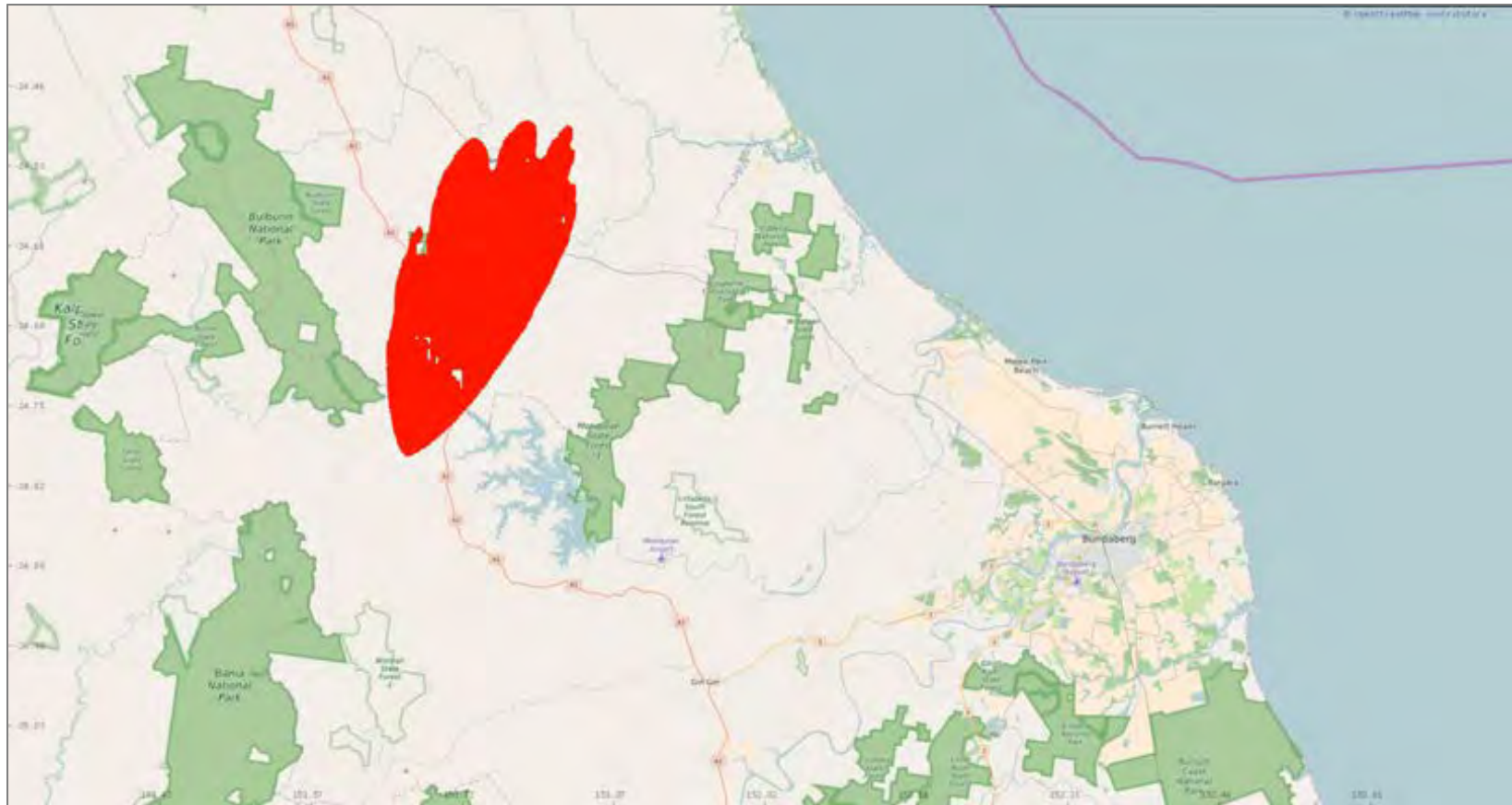
YouTube

<https://youtu.be/JZVYTkYY2u4>

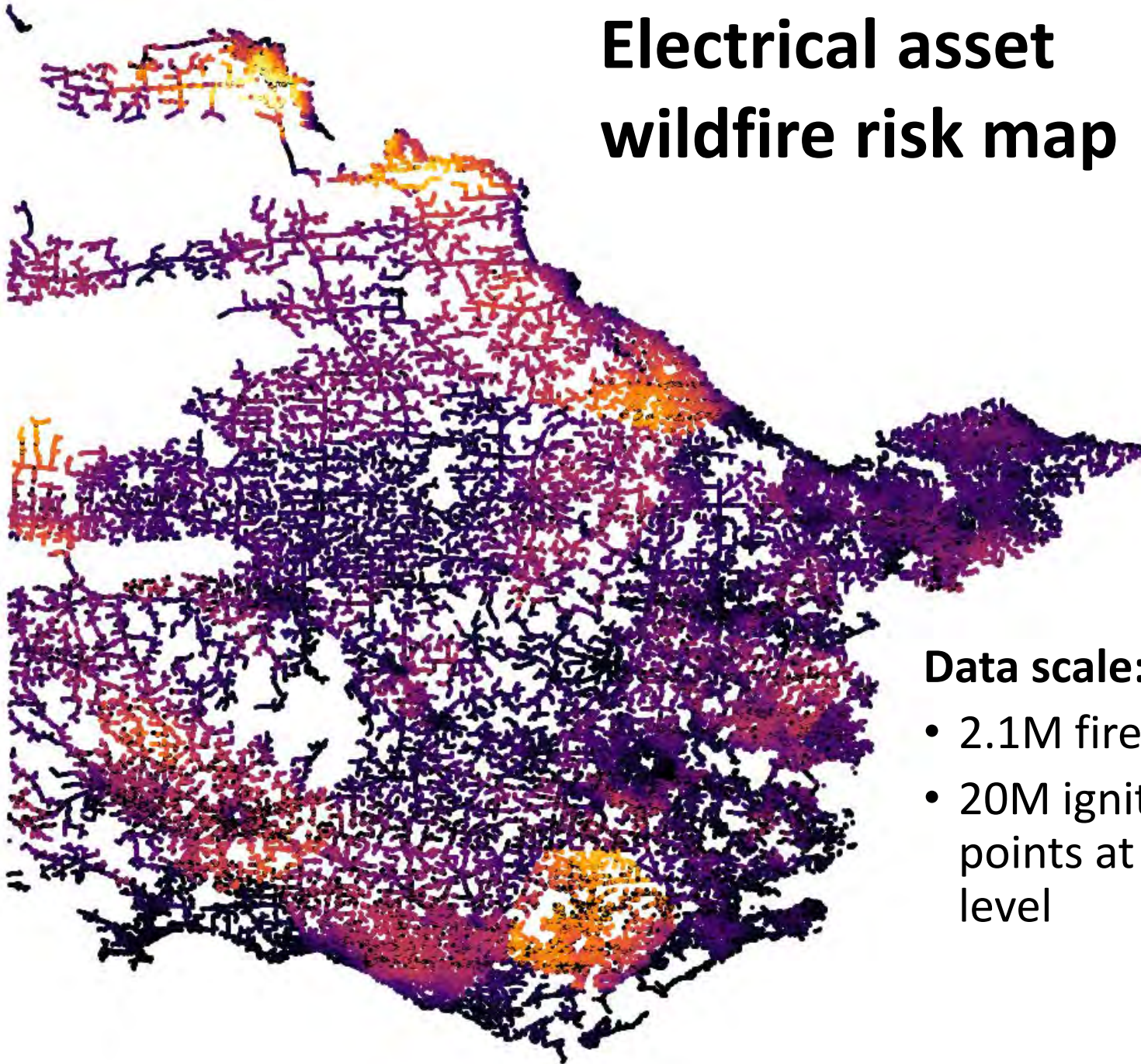
Probabilistic impact area

Wind variation

- Probability of fire reaching particular location
- Colour scale shows probability (red = high)



Electrical asset wildfire risk map



Data scale:

- 2.1M fire simulations
- 20M ignition rate data points at (pole, option) level



Current Situation: (Before introduction of Rapid Earth Fault Current Limiter)



https://youtu.be/n5_SwJzFUP4

PBSP: policy and regulatory change

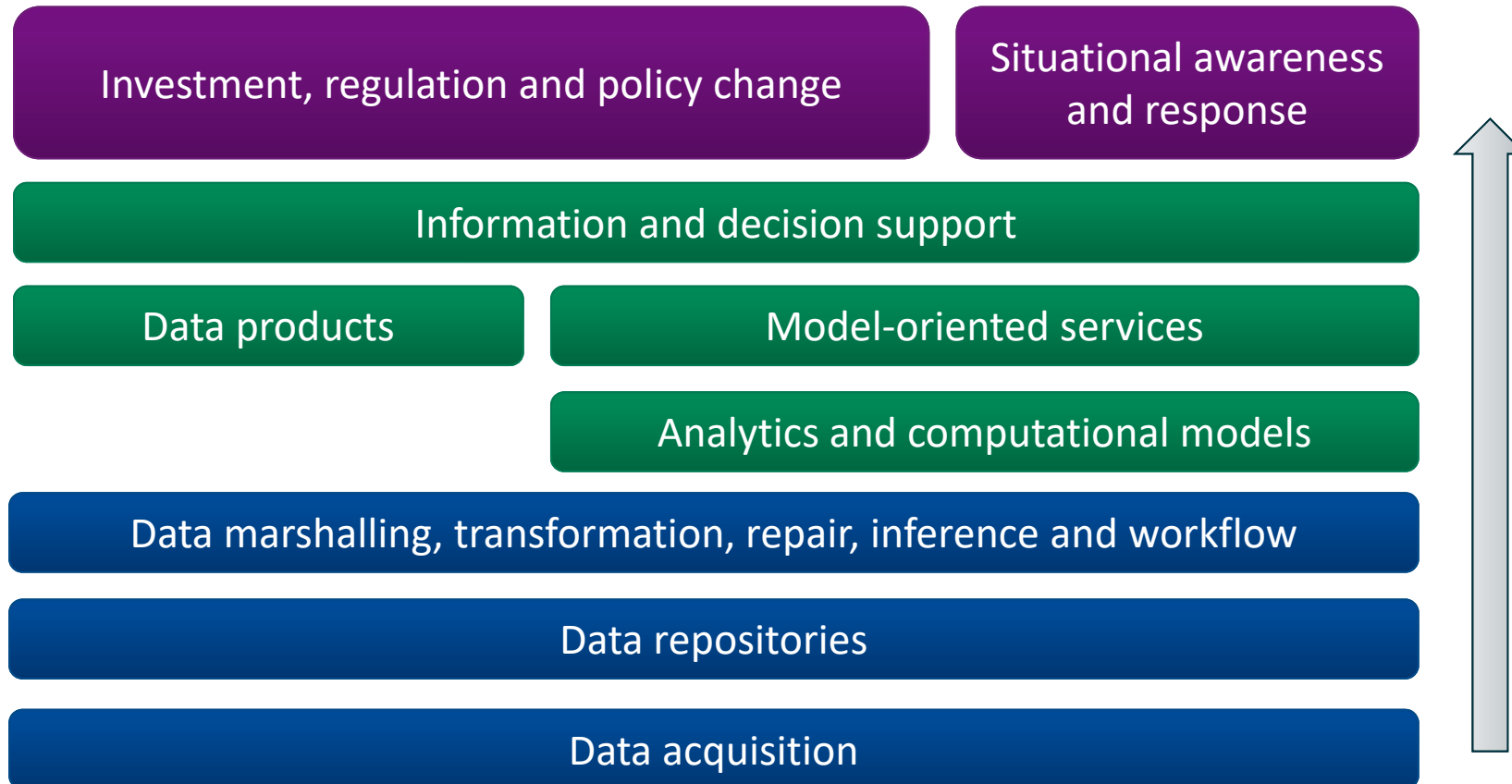


- Overall policy position oriented around facilitating data-driven optimized investment profiles, enabled by regulations which communicate technical requirements but moreover ***state the community's risk tolerance and accepted trade-offs.***
- Regulatory change leading to investment in partnership between the state and electricity companies. ***Quantitative risk analytics as a guiding principle.***
- A\$200M in targeted powerline undergrounding
 - Locations selected based on quantitative risk assessment
- A\$300M in staged REFCL rollout across codified areas
 - According to new electrical safety regulations
 - Sequencing directly based on quantitative risk assessment
 - Final A\$100M funded from processes overseen by National Energy Regulator (AER)
- Likelihood and consequence datasets as “standards”
 - “Official” estimates of fire likelihood reduction due to HV powerlines
 - Used multiple times in justifying risk-reducing exemptions to regulations
- Financial penalty scheme for electrical fire starts
 - Risk reduction estimates used in “tapering” fire counts over time
 - Expected annual cost and cost variability analysis, for fairness and acceptability
- Emerging national standard in approach and data
- Applications in other Australian states and internationally
- Prime analytics case study and a model for approaches to other hazards

Building

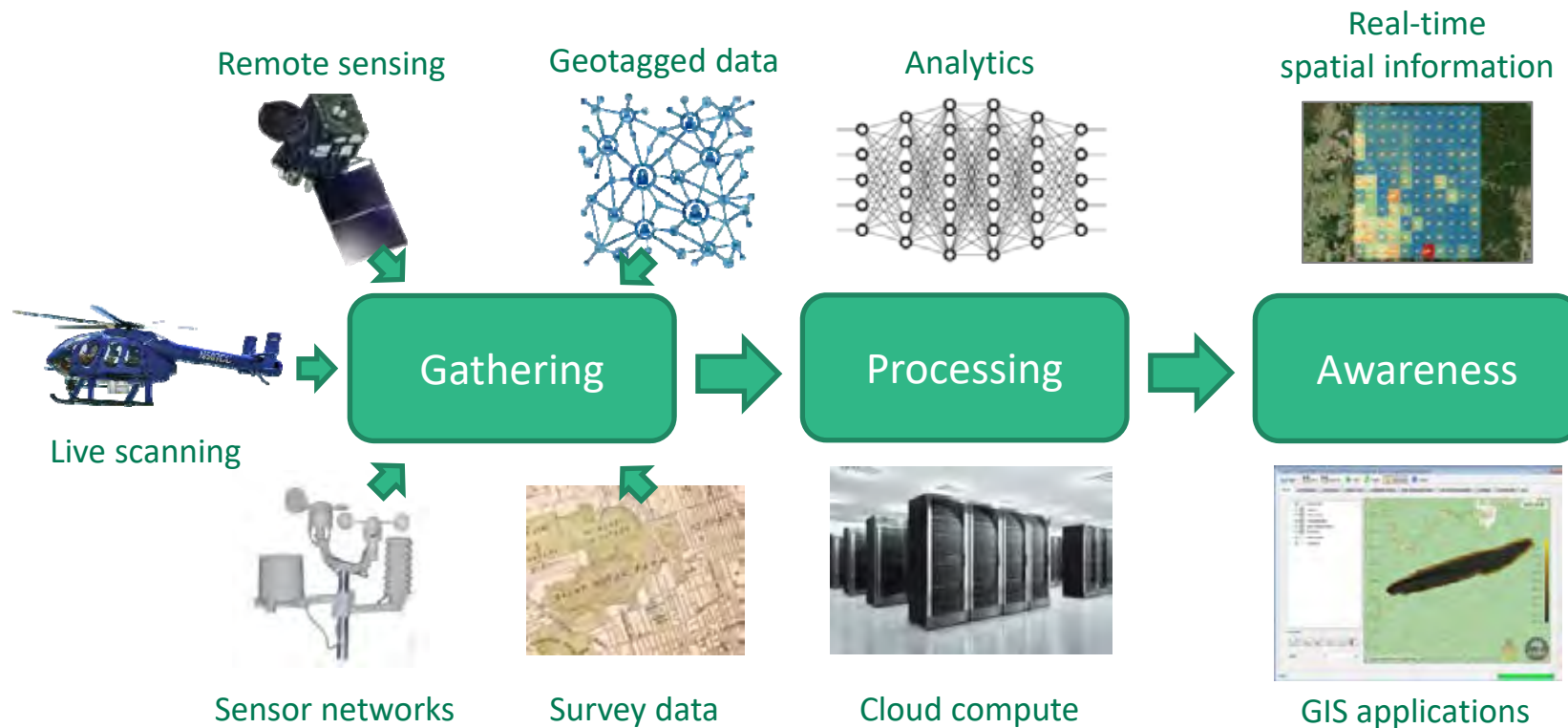
**data, modelling,
computation, and decision support**
technologies and communities

Data, technology, products and services stack

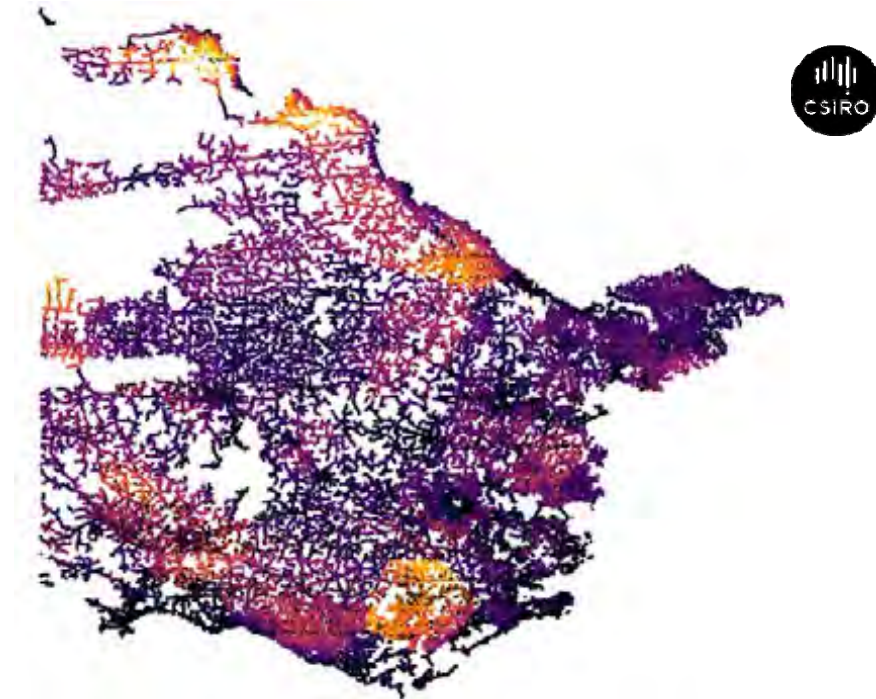


Data61's Geostack Engine

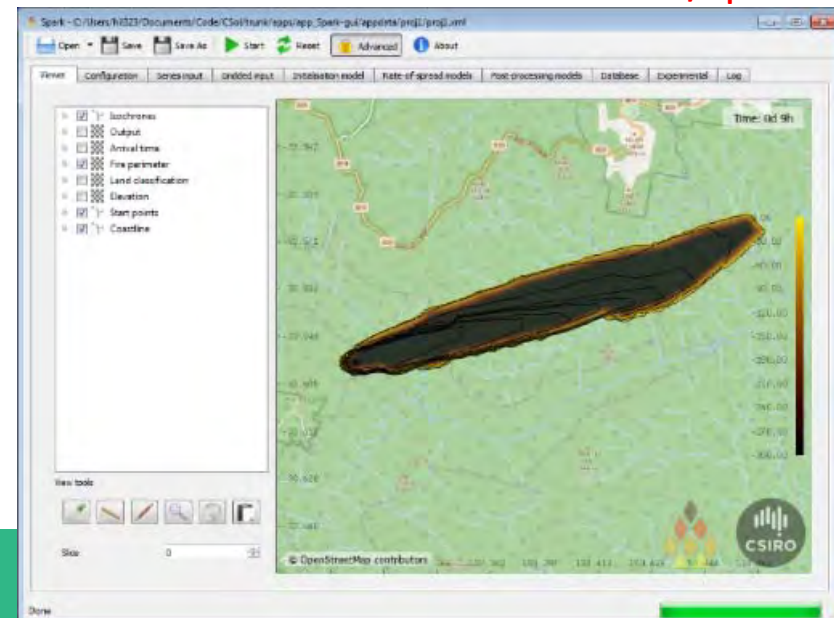
Three key components constitute **Geostack**



Fire simulation



www.research.csiro.au/spark



Concluding remarks



- Data products (e.g. fire maps), models (e.g. Spark) and systems drive informed investment, regulation and policy
- Data collection and transformation ranges in scale and complexity, from citizen engagement through to automated beneficiation of remotely-sensed data for use in models
- It is vital to ensure that key elements are commonly available and openly developed
- Groups and organisations need to contribute from a foundation of core competency, and share and use the world-class skills of others

ABOUT IDRIM

COMMITTEES


PROGRAMME

SPEAKERS

CALL FOR ABSTRACTS

SPONSORS

DESTINATION

 EXPRESSION OF INTEREST

THE 9TH CONFERENCE OF THE
INTERNATIONAL SOCIETY FOR
**INTEGRATED
DISASTER RISK
MANAGEMENT**

2–4 OCTOBER 2018
SYDNEY, AUSTRALIA



IDRIM 2018
DATA DRIVEN
APPROACHES
TO INTEGRATED
DISASTER
MANAGEMENT

IMAGE: DESTINATION NSW

EXPRESSION OF INTEREST

PROGRAMME

CALL FOR ABSTRACTS

<http://www.confer.nz/idrim2018/>



Thank You

<http://www.data61.csiro.au>

www.csiro.au

