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Ecosystem Research Infrastructure

Ecological Field Monitoring Protocols Manual

Using the Ecological Monitoring System Australia

Plot Selection and Layout Module – PLOT LAYOUT AND VISIT PROCEDURE ONLY

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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 emsa.tern.org.au/documents to ensure they are viewing the current version.

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Main front cover photograph: Bogong High Plains, Victoria.

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 Plot layout and visit protocol

1.1 Field collection

1.1.1 Pre-requisites

Pre-requisites for completing this protocol:

- The Plot selection protocol (desktop component) is required to be completed and synced prior to the Plot layout and visit protocol.
- Undertaking the Vegetation Mapping Module first may assist with plot selection in the field by providing an overview of the vegetation communities present in the project area and help to determine the suitability of the proposed plot locations.

1.1.2 Time requirements

Plot selection in the field time requirements will vary depending on the size and complexity of the project area, and the number of plots being established. As general guide:

- Allow 1–2 days for larger projects to traverse the project area and confirm the location of suitable proposed plots in the field.

Plot layout time requirements will depend on the vegetation structure and density, the landform, the level of surveyor experience, the number of locations being permanently marked and the number of plot grid points (i.e. transect ends) required to be marked out based on the modules required to meet the project biodiversity outcomes. A thick canopy may also disrupt the GNSS/GPS location device, which will impact the time required. As general guide:

- Allow between 30–60 minutes to lay out each plot.

If working across multiple plots during a visit:

- Allow 1–2 minutes to define the current plot being surveyed from the existing plots in the project area.

1.1.3 Personnel requirements

Number of personnel and skills:

- Plot selection in the field can be undertaken by a single surveyor. Selection must be undertaken by an experienced field surveyor who can recognise a homogenous 100 x 100 m area that is representative of the overall sampling unit. This surveyor must also be capable of interpreting the information generated during the desktop stratification stage.
- Plot layout is best undertaken by two personnel, one marking out the required plot components (i.e. placing pegs to mark transect end points) and the other to providing directions for peg placement according to the Monitor app.
- If the plot is simultaneously being established for the Cover Module (or any other module that requires tape measure placement), two or more surveyors are recommended.
- The surveyors must be familiar with using a tablet and GNSS device. If surveyors are not confident, time should be dedicated to practising and seeking advice before conducting this protocol.
- Plot selection in field and plot layout do not involve interference with vegetation or wildlife. Therefore, scientific permits and wildlife ethics approvals are unlikely to be required but always check with your local authority. Access permissions will likely be required.

1.1.4 Equipment

- Mobile device with the Monitor app installed
- GNSS receiver capable of achieving <30 cm accuracy (e.g. Trimble R1 or DA2), hand-held GPS, or device built-in GPS (least preferred)
- Mapping app with spatial information layers, or hardcopy maps
- Compass or equivalent
- Star droppers (ideally 1.8 m in length) or equivalent
- Star dropper driver
- Safety earmuffs
- Flagging tape, attached to clothes pegs (optional)
- Tent pegs
- Waist bag (for carrying pegs).

1.1.5 Instructions and procedures

Plot selection in the field

1. Traverse the project area and assess the suitability of proposed plot locations selected during the desktop component prior to starting any plot-based modules.
2. Determine the extent, distribution and complexity of the sampling unit(s) to be assessed and the number of units that require assessment. Compare these to the proposed plot locations selected during the desktop component.
3. Review any information collected during the desktop component to ensure that final plot selection aligns with the criteria used to select each plot (e.g. may need a consistent slope across plots, or a specific distance from a watercourse).
4. Ensure final plot selection considers positioning a fauna plot adjacent to the core monitoring plot. Even if not doing fauna monitoring during the current survey or project, permitting a paired fauna plot in the future is recommended.
5. Finalise plot locations in the field and travel to the first plot to layout.

Plot layout – create new plot (+/- fauna plot)

1. Connect your mobile device and GNSS location device. Please see the *Using the Monitor App Manual* for instructions for connecting a GNSS receiver to the Monitor app.
2. Open the Plot Selection and Layout Module in the Monitor app and select the Plot layout and visit protocol.
3. Select the *create new* plot button.
4. Select if the plot will be aligned to the cardinal directions or not. As a standard, the plot aligns in a north-south direction with the grid. If necessary, enter the *orientation* in degrees from north to alter the plot orientation.
5. Select the *plot name* from the list of proposed plots generated in the Plot selection protocol.
6. Record the *plot type*. Select *Impact* or *Control.* Select *Not applicable* if these categories do not apply.
7. Enter the plot *replicate* number (if the plot is the first or only of its type, then the number will be 1).
8. Indicate whether the plot will be *permanently marked* and if applicable, select what it will be *marked with* (e.g. star dropper) and the points of the plot that will be *marked where* (NE, NW, SE, SW, Centre). Marking at least one corner is highly recommended.
9. Confirm the *plot dimensions* are 100 x 100 m. Future versions of this module may allow alternate plot sizes.
10. If you are using data sheets to complete the plot layout in the app retrospectively, or you are only undertaking monitoring in the fauna plot during the current visit check the *manual reference point* box to indicate that you do not need to mark the plot points on the ground during the current visit.

11. Select the *plot reference point* for plot layout (NE, NW, SE or SW corner). If only one corner is to be marked this should be the reference point.
12. If you are using a manual reference point as indicated in step 10, record this location by selecting *choose on map*. You can use your *current location*, *enter specific coordinates* or choose a location *on the map*. Select *start plot layout* and *set the reference point*. The app will record the location of the *plot reference point* (green point) and *plot points* (yellow points) based on the reference point location, plot orientation and plot dimensions. Select *done* to return from the mapping interface and then complete the Plot layout component and skip to step 21.
13. If you are conducting the plot layout in the field, select *start plot layout* to bring up the mapping interface and on the ground, navigate to the recommended plot location specified during the Plot selection protocol. The recommended plot location (orange point) and your current location (blue point) are both indicated on the map.
14. Once you have located the proposed plot location, before beginning the plot layout, traverse the area to ensure that it is homogeneous. If necessary, adjust your location or alignment of the plot.
15. Once you're happy with the plot's location, select *set reference point.* The app will record the location of the *plot reference point* (green point) and *plot points* (yellow points) based on the reference point location, plot orientation and plot dimensions, and will identify where you are located (see Figure 4). The plot boundary will be displayed and the transect lines can be toggled on and off.

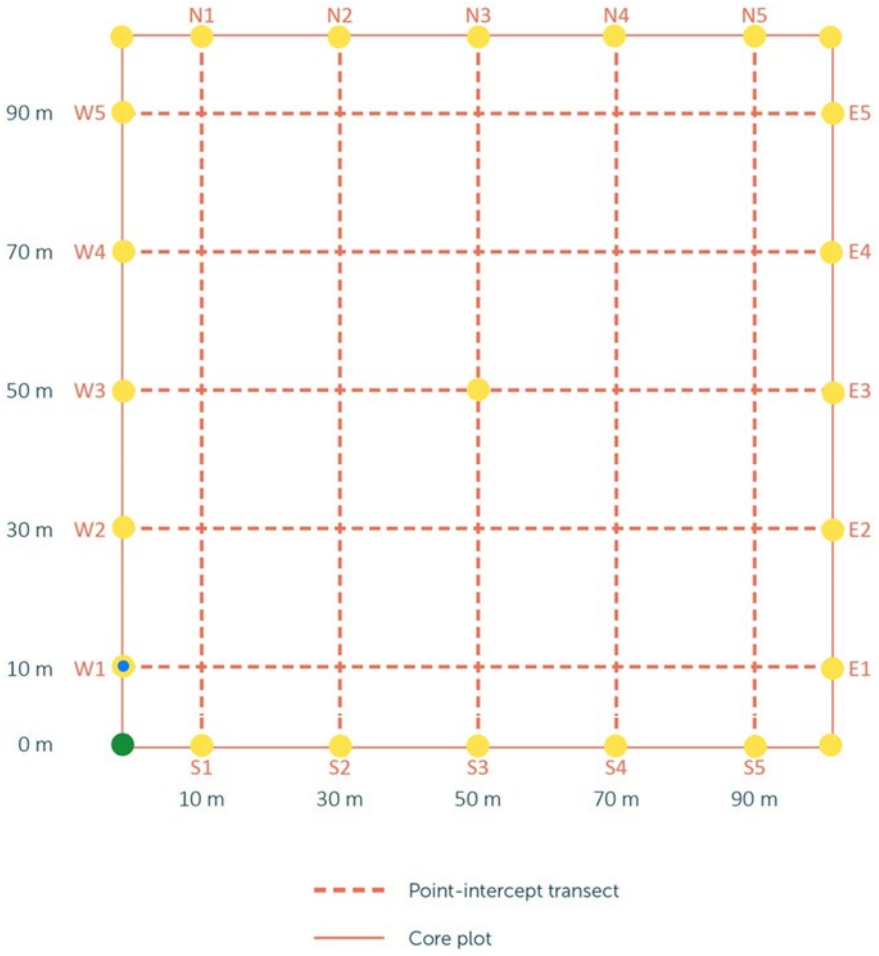

Figure 1. Core monitoring plot grid.

The core monitoring plot is displayed in the Monitor app to mark out the plot and includes the plot reference point (green), plot grid points (yellow) your current location (blue point).

16. Traverse the boundary of the plot and then to the centre point to mark all of the plot points in the app. Also mark on the ground the transect ends required for your project's monitoring modules (e.g. Cover – Enhance protocol

requires all plot points to be marked on the ground). It is important to maintain the connection between your mobile device and GNSS location device to accurately locate the plot points.

17. Line up your current location (blue point) with the plot point (yellow point) being marked. Press *mark closest point* to indicate that you have marked it on the ground. The point will turn green. It is advised that you place a tent peg with flagging tape into the ground to mark each plot point.
18. If permanently marking the plot corners and the centre point of the plot, a star dropper (or similar) should be used in place of a peg. Place flagging tape on the star droppers to aid in viewing the plot boundaries during the subsequent plot-based surveys.
19. Continue until all required plot points are marked on the ground and have been selected in the app and are displayed green.
20. Select *finish plot layout* to return from the mapping interface and then complete the Plot layout component.
21. Select if you would like to create a fauna plot that will be paired to the core monitoring plot and then complete the Fauna plot layout component. If you selected no, select *complete plot fauna layout* component and skip to step 29.
22. Select the *fauna plot reference point* for plot layout (NE, NW, SE or SW corner). If one corner is marked this should be the reference point.
23. Once standing directly at the reference point, select *start fauna plot layout* and then *set fauna plot reference point.* The app will record the *fauna plot reference point* (green point) and *fauna plot points* (yellow points) based on the fauna plot reference point location, plot orientation and plot dimensions, and will identify where you are located (blue point). The plot boundary will be displayed. If the plot boundary is not displaying in the orientation you wish, you may need to select a different *fauna plot reference point.*
24. Traverse the plot to each plot corner point. It is important to maintain the connection between your mobile device and GNSS location device to accurately locate the points.
25. Line up your current location (blue point) with each plot corner point (yellow point) being marked. Press *mark closest point* to indicate that you have marked it on the ground. The point will turn green. It is advised that you place a tent peg with flagging tape into the ground to mark each point.
26. If permanently marking the plot corners, a star dropper (or similar) should be used in place of a peg. Place flagging tape on the star droppers to aid in viewing the plot boundaries during the subsequent plot-based surveys.
27. Continue until all required plot corner points are marked on the ground and have been selected in the app and are displayed green.
28. Select *finish plot layout* to return from the mapping interface and then complete the Fauna plot layout component.
29. Create a new *plot visit* for the plot in the Plot visit component. The *start date* will automatically populate (yyyy-mm-dd hh:mm:ss), review this and change if required.
30. Record a *visit field name* that can be assigned to each plot during current the visit (e.g. Spring monitoring 2023).
31. Complete the Plot visit component then the Plot layout and visit protocol.
32. Check the summary of the data and mark it ready for submission to return to the module selection screen. The current plot and visit are now defined in the app and you can move onto the other required plot-based modules.

Plot layout – select existing plot

Follow these steps to define the current plot and visit when switching between existing plots, or undertaking a revisit.

1. Open the Plot Selection and Layout Module in the Monitor app and select the Plot layout and visit protocol.
2. *Select existing* plot layout.
3. Select the *plot name* from the list of plots existing in the project area. If just defining the current plot and visit when switching between plots during the current visit, select *complete plot layout component* and skip to step 11.
4. If undertaking a revisit that requires plot points to be marked out based on the modules required to meet the project biodiversity outcomes (e.g. Cover – Enhanced protocol requires all plot points to be marked out), connect

your mobile device and GNSS location device. Please see the *Using the Monitor App Manual* for instructions for connecting a GNSS receiver to the Monitor app.

5. Select *start plot layout for revisit* to launch the mapping interface. The plot points (yellow points) and your location (blue point) will be displayed.
6. Traverse the plot to each plot point that is required to be marked out on the ground during the revisit based on the modules required to meet the project biodiversity outcomes (e.g. Cover – Enhanced protocol requires all plot grid points to be marked out on the ground to lay out the transects). It is important to maintain the connection between your mobile device and GNSS location device to accurately locate the plot points.
7. Line up your current location (blue point) with each plot point (yellow point) being marked. Press *mark closest point* to indicate that you have marked it on the ground. The point will turn green. It is advised that you place a tent peg with flagging tape into the ground to mark each point.
8. Place flagging tape on any permanently marked corners to aid in viewing the plot boundaries during the subsequent plot-based surveys.
9. Continue until all required plot points are marked on the ground and have been selected in the app and are displayed green.
10. Select *finish plot layout* to return from the mapping interface and then complete the Plot layout component.
11. Select if you would like to layout the fauna plot that will be paired to the core monitoring plot and then complete the Fauna plot layout component. If you selected no, select *complete plot fauna layout* component and skip to step 21.
12. If you are laying out the fauna plot for the first time, you will be prompted to *create a new plot layout*, skip to step 14.
13. If there is an existing fauna plot associated with the core monitoring plot the app will indicate the location of the Fauna Plot in the mapping interface. Skip to step 15.
14. Select the *fauna plot reference point* for plot layout (NE, NW, SE or SW corner). If one corner is marked this should be the reference point.
15. Once standing directly at the reference point, select *start fauna plot layout* and then *set fauna plot reference point.* The app will record the *fauna plot reference point* (green point) and *fauna plot points* (yellow points) based on the fauna plot reference point location, plot orientation and plot dimensions, and will identify where you are located (blue point). The plot boundary will be displayed. If the plot boundary is not displaying in the orientation you wish, you may need to select a different *fauna plot reference point.*
16. Traverse the plot to each plot corner point. It is important to maintain the connection between your mobile device and GNSS location device to accurately locate the points.
17. Line up your current location (blue point) with each plot corner point (yellow point) being marked. Press *mark closest point* to indicate that you have marked it on the ground. The point will turn green. It is advised that you place a tent peg with flagging tape into the ground to mark each point.
18. Place flagging tape on any permanently marked corners to aid in viewing the plot boundaries during the subsequent fauna plot-based surveys.
19. Continue until all required plot corner points are marked on the ground and have been selected in the app and are displayed green.
20. Select *finish plot layout* to return from the mapping interface and then complete the Fauna plot layout component
21. In the Plot visit component, select *existing plot visit* and select the relevant *visit field name.* The *start date* will automatically populate (yyyy-mm-dd hh:mm:ss), review this and change if required.
22. Complete the Plot visit component then the Plot layout and visit protocol.
23. Check the summary of the data and mark it ready for submission to return to the module selection screen. The current plot and visit are now defined in the app and you can move onto the other required plot-based modules.

1.1.6 Additional guidelines

- If plot name is not automatically generated, follow the TERN naming convention (State, project code, bioregion code and 4-digit sequential number) when defining plot names (Appendix 2). You may additionally include the project number, and/or other identifiers to identify control or impact sites, and the replicate number.
- Use of star droppers is advised for permanently marking plots. These droppers may be permanently labelled with an aluminium tag, livestock tag or bright paint. This allows plots to be found easily and assists with ongoing monitoring and revisits.
- The four corners and centre of each plot should be permanently marked using star droppers. In cases where this is not possible (some Indigenous lands, private or leasehold lands, rocky outcrops, etc.) at least one corner should be marked, especially if plots are to be revisited. A note must be left within the Monitor app if the plot is not permanently marked.
- If pairing a fauna plot, consider the boundary of the core monitoring plot where it will be placed as this may influence where you permanently mark to plot/s.
- If the plot selected has dense vegetation, clothes pegs with flagging tape attached can be used in addition to tent pegs. Clothes pegs should be placed directly above tent pegs on vegetation. If this is not possible, the clothes peg should be placed in line with the tent pegs.
- Clothes pegs with flagging tape attached can be placed along the boundary of the fauna plot to aid in viewing the plot boundaries during the subsequent plot-based fauna surveys.
- If required, transect lines can be displayed in the mapping interface by selecting *transect lines*. These can be used to align tape measures for the Cover Module.

1.2 Post-field survey tasks

1.2.1 Sample curation

No samples are collected directly as part of this module.

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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