



# TERN-ing Ecosystem Science

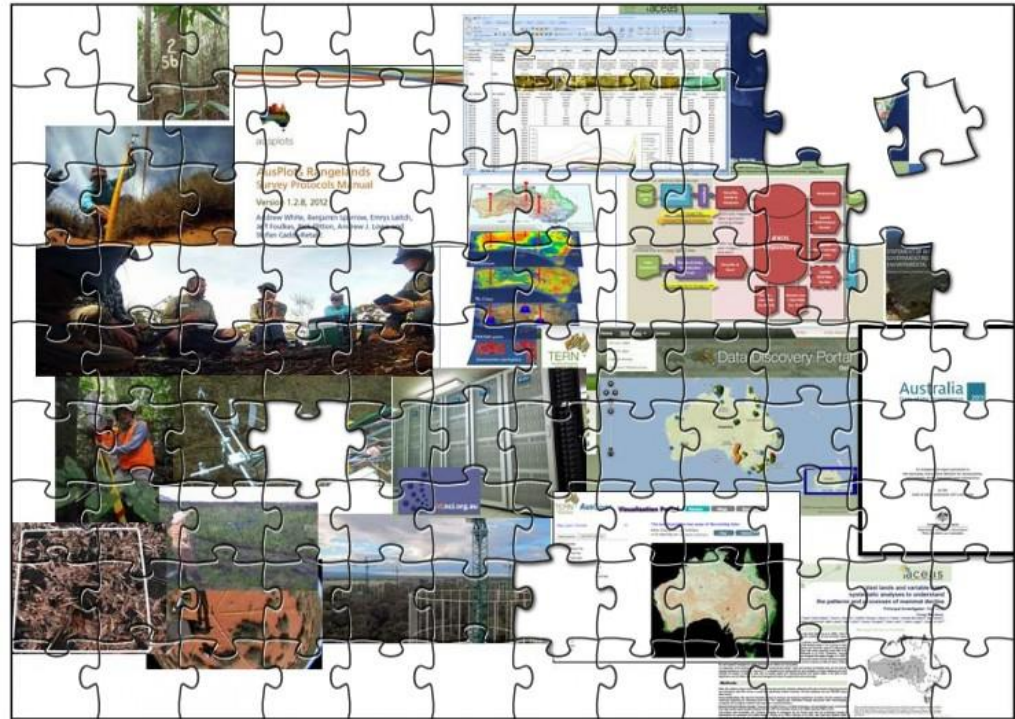
By: Brad Evans with inputs from  
Professors Stuart Phinn and Andrew Lowe  
+ Prof Tim Clancy, Dr Suzanne Long, Dr Bek Christensen, Dr Siddeswara Guru  
+ TERN Facility Directors

# Presentation Aims

**Brief: To give an honest overview of the successes and challenges of the Terrestrial Ecosystem Research Network:**

- **How TERN has enabled a more collaborative, coordinated and efficient approach to ecosystem science in Australia.**
- **How TERN will continue to be built as essential infrastructure.**
- **How TERN has struggled with the challenge of being all for one and one for all.**
- **What has worked, what has not.**
- **Why “Ecosystem Science” needs TERN... Why not?**
- **Where TERN (and the Community) could do better...**

## The Vision



**TERN's Vision** is for an Australian ecosystem science community that has undergone transformational change - from one in which effort is frequently fragmented, duplicative and short-term, to one that is national, networked, and delivering for Australia's future.

A long time ago in a galaxy far,  
far away....



# The Long TERM Plan



## Ecosystem Science Long-Term Plan



birdlife AUSTRALIA

CSIRO

gciQ Global Change Institute

TERN Terrestrial Ecosystem Research Network

ATLAS OF LIVING AUSTRALIA

SOIL SCIENCE AUSTRALIA

IMOS Integrated Marine Observing System

ESA

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

Australian Government Geoscience Australia

International Committee for Zoology, Evolution and Conservation  
Committee of the Australian Academy of Science

WET TROPICS MANAGEMENT AUTHORITY



**TERN provides** “infrastructure” to enable development of a sustainable network of *people* and ecosystem *data collection, discovery* and *sharing* systems for advancing ecosystem science and management in Australia.

**Collection  
Methods**

**Data  
Storage**

**Data  
Sharing**

**Modelling**

**Policy +  
Management**



**Instruments  
+ Sensors**

**Processing  
+ Analysis**

**Data Curation  
+ Publishing**

**Data  
Searching**

**Analysis  
+ Synthesis**



# TERN's Scope: Australian Ecosystem Science Communities

An estimate of the number of “ecosystem” scientists from various sources, 2010-2012 :

- Universities = 1619 FTE
- CSIRO = 1127 FTE
- Government agencies = ????
- NGO's = ????
- Private Companies = ????

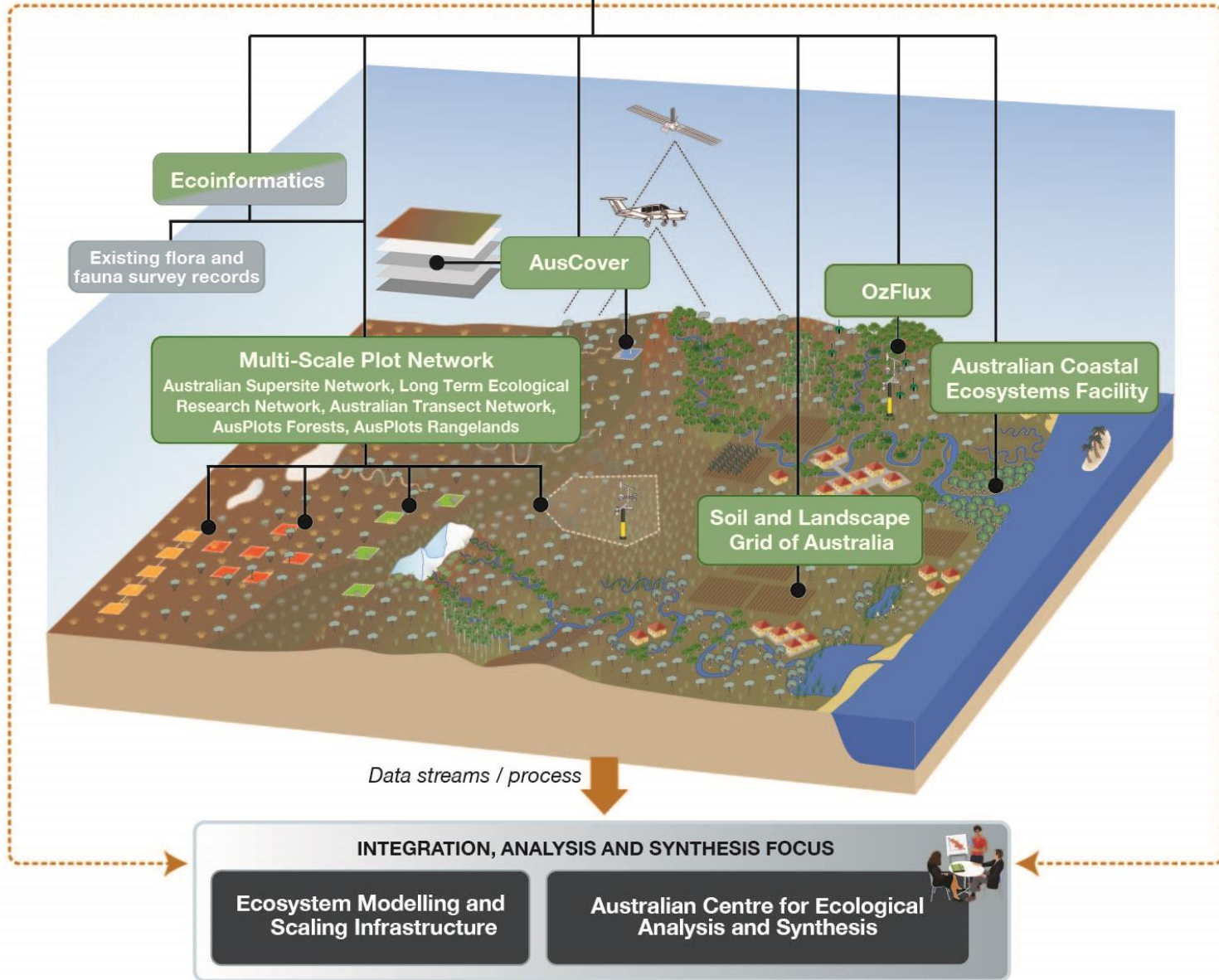
Sources: ERA 2010, CSIRO Internal Records



TERN Data  
Discovery Portal



- Data collection and distribution
- Integration and synthesis





**SOLAR RADIATION**

**ATMOSPHERE**

**BOUNDARY LAYER**

**COASTS**

Species /  
Collections  
*go to ALA*

CO<sub>2</sub>

**SOILS**

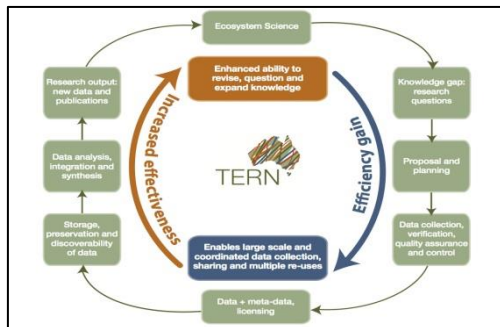
Geology / Geodesy  
*go to AuScope*

Marine  
*go to IMOS*

# • TERN's infrastructure for ecosystem science

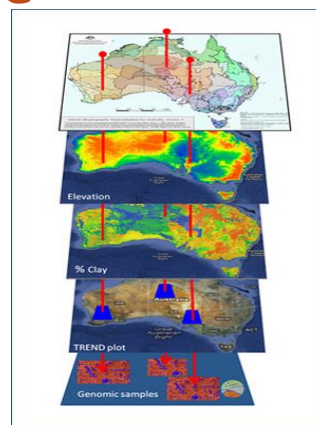


Collection Methods



Data Storage

Data Sharing



Modelling



Policy + Management



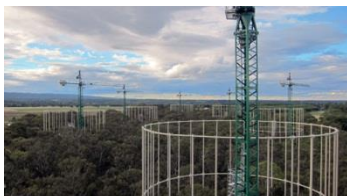
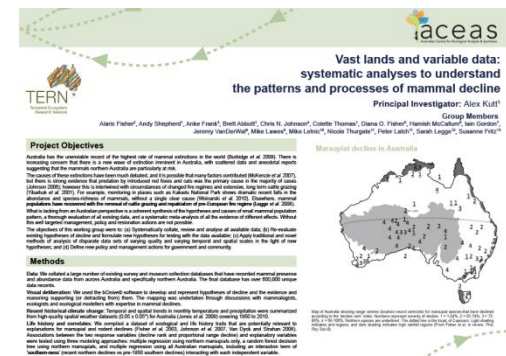
Instruments + Sensors

Processing + Analysis

Data Curation + Publishing

Data Searching

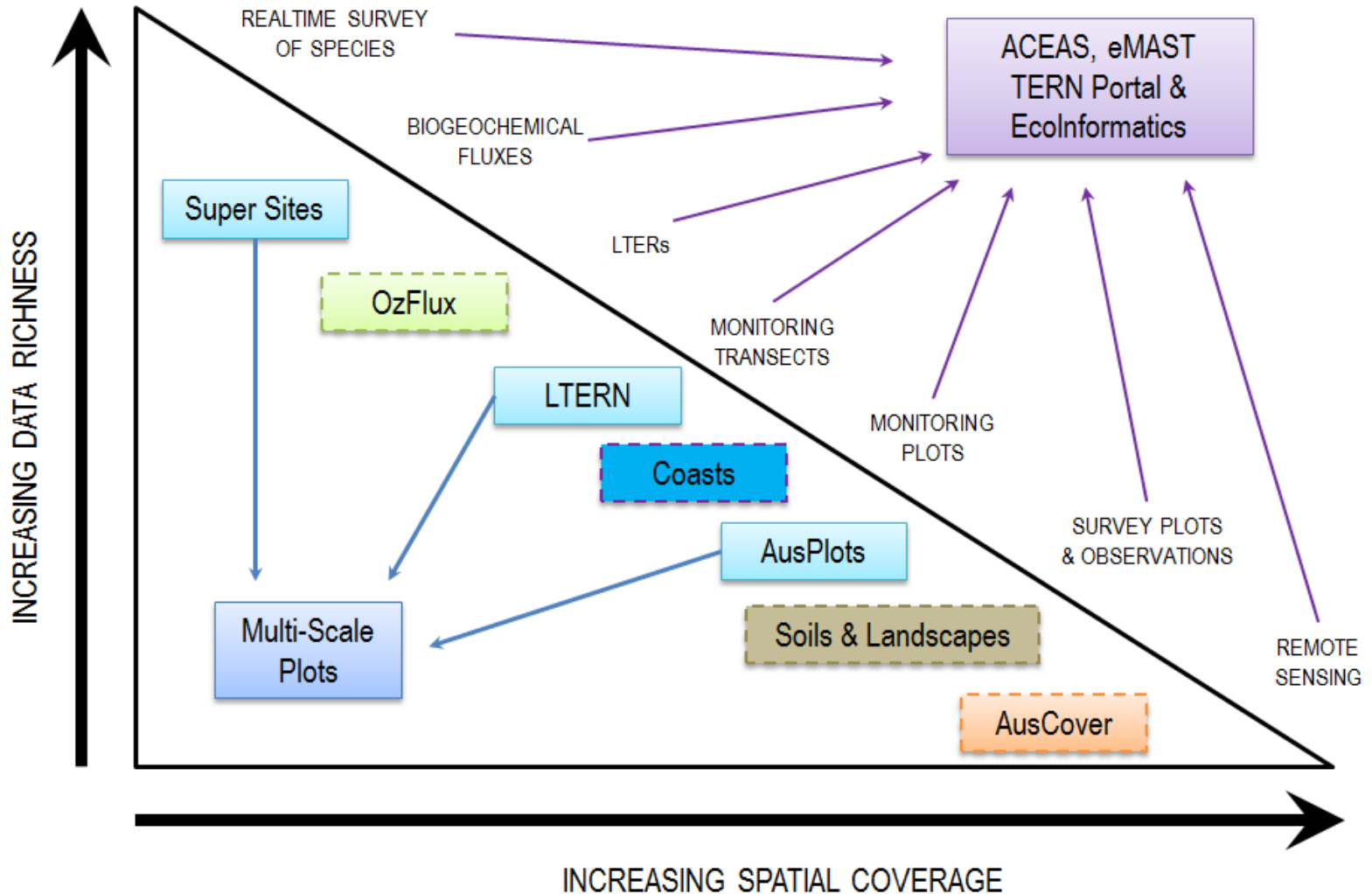
Analysis + Synthesis



# TERN's Driving Questions

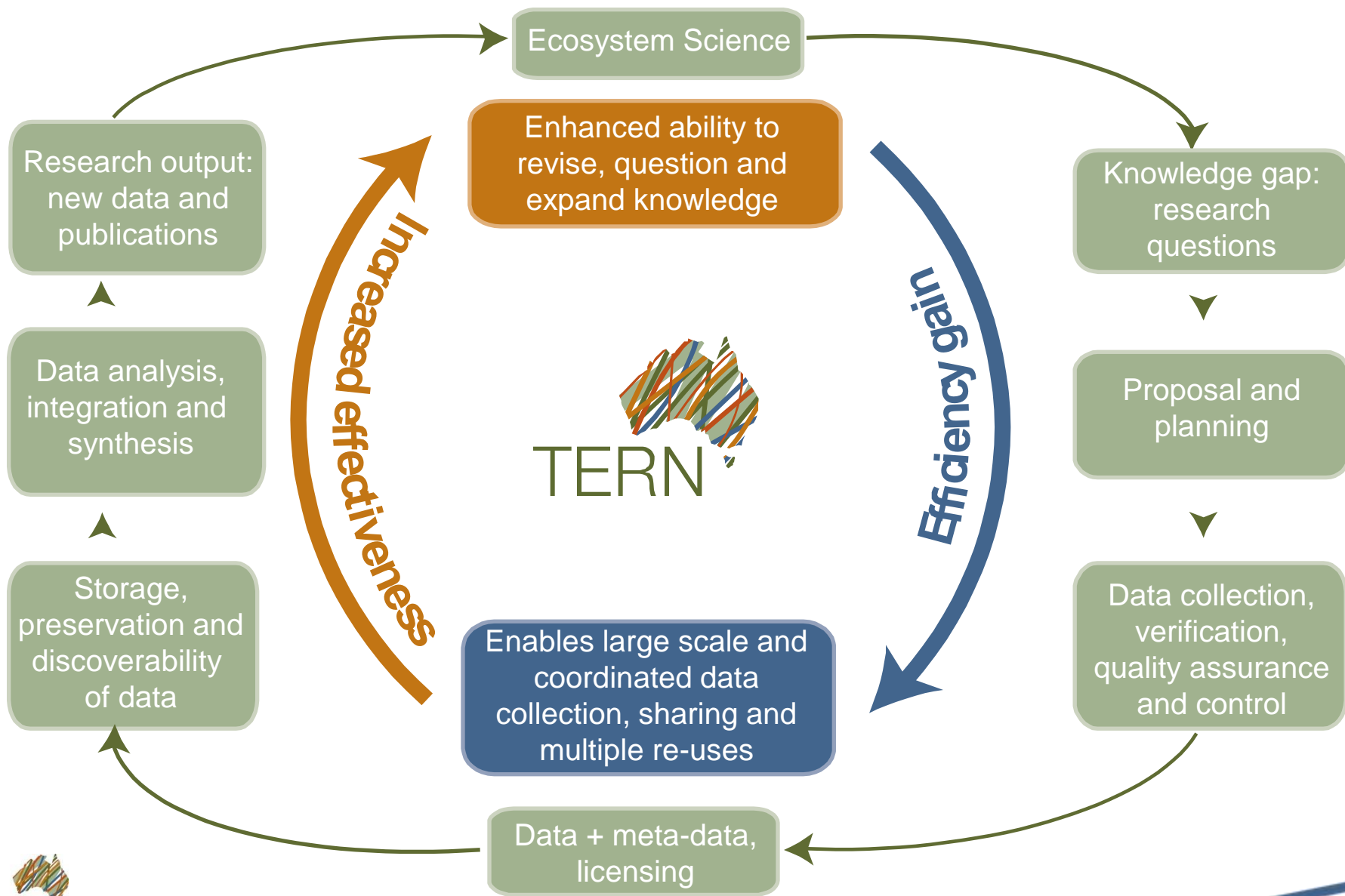
1. How are the **spatial distribution** and **abundance** of key Australian **environmental assets** changing?
2. How are **ecosystems and ecosystem processes** changing, and what are the key processes driving change?
3. How are **introduced plant and animal species** affecting native ecosystems?
4. How can we **better monitor ecosystems**?
5. How can we **better manage ecosystems**?
6. What is the **impact of management interventions** on Australian ecosystems and ecosystem processes?
7. How can we get **maximum value out of hard-won ecosystem science data by sharing** it more efficiently and effectively?

- **TERN's infrastructure for ecosystem science**





- **Ecosystem science research cycle(s)**



- **Data Citation**

# Building a Culture of Data Citation

## CREATE

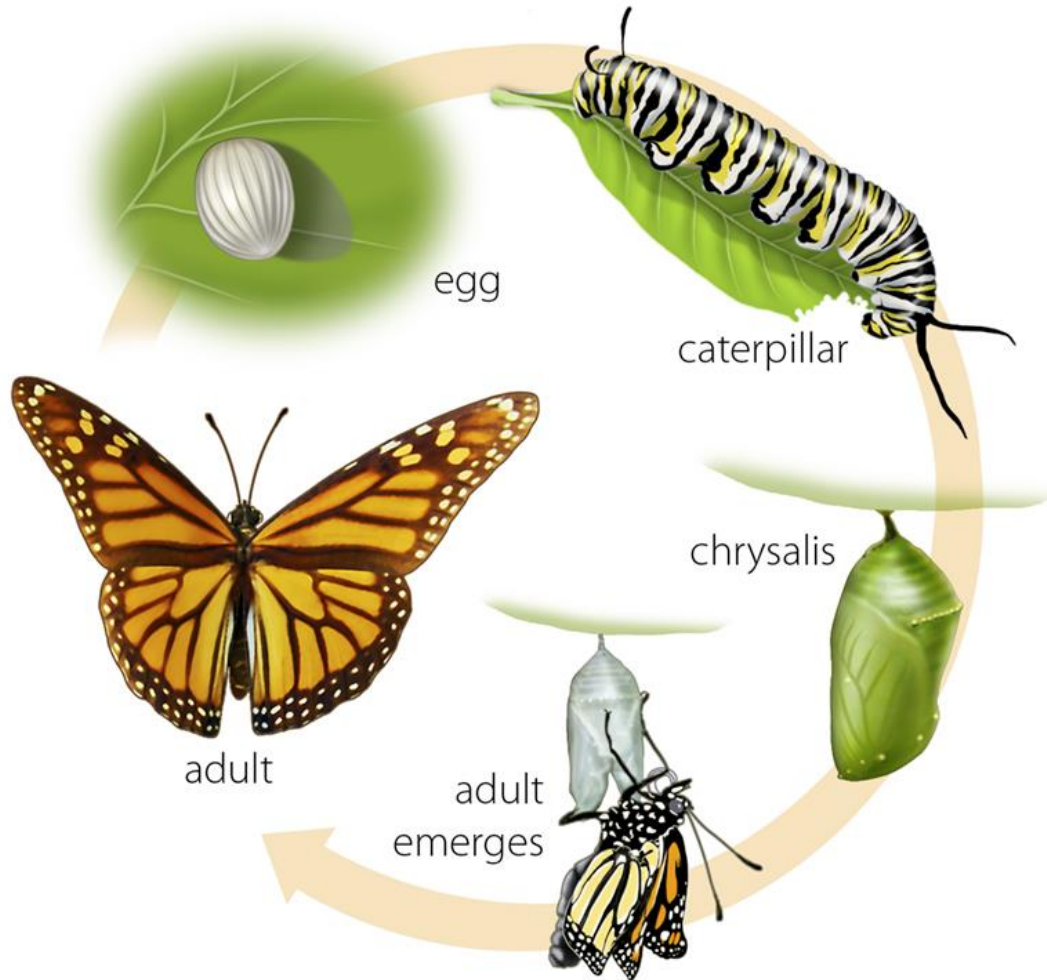
Australian researcher creates a research dataset and a publication related to the dataset



Dataset is stored in a publicly accessible repository



# TERN's impact on the ecosystem science research cycle...

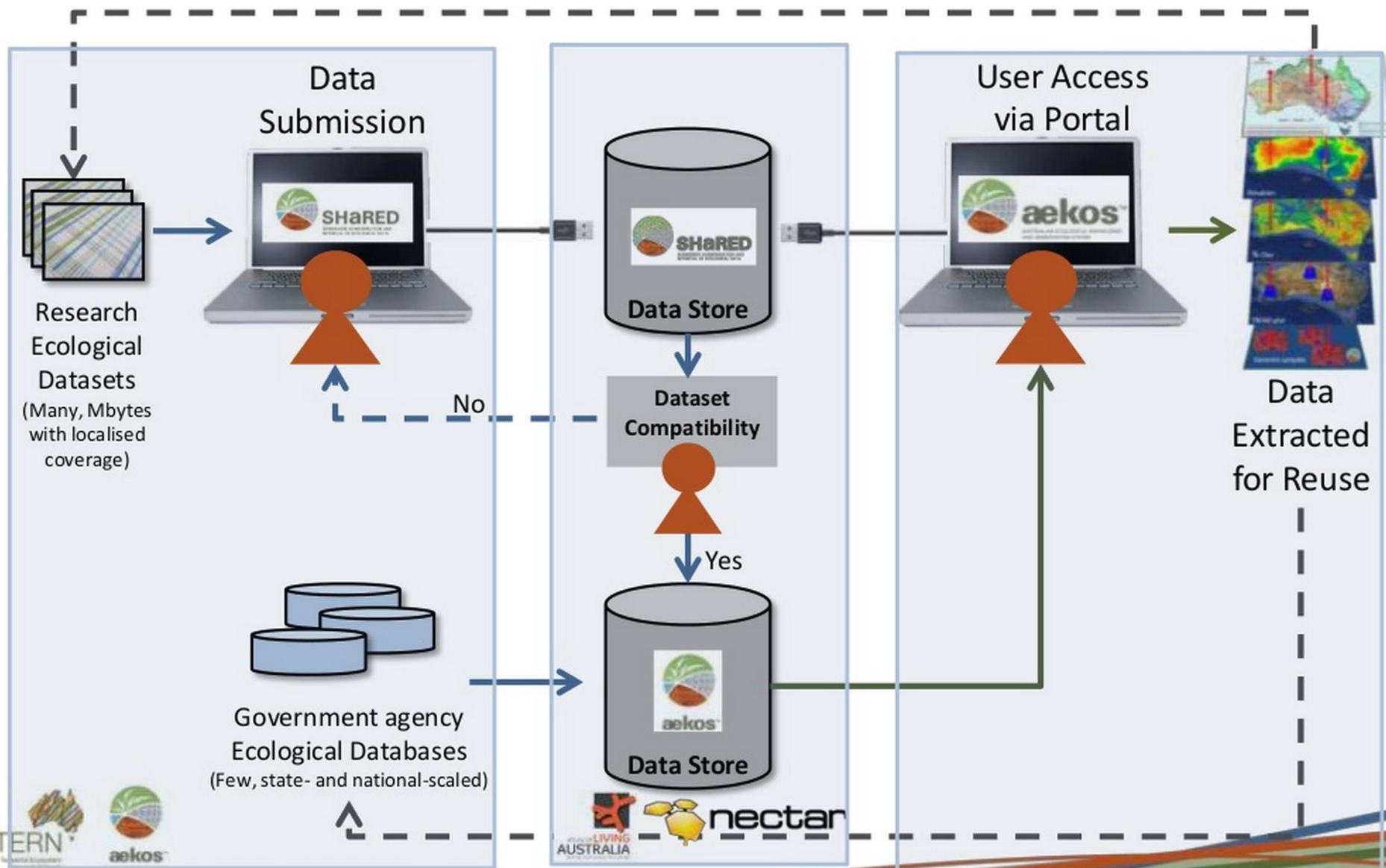


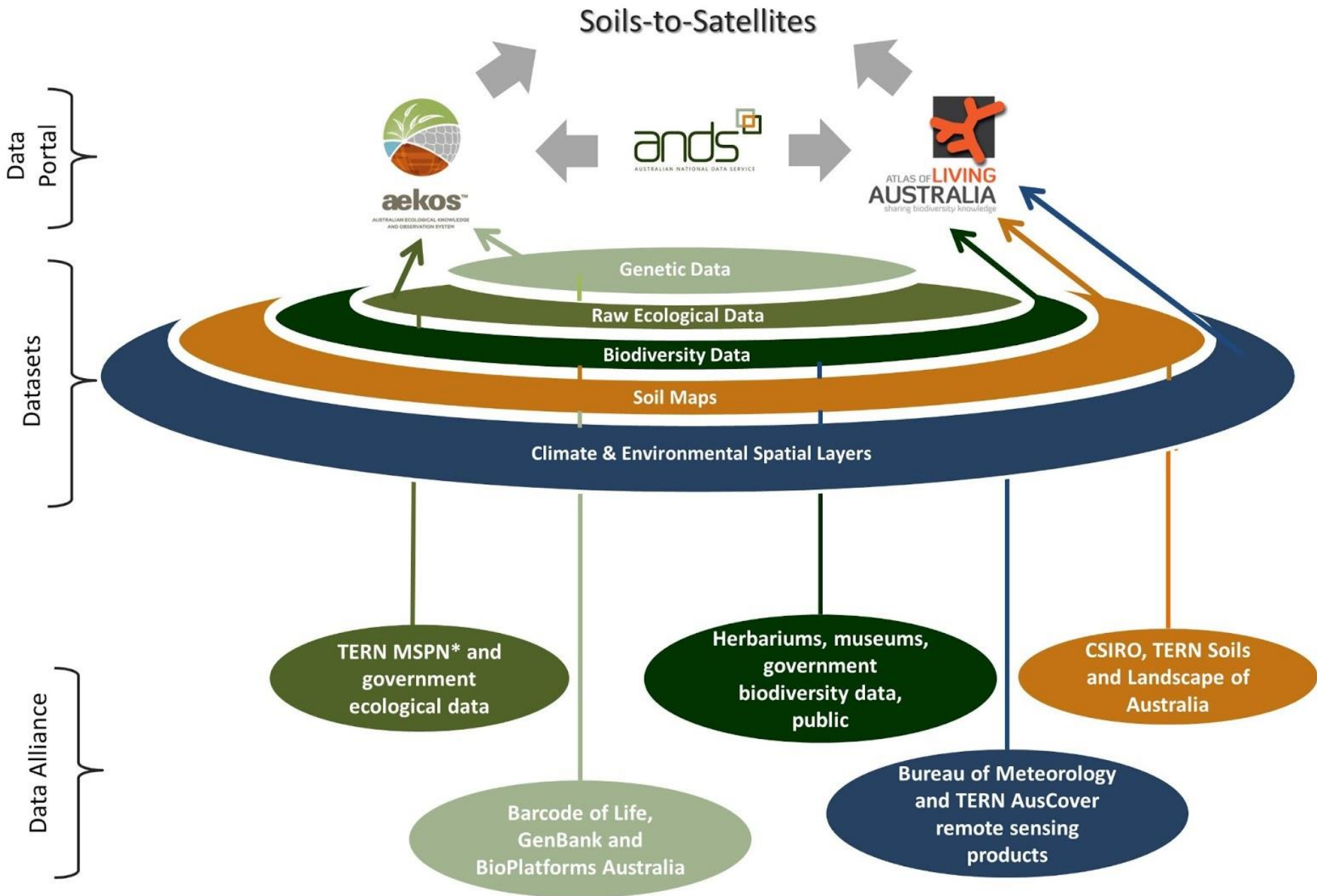
## **TERN infrastructure and processes provide:**

- **Surety of data storage and archiving;**
- **Nationally and internationally accepted data licensing standards;**
- **Data publishing as a viable research output;**
- **Data citation as a measure of research impact;**
- **Data to be verified and checked independently;**
- **Multiple returns on an initial investment when data are re-used;**
- **Data collection methods to be shared, reviewed and replicated;**
- **Nationally accepted data storage, meta-data and licensing resource;**

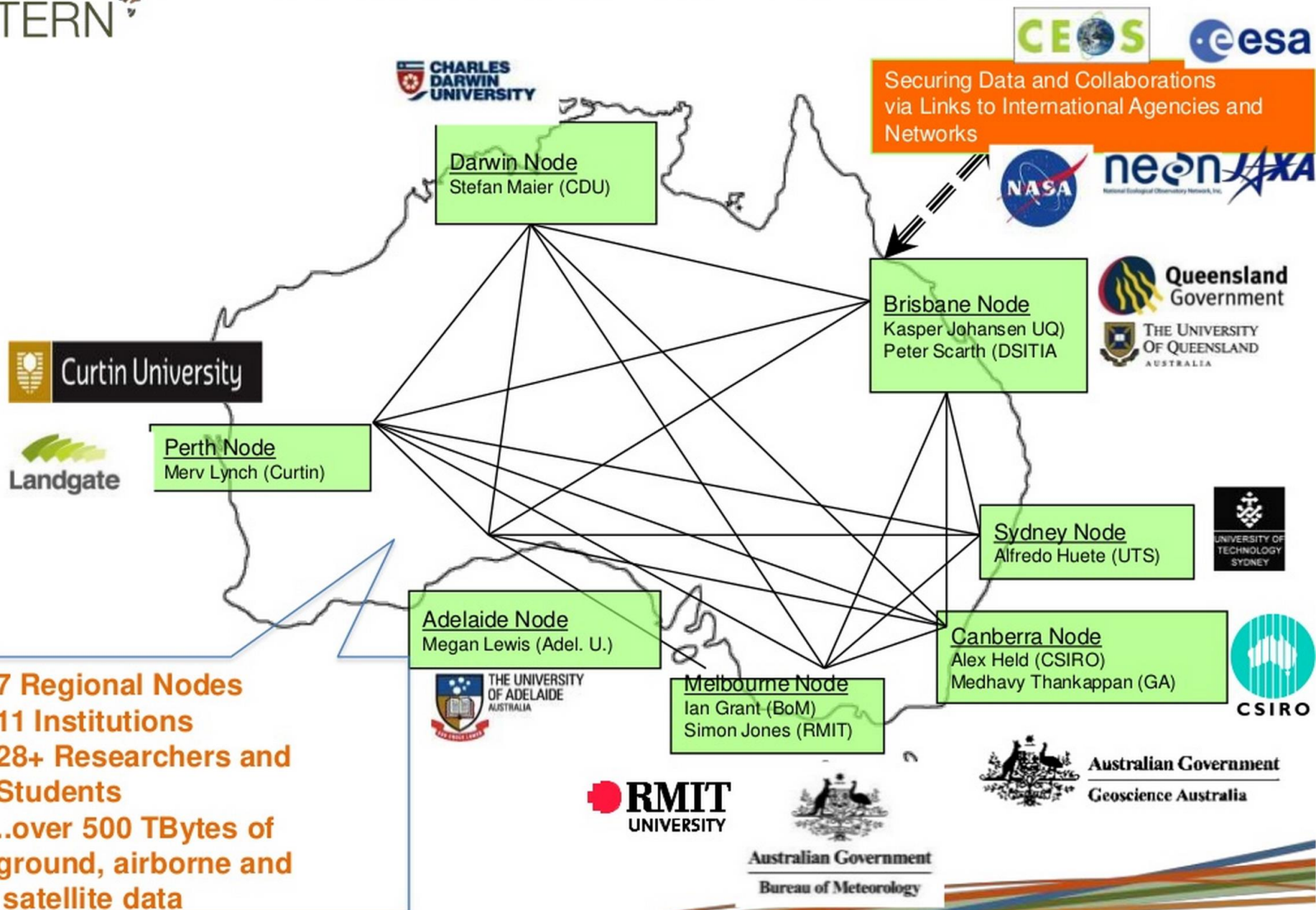


# Eco-informatics Cyberinfrastructure





# The AusCover Team & Network





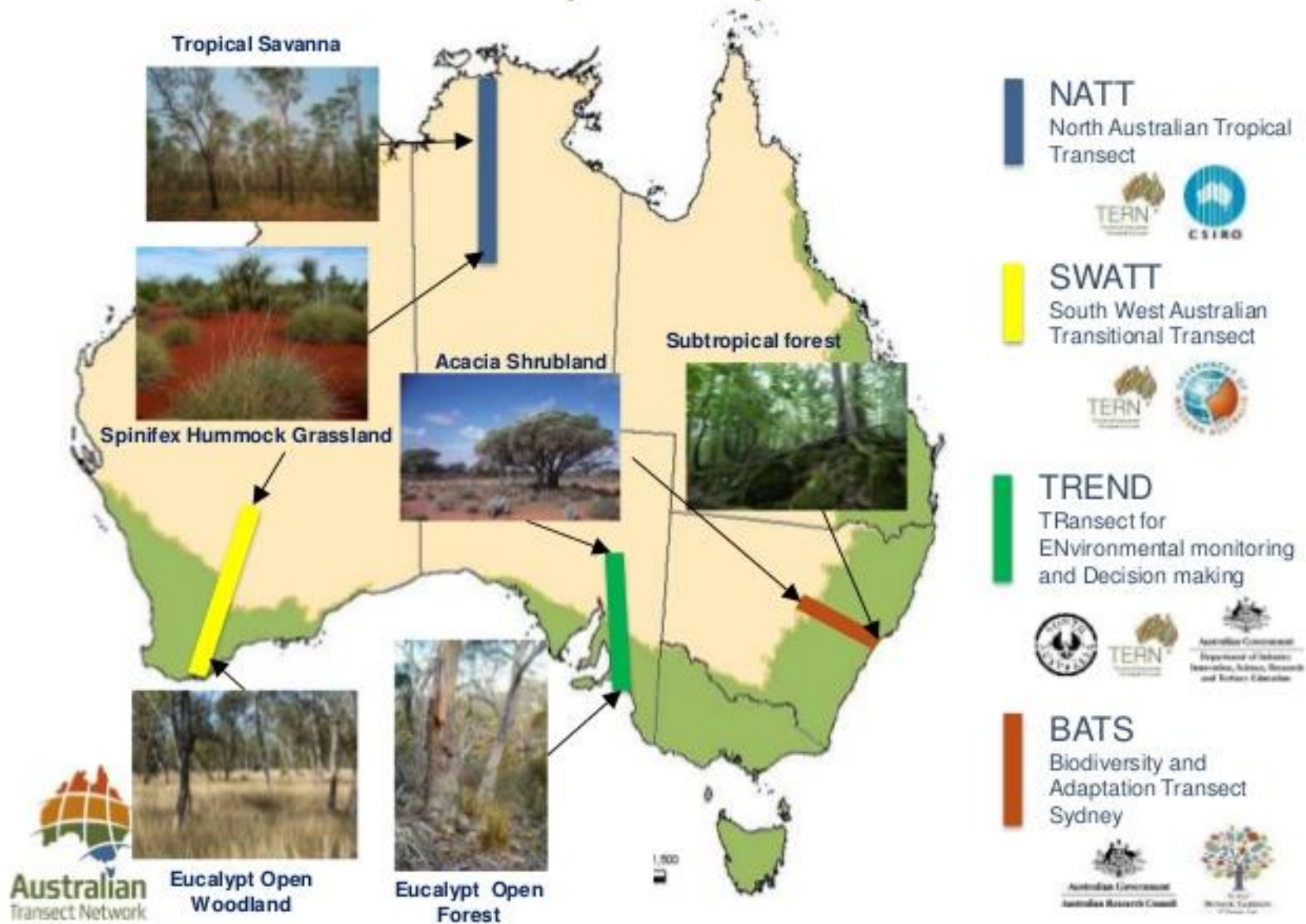
# Field Team Activities

Selected photos source © Charles Tambiah and members of the AusCover team



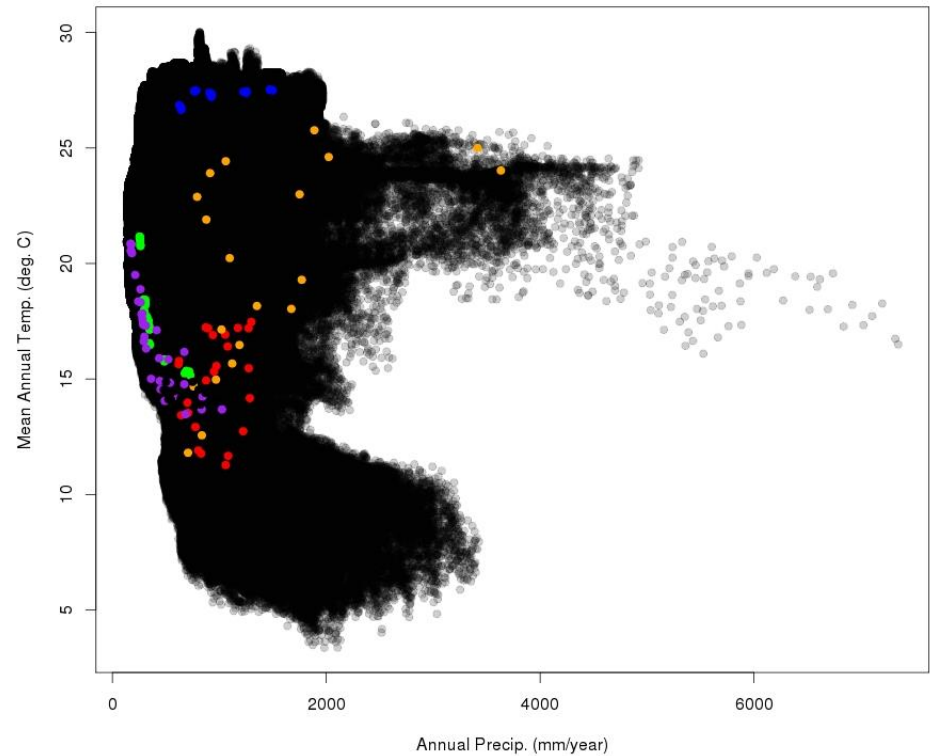
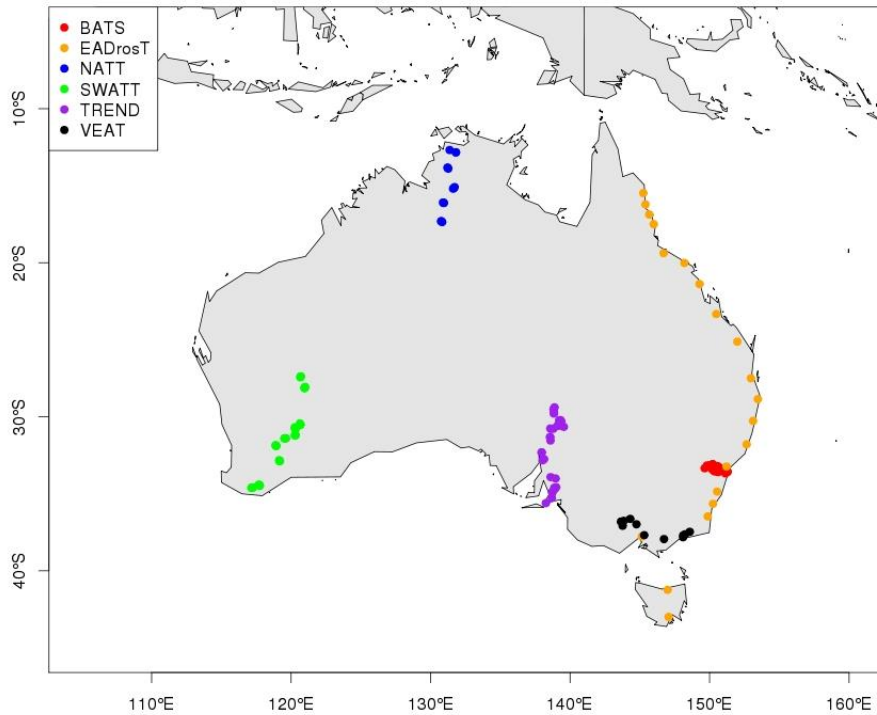


# ATN – Four primary transects





# Australian Transect Network

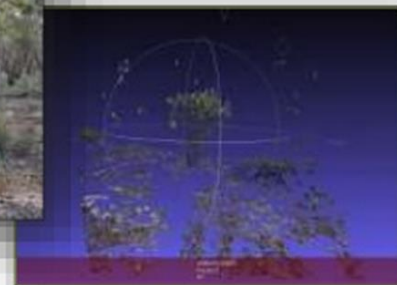


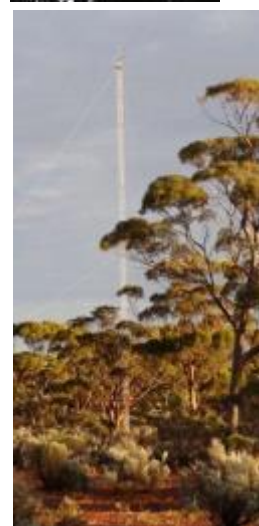
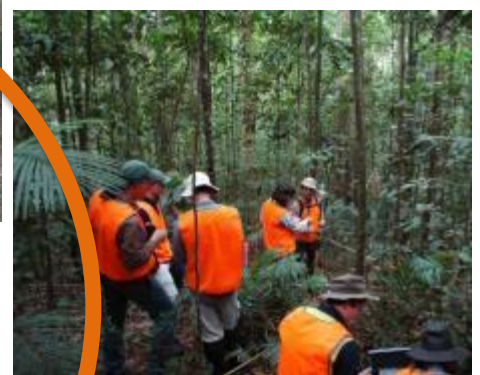


# citizen science



Connecting the public to research is a TREND priority.  
This should be a two-way dialogue.





OzFlux

AusCover  
Remote Sensing  
Data Facility

Australian  
SuperSiteNetwork

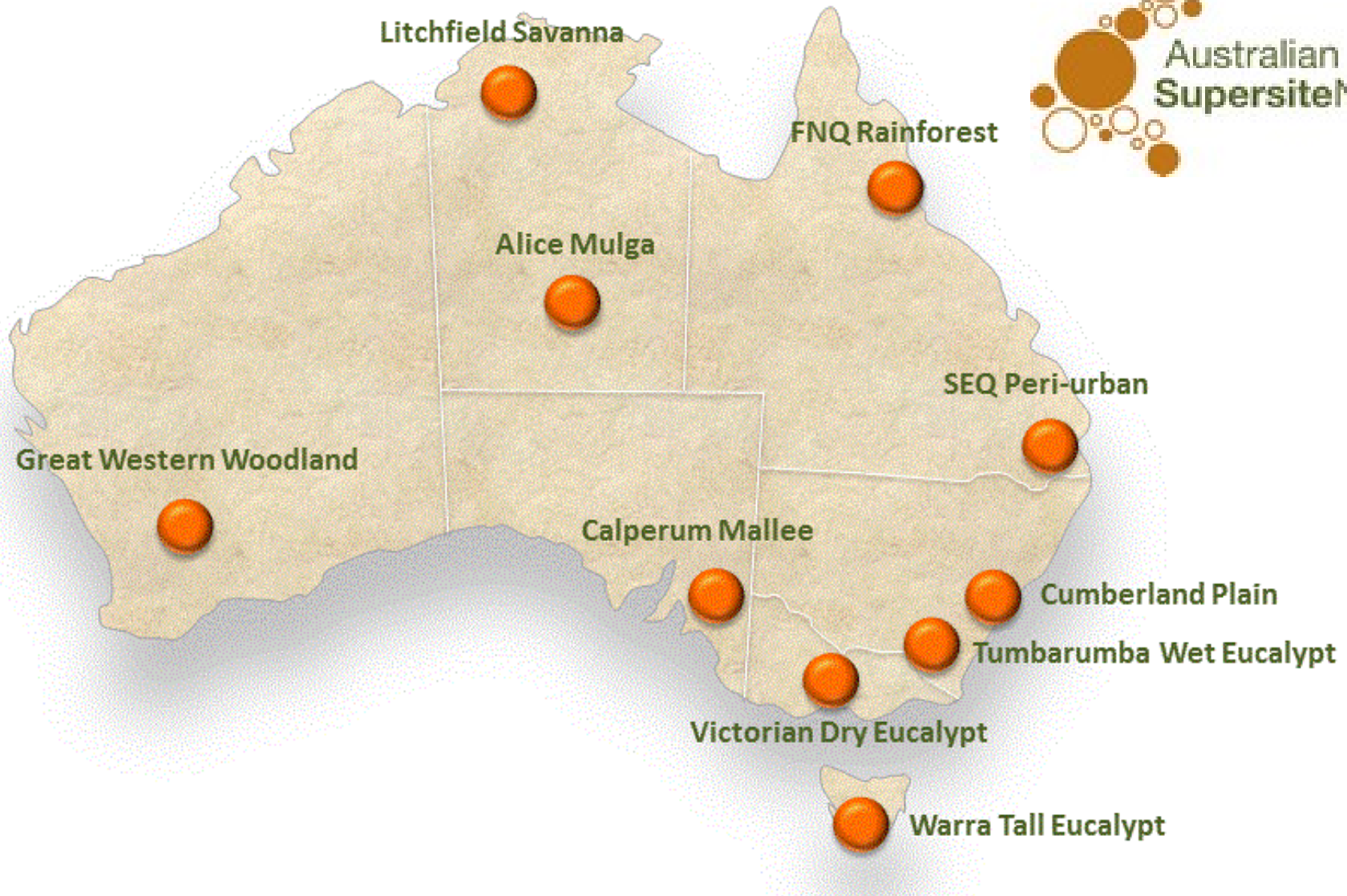
eMAST  
ecosystem Modelling  
and Scaling Infrastructure



ausplots







**Vegetation**

Composition  
Structure  
Cover

**Fauna survey records**

**Soil properties**

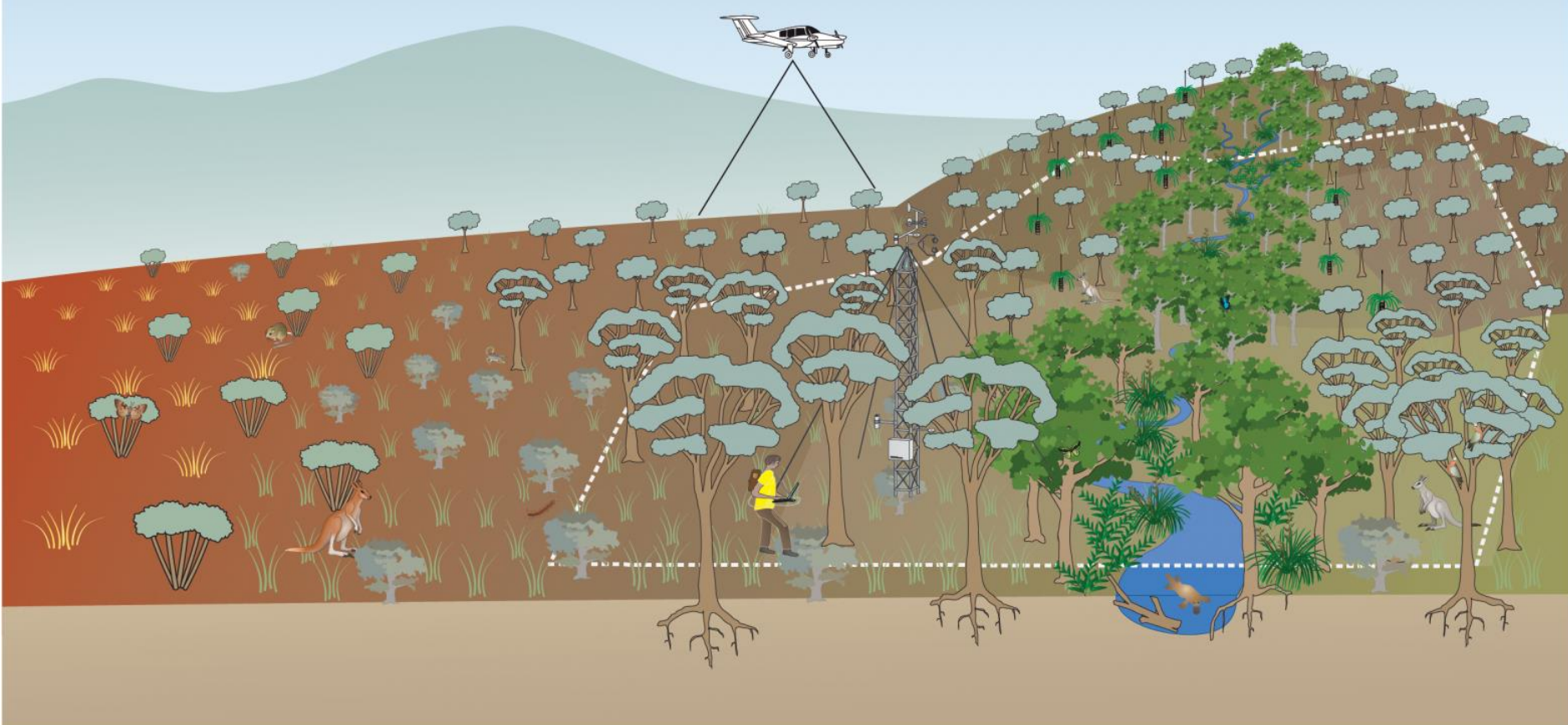
**CO<sub>2</sub> concentration and flux**

**Meteorology**

Wind  
Precipitation  
Temperature  
Solar radiation

**Water**

Surface  
Ground  
Soil





# TERN – OzFlux Achievements

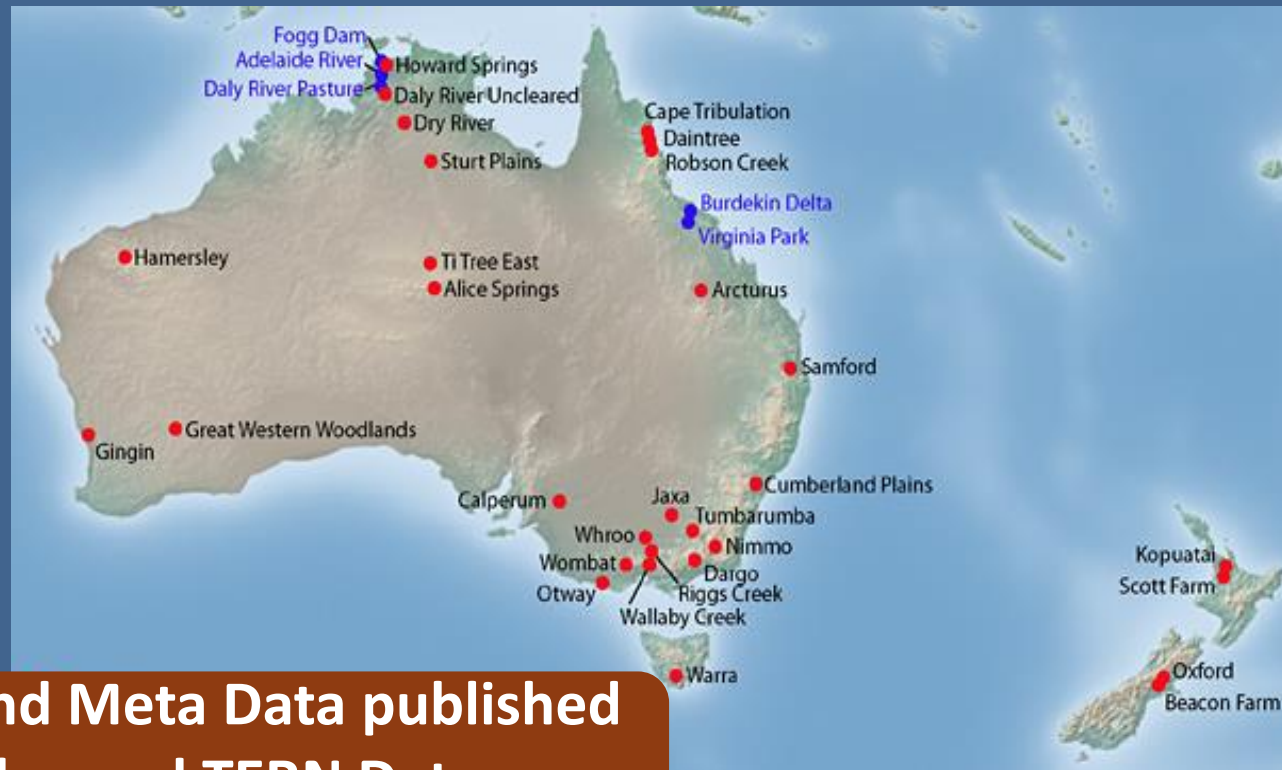
Sites 35

TERN-funded 12

Data on ODP 30

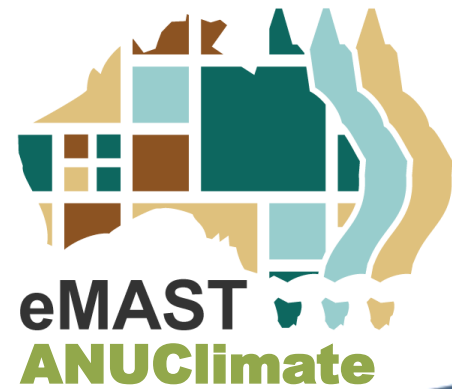
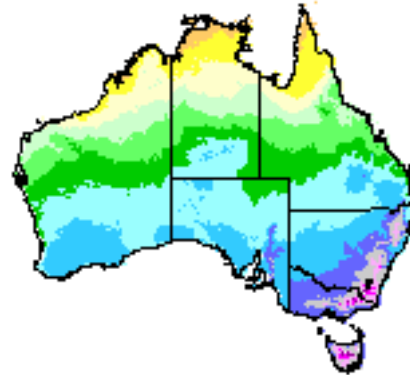
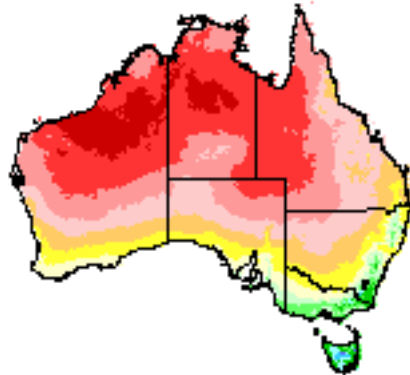
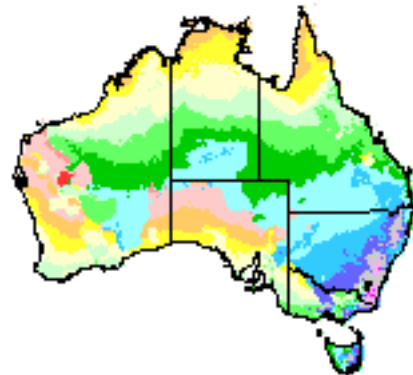
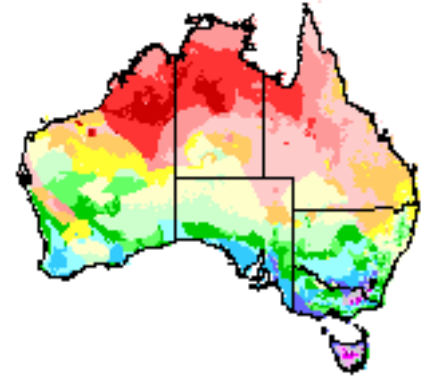
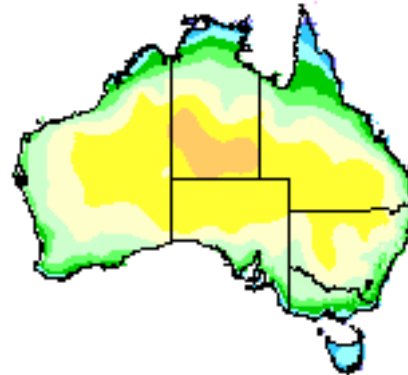
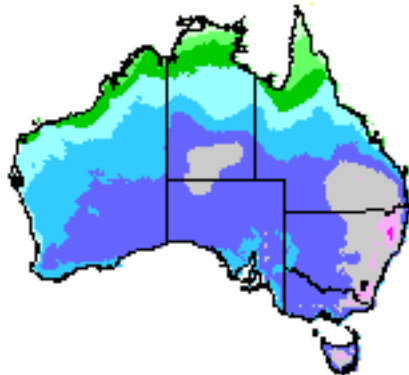
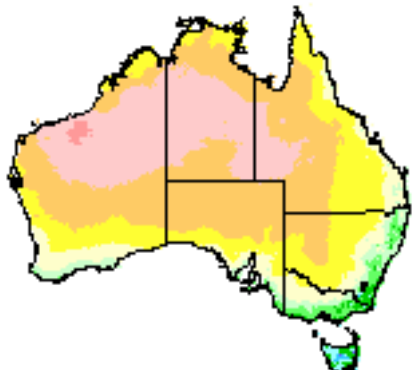
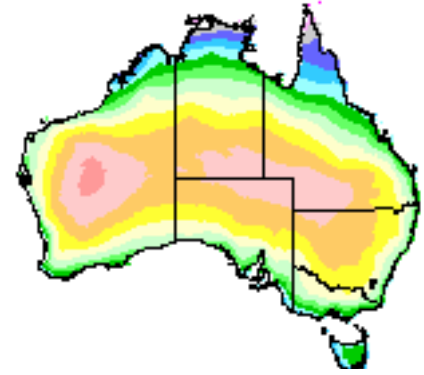
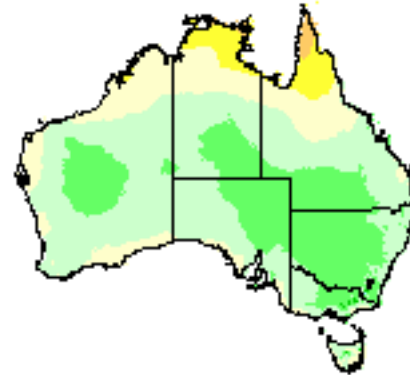
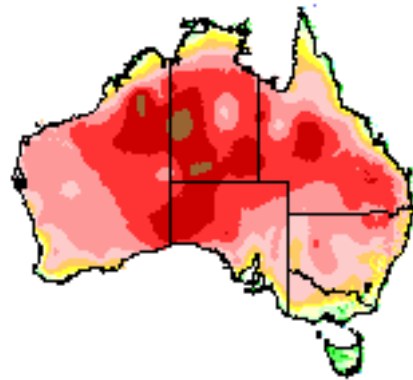
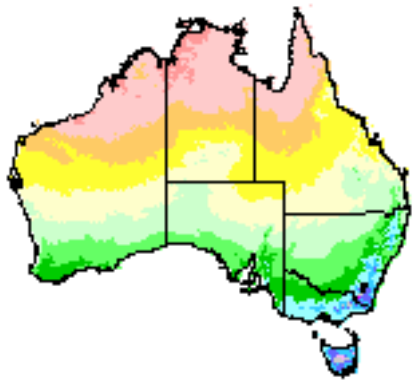
Site-Years 63

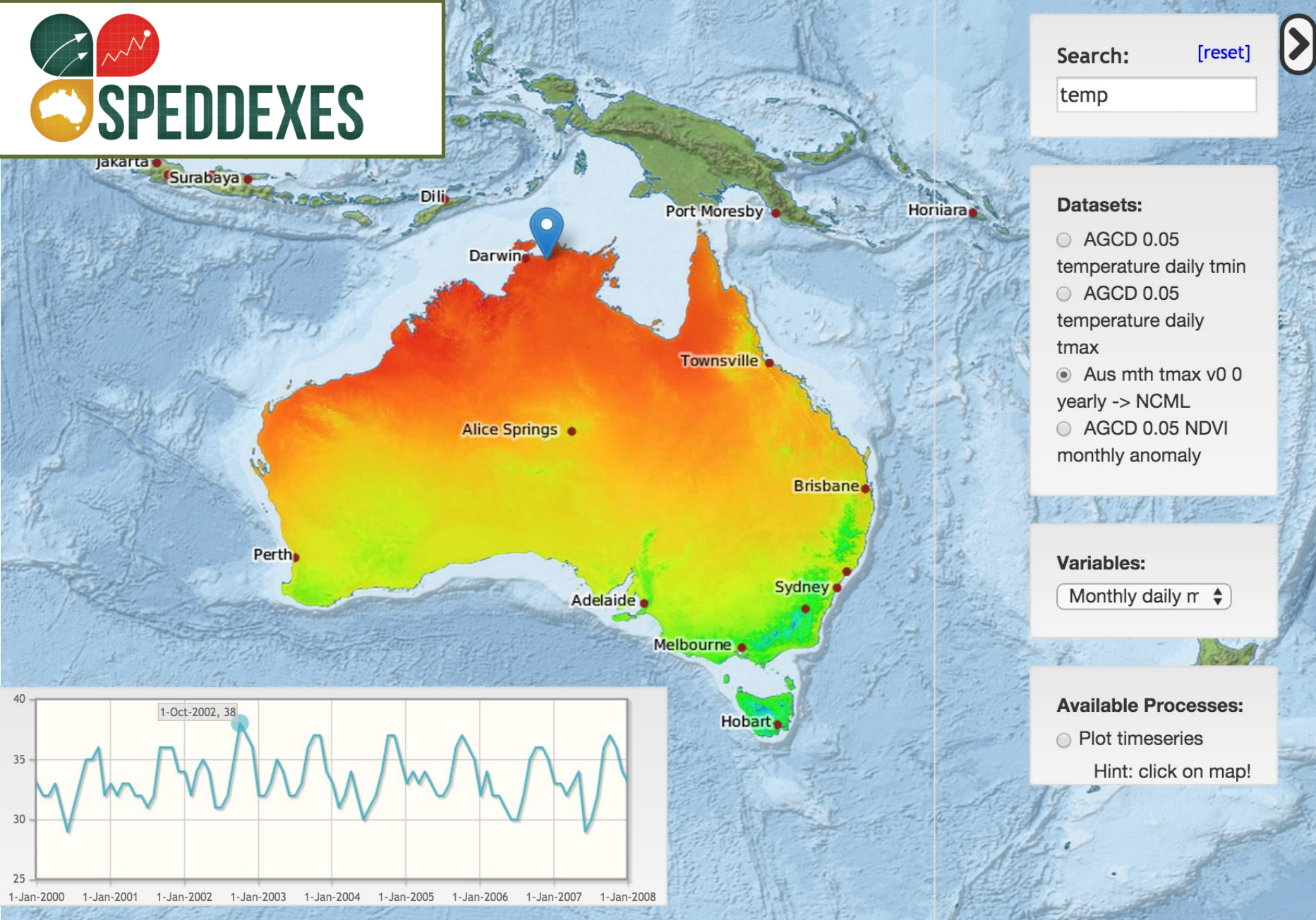
People ~60



Data and Meta Data published on OzFlux and TERN Data Portals  
THREDDS server installed on OzFlux Data Portal (ODP)







Search: [reset]

temp



Datasets:

- AGCD 0.05 temperature daily tmin
- AGCD 0.05 temperature daily tmax
- Aus mth tmax v0 0 yearly -> NCML
- AGCD 0.05 NDVI monthly anomaly

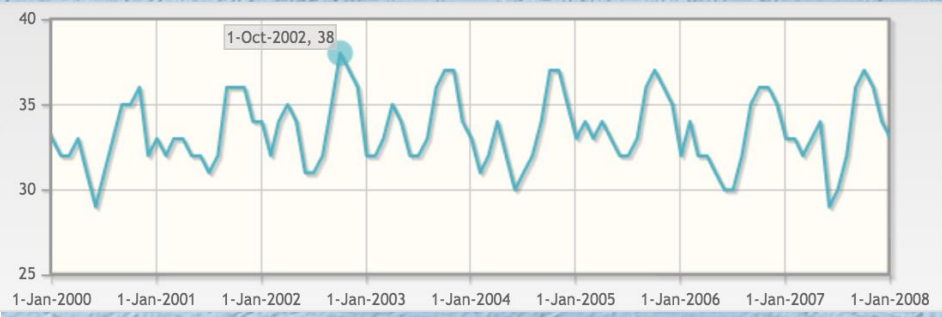
Variables:

Monthly daily rr

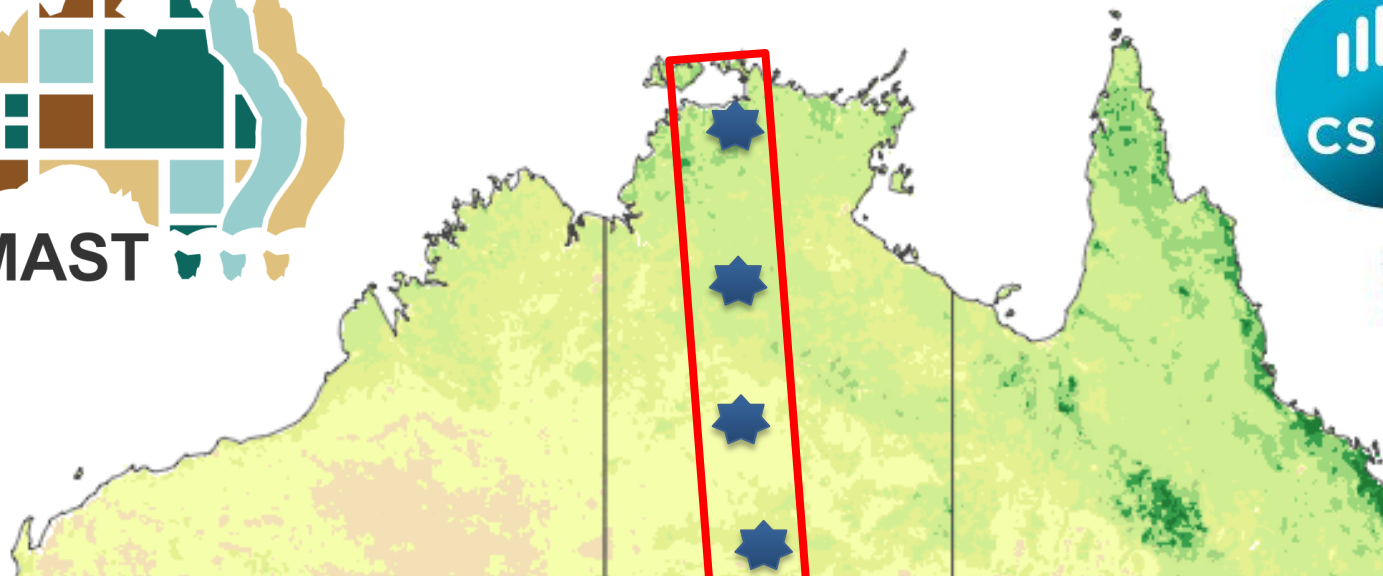
Available Processes:

- Plot timeseries

Hint: click on map!







ENVIRONMENTAL RESEARCH LETTERS  
UNCORRECTED PROOF

**Impacts of an extreme cyclone event on landscape-scale savanna fire, and greenhouse gas emission**

J. B. Hutley<sup>1</sup>, B. J. Evans<sup>2</sup>, J. Beringer<sup>3,4</sup>, G. D. Cook<sup>5</sup>, S. M. Maier<sup>1</sup> and ...

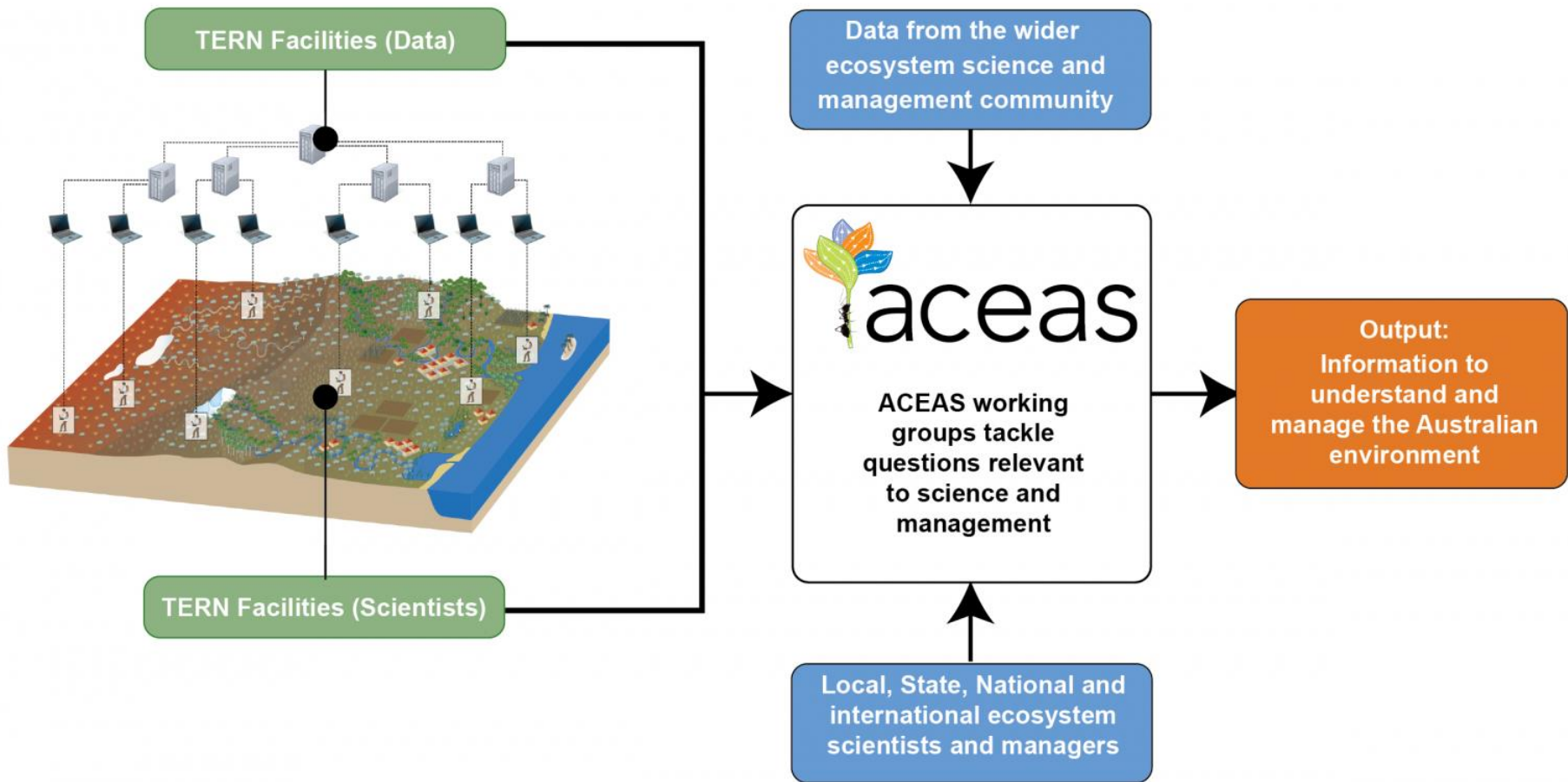
Received Date : 19-Dec-2013  
Revised Date : 16-Apr-2014  
Accepted Date : 08-Jun-2014  
Article type : Research Review

**Global Change Biology**

Fire in Australian Savannas: from leaf to landscape

title: "Fire in Australian Savannas"

...id Abramson<sup>1</sup>, Stefan K. Arndt<sup>4</sup>, Peter B ...  
...k Eamus<sup>7</sup>, Bradley J. ...





# ACEAS: Top achievement?

– helping our community deliver

**23** Final reports published

**4** ARCs stemming from ACEAS activity



**65** Analysis and synthesis activities



**698** Downloads of the most popular ACEAS final report 'Conserving koalas in the 21<sup>st</sup> century' in 2013



**79,484**

Unique visitors to the ACEAS website since 2012



**730** participants

**225** organisations

**2** ACEAS groups provided advice directly to government



**8** data product visualisations published on the Data Portal



**132**

Facebook page likes



**>29** Conference presentations, including 1 keynote address

**3** Apps

**115** mammal visualisations

**3** independent web sites

**16+** Refereed journal articles  
**2+** special editions



**478**

Twitter followers

**8,235**



views







ausplots







ausplots





# BIODIVERSITY AND ENVIRONMENTAL CHANGE

Monitoring, Challenges and Direction

Editors: David Lindenmayer, Emma Burns,  
Nicole Thurgate and Andrew Lowe

# POLICY HANDBOOK

Learning from Long-term Research  
to Better Manage Biodiversity in Australia

Emma Burns and David Lindenmayer



LTERN  
Long Term Ecological  
Research Network



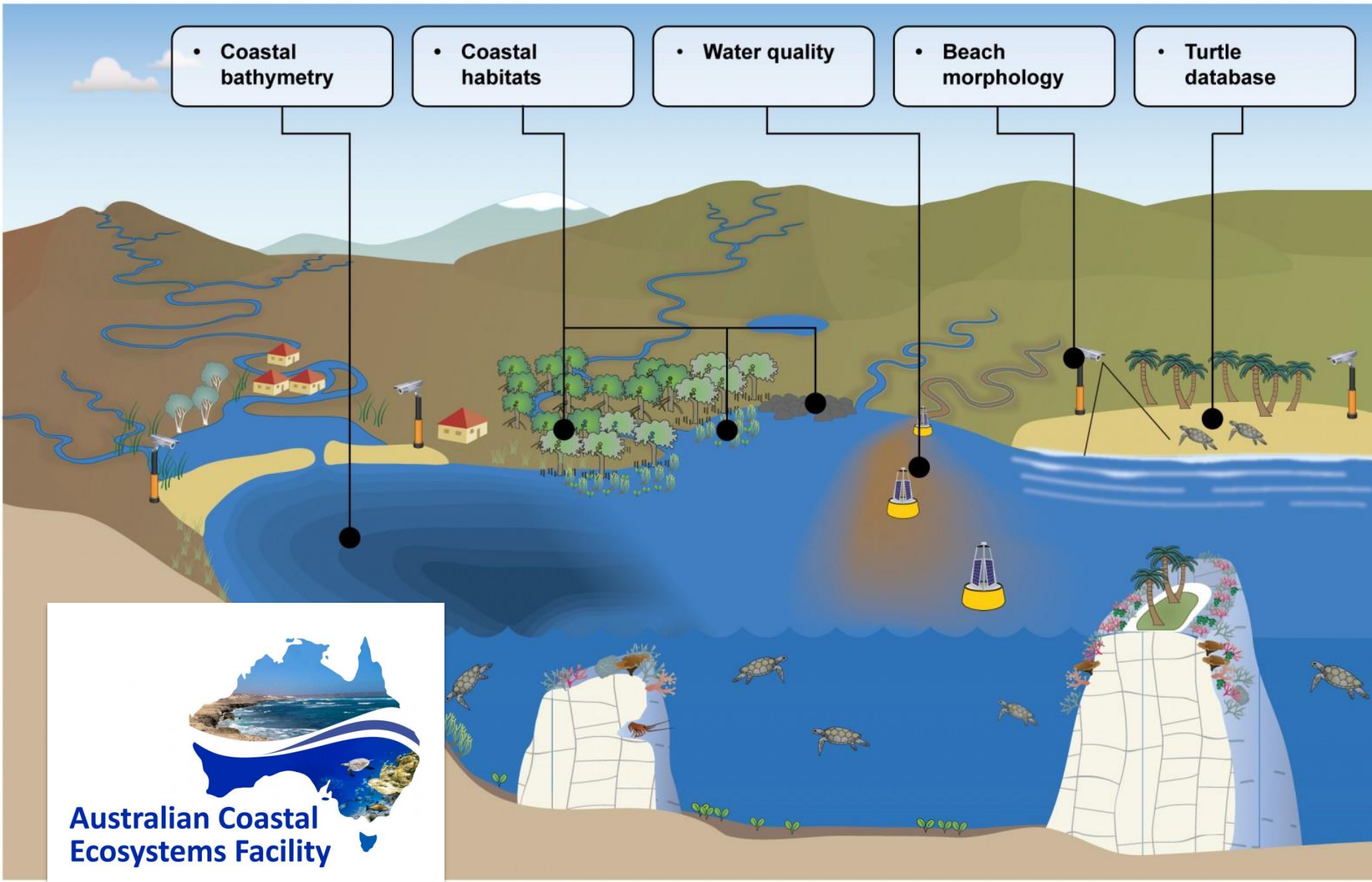
- Coastal bathymetry

- Coastal habitats

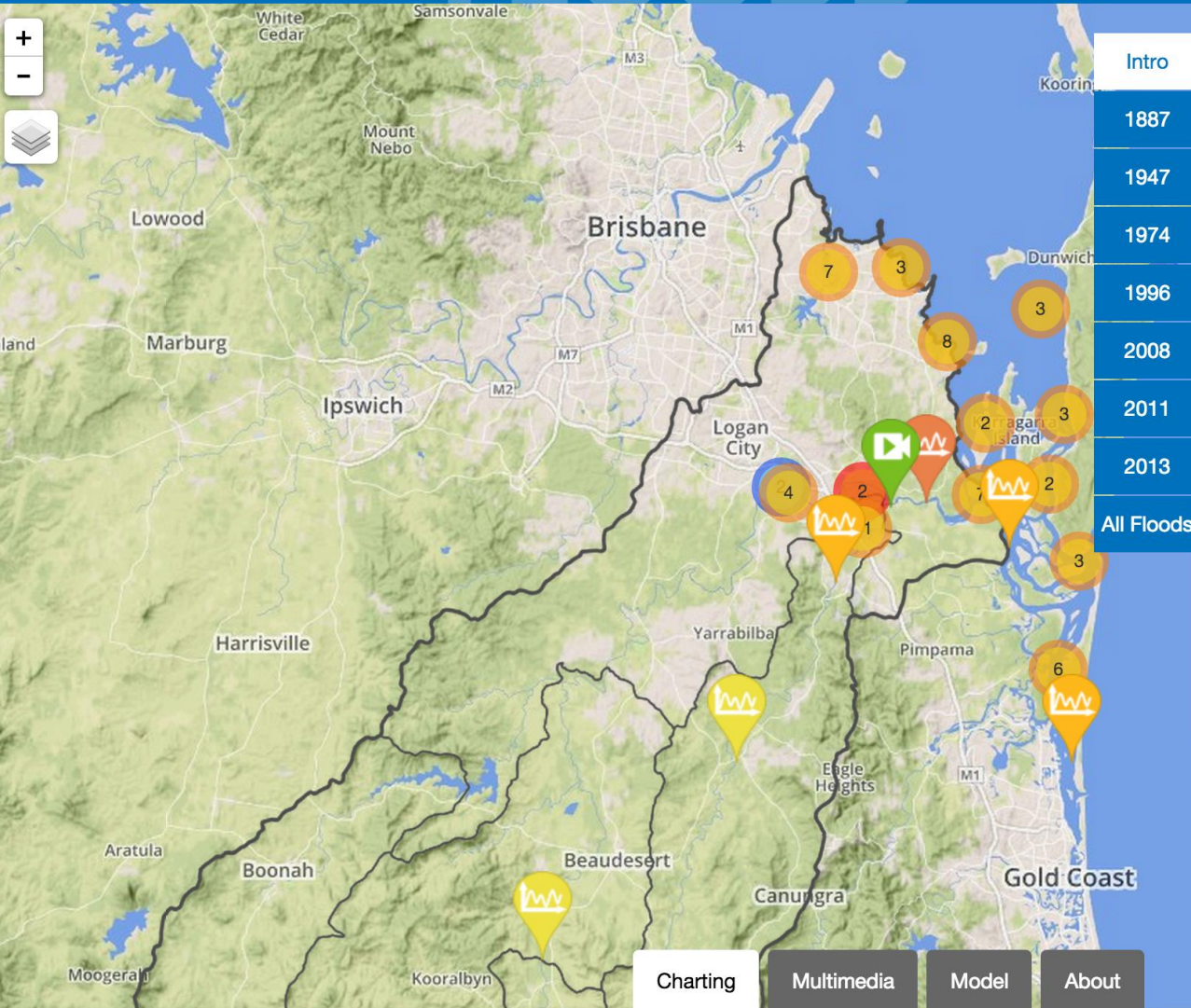
- Water quality

- Beach morphology

- Turtle database



# FLOODS in the Logan River



## Intro

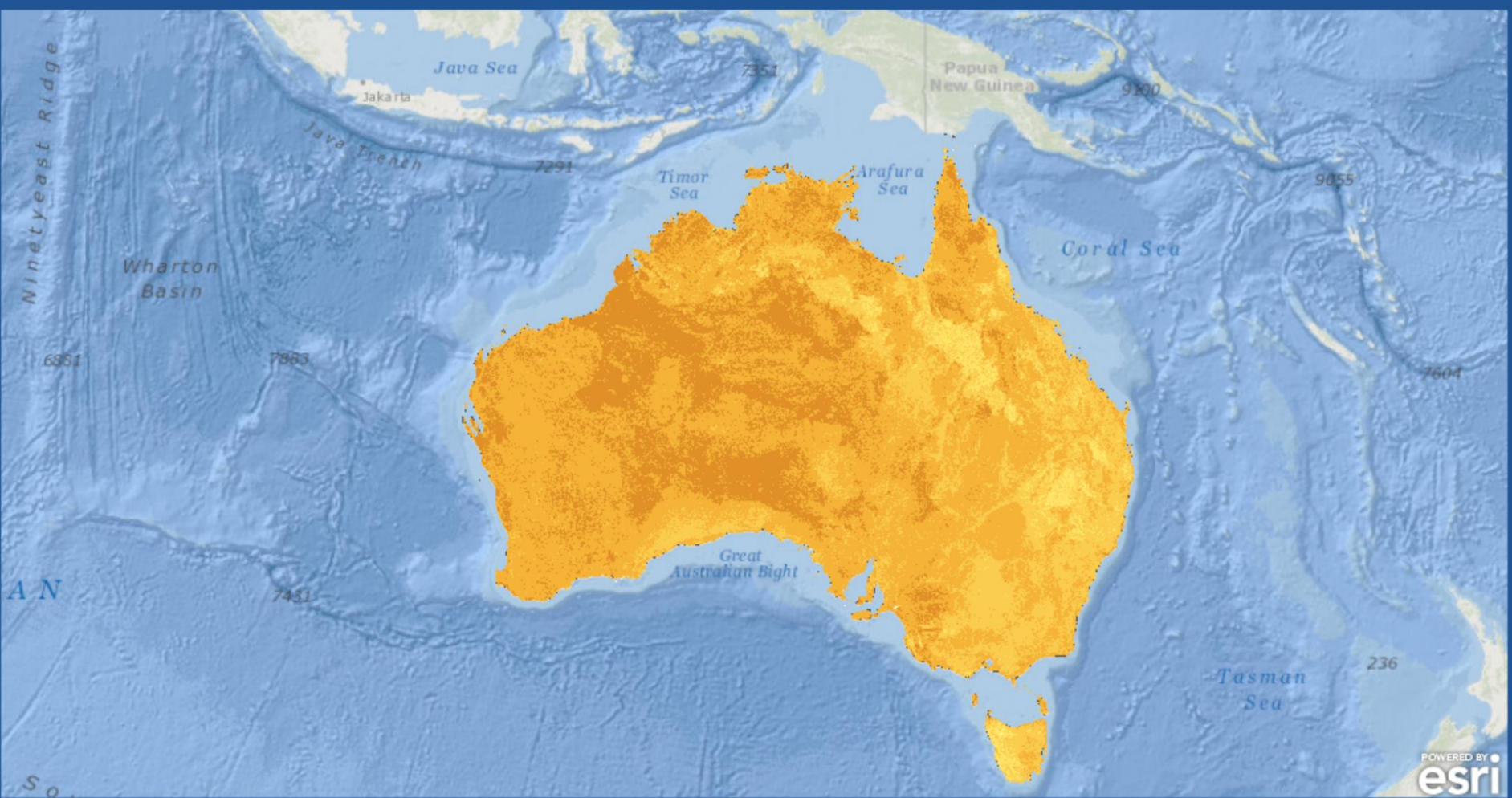
### Floods in the Logan

Recent floods in South-east Queensland have had major impacts on infrastructure, residents and the environment.

This site tells the story of recent and historical flooding in the Logan River catchment using maps, photos, videos and data.







Delivering open access to Australia's terrestrial ecosystem data



Map Based Search

Use our map interface to search for data

Showing 10 of 1,495 results

Display  results

Sort By:

## Datasets Included



### Facilities ▾

- Australian Ecological Knowledge and Observation System (1,145)
- Australian Supersite Network (160)
- Ecosystem Modelling and Scaling Infrastructure (eMAST) Facility (51)
- ACEAS (36)
- Auscover (23)
- LTERN (23)
- OzFlux: Australian and New Zealand Flux Research and Monitoring (23)
- Australian Coastal Ecosystems Facility, TERN (20)
- Soils (13)



## TERN DOI Service

[Home](#) [About](#) [Login](#)

### Welcome to TERN DOI Service

Please login to use the DOI service

### Field of Research ▾

- Earth Sciences (98)
- Biological Sciences (77)
- Environmental Sciences (74)
- Agricultural And Veterinary Sciences (13)



# Key Metrics : 2014

- **1494 data sets** ~ 100,000,000 data items
- **Metadata from all Facilities discoverable** and delivered through the TDDP
- **7 international partnerships**
- **Long-term plan for Ecosystem Science**
- **Over 400 peer reviewed publications**

## LETTER

doi:10.1038/nature11836

### **Ecosystem resilience despite large-scale altered hydroclimatic conditions**

Guillermo E. Ponce Campos<sup>1,2</sup>, M. Susan Moran<sup>1</sup>, Alfredo Huete<sup>3</sup>, Yongguang Zhang<sup>1</sup>, Cynthia Bresloff<sup>2</sup>, Travis E. Huxman<sup>4</sup>, Derek Eamus<sup>3</sup>, David D. Bosch<sup>5</sup>, Anthony R. Buda<sup>6</sup>, Stacey A. Gunter<sup>7</sup>, Tamara Heartsill Scalley<sup>3</sup>, Stanley G. Kitchen<sup>9</sup>, Mitchel P. McClaran<sup>10</sup>, W. Henry McNab<sup>11</sup>, Diane S. Montoya<sup>12</sup>, Jack A. Morgan<sup>13</sup>, Debra P. C. Peters<sup>14</sup>, E. John Sadler<sup>15</sup>, Mark S. Seyfried<sup>16</sup> & Patrick J. Starks<sup>17</sup>



# Challenge # 1 : Too much information?

How do you make sense of 100,000,000 data items?



# Challenge # 2 : What the hell is metadata?

The Sydney Morning Herald

Digital Life

What is 'metadata' and should you worry if yours is stored by law?

August 6, 2014

Comments **56**

☆ Read later

**Ben Grubb and James Massola**



# Challenge # 3 : Data citations?



Data citation refers to the practice of providing a reference to data in the same way as researchers routinely provide a bibliographic reference to outputs such as journal articles, reports and conference papers. Citing data is increasingly being recognised as one of the key practices leading to recognition of data as a primary research output.

## What about the **TOOLS** ?

A screenshot of the TERN Data Discovery Portal website. The top navigation bar includes links for "Home", "TERN data" (with a dropdown arrow), and "Contact". On the right side of the navigation bar, there are links for "My Favourites" and "My Searches". The main header area features the TERN logo (a stylized map of Australia with colorful lines) and the text "TERN Terrestrial Ecosystem Research Network". To the right of the logo is a large search icon and the text "Data Discovery Portal". Below the header, a dark banner contains the text "Delivering open access to Australia's terrestrial ecosystem data". At the bottom, there is a search bar with the placeholder text "Search ecosystem data", a blue "Search" button, and a "Map Based Search" section with the text "Use our map interface to search for data" and a green "Map Search" button featuring a small map of Australia.



## Challenge # 4 : Scope : National or International?



“I am an *international* scientist, what TERN is doing is great, but contributing is not going to help my international reputation!?”

- Several unnamed scientists

# Challenge # 5 : ~~Human~~ scientists condition?



# Challenge # 6 : Funding

A large, stylized red graphic resembling a mountain peak or a stylized letter 'A' is positioned behind the NCRIS text. The graphic is composed of many small, overlapping red shapes, creating a textured, granular appearance. It is centered horizontally and partially overlaps the top of the text.

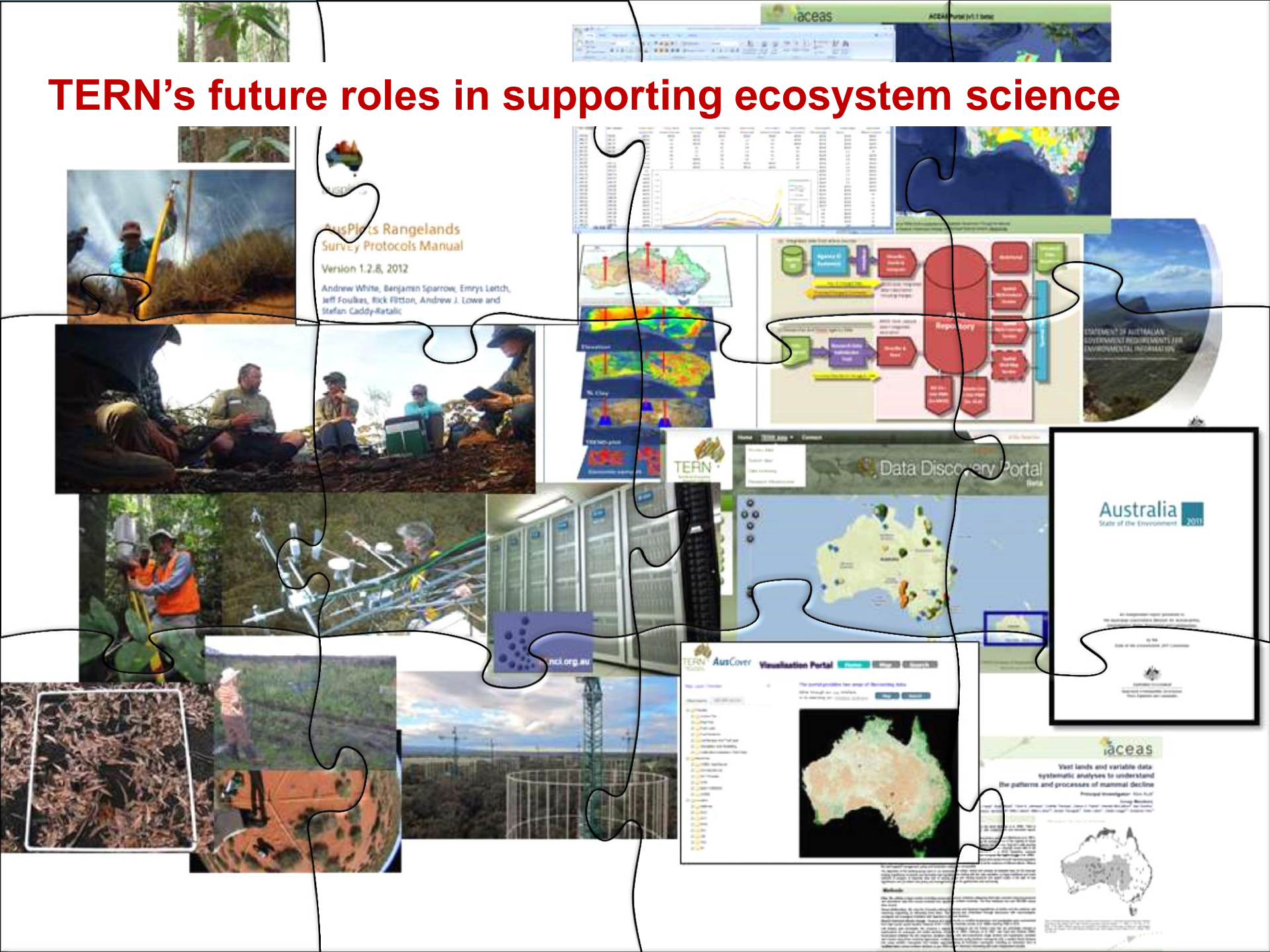
**NCRIS**

National Research  
Infrastructure for Australia

An Australian Government Initiative



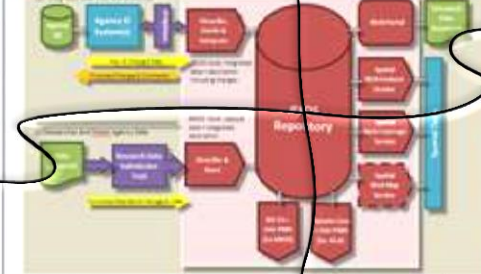
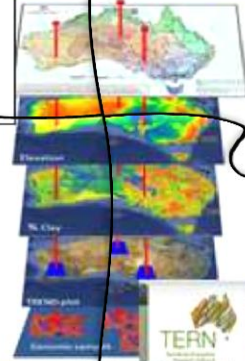
# TERN's future roles in supporting ecosystem science



## AusPlots Rangelands Survey Protocols Manual

Version 1.2.8, 2012

Andrew White, Benjamin Sparrow, Emrys Lettich, Jeff Foulkes, Rick Pittton, Andrew J. Lowe and Stefan Caddy-Ratalic



aceas  
Visit lands and variable data systematic analyses to understand the patterns and processes of mammal decline  
Principal Investigator: David Linden  
Visit lands and variable data systematic analyses to understand the patterns and processes of mammal decline  
Principal Investigator: David Linden



International Partners



TERN is supported by the Australian Government through the National Collaborative Research Infrastructure Strategy and the Super Science Initiative

