



TERN Australia Soil and Herbarium Collection

Vascular Plant Collection Guidelines – November 2024

Version 2.0

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Version control

Staff and volunteers are advised that the guidelines may undergo review.

Readers should check the website <https://www.environmentalmonitoringgroup.com.au/staff-intranet-home#/tern-surveillance-guidelines> to ensure they are viewing the current version.

Version 2.0

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1.0	20 September 2023	First published version
2.0	6 November 2024	NEW section added for barcoding specimens in the field and additional affixing of site location stickers. Updated list of TERN Safe Operating Procedures. Included additional contributors

Contributions

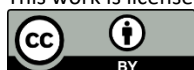
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Front cover photograph: TERN Ecosystem Surveillance field team barcoding and preparing plant specimens to press (credit: TERN Surveillance).

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For more information

TERN provides researchers with access to field and sensor data representing key attributes of Australia's terrestrial ecosystems. The data are gathered with the use of survey tools, remote sensing and sensors such as those for soil moisture, acoustics, flux and phenology. Related soil and vegetation samples are also collected by TERN for researcher use.

Key operating partners:



For more information on TERN, visit tern.org.au

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Australian national, state and territory herbaria are acknowledged for providing advice and reference to plant specimen collecting guidelines for best practice. Specifically, content has been summarised from the Australian National Botanic Gardens, Australian National Herbarium (CANB), Queensland Herbarium (BRI), Royal Botanic Gardens Sydney, National Herbarium of New South Wales (NSW) and the Western Australia Herbarium (PERTH).



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TERN Vascular Plant Collection Guidelines

Overview

TERN routinely collects vascular plant specimens from a network of almost 1000 one-hectare monitoring plots across Australia. A representative sample is collected for each species encountered within the bounds of the plot and within a 'plotless' basal sweep for 'woody' species adjacent to the plot. For further background information please refer to the "TERN Collection Management Guidelines".

These guidelines are prepared for TERN staff and volunteers, and largely follow guidelines prepared by Australian national, state and territory herbaria. The TERN vascular plant collection contributes to the TERN temporal dataset of other vegetation data, such as structure, and environmental attributes including landform and soils. An aim of this Collection is to ensure more accurate determinations of the species composition within each TERN plot. Unlike a herbarium collection, the TERN Vascular Plant Collection forms part of a long term ecological monitoring program, thus does not aim to target particular taxonomic groups. On many occasions, the plant specimens will be sterile, dry or burnt depending on the season and timing of sampling. Vascular plants are the focus of this Collection, and non-vascular plants, including bryophytes (mosses, liverworts, and hornworts), lichens and algae have not routinely been collected from each plot. Fungi are also collected from some plots, however not consistently. Thus, these guidelines provide information for collecting vascular plants and references for collecting non-vascular plants.

Safe operating procedures

Users (including, but not limited to, staff, students, volunteers and collaborators) of the TERN Australia Soil and Herbarium Collection are asked to make themselves aware of all safe operating procedures (SOP's) that relate to their work in the Collection. Relevant SOPs can be found in Appendix 1 of this document.

Equipment

This list of equipment for collecting vascular plant specimens in the field is adapted from the Ecological Monitoring System Australia (EMSA) 'Floristics Module' (Laws et al., 2023) prepared for the field monitoring protocols <https://www.tern.org.au/emsa-protocols-manual>. Details (with images) are provided for equipment where further explanation is required.

- Secateurs (use secateurs instead of breaking off material)
- Hand trowel (for digging up roots, bulbs, tubers etc)
- Gloves for handling prickly, sharp-edged, resinous, or poisonous plants
- Paper bags (various sizes) for temporary storage of plant specimens and carpological material (i.e., large fruit and seeds)
- Envelopes or small zip lock bags for storage of seeds and other small plant material
- Large heavy-duty plastic bags for storage and transport of plant specimens at the plots whilst collecting
- Plant presses and straps (day presses and field presses)
- Newspaper (tabloid size), cardboard (43.5 x 28.5 cm) and foam
- TERN voucher labels (adhesive labels with QR barcodes pre-printed)
- Flora reference keys, guides, and apps for the region (derived from Yellow Book 4th Edition)
- Revisit species list (if there was an earlier sampling event)
- Area checklist (generated from the Australian Virtual Herbarium/Atlas of Living Australia)
- Hand lens
- Long reach pruner
- Arborist throw rope (lightweight rope with weighted pouch attached to the end)
- Field dryer (including frame, gas ring and bottle, canvas skirts)
- Field notebook
- Camera

Hand lens

A 10-x hand lens is adequate for most field work as well as in the laboratory if a microscope is not available. These can be purchased from most optical or surgical suppliers. Learn to use the hand lens properly - it is important to use it when looking at details of hairs, glands, oil dots, leaf buds, fine veins, etc. The essential point is to hold the lens close to the eye and to bring the specimen up with the other hand until the lens is focused on it. Thus, the specimen is moved back and forth to get it in sharp focus, rather than moving the lens.

Field Notebook

As well as for taking notes in the field, a field notebook is another option for pressing small delicate specimens instead of using Kew mixture (i.e., spirit collection) or risking tiny specimens from falling out of the newspaper. Various field notebook sizes, including A4 and A5, should be available in the plant collection kit. Note that these should only be used for very small specimens and transferred into the field press the same day as sampling.

Flora references

This list is adapted from Lewis et al., 2024, Vegetation Chapter of the Australian Soil and Land Survey Field Handbook (Yellow Book). Note that it is not limited to this list. There may be other regional floras available that may be more suitable for an area that is being sampled. Some examples include Flora of Central Australia (Jessop, 1981), Plants of the Adelaide Plains and Hills (Jessop, 1990), Flora of the Kimberley Region (Wheeler et al., 1992) etc.

National Species List services

Vascular plants

Australian Plant Census -

<https://biodiversity.org.au/nsl/services/>

Australian Plant Name Index -

<https://biodiversity.org.au/nsl/services/search/names>

Lichens -

<https://lichen.biodiversity.org.au/nsl/services/>

AusMoss -

<https://moss.biodiversity.org.au/nsl/services/>

Fungi -

<https://fungi.biodiversity.org.au/nsl/services/>

Electronic floras and checklists

Flora of Australia Online -

<https://profiles.ala.org.au/opus/foa>

VicFlora (Victoria) -

<https://vicflora.rbg.vic.gov.au/>

FloraBase (Western Australia) -

<https://florabase.dpaw.wa.gov.au/>

PlantNet (New South Wales) -

<https://plantnet.rbg Syd.nsw.gov.au/>

FloraNT (Northern Territory) -

<http://eflora.nt.gov.au/>

eFlora SA (South Australia) -

<http://www.flora.sa.gov.au/>

Flora of Tasmania -

<https://flora.tmag.tas.gov.au/>

Flora Census (Queensland) -

<https://www.data.qld.gov.au/dataset/census-of-the-queensland-flora-2021>

Identification keys

KeyBase (various) -

<https://keybase.rbg.vic.gov.au/>

Wattle (Acacias of Australia) -

<https://apps.lucidcentral.org/wattle/text/intro/index.html>

EUCLID (Eucalypts of Australia) -

<https://apps.lucidcentral.org/euclid/text/intro/index.html>

AusGrass (Grasses of Australia) -

<https://ausgrass2.myspecies.info/>

Australian Tropical Rainforest Plants -

<https://apps.lucidcentral.org/rainforest/text/intro/index.html>

Australian Tropical Rainforest Orchids -

<https://www.anbg.gov.au/cpbr/cdkeys/RFKOrchids/key/rfkorchids/Media/Html/index.htm>

Australian Tropical Ferns and Lycophytes -

<https://keys.lucidcentral.org/search/australian-tropical-ferns-and-lycophytes/>

Collecting

Before collecting specimens, examine the size of populations and degree of variation of the species within a population. Care should be taken to ensure the population is sufficiently large to cope with the removal of one or more plants (i.e., herbs) or part of a plant for shrubs and trees.

Selecting a specimen

Vascular plant specimens collected on a TERN plot should be representative of the population at the site. Given the collection is of ecological focus, it is not possible to collect 'good quality' specimens for each species occurring on the plot, due to time constraints. Where possible though, ensure each specimen is of adequate size (i.e., small scraps or twigs are inadequate, BUT maybe that's all that is available due to environmental and climatic conditions). Each specimen ideally should comprise a range of parts (i.e., leaves, flowers, fruit, roots, bark) to aid identification and for further research.

Select vigorous, typical specimens. Avoid insect-damaged plants. Choose individuals that show the variation in leaf, flower and fruit size. It may be important to show morphological variation, involving the collection of individuals of different sizes or ages. You may need to collect more than one specimen to show the range of variation that is present, for example mature and immature parts, juvenile and adult leaves, coppice shoots. If the plant is dioecious, with male and female flowers on different plants, collect a specimen from each sex.

Growth forms

Growth forms follow the National Vegetation Information System (NVIS Working Group 2017) vocabulary. Tips and considerations are provided below for collecting various growth forms. For most growth forms use secateurs if possible, to reduce damage to the plant, as it will heal more quickly and decrease the chance of fungal infection. Secateurs also make it easier to collect a good-sized specimen and aid in pruning dense woody specimens to improve the quality of the specimen when pressing. The exception to this rule is for graminoids where a trowel should be used to dig up roots, rhizomes, bulbs, tubers etc. Or if a trowel is not available and the specimen is annual, carefully pull the plant from the base to ensure leaf bases, rootstock and flowering and fruiting stem is included in the sample. The basal parts of graminoids are important for taxonomic identification as they often provide diagnostic characters. Identification can be difficult in their absence.

Tall woody plants (includes growth forms: Tree, Tree Mallee: height 10-30m, >30m) On many occasions, tall trees might be too high to reach to obtain a specimen that includes foliage, fruit, and flowers. In these situations, either use a long reach pruner, or where trees are taller than the extension pole, an arborist's throw rope can be used. The next best option is to scavenge the ground for fallen fruit. Bear in mind this can be unreliable, especially if there are several species present in the plot (i.e., eucalypts).

For eucalypts, buds and fruits provide diagnostic characters for identification, noting that mature buds are more valuable than immature buds. It is also important to note the habit or type (tree, mallee, bloodwood, half bark etc.). A sample and description of the bark is extremely useful to aid identification. Use descriptions such as smooth, fissured, box bark, ironbark, half bark, miniritchie, and don't forget to document the colour of the bark. Photographs of the habit can also be very useful.

Medium woody plants (includes growth forms: Tree, Tree Mallee, Shrub, Mallee Shrub: height >2m, <10m) Where the crown is terminal, a long reach pruner may be required to obtain foliage, fruit and flowers. For shorter trees and shrubs, branches may be reached, and secateurs used to cut the specimen. Where specimens such as eucalypts do not have buds, flowers, or fruit on the plant, scavenging the ground for fallen fruit may be required.

Low woody plants (includes growth forms: Shrub, Heath shrub) Use secateurs for these growth forms to cut the specimen ensuring all parts of the plant are collected to aid identification (foliage, flowers, fruit etc.). Be mindful that some species have caustic sap, so it is recommended to use gloves, and be aware of the presence of thorns. With these growth forms it is usually not appropriate to collect the whole plant as it would be too large to press.

Perennial and annual graminoids (includes growth forms: tussock grasses, sedges, rushes) Grasses and sedges are often difficult to identify if they are not fertile (are not fruiting or are immature). Material including vegetative and inflorescence should be collected advanced enough that there are at least immature seeds, but not overmature where the seeds have already shed. Also ensure the base is collected either by hand pulling at the base (gloves should be worn, especially when handling sedges), or for perennials it may be necessary to use a hand trowel. In the case of exceptionally tall grasses the flowering parts and a piece of the basal parts should be collected and note the height and habit.

Hummock grasses Some species may be extremely pungent (having a sharp point), so it is also good practice to wear gloves. Like tussock grasses, it is important to collect inflorescence containing fertile material, not too immature or too mature where only the glumes are left. It is also essential to collect the foliage as some diagnostic characters, such as presence / absence of resin, wool etc. are present in the leaf axils. It is also good practice to store the florets in a small zip lock bag due to the risk of the florets falling out of the newspaper sheet (make sure they are labelled and stored with the newspaper sheet with the specimen).

Annual and perennial herbs (includes growth forms: forbs, vines, ferns) Usually herbaceous annuals, sometimes woody and perennial. These herbs can usually be collected as a whole plant (including roots), either by gently hand pulling at the base, or for perennials a trowel may be required to dig up the roots, which may include tubers (i.e., in *Vigna*). For ferns, try to collect specimens that are fertile (i.e., sporangia are present on the under surface of the fronds) and sterile fronds, as well as part of the rhizome (if present) or stalk of the frond (stipe). The position and arrangement of the sporangia are very important for the identification of ferns.

Parasitic plants (includes growth form: epiphytes and vines) For mistletoes, it is common practice to document the host species (i.e., *Acacia*, *Eucalyptus* etc.).

Rosette trees (includes growth forms: cycads, palms, tree-ferns, grass-tree) These trees have unbranched stems with a crown of leaves. When they are tall, a long reach pruner or arborist throw rope may be required. Secateurs are appropriate where foliage and fertile material can be reached. Fronds are usually much larger than a tabloid sized newspaper sheet. In these situations, the frond can either be folded in half, or if that is still too large, it can be cut into pieces and segments in separate sheets of newspaper. Bulky fruit and seeds should be collected in an appropriate size brown paper bag and labelled with the barcode and field name. For tree-ferns, a portion of a fertile frond and the base of the frond stalk bearing scales or hairs should be collected.

Succulents (includes growth forms: Chenopod shrubs, Samphire shrubs) Includes other flowering plants that are succulent e.g., genera from the family *Portulacaceae* (*Portulaca*, *Calandrinia*), *Cynanchum* (caustic vine). The main aspect to bear in mind with succulents is that they can take a much longer time to dry adequately and would possibly need to be dried further back in the lab. Succulent material is considered dried when it has a flaccid, water-soaked appearance.

Aquatics Plants growing in fresh, saline or brackish water, where the biomass is under water for most of the year. It is important to keep these specimens moist initially until they can be pressed and dried well. Generally speaking, aquatics usually take longer to dry, therefore they should be monitored to ensure they are dried adequately to avoid them going mouldy. Sometimes blotting paper is used to help absorb the excess moisture.

Non-vascular plants (includes growth forms: Lower Plants, Bryophytes, Lichen) Refer to the following guidelines for bryophytes Glime (2017) and for fungi Prance and Fechner (2017).

Bryophytes (mosses, liverworts and hornworts) are small non-vascular plants that are slow growing and usually form mat-like or cushion-like colonies that cover the substrate. Many of these species grow on the bark of trees, on rocks, or on the soil surface. The plant (or small part of the colony) is placed in a paper bag or an envelope made from folded newspaper, and allowed to dry, without pressing. These plants are easy to collect and store but are quite difficult to identify.

Lichens Like bryophytes, are usually small, slow-growing plants that are sensitive to disturbance. These organisms are treated in the same manner as bryophytes if they are to be collected and preserved. There are three types of lichens, classified on the form of the plant body or thallus: crustose lichens that are pressed tightly against the substrate; foliose lichens that have spreading leaf-like lobes and fruticose lichens with a branched cylindrical or flattened body that is not leaf-like. In most instances, part of the substrate should be carefully removed with the lichen, and fruiting bodies should be included as part of the collection.

Duplicates

It has not been common practise for TERN to collect duplicates, only unicates. However, going forward it is encouraged the field team collects enough material for one duplicate in case the herbarium in the jurisdiction the specimen was collected, wishes to retain a duplicate. This is referred to as an exchange. See '*TERN Collection Management Guidelines*' for the 'Exchange' requirements.

With herbarium collections, it is common practice to retain one specimen (i.e., for the TERN collection), particularly now that the collection is registered with Index Herbariorum and a condition of this is specimens are available for loan. On some occasions, it may be necessary to collect several duplicates, in cases where herbaria or taxonomists are interested in certain groups undergoing taxonomic revision, a reference for identification, classification, evolutionary history, molecular phylogenetics, to name a few. Herbaria (either directly or through Council of Heads of Australasian Herbaria (CHAH)) are generally contacted prior to a field trip to gauge interest in additional material for specified groups of plants. This is captured in the TERN (University of Adelaide) and CHAH Memorandum of Understanding (MOU) and accompanying Addendum to the MOU (current November 2022 for a 5-year term).

Pressing Specimens

For best results, specimens should be pressed within a few minutes of collecting due to specimens wilting soon after. This is where a day press is convenient. It is important to take care and time in the field to press specimens well. Once pressed well, specimens retain integrity for further research and for digitisation at a high resolution.

Plant presses and dryer

Day press

The preferred method when sampling a plot is to use a day press to store the specimens. The recommended approach to collecting specimens within a plot is to start in one corner and collect as many specimens from there as possible (it could be a 20x20m area), and only move on into other parts of the plot once the first corner has been exhausted. It makes it easy to avoid that corner when it comes to collecting dominant samples, because it is most likely that the common species will be picked up early on. collecting a handful of specimens, then transferring a couple of species per newspaper sheet. Try to avoid putting grasses with grasses or same genera in the same sheet to avoid mixing up seeds / fruit etc. The day press ensures the specimens don't lose quality as they are pressed immediately, then transferred to the field presses for the remaining field trip.



Figure 1. Day press.

For rapid collection of specimens at a plot, a large plastic bag can be used to gather specimens and later transfer to a field press. To avoid mixing up specimens and ease of sorting specimens to transfer them into a field press, individual specimens can be carefully placed into a brown paper bag, then into the large plastic bag. **This is not the preferred method, as the specimen will lose quality and is more difficult to press well into the field press for drying. Please avoid leaving specimens in paper bags, this makes the plant identification process by herbaria a more tedious task.**

Field press

Unlike a day press, a field press is for longer term storage and drying of specimens for the duration of a field trip (up to two weeks). Common practise by TERN is to place one sheet of newspaper between cardboard, especially for bulkier or succulent specimens. When the plant material is less bulky, is delicate and has the ability to dry quickly, use three sheets of newspaper between cardboard.



Figure 2. Field presses.

Newspaper, cardboard, and foam

Newspaper, cardboard, and foam should be available for both the day press and field press. The day press only requires 3-4 pieces of cardboard, but enough newspaper (tabloid size) to press 3-4 species in a sheet of newspaper for up to 80 species (depending on the richness at the plot being sampled). Foam can be used for bulky specimens to ensure leaves and flowers are pressed flat. Only one sheet of foam is required to absorb the 'bulkiness'.



Figure 3. Example of foam and the use of newspaper for pressing specimens in the field.

Field dryer

If sampling in the tropics, to ensure specimens do not go mouldy or undergo fungal attack, standard practise is to take a field dryer. A field dryer is collapsible and is useful in remote areas. Typically, these consist of an outer metal frame with a wire grid where the press sits on top with a gas burner below on a very low flame. Equipment required includes a gas bottle, gas ring, canvas skirts, octopus straps, drying frame (as shown below). A field dryer is usually only required when sampling in the more humid months, in the wet season and either side of the wet season (i.e., March, April and May) in northern Australia.



Figure 4. Example of field dryers being used as part of a Bush Blitz expedition on Groote Eylandt in the Northern Territory. Credit. Northern Territory Government.

Specimen arrangement

Place the specimen in the press in such a way that any flowers or fruits are obvious and will press well. If possible, spread the branchlets and leaves out to mimic the way they displayed in the field. If the specimen has large leaves, try to carefully spread them as the paper is folded across to ensure they don't become folded or scrunched during pressing (Figure 5).



Figure 5. Pressing a specimen between a sheet of newspaper using a day press.

Newspaper Sheet

Small and delicate specimens Rather than collecting one individual, collect numerous individuals of the whole plant (including roots, stems, foliage, flowers, fruit) to make up a sheet of newspaper. By collecting numerous specimens, TERN can have duplicates in the collection and provide exchanges to herbaria, whilst TERN retains a specimen. EXAMPLE genera – *Stylidium*, *Utricularia*.

Large specimens These can include specimens with large leaves, or palms, cycads etc. It is not practical to collect a whole plant for large specimens, but rather a section of the plant that includes the diagnostic characters required to identify the specimen to species level. EXAMPLE – for *Eucalyptus* (including *Corymbia* and *Angophora*), it is essential to collect the foliage, bark type and the fruit. Without the fruit and bark type it is almost impossible to identify eucalypts accurately.

Bulky specimens For bulky specimens, ensure the vegetative material is collected to fit in a sheet of newspaper, with enough material for a duplicates. Bulky specimens include plants with large and bulky seed pods, large fruit (such as *Pandanus* and *Banksia*). The bulky parts are not usually pressed between a sheet of newspaper in the field, instead they are placed in a large brown paper bag and labelled accordingly (see carpological material below). Another option is to dissect the seeds or fruit lengthwise and sometimes crosswise before pressing and drying those portions.

Dense specimens Plants that are densely branched (and prickly) are bulky and untidy to press. Secateurs should be used to trim branchlets and leaves to make flatter and easier to press and digitise. Ensure there are enough leaves and branches to show the plants arrangement.

Long and narrow specimens Long and narrow specimens such as grasses and sedges can be folded once, twice, or even three times at the time of pressing. In this way a plant of up to 1.6 metres high may be pressed onto a single sheet. Avoid including too much bulk, for example with perennial grass tussocks, tease them and split them up so they are relatively flat before pressing and always include an inflorescence (if available). Try to remove as much soil as possible from the bases (this applies to all specimens where bases/roots are collected).

Fertile specimens Large showy flowers (such as *Hibiscus*) should be pressed in a way to ensure the petals are not folded over the fertile material, including the pistil, style, and stamens. This makes it easy for determinations and avoids having to dissect the flowers. Another advantage is when they are digitised, the fertile material will be fully visible at a high resolution.

Envelopes and zip lock bags

Envelopes and zip lock bags are generally used to store seeds and small material associated with a specimen that can easily fall out of a newspaper sheet. This material is almost always required as it contains diagnostic characters for identification. Make sure you always label the envelope or zip lock bag with the barcode and field name and place it in with the newspaper sheet. Plastic zip lock bags are preferred as they can be directly used under a microscope without having to take them out of the envelope. This reduces time during the identification process at herbaria. However, ensure material in the zip lock bag is dry to avoid sweating and going mouldy.

Carpological material

Large seeds and fruit, too large and bulky to press in newspaper, should be collected in an appropriate sized paper bag and labelled with the barcode and field name. Carpological material should be stored during the field trip in an airtight container to ensure the specimens are not damaged. Ensure containers are large enough to cater for such samples.

Specimens in Silica Gel

For each specimen collected from a TERN plot, the specimen is destructively sampled (i.e., a sub sample taken from the pressed specimen) whilst in the field and ‘fresh’ into a synthetic tea bag, barcoded and stored in silica gel in an airtight Sistema container (Figure 6). The method here follows Laws et al. (2023) ‘Plant Tissue Vouchering module’ prepared for the field monitoring protocols <https://www.tern.org.au/ems-a-protocols-manual>.



Figure 6. Leaf tissue sample in synthetic tea bag, barcoded, then stored as a batch in a Sistema container with silica gel.

For up to five dominant species observed at a plot, extra material is collected and stored on silica gel (Figure 7). These samples can then be used for population genetics and isotopic analysis.



Figure 7. Leaf tissue samples of dominant species ready to store in separate synthetic tea bags and barcoded.

Barcoding Specimens

Each specimen collected within a plot and picked up in a basal sweep is affixed with a unique QR code. The workflow in the field is detailed below:

- prepare the materials required for barcoding: plant specimens, QR codes for that State/Territory, tea bags, Sistema containers, Silica Gel, Tablet used for that plot, pre-prepared Site Location stickers.
- Scan QR code with Tablet for plant specimen and use the Field Name to be consistent with Point Intercept. Affix the QR code to the base of the plant specimen, ensuring the following best practises:
 - Barcode best specimen. This is the specimen the genetic voucher is taken from.
 - Where more plant material is collected for the same species, place aside and barcode the 'best' quality material (i.e. specimen with flowers, fruit, buds, or for infertile specimens, better quality vegetative material).
 - Barcode so specimen is facing upwards. This is essential for when the specimen is mounted / imaged.
 - Affix the QR code to the specimen, not loose in the paper bag (i.e. to avoid risk of QR code falling out).
- Affix Site location sticker on OUTSIDE of newspaper sheet, NOT on the QR code. Site Location ID sticker is very useful for herbaria doing dets and collection management staff for sorting the plant specimens when they are returned to TERN.
- Destructive sample plant specimen for the Leaf Tissue sample, place it in the tea bag, scan QR code with Tablet and stick QR code on teabag. Ensure the tea bag can still be opened i.e. avoid sticking over the teabag opening.
- Plant specimens are transferred from the day press to the field press during this process (see Section
- Place teabags in Sistema container and line the bottom with 2cm of Silica Gel. Label Sistema container as per current workflow.

Additional attributes

A specimen without field data (at least locality and date) is of very little scientific value. At a minimum, the following information should be documented. Field notes are required where detail of the plant cannot be described from a pressed specimen (i.e., describe only those features which cannot be seen on the herbarium specimen, or are distorted by pressing). Once a specimen is pressed and dried, it is impossible to tell its habit i.e., prostrate, decumbent, erect etc. and many species lose flower colour once dried. A list of habit qualifiers and phenological states is provided here.

Growth Form

Growth forms and their definitions summarised from the National Vegetation Information System (NVIS Technical Working Group, 2017). The default growth forms are already available in the TERN field app. On occasions, when the species name is incorrectly defaulted to a growth form, it can be edited in the field app (AuScribe) during the barcoding process. Descriptions provided here are the national standard and for these guidelines are all-encompassing.

Table 1. NVIS Growth Forms and definitions.

Growth form	Definition
Tree	Woody plants, more than 2 m tall with a single stem or branches well above the base.
Tree mallee	Woody perennial plant. Multi-stemmed with fewer than five trunks of which at least three exceed 100 mm diameter at breast height (1.3 m). Usually, 8 m or more.
Shrub	Woody plants multi-stemmed at the base (or within 200 mm from ground level) or if single stemmed, less than 2 m.
Mallee shrub	Commonly less than 8 m tall, usually with five or more trunks, of which at least three of the largest do not exceed 100 mm diameter at breast height (1.3 m).
Heath shrub	Shrub usually less than 2 m, with sclerophyllous leaves and with an area of nanophyll or smaller (less than 225 mm ²). Often a member of one the following families: Ericaceae, Myrtaceae, Fabaceae and Proteaceae.
Chenopod shrub	Single or multi-stemmed, semi-succulent shrub of the family Chenopodiaceae exhibiting drought and salt tolerance.
Samphire shrub	Genera with articulate branches, fleshy stems and reduced flowers within the Chenopodiaceae family, succulent chenopods. Also the genus Suaeda.
Tussock grass	Grass forming discrete but open tussocks usually with distinct individual shoots, or if not, then forming a hummock.
Hummock grass	Coarse xeromorphic grass with a mound-like form often dead in the middle; genus is Triodia.
Sedge	Herbaceous, usually perennial with a tufted habit and of the families Cyperaceae or Restionaceae.
Rush	Herbaceous, usually perennial erect monocot that is neither a grass nor a sedge.
Forb	Herbaceous or slightly woody, annual or sometimes perennial plant.
Tree-fern	Characterised by large and usually branched leaves (fronds), arborescent and terrestrial; spores in sporangia on the leaves.
Fern	Ferns and fern allies, except tree-fern, above.
Bryophyte	Mosses and Liverworts.
Lichen	Composite plant consisting of a fungus living symbiotically with algae; without true roots, stems or leaves.
Epiphyte	Epiphytes, mistletoes and parasites. Plant with roots attached to the aerial portions of other plants.
Vine	Climbing, twining, winding or sprawling plants usually with a woody stem.
Palm	Palms and other arborescent monocotyledons. Members of the Arecaceae family or the genus Pandanus.
Grass-tree	Australian grass trees. Members of the Xanthorrhoeaceae family.
Cycad	Members of the families Cycadaceae and Zamiaceae.
Seagrass	Flowering angiosperms forming sparse to dense mats of material at the subtidal and down to 30 m below MSL.
Aquatic	Plant growing in an inland waterway or wetland with the majority of its biomass under water for most of the year.
Lower plant	Algae, fungus.

Habit

An enormous variety of qualifiers have been used to describe habit. However, the limited list below should cover all possibilities, and you should limit yourself to using these terms as per Laws et al. (2023) ESMA 'Floristics Module' <https://www.tern.org.au/ems-a-protocols-manual>.

This information is not recorded in the field, however with the implementation of the new version of AuScribe the following controlled vocabulary will be used and accommodated in SWARM accordingly.

Table 2.Habit terms and definitions

Term	Definition
Ascending	Weakly erect.
Climbing	Plants that climb upwards with the help of external support.
Creeping	Spread and grow outward from the original plant.
Decumbent	More or less horizontal with down-turned tips.
Erect	Upright, perpendicular.
Pendulous	Hanging down loosely.
Procumbent	More or less horizontal with up-turned tips.
Prostrate	Completely flat on the substrate including trailing plants.
Rhizomatous	Plants that send out roots and shoots from its nodes.
Straggling	Leaning or lying over other plants.
Succulent	Fleshy, juicy, soft in texture and usually thickened.
Tufted	Of many stems growing in clusters attached at the base.
Twinning	Climbing plants which wind themselves around supports.

Phenology

Phenology here uses a combination of Herbarium Information Standards and Protocols for Interchange of Data (HISPID) 6.0 and Darwin Core Terms, including [Reproductive Condition](#) (flowers, fruit, buds, sterile, fertile, leaf) and [Life Stage](#) (adult, juvenile, seedling, senescent). This information is not recorded in the field, however with the implementation of the new version of AuScribe the following controlled vocabulary will be used and accommodated in SWARM accordingly.

Table 3.Phenology terms and definitions

Term	Definition
Flowers	Flowers
Fruit	Fruit
Buds	Buds
Sterile	Sterile
Fertile	Fertile
Leaf	Leaf
Adult	A plant has reached full growth and is capable of reproduction.
Juvenile	The vegetative phase of a plants growth prior to the capacity to reproduce.
Seedling	The growth stage of a plant where the roots begin to develop and spread.
Senescent	Gradual deterioration in the function of an organism or organ with age.

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Appendices

Appendix 1. TERN Safe Operating Procedures (SOPs)

<https://www.environmentalmonitoringgroup.com.au/staff-intranet-home>

<https://www.environmentalmonitoringgroup.com.au/#/safety-and-wellbeing>

- 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

We at TERN acknowledge the traditional owners and their custodianship of the lands on which TERN operates. We pay our respects to their ancestors and their descendants, who continue cultural and spiritual connections to country.
TERN is enabled by NCRIS. Our work is a result of collaborative partnerships with many universities and institutions.

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