Ecological Field Monitoring Protocols Manual

Using the Ecological Monitoring System Australia

Floristics Module – ENHANCED PROCEDURE ONLY

Citation

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Version

Readers are advised that all modules of the Ecological Field Monitoring Protocols Manual regularly undergo revision. Readers should check the website tern.org.au/emsa-protocols-manual/ to ensure they are viewing the current version.

Version 2

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Acknowledgements and contributors

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Key components of this module were developed, written, and field tested by the TERN Ecosystem Surveillance team based at The University of Adelaide. Additional to the authors, the following team members made contributions to the project: Ellen Kilpatrick, Kate Matthews, Rhys Morgan, David Peacock, and Carly Steen. Technical components, including the development of the accompanying app, were developed by the team led by Andrew Tokmakoff, including Luke Derby, Matthew Barty, Jin Zhou, Ho Hai Huy Vo, Walid Al Naim, Muhummad Khan, and Michael Doroch. Aspects of the protocols that have been built on by this project are the result of the extensive and ongoing body of work conducted by the TERN Ecosystem Surveillance team, as part of TERN's field-based ecosystem monitoring program. A full list of team members who have contributed is available on the TERN eSupport Services website.

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Main front cover photo: *Banksia ashbyi* (Ashby's banksia), Edel Land, Shark Bay, Western Australia.

Version control

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The version history of this module is identified below. The version history of the Ecological Field Monitoring Protocols Manual, the methods and data implications, both historical, current and future interpretations of data are available from the TERN website. Enquiries should be directed to tern@adelaide.edu.au.

Version	Date	Version update overview
1	20 November 2025	First published version

1 Enhanced protocol

1.1 Field collection

1.1.1 Pre-requisites

Pre-requisites for completing this protocol:

- Generate area checklists from Atlas of Living Australia, Australasian Virtual Herbarium or herbaria electronic floras, including known, threatened, and sensitive species from the project area.
- Become familiar with the characters and habitat requirements of threatened and sensitive species potentially occurring in the project area.
- Become familiar with the TERN Vascular Plant Collection Guidelines.

1.1.2 Time requirements

Survey time requirements will vary depending on the number and experience of personnel, their familiarity with the flora of the region, and the species richness and cover within the plot.

As a general guide:

- Allow between 0.5–1.5 hours to search for flora species and collect plant specimen vouchers from the plot.
- Allow between 0.5–1.5 hours to prepare plant specimen vouchers, attach voucher labels, enter and scan the species into the app, and transfer the specimens to a field press.
- Allow approximately 10 minutes per field press, every 2–3 days during the field survey, to inspect and change newspaper if necessary.
- Allow 1–2 hours after the field survey to deliver the plant specimen vouchers to the local State or Territory herbarium.

1.1.3 Personnel requirements

Number of personnel and skills:

- Searching the plot and collecting a plant specimen voucher for all flora species present is best conducted with two personnel. This enables more ground, including microhabitats, to be covered from multiple viewpoints.
- Processing plant specimen vouchers is best conducted with two personnel, one processing the specimens and one recording the data directly into the app.
- The surveyors making the observations should be familiar with and experienced in identifying the characteristic identifiable features of flora species and how to distinguish one species from another. If surveyors are not confident, time should be dedicated to practising, using field reference guides, and seeking advice before conducting this protocol.
- Floristics surveys involve the collection of plant specimen vouchers. Therefore, scientific permits are likely to be required. Additional permits may be required for collecting threatened flora species, so always check with your local authority.

1.1.4 Equipment

- Mobile device (tablet/phone) with the Monitor app pre-loaded
- Secateurs
- Long reach pruner/arborist throw line and weight (reaching out of reach diagnostic material)
- Hand trowel
- Gloves (handling prickly, sticky, or poisonous plants)
- Satchel (carrying equipment needed during collection)
- Plant presses (day presses and field presses)
- Newspaper (tabloid size) and cardboard (43.5 x 28.5 cm)
- Foam sheets (43.5 x 28.5 x 1 cm; pressing bulky specimens)
- Envelopes (storage of seeds and other small plant material)
- Kew mixture (70:1:29 ethanol:glycerol:water) and vials (preserving delicate specimens)
- Voucher barcode labels (see the Generating Voucher Barcode Labels for EMSA Specimens and Samples instruction sheet)
- Permanent marker
- Photo reference scales (bank card sized scale, incremental pole)
- Hand lens
- Backup camera, camera batteries and SD card
- TERN Vascular Plant Collection Guidelines
- Flora reference keys, guides, and apps
- Area checklists (previous visits, ALA/AVH, electronic floras)
- Herbarium collecting books/apps (specimen collection by expert botanists)
- Field herbarium dryer (working in the tropics).

1.1.5 Instructions and procedures

1. Ensure the Plot Selection and Layout Module has been completed to mark out the plot boundary and define the current plot and visit in the Monitor app.
1. Search the entire plot for each flora species present. Search between 30 and 90 minutes or more depending on the diversity and density of the vegetation and surveyor experience.
2. Collect specimens for each flora species present within the plot, storing them in a day press. Take enough material for an A3 size herbarium sheet (Figure 1A). If the species is small, a whole plant specimen/s including basal material and roots should be collected (Figure 1B and Figure 1C). Collect extra material for plant tissue vouchers if required (see the Plant Tissue Vouchering Module).
3. Return to the field vehicle or a designated area with the equipment required to process the specimens. If you have collected an epiphyte, mistletoe or parasite, process the host species first so that you can link the epiphyte, mistletoe or parasite species to its host in the app.
4. Label each specimen securely with a unique voucher barcode label. Place the label on stems or away from any plant parts that will need to be examined for identification purposes (see Figure 1). Use paper envelopes for small specimens and attach the label to the envelope. Use vials with Kew mixture for delicate specimens and attach the label to the vial.
5. Select the Floristics Module and then the Enhanced protocol in the Monitor app.
6. Specify if the Plant Tissue Vouchering Module will be undertaken at the same time as the Floristics Module, and if you are doing the enhanced or standard protocol. This will enable a button to open a popup of the Plant Tissue Vouchering Module.

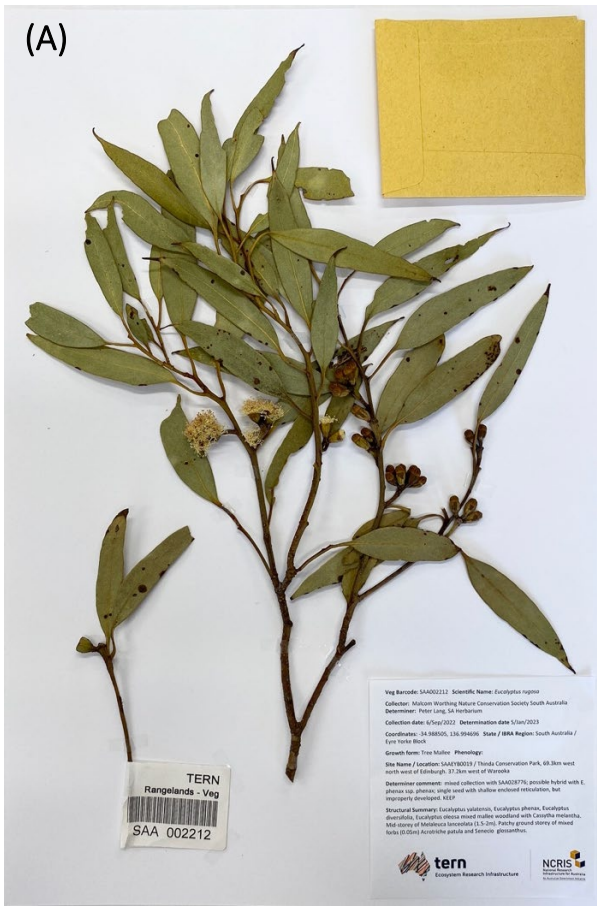

Figure 1. Plant specimen vouchers.

Plant specimen vouchers mounted on A3 paper.

(A) Plant material, including leaves, buds, flowers and fruit, taken from a large species. An envelop is used to store material that has come loose.

(B) Whole plant of a small species.

(C) Mulitiple individuals of a small species.

7. For each specimen, assign a *field name*. Assign a definitive species name if you are confident of the identification. If not, assign a descriptive name (e.g. yellow daisy flower) that can be easily remembered and distinguished from descriptive names assigned to other species.
8. For each specimen, scan the *voucher barcode* into the app by selecting the *record voucher barcode* button.
9. Record *growth form 1* from the list of NVIS growth forms (Appendix 1). Record *growth form 2* (optional) if a second, sub-dominant growth form is observed. Once a growth form is selected, its description will appear in the app. Check this to ensure you have selected the correct growth form.
10. If ephiphyte is selected as a growth form, record the *host species*.
11. Record the *habit* (optional), selecting all terms that apply to the species (Appendix 2).
12. Record the *phenology* (optional), selecting all attributes relevant the specimen (Appendix 3).
13. If required, take a *photo* (optional) of the specimen or an individual from within the plot by selecting the *camera* button. This can be a useful reference for unfamiliar species for the remainder of the survey. Use a photo reference scale in each photo (see Appendix 4). Record a *comment* (optional) of the photo if required. Take multiple photos if required.
14. If collecting plant tissue vouchers, select the *plant tissue voucher* button to open a popup of the Plant Tissue Vouchering Module. Once the associated plant tissue voucher barcode label is scanned into the app, return to the Enhanced protocol in the Floristics Module.
15. Select the *save species record* button to save the current species record.
16. Place the plant specimen voucher into a field press for long-term storage and drying (Figure 2). Use one folded tabloid-sized newspaper sheet for each specimen and use corrugated cardboard dividers frequently (at least one cardboard between every fifth specimen or more frequently for bulky specimens).
17. Select the *add another species* button to begin recording another species record and repeat steps 8–17.
18. Once all species have been recorded and their voucher barcode scanned, select the *complete floristics component* button and then queue the floristics collection submission.
19. Close the field press and tighten the straps. Label the plant press using a permanent marker on the top sheet of cardboard with the *plot number* and *date*.
20. Inspect the field press every 2–3 days during the field survey and replace newspaper when necessary.

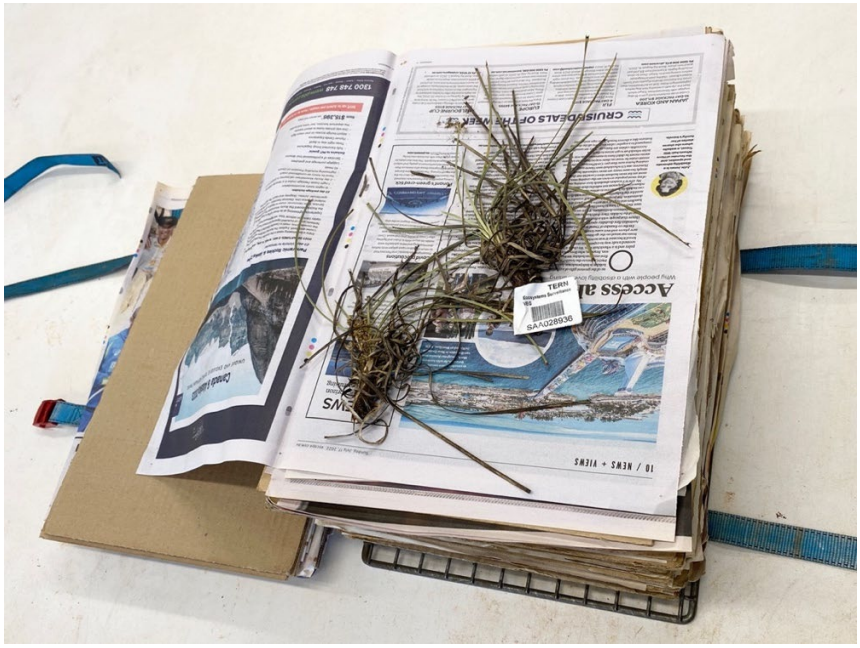

Figure 2. Plant specimen voucher placed in a newspaper sheet in a field press.

1.1.6 Additional guidelines

Survey timing

- The Floristics Module is best undertaken during the main plant emergence and reproduction period, which may vary based on survey scope, location and season. Although it is possible to survey flora outside of this period, the total number of species will likely be underestimated. Considerable effort is required to locate signs of seasonal species, and even this is unlikely to compensate for the effect of sub-optimal survey timing (Casson et al. 2009).

Searching for species

- The surveyor/s should systematically meander around the plot to ensure the whole plot is searched. Partitioning the plot into quarters or belt transects is recommended.
- If the vegetation is sparse and/or has low diversity (either naturally or due to disturbance), a search time of 30–45 minutes may be suitable.
- If the vegetation is dense and/or has high diversity, a search time of at least 90 minutes is recommended.
- Search times should be increased for inexperienced surveyors.
- Make a point of searching all micro-habitats within the plot (e.g. rocky escarpments, low points with/near water, litter underneath shrubs and trees, further away from any disturbances).
- Other surveyors can help by informing on any uncommon or inconspicuous species observed while setting up/undertaking other modules.

Collecting plant specimen vouchers

- A day press should be used during specimen collection to maintain their integrity. If one is not available, an individual paper bag per specimen can be used, each stored within a larger plastic bag during collection, and specimens should be promptly transferred to a field press.
- Once a handful of specimens are collected, transfer them to the day press. Specimens from two species can be stored in the same newspaper sheet. However, avoid putting similar species (e.g. grasses, same genera) in the same sheet to prevent mixing diagnostic characters (e.g. seeds, fruit).
- Permits are required to collect specimens and they must be collected in accordance with the conditions and guidelines for each jurisdiction.
- Additional scientific permits may be required to collect threatened species. Check with appropriate jurisdictions to ensure permits are obtained, and conditions are understood. A threatened species collection permit may require additional data to be collected, and voucher submission to the respective herbaria.
- Collection of specimens of rare, threatened or endangered species should only be made when such actions would not jeopardise the continued existence of the population.
- If collecting a specimen would jeopardise the continued existence of a rare, threatened or endangered flora population, the following can serve as a specimen (listed in decreasing order of preference):
  - Portion of fertile plant without the root.
  - Photos of plant in conjunction with a piece of fertile plant or plant parts (leaves and flowers or fruits).
  - Photos of fertile plant in conjunction with sterile plant specimen.
  - Sterile plant specimen only, or photos only.
- Discretion should be used in the case of re-visited populations of rare, threatened or endangered flora during monitoring programs as it may not be necessary to document each observation with an additional specimen.
- To aid identification, each specimen should ideally include, when available: vegetative material (i.e. leaves, phyllodes), flowers or buds, fruit and bark (for trees). For particular groups, ensure material that includes diagnostic characters is included to aid in identification based on morphology. Try to minimise the number of individual specimens needed to represent each species by maximising the number of plant components (e.g. flowers, fruit, leaves) on each specimen collected.

- If also undertaking the Plant Tissue Vouchering Module, collect young, actively growing material if available. Although it is inevitable that during some surveys only sterile or vegetative material will be available, such material should still be collected. The quantity of leaf material collected needs to be sufficient to enable removal of samples for genetic profiling (equivalent to approximately 10 cm^2 or five eucalypt leaves). For small plants, this may require collection of at least two specimens – one for a plant specimen voucher and one for a plant tissue voucher.
- For small species, collect the whole plant, including the basal material and roots, particularly for Gramineae (Poaceae), Cyperaceae and Juncaceae (Figure 1B).
- For small annuals and ephemerals, collect a number of individuals (Figure 1C).
- For specimens that you anticipate herbaria will wish to lodge (e.g. species of interest to the herbaria determined from pre-survey consultation), a duplicate should be collected.

Assigning field names

- When you assign a definitive species name, use current names published in the Australian Plant Census for consistent taxonomy across the jurisdictions .
- When assigning a field name, the field name must make sense to you as it will be used in subsequent modules for data collection. The name can be anything, but it is essential that the name is used on every occasion that you are detailing that species; you must be consistent with its use in the plot and over the project area. Your field names will not be made publicly available when the plot data is published, however herbarium staff will have access to your field names.
- Avoid using labels such as *Acacia* sp., use a descriptive word instead (e.g. *Acacia* spiky). This saves confusion later regarding whether it was a genuine species in a non-identifiable vegetative form or not.
- A photo should be taken for unknown species that have been assigned a field name to help identify them when surveying other plots or completing other modules (e.g. Cover Module).

Pressing plant specimen vouchers

- Ensure not too much material is in the newspaper sheet and the specimen is laid out flat as the specimen will not press and dry properly.
- Note that a separate batch of sequential voucher barcode labels is used for plant specimen vouchers, plant tissue vouchers, fauna vouchers, and soil samples. Therefore, care is needed to ensure the correct label is being used.
- Sheets of foam the size of the press can be used when pressing bulky items to make pressing easier and retain the integrity of the specimens.
- For wet specimens, wrap them in newspaper to assist drying-out, or store in a vial with Kew mixture. Blotting paper can also be used to absorb moisture and assist in drying.
- For small wet specimens, wrap them in newspaper and place them in a small snap-lock bag or paper bag until ready for pressing, or store in a vial with Kew mixture.
- Specimens should be placed into a field press before leaving each plot to ensure that none are lost and that diagnostic characters will be better preserved.
- Change the newspaper regularly to prevent specimens from becoming mouldy. Frequent changes will be necessary if specimens were damp when collected.
- Keep succulent plants in a separate press to facilitate more frequent changing of papers and reduce the risk of damaging other specimens.
- Succulent plants are difficult to dry and can be frozen overnight (either in the field or on return to the office) to fracture the cell walls enabling the moisture to escape. Once frozen, the specimen can be transferred to newspaper and cardboard in the press for the plot which it was recorded from.
- A field herbarium dryer may be used (especially in the tropics) to avoid specimens going mouldy.

- A photo may be useful to assist in the accurate identification of a species, particularly for species where colour is important to identification but may not be preserved in the dried specimen.

1.2 Post-field survey tasks

1.2.1 Sample curation

- Inspect the field press and change newspaper when necessary.
- Contact the local herbaria (or approved taxonomist) completing the identifications to determine the procedures for lodging plant specimen vouchers for identification (also see the Lodging EMSA Specimens and Samples information sheet).
- Check with the local herbaria (or approved taxonomist) completing the identifications and provide the required associated information. This is often a request form. Include the plot number, and location details on the form, along with the associated barcodes and field identification names, and information on the vegetation community that may be beneficial.

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