

TERN Ecological Monitoring

Methods Training 2026

Session 1. 9:00 – 10:30 am



Acknowledgement of Country

We at TERN acknowledge the Traditional Custodians throughout Australia and all nations. We honour their connections to land, water, biodiversity and culture and pay our respects to their Elders past, present and emerging.



Housekeeping

- Welcome
- This session 9:00 am to 10:30 am
- Fire exits/bathrooms
- Refreshments
- Big picture aim of the training
- Team values
- Please let one of the TERN staff members know if you need anything



Today's Agenda

Session 01

9am – 10:30am

Morning tea

10:30am – 11:00am

Session 02

11am -12:30pm

Lunch

12:00pm – 1:30pm

Session 03

1:30pm – 3:00pm

Afternoon tea

3:00pm – 3:30pm

Session 04

3:30pm – 5:00pm

Free Time

5:00pm – 6:00pm

Dinner

6:00pm – here at the Renmark Hotel, Nanya Bistro

Agenda Session 1

- 01 Intro to TERN Ecoystem Surveillance (ES)
- 02 TERN ES History
- 03 TERN ES Current
- 04 TERN Field program



The TERN Ecosystem Surveillance team have agreed to operate with a **fundamental set of values**, also in place for this training week:

People: Our core strength – our Staff, our students, our volunteers, our collaborators and our organisation

Excellence: Is our goal in all endeavours

Integrity: Underpins all work practices, based on high moral and ethical standards

Respect: Is encouraged within our organisation to support a diversity of opinions and intellectual perspective

Collaboration: A collegial, collaborative and supportive environment is vital to our success

Engagement: Our strong support for interdisciplinary work teams and collaborative engagement

Innovation: Continuous improvement and innovation are essential to accomplish our goals

Community: Involvement with external industry, government and professional organisations, and public outreach activities provide important links to the broader community

Publication: We are committed to research and publication integrity (more information available at Committee of Publication Ethics COPE).

Empathy: We attempt to understand and appreciate the feelings of others.

Assume Positive Intent: We choose to assume that people have positive intent in their interactions with us.

Intro to the team

Ben Sparrow – Associate Professor of Environmental Monitoring

TERN ES Director – TERN Cal/Val Lead

Sally O'Neill – ES Associate Director *

Ellen Neville – Project Officer (EMSA Training)

Megan Jenssen - Project Officer (EMSA Training)

Huy Vo – Software Developer *

The Campsite

- You'll have some familiarity
 - Keep doors closed (no unwelcome friends)
 - Shoes on outside
 - Dining room
 - Don't leave the immediate vicinity of the buildings without notifying one of the TERN team.
 - Check in / check out
- Toilets/Showers
 - Fires
 - Charging things
 - If You need help – Where we are?
 - If you're unsure, or if you need help please ask.
 - First aiders (= Where to find supplies)
 - The river – CAUTION!

Theory Venue – The Hotel Renmark

- Bathrooms
- In case of evacuation
- Tea/ Coffee / Catering
- Dinner
- Lecture Notes
- Transport



In the Field

- Checking in and out when going into the field
- Groups – Which and Where
- When arriving at a site
 - Stay with the vehicles until after the Toolbox Talk.
 - Will identify risks, and what you should do
 - Where are first aid kits
 - Who is first aid qualified
 - Communications
- Follow directions in regards to vehicle use
- Risks associated with today's activities
- Doing Take 5's
- Care with Equipment
- Personal
 - Water (more in vehicles)
 - Snacks and lunch
 - Sunscreen and bug spray
 - HiVis Vests
- You should bring
 - Long sleeve shirts
 - Broad brim hats
 - Warm clothes
 - Rain Gear
 - Sunnies
 - Sturdy Boots & either long trousers or Gaiters
- Bathroom facilities (or lack thereof)

In the Field - Drones

- While the drone is in the air please direct all questions to one of our team members (not the pilot)
- Risks
 - Rotors
 - Batteries
 - Getting lost (RTH)
 - Collision avoidance
- The team will clearly identify when a mission is starting / stopping.



Legally Drones are considered Aircraft and the Operator a Pilot with the associated obligations



There will be plenty of opportunities to investigate the equipment (but please clear with the pilot first)



When in use there are requirements about how close you're allowed to be.

Any Safety Questions or concerns?



Intro to TERN Ecosystem Surveillance (ES)

Presented by:

Ben



Strategic Vision

- Went through a process looking at the big picture of ecological monitoring
- What was needed?
- Settled on three scales of monitoring
- **Ecosystem Landscapes** (incorporated Soils and Auscover) – Looked at the ***where*** and ***when*** on env. Change
- **Ecosystem Surveillance** (Inc. Ausplots and ATN) – Looked at ***what*** was changing, magnitude and direction
- **Ecosystem Processes** – (Inc OzFlux and SuperSites) Looked at ***why*** change was occurring, and how we can manipulate that change
- Data Services and Analytics – (previously each facility had its own data team + Ecoinformatics) – Coordinate and deliver data TERN-wide
- Some previous facilities were not supported moving forward



The Funnel Diagram

Continental-scale Monitoring



WHERE & WHEN

Where & when is change occurring?



Regional-scale Monitoring



WHAT & HOW

What is changing? What direction is the change?
What is the magnitude of change?

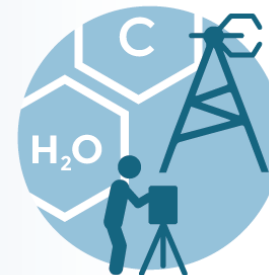


Local-scale Monitoring



WHY

Why is change occurring?
How do we mitigate unwanted change?



TERN Ecosystem Surveillance



- Was created from Ausplots and the Australian Transect Network
- ATN was already collecting data using the Ausplots method, so integration was easier
- Continued to strategically collect data across the continent, whilst ensuring more frequent collection (aiming for 5 year intervals) along transects as they had been chosen as areas where environmental change was likely to be more rapid/significant
- Continued support for DERG (LTER capability already collecting Ausplots)



‘Start up’ to ‘Current Phase’

The TERN Ecosystem Surveillance JOURNEY



Three Themes

Organisational Scope

Infrastructure

The Team



To understand where we are now – a truly operational focus

- Dedicated specialised teams (more on that later)
- Data collection, sample collection, data management all needed to be upscaled
- Significant external interest in the program
- External funding to support complementary work (EMSA)



With a fabulous Collection!

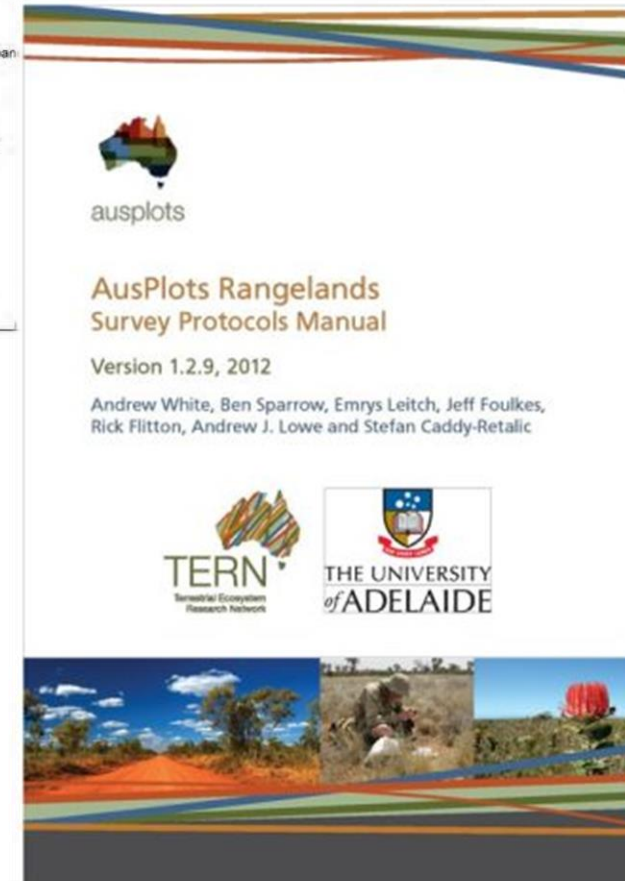
- A very big Shed for our growing Collection
- Capex investment in the future



A brief history of our organisational Scope

Start Up: 2011

- **Development of infrastructure**
 - Established the plot network and scope - Rangelands
 - Developed ecological monitoring methods
- **Program viability questioned**
- **Proof of concept**
 - Nothing similar existed previously
 - No track record to leverage off



Organisational Scope

Start Up: 2011

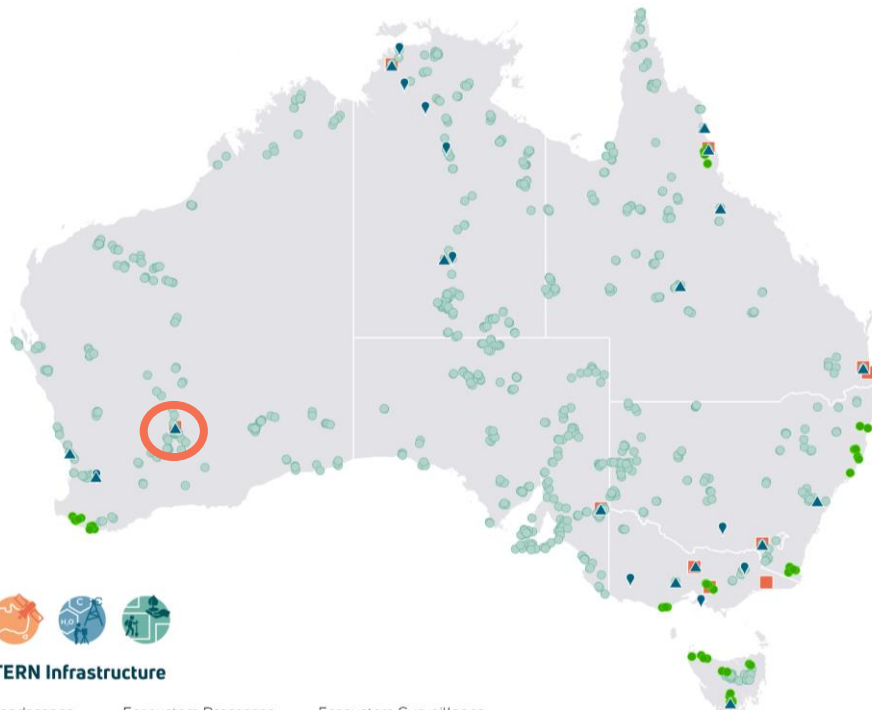
- **Start-up mentality**
 - Small multidisciplinary team
 - Resource constrained
 - Ingenuity – creative solutions to practical problems
- **Core values**
 - Flexibility
 - Innovation
- **2017 transition point**
 - Consolidation of existing foundational facilities



Organisational Scope

Current Phase: 2025

- **Delivery of infrastructure**
 - Operational ecological monitoring program - core business
 - 1,000th plot in WA during GEO-TREES field campaign



TERN Infrastructure

Landscapes Ecosystem Processes Ecosystem Surveillance

■ CalVal Site ▲ TERN SuperSite ● Ausplot

◆ TERN OzFlux Tower ● Forest plot

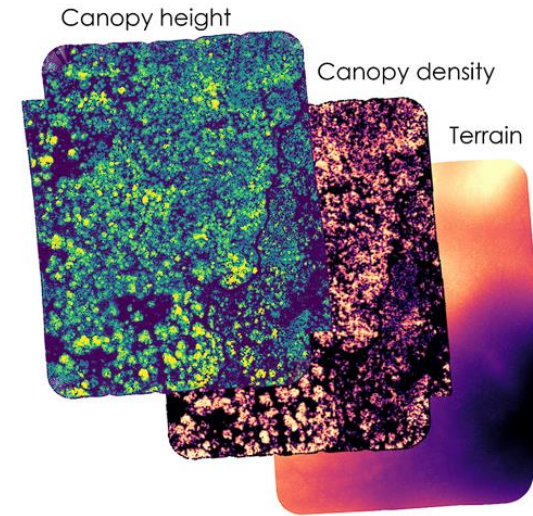
Last updated on Thursday, 28 November 2024



Organisational Scope

Current Phase: 2025

- **Foundation for other programs**
 - UAV program
 - Environmental Monitoring System Australia (EMSA)
 - Tech projects (app development e.g. MONITOR, Grassy Weeds)
- **Internal expertise and experience**
 - Leverage external partnerships
 - Inform national and international programs



Food and Agriculture Organization
of the United Nations



Australian
Citizen Science
Association | SA



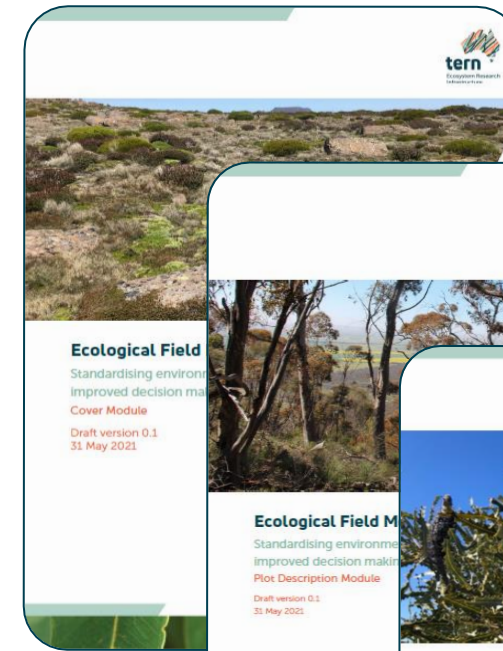
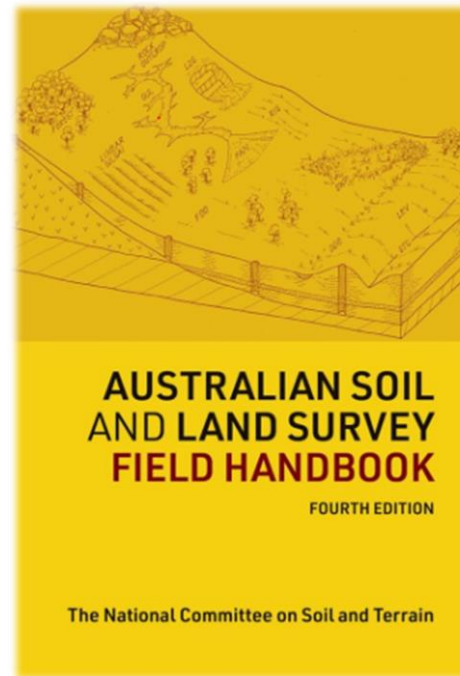
Rangelands => EMSA

EMSA => Rangelands

Organisational Scope

Current Phase: 2025

- **Established program**
 - Proven capability
 - Leading best practise
 - National standards
- **Towards a mature organisation**
 - Increased rigor, structure, documentation, communication
 - Developing specialised work units
 - Data-driven decision making
 - Continuous improvement
 - Retains foundational values
 - Flexibility
 - Innovation
 - Ingenuity



Infrastructure



Infrastructure

Start Up: 2011

- From zero
 - No nationally consistent ecological monitoring program
 - Training
 - Collaboration

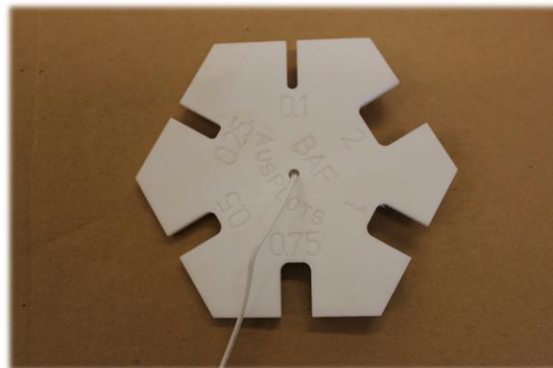


Infrastructure

Start Up: 2011

- From zero

- Fleet was small and hired
- Equipment was often 'not off the shelf' – BLUEPRINTS
- Selected attributes that can be collected consistently and rapidly to detect change



Infrastructure

Start Up: 2011

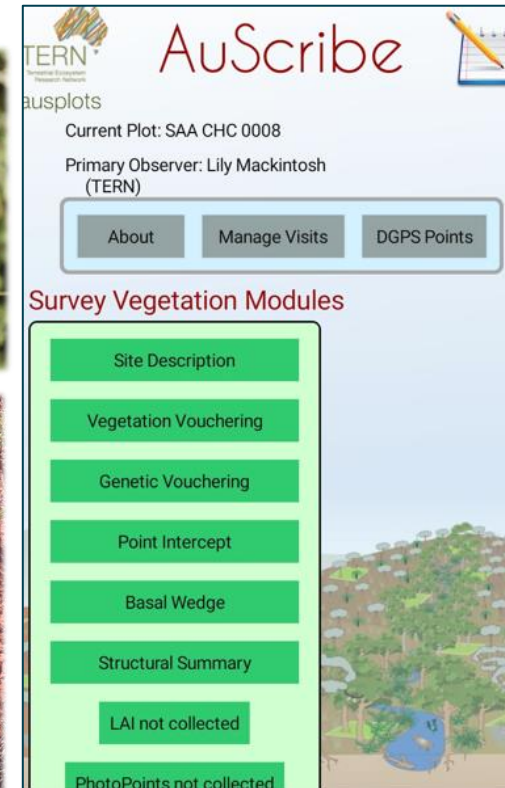
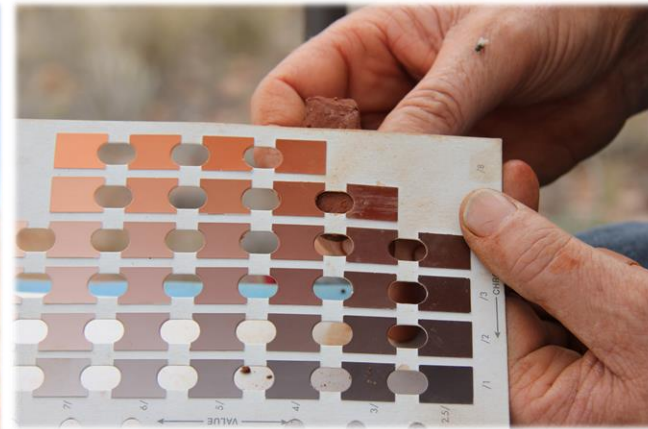
- **Innovation**

- Used best practices where available in NEW applications
- Implemented existing standards (i.e. Yellow Book)
- Initial investment in sound concepts
 - Collection of physical samples
 - Unique identifiers (barcodes)
 - Controlled vocabularies
 - Customised electronic data collection systems
 - Relational data systems
 - Linking field data to remotely sensed data

- **Multidisciplinary approach**

- Vegetation and soils
- Ecological concepts integrated with relational data systems

- **Workflows with a focus on efficiency**

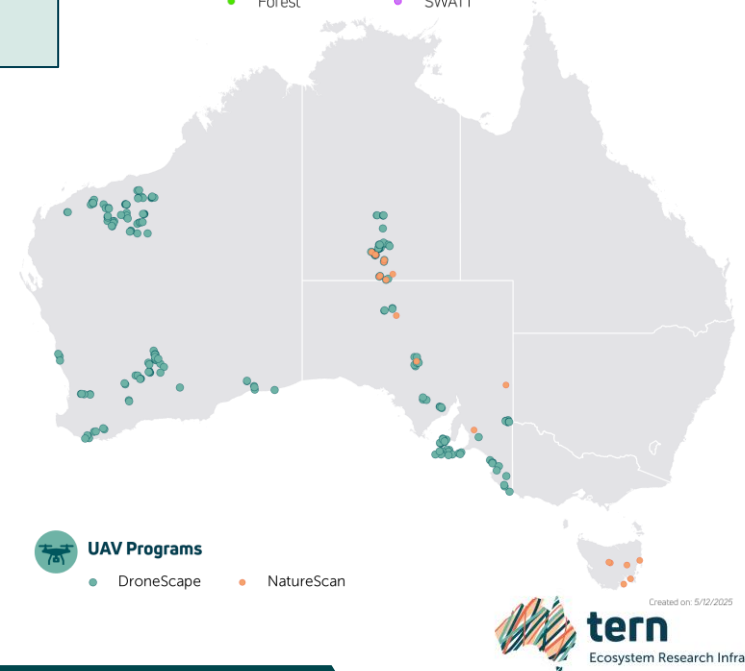
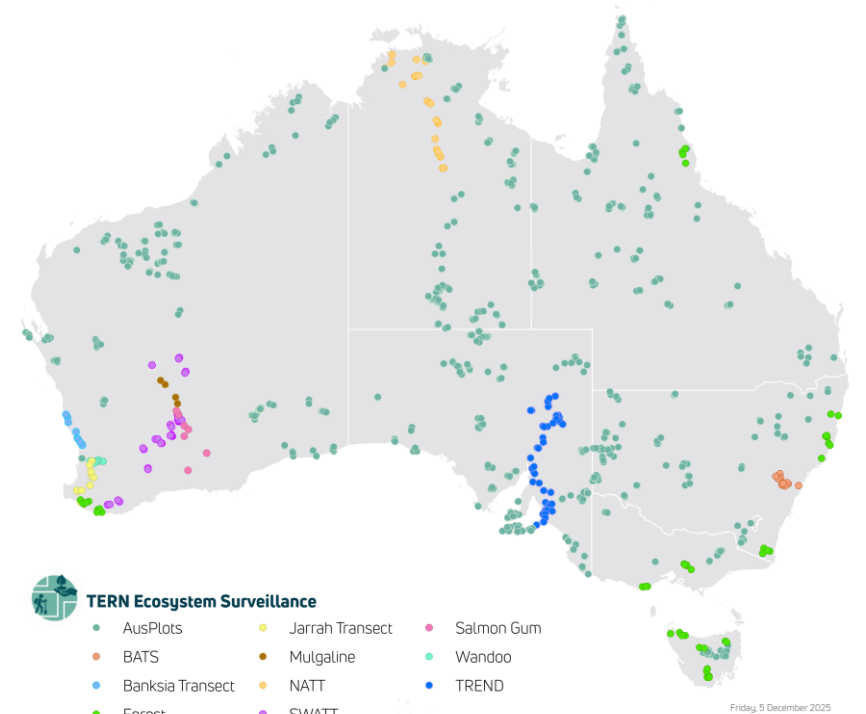


Infrastructure

Current Phase: 2025

- **Current infrastructure**
 - Australia-wide operational ecological and UAV monitoring programs
 - Nationally recognised methods (8 AusPlots protocols)
 - Foundational platform that other programs can build on

- + Follows Yellow Book
- + AusPlots 8 standard modules
 - + Plot selection and layout
 - + Plot description
 - + Photopoints
 - + Soils
 - + Basal area
 - + Cover
 - + Floristics
 - + Plant tissue vouchering



TERN Key operating partners:



Government of South Australia
Department of State Development

Co-investment

Project partner:



Infrastructure

Current Phase: 2025

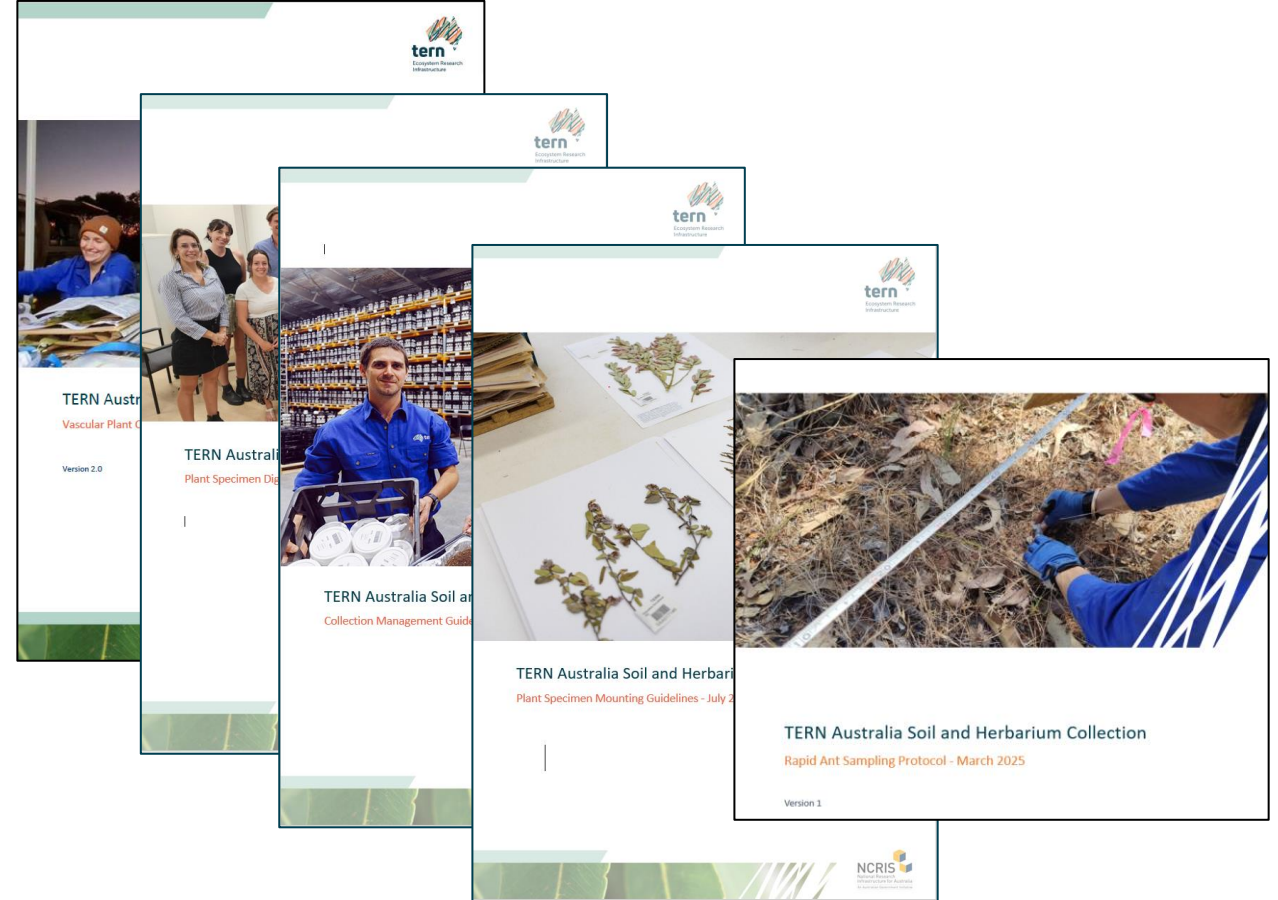
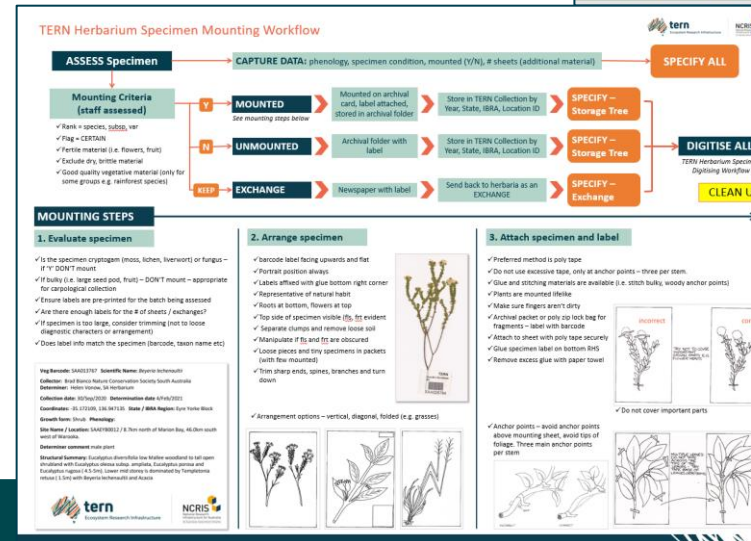
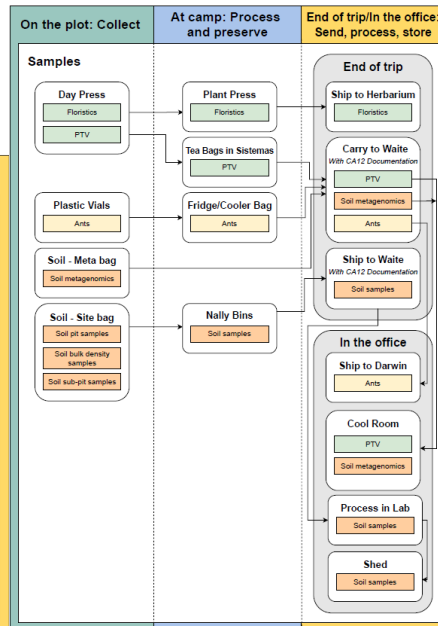
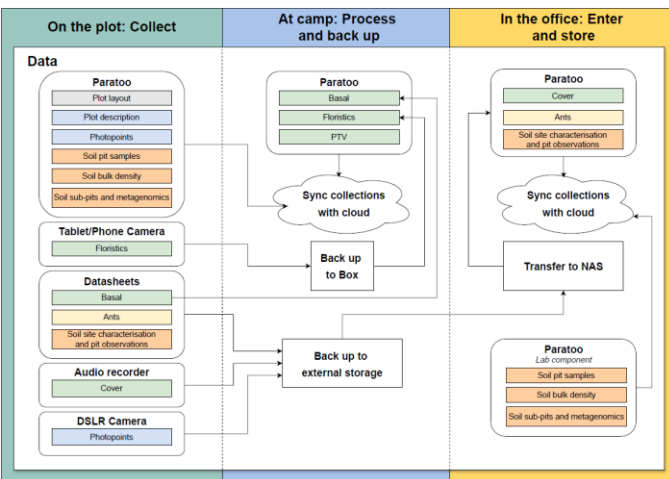
- **Maintenance and continued development**
 - Investment in the fleet
 - Growing the infrastructure network (temporal, geographic)
 - Plots ~1,000 – revisits ~400
 - Samples ~200,000
 - Data – value adding, controlled vocabularies
- **Increased access – FAIR principles**



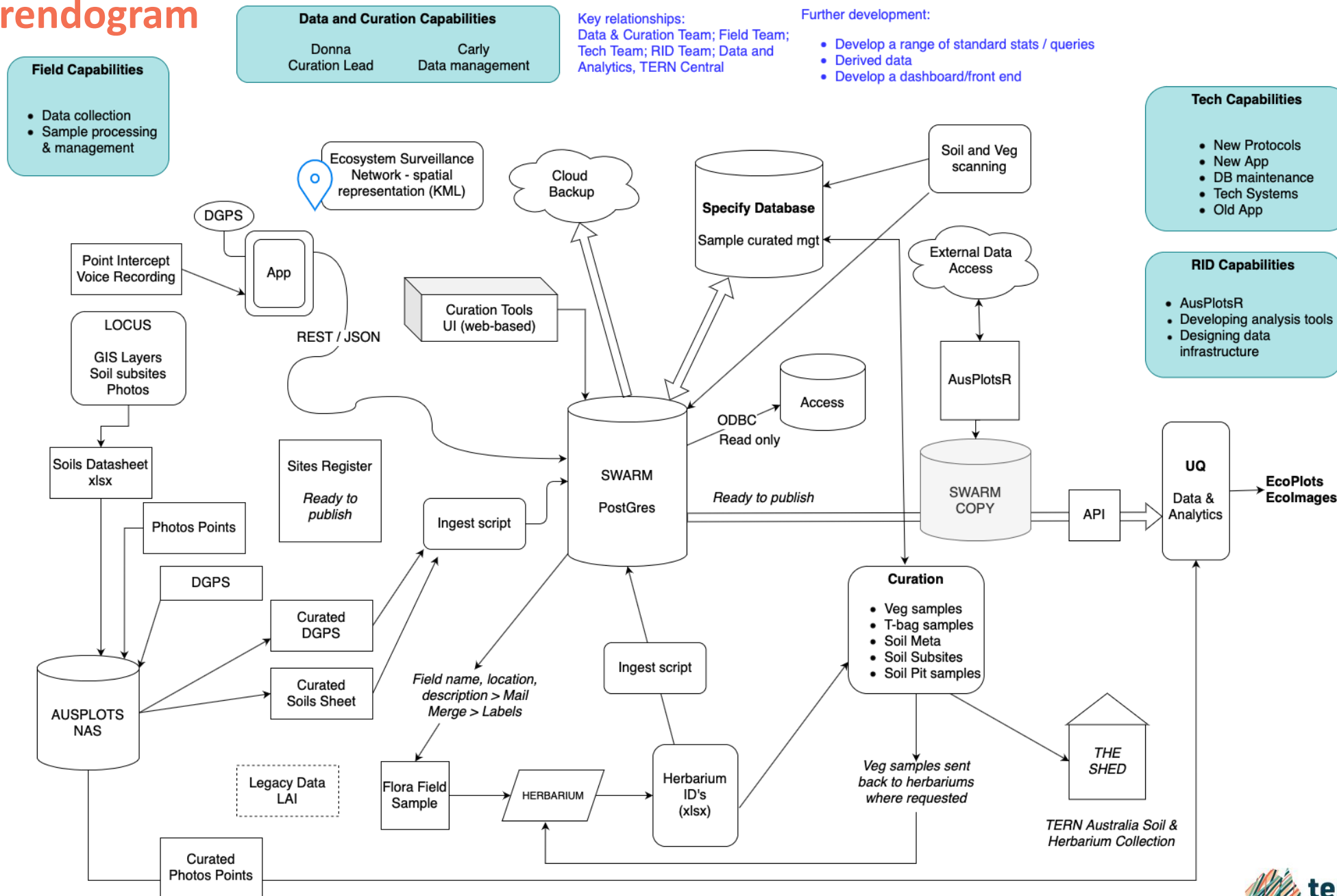
Infrastructure

Current Phase: 2026

- Process improvement focused on consistency
 - Documentation (guidelines, protocols, policies, registers, MoUs)
 - Refinement of workflows
 - QA/QC processes
 - Curation



Horrendogram



The Team



The Team

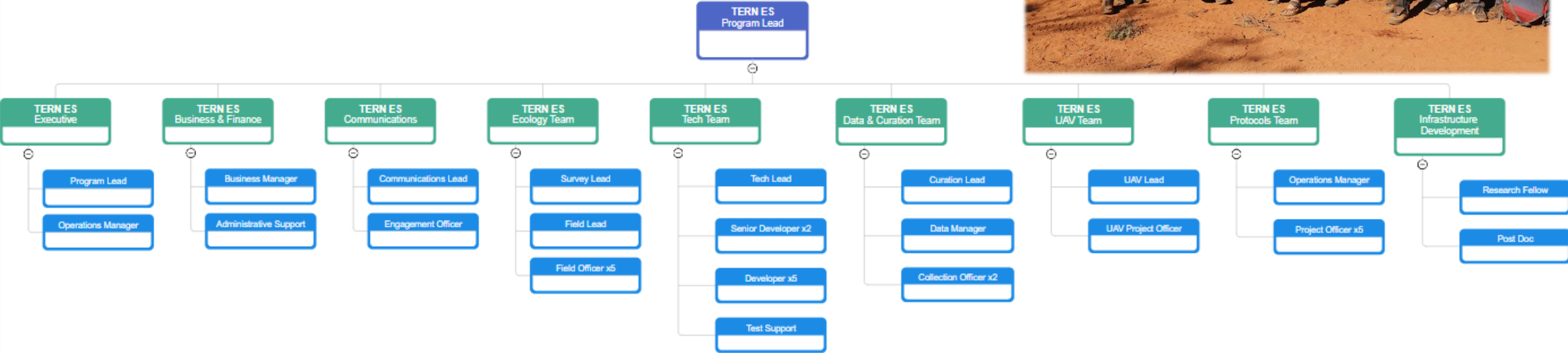
Start Up: 2011

- **Small, versatile team (3.5 FTE)**
 - Single team focused on:
 - rapid data collection
 - network expansion
 - Staff performing multiple roles
 - Higher workloads = risk of burnout
- **Agility and flexibility**
 - Coordination is easy amongst a small team
 - Less documentation required
 - Increased consistency of data collection



The Team

Current Phase: 2025



The Team

Current Phase: 2025

- **Specialised roles and expertise**
 - Specialised teams
 - Development of a skilled and experienced team
 - National standards
- **Consistency and rigor**
 - Larger teams require improved:
 - Communication and coordination
 - Documentation and workflows
 - Clear definitions of roles and responsibilities
- **Safety**
 - Robust procedures (SOPs)
 - Communication plan
 - Up-to-date training



TERN-ES SOP's

- Working Safely at TERN
- Safe Use of Vehicles
- Working Safely in the Shed and Lab
- Working Safely in the Office
- Working Safely in the Field

TERN ECOSYSTEM SURVEILLANCE

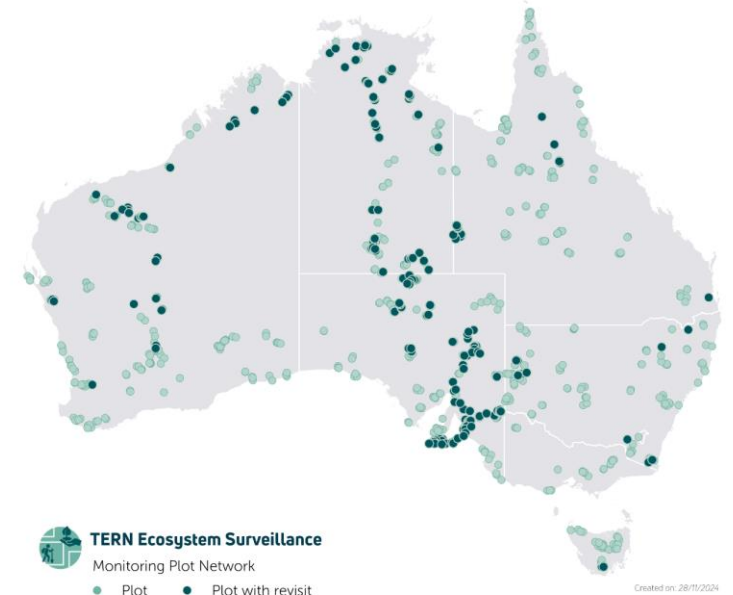
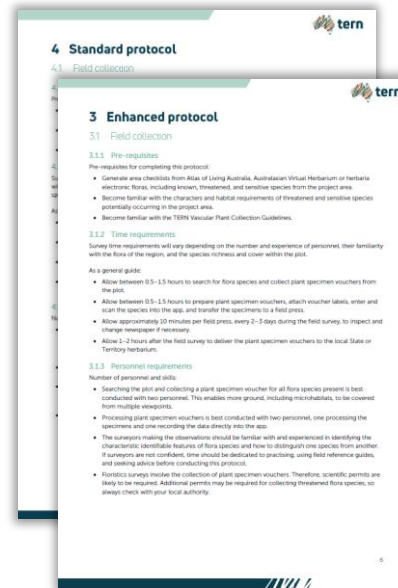
Field-Based Monitoring Program

Ben



TERN ES Monitoring Platform

- Plot-based field monitoring program across a national network of plots and transects
 - 1,000 x 1-Ha plots
 - Standardised methodology
 - Ecological data and samples collected at each plot



Monitoring Approach

- Detecting ecosystem change
 - What, how much, in which direction
- Broad spatial and temporal scope
- Focused on trends



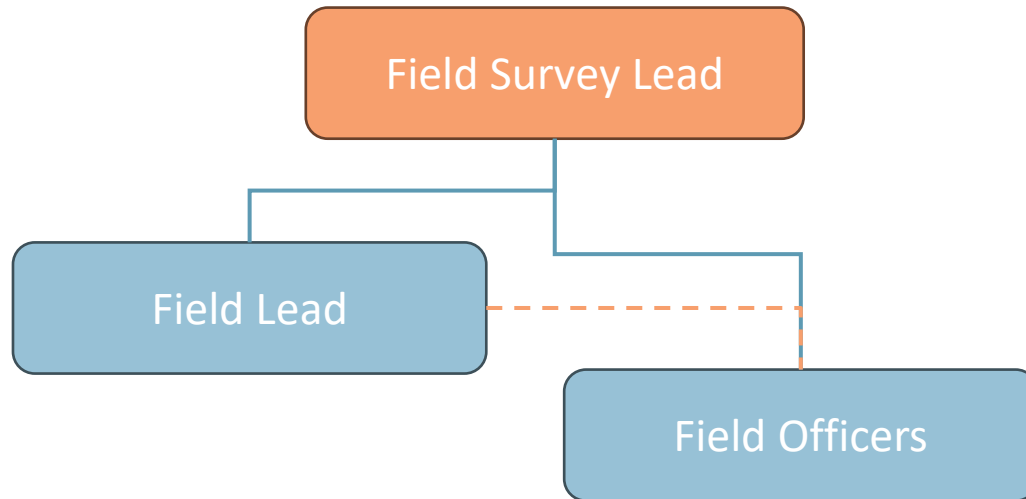
Methodology

- Standardised survey methods
 - Quantitative data
 - Repeatable
 - Comparable data across spatial scales
- Field data collection app
 - Standardised terminology
 - Efficiency
 - Quality assurance and data completeness



TERN ES Ecology Team

- Conduct field surveys to collect data and samples following established protocols
- Data and sample management
- Health and safety



Monitoring Variables



PLOT SELECTION
AND LAYOUT



PLOT
DESCRIPTION



PHOTOPOINTS



FLORISTICS



PLANT TISSUE
VOUCHERING



COVER



FIRE SEVERITY



BASAL AREA



INVERTEBRATE
FAUNA



SOILS



Data and Sample Collection



Ecological data

- Plot location
- Plot description
- Cover
- Basal area
- Soil site characterisation
- Soil pit observations



Images

- Photopoints
- Floristics in-situ
- Soil pit faces



Physical samples (& associated data)

- Floristics vouchers
- Plant tissue vouchers
- Soil pit samples
- Soil sub-pit samples
- Soil metagenomics samples
- Soil bulk density samples
- Ants



Data considerations

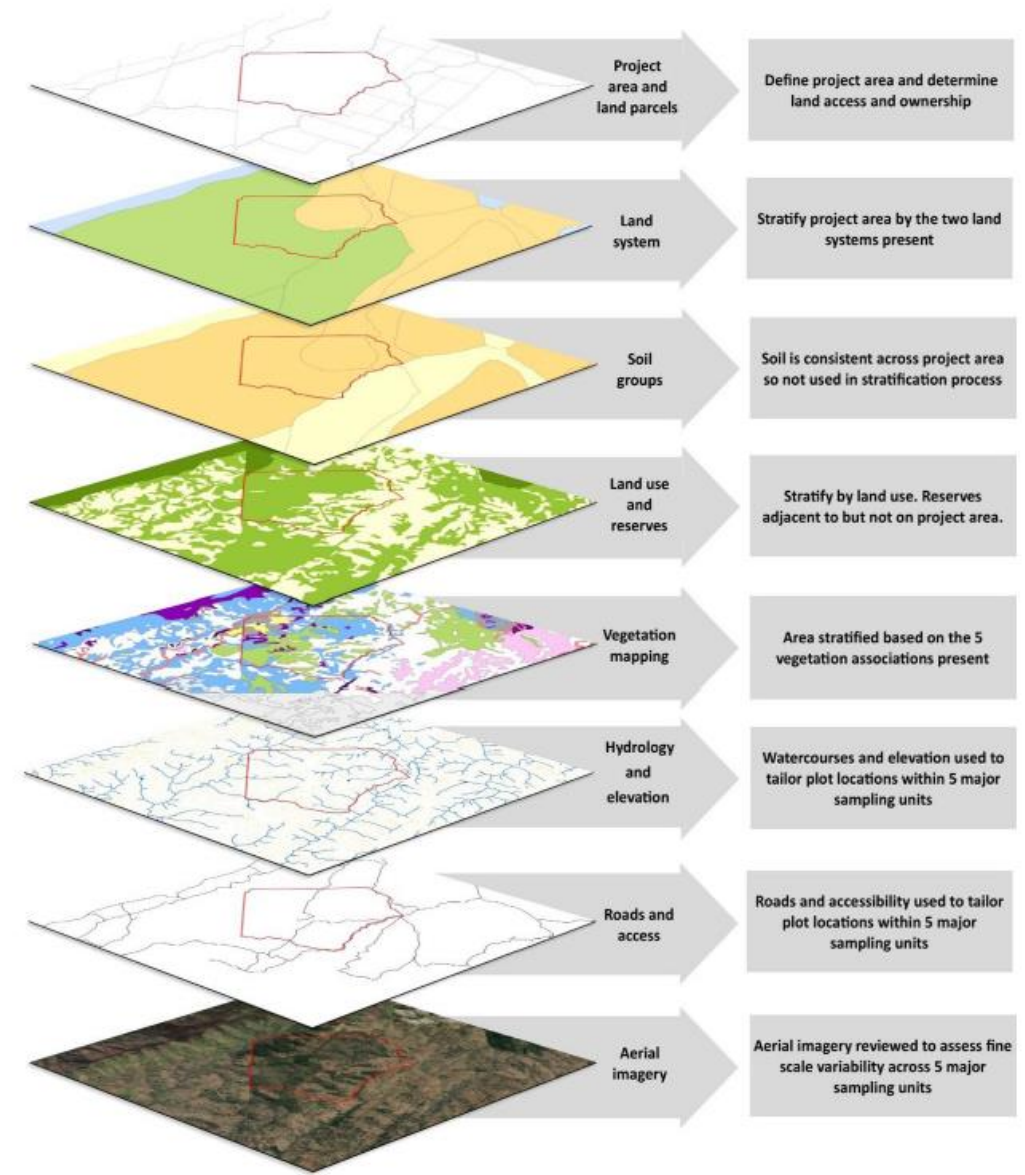
FAIR Data Principles: Findable, Accessible, Interoperable, and Reusable

- + Recording data consistently
 - + Standardised fields
 - + Controlled vocabularies
 - + Completeness
 - + Accurately
 - + Repeatable
 - + Comparable
- + How is data being collected
 - + What will the final data output look like
 - + Storage of data
 - + Relational Database / Spreadsheet / Shapefile
 - + Recognised data repository
 - + Findable and accessible
- + Metadata
 - + What are you collecting
 - + Who collected it
 - + How was it collected
 - + When was it collected
 - + How can it be accessed and who can access it



Plot Selection

- Scientific and environmental information
- Historical information
- Logistical considerations
- Political or legislative considerations



from McCallum et al. 2024, EMSA Plot Selection and Layout

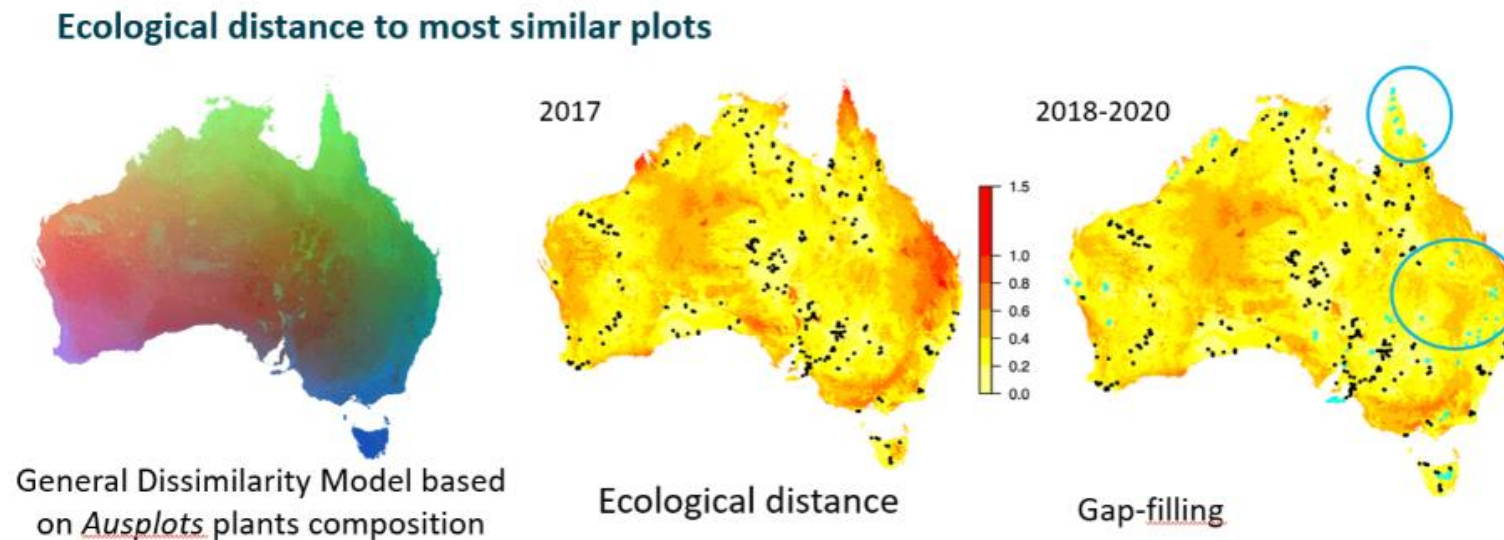
How we prepare for Field Work

- Health and safety
- Planning and logistics
 - Scheduling
 - Land access and permits
- Equipment and vehicle management
- Sample management
- Biosecurity

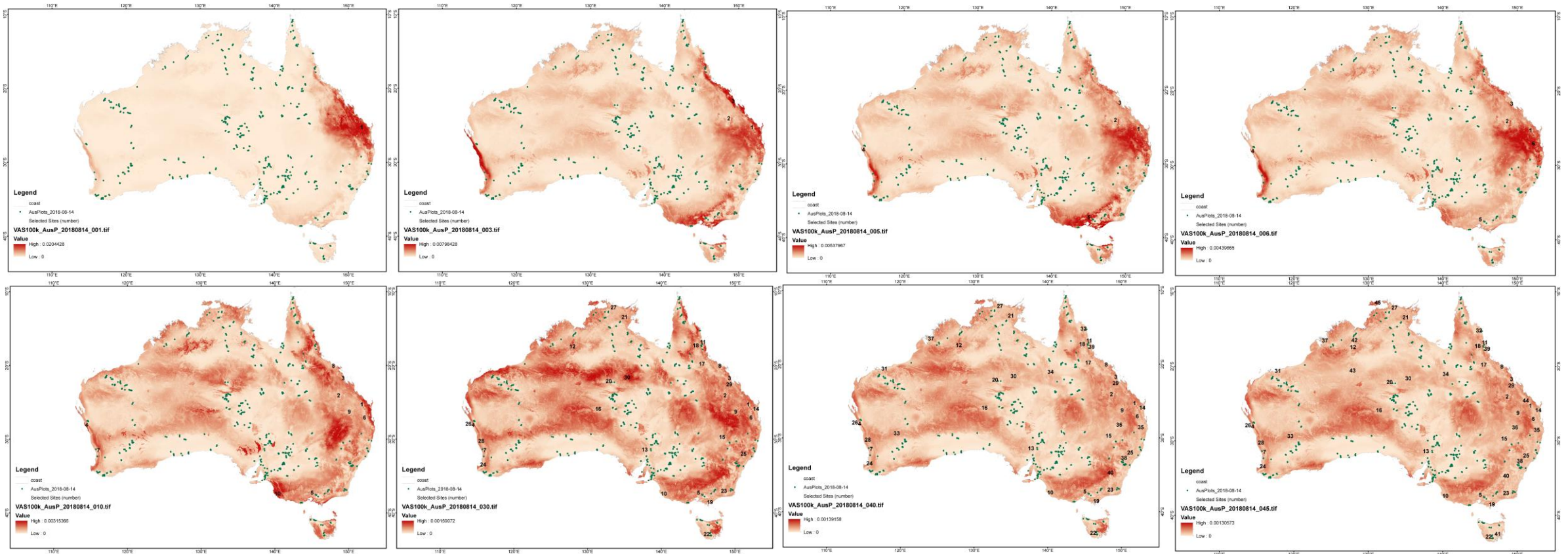


Where to Monitor? Gaps Analysis

- A significant amount of work on the strategy behind gap-filling
- Identified that previous stratification was good – but future better with Generalised Dissimilarity Modelling to focus on areas to visit



Modelling ... 45 + iterations later



– Glenn Manion, Simon Ferrier, Dan Faith, Kristen Williams

Iteratively selects locations with highest complementarity in environmental space, adds the XY coordinates to existing survey sites and repeats the process





We at TERN acknowledge the Traditional Custodians throughout Australia, New Zealand and all nations. We honour their profound connections to land, water, biodiversity and culture and pay our respects to their Elders past, present and emerging.

TERN is enabled by NCRIS.

Our work is a result of collaborative partnerships with many universities and research institutions.

To find out more please go to **tern.org.au**.

End of session – spare slides below are hidden