

TERN Ecological Monitoring

Methods Training 2026

Session 3. 1:30 – 3:00 pm



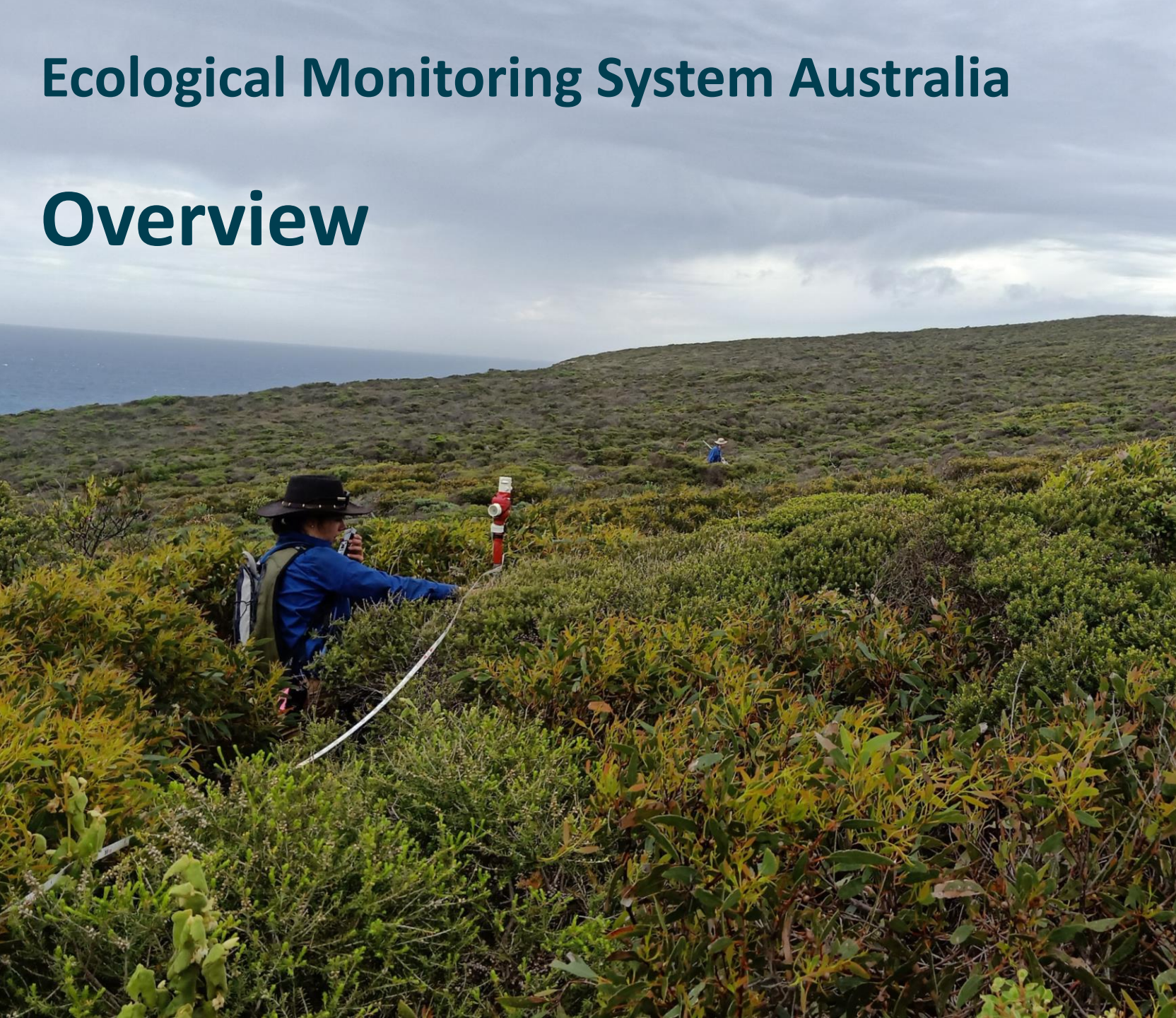
Agenda Session 3

- 01 Ecological Monitoring System Australia (EMSA)
- 02 TERN Field Data Collection Methods - Vegetation
- 03 TERN Field Data Collection Methods - Soils



Ecological Monitoring System Australia

Overview

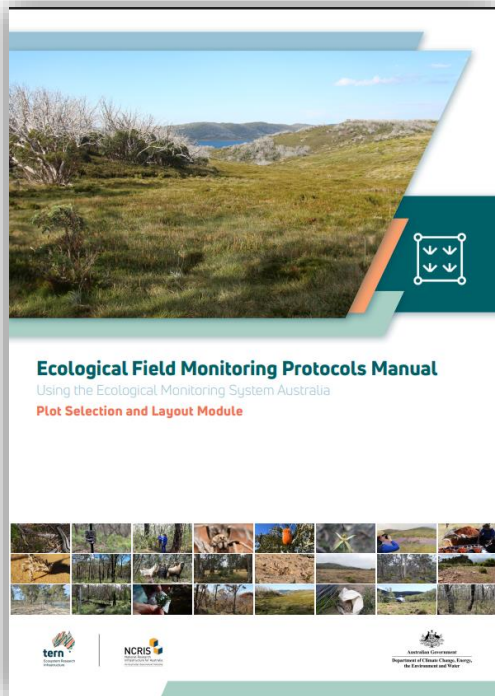


Ecological Monitoring System Australia

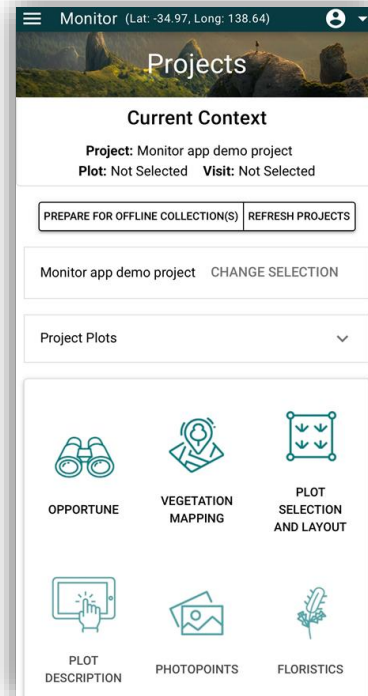
What is EMSA?



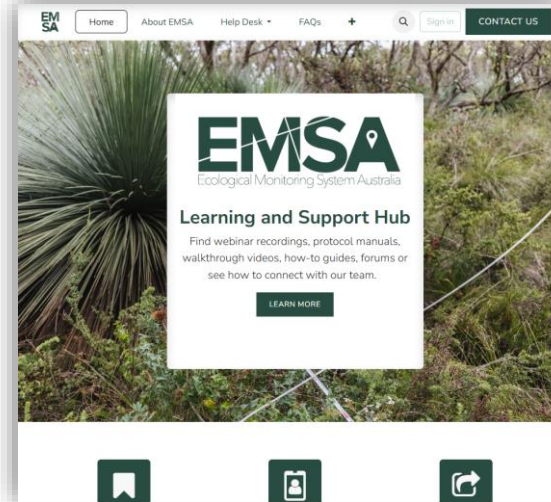
EMSA, the Ecological Monitoring System Australia, is a set of nationally standardised survey modules and data systems aimed at improving the collection, management and storage of ecological field data.



Module manuals



Field data
collection app



A learning and support hub



Data management system

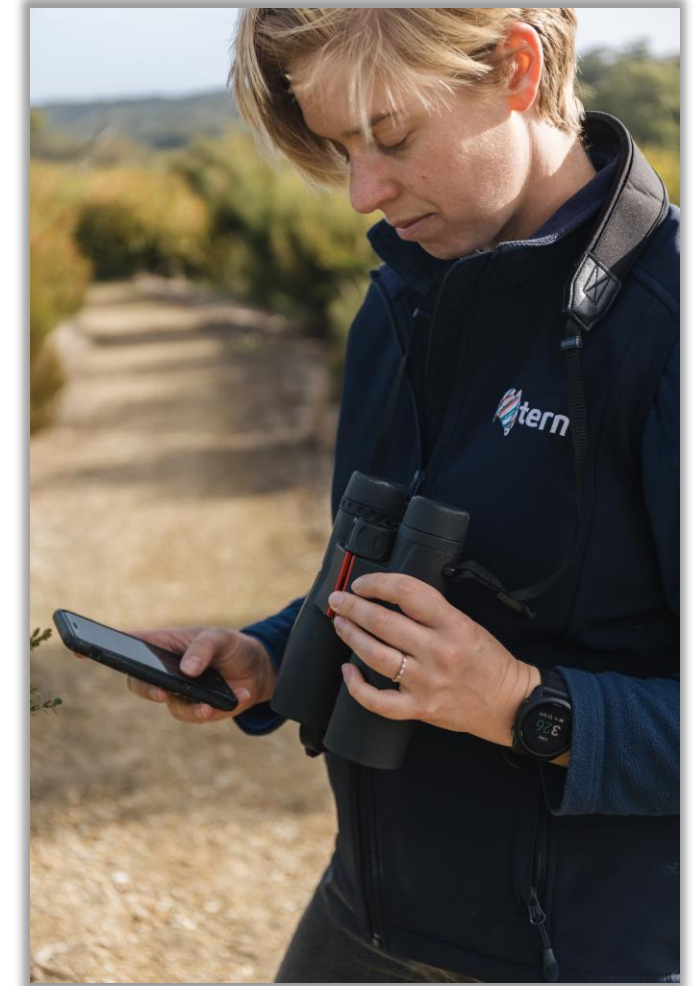


On-ground training

Ecological Monitoring System Australia

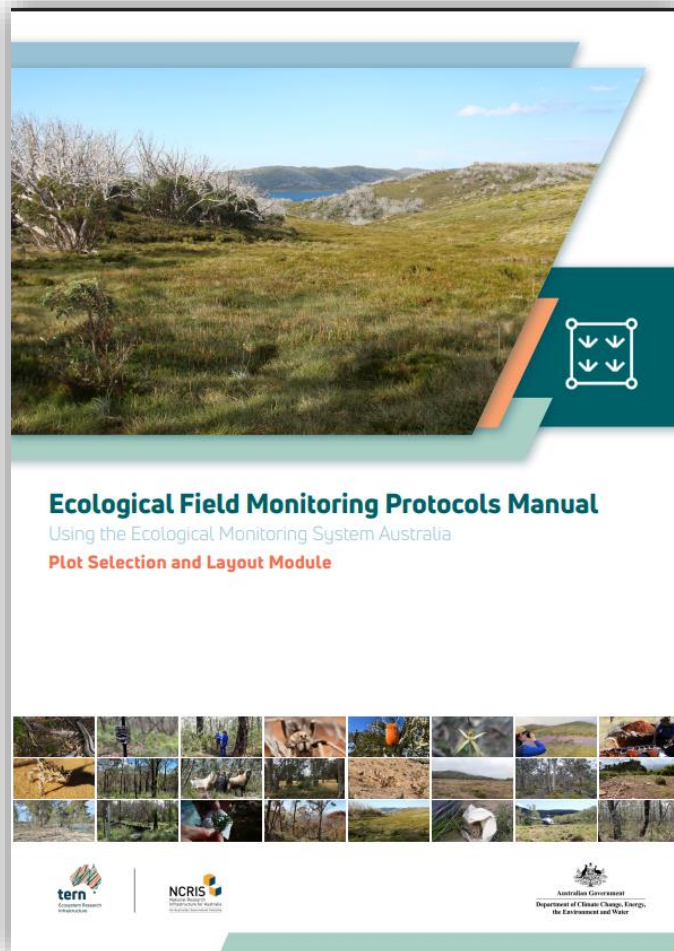
Why EMSA?

- + The broad aim of EMSA is to provide:
 - + **Clear protocols** for monitoring **Australian** systems
 - + Produce data that is **quantative** and data collection that is **repeatable**
 - + Produce datasets that can be used to **quantify environmental change**
- + Before EMSA, monitoring data collected by NRM projects was:
 - + Collected using a variety of **different methods**
 - + Collected at **different scales**
 - + Held in **different formats** all over the country
- + This non-standardisation of data collection:
 - + Limited **combining and comparing** different data across projects
 - + Made it difficult to **assess the effectiveness** of NRM programs
 - + Made it difficult to look at **environmental outcomes at a continent scale**

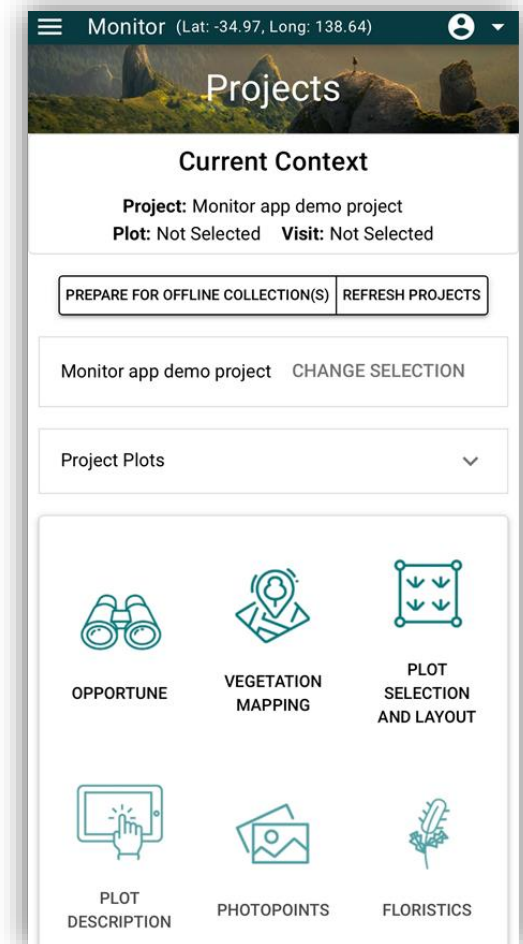


Ecological Monitoring System Australia

What is TERN's role in EMSA



- + Contracted by DCCEEW to develop standardised monitoring methods for Natural Resource Management (NRM) programs
- + Researched and developed standardised monitoring methods
- + Consulted the NRM community extensively throughout this process
- + Developed the data collection app – Monitor
- + Ongoing support via the EMSA help desk, on-ground training and EMSA website
- + Developed and delivering on ground training

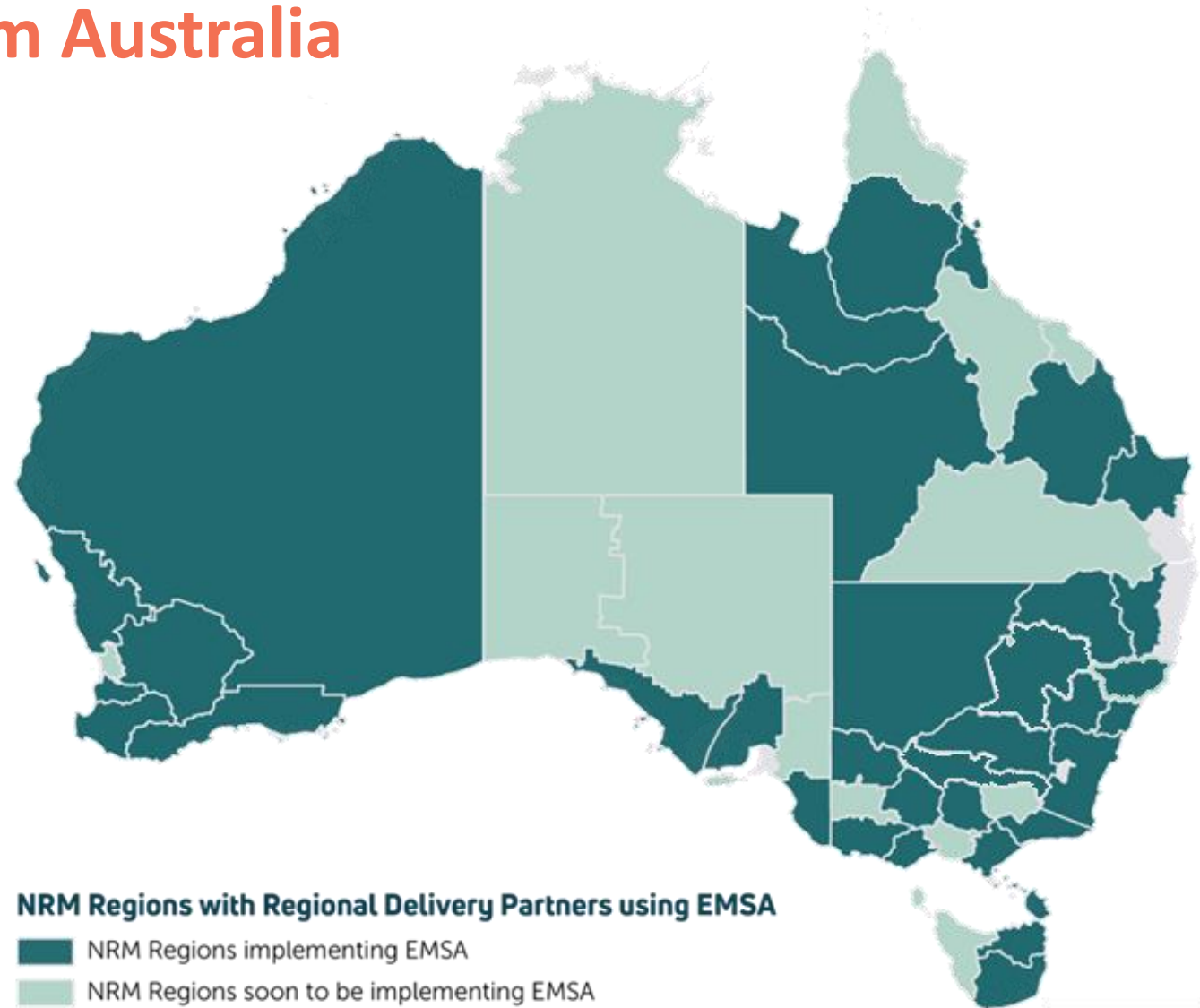


Ecological Monitoring System Australia

Who is using EMSA

- + 32 NRM regions using EMSA
- + 56 NRM projects using EMSA
- + 186 plots on the ground
- + 1494 Monitor data sets submitted*

*excluding Plot Selection and Targeted Surveys modules



Ecological Monitoring System Australia Modules



OPPORTUNE



VEGETATION
MAPPING



PLOT SELECTION
AND LAYOUT



PLOT
DESCRIPTION



PHOTOPOINTS



FLORISTICS



PLANT TISSUE
VOUCHERING



COVER



FIRE SEVERITY



BASAL AREA



COARSE WOODY
DEBRIS



RECRUITMENT



HERBIVORY AND
PHYSICAL
DAMAGE



VERTEBRATE
FAUNA



INVERTEBRATE
FAUNA



CONDITION



TARGETED
SURVEYS



CAMERA
TRAPPING



FAUNA AERIAL
SURVEYS



SIGN-BASED
FAUNA SURVEYS



FAUNA GROUND
COUNTS



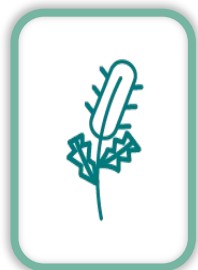
SOILS

Ecological Monitoring System Australia Modules & Protocols

- + Modular so they can be tailored to specific project needs
- + Modules may have one or more protocol variations
 - + Standard vs Enhanced
 - + Plot vs off-plot
 - + Multiple methodologies



Method of data collection

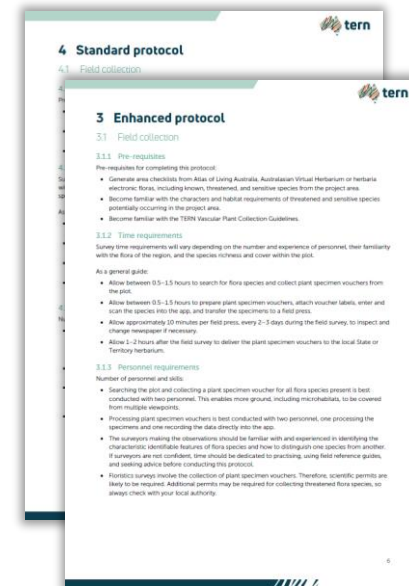


FLORISTICS

Module icon

Floristics		CLOSE
Protocol	Description	
Floristics - Enhanced	Collect plant specimen vouchers for all species present in a plot.	START
Floristics - Standard	Plant specimen vouchers collected for a subset of the species present in a plot and photo collected for the remaining species.	START

Protocol



Manual sections



Ecological Monitoring System Australia Module Manuals

- + Step by step instructions and procedures
- + Additional guidelines
- + Figures and diagrams
- + Detailed rational for methodologies
- + Multiple protocols
- + Equipment list
- + Time requirements
- + Outlines relationships with other EMSA modules (dependencies)
- + Data use and reason for collection
- + emsa.tern.org.au



The cover of the 'Ecological Field Monitoring' module manual features a large photograph of a coastal landscape with green grass and shrubs under a blue sky. Below the photo, the title 'Ecological Field Monitoring' is displayed in a bold, dark font, followed by the subtitle 'Using the Ecological Monitoring System Australia' in a smaller font. At the bottom of the cover, there is a grid of small images showing various field activities, and logos for 'tern' and 'NCRIS' are visible.

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Ecological Monitoring System Australia

emsa.tern.org.au



TERN monitoring vs EMSA monitoring



OPPORTUNE



VEGETATION
MAPPING



PLOT SELECTION
AND LAYOUT



PLOT
DESCRIPTION



PHOTOPOINTS



FLORISTICS



PLANT TISSUE
VOUCHERING



COVER



FIRE SEVERITY



BASAL AREA



COARSE WOODY
DEBRIS



RECRUITMENT



HERBIVORY AND
PHYSICAL
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VERTEBRATE
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INVERTEBRATE
FAUNA



CONDITION



TARGETED
SURVEYS



CAMERA
TRAPPING



FAUNA AERIAL
SURVEYS



SIGN-BASED
FAUNA SURVEYS



FAUNA GROUND
COUNTS



SOILS

Field Data Collection Methods

Overview



Plot Selection
and Layout



Plot Description



Photopoints



Floristics



Plant tissue
vouchering



Cover



Fire severity



Basal Area



Invertebrates



Soils

Field Data Collection Methods

Plot Selection & Layout Module



Plot Selection
and Layout



Plot Description



Photopoints



Floristics



Plant tissue
vouchering



Cover



Fire severity



Basal Area



Invertebrates



Soils



Plots

- + Site locality and description
- + Panoramic site photo
- + Vegetation structure and composition
- + Floristic inventory
- + Basal area
- + Soil characterisation
- + Geomorphology
- + Substrate





Plot Selection Protocol

Plot Name: SASMDD0001

Monitor GPS not available

Create New Plot Selection

Create New Plot Selection 1

Plot Name:
SASMDD0001

State *
South Australia

Program *
Supersite

Bioregion *
Murray Darling Depression

Unique Digits *
0001

Recommended Location *
CHOOSE ON MAP

State/Territory

Northern Territory NT
South Australia SA
New South Wales NS
Queensland QD
Western Australia WA
Australian Capital Territory CT
Tasmania TC
Victoria VC

Program

AusPlots A
Supersites S
Transects T
General use G
LTERN L
Training TRA
MERIT M

Unique Digits

0001

IBRA Bioregion



IBRA Bioregion

Arnhem Coast ARC
Arnhem Plateau ARP
Australian Alps AUA
Avon Wheatbelt AVW
Brigalow Belt North BBN
Brigalow Belt South BBS
Ben Lomond BEL
Broken Hill Complex BHC
Burt Plain BRT
Carnarvon CAR
Central Arnhem CEA
Central Kimberley CEK
Central Ranges CER
Channel Country CHC
Central Mackay Coast CMC
Coolgardie COO
Cobar Penplain COP
Coral Sea COS
Cape York Peninsula CYP
Daly Basin DAB
Darwin Coastal DAC
Dampierland DAL
Desert Uplands DEU
Davenport Murchison Ranges DMR
Darling Riverine Plains DRP
Einasleigh Uplands EIU
Esperance Plains ESP
Eyre Yorke Block EYB
Finke FIN
Flinders Lofty Block FLB
Furneaux FUR
Gascoyne GAS
Gawler GAW
Geraldton Sandplains GES
Gulf Fall and Uplands GFU
Gibson Desert GID
Great Sandy Desert GSD
Gulf Coastal GUC
Gulf Plains GUP
Great Victoria Desert GVD
Hampton HAM
Indian Tropical Islands ITI
Jarrah Forest JAF
Kamantoo KAN
King KIN
Little Sandy Desert LSD
MacDonnell Ranges MAC
Mallee MAL
Murray Darling Depression MDD
Mitchell Grass Downs MGD
Mount Isa Inlier MII
Mulga Lands MUL
Murchison MUR
Nandewar NAN
Naracoorte Coastal Plain NCP
New England Tablelands NET
NSW North Coast NNC
Northern Kimberley NOK
NSW South Western Slopes NSS
Nullarbor NUL
Ord Victoria Plain OVP
Pine Creek PCK
Pilbara PIL
Pacific Subtropical Islands PSI
Riverina RIV
Subantarctic Islands SAI
South East Coastal Plain SCP
South East Corner SEC
South Eastern Highlands SEH
South Eastern Queensland SEQ
Simpson Strzelecki Dunefields SSD
Stony Plains STP
Sturt Plateau STU
Southern Volcanic Plain SVP
Swan Coastal Plain SWA
Sydney Basin SYB
Tanami TAN
Tasmanian Central Highlands TCH
Tiwi Cobourg TIW
Tasmanian Northern Midlands TNM
Tasmanian Northern Slopes TNS
Tasmanian South East TSE
Tasmanian Southern Ranges TSR
Tasmanian West TWE
Victoria Bonaparte VIB
Victorian Midlands VIM
Warren WAR
Wet Tropics WET
Yalgoo YAL



Plot layout and visit protocol

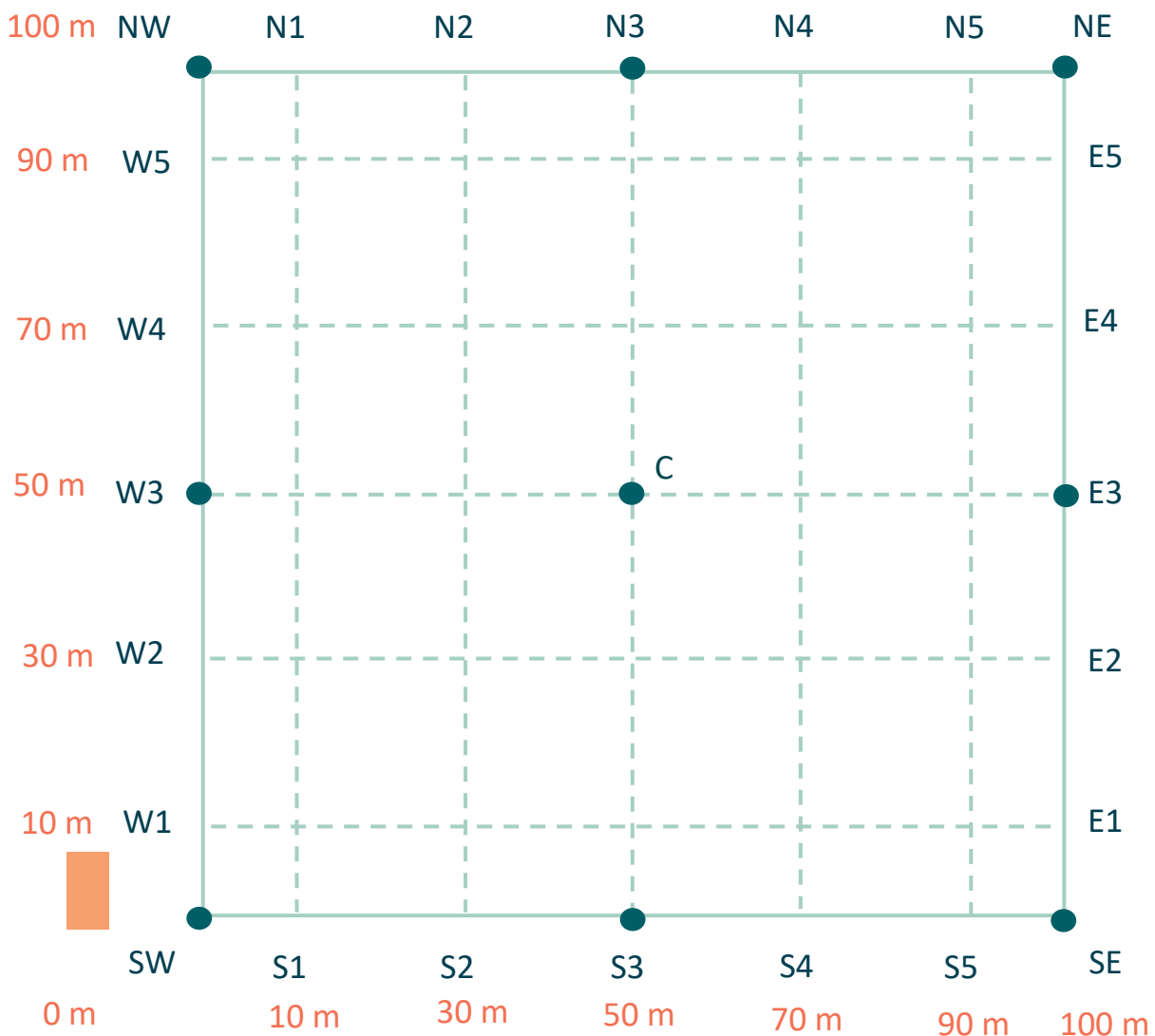
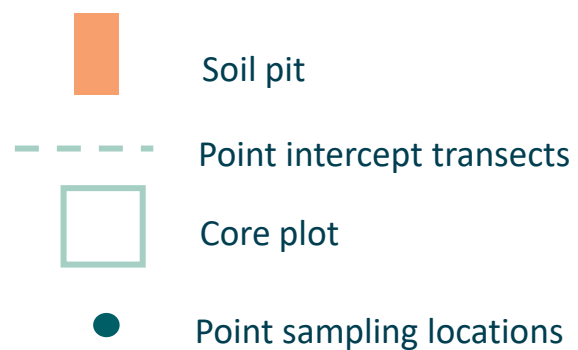
Ground truthing a plot location

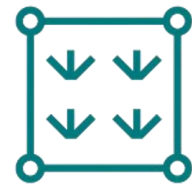
- + Walk across a proposed site and ask these questions:
 - + Is the vegetation and soil type homogenous across the site?
 - + Is this site representative of the vegetation we are aiming to monitor?
 - + Is the site accessible for monitoring?
 - + Are there any hazards that would make working on this site unsafe?
- + When revisiting a site:
 - + Has any of the above changed, making this site inappropriate for further monitoring?





Plot Layout & Visit Protocol





Plot Layout & Visit Protocol Equipment

- + Tent pegs
- + Clothes pegs
- + Star droppers
- + Post driver
- + GNSS receiver
- + Monitor App
- + Flagging tape

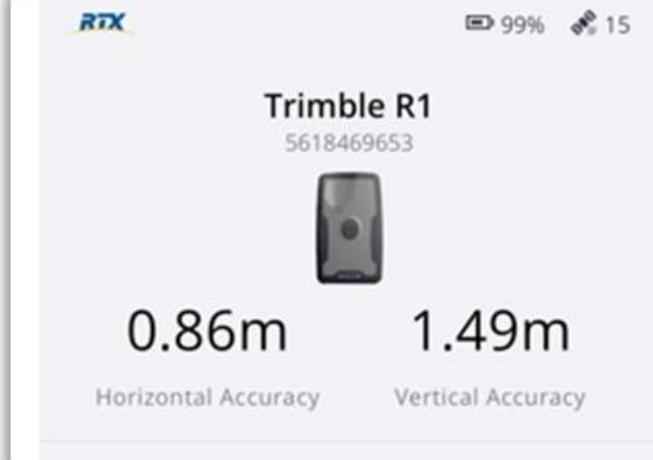




Plot Layout & Visit Protocol

GNSS Receivers

- + TERN Plot protocols use **sub metre** location precision for laying out plots
- + GNSS - Global Navigation Satellite Systems
 - + GPS - Global Positioning System (US Gov owned and operated)
 - + GLONASS (Russian Gov owned and operated)
 - + Galileo (European union agency for space program owned and operated)
- + TERN use Trimble R1 DGPSs
 - + Require a subscription

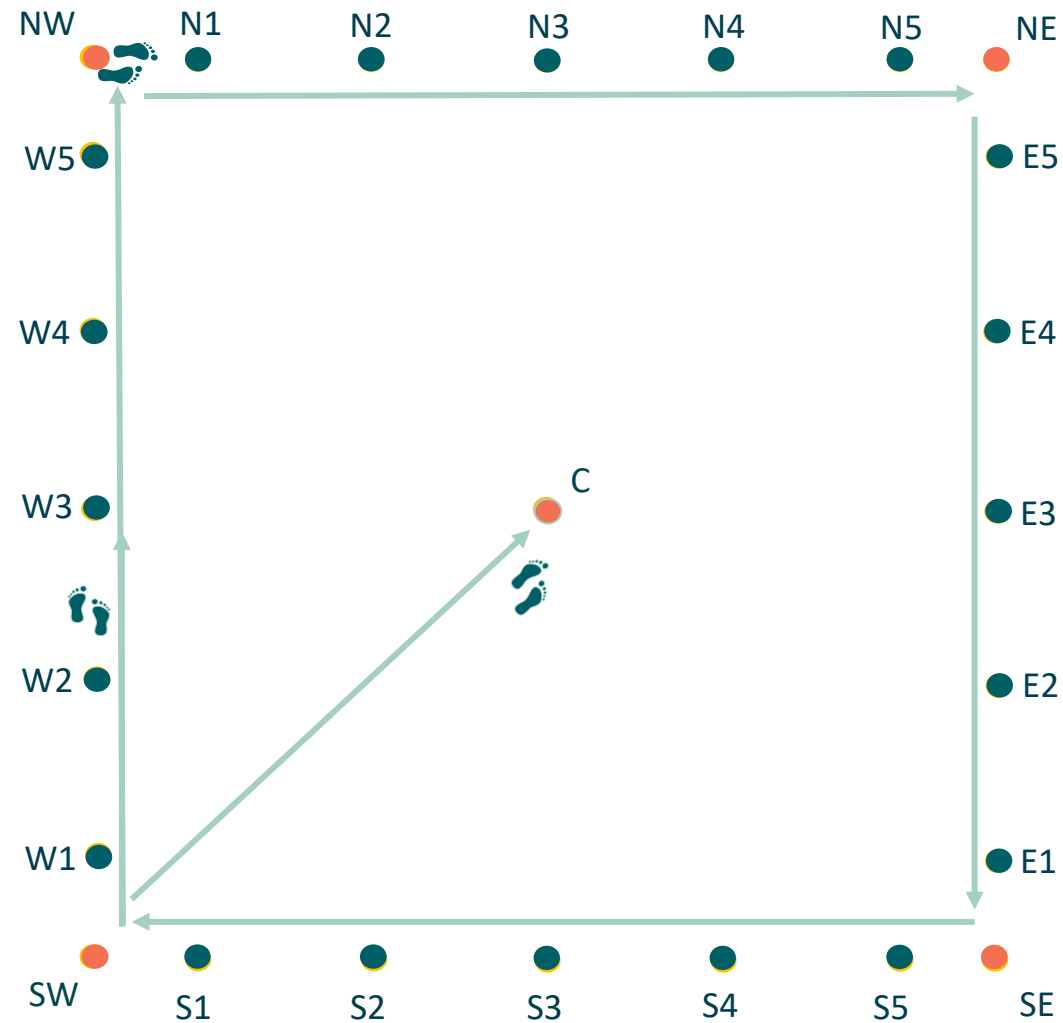




Plot Layout & Visit Protocol

Laying out the plot

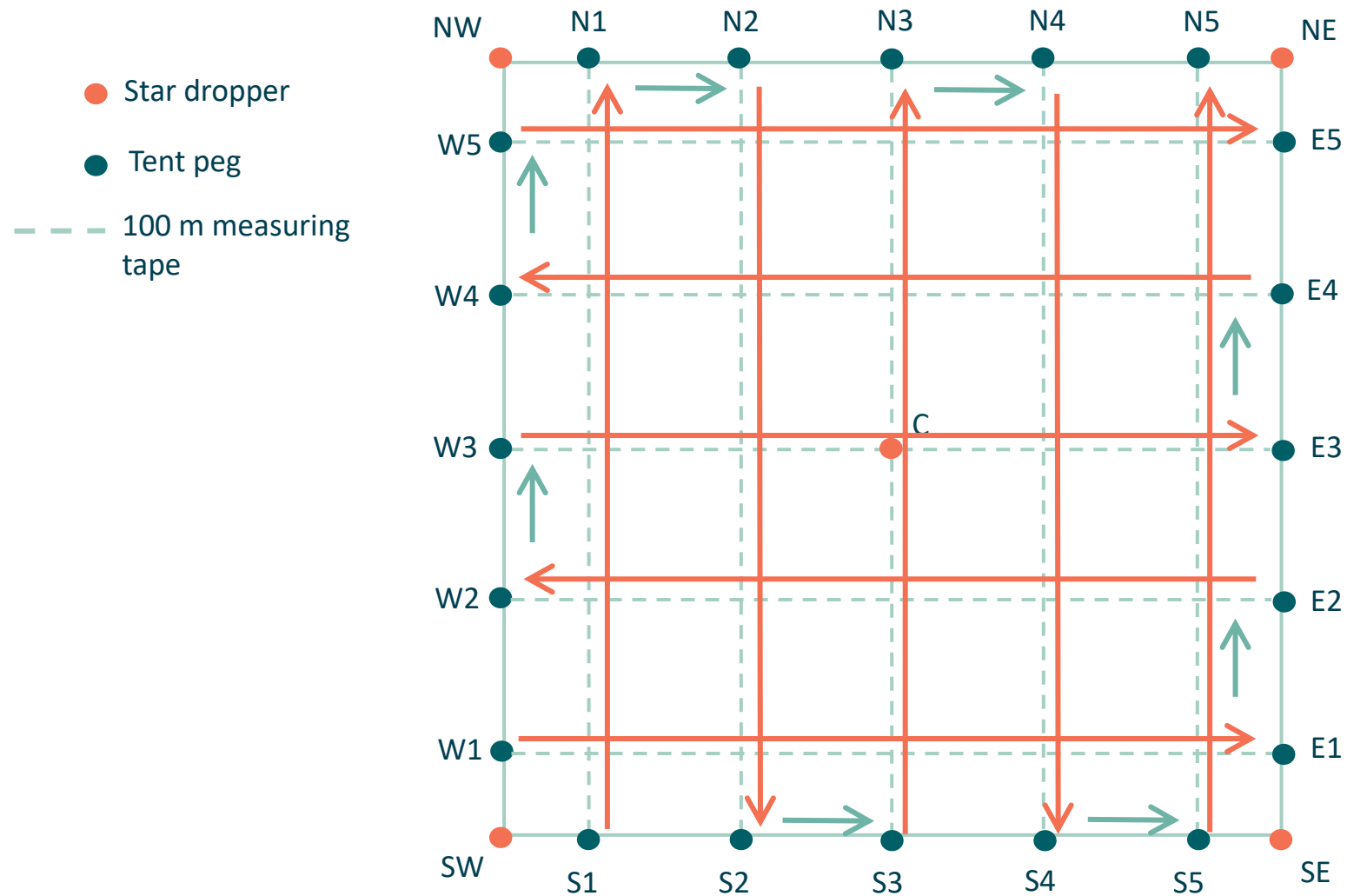
- Star dropper
- Tent peg





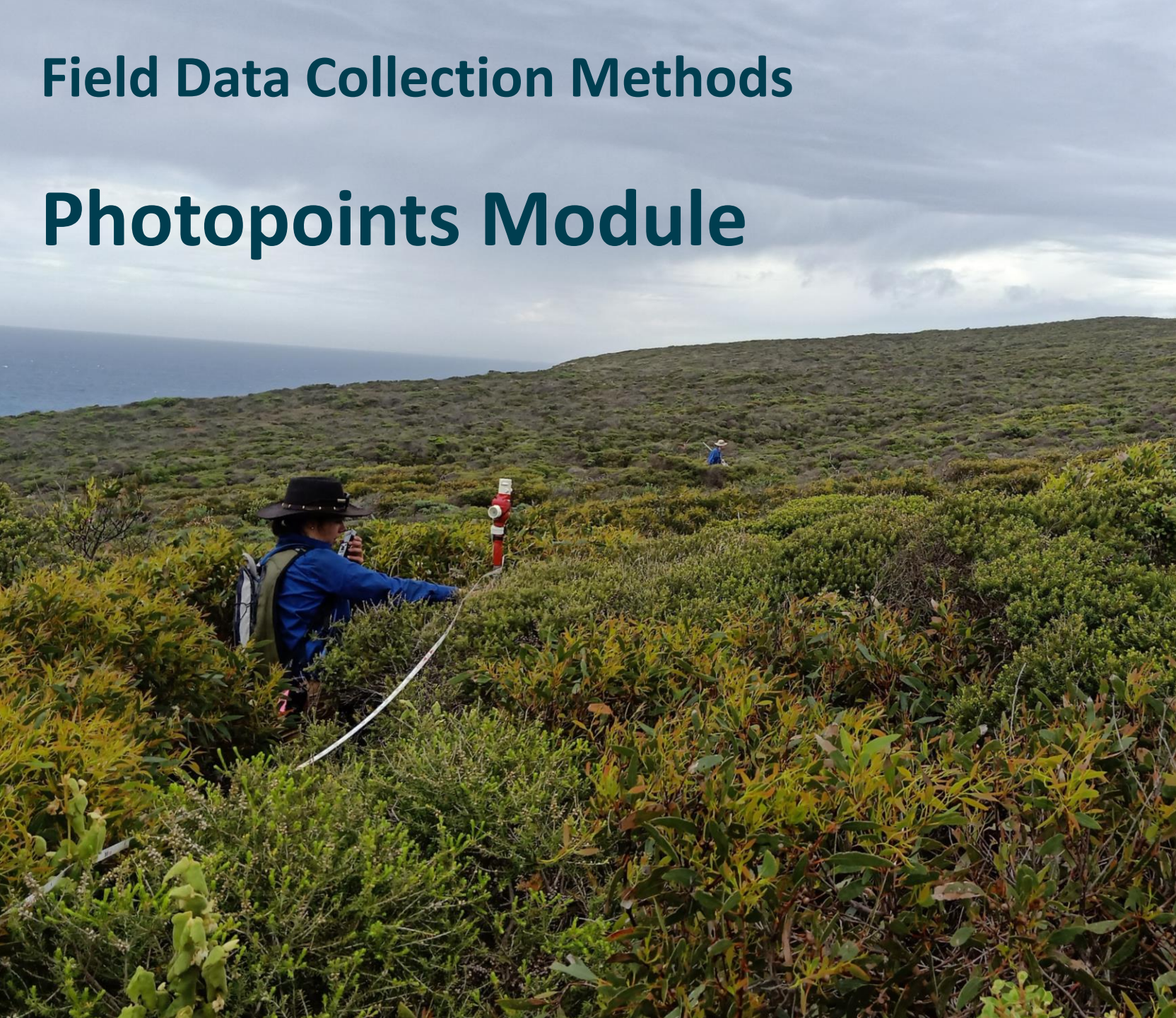
Plot Layout & Visit Protocol

Laying out the tapes



Field Data Collection Methods

Photopoints Module



Plot Selection
and Layout



Plot Description



Photopoints



Floristics



Plant tissue
vouchering



Cover



Fire severity



Basal Area



Invertebrates



Soils



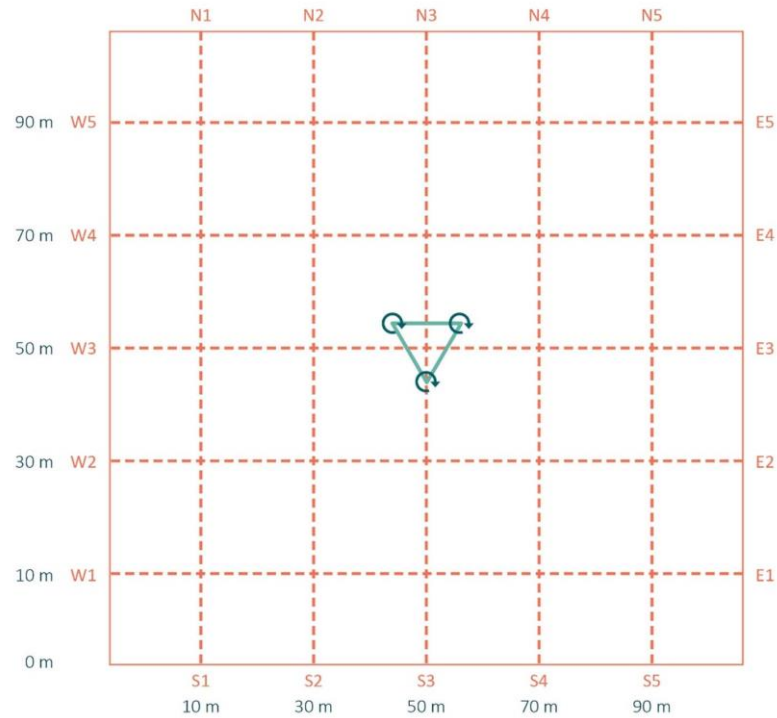
Photopoints Module

- + 360° panoramas captured using one of three protocols
 - + DSLR Panorama
 - + Compact Camera Panorama
 - + Device Panorama
 - + Visual reference recording environmental change over time
- + DSLR panorama data uses:
 - + Create 3D point clouds
 - + Estimate basal area & biomass

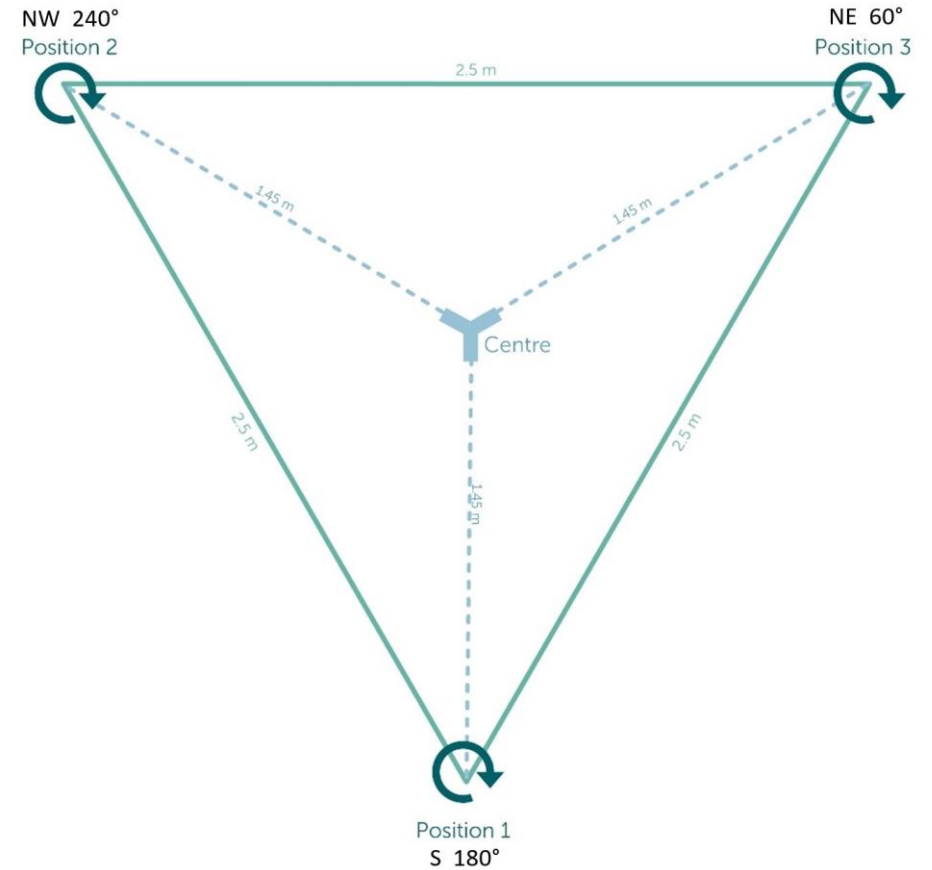




Photopoints Module



-  Photopoint position (indicative location/orientation)
-  Photopoint (indicative location)
-  Point-intercept transect
-  Core plot





Photopoints Panorama DSLR Protocol Equipment

- + Star dropper
- + Post driver
- + GNSS receiver
- + Short measuring tape
- + Tent peg
- + Tripod
- + DSLR camera
- + Monitor App
- + Electrical tape

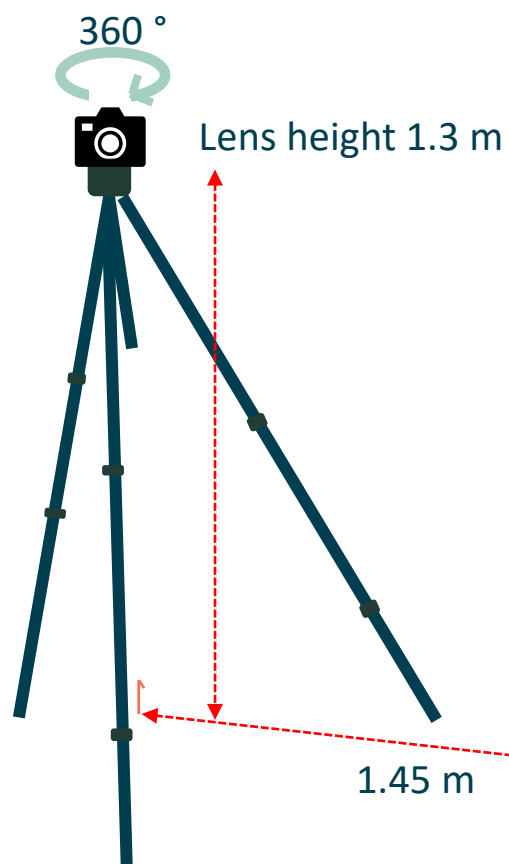




Photopoints Panorama DSLR protocol Survey Steps



**Panorama
Position 1**
south



permanent photopoint marker
(star dropper)

tape mark at 1.3 m

tape mark at 1.05 m

**Panorama
Position 2**
north-west

1.45 m

1.45 m

**Panorama
Position 3**
north-east

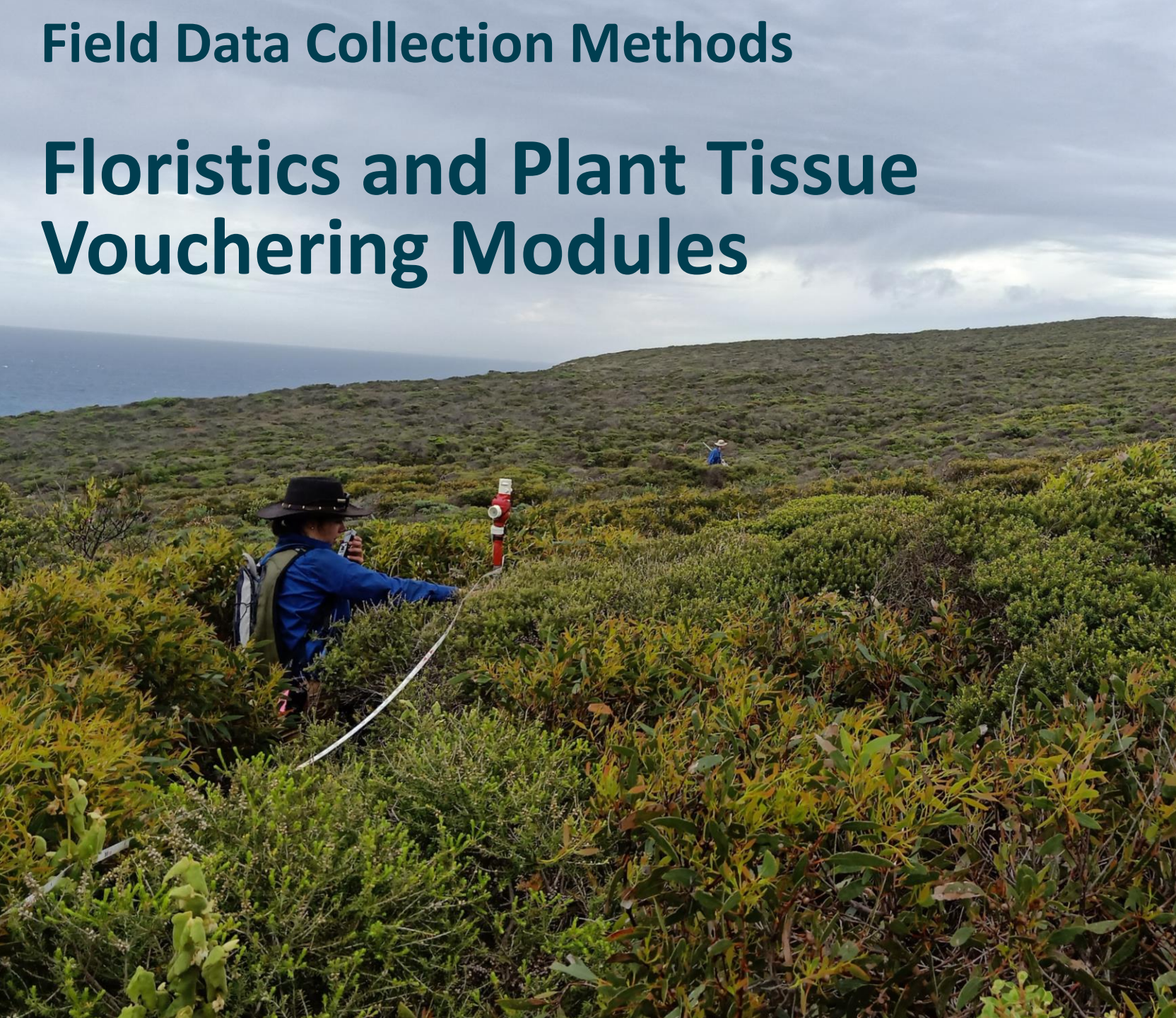


NE

NW

Field Data Collection Methods

Floristics and Plant Tissue Vouchering Modules



Plot Selection
and Layout



Plot Description



Photopoints



Floristics



Plant tissue
vouchering



Cover



Fire severity



Basal Area



Invertebrates



Soils



Floristics Module



- + Inventory species occurring in the plot
 - + Collect voucher specimens (enhanced protocol)
 - + Give all specimens a 'field name'
 - + Field names carry over to other protocols (e.g. Cover)
 - + Herbarium or EMSA-approved botanist to verify species names for all voucher specimens

- + Revisits (standard protocol)
 - + Photograph species already on the species list
 - + Only collect voucher specimens for new species

Floristics data uses:

- + Dated inventory of species
- + Presence/absence
- + Floristics descriptions





Floristics Module EMSA-approved Botanist

- + EMSA-approved botanists may verify species IDs in the place of herbarium-based botanist.
- + *Requirements to make flora species determinations in the Floristics Module (factsheet)*
- + *Application form to be recognised as an EMSA-approved Botanist*

OFFICIAL: Sensitive Personal-Privacy

EMSA

Ecological Monitoring System Australia Application form to be recognised as an EMSA-approved Botanist

Overview

- Read this application form in unison with the information sheet Ecological Monitoring System Australia: Requirements to make flora species determinations in the Floristics module.

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EMSA

Ecological Monitoring System Australia Requirements to make flora species determinations in the Floristics module

Overview

The Ecological Monitoring System Australia, EISA, is a set of nationally standardised survey modules and data systems aimed at improving the collection, management and storage of ecological field data. This includes:

- a manual detailing comprehensive instructions for a range of ecological field survey modules
- a field data collection app, called iMonitor
- a centralised data management and storage system – the Australian Government's Biodiversity Data Repository (BDR).

This information sheet provides details on who can determine species identifications in the Floristics module.

The EISA Floristics module includes two protocols to record flora species composition within a core, 1 ha, monitoring plot:

- Enhanced protocol** – plant specimen vouchers collected for all species present in a plot for identification by a relevant state/territory herbarium or EISA-approved Botanist.
- Standard protocol** – plant specimen vouchers for a subset of the species (new, unknown, important, contentious and/or threatened species) present in a plot for identification by the relevant herbarium or EISA-approved Botanist. Field botanist identification and plant photo vouchers are collected for the remaining species.

The enhanced protocol is always recommended the first time the plot is surveyed by ecologists and field botanists, and field names and field numbers are then provided to the relevant herbaria (typically for identification by their taxonomist/s (Herbaria Taxonomist), or to a taxonomist for the plot, ideally covering the project. Subsequent surveys may use the standard protocol, again for the same species, but they can assign species determinations to the same as a species detected previously and determined by the herbarium. However, if 'new' species are collected, i.e. species not previously recorded, or contentious species (difficult to identify/undergoing revision), or threatened species, then those vouchers must be provided to the relevant herbarium or EISA-approved Botanist.

EMSA Floristics module	
Enhanced protocol – all vouchers	
"Preferred recommendation, especially for 1st time surveys"	
Standard protocol – vouchers of new, unknown, important, contentious and/or threatened species	
Standard protocol – vouchers of species previously recorded during a survey using the enhanced protocol, and previously determined by an EISA-approved Botanist	
Standard protocol – vouchers of easily identifiable species that cannot be confused with any other species	

1

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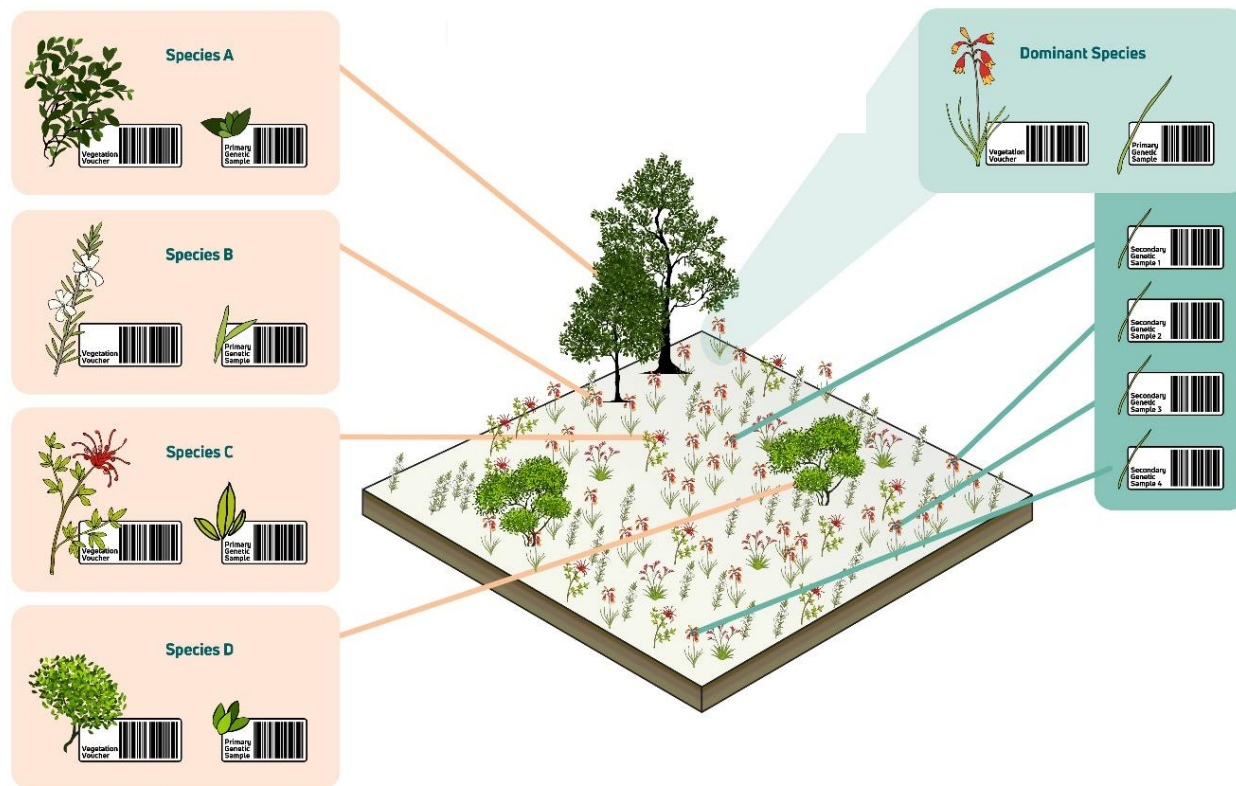
	Self-assessed points
Enhanced protocol – all vouchers	[]
Standard protocol – vouchers of new, unknown, important, contentious and/or threatened species	[]
Standard protocol – vouchers of species previously recorded during a survey using the enhanced protocol, and previously determined by an EISA-approved Botanist	[]
Standard protocol – vouchers of easily identifiable species that cannot be confused with any other species	[]





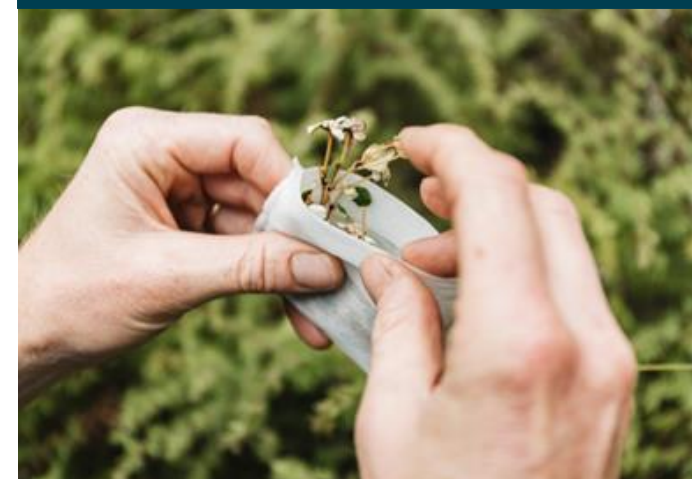
Plant Tissue Vouchering Module

- + Collect, dry and store plant tissue vouchers from within the plot
- + Replicate collections for dominant species from each stratum



Plant tissue voucher uses:

- + Molecular analysis including:
 - + DNA Barcoding
 - + Population genetics
 - + Stable isotope
 - + Leaf trait analyses
- + Accurate species ID
- + Identify genetically important populations.





Floristics & Plant Tissue Vouchering Enhanced Collection Equipment

- + Secateurs
- + Trowel
- + Day press (cardboard & paper)
- + Small book press
- + Paper envelopes
- + Telescopic pruners
- + Throw rope
- + Camera (phone is okay)
- + Satchel bag (to hold equipment)





Floristics & Plant Tissue Vouchering Enhanced Protocol Collection Steps

- + Collect voucher specimens for all species on the plot
- + Collect specimens that:
 - + Representative of the population
 - + Include distinguishing ID features (flowers and seeds etc.)
 - + Are fertile (if possible)
 - + Have above and below ground structures (forbs)
- + Voucher specimens are pressed and dried.
 - + Collect into a day press on the plot
 - + Transfer into a field press when barcoding and naming.
 - + Photographs may be taken and entered into the Monitor app to accompany the pressed specimen





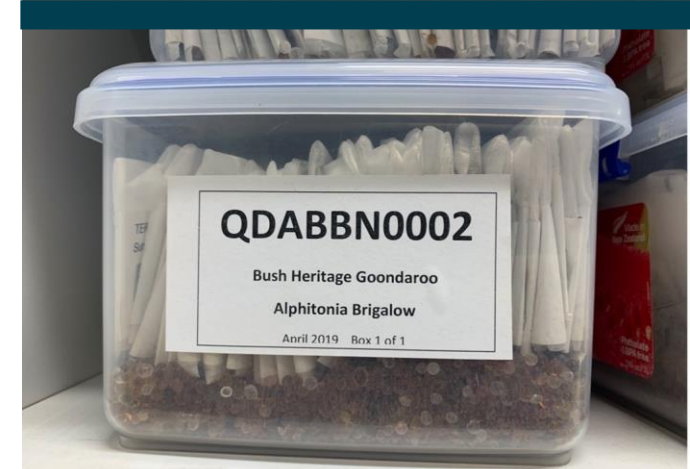
Floristics & Plant Tissue Vouchering Enhanced Protocol Collection Steps





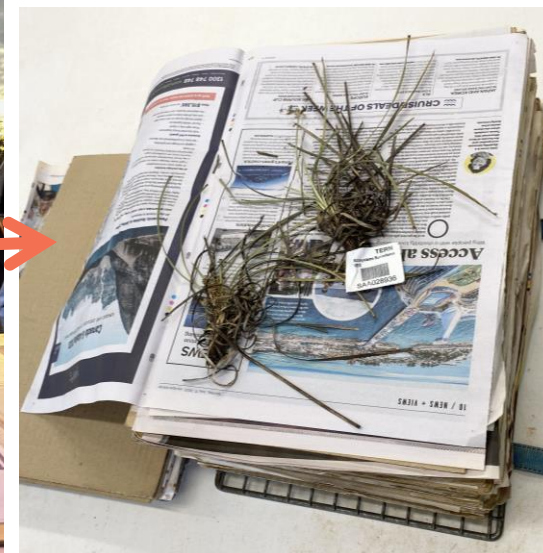
Floristics & Plant Tissue Vouchering Equipment

- + Collected plant specimens
- + Barcodes
- + Field press (paper & cardboard)
- + Secateurs
- + Monitor app
- + Teabags
- + Sistema container with silica beads





Floristics Enhanced Protocols Processing Steps





Floristics Enhanced Protocol App fields

- + Field Name*
- + Growth form*
- + Habit
- + Phenology
- + Photo/s

Monitor (Lat: -34.97, Lng: 138.64, Alt: n/a)

staging - 1.0.10-RC6 - for test use only ?

- ✓ Floristics survey - Enhanced (start)
- ✎ Floristics voucher - Enhanced

Floristics voucher - Enhanced

Floristics Veg Voucher Full 1

FLORISTICS PLANT TISSUE PHOTO

Field Name *
Acacia pycnantha [Species] ✕ ?

Label format: Canonical Name [taxon rank]

Voucher Barcode *

EDIT BARCODE

☐ Manual Barcode Entry

Saved barcode: TestBarcode001 ✕

Growth Form 1 *
Shrub ✕ i

Growth Form 2 ✕ i

Record if more than one growth form is present in the plot.

Habit
Erect ✕ i

Phenology
Flowers ✕ Buds ✕ Leaf ✕ i



Floristics Module

Field name conventions

- + Use a field name if you can't confidently identify a plant to species level.
- + Be descriptive and use clear botanical language where possible.
- + Consider who else may be referring to Floristics vouchers during their surveys

How useful are these field names?

- + Wattle 1
- + Yellow flower, prickly
- + *A. para*
- + Kangaroo thorn
- + Acacia, spiny, flowers on peduncle
- + *Acacia paradoxa*

Monitor (Lat: -34.97, Long: 138.64)

staging - - for test use only ?

Floristics voucher - Enhanced

1 ^

Field Name *

Acacia paradoxa, spiny, flower on peduncle

Voucher Barcode *

Barcode *

EN0002

Format: AAA12378

Retype Barcode *

EN0002

RECORD BARCODE

Saved barcode: EN0002

Growth Form 1 *

Shrub

Habit

Erect

Phenology

Leaf Flowers Fertile

Adult Fruit



VicFlora: Geoff Lay



VicFlora: Ian Clarke



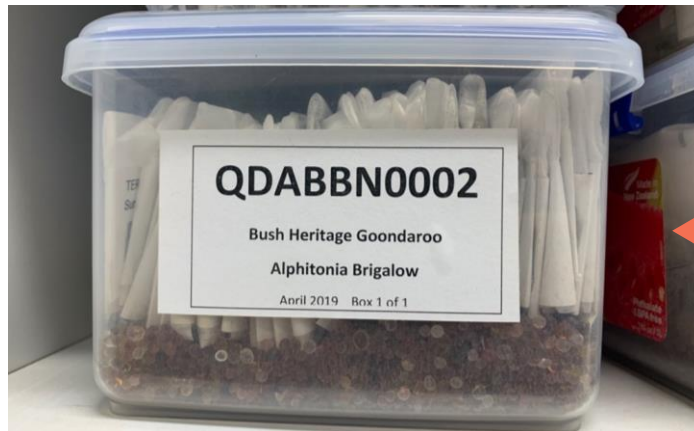
VicFlora: Neil Blair



VicFlora: Lorraine Jansen

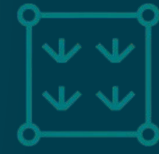


Plant Tissue Vouchering Enhanced Protocols Processing Steps



Field Data Collection Methods

Cover & Fire Severity Modules



Plot Selection
and Layout



Plot Description



Photopoints



Floristics



Plant tissue
vouchering



Cover



Fire severity



Basal Area



Invertebrates



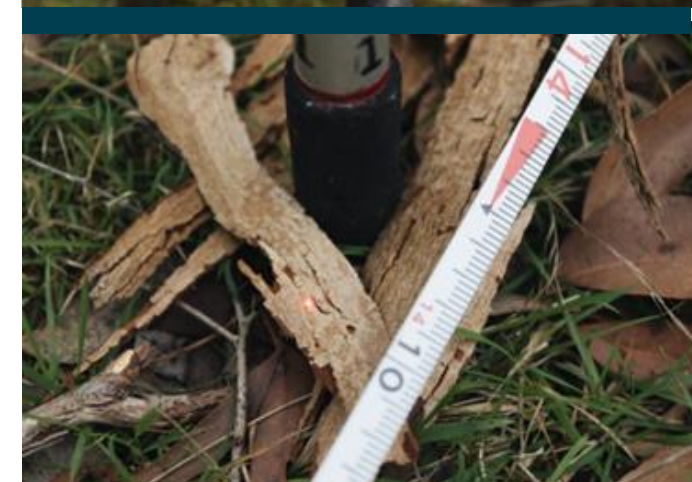
Soils



Cover Module



- + Requires Floristics vouchers
 - + Record substrate and vegetation cover
 - + **Enhanced protocol**
 - + Records the substrate, vegetation and vegetation height at 1010 points across a plot
 - + **Standard protocol**
 - + Has a smaller samples size (404 points)
 - + Collects fractional cover
 - + Classifies vegetation as photosynthetic or non photosynthetic
- + Cover data uses:
 - + Estimate cover and species richness
 - + Estimate habitat structure and composition
 - + Vegetation classification (contributes to NVIS Level 5)
 - + Remote sensing validation





Fire Severity Module

- + Additional attributes measured during Cover - point intercept surveys
- + Record if the vegetation intercepted is scorched or charred and if there is resprouting
- + Record the maximum height of tree fire scars at 4 locations in the plot
- + Requires Floristics vouchers

- + Fire severity data uses:

- + Fire severity monitoring and mapping
- + To plan and assess prescribed burns
- + Calibrate and validate UAV fire severity products





Cover & Fire Severity Enhanced Protocols Equipment

- + Densitometer
- + Laser pointer
- + Staff with graduate measurements
- + Voice recorder
- + 100 m measuring tape
- + Tent pegs



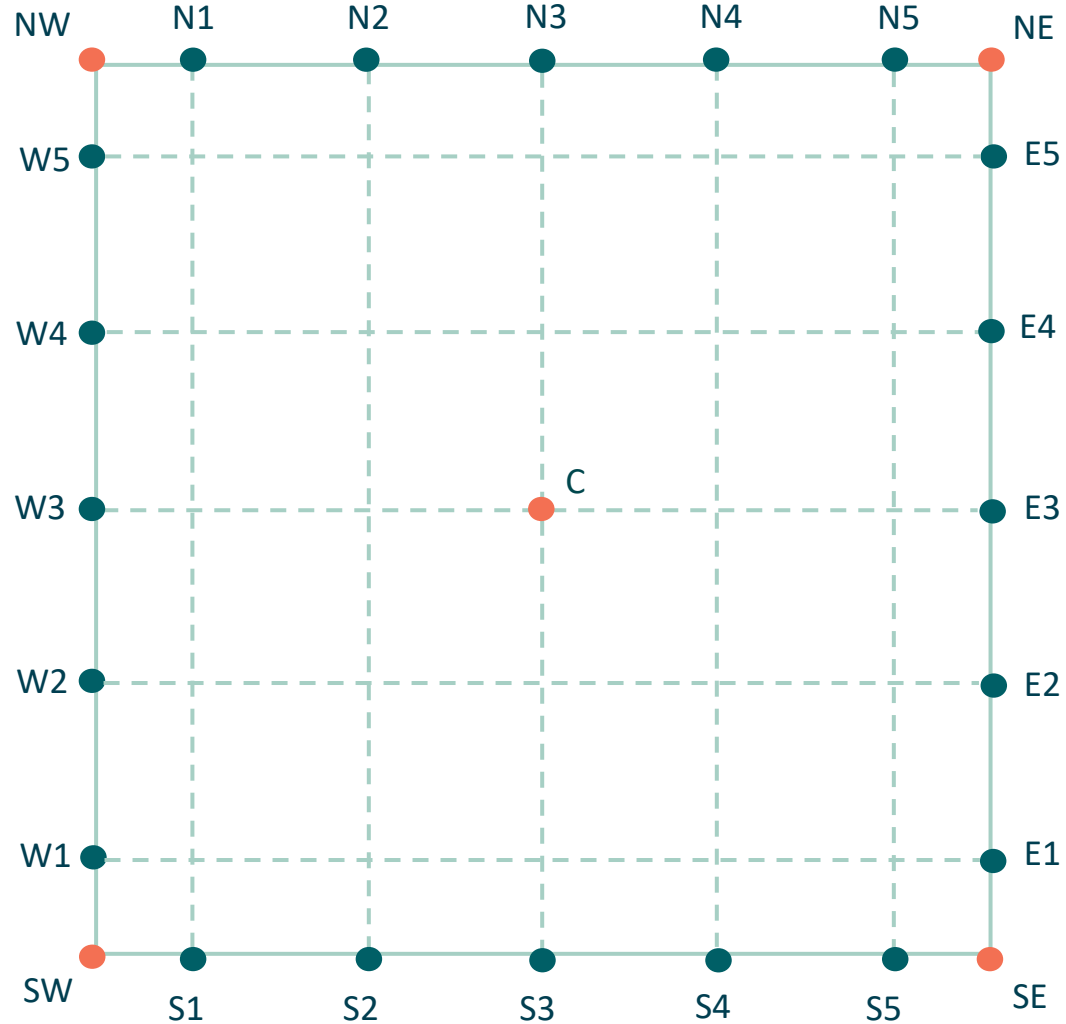


Cover & Fire Severity Enhanced Protocols Survey Steps

● Star dropper

● Tent peg

— — — 100 m measuring
tape





Cover & Fire Severity Enhanced Protocol Survey Steps

At every metre along the transect record the:

- + Substrate
- + Species intercepted
- + Height of intercept





Cover & Fire Severity Enhanced Protocols

Point Intercept - Substrate



Bare



Crypto



Litter



CWD



Gravel



Rock



Outcrop



Lichen on rock



Lichen on outcrop



Water



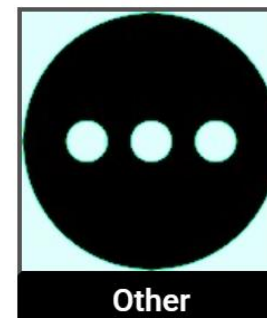
Black ash



White ash



Unknown



Other



Not Collected



Cover & Fire Severity Enhanced Protocol

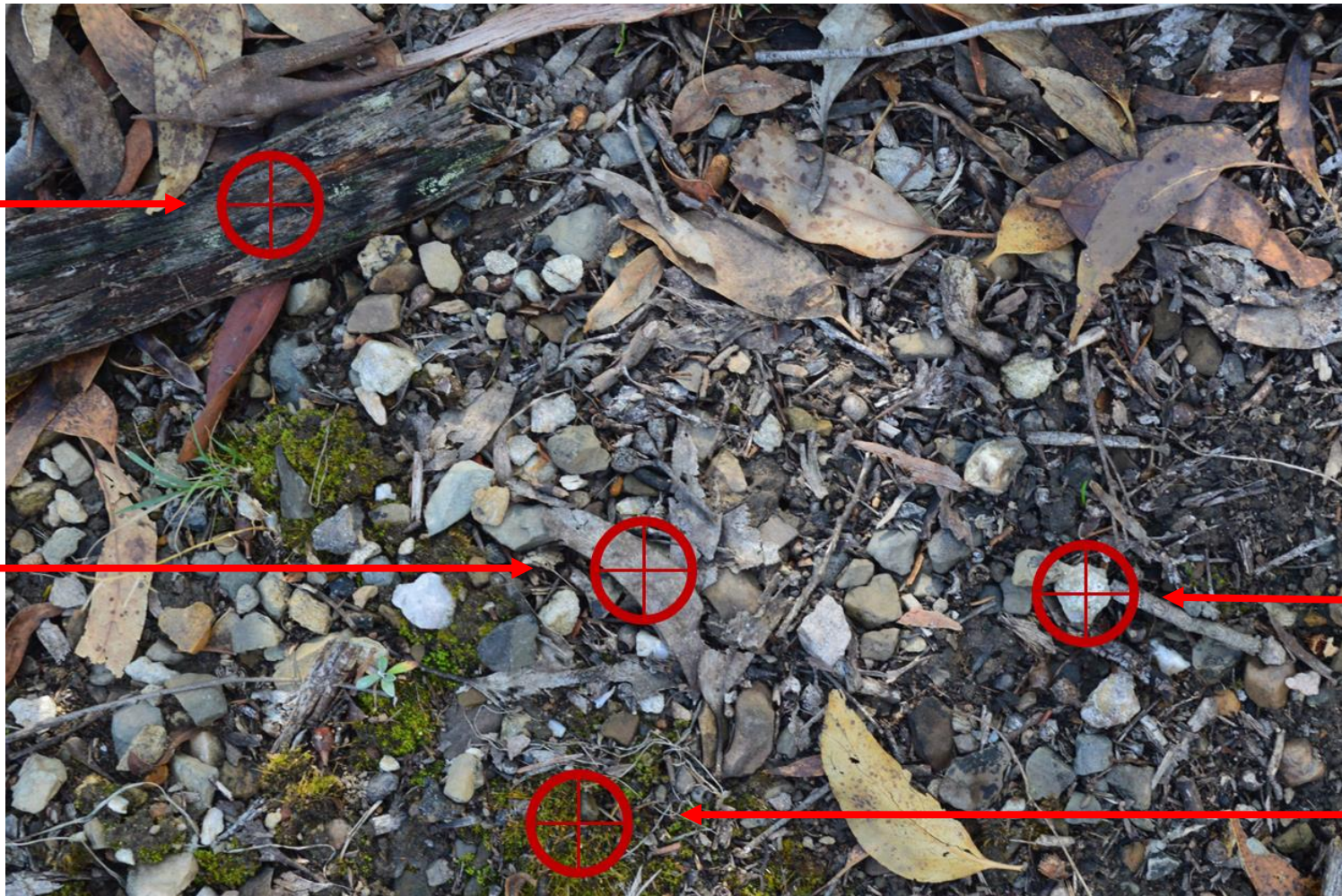
Point Intercept - Substrate

Coarse Woody Debris

Leaf Litter

Gravel

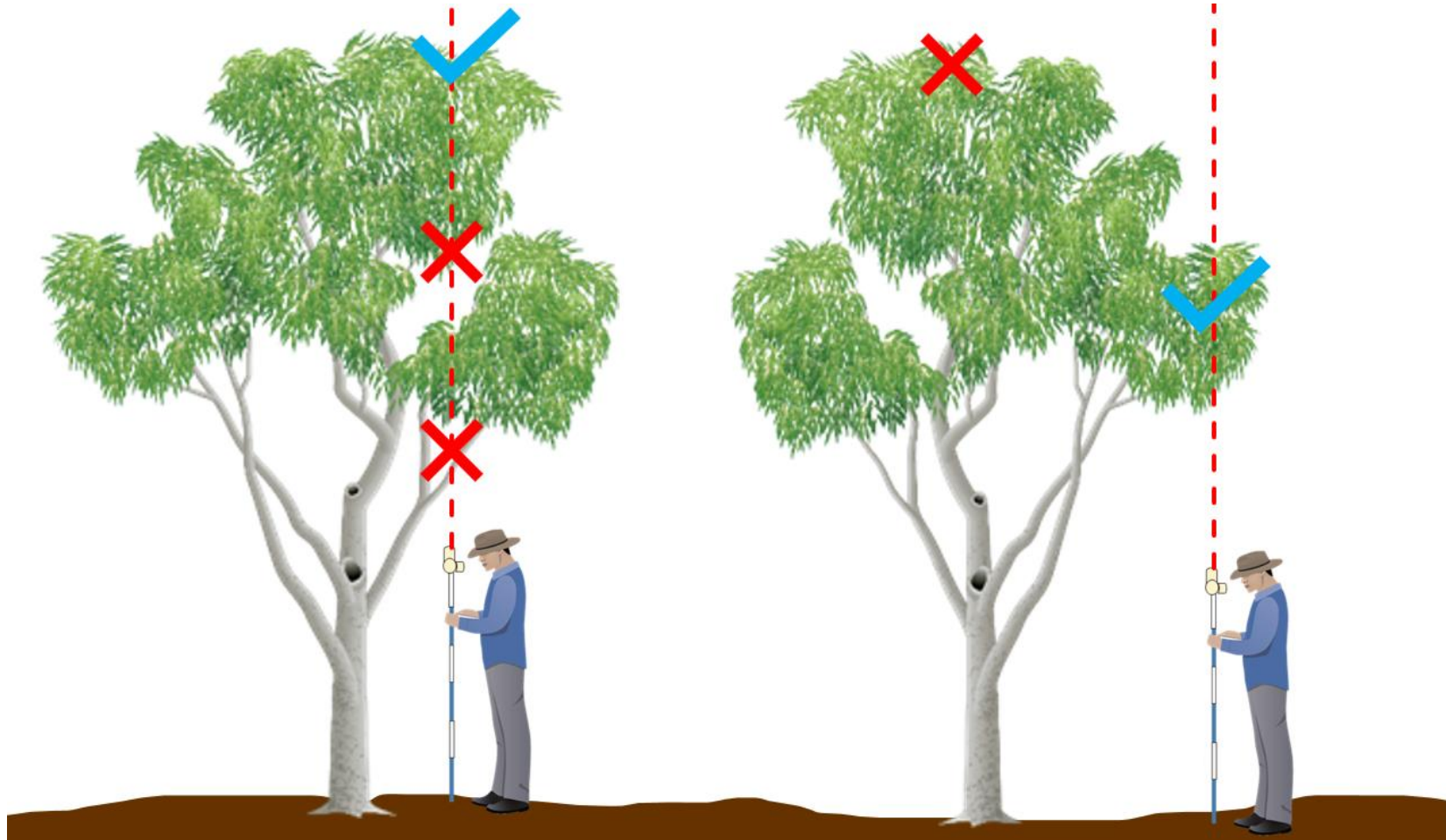
Cryptogam

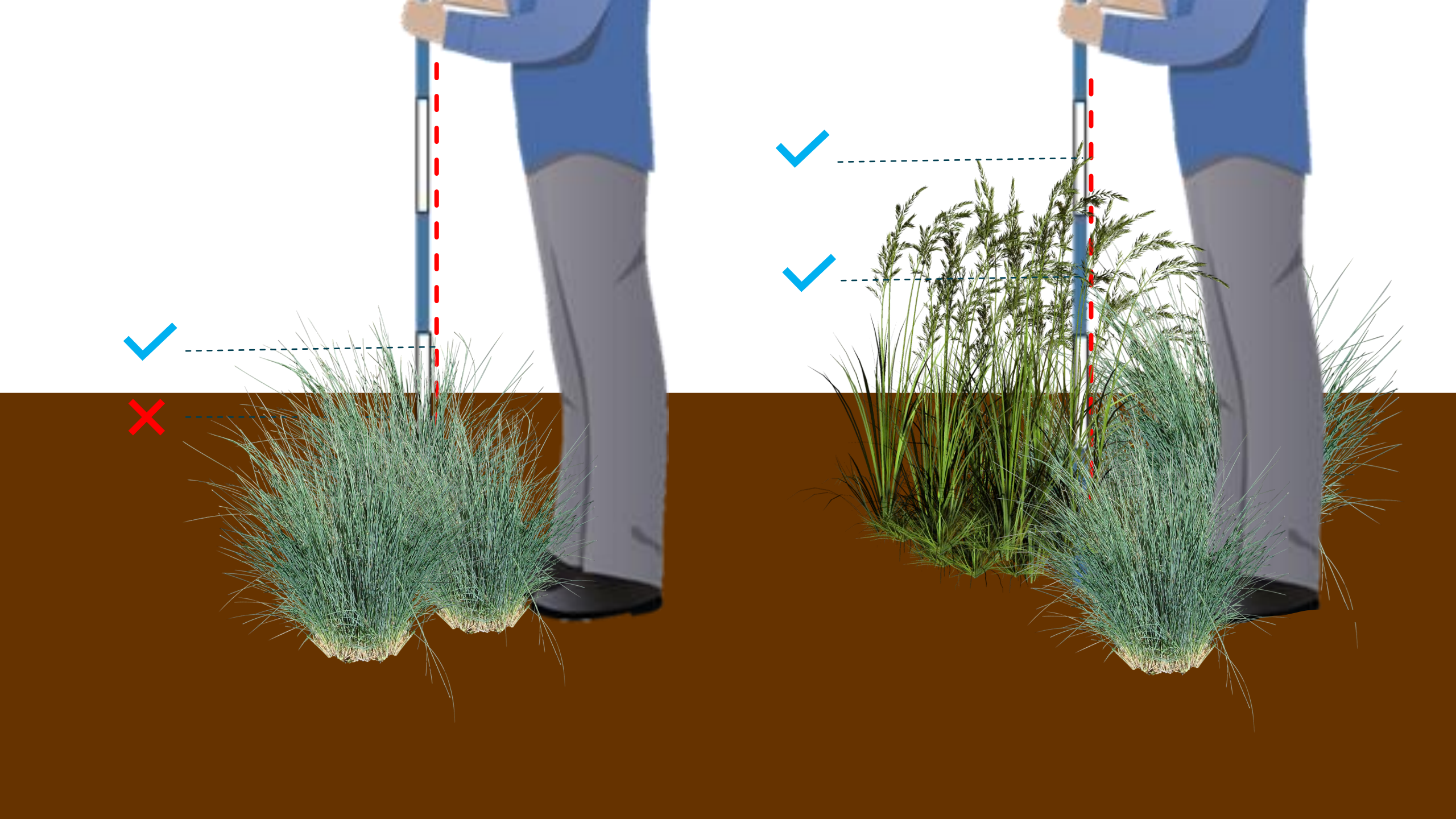




Cover & Fire Severity Enhanced Protocols

Point Intercept – Intercept Height







Cover & Fire Severity Enhanced Protocol Point Intercept – In-canopy Sky



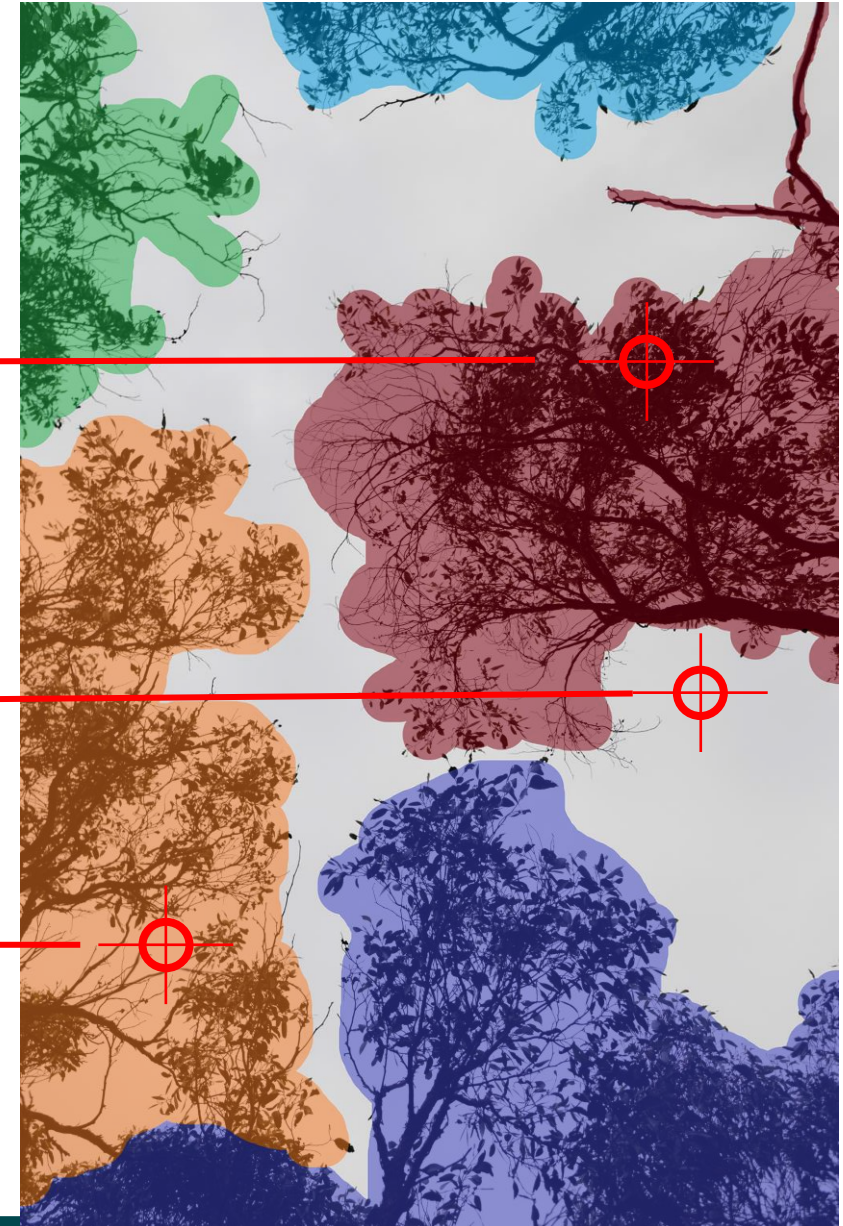
Record:

- + Floristics voucher*
- + Estimated height of intercept*

No record

Record:

- ☒ In canopy sky
- + Floristics voucher*
- + Estimated height of surrounding canopy*



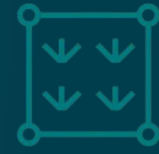
An intercept for
Eucalyptus sp.

“In Canopy Sky” for
Eucalyptus sp.



Field Data Collection Methods

Plot Description Module



Plot Selection
and Layout



Plot Description



Photopoints



Floristics



Plant tissue
vouchering



Cover



Fire severity



Basal Area



Invertebrates

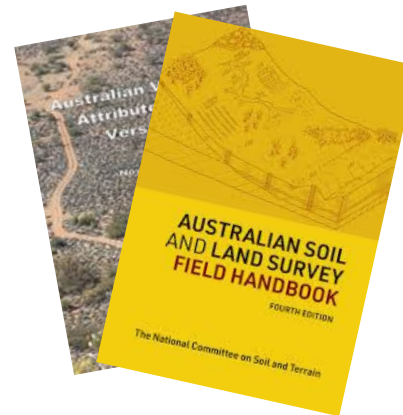


Soils



Plot Description Module

- + Physical description of the plot
- + Provides context for the data collected
- + Standard terminology for describing the physical characteristics of the plot
 - + The National Vegetation Information System (NVIS)
 - + Australian Soil and Land Field Survey Handbook (Yellow Book).
- + Revisits capture change in vegetation
 - + Physical disturbance like fire, flood, grazing etc.
 - + Ecological change such as flowering, fruiting, die back, recruitment etc.



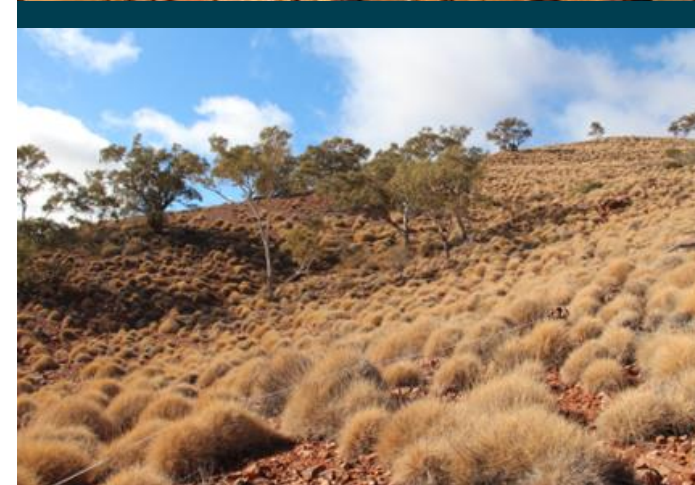


Plot Description Enhanced Protocol

Landscape Observations

- + Plot Description puts the plot and surveys in context within the landscape.
- + Observations within a representative area of the plot:
 - + Slope*
 - + Aspect*
 - + Relief*
 - + Landform element*
 - + Outcrop Lithology
 - + Coarse Fragment Lithology
- + Observations of the surrounding landscape ~300 m radius:
 - + Modal slope*
 - + Landform pattern*

* Required field





Plot Description Protocol Flora Observations

- + Structural formation*
- + Growth stage* (community)
- + Plant species life stage
- + Site disturbance
- + Impact of introduced plants
- + Site disturbance
- + Nearest infrastructure
- + Land Use

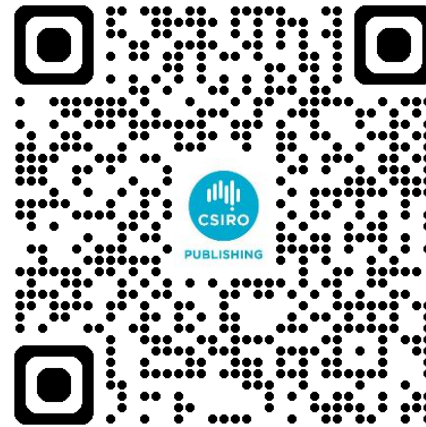
* Required field





Plot Description Protocols Equipment

- + Monitor app
- + Clinometer (or another instrument for measuring slope)
- + Australian Soil and Land Survey handbook (Yellow Book)



Yellow Book download from
CSIRO Publishing



Structural summary

Data collected in the Floristics and Cover protocols provides:

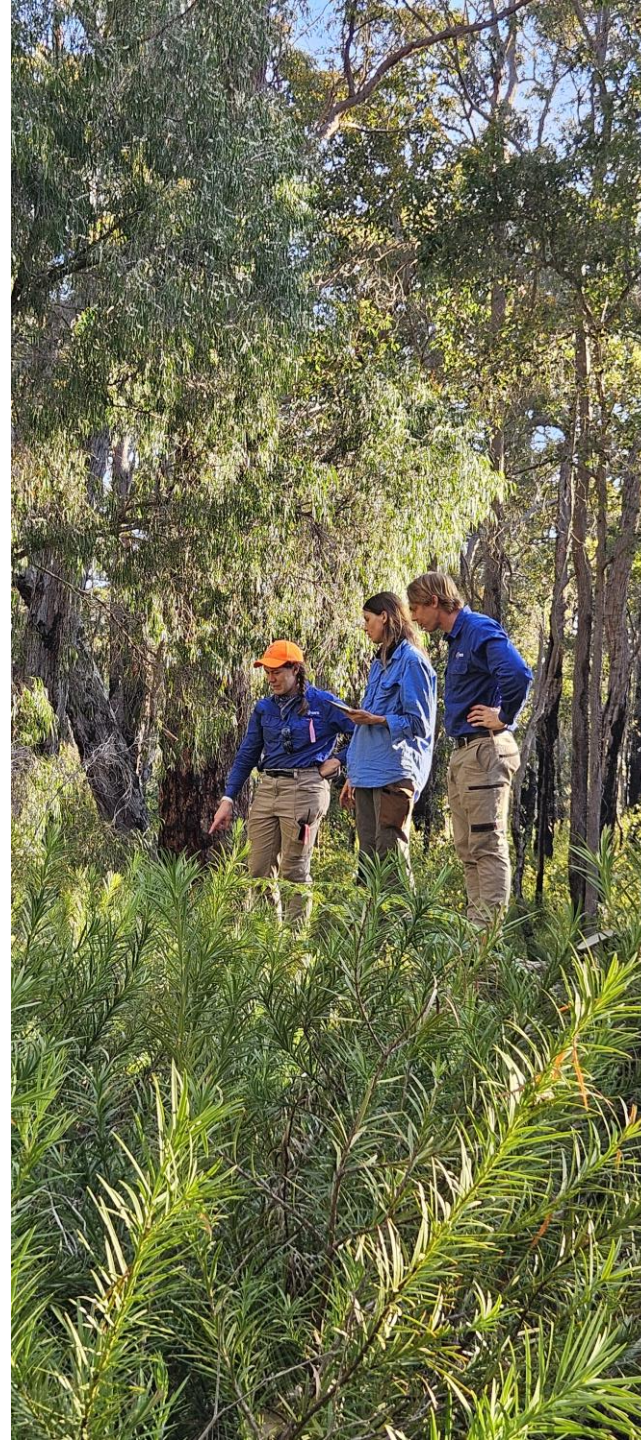
- + Species names
- + Growth form
- + Point intercepts (for species and substrate)

Floristics and Cover protocols don't collect

- + Average height of stratum (so we record this in the Plot Description module)

Can derive:

- + Cover (per species and per stratum across the plot)
- + Vegetation Association (NVIS Level)

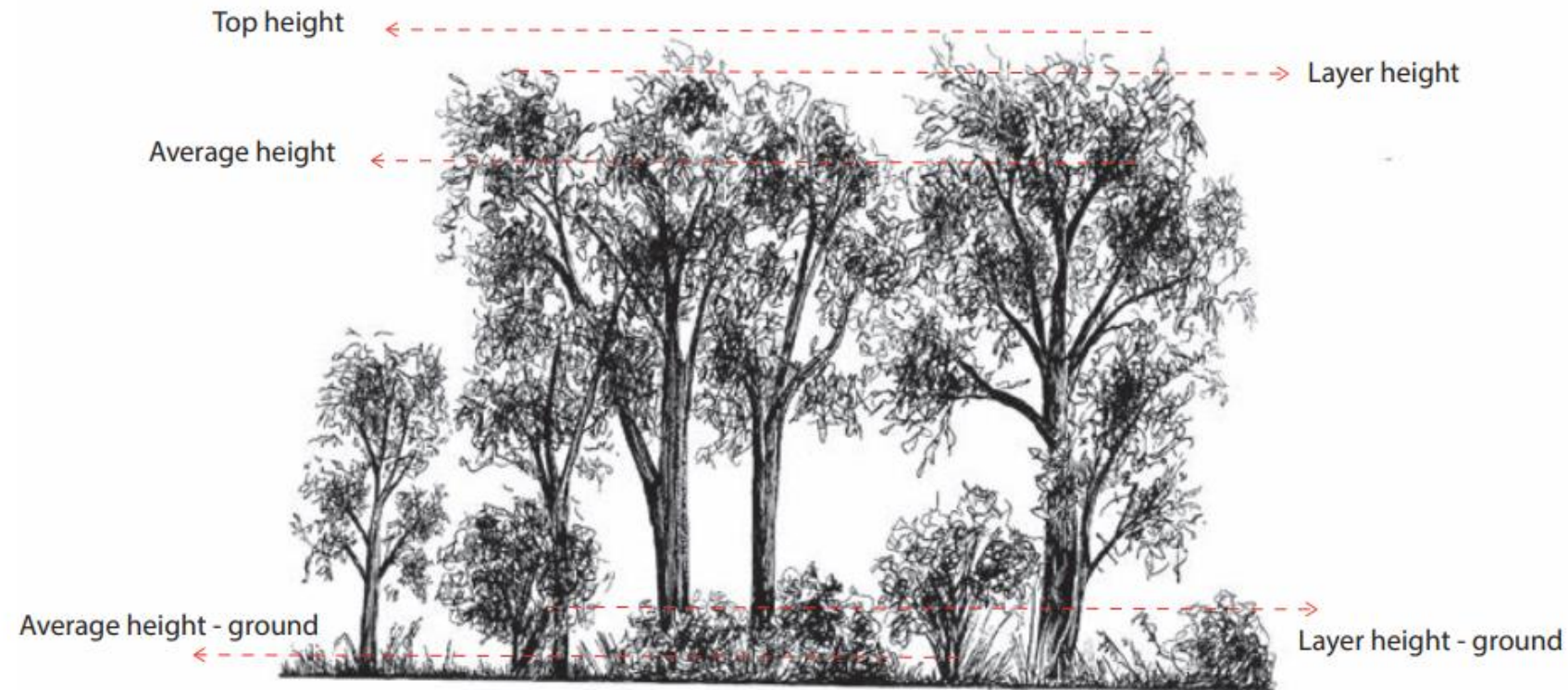


Structural summary

NVIS Level 5 – Vegetation Association

Vegetation attributes for species in the upper, mid and ground stratum with foliage projective cover $\geq 5\%$

- + Stratum
- + Growth form
- + **Average** height
- + Foliage projective **cover**



Emergent Layer

Acacia estrophiolata – 1

Upper Layer

Acacia aneura - 1

Acacia estrophiolata – 2

Hakea divricata - 3

Mid Layer

Senna artemisoides

ssp. filifolia - 1

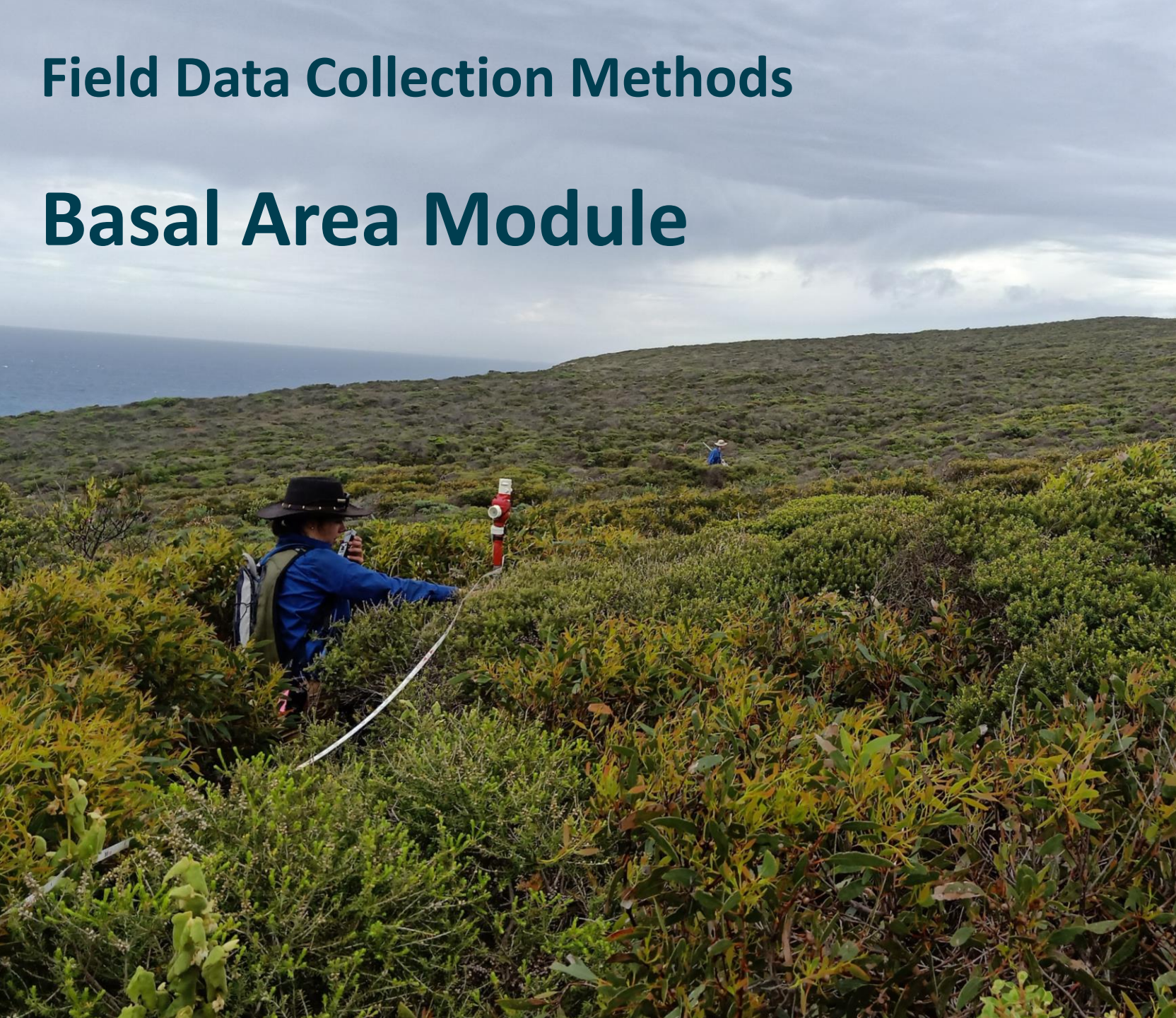
Ground Layer

Cenchrus ciliaris - 1



Field Data Collection Methods

Basal Area Module



Plot Selection
and Layout



Plot Description



Photopoints



Floristics



Plant tissue
vouchering



Cover



Fire severity



Basal Area



Invertebrates



Soils



Basal Area Module

- + Requires Floristics vouchers
 - + Measures the average area within the plot occupied by trees
 - + Provides information on stand density.
 - + **DBH Protocol**
 - + Plot sampling
 - + Measure DBH for all trees within 40 x 40 m or 100 x 100 m area
 - + **Basal Wedge Protocol**
 - + Point sampling, rapid assessment
 - + Using handheld gauge (basal wedge)
- + Basal area data uses:
 - + To monitor tree growth
 - + To calculate tree biomass and carbon sequestration (using allometric equations)





Basal Wedge Protocol Equipment

+ Basal Wedge

+ Monitor App



Basal Wedge Observation

Basal Wedge Observation 1

Basal Sweep Sampling Point *

☐ No Species To Record

Basal Wedge Sweep

Basal Wedge Sweep 1

☐ Group Species

Floristics Voucher *

Select one or many vouchers

Basal Area Factor *

Select the basal area factor (BAF) aperture that will allow for at least seven trees to be counted 'in'

In Trees *

Trees where the trunk or stem at breast height (1.3 m above ground level) is wider than the aperture of the BAF used on a TERN Basal Wedge.

Borderline Trees *

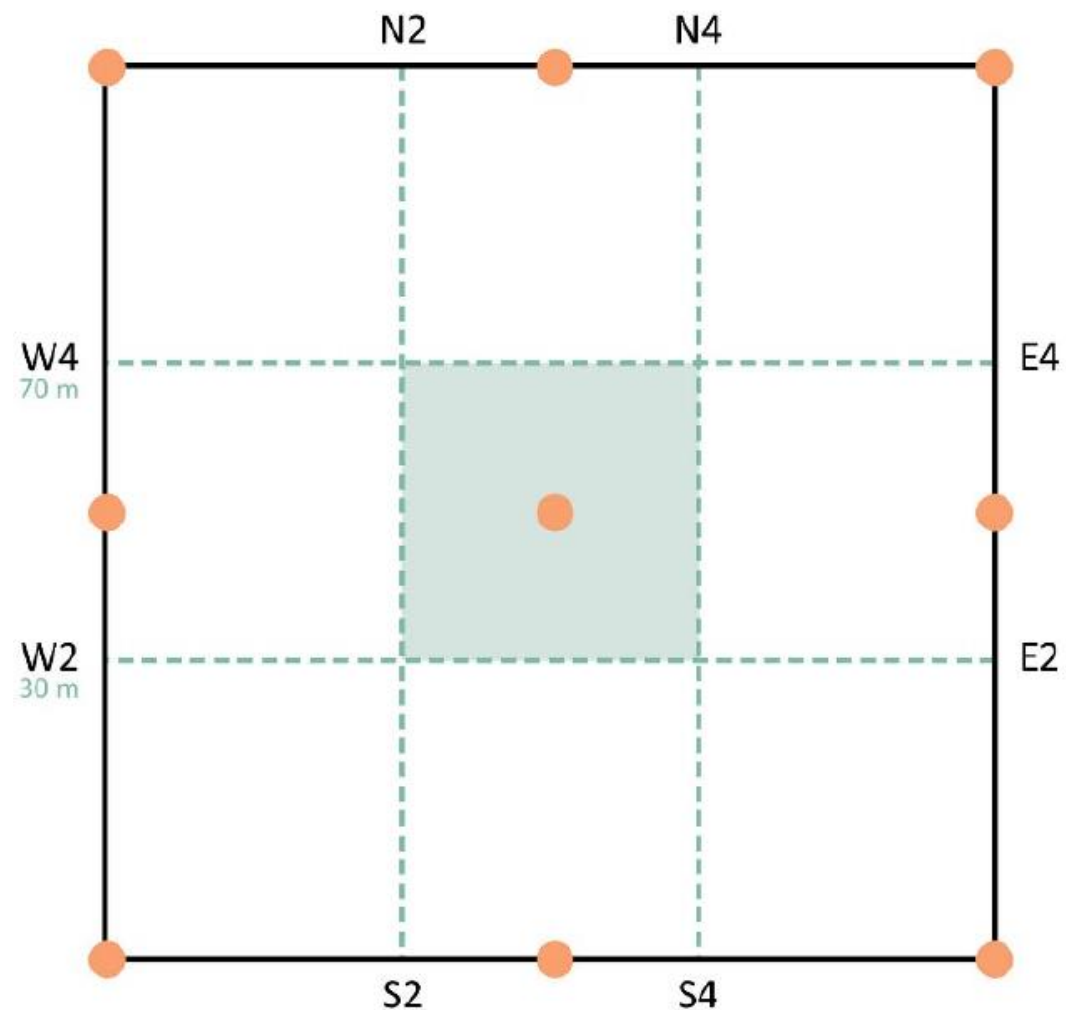
Trees where the trunk or stem at breast height (1.3 m above ground level) is the exact width of the aperture of the BAF used on a TERN Basal Wedge.

SAVE BASAL WEDGE SWEEP 1

ADD BASAL WEDGE SWEEP



Basal Wedge Protocol Survey Steps



- Condition point intercept
- 40 x 40 m sub-plot
- 100 x 100 m core monitoring plot
- Basal wedge sampling location



Basal Wedge Protocol Survey Steps

Record:

- + Basal Wedge aperture
- + Tree species
- + Number of 'in hits'



'in' (+1)



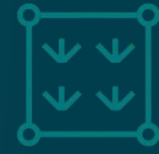
'borderline' (+0.5)



'out' (0)

Field Data Collection Methods

Invertebrate Fauna Module



Plot Selection
and Layout



Plot Description



Photopoints



Floristics



Plant tissue
vouchering



Cover



Fire severity



Basal Area



Invertebrates



Soils



Invertebrate Fauna Module

- + 5 protocols for collecting invertebrate species
- + The protocols target different insect types
 - + Wet pitfall trapping
 - + Rapid ground trapping
 - + Malaise trapping
 - + Pan trapping
 - + Active search
- + TERN Plots use the Rapid ground trapping protocol for ant collection





Rapid Ground Trapping Protocol Equipment

- + Bait – honey & cat food
- + Plastic vials with screw top lids
- + 95% ethanol
- + Cotton buds
- + Flagging tape



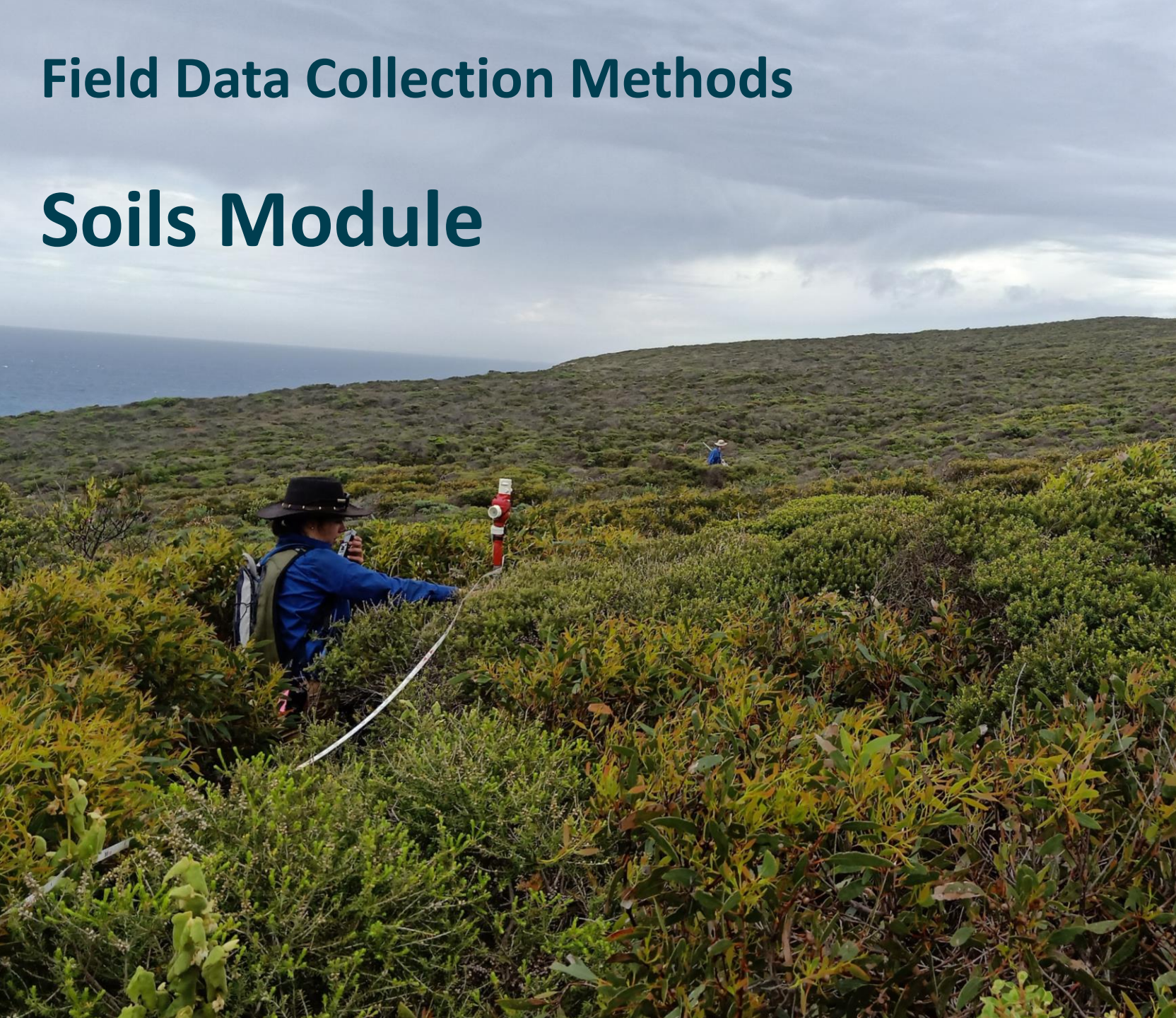


Rapid Ground Trapping Protocol Survey steps



Field Data Collection Methods

Soils Module



Plot Selection
and Layout



Plot Description



Photopoints



Floristics



Plant tissue
vouchering



Cover



Fire severity



Basal Area



Invertebrates



Soils

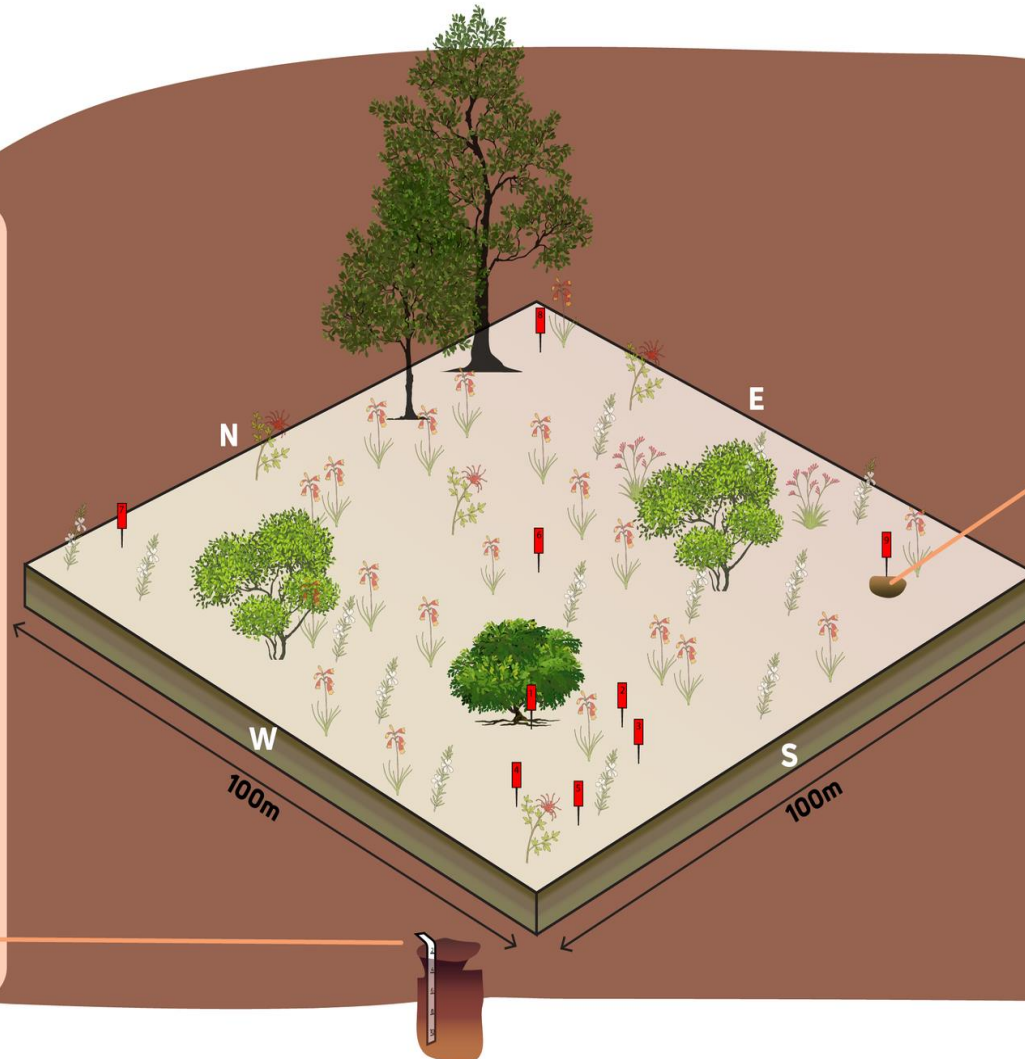
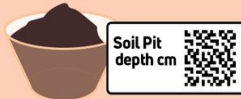


Soils Module

Soil Pit

(Outside South West corner of plot)

- Soil characterisation and contextual information collected.
- Samples collected at intervals down the soil profile.



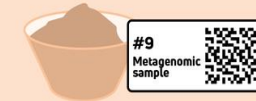
9

Soil Subsites

9 per plot

Soil Metagenomics

- Soil surface scraping (top 3 cm)
- Micro-habitat recorded



Subsite Pit

- Micro-habitat recorded
- Pit dug to 30 cm
- Soil sample collected at 3 depths;
 - 0-10 cm
 - 10-20 cm
 - 20-30cm

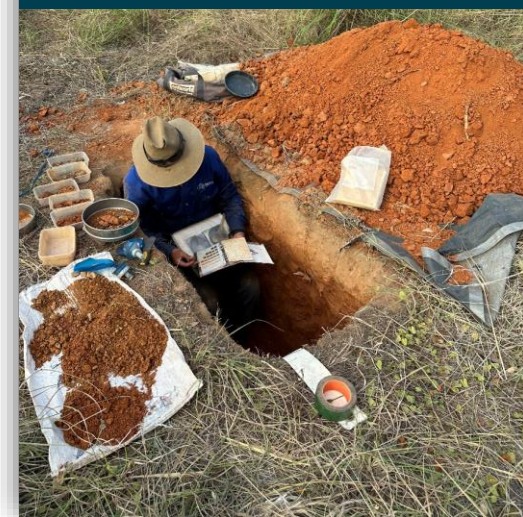




Soil pit protocols

Equipment

- + Digging tools (big & small)
- + Labelled zip lock bags
- + 1-2 m Pit tape
- + Spray bottle with water
- + 2mm sieve & catcher
- + Hand lens
- + Clinometer
- + Australian Soil and Land Survey Field Book (Yellow book)
- + Munsell Soil Colour Charts
- + The Australian Soil Classification
- + Soil bulk density kit
- + Knife
- + Trowel
- + Bolster & Hammer
- + Wire scrubbing brush
- + Permanent texta





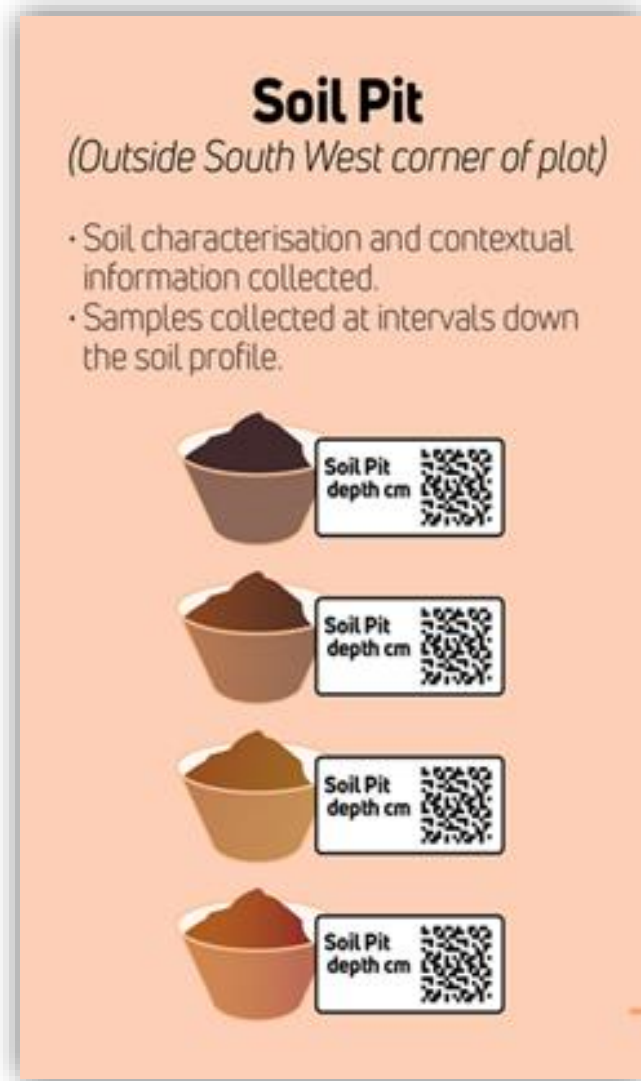
Soils Module

Soil Sample Pit Protocol

- + Level of soils data collected depends on available expertise – abbreviated and enhanced options

Samples and abbreviated data

- + Pit or augur to 1m
 - + Record horizon depths if confident
 - + Soil samples
- + 10x 500g samples
 - + Coarse fragments
 - + Lab analysis: pH, EC, LIR spectroscopy





Soils Module

Soil Site Observation & Characterisation Protocol

- + Pit to 1m+
 - + Soil characterisation by horizon
 - + Diagnostic features
 - + Field tests
- + Australian Soil Classification
- + Sample collection
 - + 10x 500g samples, avoiding horizon boundaries
 - + Lab analysis: pH, EC, LIR spectroscopy





Soils Module

Soil Bulk Density Protocol

- + 3 samples collected
 - + 0-10cm
 - + 10-20cm
 - + 20-30cm
- + Lab analysis of samples
 - + Weight (wet and dry)
 - + Volume
 - + Density of fine earth and gravel





Soil Subsite and Metagenomics Protocols

Equipment

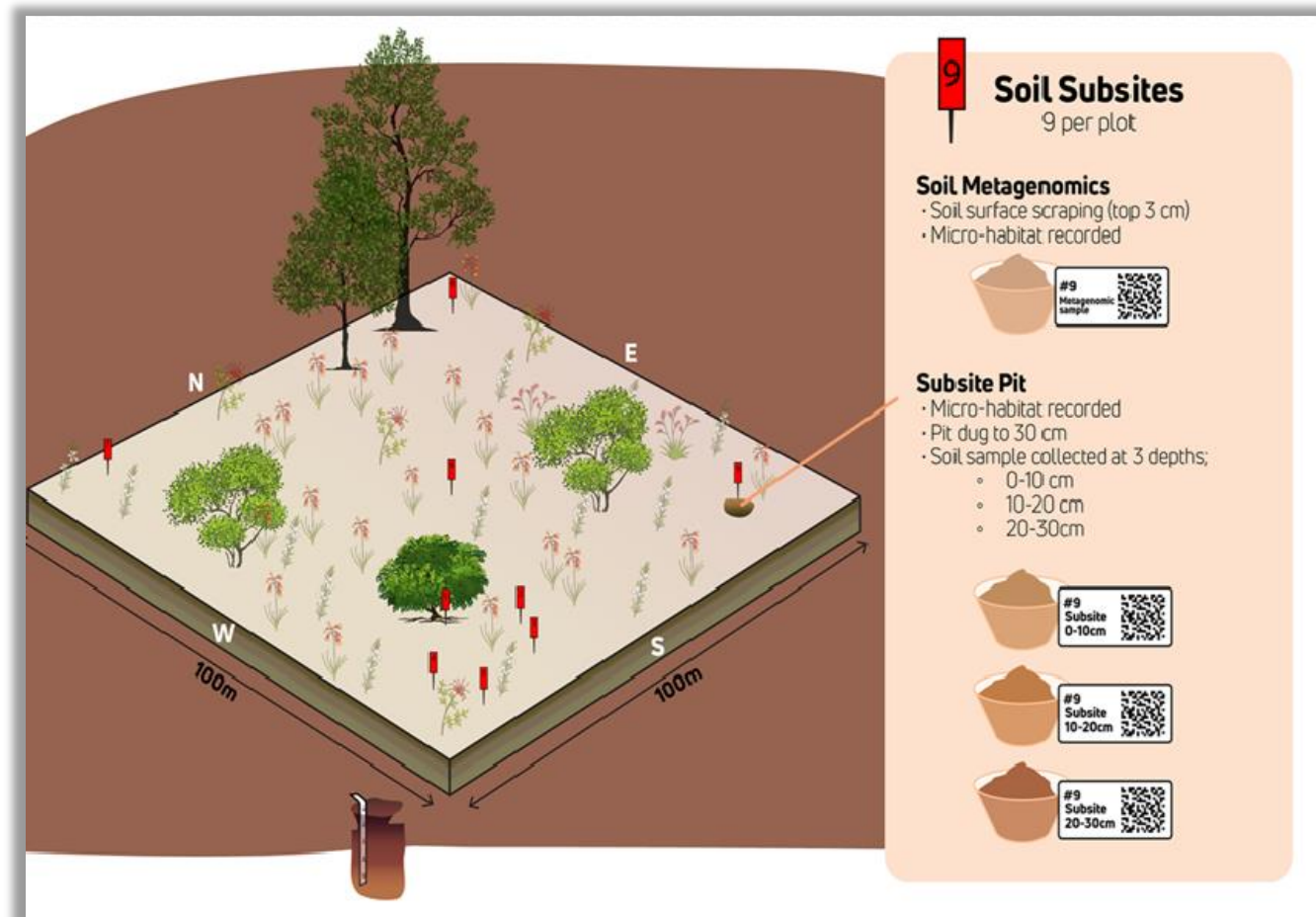
- + Sieve & catcher
- + Paint scraper
- + Methylated spirits
- + Pin flags
- + Gloves
- + Geo pic
- + Compact shovel
- + Labelled zip lock bags



Soils Module

Soil Subsites and Metagenomics Protocol

- + Soil metagenomics
- + Subsite pits
 - + Different microhabitats
 - + 3 samples collected
 - + 0-10cm
 - + 10-20cm
 - + 20-30cm





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**.



Invertebrates



Fire severity



Opportune



Cover



Plot Selection
& Layout



Basal Area



Photopoints



Floristics



Plant tissue
vouchering



Plot Description



Soils