

Procedures Manual

Baseline Condition Assessment

Sarah Sharp
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Acknowledgements

These methods have been based on existing survey sheets developed by Conservation Planning and Research, Environment and Planning Directorate. Modifications were made to enable the data to be analysed for a broader spectrum of interpretation, at the same time as remaining simple to use and to follow the methodology. Permission was gained from Territory and Municipal Services to use and modify the 2012 Baseline Condition Assessment Procedures Manual to produce this final version. Many thanks to those people who have contributed to the revision of the field sheets and provided advice on their effectiveness and practicality. In particular I would like to thank Rob Jessop and David Moore (both of Rob Jessop Pty Ltd) who have significantly tried and tested the methods, and simplified the way that they are undertaken and recorded. Earlier versions were tested by Paul McPherson and Kris Nash who gave excellent feedback, which I have incorporated.

1. Overview

The methods described in the Manual have been based on and are consistent with guidelines developed by Conservation Planning and Research (CPR 2012, unpublished), (DECCW 2011), and built on in Sharp et al. (2005) and Sharp and Gould (2014).

The baseline condition assessment enables:

- Identification of vegetation zones based on similarity of structure and composition (which reflects condition);
- Identification of the vegetation community that occurs within each vegetation zone;
- Development of a condition score against a vegetation type benchmark for each vegetation zone based on Biometrics (DECCW 2011);
- Development of a floristic score for all grass-dominated vegetation zones based on Rehwinkel 2007;
- Identification of the diversity of plant species and vegetation structure present in each patch and conservation area;
- Identification of habitat features that may be supporting particular groups of fauna species; and
- Identification of issues present that require management intervention (e.g. rabbit disturbance, dumping, erosion and invasive weeds) in each remnant and patch to guide the development and implementation of operational plans

Guidelines are provided to facilitate consistency in the way the data are collected and to enable consistency in collating summaries according to the interpretation guidelines (section 4).

The results of the baseline condition assessment provides a comprehensive set of data that assists in assessing the condition of the sites prior to the application of management and provides a score for condition and diversity to compare with other remnants of the same vegetation types.

The information will then be used to:

- Identify a strategic conservation goal and desired outcomes for each vegetation zone;
- Assist with determining placement of infrastructure, recreation nodes and areas to protect for conservation outcomes;
- Assist in the identification of actions required to manage the conservation areas for conservation (e.g. fencing or revegetation requirements) that can be incorporated into operational plans;
- Identify what should be monitored to determine if the management being applied realise the desired outcomes; and
- Compare changes in condition and diversity within the polygons over time, based on the scores of the baseline condition assessment.

2. Survey program

While survey programs are likely to have different goals and objectives, time-frames and purposes, it is important to retain as much similarity as possible between studies to enable comparison of data and results, over time within one site and between sites. These methods, therefore, presented in this Manual are designed to cover a range of purposes, and allow for some modification according to the study itself. The interpretation section provides information on which data sheets are used to answer specific questions, so this provides guidance as to what sheets are required to answer particular questions. For more information on survey method and formulating questions, see Sharp and Gould 2014.

Surveys are undertaken at the polygon (vegetation unit) level and at the plot level. Polygon surveys provide primarily qualitative data to assist in determining the overall condition and features in the units that assist in determining management requirements. Plots provide quantitative data to assess condition. Guidelines for collection of the data are included.

Requirements:

1. Maps showing the location of patches, and the vegetation types within each patch;
2. A copy of this manual which includes sections on undertaking the surveys and interpreting the data and hard copies of the field sheets;
3. Field equipment; and
4. Electronic copies of the excel spreadsheets for entering the data.

In addition training in undertaking the surveys can be provided, to ensure the data collected are consistent with other studies.

The raw data should be submitted as electronic files, together with the hard copy field sheets. Two copies of the data should be retained at all times, and stored in separate locations, in case of loss or corruption of one set of data.

2.1 Overview of assessment procedures

2.1.1. Map the polygons

Identify polygons containing similar structure and apparent composition and draw on orthophoto images. These are the basis of the vegetation zones that are surveyed, but will be reviewed in the field to ensure they reflect homogeneity of structure, habitat and condition.

2.1.2. Undertake assessments in each polygon (vegetation unit)

Within every vegetation unit, identify the key characteristics – is the unit native, what is the structure, what is the overall condition, are there any species of interest, or potential species of interest.

Review patch boundaries

While undertaking a general look around the patch, review whether the boundaries are reflecting an homogenous area in terms of structure and composition. Modify these boundaries if required.

Describe the characteristics of each vegetation unit (Field sheet 1)

Record physical features, structure, dominant species, weeds and disturbance factors. The information collected is used to assess the overall condition, management issues and vegetation type.

Identify the vegetation structure of the vegetation unit, including assessment of cover of each of the stratum, dominant species in each stratum and tree species that are regenerating in the zone.

Fauna habitat (Field sheet 2)

Identify attributes that are used to determine the species likely to be present or using the vegetation zone. Potential habitat for threatened species is identified. Waterbodies in the vegetation zone are identified and described. Other opportunistic species and attributes, including hollows, rare plant locations, old mature trees are recorded, together with their location.

Plant richness survey (Field sheet 5)

Record presence of all plant species observed in each vegetation unit. The same sheet may be used to record cover of species in the plot within the vegetation zone (see below).

2.1.3. Survey in plots and transects

In those vegetation zones where more information is required, including a quantitative assessment of condition for comparison with other areas, surveys in one or more representative plot/s and associated transects are undertaken.

Plot location and description (Field sheet 3)

Identify waypoints and other information (including photos) to assist with re-locating the plot if it is to be included in a monitoring program.

Describe the vegetation and other attributes of the plot and transect.

Take photopoints into the plot to aid with interpreting quantitative data.

Indicator 4 Species cover (Field sheet 4)

Undertake a point-intercept assessment of at least 50 points along a tape to record frequency of each of the following categories of groundcover: native herbaceous plants (grasses, shrubs less than 1 m tall and other groundflora), exotic annual herbaceous plants, exotic perennial species, bare ground, rocks, coarse and fine litter and cryptogams. The frequency measure is converted to percentage cover (frequency/no of points measured)*100.

Woody vegetation cover of natives and introduced species is assessed for the upper stratum (greater than 2 m tall); and mid stratum (1 – 2 m tall) at 10 or more points. This is Indicator 3 in Sharp and Gould (2014). Assessments are made at multiple points along a transect estimating percentage foliage cover at that point, and then the average cover determined. Regeneration is noted. Length of fallen timber and the number of trees with hollows are measured and recorded.

Plant diversity survey (Field sheet 5)

Record plant species and estimate cover in a plot, size 20 x 50 m for species >2 m tall and sub-plot 20 x 20 m for species 2 m or less. This is Indicator 1 in Sharp and Gould (2014). Estimate percentage cover using the Braun Blanquet abundance cover score, where 'r' equates to less than 4 specimens of herbaceous species being present, and '+' equates to 4 to 15 specimens of herbaceous species. This latter abundance is used to assess floristic score according to Rehwinkel (2007).

2.2 Methods used for assessing or monitoring the condition of a site

Vegetation and habitat attributes are measured at three spatial levels: the vegetation zone, plots and transects, depending on the information that is being collected. The plot survey method is used to measure species diversity, structural diversity and habitat features. Transects are used to measure vegetation at points along a line, and are useful to measure the frequency of a species or group of species that is present. Particular species that occur within the site are measured within a vegetation zone.

How to apply these methods is outlined in detail as part of the instructions for measuring each indicator.

Vegetation zone

A vegetation zone is an area that does not have a defined size or shape (a polygon), but indicates the area in which the vegetation species composition, structure and condition is relatively homogenous. Several attributes are measured within the vegetation zones.

Plots

The plot survey is used to collect quantitative data for comparing sites and vegetation communities. The plot size to be used is 0.1 ha, usually measured within a 20 x 50 m plot, consistent with national, NSW and ACT recommended standards (Hnatiuk et al. 2009; DECCW 2011; CPR 2012). If a vegetation zone is long and narrow (such as along a roadside or along a riverbank) the shape may be modified but not the size (e.g. a 100 m x 10 m plot may be more practical). Plants 2 m or taller are measured in the entire 0.1 ha plot, and plants smaller than 2 m are measured in a 0.04 ha sub-plot (usually 20 x 20 m) (Figure 1). If a site only contains vegetation less than 2 m only the 0.04 ha plot is established. Each plot is to be placed so that the 50 m length is running N–S, independent of slope (where practical/feasible).

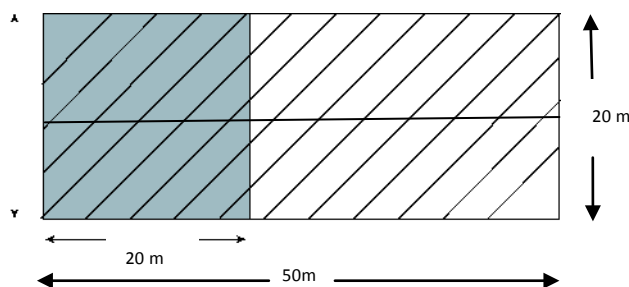


Figure 1. The recommended shape and layout of a 0.1 ha plot. The 20 m x 20 m sub-plot (0.04 ha) is used to measure abundance of all species less than 2 m tall. The location of the transect most generally used is down the middle of the long axis.

Transects

Transects are linear (although they may not be a straight line), and provide fixed points to determine changes to vegetation and other features. This method is used to provide a quantitative measure of plant frequency, which is equated to cover. Two ways of measuring along transects are used:

Point-intercept transect

Groundlayer attributes

Along a tape at set intervals a plant species (or plant group) and other features such as rocks, bare ground or litter are recorded if they touch a narrow wire (Figure 2). While the position of this transect is not important, it is practically generally down the middle of the long axis (see

Figure 1). More than one feature that is being recorded may touch the wire. If so, they are both recorded. The number of times a particular feature is recorded is summed to provide a frequency score of that feature. This method is used in the Manual to measure groundstorey cover (Recording Sheet 2), which is the relative cover of groundlayer species and other ground cover (rocks, bare ground and litter).



Figure 2. Recording groundlayer attributes along a point-intercept transect. Record what the wire is touching at set one metre intervals along the tape. It may be more than one feature. Record 50 measurements to provide adequate measurements for estimation of cover.

Mid- and upperstorey vegetation

Transects are also used to measure cover of woody species: in the mid-stratum (1 – 2 m tall) and upper stratum (>2 m tall) tall, of native and introduced species (Recording sheet 3). Lay a tape out through the length of the plot commencing at the mid point along the long axis. At five metre intervals estimate the projective cover of mid-storey and overstorey vegetation. A minimum of ten measurements are collated, and more if the plot is very variable.

Percentage foliage cover is be estimated using diagrams (see Chapter 3, instructions for field sheet 4, Species Cover), or alternatively, there is an app for android smartphones that will photograph cover from beneath, and estimate projective foliage cover (<https://play.google.com/store/apps/details?id=com.scrufster.habitapp>). This method is likely to be much more accurate than estimation from diagrams. It cannot be downloaded onto Apple products, unfortunately.

2.3 Number of plots to measure

If undertaking a baseline assessment of many plots, measure data in one plot, in which the vegetation is representative of the entire polygon. If establishing plots in polygons identified for ongoing monitoring, however, collect data from multiple plots. The recommended minimum number of plots to be established to counter the variability across polygons (based on DECCW 2011) is:

Size of vegetation zone	Number of plots and transects
>0.25 - <2 ha	2
2 - <4 ha	3
4 to <20 ha	4
20 – <50 ha	5
>50 ha	6

3. Baseline condition assessment detailed instructions

3.1 Map the vegetation and physical features

It is very important to have a map of your area, indicating the major physical features, boundaries of vegetation zones (types of vegetation based on structure and composition), and the location of monitoring or assessment plots. Other features that may be marked include boundaries of areas burnt, locations of weed infestations and/or treatment areas, locations of other species of interest.

Timing: any time, but before planning for monitoring and undertaking monitoring.

Method used: Entire site assessment

Equipment

- Map of the site: aerial photo or satellite image
- Plastic overlays
- Permanent and erasable markers

Instructions

Obtain a copy of the site: an aerial photo or satellite image

1. Mark physical features on the map: fences, waterbodies, tracks and other features such as buildings or yards
2. Draw vegetation zone boundaries:
On a plastic overlay or on the map, draw a line around vegetation zones, so that each zone is relatively uniform, based on tree species, similar understorey, land use history and level of disturbance. It is likely that areas with different management history are also different in terms of vegetation, so often fenceline boundaries mark the edge of vegetation zones. Give each zone a unique name or number. The shape and size of each vegetation zone will be different. If an area is less than 0.25 ha (approximately 50 m x 50 m), then include it as a patch within the adjacent vegetation zone.
3. Look for areas that generally have the same tree species and structure, similar understorey, land use history and level of disturbance. Mark out areas where revegetation has occurred.

3.2 Undertake field work

1. Check the boundaries of the vegetation zones and redraw the boundaries if necessary to make them more accurate.
2. Take the map out into the field when you establish the plots to mark on the location.
3. In all vegetation zones, fill out sheets 1, 2 and 5.
4. In the vegetation zones with more than 50% native groundcover (estimated), and a diversity of species, establish a plot and transect and fill out sheets 3, 4 and 5 (including plot and polygon survey).

Field equipment required:

- Map of the study area marked out
- Plant field guides
- Field data sheets
- Permanent and erasable markers, clipboards
- GPS
- Camera
- Temporary post for photo monitoring and sign to attach to mark on the plot number
- 4 measuring tapes, at least one of which is 50 m
- Flags
- Tent pegs
- Pointer (approx. 3 mm diameter) for point step measurements
- Overstorey projective foliage cover app:
<https://play.google.com/store/apps/details?id=com.scrufster.habitapp>

Recording sheets:

In the vegetation zone (polygon):

- 1: Vegetation zone description, regeneration, canopy cover
- 2: Fauna habitat, potential threatened species habitat, waterbody features, opportunistic species and attributes
- 5: Vegetation zone plant species survey

In the plot and/or transect:

- 3: Plot location, plot description, photopoints
4. Species cover: groundcover, woody vegetation cover, regeneration in the plot, length of fallen timber and number of trees with hollows
5. Plant species diversity in cover/abundance classes

3.3 Accessing materials for field work

Point line wire

A useful point line wire can be made from 'piano wire' that is available in hobby stores. It is strong and doesn't bend. A good width is 2 or 3 mm. The length is 800 mm, which is comfortable to use. Otherwise use a rigid wire flag, but these are shorter, and not as comfortable to use, as you have to bend over to put it down each time.

Sighter post for photomonitoring

A light, portable sighter post can be made from a length of polypipe, at least 1 m in length and about 1.5 cm in width, a brick nail (20 cm long) and a stiff plastic sheet or a small whiteboard approximately 15 cm x 20 cm in size.

Mark or tape around with coloured or black insulation tape at each 10 cm interval, ideally with a different colour tape at 0.5 m and 1 m. Cut a vertical slit in the top of the post, about 3 cm long in which to insert the plastic sheet.

On site, using a non-permanent marker, write the plot number and date on the sheet. Insert the sheet into the slit on the top of the pipe. Hammer the nail part-way into the ground at the selected distance and insert the polypipe over it so that it is vertical. Ensure the writing on the sheet can be seen in the photo, for identification later.

Measuring tapes

Tapes are available from hardware stores. Prices start from about \$20 for a 50 m tape; these are OK, but not great quality. There is no need to spend more than \$60, however, for a 50 m or 60 m tape.

Losing equipment in the field

It is easy to lose equipment that is lying in grass. It is recommended to wind brightly coloured tape around tent pegs, hammers, point-line wire, etc., so they are a bit more visible when collecting equipment when you leave.

Measuring overhead cover

App for measuring tree and shrub cover (overhead and side-on):

<https://play.google.com/store/apps/details?id=com.scrufster.habitapp>

3.4 Instructions for collecting data and filling in field sheets

3.4.1 Assessment of vegetation zones

Field Sheet 1. Vegetation Zone Description

The baseline vegetation zone description provides valuable information on what is present, what habitat is present, what the overall condition is, and identifies any particular issues that should be addressed. It complements monitoring, as it assists in explaining why some things are likely to be there and why changes may be occurring. You will be identifying:

- Boundaries around uniform areas of vegetation;
- Information on the management, land use, and condition;
- The dominant species, growth forms and habitat; and
- Indicators of disturbance or threats.

Timing and frequency: Any time, but before planning for monitoring and undertaking monitoring. Done once only, before assessment begins.

Method used: Reconnaissance of vegetation zones within the site

Instructions

1.1 Vegetation zone description

1. Fill out a separate sheet for each vegetation zone.
2. Walk around the zone to get an idea of what it is like overall.
3. Referring to the map, check to ensure the boundaries that are drawn around the vegetation zone reflect uniformity of vegetation, land use and disturbance. Look for differences in the groundlayer and the upper layer. For example, if you have an area that contains a similar tree structure, but the groundlayer in one part is native and introduced in another, ensure that you divide it into two vegetation zones. If there are small, distinctly different patches, separate them if you would answer yes to the question, 'Would I manage this patch separately from the rest?' If so, mark it as a separate zone. If no, then it would be useful to indicate that this area is different (e.g. a rocky outcrop). Redraw the boundaries on the map if required.
4. Write in the response that best fits the vegetation zone: circle correct response or A; C; O; R.
5. Describe the vegetation zone in your own words.
6. Other history: You may also know other information about the veg zone that would be useful to collate, such as fire history, management history etc.

Structural formation

Forest	Tree crowns generally touching with overlap or only slight separation. Branches begin high up tree trunks. Shrubby understorey in natural state.
Woodland	Tree crowns clearly separated. Branches closer to ground. May have a grassy understorey or contain shrubs.
Shrubland	Treeless or with isolated trees. Dominated by shrubs.
Grassland	Treeless or with isolated trees. Few or no shrubs. May be naturally treeless or a derived grassland due to past trees clearance.
Waterbody	A site with permanent or ephemeral water, flowing or still. May be a drainage line, creek, river, natural pond, swamp or dam.

Abundance:

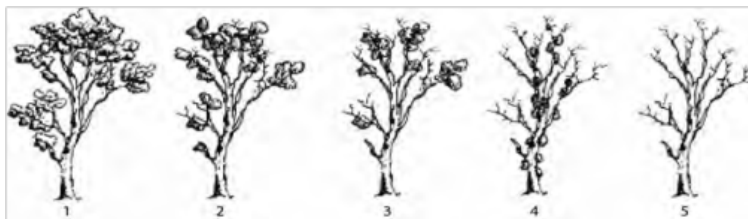
Abundant	Feature occurs in an almost continuous manner or over more than approximately 75% of the area.
Common	Feature encountered commonly, approximately more than 25% of the area i.e., without having to search for it, but not distributed continuously.
Occasional	More than one or a few cases but not encountered frequently, less than approximately 25% of the area.
Rare	Isolated, very infrequent, one to three specimens.

Levels of grazing

Low	Little or no evidence of grazing pressure, and/or little or no dung present.
Medium	Ground cover vegetation is showing evidence of grazing. Dung obvious without too much searching.
High	Vegetation height and density significantly reduced by grazing. There may be bare ground between plants and dung widespread or disturbed camps.

1.2 Regeneration

1. Record the tree species present in the zone and indicate whether they are regenerating.
2. Identify the health of each tree species in the vegetation zone.
3. Calculate the proportion of species that are regenerating.



1. Very good 2. Good 3. Moderate 4. Poor 5. Very poor

1.3 Canopy cover

1. Write down the canopy cover: Estimate the canopy cover class of each stratum. Height in classes (the most common height) is identified. Upper stratum is used to record species >2m in height; mid, species 1 - 2 m in height and lower <1 m in height. Up to five Dominant, Co-dominant or Sub-dominant species are identified in each stratum.
For example, if trees are 10 m - 20 m tall and 20% - 50% cover, write S7; E. blak (D), E. mell (S), Acac deal (S), Pyracantha (S).

Field Sheet 2. Fauna habitat

The information on this sheet identifies the diversity of habitat features present, whether there is existing or potential habitat for threatened species (in which case the location is defined), what type of waterbodies are present, and their main features and whether there are other opportunistic species and features. You will be recording:

- Attributes present
- Location of threatened species or their habitat

Timing and frequency: Any time, but at the time when plant species of interest are most likely to be identified.

Method used: Reconnaissance of vegetation zones within the site

Instructions

2.1 Fauna habitat

After walking around the vegetation zone, identify the relative abundance of the fauna habitat attributes.

2.2 Potential threatened species habitat

GPS locations of actual or potential threatened species habitat. Estimate the numbers of plants present, if relevant.

2.3 Waterbody features in vegetation zone

Identify the type of waterbody and describe its features.

2.4 Opportunistic species

1. Record with GPS the location of significant species and declared or other environmental weeds.
2. For mature trees >50 cm dbh note height, approx. circumference, if it has hollows.
3. For threatened or rare species record GPS and note area of occupancy on map, identify approx. pop size, age, reproductive stats, health, threats.
4. For declared weeds: isolated plants: record GPS; patches: record GPS and note area of occupancy on map.

Field Sheet 5: Plant Species Survey of the Vegetation Zone

A species list provides information on the overall condition of the site and the type of vegetation that is present. The species list can assist in identifying what vegetation community is present.

The assessment of abundance may be used (Abundant, common, occasional, rare) to give a sense of the relative abundance of species – it is not designed to be more than a broad estimate, to help with understanding of the character of the vegetation zone.

You will be recording:

- The variety of species present in the zone
- A record of the species that are of importance (weeds and native species)
- The relative cover of species (although this assessment of cover is only a rough estimate)

Timing: Spring or early summer

Instructions

1. Walk around the zone, and put a tick against species that are present e.g.

Species	Zone	Plot
<i>Acacia dealbata</i>	√	

Look out particularly for rare or uncommon species that may be in specialised habitat such as rocky areas, drainage lines, patches of trees etc.

Where only a genus is listed on the sheet, insert the species if possible.

If you encounter species you cannot identify, take a photo, identify the species by a number or descriptive name, and identify later.

2. When you believe that you have seen all the species present, you may record each species marked as:

Abundant	Species occurs in an almost continuous manner or over more than approximately 75% of the area.
Common	Species encountered commonly, approximately more than 25% of the area i.e., without having to search for it, but not distributed continuously.
Occasional	More than one or a few cases but not encountered frequently, less than approximately 25% of the area.
Rare	Isolated, very infrequent, one to three specimens.

Species	Zone	Plot
<i>Acacia dealbata</i>	√ O	

The number on some entries indicates the page it is found in Grassland Flora (Eddy et al., 1997; 2011).

3.4.2 Assessment in plots and transects

Field Sheet 3. Plot Location and Description

This field sheet provides information on where the plot was established to enable re-location, and describes the attributes of the plot.

Timing and frequency: Any time, but before undertaking surveys.

Instructions

3.1 Plot location

1. Assessment sites should be at least 10 m away from the area boundary, as this zone is likely to be more disturbed. This may not always be possible. For monitoring programs choose sites that can be easily re-located.
2. In an area that contains woody vegetation over 2 m tall, the convention is to undertake the measurements within a 0.1 ha plot, generally 20 m x 50 m plot. In an area that contains grassland, sedgeland or low shrubland (<2 m in height), the convention is to undertake the measurements within a 0.04 ha plot, usually 20 m x 20 m. Where plots of these dimensions do not fit, for example, in a long and narrow area such as a roadside, another shape plot may be used (e.g. 10 m x 100 m or 10 m x 40 m respectively).
3. Establish the plots. The number of plots will depend on the size of the vegetation unit (see 2.3). Set up the plots in areas that are representative of the vegetation zone.
4. Work out which direction your plot or transect will follow. Generally, unless there is good reason not to, the long side of the plot runs along the contour, to minimise internal differences due to slope.
5. Mark out the sites:
 - a) *Plot based assessments:* For different shape plots (or different size, modify the lengths of the tape accordingly).
 - i. Starting at one corner, pull the tape out 50 m to mark the first side of the plot.
 - ii. Put a peg in at 50 m and then pull a tape out to 20 m at right angles.
 - iii. Put a peg in at 20 m and then pull a tape out to 50 m at right angles.
 - iv. Put a peg in at 50 m and then pull a tape out to 20 m at right angles. You will need to adjust the tape to make the corners as close to right angled as possible.
 - b) *Transect based assessment:*
 - i. Identify the start and end points of the transect (usually at 10 m along the short axis to measure along the long axis).
6. There are different measures of location on GPS and maps. Refer to your GPS or map details to determine which datum is used. In some GPS units you have a choice of which datum to use. The preferred datum is GDA94.
7. For each plot or transect that you establish, fill out the Plot Location recording sheet. Provide enough detail so that someone else can find the plot without assistance.

3.2 Plot description

1. For each plot or transect that you establish, fill out the Plot Description recording sheet.
2. Explanations: give an estimate or what you think answers the question best.
 - Landuse: may include urban park, roadside, railway easement, reserve, rural land, etc.
 - Landform element: where does the site occur in the landscape?
 - Structural formation: see 1. Description of the vegetation zone.
 - Height of the groundlayer: give an approximate height to the nearest 10 cm of the vegetation, not including flower or seed stems.

- Regeneration present: see Indicator 3 (Condition of Native Trees and Shrubs) for descriptions.
- Tree health: circle one or more for the most common description of tree health.
- Planting: if it is clear that there has been planting, indicate whether native or introduced, growth form.
- Significant weeds: list the weeds of most concern in the site.
- Plot disturbance: indicate if you can see any disturbance, past or present, affecting the condition of the site.
- Erosion: indicate if you can see any erosion, past or present, affecting the condition of the site and whether it shows indications of still actively eroding, whether it is stabilised and not currently active.
- Plot management: indicate what management is occurring.
- Grazers: may be deliberately introduced, native grazers or pests.
- Description: provide a description that puts in words what you can see.

3.3 Photopoint

1. At a defined point in front of the point at which the photo is to be taken, hammer in a “sighter” post (see Section 3.3 on how to make an easily transportable temporary sighter post). Attach a card to the sighter post with the date and name of the plot. This will help with record keeping. Write down the distance of the sighter post from the point from which the photo is taken. Try to minimise the amount of trampling between the camera post and the sighter post.
2. For a plot, the sighter post should be along the direct line of sight to the centre of the assessment site). For a transect, put the stake in along the transect line. The post should be 1 to 1.5 m tall. In some situations the best ‘sightline’ for the photopoint is not towards the centre of the monitoring site, e.g. a large bush is 2 m away and blocks the camera view in that direction. If this is the case, choose a line of sight that is more appropriate
3. Record the location of the photopoint, and the distance and compass bearing of the sighter post from the camera post. Take two steps back and line-up both the corner post and the sighter post before taking the bearing. Use this information to find the exact point in future if required. There are smartphone apps that contain compasses.
4. Record the height of the camera above ground on the data sheet and ensure you use the same height each time you take a photograph in the future, e.g., “taken at eye level, 1.5 m high”.
5. Take the photo with the middle of the frame focussing on the top of the sighter post and take the photo in normal mode. Ensure the sign indicating the date and site number is visible before setting up the sighter post for the first time. Take a photo each time in the same way: landscape or portrait, and focus on the same point, so that each time the same details are in the photo.

Field Sheet 4. Species Cover (Indicator 4, Sharp and Gould 2014)

This indicator is used to measure changes in abundance of species groups in the groundlayer (plants less than 1 m tall), midstorey (plants 1 m - 2 m tall) and upperstorey. It provides an insight into how species groups are responding to management interventions.

Timing: usually spring or early summer

Method used: Transect

Instructions

4.1 Groundcover

Use this to calculate cover for all groundcover, i.e., species less than 1 m in height. Take at least 50 measurements.

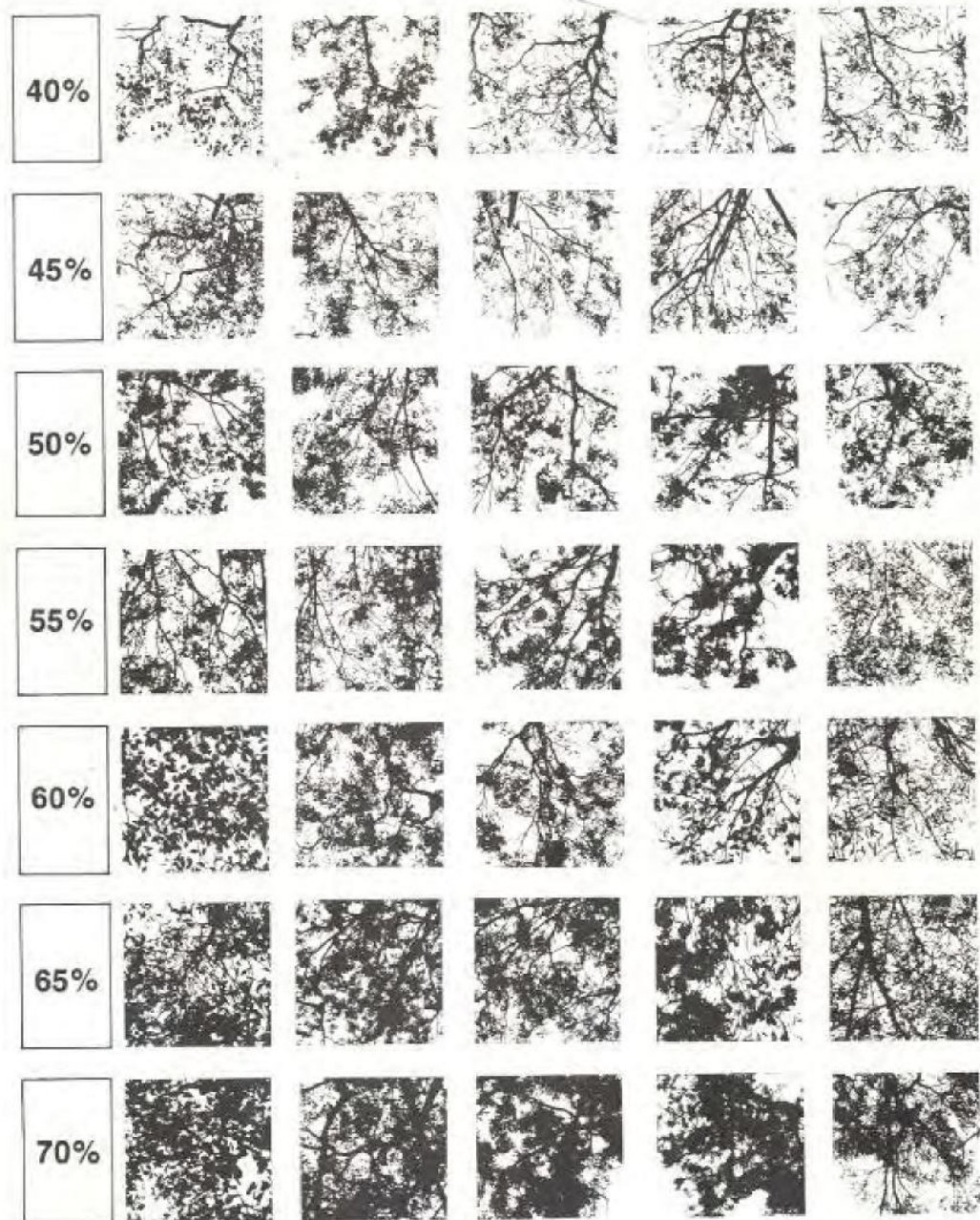
1. Preferred method: At each 1 m interval place the point of the fine wire directly adjacent to the tape. Record what is touched as a tally. If you 'hit' two or more species groups or a species group and another attribute, for example a rock, at one point, mark it as a hit for each group. If touching a plant and also bare ground that is clearly visible through the plants, record both. If the bare ground is not clearly visible through the plant, do not record it (effectively the bare ground is protected by the plant).
2. As per the NSW Biometric method: a single record at each point is recorded at 1 m intervals, being the attribute that is highest above ground.
3. If touching a stem that appears to be dead, but is still attached to the plant, count it as that plant. If the stem is detached, count it as litter.
4. To calculate percentage cover for each group or species, add up the number of hits (tallies) for each group (F), divide by the total number of measurements made (P) and multiply by 100. For example, if you have a tally of 12, from 50 points that were measured, the percentage cover is $(12/50) \times 100 = 24\%$. Note that the total percentage cover may be over 100% due to overlapping plants.
5. Calculate the proportion of native species compared to introduced perennial species ($N/(N+EP)$).

4.2 Woody vegetation cover

Use this to measure the woody stratum present over 1 m. Measure mid-storey (1-2 m) separately from upper storey (>2 m). Measure native and exotic overstorey separately. Take at least 10 measurements for each.

1. Measure percentage foliage cover of upper storey and mid storey and exotic and native vegetation separately, each at ten points along a transect, using diagrams (see Figure >), or alternatively, there is an app for android smartphones that calculates the projective foliage cover on the basis of a photo taken of the canopy overhead. The app is available at <https://play.google.com/store/apps/details?id=com.scrufster.habitapp>. This method is likely to be much more accurate than estimates from diagrams.
2. To calculate percentage cover, average the 10 measurements.

These photos assist with estimates of percent foliage cover (Hnatiuk et al., 2009, p85). Rows show similar crown types for different leaf sizes (large to small, left to right). *Acacia phyllodes* is in the right-hand column. Most Australian woody plants are in the range 40–70%.



4.3 Regeneration of remnant trees and shrubs in the plot

1. Write the names of all the main tree and shrub species that are present in the plot. If Indicator 1 has been undertaken you will already have this list. Place a (P) next to plants you know have been planted.
2. For each species, record the number of plants that are within each regenerative stage. If there are more than 10 plants, record in classes of ten (11-20; 21-30; etc).
3. For unknown species, write down your own name-description, e.g. narrow-leaved rough bark tree, on the score sheet. Use the Unknown Species Identification sheet to record their details so you can get these plants identified later.

	Regenerative stages for trees	Regenerative stages of shrubs
Seedlings	<1 m for Eucalypts, may be multi-stemmed.	Have not flowered
Juveniles and/or saplings	Have not flowered, fruited, no buds or nuts, usually spindly, one main trunk with little side branching, and where the trunk is less than 5 cm in diameter at 1.2 m.	
Young	May have flowered and fruited but have not attained maximum size or adult shape.	
Mature	Flowering, fruiting, full size, typical adult shape.	Have flowered
Very old mature	Most have lost branches or the main trunk, may have hollows, mostly very broad, gnarled.	
Senescent	Dead or dying, with many branches with few leaves or small branches.	Dead or dying

4.4 Length of fallen timber in the plot

Measure the total length of timber that falls within the plot that is greater than 5 cm diameter and longer than 0.5 m in length. Use each cell to write down the lengths as you go, or else add them up cumulatively in your head.

4.5 Number of trees with hollows in the plot

Count the total number of trees that contain hollows that are more than 1 m off the ground, have an entrance wider than 5 cm and have evident depth.

Field sheet 5. Plant Species Diversity

Method used: 0.1 ha plot (usually 20 m x 50 m) and 0.04 ha sub-plot (usually 20 m x 20 m)

Instructions

1. The 0.1 ha plot (usually 20 m x 50 m) is used for surveying species taller than 2 m. Species less than 2 m tall are measured in the 0.04 ha sub-plot (usually 20 m x 20 m).
2. Traverse each area in a systematic way, and record each different species that you find:
 - a. Record all species over 2 m tall within the entire 0.1 ha plot.
 - b. Record all other species up to 2 m tall within a 0.04 ha plot.
 - c. Indicate with a \surd in the right hand column on field sheet 5.
3. When complete, estimate cover for each species using the Braun-Blanquet cover abundance scores:

r: <5% cover, less than 4 specimens
+: <5% cover, 4-approximately 15 specimens (herbaceous species)
1: <5% cover, >15 specimens
2: 5-25% cover
3: >25-50% cover
4: >50-75% cover
5: >75% cover

Species	Zone	Plot
<i>Acacia dealbata</i>	\surd 0	\surd 1

4. Interpreting the data

4.1 Entering the data

Enter the data on spreadsheets (available from S. Sharp, tel. 0402 576412 or sarah.sharp@grapevine.net.au).

The spreadsheets provide a systematic way to enter the data, and formulae have been prepared to summarise the data.

Summarise the condition of each of the vegetation units.

4.2 Interpreting the data

Use the data and the background information below (Items 1 to 9) to respond to the following questions for each vegetation unit within each patch of vegetation. These questions form the basic information that is required to be known for each vegetation unit.

Questions	Sources of data
1. Is the vegetation in the patch predominantly native?	Definition of vegetation (Item 3) Field sheets 1, 5
2. What is the structural formation?	Tree cover classes and structural formation (Item 1) Field sheets 1, 4
3. What vegetation community is present?	Vegetation communities (Item 2) Field sheets 1, 4
4. What vegetation community is likely to have occurred in the unit prior to disturbance?	Vegetation communities (Item 2) Field sheets 1, 4
5. Is the community endangered Box-Gum Woodland or Natural Temperate Grassland?	Definition of EECs (Item 3, 4) Field sheets 1, 4
6. What condition score does the vegetation unit have against the benchmark (DECCW 2011)?	Vegetation score (Item 5.1) Field sheets 1, 4, 5
7. What floristic scores do grassy vegetation types have (Rehwinkel 2007)?	Abundance of species (Rehwinkel revised list) Field sheet 5
7. Are there important plants (threatened, rare and uncommon)?	Important species (Item 6, 7, 8, 9) Field sheets 2, 5
8. Are there important habitats for threatened or declining fauna?	Item 7, 8 Field sheets 2
9. Are further fauna or flora surveys recommended? For which species/areas?	Potential threatened and rare species (Item 6, 7, 8, 9) Field sheets 2
10. What are the management issues (weeds, significant species, disturbance, erosion etc)?	All sheets

4.3 Background information for interpretation

Item 1. Tree cover classes and structural formation (Hnatiuk et al., 2009)

Canopy Cover	Projective foliage cover	Structural formation
0-20%	<10%	grassland, shrubland, wetland or sedgeland
21-50%	10-30%	woodland
51-80%	30-70%	open forest
81-100%	>70%	Forest or plantation

Item 2. Vegetation communities in the ACT likely to be in the lowlands of ACT (Draft ESDD, unpublished)

Short name	Reference to vegetation community type
River Tussock Tableland Wet Tussock Grassland	r2: River Tussock-Kangaroo Grass-Rush wet tussock grasslands of footslopes, drainage lines and flats of the SEH bioregion
Wet Tussock Grassland	r3: Wallaby grass – Kangaroo grass – Rush tussock grassland of seasonally wet sites of the SEH bioregion
Wallaby grass – Tall Speargrass Grassland	r5: Wallaby grass – Tall Speargrass – Common everlasting tussock grasslands of the SEH bioregion
Kangaroo Grass – Wallaby Grass – Spear Grass Tableland Dry Tussock Grassland	r6: Dry Tussock Grassland of the Monaro in the SEH bioregion
Kangaroo Grass – Purple Wire-grass Dry Tussock Grassland	r8: Kangaroo Grass – Purple Wire-grass – Wattle Mat-rush dry tussock grassland in the Southern Tablelands region of the South Eastern Highlands Bioregion
Tall Speargrass – Corkscrew Grass – Wallaby-grass disclimax Grassland	q3: Tall Speargrass – Corkscrew Grass – Wallaby-grass Disclimax Grassland of the South Eastern Highlands Bioregion
Tableland Riparian Fringing Wetlands	
Burgan Tableland Shrubland - riparian and dryland	u181: River Bottlebrush – Burgan rocky riparian shrubland in the South Eastern Highlands and upper South Western Slopes Bioregions
Yellow Box – Red Gum Tableland Grassy Woodland	u19: Blakely's Red Gum – Yellow Box +/- White Box tall grassy woodland of the Upper SWS and western SEH bioregion
Yellow Box – Apple Box Grassy Woodland	u178: Yellow Box – Apple Box tall grassy woodland of the SEH
Snow Gum – Candlebark Tableland Woodland	u27: Snow Gum – Candlebark tall grassy woodland in frost hollows and gullies primarily of the Namadgi Range
Bundy – Red Stringybark Grassy Woodland	u66: Bundy – Red Stringybark mid high grassy herbaceous open woodland of the SEH and upper slopes subregion of the SWS
Broad leaved Peppermint - Apple Box Tableland Woodland	u29: Apple Box – Broadleaved Peppermint tall shrub grass woodland primarily on granitoids of the SEH bioregion
Broad-leaved Peppermint – Candlebark Sclerophyll Woodland	u21: Broad-leaved Peppermint – Candlebark tall dry sclerophyll woodlands to open forest of quartz rich ranges of the upper SEH and lower AA bioregions.
Bundy – Broad-leaved Peppermint Shrubby Woodland	u18: Bundy – Broadleaved Peppermint mid high shrubby woodland to open forest on granite substrates primarily in Namadgi Range
Drooping She-oak Woodland	q1: Drooping She-oak low woodland to open forest on shallow infertile hillslopes in the Australian Capital Territory and surrounds
River She-oak Tableland Riparian Woodland	p32d: River She-oak dry forest on sand/gravel alluvial soils along major watercourses of the South Eastern Highlands and upper South Western Slopes Bioregions

Short name	Reference to vegetation community type
Black Cypress Pine Tableland Open Forest - riparian and dryland	u191: Black cypress pine – brittle gum tall dry open forest on hills primarily in the Cooma region
Brittle Gum - Scribbly Gum forest	m51: Brittle Gum - Scribbly Gum shrub-grass tall dry sclerophyll woodland on exposed quartz-rich slopes and ridges at primarily in the Monaro and Kybeyan-Gourock subregions of the South Eastern Highlands
Red Stringybark – Scribbly Gum Tableland Forest	p14: Red Stringybark – Scribbly gum – Red-anthered Wallaby grass tall grass shrub dry sclerophyll woodland to open forest on loamy ridges of the central SEH bioregion
Depauperate native pasture	
Tree Plantation	
Exotic pasture	

Item 3. White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and derived native grasslands

EPBC Act: Box-Gum Woodland is listed as a Critically Endangered Ecological Community (CEEC) under the Commonwealth EPBC Act and as an Endangered Ecological Community (EEC) under the ACT NC Act.

The CEEC listed under the EPBC Act must meet the following criteria:

- a) Have White Box, Yellow Box and/or Blakely's Red Gum as the most common species currently or in the past; AND
- b) Have a predominantly native understorey AND EITHER
 - Be greater than 0.1 ha and contain at least 12 native, non-grass understorey species (including forbs, shrubs and ferns), including at least one important species (as defined in the declaration);
 - OR
 - Be greater than 2 ha with natural regeneration of the overstorey species, OR have at least 20 mature trees (greater than 125 cm circumference at 130 cm height) per hectare.

NC Act: The definition accepted by the ACT Flora and Fauna Committee for the community listed under the NC Act is less quantitative:

Yellow Box/Red Gum Grassy Woodland is an open woodland community in which either or both of Yellow Box *Eucalyptus melliodora* and Blakely's Red Gum *E. blakelyi* are usually present and commonly dominant or co-dominant. Apple Box *E. bridgesiana* is a frequent associate. The trees form an open canopy above a species-rich understorey of native tussock grasses, herbs and scattered shrubs. The combination results in a variegated mosaic of vegetation patches with features that are transitional between forest and grassland, and the community is frequently interspersed with these other vegetation types.

Item 4. Natural Temperate Grassland

EPBC Act: Natural temperate grassland is grassy vegetation dominated by moderately tall (25–50 cm) to tall (50–100 cm), dense to open tussock grasses in the genera *Austrodanthonia*, *Austrostipa*, *Bothriochloa*, *Poa* and *Themeda*. Up to 70% of all plant species may be forbs (i.e. herbaceous, non-grassy/non-grass-like plants). The community may be treeless or contain up to 10% [projective foliage] cover of trees, shrubs or sedges. It occurs within the geographical region of the Southern Tablelands of NSW and the ACT at altitudes between 560 m in central and northern parts of its distribution and 1200 m in the south, in valleys influenced by cold air drainage and in broad plains (Endangered Species Scientific Subcommittee 2000).

NC Act: Natural Temperate Grassland is a native ecological community that is dominated by native species of perennial grasses. There is also a diversity of other native herbaceous plants (forbs) present. An important characteristic of the community is that it is naturally treeless, or has less than 10% projective foliage cover of trees, shrubs and sedges in its tallest stratum. In the ACT natural temperate grassland occurs up to an altitude of 625 m.

Item 5. Scoring vegetation condition in the ACT

5.1 Assessing native vegetation (Gibbons unpublished, based on Gibbons et al (2008))

The method takes 10 parameters and for each gives a score ranging from 0 – 3, depending on the condition of the parameter at the site under investigation. If the parameter is in a condition that is close to that of benchmark or little disturbed sites it will score 3, while if it is a long way from the benchmark condition it will score 0. For example one of the measures is the native plant diversity contained within a 20 m x 20 m quadrat. The benchmark score for ACT Box –Gum woodland is 35 species. Thus a site with 30-50 species in a 20 m x 20 m area will score 3, while if only 10 species are found it will score 1, while it will score 0 if only a couple of natives are present.

The 10 parameters are collected from either 20 m x 20 m plots or 20 m x 50 m plots. An area under consideration is divided up into ACT classification vegetation zones and roughly the same condition. The Gibbons method has a guide to the number of plots that should be collected per zone but generally it is 2 or 3, but goes up to 10 in zones that are 1000s of hectares and down to 1 in zones of a few hectares.

A current score is calculated for a site that can be between 0 and 100. Depending on what management activities are committed, an increased score is assigned to each relevant parameter, but there are limits. Obviously trees with hollows can't be increased, and generally you are only allowed to jump up one score category.

Within each vegetation zone, a site value assessment is carried out using transects and plots to collect the site attribute data.

Sitedata collected for each of the 10 condition attributes is then compared against benchmarks. Benchmarks represent the range of variability for the condition attribute in relatively unmodified examples of the same vegetation type. Each condition attribute is allocated a score from 0-3 (0=low, 1=moderate, 2=high, 3=very high) based on the difference between its measured value and its benchmark.

The following equation determines the site value score applying to the site attribute scoring in the table below

$$\frac{\{\sum(a_v w_v)\} + 5[(a_a a_g) + (a_b a_i) + (a_n a_j) + (a_c a_k)]}{S_c - c} \times 100$$

where S_c is the current Site Value score of the vegetation zone

a_v is the attribute score for the v th site attribute (a-j) as defined

w_v is the weighting for the v th site attribute (a-j) as defined

a_k is equal to $(a_d + a_e + a_f)/3$, the average score for attributes d, e, f

c is the maximum score that can be obtained given all attributes a-j being at benchmark for the vegetation type (maximum score of 480 for non grassland communities and 142.5 for grasslands).

The term 'within benchmark' means a measurement that is within (and including) the range of measurement identified as the benchmark for that vegetation type. The term '<benchmark' means a measurement that is less than the minimum measurement in the benchmark range. The term '>benchmark' means a measurement that is greater than the maximum measurement in the benchmark range.

Attribute contribution to the site value

Site attribute	Site attribute score				Attribute weight
	0	1			
(a) Native plant species richness (plot)	0	>0-<50% of benchmark	50-<100% of benchmark	Benchmark	25
(b) Native over-storey cover (transect)	0-10% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	10
(c) Native mid-storey cover (transect)	0-10% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	10
(d) Native ground cover (grasses) (transect)	0-10% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	2.5
(e) Native ground cover (shrubs) (transect)	0-10% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	2.5
(f) Native ground cover (other) (transect)	0-0% or >200% of benchmark	>10-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	2.5
(g) Exotic plant cover (calculated as percentage of total ground and mid-storey cover) (transect)	>66%	>33-66%	>5-33%	0-5%	12.5
(h) Number of trees with hollows (plot)	0 (unless benchmark includes 0)	>0-<50% of benchmark	50-<100% of benchmark	Benchmark	20
(i) Proportion of over-storey species occurring as regeneration (entire zone)	0	>0-<50%	50-<100%	100%	5
(j) Total length of fallen logs (plot)	0-10% of benchmark	>10-<50% of benchmark	50-<100% of benchmark	Benchmark	10

2

5.3 Floristic diversity score

Floristic scores are based on weightings that have been applied to species that occur in natural grasslands. The weighting is related to the rarity of species based on analyses of species data from surveys undertaken in over 650 sites containing grassland or grassy woodland in the South-Eastern Highlands. The method enables a quantitative and comparative score to be developed for each plot and applied to sites.

This method relies on three groupings of species, referred to as:

Common or increaser species;

Significance Level 1: Moderately significant species are encountered less frequently, and known to occur in less disturbed sites; and

Significance Level 2: Highly significant species are the rarest of the grassy ecosystems species, are known to occur in the least disturbed site and have the highest significance weighting.

How this is applied is currently under revision. However the data collected in the monitoring enables this score to be applied, where the 'rare' class is used to equate to less than 5% cover and 1 to 4 specimens in the plot.

Item 6. Important species for Box-Gum Grassy Woodland

This species list comprises the species identified as 'Important' in Box-Gum Grassy Woodland and are used to assess the presence of Box-Gum Woodland under the EPBC listing (SEWPAC 2012a). No such list exists for the national listing of Natural Temperate Grassland in the Southern Tablelands (SEWPAC 2012b), but many of these species are also endemic to NTG. The list is presented here in full, but some of the species are not known to occur in the ACT.

Species	Common Name	Gr. Form
<i>Cheilanthes distans</i>	Bristly Cloak Fern	Fern
<i>Dichanthium sericeum</i>	Queensland Blue-grass	Grass
<i>Dichelachne crinita</i>	Longhair Plumegrass	Grass
<i>Dichelachne hirtella</i>	Slender Plumegrass	Grass
<i>Dichelachne inaequiglumis</i>	Plume Grass	Grass
<i>Dichelachne micrantha</i>	Short-hair Plumegrass	Grass
<i>Dichelachne parva</i>	Plume Grass	Grass
<i>Dichelachne rara</i>	Plume Grass	Grass
<i>Rytidosperma pallidum</i>	Silvertop Wallaby Grass, Redanther Wallaby Grass	Grass
<i>Sorghum leiocladum</i>	Wild Sorghum	Grass
<i>Themeda triandra</i>	Kangaroo Grass	Grass
<i>Tripogon loliiformis</i>	Fiveminute Grass	Grass
<i>Ajuga australis</i>	Australian Bugle, Austral Bugle	Herb
<i>Alternanthera nana</i>	Hairy Joyweed, Downy Pigweed	Herb
<i>Ammobium alatum</i>	Tall Ammobium	Herb
<i>Ammobium craspedioides</i>	Yass Daisy	Herb
<i>Arachnorchis</i> spp.	Spider Orchids	Herb
<i>Arthropodium milleflorum</i>	Vanilla-lily, Pale Vanilla-lily	Herb
<i>Arthropodium minus</i>	Small Vanilla Lily	Herb
<i>Asperula conferta</i>	Common Woodruff	Herb
<i>Asperula scoparia</i>	Prickly Woodruff	Herb
<i>Brachyscome aculeata</i>	Hill Daisy	Herb

Species	Common Name	Gr. Form
<i>Brachyscome decipiens</i>	Field Daisy	Herb
<i>Brachyscome diversifolia</i>	Large-headed Daisy	Herb
<i>Brachyscome graminea</i>	Grass Dairy	Herb
<i>Brachyscome heterodonta</i>	Lobe-seed Daisy	Herb
<i>Brachyscome multifida</i>	Cut-leaved Daisy	Herb
<i>Brachyscome rigidula</i>	Leafy Daisy	Herb
<i>Brachyscome scapigera</i>	Tufted Daisy	Herb
<i>Brachyscome spathulata</i>	Spoon Daisy	Herb
<i>Brunonia australis</i>	Pincushion, Blue Pincushion	Herb
<i>Bulbine bulbosa</i>	Bulbine Lily, Native Onion, Native Leek, Golden Lily	Herb
<i>Bulbine glauca</i>	Rock Lily	Herb
<i>Burchardia umbellata</i>	Milkmaids	Herb
<i>Caesia calliantha</i>	Blue Grass-Lily	Herb
<i>Calocephalus citreus</i>	Lemon Beautyheads	Herb
<i>Calochilus robertsonii</i>	Purplish Beard Orchid	Herb
<i>Calotis cuneifolia</i>	Purple Burr-daisy	Herb
<i>Calotis glandulosa</i>	Mauve Burr-daisy	Herb
<i>Calotis lappulacea</i>	Yellow Burr-daisy, Yellow Daisy-burr	Herb
<i>Calotis scabiosifolia</i>	Rough Burr-daisy	Herb
<i>Centella asiatica</i>	Pennywort	Herb
<i>Chrysocephalum apiculatum</i>	Yellow Buttons, Common Everlasting	Herb
<i>Chrysocephalum semipapposum</i>	Clustered Everlasting, Yellow Buttons	Herb
<i>Craspedia canens</i>	Billy Buttons, Grey Billybuttons	Herb
<i>Craspedia variabilis</i>	Billy Buttons	Herb
<i>Cullen microcephalum</i>	Dusky Scurf-pea, Mountain Psoralea	Herb
<i>Cullen tenax</i>	Emu-foot, Emu Grass, Tough Scurf-pea	Herb
<i>Daucus glochidiatus</i>	Australian Carrot, Native Carrot, Austral Carrot	Herb
<i>Desmodium brachypodum</i>	Large Tick-trefoil	Herb
<i>Desmodium varians</i>	Slender Tick-trefoil	Herb
<i>Dianella longifolia</i>	Smooth Flax Lily	Herb
<i>Dianella revoluta</i>	Blueberry Lily, Black-Anther Flax Lily, Spreading Flax Lily	Herb
<i>Dichopogon fimbriatus</i>	Chocolate Lily, Nodding Chocolate Lily	Herb
<i>Dipodium punctatum</i>	Hyacinth Orchid, Pink Hyacinth Orchid	Herb
<i>Diuris aequalis</i>	Buttercup Doubletail	Herb
<i>Diuris behrii</i>	Golden Cowslips	Herb
<i>Diuris chryseopsis</i>	Common Golden Moths	Herb
<i>Diuris dendrobioides</i>	Long-tail Purple Diuris, Wedge Diuris	Herb
<i>Diuris maculata</i>	Leopard Orchid, Nanny Goats, Leopard Diuris, Spotted Doubletail	Herb
<i>Diuris monticola</i>	Highland Golden Moths	Herb
<i>Diuris ochroma</i>	Pale Golden Moths	Herb
<i>Diuris pedunculata</i>	Small Snake Orchid, Golden Moths, Cowslip Orchid,	Herb
<i>Diuris punctata</i>	Purple Donkey-orchid, Purple Double-tails, Purple Diuris	Herb
<i>Diuris semilunulata</i>	Donkey-ears	Herb
<i>Diuris sulphurea</i>	Tiger Orchid, Hornet Orchid	Herb

Species	Common Name	Gr. Form
<i>Eriochilus cucullatus</i>	Parson's Bands	Herb
<i>Eryngium ovinum</i>	Blue Devil	Herb
<i>Eryngium vesiculosum</i>	Prostrate Blue Devil, Prickfoot	Herb
<i>Galium gaudichaudii</i>	Rough Bedstraw	Herb
<i>Gastrodia sesamoides</i>	Cinnamon Bells, Potato Orchid	Herb
<i>Genoplesium</i>	Midge Orchids	Herb
<i>Geranium antrorsum</i>	Antrorse Geranium	Herb
<i>Geranium graniticola</i>	Granite Cranesbill	Herb
<i>Glossodia major</i>	Wax-lip Orchid, Parson-in-the-pulpit	Herb
<i>Glycine clandestina</i>	Twining Glycine	Herb
<i>Glycine tabacina</i>	Glycine Pea, Variable Glycine	Herb
<i>Goodenia hederacea</i>	Forest Goodenia, Ivy Goodenia	Herb
<i>Goodenia pinnatifida</i>	Scrambled Eggs, Cut-leaf Goodenia	Herb
<i>Gratiola nana</i>	Creeping Brooklime	Herb
<i>Gratiola pedunculata</i>	Brooklime	Herb
<i>Gratiola peruviana</i>	Austral Brooklime	Herb
<i>Hymenochilus bicolor</i>	Bicolor Greenhood	Herb
<i>Hymenochilus cycnocephalus</i>	Swan Greenhood	Herb
<i>Hymenochilus muticus</i>	Midget Greenhood, Blunt Greenhood, Dwarf Greenhood	Herb
<i>Hypericum gramineum</i>	Small St John's Wort	Herb
<i>Hypericum japonicum</i>	Small St John's Wort, Matted St John's Wort	Herb
<i>Isoetopsis graminifolia</i>	Grass Cushion	Herb
<i>Kennedia prostrata</i>	Running Postman, Scarlet Running Pea, Scarlet Coral-pea	Herb
<i>Lagenophora stipitata</i>	Blue-bottle Daisy, Common Lagenophora	Herb
<i>Laxmannia gracilis</i>	Slender Wire-Lily	Herb
<i>Leptorhynchos elongatus</i>	Lanky Buttons, Hairy Buttons	Herb
<i>Leptorhynchos squamatus</i>	Scaly Buttons	Herb
<i>Leucochrysum albicans</i>	Hoary Sunray	Herb
<i>Linum marginale</i>	Wild Flax, Native Flax	Herb
<i>Lotus australis</i>	Austral Trefoil, Australian Trefoil	Herb
<i>Microseris lanceolata</i>	Yam Daisy, Murnong	Herb
<i>Microtis parviflora</i>	Slender Onion-orchid	Herb
<i>Microtis unifolia</i>	Common Onion-orchid, Onion-orchid	Herb
<i>Ophioglossum lusitanicum</i>	Adder's Tongue	Herb
<i>Oreomyrrhis eriopoda</i>	Australian Carraway	Herb
<i>Pelargonium australe</i>	Native Storks-bill, Austral Storks-bill, Wild Geranium	Herb
<i>Pelargonium inodorum</i>	Scentless Storks-bill	Herb
<i>Pelargonium rodneyanum</i>	Magenta Storks-bill	Herb
<i>Plantago gaudichaudii</i>	Narrow-leaf Native Plantain, Narrow Plantain	Herb
<i>Plantago varia</i>	Variable Plantain, Small Plantain, Sago-weed	Herb
<i>Podolepis hieracioides</i>	Tall Copper-wire Daisy	Herb
<i>Podolepis jaceoides</i>	Showy Copper-wire Daisy	Herb
<i>Polygala japonica</i>	Dwarf Milkwort	Herb
<i>Poranthera microphylla</i>	Small Poranthera, Small-leaved Poranthera	Herb
<i>Prasophyllum petilum</i>	Tarengo Leek Orchid	Herb
<i>Ptilotus erubescens</i>	Hairy Tails, Hairy Heads	Herb

Species	Common Name	Gr. Form
<i>Ranunculus lappaceus</i>	Common Buttercup, Australian Buttercup	Herb
<i>Rhodanthe anthemoides</i>	White Sunray, Chamomile Sunray	Herb
<i>Rumex dumosus</i>	Wiry Dock	Herb
<i>Rutidosia leiolepis</i>	Monaro Golden Daisy	Herb
<i>Rutidosia leptorhynchoides</i>	Button Wrinklewort	Herb
<i>Rutidosia multiflora</i>	Small Wrinklewort	Herb
<i>Scleranthus biflorus</i>	Spiny Mat-plant, Knawel, Cushion-bush, Two-flowered Knawel	Herb
<i>Sebaea ovata</i>	Yellow Centaury	Herb
<i>Sida corrugata</i>	Corrugated Sida	Herb
<i>Solenogyne dominii</i>	Smooth Solenogyne	Herb
<i>Solenogyne gunnii</i>	Hairy Solenogyne	Herb
<i>Spiranthes sinensis</i>	Austral Ladies' Tresses	Herb
<i>Stackhousia monogyna</i>	Creamy Candles, Creamy Stackhousia	Herb
<i>Stellaria filiformis</i>	Thread Starwort	Herb
<i>Stuartina hamata</i>	Crooked Cudweed, Hooked Cudweed	Herb
<i>Stuartina muelleri</i>	Spoon Cudweed	Herb
<i>Stylidium graminifolium</i>	Grass Triggerplant	Herb
<i>Stypandra glauca</i>	Nodding Blue Lily	Herb
<i>Swainsona behriana</i>	Behr's Swainson-pea	Herb
<i>Swainsona monticola</i>	Mountain Swainson-pea	Herb
<i>Swainsona oroboides</i>	Variable Swainson-pea	Herb
<i>Swainsona queenslandica</i>	Smooth Darling Pea	Herb
<i>Swainsona recta</i>	Mountain Swainson-pea, Small Purple-pea	Herb
<i>Swainsona reticulata</i>	Kneed Swainson-pea	Herb
<i>Swainsona sericea</i>	Silky Swainson-pea	Herb
<i>Thelymitra ixioides</i>	Spotted Sun-orchid, Dotted Sun-orchid	Herb
<i>Thelymitra malvina</i>	Mauve-tuft Sun-orchid, Mauve-tufted sun orchid	Herb
<i>Thelymitra pauciflora</i>	Slender Sun-orchid, Few-flowered Sun-orchid	Herb
<i>Thelymitra rubra</i>	Pink Sun-orchid, Salmon Sun-orchid, Red Sun-orchid	Herb
<i>Thesium australe</i>	Austral toadflax, Austral Toad-flax, Australian Toadflax	Herb
<i>Thysanotus patersonii</i>	Twining Fringe-lily	Herb
<i>Thysanotus tuberosus</i>	Common Fringe-lily	Herb
<i>Tricoryne elatior</i>	Yellow Rush-lily, Yellow Autumn-lily	Herb
<i>Triptilodiscus pygmaeus</i>	Austral Sunray	Herb
<i>Velleia montana</i>	Velleia	Herb
<i>Velleia paradoxa</i>	Spur Velleia	Herb
<i>Veronica gracilis</i>	Slender Speedwell	Herb
<i>Viola betonicifolia</i>	Showy Violet, Arrow-head Violet, Native Violet, Purple Violet	Herb
<i>Wurmbea dioica</i>	Early Nancy	Herb
<i>Zornia dyctiocarpa</i>	Zornia	Herb
<i>Acacia dawsonii</i>	Poverty Wattle, Dawson's Wattle, Mitta Wattle	Shrub
<i>Acacia decora</i>	Western Silver Wattle	Shrub
<i>Acacia genistifolia</i>	Spreading Wattle, Early Wattle, Wild Irishman	Shrub
<i>Astroloma humifusum</i>	Native Cranberry, Cranberry Heath	Shrub
<i>Bossiaea buxifolia</i>	Box-leaved Bitter-pea	Shrub
<i>Bossiaea prostrata</i>	Creeping Bossiaea, Prostrate Bitter-pea	Shrub

Species	Common Name	Gr. Form
<i>Bossiaea riparia</i>	River Leafless Bossiaea	Shrub
<i>Daviesia genistifolia</i>	Spiny Bitter-pea, Broom Bitter-pea	Shrub
<i>Daviesia latifolia</i>	Hop Bitter-pea	Shrub
<i>Daviesia leptophylla</i>	Narrow-leaf Bitter-pea	Shrub
<i>Daviesia mimosoides</i>	Narrow-leaf Bitter-pea	Shrub
<i>Daviesia ulicifolia</i>	Gorse Bitter-pea	Shrub
<i>Dillwynia cinerascens</i>	Grey Parrot-pea	Shrub
<i>Dillwynia glaucula</i>	Michelago Parrot-pea	Shrub
<i>Dillwynia prostrata</i>	Matted Parrot-pea	Shrub
<i>Dillwynia retorta</i>	Heathy Parrot-pea	Shrub
<i>Dillwynia sericea</i>	Showy Parrot-pea	Shrub
<i>Discaria pubescens</i>	Australian Anchor-plant	Shrub
<i>Dodonaea procumbens</i>	Trailing Hop-bush	Shrub
<i>Exocarpos strictus</i>	Pale Ballart, Pale-fruit Ballart, Dwarf Cherry	Shrub
<i>Gompholobium huegelii</i>	Pale Wedge-pea	Shrub
<i>Grevillea iaspicula</i>	Wee Jasper Grevillea	Shrub
<i>Grevillea lanigera</i>	Woolly Grevillea	Shrub
<i>Grevillea ramosissima</i>	Fan Grevillea, Branching Grevillea, Prickly Parsley Bush	Shrub
<i>Grevillea rosmarinifolia</i>	Rosemary Grevillea	Shrub
<i>Grevillea wilkinsonii</i>	Tumut Grevillea	Shrub
<i>Hakea microcarpa</i>	Small-fruit Hakea, Small-fruited Needlebush	Shrub
<i>Hardenbergia violacea</i>	False Sarsparilla, Purple Coral-pea, Native Lilac	Shrub
<i>Hibbertia calycina</i>	Lesser Guinea-flower	Shrub
<i>Hibbertia obtusifolia</i>	Hoary Guinea-flower	Shrub
<i>Hibbertia riparia</i>	Stream Guinea-flower, Erect Guinea-flower	Shrub
<i>Hovea linearis</i>	Creeping Hovea	Shrub
<i>Indigofera adesmiifolia</i>	Tick Indigo, Leafless Indigo, Broad-leaved Indigo	Shrub
<i>Indigofera australis</i>	Austral Indigo, Australian Indigo, Native Indigo, Hill Indigo	Shrub
<i>Kunzea parvifolia</i>	Violet Kunzea, Tickbush	Shrub
<i>Lespedeza juncea</i>	Perennial Lespedeza	Shrub
<i>Leucopogon fletcheri</i>	Pendant Beard Heath	Shrub
<i>Leucopogon fraseri</i>	Beard Heath	Shrub
<i>Leucopogon virgatus</i>	Common Beard Heath	Shrub
<i>Mirbelia oxylobioides</i>	Mountain Mirbelia	Shrub
<i>Muehlenbeckia tuggeranong</i>	Tuggeranong Lignum	Shrub
<i>Pimelea curviflora</i>	Curved Rice-flower	Shrub
<i>Pimelea glauca</i>	Shrubby Rice-flower	Shrub
<i>Pimelea pauciflora</i>	Poison Pimelea, Poison Rice-flower	Shrub
<i>Pultenaea fasciculata</i>	Bush-pea	Shrub
<i>Pultenaea microphylla</i>	Spreading Bush-pea	Shrub
<i>Pultenaea procumbens</i>	Heathy Bush-pea	Shrub
<i>Pultenaea spinosa</i>	Bush-pea	Shrub
<i>Pultenaea subspicata</i>	Low Bush-pea	Shrub
<i>Rulingia prostrata</i>	Dwarf Kerrawang	Shrub
<i>Templetonia stenophylla</i>	Leafy Templetonia, Leafy Mallee-pea	Shrub
<i>Exocarpos cupressiformis</i>	Cherry Ballart, Native Cherry, Wild Cherry, Cherry Wood	Shrub /Tree

Species	Common Name	Gr. Form
<i>Jacksonia scoparia</i>	Winged Broom-pea, Dogwood, Broom	Shrub /Tree
<i>Kunzea ericoides</i>	Burgan, Kanuka	Shrub /Tree

Item 7. A checklist of groundlayer plants that are indicative of lower levels of disturbance in Pink-tailed Worm-lizard habitat

These species therefore may be found in association with less-disturbed Pink-tailed Worm-lizard habitat (from Sharp et al., in prep.)

<p>Grasses/graminoids</p> <p><i>Aristida ramosa</i> <i>Cymbopogon refractus</i> <i>Poa sieberiana</i> <i>Sorghum leiocladum</i> <i>Themeda australis</i> <i>Dianella revoluta</i> <i>Dianella</i> sp. <i>Lomandra bracteata</i> <i>Lomandra filiformis</i> <i>Lomandra longifolia</i> <i>Lomandra multiflora</i> <i>Lomandra</i> sp. <i>Luzula</i> sp.</p> <p>Forbs</p> <p><i>Acrotriche serrulata</i> <i>Ajuga australis</i> <i>Asperula conferta</i> <i>Asplenium flabellifolium</i> <i>Astroloma humifusum</i> <i>Bulbine bulbosa</i> <i>Cheilanthes distans</i> <i>Cheilanthes sieberi</i> <i>Chrysocephalum apiculatum</i> <i>Desmodium varians</i> <i>Epilobium billardierianum</i> <i>Eryngium rostratum</i> <i>Galium gaudichaudii</i> <i>Glycine clandestina</i> <i>Glycine tabacina</i> <i>Gonocarpus tetragynus</i> <i>Goodenia hederacea</i> <i>Helichrysum scorpioides</i></p>	<p><i>Hydrocotyle laxiflora</i> <i>Isoetopsis graminifolia</i> <i>Leptorhynchus squamatus</i> <i>Lissanthe strigosa</i> <i>Luzula</i> sp. <i>Opercularia hispida</i> <i>Plantago varia</i> <i>Polygala japonica</i> <i>Poranthera microphylla</i> <i>Stackhousia monogyna</i> <i>Stellaria pungens</i> <i>Stypandra glauca</i> <i>Tricoryne elatior</i> <i>Triptilodiscus pygmaeus</i> <i>Velleia paradoxa</i> <i>Viola betonicifolia</i> <i>Wurmbea dioica</i></p> <p>Low or procumbent shrubs</p> <p><i>Acrotriche serrulata</i> <i>Astroloma humifusum</i> <i>Brachyloma daphnoides</i> <i>Cryptandra amara</i> <i>Dillwynia retorta</i> <i>Dillwynia sericea</i> <i>Hibbertia riparia</i> <i>Hovea heterophylla</i> <i>Leucopogon</i> sp. <i>Lissanthe strigosa</i> <i>Melichrus urceolatus</i> <i>Mirbelia oxylobioides</i> <i>Monotoca scoparia</i> <i>Pultenaea procumbens</i> <i>Phyllanthus hirtellus</i> <i>Pimelea curviflora</i></p>
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Item 8. Potential rare and threatened species in the Lower Molonglo Corridor (Sharp et al., in prep)

EPBC Act and NC Act listed fauna in woodland, riparian, aquatic and corridor habitat in the Lower Molonglo River Valley Conservation Areas

		Woodland / grassland	Riparian/aquatic	Corridor	Breeding record	
Known to occur						
White-bellied Sea-eagle ^{4,1}	M EPBC		✓		✓	One unconfirmed breeding record in Molonglo Valley (Olsen & Fuentes 2004).
Little Eagle ⁴	V NC	✓			✓	One active nest in Molonglo Valley in 2002-2003 (Olsen & Fuentes 2004), nesting and foraging territories identified in Debus (2006).
Latham's Snipe ⁵	M EPBC		✓			
Glossy Black-cockatoo ⁵	V NC	✓	✓	✓		
Yellow-tailed Black-cockatoo ⁵	P NC	✓	✓	✓		
Gang-gang Cockatoo ⁵	P NC	✓				
Major Mitchell's Cockatoo ⁵	P NC	✓				Coppin's Crossing
Superb Parrot ²	V NC V EPBC	✓			✓	Superb Parrot habitat use is focused on Central Molonglo and the Kama Nature Reserve with Box-gum Woodland important for nesting and feeding (Ecological 2011a).
Swift Parrot ³	V NC E EPBC M EPBC	✓		✓		Molonglo Valley is not known as an important area for the Swift Parrot; recorded once by COG at Kama Nature Reserve (Ecological 2011a).
White-throated Needletail ^{4,5}	M EPBC	✓				
Rainbow Bee-eater ⁴	M EPBC		✓		✓	
Brown Treecreeper ^{4,6}	V NC	✓				Kama Nature Reserve
Regent Honeyeater ²	E NC, E EPBC, M EPBC	✓		✓		

¹ Debus 2006

² Ecological (2009)

³ Ecological (2011a)

⁴ Barrer *et al.* (1992)

⁵ Birddata (2012)

⁶ Biosis (2006)

		Woodland / grassland	Riparian/aquatic	Corridor	Breeding record	
Painted Honeyeater ²	V NC	✓		✓	✓	Uriarra Crossing
Hooded Robin ²	V NC	✓				
Varied Sittella ⁴	V NC	✓				Common in 1992 in open forest and edges
Satin Flycatcher ⁴	M EPBC		✓			
Rufous Fantail ⁴	M EPBC		✓			
White-winged Triller ⁴	V NC	✓				Rare in 1992
Australasian Figbird ⁵	P NC		✓			
Pink-tailed Worm-lizard ^{4,7}		✓	✓		✓	
Likely to occur						
Spotted-tailed Quoll ⁴	V EPBC	✓		✓		
Grey-headed Flying-fox ⁸	V EPBC		✓	✓		
Great Egret ³	M EPBC		✓			
Cattle Egret ³	M EPBC		✓			
Fork-tailed Swift ³	M EPBC	✓		✓		
Macquarie Perch ⁶	E NC E EPBC		✓			Recorded prior to 1990 (Beitzel et al. 2009)
Silver Perch ⁶	E NC		✓			
Murray Cod ⁷	E EPBC		✓			Recorded prior to 2000 (Beitzel et al. 2009)
Potential to occur						
Golden Sun Moth	CE EPBC	✓				Not found despite surveys.
Perunga Grasshopper	V NC	✓				
Striped Legless Lizard	V EPBC V NC	✓				

Item 9. Significant plant species recorded in the Lower Molonglo River Valley (Sharp et al, in prep.)

Species	Status	Habitat
Trees		
River She-oak <i>Casuarina cunninghamiana</i>	Protected (NC Act)	Alluvial soils on river banks between normal water levels and maximum flood levels, between boulders, in rock cracks and on sandy and shingle terraces (Sharp et al. 2007, Johnston et al. 2009).
Shrubs		
Prickly Moses <i>Acacia ulicifolia</i>	Rare and Uncommon Plants of the ACT list (CPR 2012)	West-facing sites in woodland
<i>Bertya rosmarinifolia</i>	Rare and Uncommon Plants of the ACT list	Riparian Woodland and shrubland

⁷ Ecological (2011b)

⁸ Atlas of Living Australia (2012)

Species	Status	Habitat
Mountain Leafless Bossiaea <i>Bossiaea grayi</i> , formerly <i>B. bracteosa</i> sens lat	(CPR 2012) Protected (NC Act) (as <i>B. bracteosa</i>) Rare and Uncommon Plants of the ACT list (CPR 2012)	Grows in sand amongst boulders on river banks dominated by <i>Casuarina cunninghamiana</i> or occasionally in shrubland of rock outcrops close to the river (McDougall 2009). On rock outcrops at or a little above high flood level, and further from the river, on a protected south-facing gully slope amongst Burgan (Barrer 1992).
Australian Anchor Plant <i>Discaria pubescens</i>	Rare and Uncommon Plants of the ACT list (CPR 2012) Protected (NC Act) ROTAP 3RCA	Woodland, forest, among rocks and on deeper soils (Barrer 1992). Low cliff face among rocks (ngnvironmental 2011).
Tick Indigo <i>Indigofera adesmiifolia</i>	Rare and Uncommon Plants of the ACT list (CPR 2012)	Rocky places, mostly on volcanics. Widespread in woodland.
Pale Pomaderris <i>Pomaderris pallida</i>	Protected (NC Act) ROTAP 2Vci Threatened (NSW) – V Threatened (Cwlth) – V Rare and Uncommon Plants of the ACT list (CPR 2012)	Often shallow woodland soils on rocky WSW-facing slopes (Barrer 1992).
Forbs		
Stiff Woodruff <i>Asperula ambleia</i>	Rare and Uncommon Plants of the ACT list (CPR 2012) ACT Protected	Rocky riparian sites
Milkmaids <i>Burchardia umbellata</i>	Rare and Uncommon Plants of the ACT list (CPR 2012) Protected (NC Act)	Recorded in a high slope seepage area, colonised by Burgan (Barrer 1992).
Yellow Burr-daisy <i>Calotis lappulacea</i>	Rare and Uncommon Plants of the ACT list (CPR 2012)	Rock outcrops in Burgan shrubland and grassland derived from Box-Gum Woodland (ngnvironmental 2012a)
Large Tick-trefoil <i>Desmodium brachypodium</i>	Rare and Uncommon Plants of the ACT list (CPR 2012)	Woodland on higher east-facing slopes.
Blue Flax-lily <i>Dianella longifolia</i>	Protected (NC Act) (as <i>D. laevis</i>) Rare and Uncommon Plants of the ACT list (CPR 2012)	Appears to prefer such steep, protected, south or south-east facing sites, apparently inaccessible to sheep, although a plant was noted on the north-eastern side of a limestone outcrop (Barrer 1992). Native grassland (Kangaroo Grass dominant) (ngnvironmental 2011).
Hoary Sunray <i>Leucochrysum albicans</i>	Threatened (Cwlth) – E Rare and Uncommon Plants of the ACT list (CPR 2012)	Woodland and grassland
Yam Daisy, Murnong <i>Microseris lanceolata</i>	Rare and Uncommon Plants of the ACT list (CPR 2012)	Native grassland
Notched Swainson-pea <i>Swainsona monticola</i>	Rare and Uncommon Plants of the ACT list (CPR 2012)	Grassy woodland
Twining Fringe-lily <i>Thysanotus patersonii</i>	Rare and Uncommon Plants of the ACT list (CPR 2012)	Rocky sites
All orchids <i>Pterostylis rufa</i> ssp	Protected (NC Act)	<i>Pterostylis rufa</i> ssp <i>aciculliformis</i> grows in shallow rocky soils in a variety of habitats (Barrer 1992).

Species	Status	Habitat
<i>aciculliformis</i>		
Purple Donkey Orchid <i>Diuris punctata</i>	Rare and Uncommon Plants of the ACT list (CPR 2012)	Grassland and grassy woodland
Graminoids		
Blady Grass <i>Imperata cylindrica</i>	Rare and Uncommon Plants of the ACT list (CPR 2012)	
Ferns		
Bristly Cloak Fern <i>Cheilanthes distans</i>	Rare and Uncommon Plants of the ACT list (CPR 2012) Protected (NC Act)	Steep, rocky, timbered, north-facing slopes (Barrer 1992). Box-Gum Woodland secondary grassland (ngnhenvironmental 2012a)
Sickle Fern <i>Pellaea falcata</i>	Rare and Uncommon Plants of the ACT list (CPR 2012) Protected (NC Act)	Rocky places in sclerophyll forest and rainforest, widespread on the coast and ranges.
Necklace Fern <i>Asplenium flabellifolium</i> Rough Maiden Hair Fern <i>Adiantum hispidulum</i> Gristle Fern <i>Blechnum cartilagineum</i> Rasp Fern <i>Doodia aspera</i> Bristly Cloak Fern <i>Pleurosorus rutifolius</i> Tender Brake <i>Pteris tremula</i>	Protected (NC Act) – all ferns except Bracken and <i>Cheilanthes</i> spp.	Variety of rocky and sheltered habitats (Barrer (1992). Rocky knoll in Kangaroo Grass grassland (ngnhenvironmental 2011).

5. References

- Conservation Planning and Research (2012) Survey guidelines for determining lowland vegetation classification and condition in the ACT. Unpublished report, Territory and Municipal Services, ACT.
- Department of Environment, Climate Change and Water NSW (DECCW) (2011) Operational Manual for BioMetric 3.1. Department of Environment, Climate Change and Water, NSW Sydney
- Eddy D, Mallinson D., Rehwinkel R. and Sharp S. (2011). *Grassland Flora, a field guide for the Southern Tablelands (NSW & ACT)*. 2nd Edition. Environment ACT, Canberra.
- Gibbons P., Briggs S.V., Ayers D.A., Doyle S., Seddon J., McElhinny C., Jones N., Sims R. and Doody J.S., (2008) Rapidly quantifying reference conditions in modified landscapes. *Biological Conservation* 141: 2483 – 2493
- Hnatiuk R.J., Thackway R. and Walker J. (2009). Vegetation. In, *The National Committee on Soil and Terrain (eds), Australian Soil and Land Survey Field Handbook*. Third Edition. CSIRO Publishing, Collingwood Victoria.
- Rehwinkel R. (2007). A method to assess grassy ecosystem sites: using floristic information to assess a site's quality. NSW Department of Environment and Climate Change, unpublished report to the Natural Temperate Grassland National Recovery Team.
- Sharp S., 2012. Procedures Manual – Baseline Condition Assessment in the Lower Molonglo River Valley Conservation Areas. Unpublished report to the Territory and Municipal Services, ACT Government.
- Sharp S., Dorough, J., Rehwinkel, R., Eddy, D. and Breckwoldt, A., 2005. *Grassy Ecosystem Management Kit: A Guide To Developing Conservation Management Plans*. Environment ACT, Canberra.
- Sharp S. and Gould L., 2014. ACT Region Vegwatch Manual: Vegetation and habitat condition assessment and monitoring for Community. Molonglo Catchment Group, Canberra.
- Sharp S., Osborne W., ngh environmental (in prep). Molonglo Ecological Management Guidelines. Report to the Territory and Municipal Services.
- SEWPAC (2012a) SPRAT Profile for White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands. <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity>. Accessed June 2012.
- SEWPAC (2012b) SPRAT Profile for Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory. <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=14>. Accessed June 2012.
- Habitat App for measuring projective cover:
<https://play.google.com/store/apps/details?id=com.scrufster.habitapp>

6. Field sheets

Date		Site Location		Veg Zone	
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1.1 Vegetation Zone Description

Attributes	Circle or indicate A : abundant, C : common, O : occasional or R : rare; as relevant
Land use (circle):	Farm; Urban park; Reserve; Roadside; Other:
Aspect	N; NE; E; SE; S; SW; W; NW; 0 (flat)
Landform	Ridge or crest; Hilltop; Hillslope; Footslope; Flat; Valley Floor; Drainage Line; Riparian zone
Drainage	Well drained; Moderately drained; Poorly drained
Soil depth	<2 cm; 2-5 cm; 5-20 cm; >20 cm
Structural Formation	Forest; Woodland; Shrubland; Grassland; Derived Grassland; Waterbody; Sedgeland; Plantation: native; exotic
Veg Type (A, C, O, R)	Remnant (); Regeneration (); Planted (); Native (); Exotic ()
Tree Age (A, C, O, R)	Seedling (); Sapling (); Mature (); Old Growth (); Dead mature trees ()
Planting (A, C, O, R)	Local Native (); Non Local Native (); Exotic (); None Trees (); Shrubs (); Grasses (); Forbs (wildflowers) ()

Indicate: **Intensity:** Light, Moderate or Severe; **Age:** Ongoing; Recent; Not recent or Old; **Frequency:** Rare; Occasional; Frequent

Current Site Mgmt	Weed Control; Mowing; Recent Fire (date if known:); Other:
Grazers	Cattle (); Sheep (); Horses (); Roos (); Rabbits (); Unknown (); Other: ()
Site Condition	Soil Disturbance (); Recent clearing (); Stumps (); Dumping (); Artificial Drainage (); Weeds (); Compaction (); Timber harvesting (); Flood damage (); Firewood collection (); Dense regrowth (); Fertiliser addition (); Other: ()
Erosion	Sheet (); Gully (); Streambank (); Rill () Is erosion: Active? Y N (i.e visible soil deposits, slumping of banks, wash-away etc)
Key management issues, other threats, issues, pests	
Site Description general observations	

1.2 Regeneration

Tree species present in zone	Regenerating?	Health: 1 (Very Good) to 5 (Very poor)
Number regenerating		
Proportion regenerating		

1.3 Canopy Cover

Canopy Cover class: Dense:>75%; Mid-dense: 50-75%; Sparse:20-50%; Very Sparse: 0.25 – 20%; Isolated Plants: <0.25%; Isolated Clumps: <0.25%

Height class: 0: <0.05 m; 1: 0.06–<0.25 m; 2: 0.26–0.5 m; 3: 0.51–1 m; 4: 1.01–2 m; 5: 2.01–5 m; 6: 5.01–10 m; 7: 10.01–20 m; 8: 20.01–35 m; 9: 35.01–50m

Strata	Canopy cover class, height	Dominant species (dominant, co-dominant or sub-dominant)
Emergent		
Upper		
Mid		
Lower		

Date		Site Location		Veg Zone	
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2.1 Fauna habitat

Attribute	R, O, C, A	Comments
Tree hollows		
Large trees (>50 cm dbh)		
Dead standing trees		
Stumps		
Mistletoes		
Regenerating tree thickets		
Native shrub thickets		
Exotic shrub thickets		
Logs and fallen timber (>10 cm dbh)		
Litter (leaves, twigs, bark)		
Loose rocks		
Outcropping rocks		
Crypogams		
Patches of bare ground		
Patchy tall herbs (>50 cm) and short herbs (<0.25 cm) present		

2.2 Potential threatened species habitat

Habitat type	Location	Potential threatened species supported

2.3 Waterbody features in vegetation zone

Feature	1	2	3	4	5
Type					
Location					
Permanent water					
Shallow banks/beach areas					
Fringing aquatic vegetation					
Emergent vegetation					
Floating vegetation					
Emergent timber/rocks in water					
Other....					

2.4 Opportunistic species and other attributes

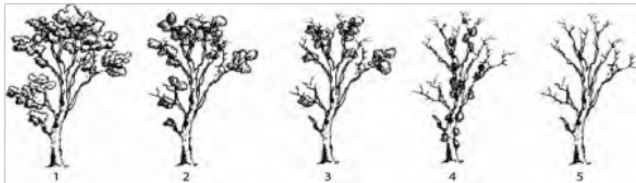
Opportunistic Record	Location (GPS)	Status	Notes

Site Location		Veg Zone/Plot #	
Date established		Establishment/Survey by	

3.1 Plot Location

Description of the location of the plot in the vegetation zone			
Plot markers, dimensions, orientation			
Transect orientation, location			
NW: X: Y: .		NE: X: Y: .	
SW: X: Y: .		SE: X: Y: .	

3.2 Plot Description

Land use			
Slope (% , or flat, gentle, steep)	Elevation (from map)	Aspect: N; NE; E; SE; S; SW; W; NW; O	
Landform element Structural Formation	Ridge or crest; Hilltop; Hillslope; Foothill; Flat; Valley Floor; Drainage Line; Riparian zone Forest; Woodland; Shrubland; Grassland; Derived Grassland; Waterbody; Sedgeland; Plantation: native; exotic		
Height of the groundlayer not including flower or seedheads			
Regeneration present	Seedlings; Saplings; Immature trees; Mature trees; Very old mature trees; Senescent trees		
Tree health (circle): 1. Very good 2. Good 3. Moderate 4. Poor 5. Very poor			
Planting: Yes/No	Local Native (); Non Local Native (); Exotic (); Don't know () Trees (); Shrubs (); Grasses (); Forbs (wildflowers) ()		
Significant weeds (circle and indicate Abundant, Common, Occasional, Rare)	Serrated Tussock (); African Lovegrass (); Chilean Needlegrass (); St John's Wort (); Blackberry (); Woody weeds (); Other:		
Plot disturbance (indicate Low, Medium, High)	Soil disturbance (); Recent clearing (); Dumping (); Artificial drainage (); Salinity (); Other:		
Erosion (indicate Active or Stabilised)	Sheet (); Rill (); Gully (); Streambank ()		
Plot management (circle)	No active management; Weed control; Ploughing; Mowing; Recent fire; Grazing; Other:		
Grazers (circle)	Cattle; Sheep; Horses; Kangaroos; Rabbits; Other		
Description of plot/ Management issues			

3.3 Photopoint

Photo #			
GPS location of camera post		Direction of photo	
Height of camera post:		Portrait or Landscape	
Height of sighter post:		Distance of sighter post from camera post:	
Time of day:		Weather conditions:	

Date		Location		Veg Zone, plot#	
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4. Species Cover (Indicator 4, Sharp and Gould 2014).

4.1. Groundcover	Total no of points measured (P):	Frequency (F)	% cover (F/P)x100
Cryptogams (mosses, lichens, fungi and/or algae)			
Bare Earth			
Rocks			
Litter/Dead Vegetation			
Annual introduced grass and forbs			
Perennial introduced grasses, forbs and shrubs < 1m			
Native grasses			
Native shrubs < 1 m tall			
Other native ground stratum species			

4.2 Woody Vegetation Cover Measured at 10 points along plot centreline transect

Upper Stratum	1	2	3	4	5	6	7	8	9	10	Mean
% foliage cover Native > 2m tall											
% foliage cover Exotic > 2m tall											

Mid Stratum	1	2	3	4	5	6	7	8	9	10	Mean
% foliage cover Native 1 – 2 m tall											
% foliage cover Exotic 1 – 2 m tall											

4.3 Regeneration of remnant trees and shrubs in the plot

Species Name	Seedling (trees and shrubs)	Sapling/Juvenile (trees)	Young Adult (trees)	Mature Adult (trees and shrubs)	Very old mature trees	Senescent (trees and shrubs)	Age groups present
	Number	Number	Number	Number	Number	Number	Number

4.4 Length of fallen timber (all fallen timber within plot greater than 10 cm in diameter)

4.5 Number of trees with hollows

No. trees with hollows	
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Date		Location		Veg Zone, plot #	
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5. Plant Species Diversity: Plot and Vegetation Zone (Indicator 1, Sharp and Gould 2014)

In Column 1 indicate abundance in **20 m x 20 m** plot for vegetation <2m, indicate abundance in **50 m x 20 m** plot for vegetation >2m. Circle for vegetation >2m.
r solitary (approx 1-3) <5%; + few (approx. 4-15) <5%; 1 numerous / scattered < 5%; 2 5-25%; 3 25-50%; 4 50-75%; 5 >75%

Indicate presence / absence with a tick for **vegetation zone** in Column 2 for species not otherwise recorded in the plot survey.

Exotic or non-local species		<i>Pyracantha</i> sp.		<i>Hovea heterophylla</i> 114		<i>Isotoma fluviatilis</i> 102	
<i>Acacia baileyana</i> 124		<i>Rosa rubiginosa</i>		<i>Indigofera adesmiifolia</i>		<i>Juncus</i> sp. (native) 48	
<i>Acetosella vulgaris</i> 124		<i>Rubus fruticosus</i> complex		<i>Indigofera australis</i>		<i>Lepidosperma laterale</i>	
<i>Aira</i> sp. 46		<i>Rumex crispus</i>		<i>Leptospermum</i> sp.		<i>Leptorhynchos squamatus</i> 80	
<i>Anagallis arvensis</i>		<i>Salvia verbenaca</i> 106		<i>Leucopogon fletcheri</i>		<i>Lomandra bracteata</i> 54	
<i>Arctotheca calendula</i> 88		<i>Sherardia arvensis</i>		<i>Lissanthe strigosa</i> 140		<i>Lomandra filiformis</i> 54	
<i>Avena</i> sp.		<i>Silene gallica</i>		<i>Melichrus urceolatus</i> 140		<i>Lomandra filiformis coriacea</i>	
<i>Briza maxima</i> 46		<i>Solanum nigrum</i>		<i>Pultenaea procumbens</i> 142		<i>Lomandra longifolia</i> 54	
<i>Briza minor</i> 46		<i>Sonchus</i> sp. (Sow thistle)		<i>Pomaderris angustifolia</i>		<i>Lomandra multiflora</i> 54	
<i>Bromus</i> sp. 46		<i>Spergularia rubra</i>		<i>Solanum cinereum</i>		<i>Luzula densiflora</i> 50	
<i>Carthamus lanatus</i> (Saffron)		<i>Stellaria media</i>		Other (native forbs, rushes and sedges)		<i>Lythrum hyssopifolia</i>	
<i>Celtis australis</i>		<i>Taraxacum</i> sect. <i>Ruderallia</i>		<i>Acaena novae-zelandiae</i> 136		<i>Microseris</i> sp. Snowfields 86	
<i>Centaurium</i> sp. 122		<i>Tolpis barbata</i> 88		<i>Acaena ovina</i> 136		<i>Microtis unifolia</i> 64	
<i>Cerastium</i> sp.		<i>Tragopogon</i> sp.		<i>Alternanthera nana</i>		<i>Opercularia hispida</i>	
<i>Chondrilla juncea</i>		<i>Trifolium</i> sp. 116		<i>Amyema</i> sp.		<i>Oxalis perennans</i> 116	
<i>Cirsium vulgare</i> (Spear)		<i>Verbascum thapsus</i> 126		<i>Arthropodium milleflorum</i> 58		<i>Persicaria prostrata</i>	
<i>Conyza</i> sp.		<i>Verbascum virgatum</i> 126		<i>Asperula conferta</i> 92		<i>Pimelea curviflora</i> 90	
<i>Cotoneaster</i> sp		<i>Vulpia</i> sp. 46		<i>Asperula scoparia</i> 92		<i>Plantago varia</i> 128	
<i>Crataegus</i> sp.		Native trees and tall shrubs		<i>Bulbine bulbosa</i> 62		<i>Rumex brownii</i> 124	
<i>Cynodon dactylon</i> 34		<i>Acacia dealbata</i>		<i>Calotis lappulacea</i> 98		<i>Schoenus apogon</i> 52	
<i>Cynosurus echinatus</i>		<i>Acacia genistifolia</i>		<i>Carex appressa</i> 52		<i>Scleranthus biflorus</i> 132	
<i>Cyperus eragrostis</i>		<i>Acacia implexa</i>		<i>Carex breviculmis</i> 52		<i>Senecio</i> sp. (native)	
<i>Dactylis glomerata</i> 44		<i>Acacia melanoxylon</i>		<i>Carex inversa</i> 52		<i>Solenogyne dominii</i> 130	
<i>Echium plantagineum</i> 106		<i>Acacia parramattensis</i>		<i>Chamaesyce drummondii</i>		<i>Stackhousia monogyne</i> 90	
<i>Echium vulgare</i> 106		<i>Acacia rubida</i>		<i>Cheilanthes</i> sp. 138		<i>Stellaria pungens</i>	
<i>Eleusine tristachya</i>		<i>Allocasuarina verticillata</i>		<i>Chenopodium pumilio</i>		<i>Styandra glauca</i>	
<i>Eragrostis curvula</i> 42		<i>Brachychiton populneus</i>		<i>Chrysocephalum apiculatum</i> 74		<i>Tricoryne elatior</i> 62	
<i>Erodium cicutarium</i> 104		<i>Bursaria spinosa</i>		<i>Chrysocephalum semipapposum</i>		<i>Triptilodiscus pygmaeus</i> 80	
<i>Festuca arundinacea</i> 44		<i>Callitris endlicheri</i>		<i>Clematis leptophylla</i>		<i>Vittadinia cuneata</i> 100	
<i>Gamochaeta americana</i> 130		<i>Casuarina cunninghamiana</i>		<i>Convolvulus angustissimus</i> 120		<i>Vittadinia gracilis</i>	
<i>Hirschfeldia incana</i>		<i>Eucalyptus blakelyi</i> 146		<i>Craspedia variabilis</i> 82		<i>Vittadinia muelleri</i>	
<i>Holcus lanatus</i> 42		<i>Eucalyptus bridgesiana</i> 148		<i>Crassula sieberiana</i>		<i>Wahlenbergia communis</i> 102	
<i>Hordeum (Critesion)</i> sp. 46		<i>Eucalyptus dives</i> 148		<i>Cymbonotus lawsonianus</i> 88		<i>Wahlenbergia gracilentia</i>	
<i>Hypericum perforatum</i>		<i>Eucalyptus macrorhyncha</i> 148		<i>Cynoglossum suaveolens</i>		<i>Wahlenbergia gracilis</i>	
<i>Hypochaeris glabra</i> 86		<i>Eucalyptus mannifera</i> 146		<i>Daucus glochidiatus</i> 138		<i>Wahlenbergia luteola</i>	
<i>Hypochaeris radicata</i> 86		<i>Eucalyptus melliodora</i> 146		<i>Desmodium varians</i> 112		<i>Wahlenbergia stricta</i>	
<i>Lactuca serriola</i>		<i>Eucalyptus nortonii</i> 148		<i>Dianella revoluta</i> 56		<i>Wurmbea dioica</i> 60	
<i>Lepidium africanum</i>		<i>Eucalyptus pauciflora</i> 148		<i>Dichondra repens</i> 134		<i>Xerochrysum viscosum</i> 84	
<i>Ligustrum</i> sp.		<i>Eucalyptus polyanthemus</i> 146		<i>Dichopogon fimbriatus</i> 58		Native grasses	
<i>Linaria pelisserana</i> 104		<i>Eucalyptus rossii</i> 146		<i>Diuris sulphurata</i>		<i>Aristida ramosa</i> 34	
<i>Lolium perenne</i> 44		<i>Eucalyptus rubida</i> 148		<i>Drosera peltata</i> 92		<i>Austrostipa bigeniculata</i> 14	
<i>Lolium rigidum</i> 44		<i>Exocarpus cupressiformis</i>		<i>Einadia nutans</i>		<i>Austrostipa densiflora</i> 14	
<i>Lycium ferocissimum</i>		<i>Kunzea ericoides</i>		<i>Eleocharis acuta</i>		<i>Austrostipa scabra</i> 14	
<i>Malva</i> sp.		Other (native shrubs)		<i>Epilobium billardiianum</i> 120		<i>Bothriochloa macra</i> 24	
<i>Marrubium vulgare</i>		<i>Acrotriche serrulata</i>		<i>Erodium crinitum</i> 104		<i>Chloris truncata</i> 34	
<i>Modiola caroliniana</i>		<i>Astroloma humifusum</i> 140		<i>Eryngium ovinum</i> 108		<i>Cymbopogon refractus</i>	
<i>Myosotis discolor</i>		<i>Bossiaea buxifolia</i> 142		<i>Euchiton</i> sp. (native) 130		<i>Dichelachne</i> sp. 26	
<i>Nassella neesiana</i> 40		<i>Brachyloma daphnoides</i> 140		<i>Galium gaudichaudii</i> 92		<i>Elymus scaber</i> 20	
<i>Nassella trichotoma</i> 40		<i>Cassinia longifolia</i>		<i>Geranium retrorsum</i> 118		<i>Enneapogon nigricans</i> 32	
<i>Onopordum acanthium</i>		<i>Cassinia quinquefaria</i>		<i>Geranium solanderi</i> 118		<i>Eragrostis brownii</i>	
<i>Orobanche minor</i>		<i>Cryptandra amara</i> 140		<i>Glycine clandestina</i> 112		<i>Lachnagrostis filiformis</i>	
<i>Parentucellia latifolia</i> 122		<i>Daviesia genistifolia</i> 142		<i>Glycine tabacina</i> 112		<i>Microlaena stipoides</i> 22	
<i>Paronychia brasiliana</i>		<i>Daviesia leptophylla</i> 142		<i>Gonocarpus tetragynus</i> 124		<i>Panicum effusum</i> 28	
<i>Paspalum dilatatum</i>		<i>Daviesia mimosoides</i>		<i>Goodenia hederacea</i> 70		<i>Poa labillardierei</i> 12	
<i>Petrorhagia nanteuillii</i> 120		<i>Dodonea viscosa</i>		<i>Goodenia pinnatifida</i> 70		<i>Poa sieberiana</i> 12	
<i>Phalaris aquatica</i> 44		<i>Dillwynia sericea</i>		<i>Haloragis heterophylla</i> 134		<i>Rytidosperma pallidum</i> 18	
<i>Plantago lanceolata</i> 128		<i>Hardenbergia violacea</i>		<i>Hydrocotyle laxiflora</i> 134		<i>Rytidosperma</i> spp 16	
<i>Polygonum aviculare</i>		<i>Hibbertia obtusifolia</i> 144		<i>Hypericum gramineum</i> 72		<i>Sorghum leiocladum</i> 38	
<i>Prunus</i> sp.		<i>Hibbertia riparia</i> 144		<i>Hypoxis hygrometrica</i> 62		<i>Themeda triandra</i> 10	

