Australian National University

The Namadgi cosmic ray sensor & spatial vegetation and water prediction

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workshop ACT environmental sensing activities
13 February 2015

www.wenfo.org/wald/

Cosmic rays for fire and flood monitoring

The cosmic ray soil moisture probe is a recently invented technology that is set to revolutionise our ability to monitor soil and biomass moisture content.

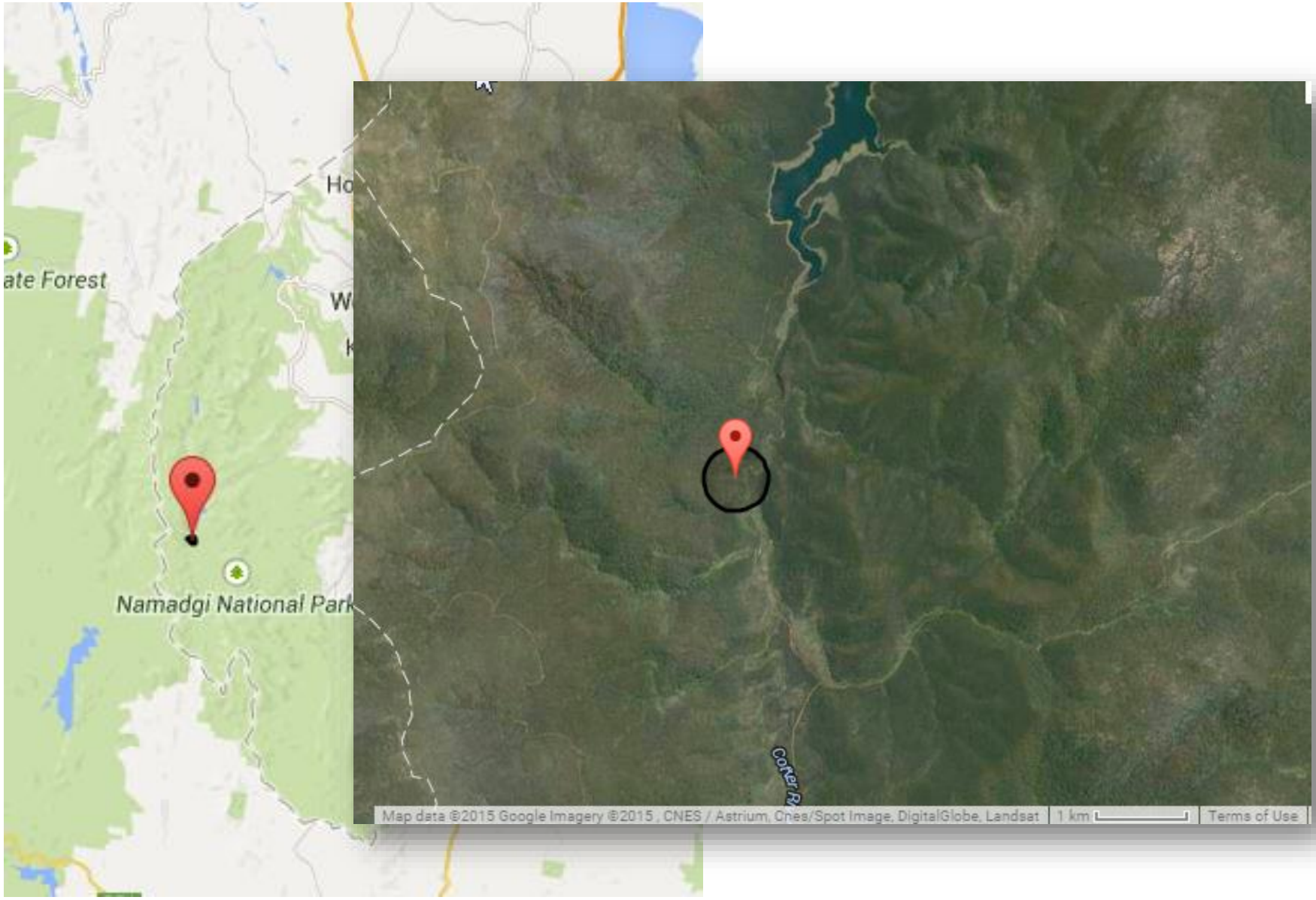
As a part of CSIRO's CosmOz network, this project investigates the potential of this technology for flood and fire risk monitoring in a remote part of the Cotter catchment in Namadgi National Park.

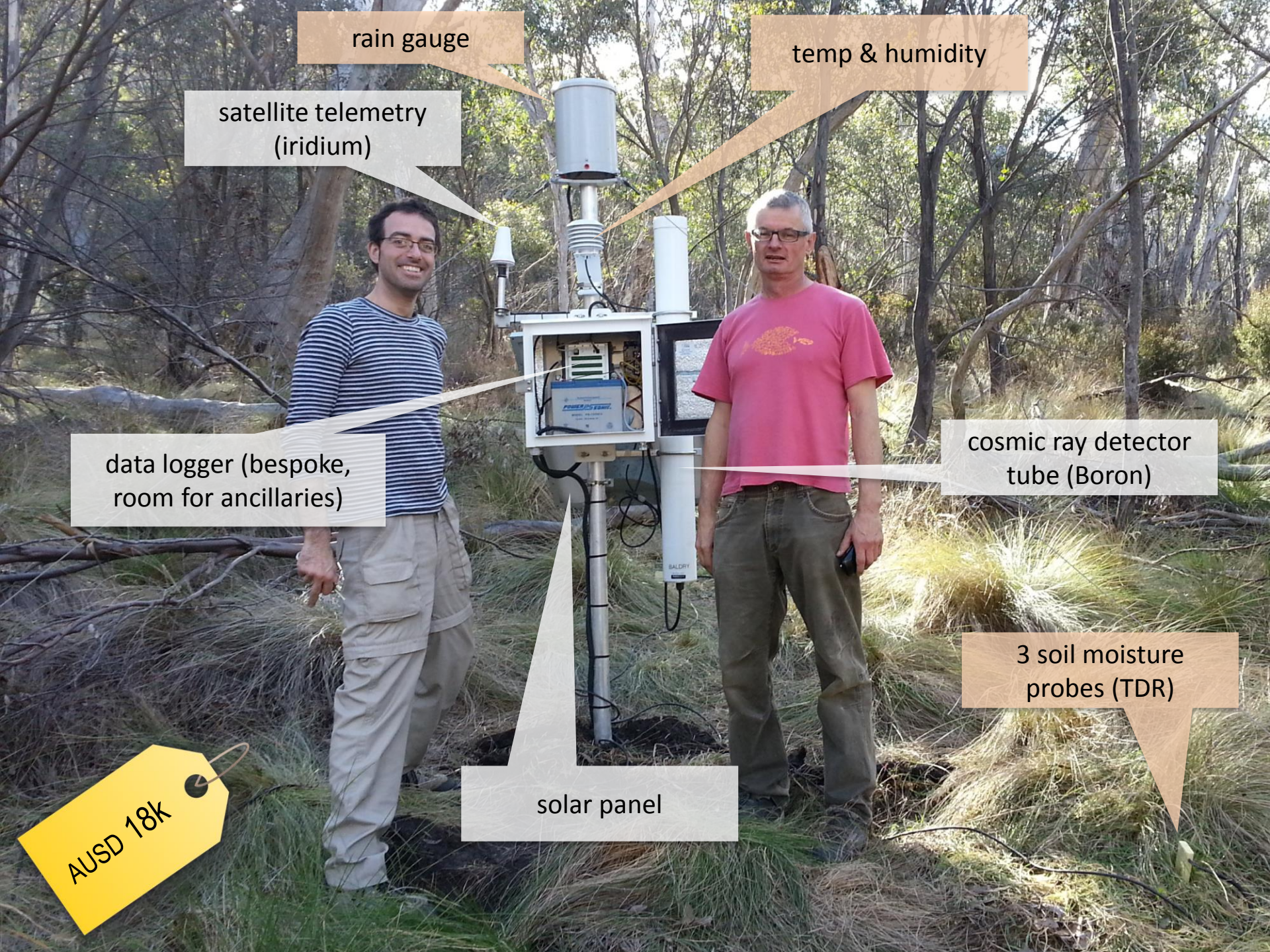
[View latest measurements]

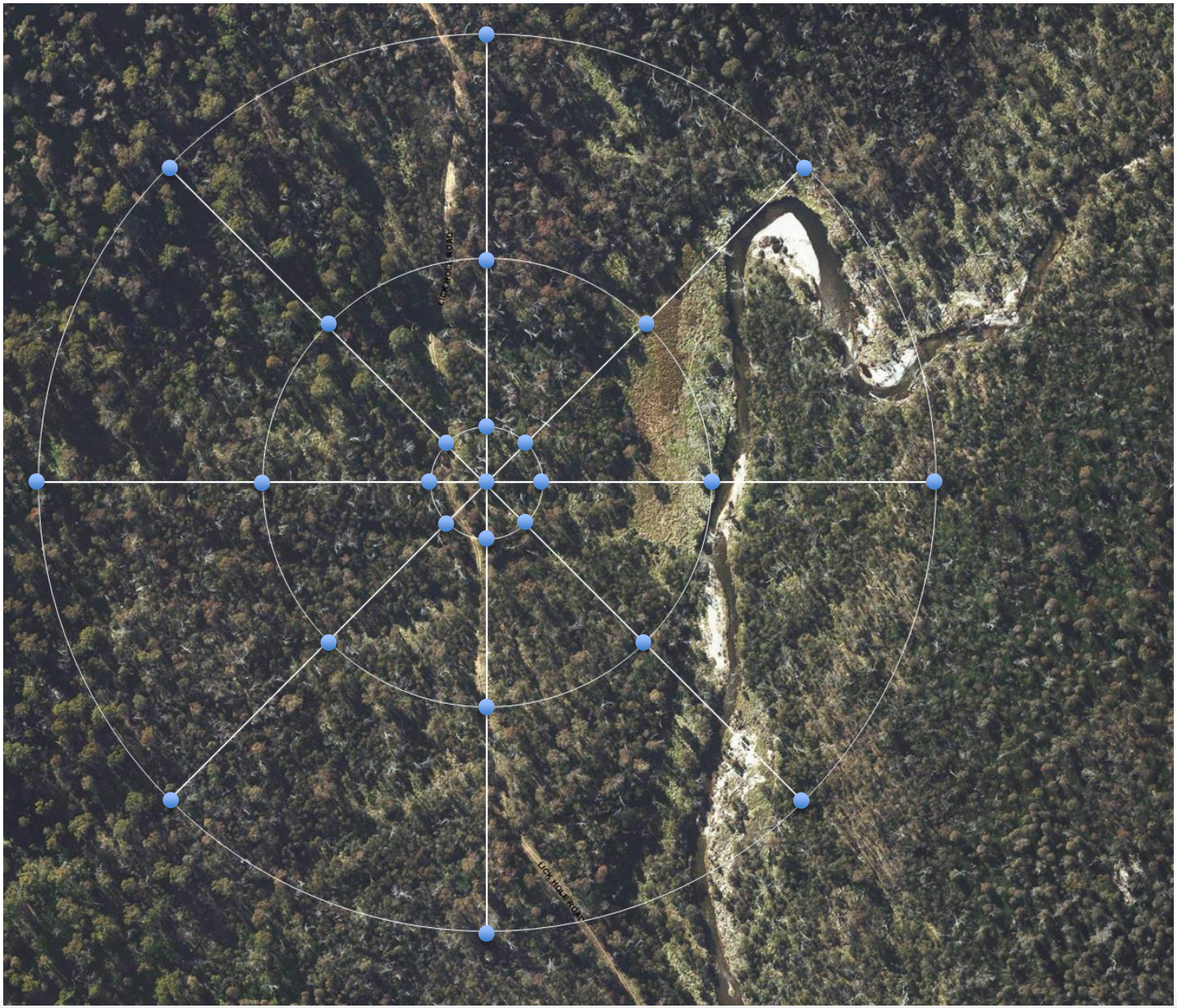
Funding: Actew/ActewAGL Endowment Fund

Partners: CSIRO, Actew, ACT government

http://www.wenfo.org/wald/projects/


ate Forest
Namadgi National Park
Map data ©2015 Google Imagery ©2015 , CNES / Astrium, Cnes/Spot Image, DigitalGlobe, Landsat
1 km
Terms of Use


rain gauge
temp & humidity
satellite telemetry (iridium)
data logger (bespoke, room for ancillaries)
cosmic ray detector tube (Boron)
3 soil moisture probes (TDR)
solar panel
AUSD 18k


LOCKHOUSE ROAD
LOCKHOUSE ROAD

bushfire&natural HAZARDSCRC

MAPPING BUSHFIRE HAZARD AND IMPACT

Developing spatial information on fire hazard for planners, land managers and emergency services

Dr. Marta Yebra, Prof. Albert Van Dijk and Dr. Geoff Cary

Fenner School of Environment and Society, ANU College of Medicine, Biology and Environment, ACT.

An Australian Government Initiative

CRC AUSTRALIA

Australian National University

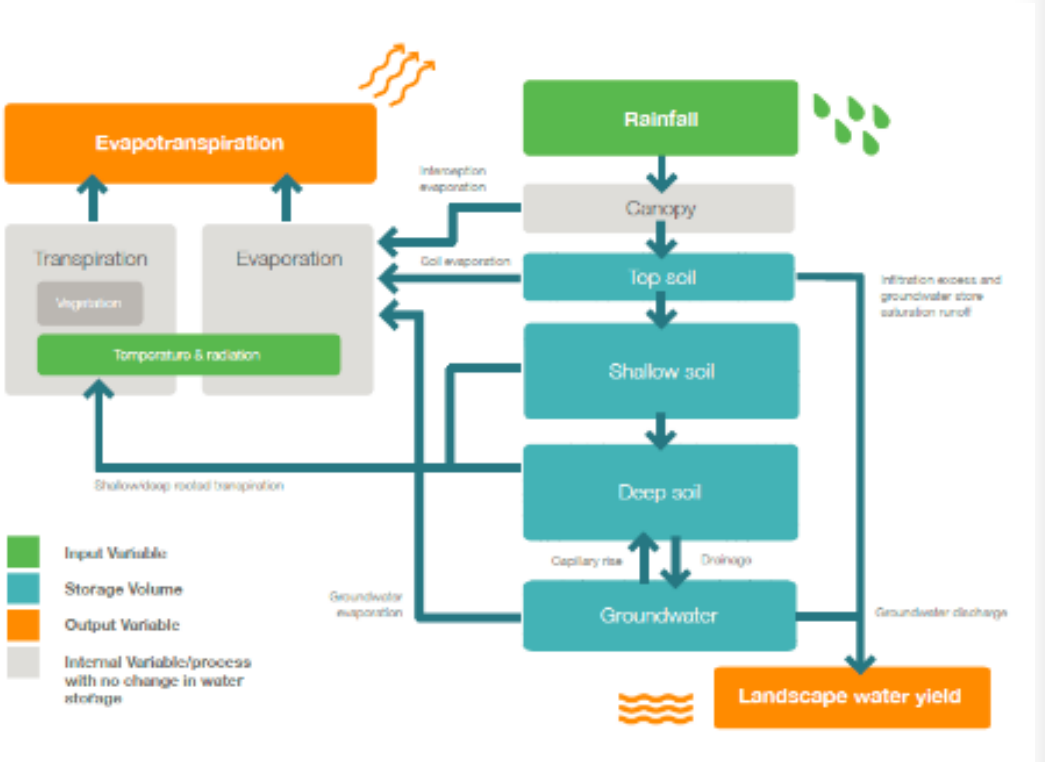
SPATIAL ESTIMATION OF FIRE IMPACTS

..at high resolution (30m, daily), for use fire management and impact assessment.

Spatial forest growth, water use and carbon uptake model based on the AWRA model developed for Bureau of Meteorology.

Predicts

- soil/litter moisture patterns
- vegetation growth
- water use
- streamflow generation
- etc etc



SPATIAL ESTIMATION OF FIRE IMPACTS

Input data

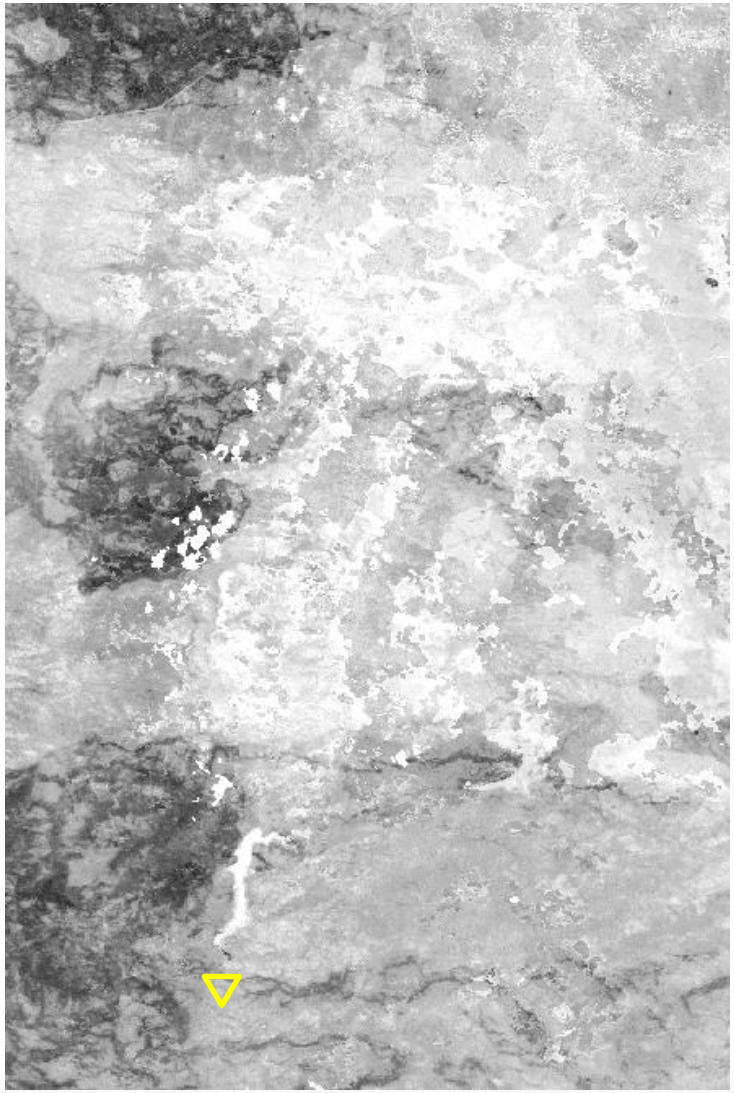
- 30m GA Data Cube **Landsat imagery** (vegetation NDVI)
  thanks Juan Guerschman, CSIRO

- 30m relief and landscape morphology (TERN, GA) from SRTM **Digital Elevation Model**
  thanks John Gallant, CSIRO

- 1km TERN e-Mast daily **precipitation** and **temperature**

- 5km BAWAP/SILO daily **short-wave radiation**

INPUT: LANDSAT NDVI

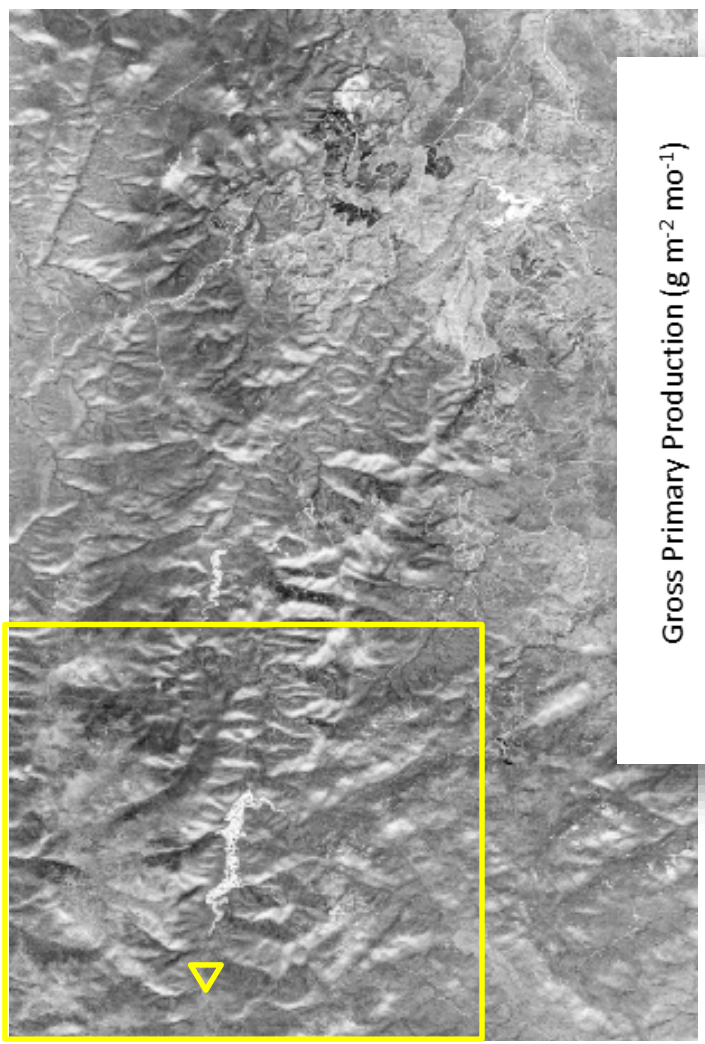


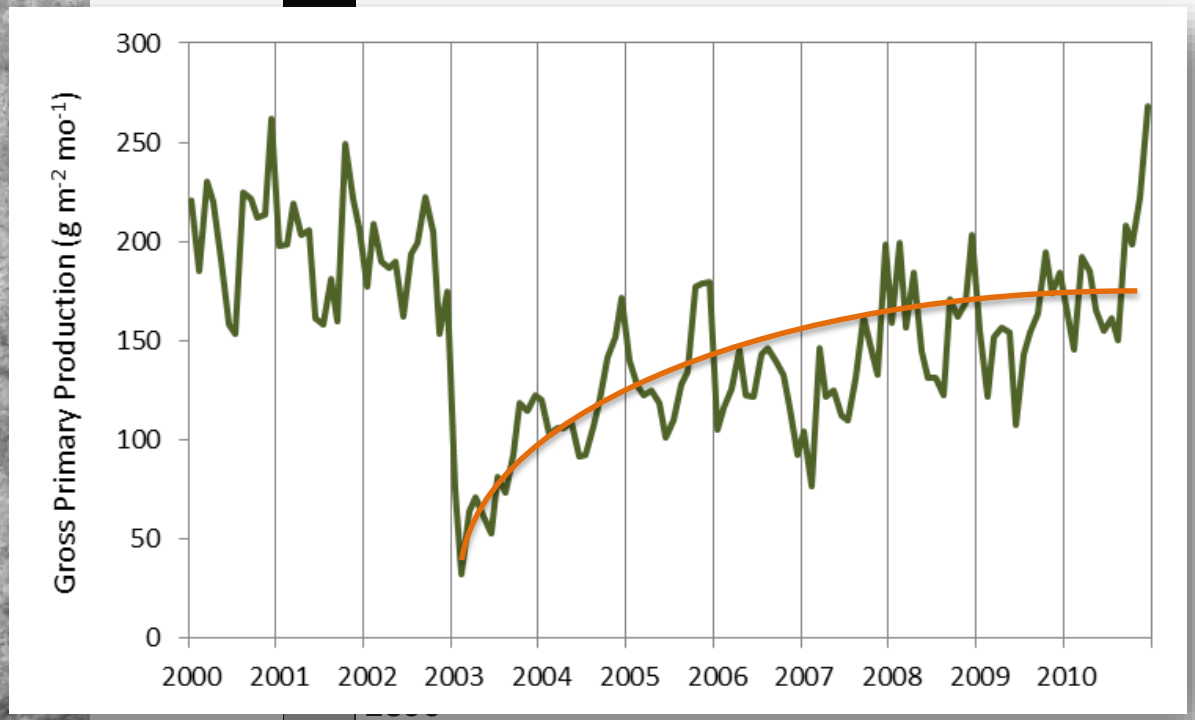
December 2002

February 2002

OUTPUT: GROWTH RATES

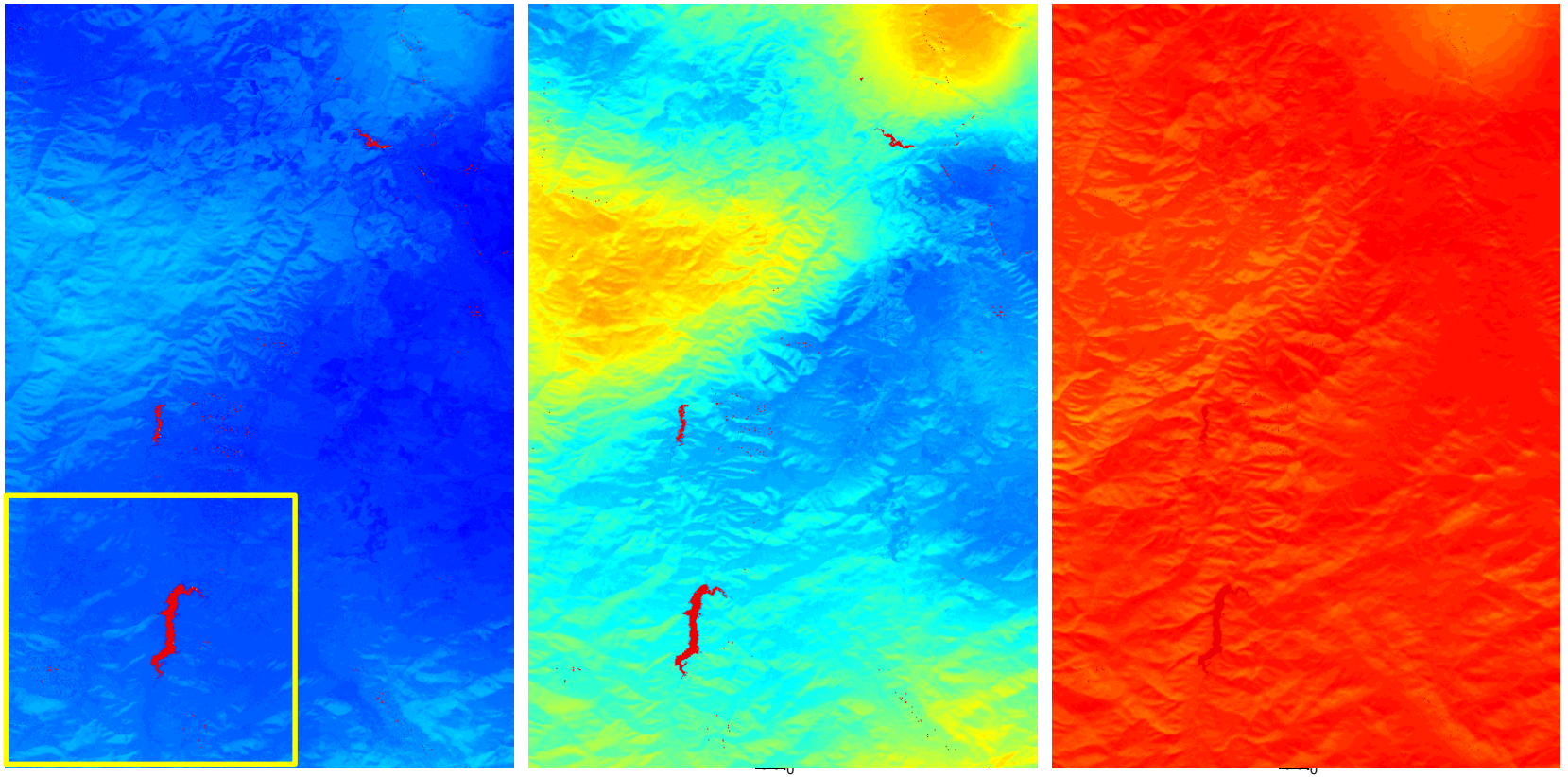
Gross Primary Production (2010)





OUTPUT: SOIL MOISTURE PATTERNS

estimated moisture vol.% in top 10 cm mineral soil

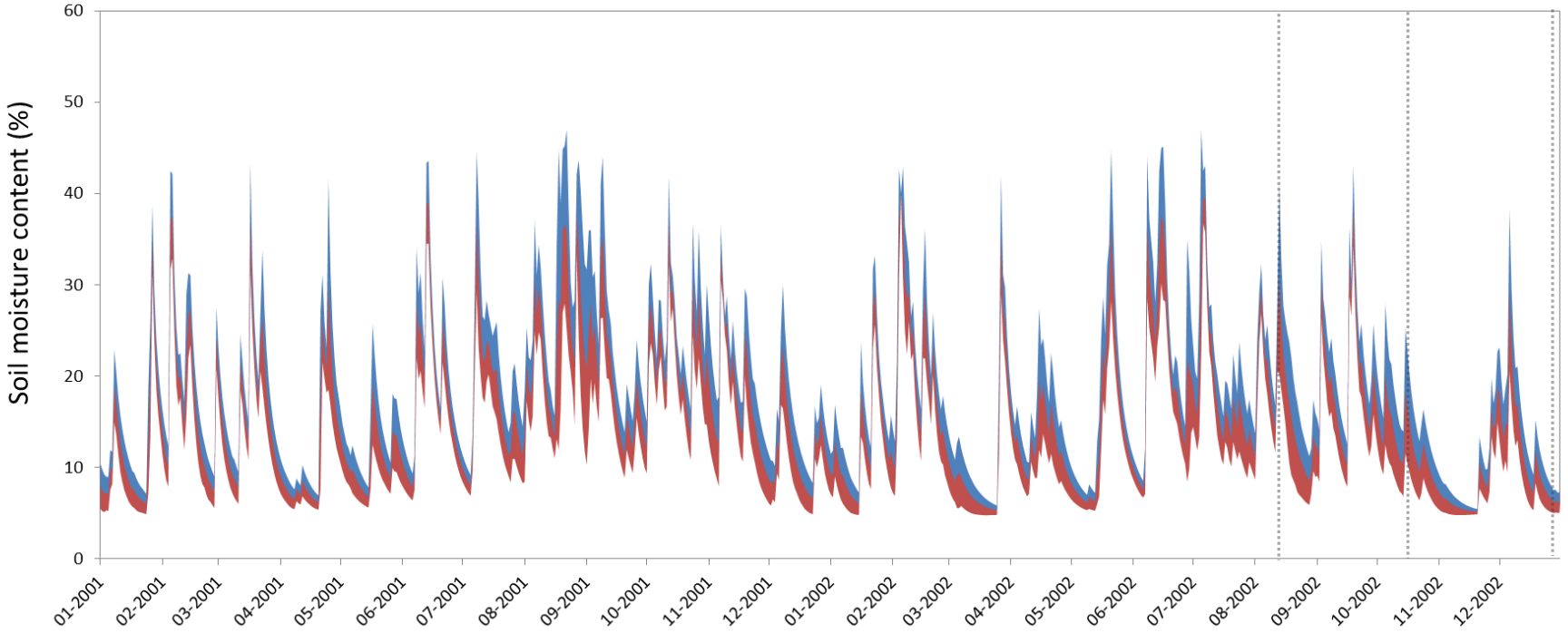


6 August 2002

16 October 2002

29 December 2003

OUTPUT: SOIL MOISTURE PATTERNS

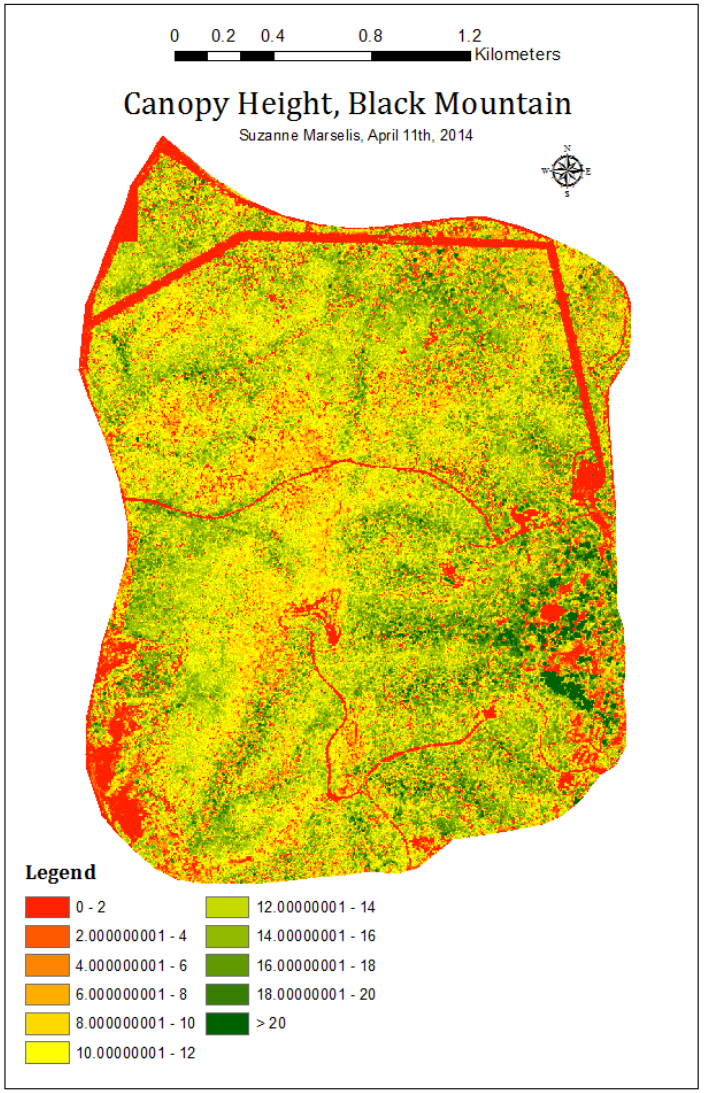


SOME (FOR ME) NEW SCIENCE QUESTIONS

- In what way does moisture contents vary between fuel types and how is are the physics best modelled?
  - live vegetation
  - elevated/bark fuel
  - surface fuel
  - top soil
- Can biomass and fuel accumulation be predicted from growth rate (GPP)?
- Can some aspects of fuel structure be predicted? (e.g. understorey)
- **Is any of this practically useful?**
  For example for:
  - planning burns
  - improved fire danger rating
  - fire spread modelling?

TO BE INVESTIGATED NEXT: LIDAR

- Can potentially be used to
  - **Drive model** (e.g. tree height)
  - **Assess predictions** (e.g. of biomass patterns)
  - **Understand sources of error** (e.g., from NDVI to canopy cover fraction)
  - **Extend model** (e.g., from GPP to biomass accumulation)
- .. same or similar holds for just about **any other measurements** of vegetation/fuel, soil, water, weather..



SUMMARISING

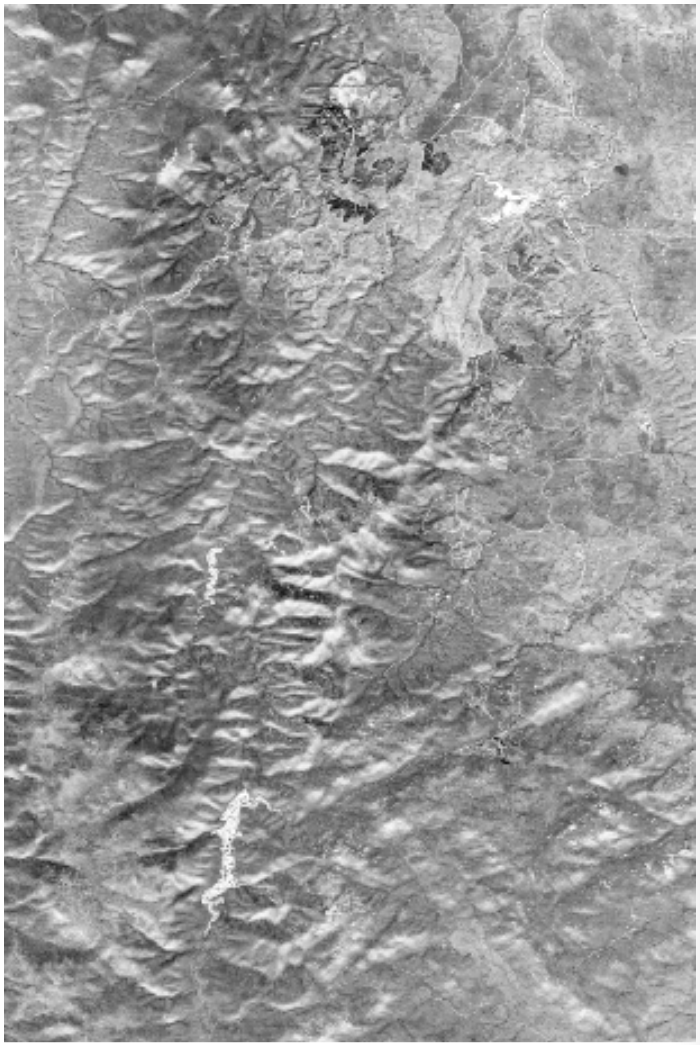
- Spatial estimates of various aspects of vegetation (fuel/carbon/biomass) and water can be generated
  - anywhere in Australia
  - at 30 m detail
  - daily time step

- Is there a **practical use** for it? *What mapping products could you potentially see an application for?*

- Although driven by observations, it is still essentially a model, and so prediction **quality assessment** is paramount.

- This can be achieved using a comprehensive range of observations :
  - vegetation, weather, water or soil
  - point-based or airborne

  Would you like to collaborate?




THANK YOU