Gary Morgan AFSM

Principal Consultant

Global Wildland Fire Management Services, Australia

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European Commission (EC),
GOFC GOLD Fire Implementation Team (GOFC Fire IT)

20 - 23rd Nov 2017
Cumberland Lodge (Berkshire, UK)

United Kingdom

Total Population
65.6 million (2016)

Land Mass
243,610 km²

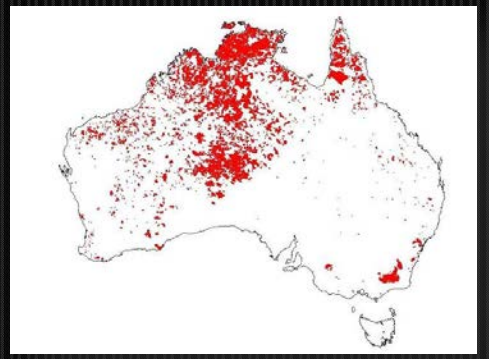
.

Australia

Total Population
24.5 million (2017)

Land Mass
7,692,024 km²

Approx. 45,000 wildland fires per year
Approx. 1.2m ha prescribed fire per year



Area burnt 2002 / 2003

Eugene VON GUÉRARD *Bush fire between Mt Elephant and Timboon 1857*


MASS
EXTINCTION
BUSH
FIRES
SEVERE
DROUGHT
NEXT 100 YEARS

Aussie Olympic Volley ball coach giving team instructions – come on, hop to it!

Improved data collection and analysis is required

- **Current situation in Australia:**
  - **No national agreement of data to be collected for wildland fires.**
  - **Varying methods for data capture and accuracy of data collected.**
  - **Some degree of doubt in the usefulness of data.**
  - **Difficult to harmonize and conduct trend analysis.**

Australia is currently collecting:

1. Area burnt by wildland fire (unplanned fire)
2. Area burnt by prescribed wildfire (planned fire)

To report under the Montreal Process in its State of the Forest Report for 2018

Australia needs to determine:

1. **What is the desired landscape in a fire prone environment?**
   (Healthy forest, no lives lost, improved biodiversity, reduced GHG emmission, improved threatened species habitat, minimal smoke disruption and reduced human health impacts)
2. **What are the performance measures?**
3. **What data should be collected for analysis?**
4. **How should the data be collected?**
5. **Will the data be compatible with that from other countries?**


FIRE DANGER TODAY
LOW
MODERATE
HIGH
VERY HIGH
EXTREME

Future for our sunburnt country – research and smart use of existing technologies.

Copernicus Australia Roadmap

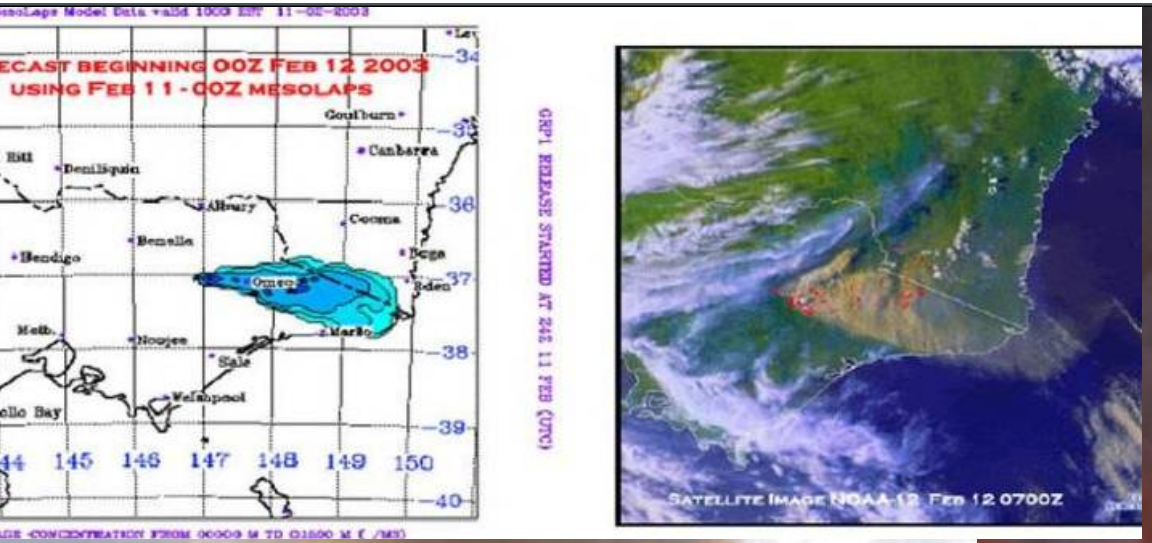
The Copernicus Australia data hub will ramp up to Full Operating Capability in 2018 with three main stages.

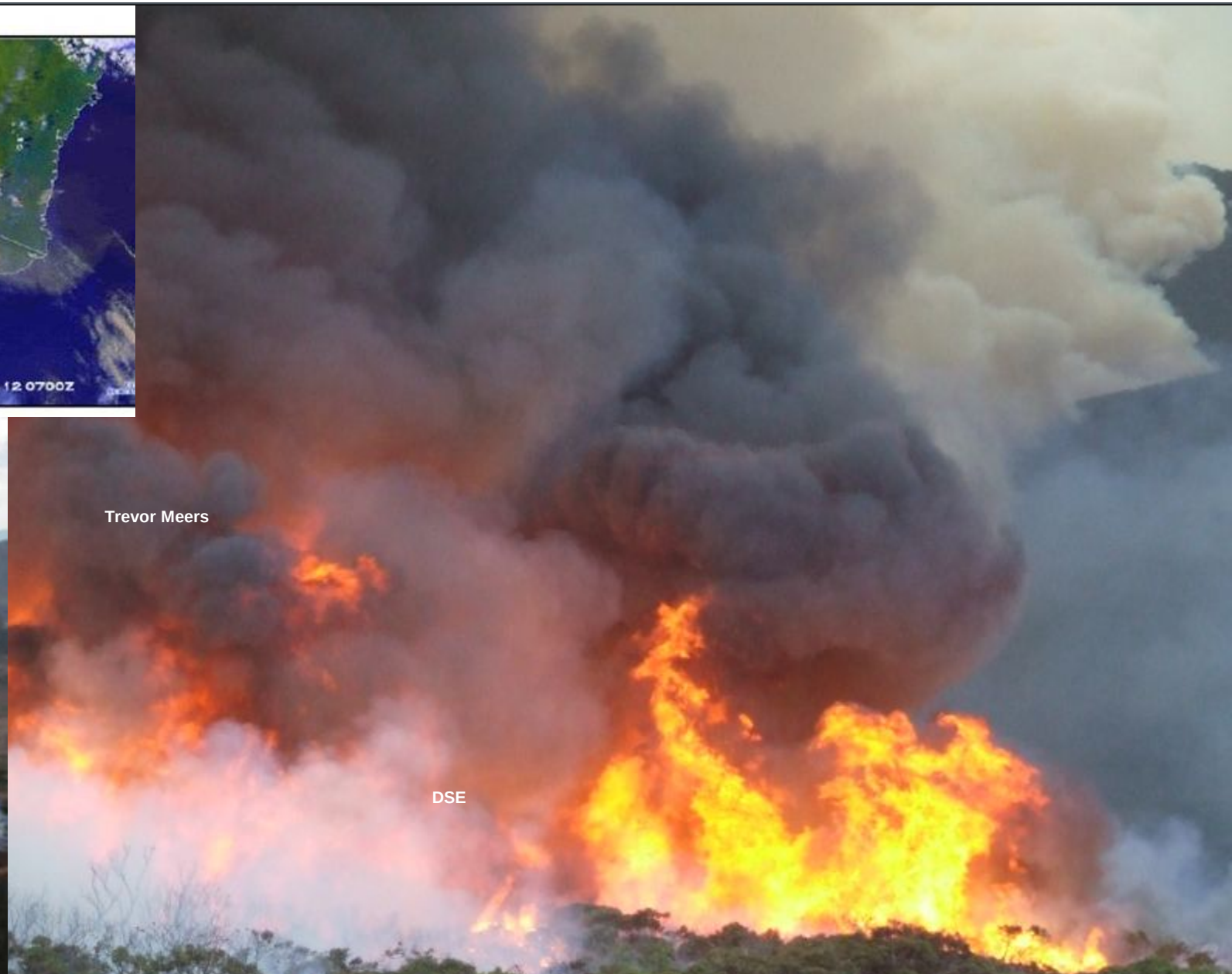
Stage 1 - Original Format Data Files: Delivered at launch focusing on the replication of the data holdings from ESA and EUMETSAT in their original formats in Australia.

Stage 2 - Analysis-Ready Data: Delivered in early 2017 focusing on the ongoing production of Analysis Ready collections of the Sentinel missions with interoperable services increasing accessibility.

Stage 3 - Cloud and HPC: Delivered in early 2018 focusing on scaling up delivery services and enabling industry exploitation of the collections.

Research Impact – smoke plume prediction





Short-term predictions of smoke and heat emissions from prescribed fires

Sean F. Walsh, Thomas J. Duff, John Loschiavo, Derek M. O. Chong, Carl P. Meyer, Martin E. Cope, Matthew Chick, Melissa Fedrigo, Kevin G. Tolhurst

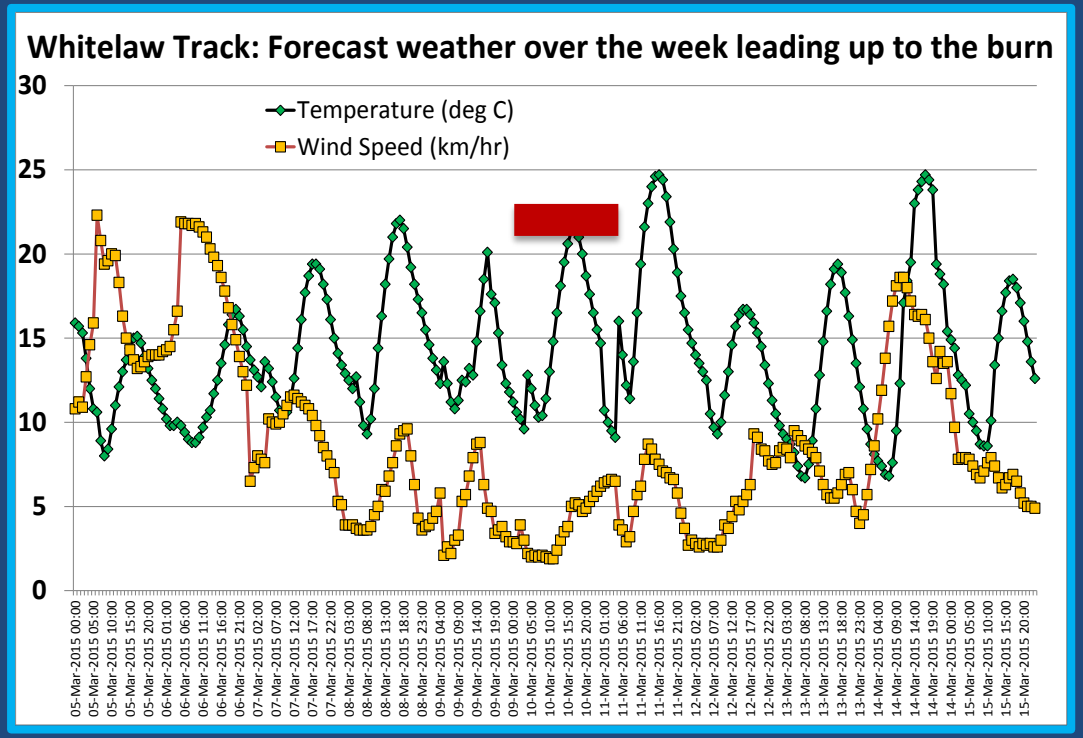
Contact: kgt@unimelb.edu.au

THE UNIVERSITY OF MELBOURNE

CSIRO

Model input data

- Burn boundary
- PHOENIX fuel model
- Topography
- Burn prescription
- Weather forecast
- Date/time, duration



Case Study

Measured fuel consumption : **1299 tonnes**

95% confidence interval : 1266-1332

Predicted fuel consumption: **1936 tonnes**

Case Study

Predictions for:

Carbon emissions : **924 tonnes**

Heat released : **33.9 x 10^3 GJ**

PARTNERSHIPS IN EARTH OBSERVATION: Collaborative SAR Solutions UK and Australia

Professor Anthony Milne

Cooperative Research Centre for Spatial Information (CRC-SI), Carlton, Victoria, Australia

School of Biological, Earth and Environmental Sciences, The University of New South Wales, Sydney, Australia Ph (61) 2 9451 4628 Mobile (61) 04 27914805

INTERNATIONAL ASTRONAUTICAL CONGRESS 2017
ADELAIDE, AUSTRALIA • 25-29 SEPTEMBER 2017

PARTNERSHIPS IN EARTH OBSERVATION:
Collaborative SAR Solutions UK and Australia

Objectives

The project is about building research capacity and capability.

Common belief there is high potential for collaborative, global market development for synthetic aperture radar (SAR) data and its associated value-adding services.

Major objective to put a collaborative framework and infrastructure in place, that would foster joint technological and scientific research and enable product innovation and development between Australia and the UK companies.

Lay the foundations for future export opportunities for both UK and Australian companies to the greater Asia-Pacific region.

CATAPULT
Satellite Applications

Innovate UK
Technology Strategy Board

The Satellite Applications Catapult officially launched on 4 April 2013.

Satellite Applications Catapult Ltd is an independent technology and innovation company.

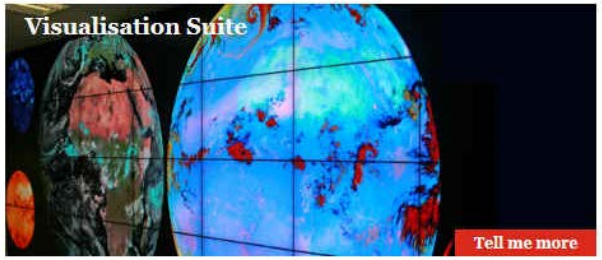
It is one of a network of elite centres established by Innovate UK to accelerate the take-up of emerging technologies and drive economic growth.

Vision *"To be a world-leading technology and innovation company, helping businesses of all sizes to realise the potential from space. By embracing a pioneering, agile, collaborative and entrepreneurial spirit, we create valued partnerships to deliver game-changing results."*

Closing the gap between research and commercialisation.

Harwell, UK

Facilities



Why SAR?

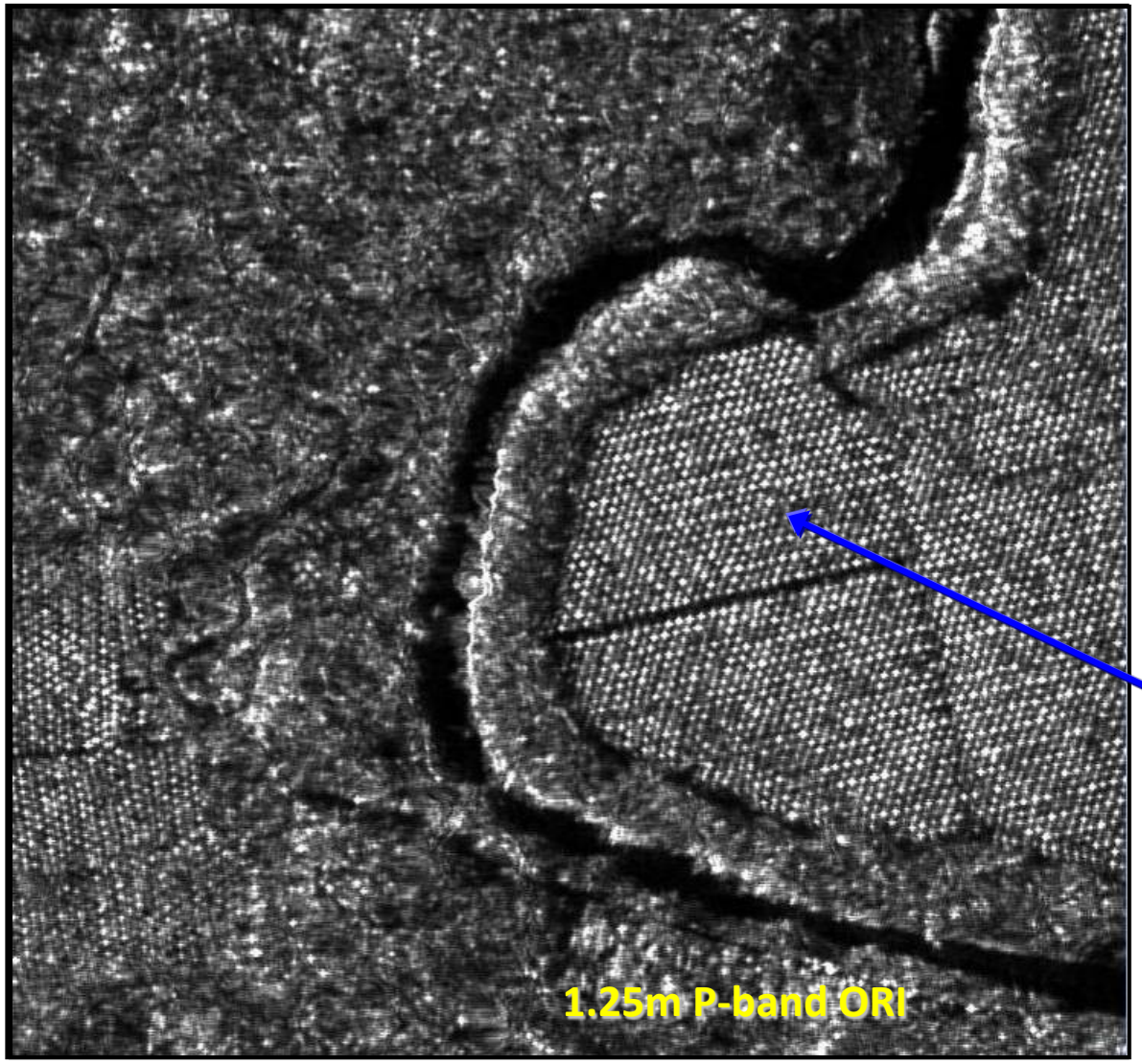
- **SAR science and technology expanding worldwide – major EO research and applications frontier.**
- **Dimensionality of data and developing applications base.**
- **Value to be extracted greater than investment in other EO systems.**
- **Defence a major driver of radar development.**
- **The CEOD study reported that after Low Resolution Optical Data, SAR was the next most widely used data type in Australia and that the use of both is expected to grow substantially.**
- **Capacity to contribute to a country's information needs.**

CSIRO

Australian Government
Geoscience Australia

crc•si

Airborne GeoSAR X and P band



1.25m X- and P-band Radar Images

Orchards and trails, irrigation patters, drainages exposed in P-band

Capable of counting trees in plantations

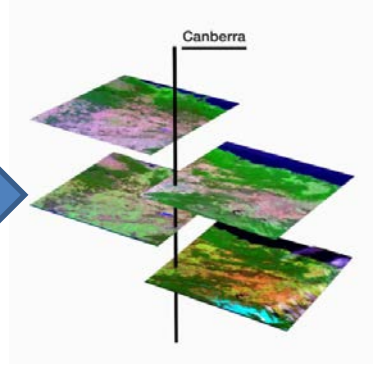
Papua New Guinea

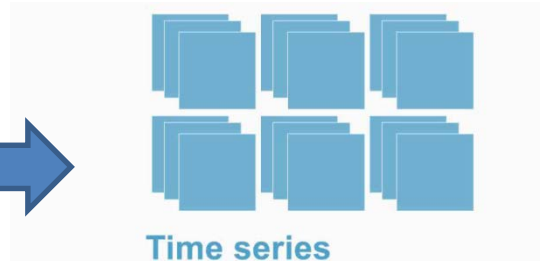
Australian Government
Geoscience Australia

Australian Geoscience Data Cube

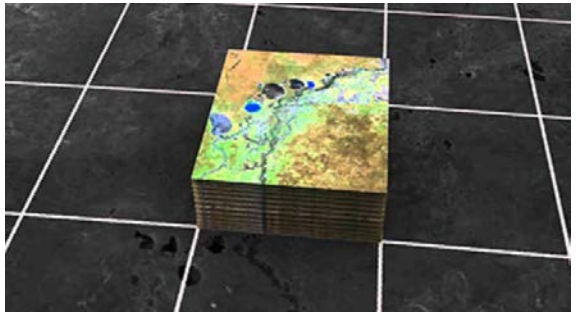
Orthorectification

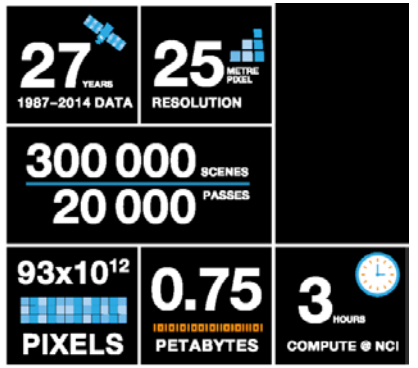
Calibration





Three decades of data



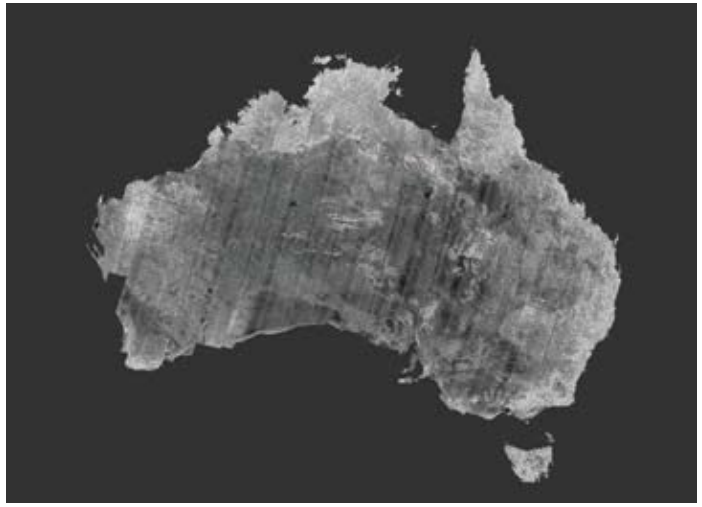


Landsat Data Cube - a multi-dimensional space, time, data type stack of spatially aligned pixels ready for analysis

http://www.datacube.org.au/

Sentinel Datacube Development

- Sentinel-1
  - 451 GRDH-DV (VV+VH) acquired in from January to May 2015
  - Product @ 40 m by employing the SRTM DEM
  - Mosaic (103566x82716)

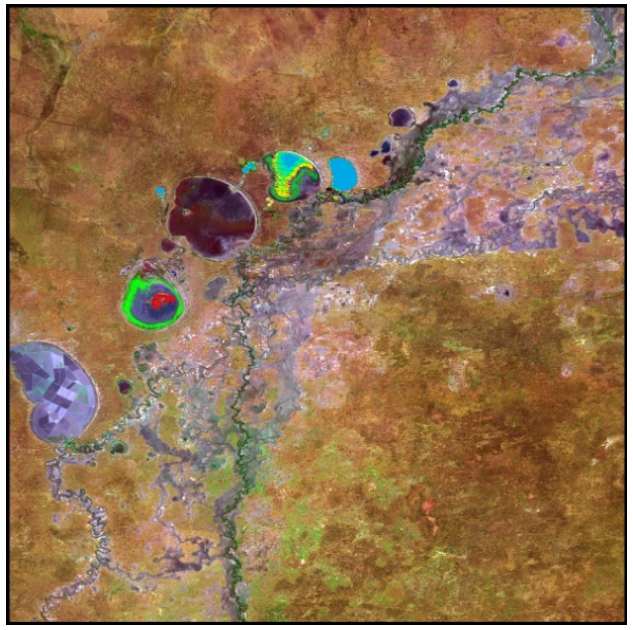


- Sentinel-1
  - 32 GRDH-DV (VV+VH) acquired in from March-April 2016
  - Product @ 20 m by employing the SRTM DEM
  - Mosaic (99231x61125)

Australian Government
Geoscience Australia

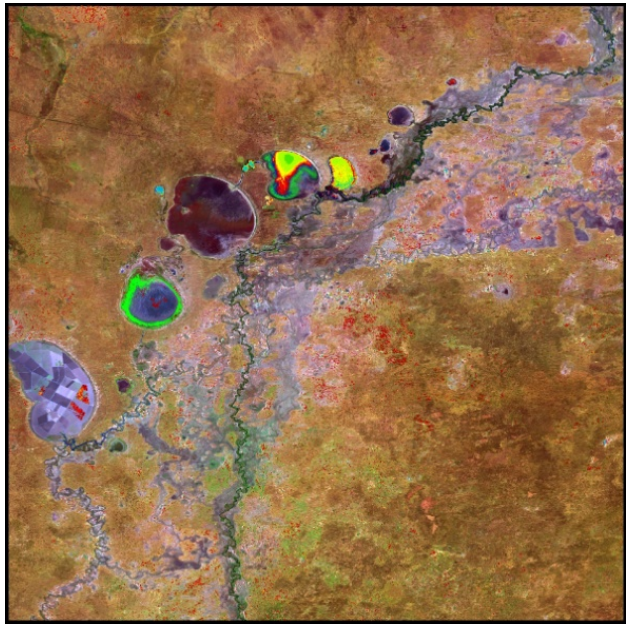
Water Observations from Space (Wofs)

Landsat-Derived Surface Water



Landsat 7 & 8 results between Sept 2015 and Jan 2016 are combined in a water observation frequency.

SAR-Derived Surface Water



The Sentinel-1a results over the same period of Sept 2015 to Jan 2016.

The same colour scheme has been used: red areas have very low counts of water observation while blue have high.

- The SAR is detecting water across the study area almost as well as Landsat
- The Landsat water classifier is the outcome of several years of work.
- Still in the early stages of repeatable time series SAR.
- Combination of SAR and Optical will be powerful and provide a complementary solution for WOfS

Forestry Demonstrator

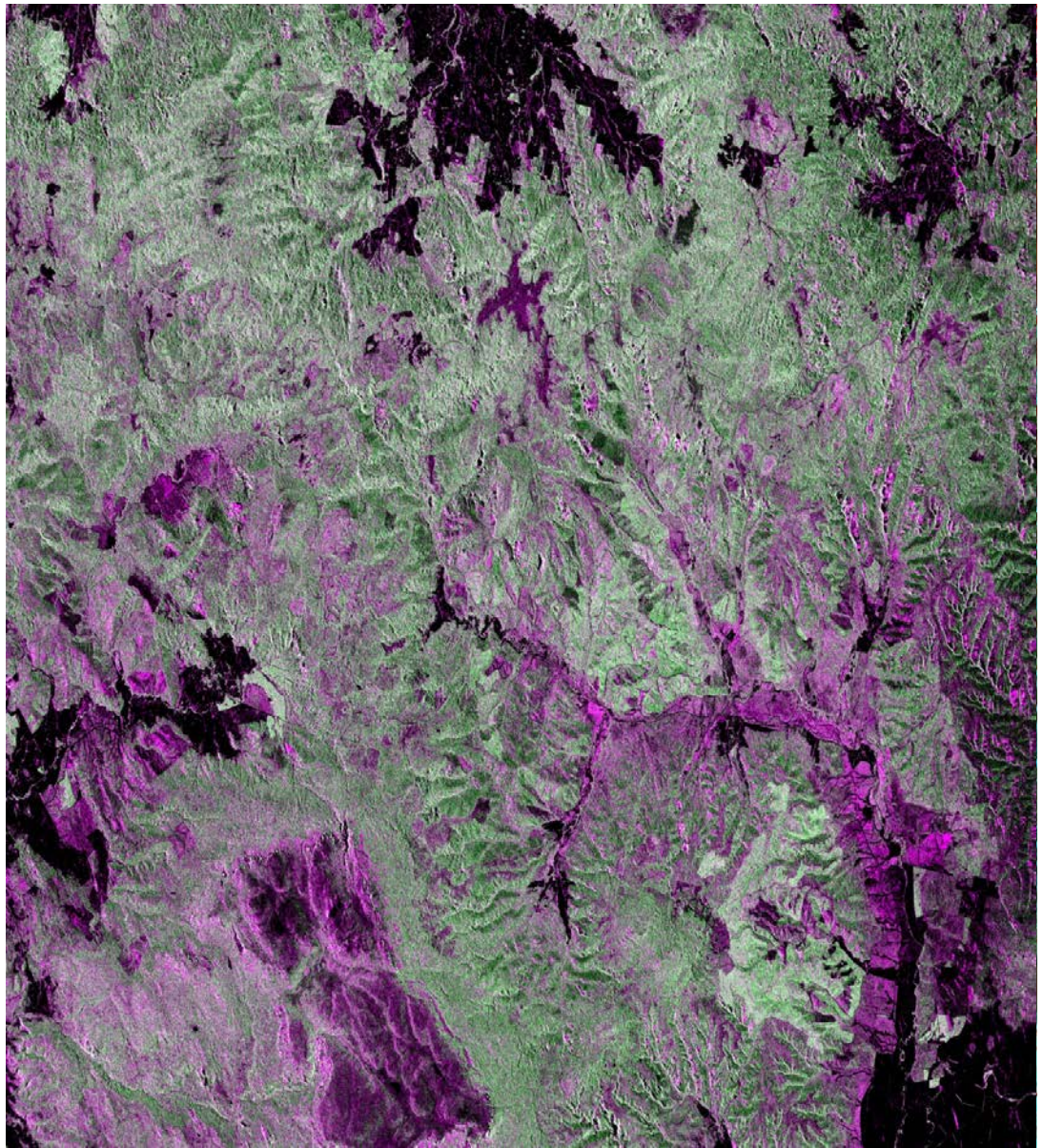
ALOS-2 PALSAR-2 HH:HV:HH in RGB

Sentinel-1A VV:VH:VV in RGB

Landsat-8 NIR:Red:Blue

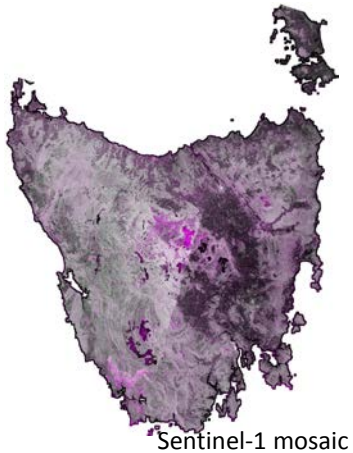
SVM classification of Land cover

Forest/Non-forest



Forestry Demonstrator showcased 3 products

- Interoperability of C- and L-band SAR and Optical data for Forest and land cover mapping
- Evaluate performance of Sentinel-1A time-series for Forest cover change mapping
- Provision of sustainable NFMS service - Deforestation, degradation, regrowth, biomass estimates



Sentinel-1 mosaic
VV:VH:VV in RGB

crc•si Spatially Enabling Australia and New Zealand

For further information please contact:

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Slides courtesy Prof Tony Milne AO | e:t.milne@unsw.edu.au

Australian Government Department of Industry, Innovation and Science | Business Cooperative Research Centres Programme

SATELLITE NAVIGATION SYSTEMS
HELPING WITH THE PROVISION OF INFORMATION AND WARNINGS.

Combining mobile telecommunication services and satellite-based communication using next generation Global Navigation Satellite Systems (GNSS) such as the Japanese Quasi-Zenith Satellite System (QZSS) for the provision of emergency information and warnings.

The Japanese GNSS-based warning system can be tailored to transmit messages according to people's location and situation through a GNSS receiver terminal embedded in mobile phones and in-car navigation units.

Suelynn Choy[1], John Handmer [1,5], Joshua Whittaker [1,5], Yuki Shinohara [2], Tomohiro Hatori [3] and Naohiko Kohtake [4]

1 RMIT University
2 NTT DATA Corporation
3 PASCO Corporation
4 Keio University
5 Bushfire and Natural Hazards CRC

SATELLITE NAVIGATION SYSTEMS
HELPING WITH THE PROVISION OF INFORMATION AND WARNINGS.

The satellite based system offers a number of advantages for real-time disaster alerts over current approaches to sending warnings via personal devices.

Advantages include:

1) GNSS with location-based information can be used during an emergency. This provides the ability to indicate high priority and targeted messages for specific areas and groups;
2) The service can cover a wide area simultaneously – e.g. the whole of Australia – because of its wide area broadcast footprint, and within the broadcast area, there is no limit to the number of people who can be warned simultaneously;
3) The messages can still be received even when terrestrial communications infrastructure is damaged or not available. This allows for redundancy; and
4) As the system is independent of mobile phone coverage it would reach people wherever they are, regardless of the existence of mobile phone coverage.

MONITORING FIRE RISK USING SATELLITE MICROWAVE REMOTE SENSING

Soil surface wetness is continuously observed over Australia by satellites using passive microwave (e.g., SMOS, AMSR2) and radar instruments (e.g., ASCAT) as well as available from several models.

They also provide information of fuel litter moisture content.

This project will analyse which of these data can be used to improve application of operational fire danger rating systems such as the McArthur Forest Fire Danger index.

The Australian National University
A) Dr. Marta Yebra, B) Prof. Albert Van Dijk, C) Dr. Geoff Cary

SATELLITE REMOTE SENSING OF FOREST FUEL LOAD, STRUCTURE AND MOISTURE CONTENT

There are several satellite-derived data relevant to forest fuel structure and moisture content but for which the utility for fire applications has not yet been assessed in Australia.
Examples include observations from satellite Light Detection And Ranging (ICESat/GLAS), radar (ALOS PALSAR, ASAR GM) and optical (MODIS, Landsat) observations and derived products.

This project will evaluate some of these data sources in terms of relevance, suitability for fire management, and operational readiness.

Dr. Marta Yebra, Prof. Albert Van Dijk, Dr. Geoff Cary
The Australian National University

FIRE DETECTION IN REMOTE AUSTRALIA USING HIMAWARI-8

Accurately estimating background temperature is vital for identifying fire using Remote sensing.

New temporal-based methods for temperature estimation are harnessing the increased stream of imagery from new satellite sensors to improve our understanding of the diurnal cycle of the landscape.

While the Himawari-8 satellite sensors are already proving useful for fire detection, existing algorithms are limited in their ability to resolve the effect of ground temperature, particularly when it matters most: on hot days.

Bryan Hally1,2 , Dr. Luke Wallace1, Dr. Karin Reinke1 & Prof Simon Jones1

1 School of Science, RMIT University, Melbourne, Australia 2 Faculty for Geo-information Science and Earth Observation (ITC), University of Twente, Enschede, Netherlands
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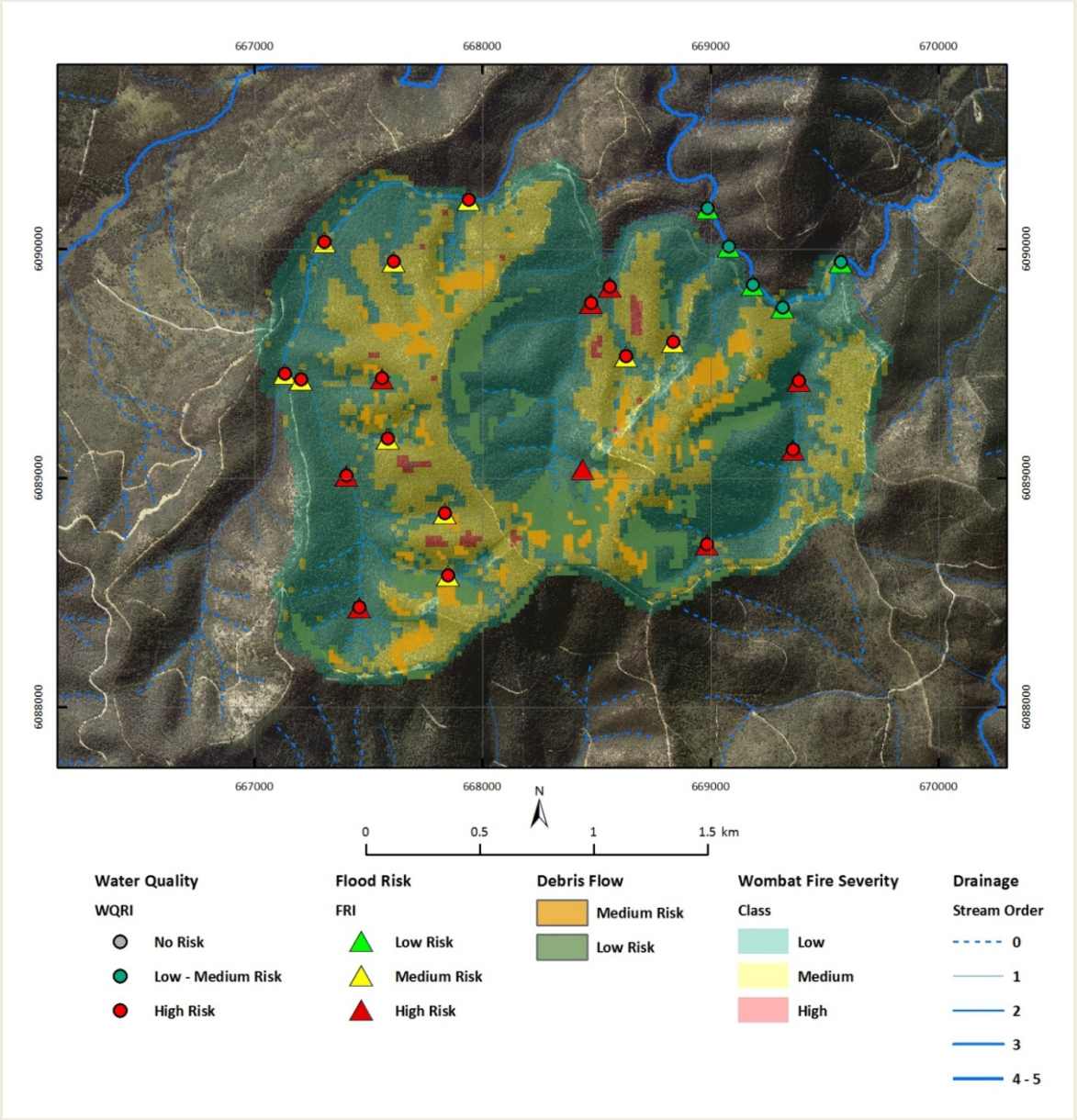
Development of a tool for assessing post-fire hydrological risk

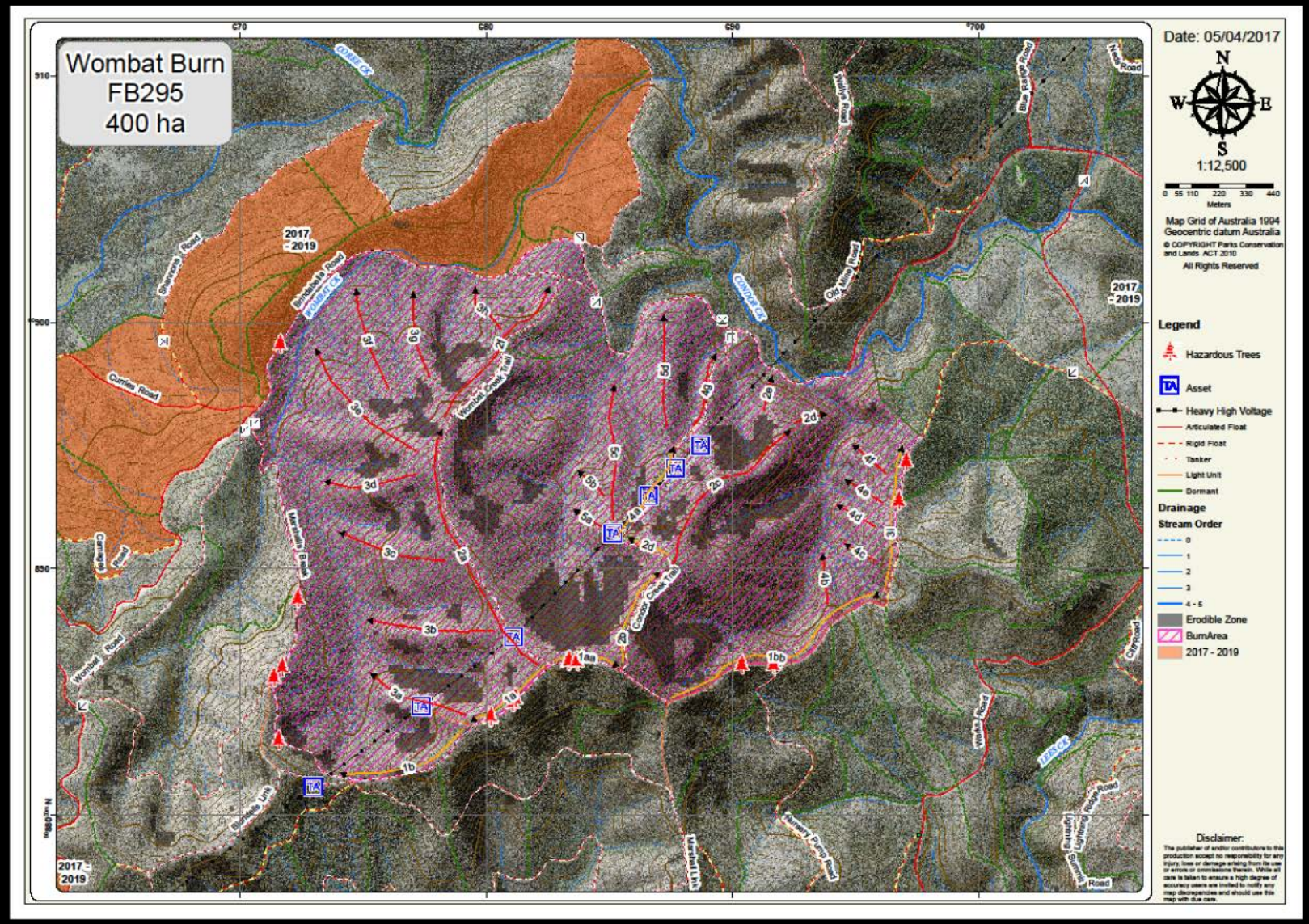
Adam Leavesley, Noreen Krusel and Petter Nyman

Contact: Adam.Leavesley@act.gov.au



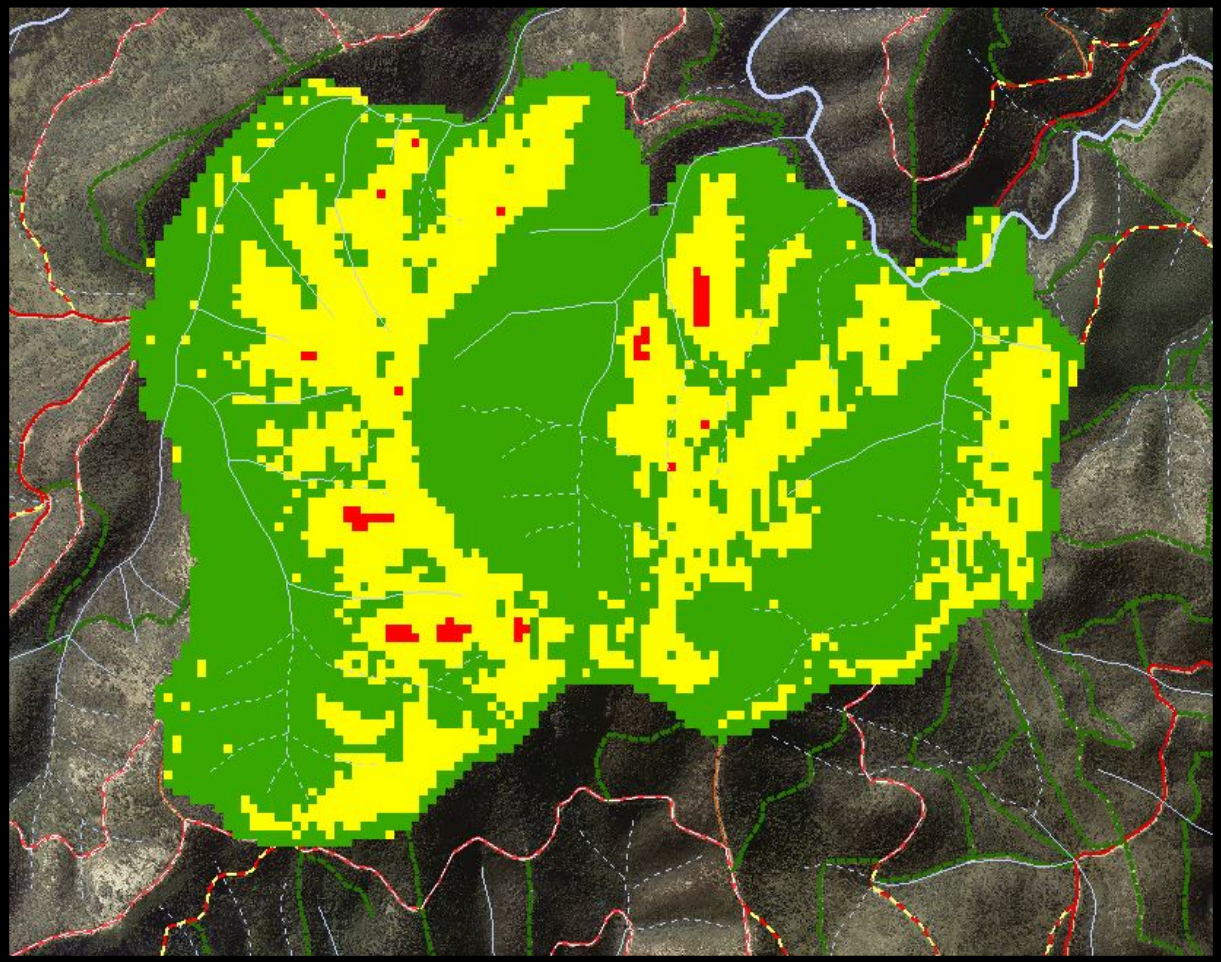
Post-fire erosion tools

Post-fire erosion tools



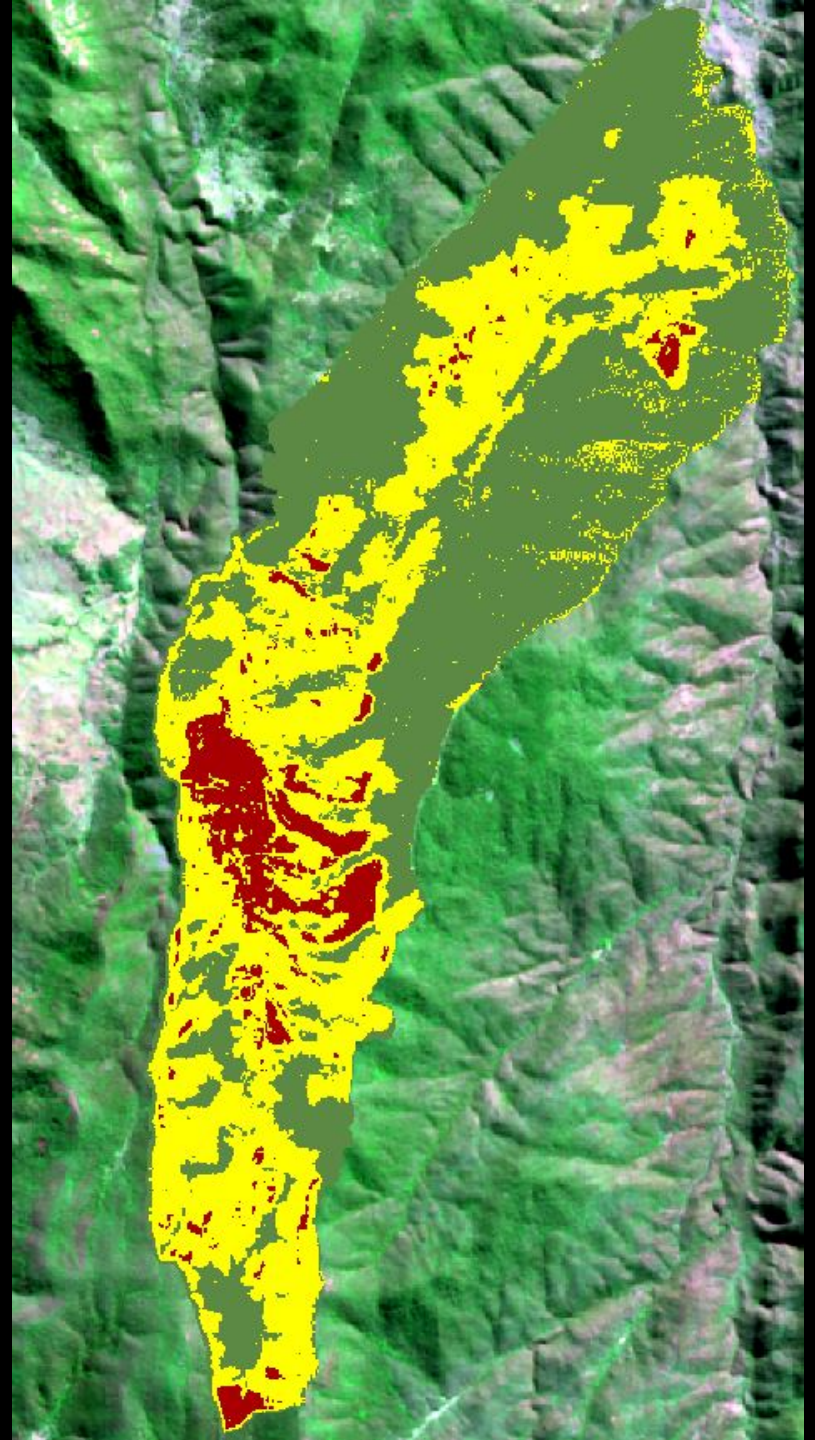
Post-fire erosion tools – fire severity mapping

Green=Unburnt
Yellow=Low intensity
Red=High intensity, >50% canopy scorch



Landsat using FIREMON method

Capability developed in partnership with Geoscience Australia thru linkages established at the BNHCRC.



Fire Severity Analysis of ACT Parks and Conservation Service Brandy Flat Hazard Reduction Burn fire severity map

Used:
Normalised Burn Ratio derived from the LandSat 8 Operational Land Imager.

Fire severity assessment derived from normalised burn ratio (developed by the US Forest Service and adapted for use in the ACT) :
Green = Unburnt, Yellow = Low, Red = High

The analysis returned an accuracy of 92%

ground-truthed by helicopter GPS.

Area of wildfire not the usual fire front

Black Saturday,2009
Phoenix RapidFire
Dr. Kevin Tolhurst
kgt@unimelb.edu.au


BROTHERS
ESTABLISHED 1885 JOHN F. BROWN
BROWN BROTHERS
MILAWA · AUSTRALIA
AUSTRALIAN TAWNY
South Eastern Australia
18.0% VOL
ESTATE BOTTLED
750ml

Gary Morgan AFSM

Principal Consultant

Global Wildland Fire Management Services, Australia

Gary.Morgan.Aust@gmail.com

European Commission (EC),
GOFC GOLD Fire Implementation Team (GOFC Fire IT)