

# Land Manager's Monitoring Guide

## Native plant richness indicator

Prepared by:

Environment and Resource Sciences

Department of Environment and Resource Management

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## What is it?

Native plant richness refers to the number of different plant species in an area of vegetation. Regular monitoring involves identifying the plant species and plant forms within a monitoring area over time and can include counting the number of plants for abundance and relative abundance (see 'Glossary').

Monitoring native plant richness requires some ability to identify native plants or access to someone with such skills. Identifying and recording the native plant species in an area tells you about the presence or absence of plant species. Recording the number of each species (its abundance) will provide a clearer picture of what is happening to the area of vegetation.

## Other factors and related indicators

There are a number of other vegetation-related monitoring activities you may want to carry out at the same time as monitoring native plant richness. These include:

- Deep-rooted perennials
- Fallen woody material
- Ground cover
- Impacts on native vegetation
- Large trees
- Native plant richness
- Native vegetation area
- Organic litter
- Pasture species
- Recruitment of woody plants
- Shrub cover
- Tree canopy cover & health
- Vegetation density
- Weed cover
- Weed species
- Yearly pasture use

You may consider using 'photopoints' as an additional technique to support the monitoring of native plant richness. Photopoints are photographic records for a particular location over time. For both levels of monitoring, it can assist in providing visual evidence of the plant species present and give you a general idea of the relative dominance of different plant species. It will not provide actual data on the change in plant species numbers.

## Why monitor this indicator?

Monitoring native plant richness will show you whether plant diversity on your property is increasing or decreasing. To manage the vegetation on your property for the long term, it is important not only to know how much vegetation you have (see 'Native vegetation area' indicator) and how healthy it is, but also to know how rich in plant species the vegetation is and how this richness may change as a result of your management actions and other influences.

Australia is regarded as a mega diverse continent because of the very large number of plant and animal species that occur here. It is now acknowledged that most vegetation in Australia is impacted by human activity and requires some level of active management to minimise these influences to conserve our unique natural heritage. Many land managers recognise that they have a duty of care to contribute to conserving biodiversity.

From a distance two patches of vegetation may appear the same. However, within small districts there can be dozens of different types of native vegetation and different levels of vegetation quality.

It is important to be able to accurately identify native vegetation on your property, as some vegetation types may be more 'significant' or more sensitive to different management actions than others. Monitoring native plant richness will

help you work out how different vegetation types and individual plant species respond to your management techniques. If available you may be able to compare your data with the expected species range for that particular vegetation type.

Monitoring native plant richness is essential for making informed management decisions that may impact on native vegetation. Specifically, native plant richness will tell you:

- What native plant species exist in a given area
- If and how the species present are changing over time and throughout seasons (if measured seasonally)
- Whether the relative dominance of plant species and plant forms within the area is changing over time (if a calculation or estimate of abundance is undertaken) – this can be an early indicator of vegetation thickening
- About the impacts of your management actions on the plant species within the area you are monitoring
- What is required to improve or maintain biodiversity on your property.

## **Planning to monitor this indicator**

The ‘Developing your monitoring plan’ part of the ‘Monitoring overview’ section of the Land Manager’s Monitoring Guide discusses seven key questions that help to define the why, what, who and how of monitoring:

1. What are your monitoring objectives?
2. How will your data be used?
3. What will you monitor?
4. Where will you monitor?
5. When and how often will you monitor?
6. Who will be involved and how?
7. How will your data be managed?

These seven questions should be considered for every indicator that you plan to monitor. In addition to the concepts discussed in the ‘Monitoring overview’ you should also consider the following issues that are specific to this indicator when planning your monitoring.

Monitoring native plant richness is mainly a field-based activity that requires some planning and recording time.

### **What are your monitoring objectives?**

As with all monitoring activities you will need to clearly identify why you want to monitor native plant richness and how monitoring this indicator may support your property or business planning objectives. When setting your monitoring objectives for native plant richness following should be considered:

- Your management priorities
- Any catchment, regional or state priorities that may be relevant to the vegetation on your property and the presence of ‘endangered’ or ‘of concern’ regional ecosystems
- Areas you are rehabilitating or revegetating
- Areas of proposed changes in land use
- Other indicators that you may be monitoring at the same time or within the area of vegetation.

### **How will your data be used?**

Your local on-ground natural resource management organisations such as catchment, Landcare or conservation groups involved in managing and restoring areas of native vegetation may be interested in the information you have gathered about native plant richness.

If combined with other vegetation related data, your native plant richness data may be of interest to your regional natural resource management body. These bodies are now required to report on a range of native vegetation indicators listed in the National Framework for Natural Resource Management Standards and Targets (AG, 2004) and they may be interested in your data. To find out if your information is needed or how to participate in existing monitoring programs you can contact your local natural resource management regional body <[www.regionalnrm.qld.gov.au](http://www.regionalnrm.qld.gov.au)>.

The Queensland Herbarium encourages the submission of plant specimens or electronic images to develop and update the state collection. You can send plant specimens or scanned images of the plants to the Queensland Herbarium <[http://www.derm.qld.gov.au/wildlife-ecosystems/plants/queensland\\_herbarium/](http://www.derm.qld.gov.au/wildlife-ecosystems/plants/queensland_herbarium/)>. You will need to submit a Queensland Herbarium form with the specimen. This is found at the back of the Queensland Herbarium publication *Collecting and preserving plant specimens, a manual* <[http://www.derm.qld.gov.au/wildlife-ecosystems/plants/queensland\\_herbarium/publications/pdf/collecting\\_manual\\_v5.pdf](http://www.derm.qld.gov.au/wildlife-ecosystems/plants/queensland_herbarium/publications/pdf/collecting_manual_v5.pdf)>.

## What will you monitor?

### BioCondition Assessment framework

This native plant richness indicator is consistent with the BioCondition Assessment Framework (see 'Glossary') developed by the Queensland Department of Environment and Resource Management. The framework provides a means of assessing biodiversity at a patch, property or paddock scale that is compared to benchmarks for the particular vegetation type. This indicator module uses the same methods as the 'native plant species richness' attribute of the framework and the data collected, along with other data, can be used to complete a BioCondition Assessment. This attribute is one of ten used to compile the dataset for conducting a BioCondition Assessment <<http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/biocondition.html>>. Most of these attributes use a common assessment or monitoring area from which to record information.

### Existing guides and benchmarks

The process of identifying the plants on your property can be hastened if you are able to compare your identification with a likely list for the vegetation type. Your local Landcare or other on-ground action group, a local botanist or local government may be able to provide you with a list. A local plant identification guide will also be very helpful. Regional ecosystem maps and the regional ecosystem description database <[http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/regional\\_ecosystems/index.php](http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/regional_ecosystems/index.php)> published by the Department of Environment and Resource Management provide information on mapped remnant vegetation and the plants species associated with them.

Each vegetation type or regional ecosystem (see 'Glossary') has a typical or benchmark range of species that can be expected to occur. If this information is available to you, comparing the benchmark to your own native plant richness data will provide the clearest picture of what is happening to the area of vegetation.

### Existing monitoring in your area

Before you start monitoring any indicator it is strongly recommended that you explore who else is monitoring in your area, what they are monitoring and how they are monitoring it. Doing this will not only make sharing your data easier if you chose to do so but will also help you become more familiar with:

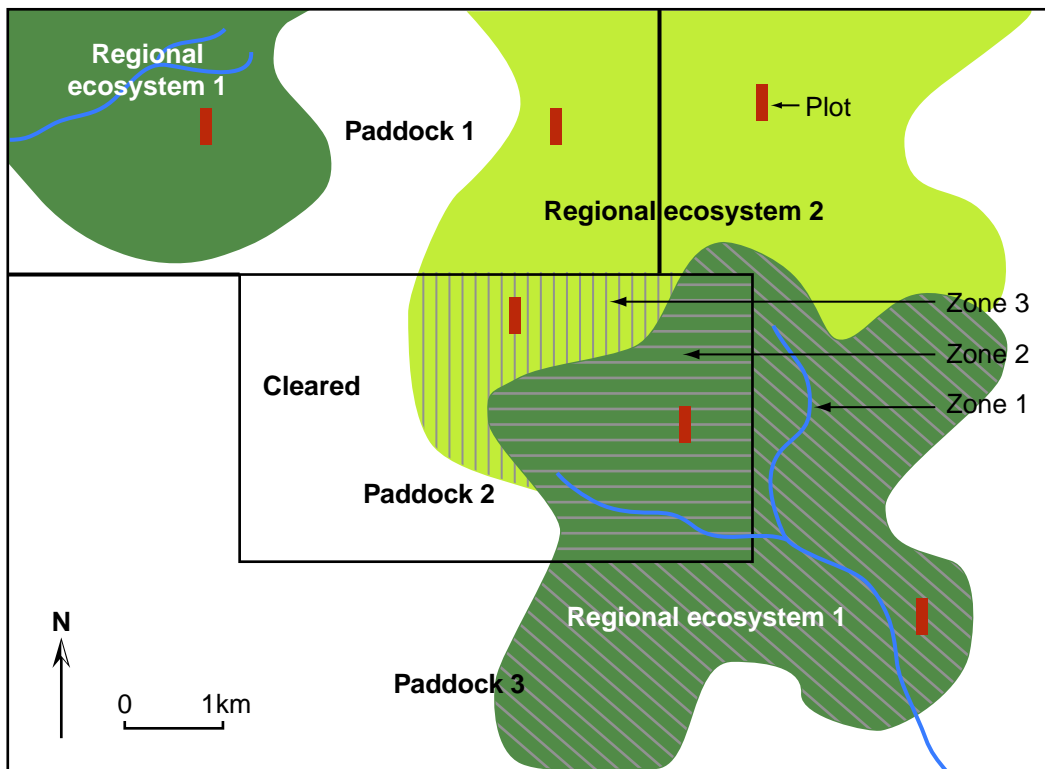
- Any area specific issues that may influence your monitoring
- What strategies and/or methods have proven successful within your area

Other land managers, local botanists, your Landcare or catchment group or your regional natural resource management body <[www.regionalnrm.qld.gov.au](http://www.regionalnrm.qld.gov.au)> may be monitoring native vegetation in your area. To enable strategic management of native vegetation in your area Landcare or other on-ground groups may benefit from the pooling together of information from a number of similar vegetation sites across the district. Contact these groups, as they may be able to provide information and any specific recommendations for your area.

## Where will you monitor?

If you want a complete picture, all different vegetation types (see 'Glossary') and all areas subject to different management on the property should be monitored for native plant richness. The combination of a particular vegetation type and management action can be called a zone.

If you have one type of vegetation and one dominant land practice that uses the same management actions throughout the property, then you have only one zone and would only need to monitor in one location. However, many properties have a number of vegetation types that are subject to different management actions. In these circumstances a number of different zones will have their own plant species richness that responds differently to your management decisions (figure 1). For larger properties or those with complex landscapes or production systems there could a large number of zones.



**Figure 1: Working out where to monitor native plant richness (EPA, 2005)**

Some thought needs to go into the placement of monitoring areas within zones to minimise the number of sites but still ensure you represent the range of vegetation and management actions on the property. Selecting and setting up a suite of monitoring areas that are representative of all the vegetation types and key management influences is a one off exercise. You can then choose and prioritise which areas you monitor and how often. Areas of native vegetation that are affected by management actions (e.g. grazing, burning or weed encroachment) are the most obvious sites where changes are likely to occur. However, you may also want to select zones of the same vegetation type that are least affected for comparison.

From a property management perspective, monitoring areas located at the edge of vegetation patches are likely to be influenced the most by management activities. Influential events may include changes in land use, stock grazing remnant vegetation, weed incursion and spray drift.

In some situations, the monitoring area may be better located at the centre of the area of remnant vegetation, for example, if you're monitoring for nature conservation purposes you may want to monitor the quality of the core vegetation area of an endangered regional ecosystem. This is because these sites are least likely to be disturbed by outside influences and the plant species richness will be more representative of the original vegetation type.

If you have monitoring areas in both disturbed and undisturbed areas of the same vegetation type, you will be able to more clearly identify the impact of your management activities. You should also consider locating sites in patches of vegetation that are adjacent to different land uses to allow you to assess any differences in the impact of the land uses.

When deciding the area and location of the vegetation to be monitored you should consider:

- Your management priorities and goals (e.g. do you want to determine the impact of grazing?)
- The number and variety of areas of vegetation
- Areas of proposed changes in land use or management (e.g. are you revegetating degraded areas with native species?)
- Presence of 'endangered' or 'of concern' vegetation or rare and threatened species
- Other indicators you may want to monitor within an area or along a transect (e.g. as part of a BioCondition Assessment)
- Areas of special interest in your catchment or region.

## Plots, transects and quadrats

Most of the vegetation indicators provided in this guide use plots, transects and/or quadrats for collecting data from monitoring (or assessment) areas. These plots, transects and quadrats should be arranged according to the standard 'assessment area' of the BioCondition Assessment Framework as detailed in 'How do I measure it'.

Plots are simply a defined area in which observations are made. Monitoring native plant richness uses a 50x10m plot. Transects are lines through areas of vegetation along which observations are made. Quadrats (in this context) are 1x1m square areas used at set intervals along the main transect and are also used for the ground cover and organic litter indicators.

## When and how often will you monitor?

You will need to decide the frequency at which you will monitor native plant richness. The monitoring frequency may be:

- Annual or every two, three or more years at the same time of year, e.g. the end of the growing season
- Seasonal if you want to identify plants that may only be present under certain conditions, e.g. short-lived winter forbs or species present after drought-breaking rain
- Before and after any major changes on a property, e.g. changing land use, a major fire or a drought.

The frequency of monitoring will be influenced by:

- Property activities, e.g. revegetation, clearing or infrastructure construction
- Season, e.g. some plants may not be present in certain seasons and be dominant in others. Some species may only flower at certain times of year influencing the accuracy of plant identification
- Climate, e.g. vegetation dieback and weed encroachment are influenced by climate.

## Who will be involved and how?

You can easily build up your own plant identification library by pressing and drying your own specimens and storing them in a suitable folder. If you have a personal computer and scanner you can do this even more effectively by scanning your samples and storing the images electronically. The use of a scanner allows you to zoom in and record particular features of the plant such as leaf shape, fruits or flowers, etc. in great detail. If you are unsure of the species name you can send plant specimens or scanned images of the plants to the Queensland Herbarium for identification – this is a free service. If you intend to submit material to the Queensland Herbarium for identification you should consult the information they provide on how to collect plant specimens (see 'How to send botanical specimens for identification or for incorporation into the state collection' <[http://www.derm.qld.gov.au/wildlife-ecosystems/plants/queensland\\_herbarium/publications/pdf/how\\_to\\_send\\_specimens7.pdf](http://www.derm.qld.gov.au/wildlife-ecosystems/plants/queensland_herbarium/publications/pdf/how_to_send_specimens7.pdf)>). You will also need to submit a Queensland Herbarium plant identification request form with the specimen <<http://www.derm.qld.gov.au/register/p00728aa.doc>>.

## How do you measure it?

To monitor native plant richness, you need to conduct an initial plant survey at your chosen locations to obtain a baseline list of species and then monitor the change in species over time.

Two levels of monitoring change in native plant richness are provided in this guide. Level 1 monitoring is recommended if you want to quickly conduct and regularly check up on the number of plant species that make up the vegetation you manage. If you want a clearer picture of what is happening to native plant richness on your property, want to compare your data with what is expected for the particular vegetation type or want to share your data with nearby land managers or others, then you need to collect more detailed and accurate information as described in level 2 monitoring.

For level 1 the location of monitoring sites is recorded using maps and hand drawn overlays, while for level 2 it is recorded using GPS equipment and GIS software. Level 1 monitoring provides an indication of plant species presence, while level 2 provides an estimate of the richness of each plant form (trees, shrubs, grasses, forbs and others) and the abundance class and relative abundance of each plant species.

## How do you measure it? - Level 1 monitoring

### Key aspects of level 1 monitoring

- Choose monitoring locations
- Use fixed markers to identify on-ground locations
- Collect baseline information on number of plant species
- Monitor regularly

### Skills needed

The range of skills required to effectively monitor native plant richness to Level 1 include:

#### Selecting locations for monitoring

- Understanding of the vegetation types or regional ecosystems on your property
- Understanding of the key management activities you undertake and how they may influence native vegetation
- Understanding of the use of plots (from information provided in this guide)

#### Identifying plants

- Ability to identify native plant species in your area or access to someone who can (such as a local botanist or the Queensland Herbarium)

#### Illustrating data and analysing trends

- Ability to prepare basic graphs
- Understanding of the relationship between results
- Understanding of seasonal and time influences on results

### Equipment and costs

The main costs associated with monitoring native plant richness are shown below:

#### Maps

To select the most appropriate location for your monitoring you will need maps, aerial photography or satellite imagery of the vegetation on your property. You may have prepared your own vegetation maps as part of your property plan or have a Queensland Herbarium regional ecosystems map <[http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/regional\\_ecosystems/introduction\\_and\\_status/regional\\_ecosystem\\_maps/index.php](http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/regional_ecosystems/introduction_and_status/regional_ecosystem_maps/index.php)>.

#### Aerial photography

Printed aerial photography is available from the Queensland Department of Environment and Resource Management <[www.derm.qld.gov.au/property/mapping/aerial\\_photography.html](http://www.derm.qld.gov.au/property/mapping/aerial_photography.html)> as single photos at medium-scale (about 1:25 000 to 1:75 000) and enlargements (up to 8 times). The availability of aerial photos varies across the state and their cost ranges, depending upon the size and resolution of the image, from approximately \$16 for small low resolution copies to about \$85 for large (up to 1200mm x 900mm) (price as at 1/9/2010 – please check for any change).

Digital aerial photography is also available from the Queensland Department of Environment and Resource Management <[www.derm.qld.gov.au/property/mapping/aerial\\_photography.html](http://www.derm.qld.gov.au/property/mapping/aerial_photography.html)> and similarly vary in cost from approximately \$22 to \$140 (price as at 1/9/2010 – please check for any change). Once again availability varies across the state. Large properties may require several photos compiled into a digital photo mosaic. Not all digital aerial photographs are geo-referenced (to a map projection) (see 'Glossary'); it is important to check before you purchase.

#### Satellite images

Digital or printed satellite images of recent and/or historical images are available from:

- The Queensland Department of Environment and Resource Management <[www.derm.qld.gov.au/property/mapping](http://www.derm.qld.gov.au/property/mapping)>. SLATS (Statewide Landcover and Trees Study) customised Landsat images show vegetation, property boundaries and place names. See website for latest prices <[http://www.derm.qld.gov.au/services\\_resources/item\\_details.php?item\\_id=7982](http://www.derm.qld.gov.au/services_resources/item_details.php?item_id=7982)>.

- Geoimage Pty Ltd <[www.geoimage.com.au](http://www.geoimage.com.au)>
- Terranean Mapping Technologies < <http://www.terranean.com.au/>>
- Google Earth <<http://earth.google.com/>> - If you have broadband Internet access, Google Earth now provides online access to recent satellite imagery of almost everywhere on Earth.

Other organisations such as regional NRM bodies and AgForward may be able to assist with access to and interpretation of imagery.

### Minor items

- Tape measure – 50m or 100m fibreglass with 1cm increments
- Markers – tyres or painted star pickets or some other permanent markers. The number will vary; for example, you will need: one for the central point, at least two at each end of transect, five if marking corners, or even more if you are setting up a complete BioCondition Assessment Framework transect.
- Stationery – writing pad, pens, pencils, eraser, ruler, printing ink etc.
- Local plant identification book – Most parts of Queensland now have plant identification guides that are available from bookshops for about \$30–\$40
- Plant press, paper, labels or tags for specimens
- Queensland Herbarium plant identification request forms <<http://www.derm.qld.gov.au/register/p00728aa.doc>>.

### Time taken

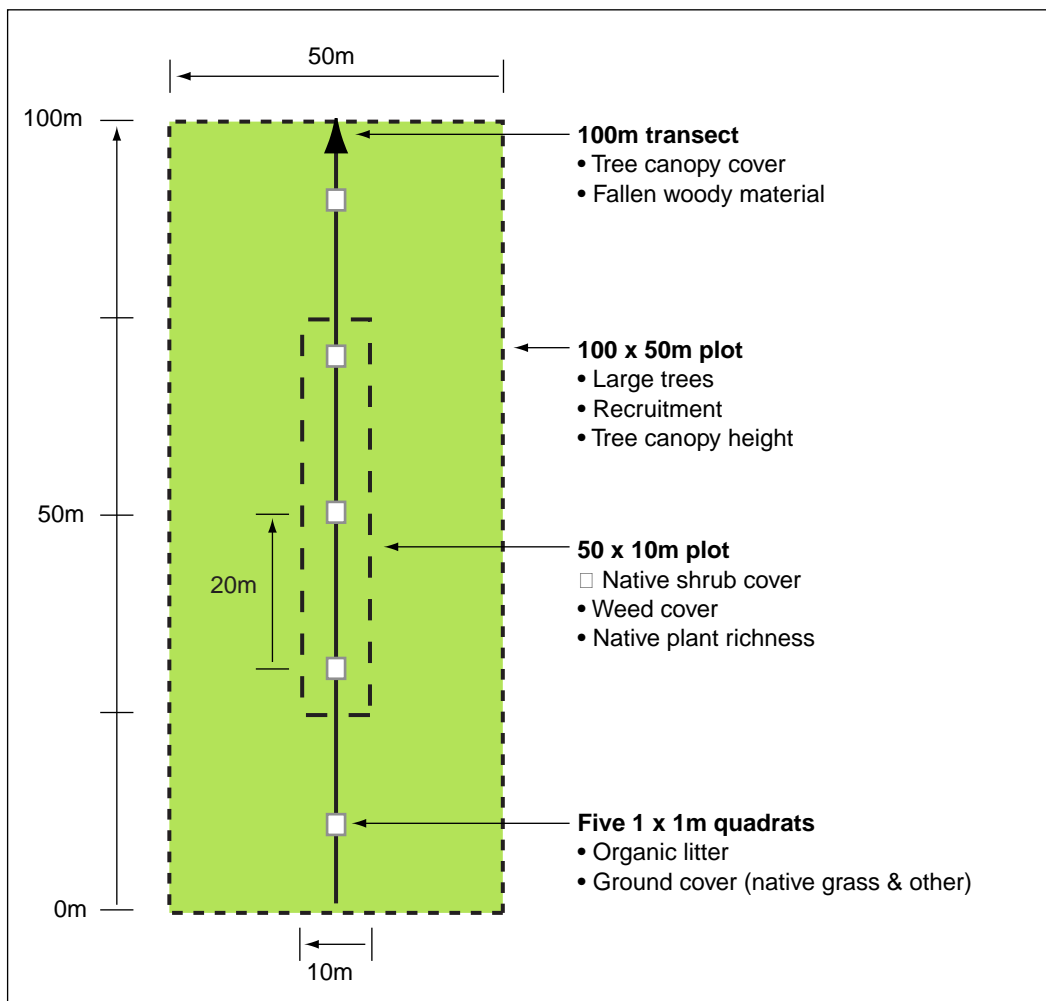
The time taken to monitor native plant richness can depend upon:

- The size of the property and the complexity of the landscape (complex landscapes may require more monitoring areas to get a complete picture)
- The time taken to identify the plants species – depends upon the level of skills and experience of the plant identifier, who you have access to or whether you send or email the images to the Queensland Herbarium
- The frequency of your monitoring.

You will find that your first survey will take a while. As you gain experience in plant identification, subsequent surveys may take just half an hour per site, as you will already be familiar with the species present and mainly be recording changes.

### Setting up

1. Select the most appropriate locations and the number of monitoring areas that you will set up. Regional ecosystem maps, aerial photographs, satellite images and details from your property plan may assist in selecting suitable locations. If you want to use the same monitoring area for collecting other vegetation data it is recommended that you use the 100x50m standard ‘assessment area’ layout described for a BioCondition assessment (figure 2). For monitoring native plant richness you will only use a 50x10m area that can be the central sub plot of this larger area.



**Figure 2: Standard layout for a BioCondition assessment area**

2. Mark the centre of your area and the start and finish of each of your transects with durable and clearly visible markers (e.g. a red and/or white painted or capped star picket or a tyre attached to the ground to avoid movement by cattle in grazing areas).
3. Record the location of the monitoring area on your property plan and consider recording the following details:
  - Monitoring area number or name
  - Location
  - Length and width of plot
  - Position in landscape (e.g. crest, valley, mid-slope, ridge)
  - Orientation of plot (e.g. north–south).
4. If you want to use these locations as photopoints, take your first photographs as described in ‘Use of photopoints’.

## Monitoring procedure

### Initial recording

1. Start at one end of the plot and identify each plant species along the 50m transect to 5m either side. You may need to use a plant identification guide to help you, or collect specimens for later identification. Take old newspapers with you for placing the plant specimens in between and clearly label each specimen. For less common plants, plants of particular interest or ones that you cannot identify and want to come back to again you may want to note the approximate distance of the plant from the start of the transect.
2. Note the following on your field recording sheet:

- Monitoring area number or name
- Common/local name and scientific (if known) of the plant species
- Date of recording
- Name of recorder and plant identifier (if different)
- Confidence level (low, medium, high)
- Climatic conditions (e.g. drought, heavy rainfall).

3. Repeat steps one and two for each location you have decided to monitor.

The above process will provide you with a baseline assessment of native plant richness at each location you have decided to monitor.

### **Ongoing monitoring**

1. To monitor change in the native plant richness repeat steps of the initial recording procedure above at the frequency you have decided. You can use the list of species from your baseline assessment as a checklist.
2. If you are also keeping a photographic record of your monitoring areas you should take photos each time you carry out the monitoring procedure (see 'Use of photopoints')

### **Data quality considerations**

To collect reliable, high quality data it is essential always to carry out the following tasks:

- Identify the on-ground location of the monitoring area and start and finish points of transects (and the quadrat points if used for other indicators) with fixed markers to ensure that you are monitoring the same area of vegetation over time.
- Record the marked locations of monitoring areas and start and finish points of transects (and quadrat points if necessary) on an overlay of a hand-drawn plan.
- Record the level of confidence or accuracy of your plant identification as follows:
  - Low – able to pick the difference between species, only know common name, reasons to doubt identification
  - Medium – reasonably confident of identification, know scientific name, confirmed from plant identification books
  - High – very confident – know scientific name, know species it may be confused with, confirmed by your or other person's experience or training.
- Use current scientific names where possible. Common or local names are very unreliable if used on their own.

## **How do you measure it? – Level 2 monitoring**

### **Key aspects of level 2 monitoring**

- Choose monitoring locations
- Use fixed markers to identify on-ground locations
- Record locations using GPS
- Collect baseline information on native plant richness by measurement of cover (%) of each plant form group
- Monitor regularly

### **Skills needed**

The range of skills required to effectively monitor native plant richness to Level 2 include:

#### **Selecting locations for monitoring**

- Understanding of the vegetation types or regional ecosystems on your property
- Understanding of the key management activities you undertake and how they may influence native vegetation

- Understanding of the use of plots (from information provided in this guide)

### **Plant identification**

Ability to identify native plant species in your area or access to someone that can (such as a local botanist or the Queensland Herbarium)

### **GIS/GPS skills**

- Ability to use a personal computer and Geographic Information System (GIS) software
- Ability to use a Global Positioning System (GPS) unit for recording locations and data
- Ability to manage GIS data

### **Illustrating data and analysing trends**

- Ability to prepare basic graphs
- Understanding of the relationship between results
- Understanding of seasonal and time influences on results

## **Equipment and costs**

The main costs associated with monitoring native plant richness are shown below:

### **Maps**

To select the most appropriate location for your monitoring you will need maps, aerial photography or satellite imagery of the vegetation on your property. You may have prepared your own vegetation maps as part of your property plan or have a Queensland Herbarium regional ecosystems map <[http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/regional\\_ecosystems/introduction\\_and\\_status/regional\\_ecosystem\\_maps/index.php](http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/regional_ecosystems/introduction_and_status/regional_ecosystem_maps/index.php)>.

### **Aerial photography**

Printed aerial photography is available from the Queensland Department of Environment and Resource Management <[www.derm.qld.gov.au/property/mapping/aerial\\_photography.html](http://www.derm.qld.gov.au/property/mapping/aerial_photography.html)> as single photos at medium-scale (about 1:25 000 to 1:75 000) and enlargements (up to 8 times). The availability of aerial photos varies across the state and their cost ranges, depending upon the size and resolution of the image, from approximately \$16 for small low resolution copies to about \$85 for large (up to 1200mm x 900mm) (price as at 1/9/2010 – please check for any change).

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### **Satellite images**

Digital or printed satellite images of recent and/or historical images are available from:

- The Queensland Department of Environment and Resource Management <[www.derm.qld.gov.au/property/mapping](http://www.derm.qld.gov.au/property/mapping)>. SLATS (Statewide Landcover and Trees Study) customised Landsat images show vegetation, property boundaries and place names. See website for latest prices <[http://www.derm.qld.gov.au/services\\_resources/item\\_details.php?item\\_id=7982](http://www.derm.qld.gov.au/services_resources/item_details.php?item_id=7982)>.
- Geoimage Pty Ltd <[www.geoimage.com.au](http://www.geoimage.com.au)>
- Terranean Mapping Technologies <<http://www.terranean.com.au/>>
- Google Earth <<http://earth.google.com/>> - If you have broadband Internet access, Google Earth now provides online access to recent satellite imagery of almost everywhere on Earth.

Other organisations such as regional NRM bodies and AgForward may be able to assist with access to and interpretation of imagery.

### **GPS receiver**

A wide range of GPS receivers are now available from camping, boating, scientific, and electronics stores, with costs

starting at around \$250. Most enable you to take precise position coordinate readings and record details about each position in an attributes table that can be downloaded to your computer.

### **GIS software**

The basic function of GIS software is to display digital images and overlay data layers. Costs vary depending on software. GIS software is constantly being upgraded and there are now many vendors. Use of online search engines set to Australia will readily identify some of these providers. Basic functions include display of digital images and overlaying of data layers. Costs vary depending on software.

### **Colour printer**

A large range of bubble jet, inkjet or laser colour printers to print maps for field use are available from electrical outlets and department stores. If you want to print maps to A3 size paper and above you may need to go to more specialist suppliers. Costs vary significantly.

### **Minor items**

- Tape measure – 50m or 100m fibreglass with 1cm increments
- Markers – tyres or painted star pickets or some other permanent markers. The number will vary; for example, you will need: one for the central point, at least two at each end of transect, five if marking corners, or even more if you are setting up a complete BioCondition Assessment Framework transect.
- Stationery – writing pad, pens, pencils, eraser, ruler, printing ink etc.
- Local plant identification book – Most parts of Queensland now have plant identification guides that are available from bookshops for about \$30–\$40
- Plant press, paper, labels or tags for specimens
- Queensland Herbarium plant identification request forms  
<<http://www.derm.qld.gov.au/register/p00728aa.doc>>.

### **Time taken**

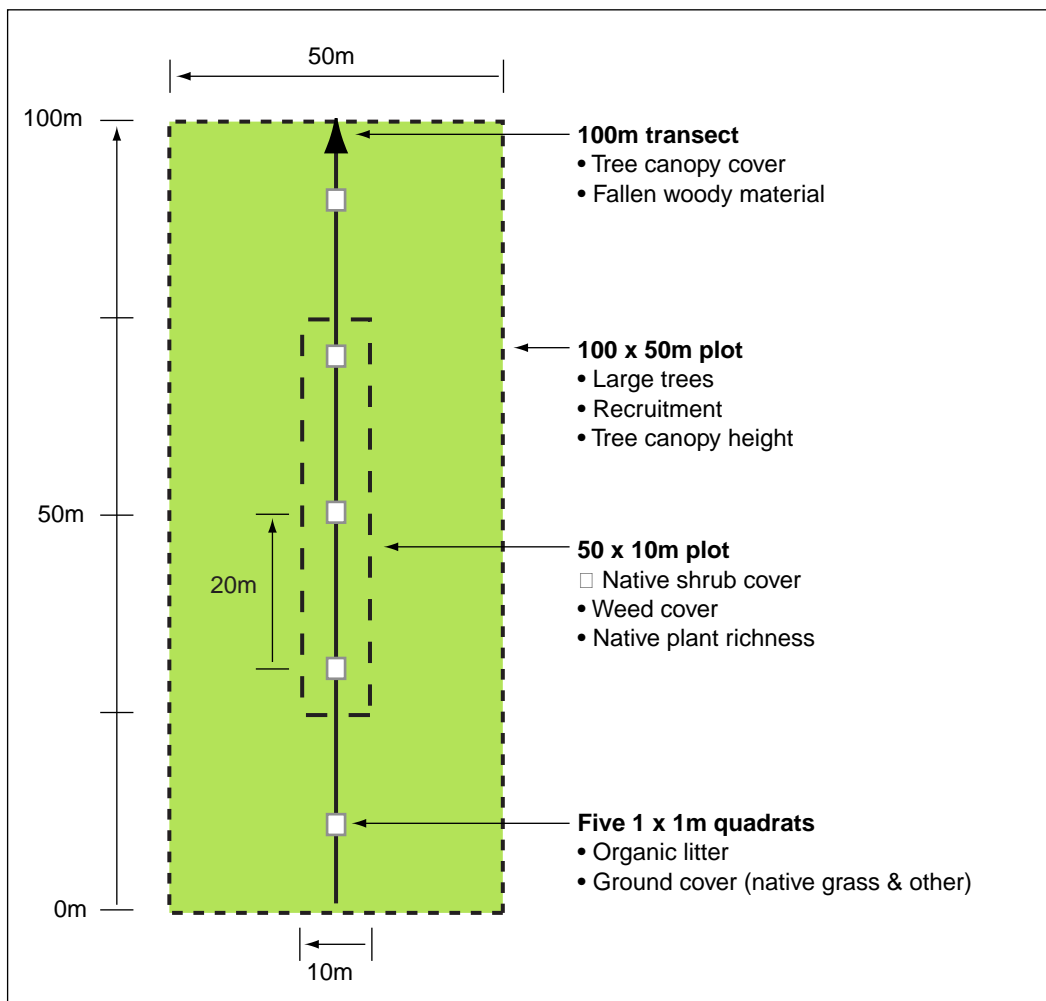
The time taken to monitor native plant richness can depend upon:

- The size of the property and the complexity of the landscape may require more monitoring areas to get a complete picture
- The time taken to identify the plants species – depends upon level of skills and experience of plant identifier, who you have access to or whether you send or email the images to the Queensland Herbarium
- The frequency of your monitoring.

You will find that your first survey will take a while. As you gain experience in plant identification, subsequent surveys may take just half an hour per site, as you will already be familiar with the species present and mainly be recording changes.

### **Setting up**

1. Select the most appropriate locations and the number of monitoring areas that you will set up. Regional ecosystem maps, aerial photographs, satellite images and details from your property plan may assist in selecting suitable locations. If you want to use the same monitoring area for collecting other vegetation data it is recommended that you use the 100x50m standard ‘assessment area’ layout described for a BioCondition assessment (figure 3). For monitoring native plant richness you will only use a 50x10m area that can be the central sub plot of this larger area.



**Figure 3: Standard layout for a BioCondition assessment area**

2. Mark the centre of your area and the start and finish of each of your transects with durable and clearly visible markers (e.g. a red and/or white painted or capped star picket or a tyre attached to the ground to avoid movement by cattle in grazing areas).
3. Measure the coordinates of the centre of your area and the start and finish points of the transect using your GPS unit. Record the details in the metadata section of the monitoring area data sheet or in the attributes table on your GPS unit. These details should include:
  - Monitoring area number or name
  - Location
  - Length and width of plot
  - Position in landscape (e.g. crest, valley, mid-slope, ridge)
  - Orientation of plot (e.g. north-south)
4. If you want to use these locations as photopoints, take your first photographs as described in ‘Use of photopoints’.

## Monitoring procedure

### Initial recording procedure

1. Start at one end of the plot and identify each plant species along the 50m transect to 5m either side. You may need to use a plant identification guide to help you, or collect specimens for later identification. Take old newspapers with you for placing the plant specimens in between and clearly label each specimen. For less common plants, plants of particular interest or ones that you cannot identify and want to come back to again you may want to take a GPS reading for these plants.

2. Note the following on your field data sheet or in the attributes table of your GPS unit:
  - Monitoring area number or name
  - Common or local and scientific name (if known) of the plant species
  - Date of recording
  - Name of recorder and plant identifier (if different)
  - Confidence level (low, medium, high)
  - Climatic conditions (e.g. drought, heavy rainfall)
  - Form of plant – trees, shrubs, grass, forbs or other
  - Number of each species seen.
3. Count the number of plants of each species that you observe for the full 10m width (5m x 2) of the transect. If you are using the data sheet you may find it useful to do this by tallying in bunches of five (e.g. |||| |||| ||||). Each time you come across another plant of the same species simply put a line adjacent to its name in the list you are generating. Once you get to the fifth one, draw a line through the four lines that already exist side by side.
4. At the end of each transect, calculate the total number of each species and record the occurrence on the recording sheet. Then give each species an ‘abundance classification’ based on: A = abundant; C = common (always a few); U = uncommon (for example 2–3 patches or an individual present); or R = rare (only one specimen found).
5. Repeat steps 1–4 for each location you have decided to monitor.
6. Once you have collected all your data load your GPS data into your GIS. You may need to adjust your GIS data to get these points into polygons or edit existing polygons to the new points.

The above process will provide you with a baseline assessment of native plant richness at each of the locations you have decided to monitor.

### **Ongoing monitoring procedure**

1. To monitor change in the native plant richness repeat steps of the initial recording procedure above at the frequency you have decided. You can use the list of species from your baseline assessment as a checklist.
2. If you are also keeping a photographic record of your monitoring areas you should take photos each time you carry out the monitoring procedure (see ‘Use of photopoints’)

### **Data quality considerations**

- To collect reliable, high quality data it is essential always to carry out the following tasks:
- Identify the on-ground location of the monitoring area and start and finish points of transects (and the quadrat points if used for other indicators) with fixed markers to ensure that you are monitoring the same area of vegetation over time.
- Record the marked locations of monitoring areas and start and finish points of transects (and quadrat points if necessary) using a GPS unit and GIS software.
- Record the level of confidence or accuracy of your plant identification as follows:
  - Low – able to pick the difference between species, only know common name, reasons to doubt identification
  - Medium – reasonably confident of identification, know scientific name, confirmed from plant identification books
  - High – very confident – know scientific name, know species it may be confused with, confirmed by your or other person’s experience or training.
- Use current scientific names where possible. Common or local names are very unreliable if used on their own.

### **How to record your results**

When you are working in the field the simplest way to record your data is to have a field recording sheet with you. A field recording sheet will help ensure that your data is recorded in a way that is easy to read later and will also act as a

checklist to ensure that you don't miss recording any important information.

The data recorded on the field recording sheet for level 1 monitoring (table 1) should include:

- Date
- Monitoring area number or name
- Recorder and/or identifier
- Scientific name of plant species
- Local or common name of plant species
- Total number of species present
- Confidence (low, medium, high)(see 'Data quality considerations' within 'How do I measure it – level 1' and 'How do I measure it – level 2')
- Notes

**Table 1: Typical field recording sheet for level 1 monitoring**

<b>Date</b>		<b>Monitoring area name or number</b>	
-------------	--	---------------------------------------	--

Item number	Local or common name	Scientific name	Recorder and/or identifier	Confidence
1				
2				
3				
4				

<b>Total number of species</b>		<b>Notes</b>	
--------------------------------	--	--------------	--

The data recorded on the field recording sheet for level 2 monitoring should include the data collected for level 1 monitoring plus:

- A count and the totals of the number of each species
- A description of plant form – tree, shrub, grass, forbs and others
- A total of each plant form present
- A tally of each species present
- A plant total for each species
- An estimated abundance class (see 'Glossary')
- A calculation of the relative abundance (plant total for species/total plant count).

Table 2 shows a typical set of data collected on one occasion at one location for native plant richness level 2 monitoring. This baseline information on its own gives you a clear picture of the range of species that were observed on this day.

**Table 2: Typical field recording sheet for level 2 monitoring and example data**

<b>Date</b>	20/07/2005	<b>Monitoring area number or name</b>	P1	<b>Notes</b>	17 & 18 sent to Qld Herbarium
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Item	Local or common name	Scientific name	Recorder/ Identifier	Confidence & notes	Plant form	Tally of each species	Plant totals	Abundance	
								Class	Relative
1	Blue gum	<i>Eucalyptus tereticornis</i>	Jane H	H	T	III III III III III III	29	A	11%
2	Brisbane wattle	<i>Acacia fimbriata</i>	Jane H	H	S	III III III III	18	A	7%
3	Black wattle	<i>Acacia falcata</i>	Jane H	H	S	III	4	C	2%
4	Lemon scented tea tree	<i>Leptospermum petersonnii</i>	Jane H	H	S	III III III III III I	21	A	8%
5	Kangaroo grass	<i>Themedia triandra</i>	Jane H	H	G	III III	9	C	3%
6	Queensland blue-grass	<i>Dichanthium sericeum</i>	Jane H	H	G	III III	8	C	3%
7	Paddock lovegrass	<i>Eragrostis leptostachya</i>	Jane H	H	G	III III III III III III	23	A	9%
8	Barbed wire	<i>Cymbopogon refractus</i>	Jane H	H	G	III III III III III III	24	A	9%
9	Gum top box	<i>Eucalyptus mollucana</i>	Jane H	H	T	III III III III	19	A	7%
10	Narrow leaf ironbark	<i>Eucalyptus crebra</i>	Jane H	H	T	III	4	C	2%
11	Brisbane laurel	<i>Pittosporum revolutum</i>	Jane H	H	S	III III III III	19	A	7%
12	Davesia	<i>Davesia squarosa</i>	Jane H	H	S	III III III	14	A	5%
13	May	<i>Baekea virgata</i>	Jane H	H	S	III III III	14	A	5%
14	Swamp tea-tree	<i>Melaleuca irbyana</i>	Jane H	H	S	III III III	14	A	5%

15	Mattrush	Lomandra longifolia	Jane H	H	O	III	4	U	2%
16	Sago flower	Ozothamnus diosmifolius	Jane H	H	F	III III	9	C	3%
17	Forb 1		Jane H	L	F	III III III	13	U?	5%
18	Forb 2		Jane H	L	F	III III III III	19	U?	7%
19									0%
20									0%

<b>Tree total</b>	3	<b>Total plant count:</b>	265
<b>Shrub total</b>	7		
<b>Grass total</b>	4		
<b>Forb total</b>	3		
<b>Other total</b>	1		
<b>Species total</b>	18		

## Metadata

There are two aspects to recording monitoring information: the data you collect each time you monitor and the metadata associated with your monitoring data. Metadata is data that describes data or is “data about data”. It describes the: who, what, when, where, why and how about a data set. Metadata is critical to preserving the usefulness of data over time. Metadata includes information about the set up, condition and maintenance of your monitoring bore/s and descriptive information about your dataset.

It is important record the following information at the time of setting up your monitoring sites (table 3):

- Monitoring area number or name
- Location
  - Level 1 – Clear description and marked on your property plan
  - Level 2 – GPS coordinates (GDA94)
- Position in landscape (e.g. crest, valley, midslope, ridge)
- Orientation of plot (e.g. north–south)
- Length and width of plot (m).

**Table 3: Typical data sheet for recording metadata about the location of level 2 monitoring sites with example data**

Monitoring area number or name	Location	Position in landscape	Orientation	Length and width of plot (m)
Top paddock – P1	Centroid – Q1.3 – 27.30691S 152.30499E	Ridge	N – North 0	100m
Big gully – P2	Centroid – Q2.3 – 27.30692S 152.30495E	Riparian zone	S – South 180	100m
Flat patch – P3	Still to get GPS	Floodplain	NNE – North-northeast 22.5	100m
Shelter belt – P4	Centroid – Q4.3 – 27.30692S 152.30489E	Midslope	NNE – North-north-east 22.5	100m

Descriptive information (table 4) about your dataset should include:

- Short description of the contents of the dataset
- Name of the land manager or business responsible for the dataset
- Brief assessment of reliability of the information in the dataset
- Brief history of the source and processing steps used to produce the dataset
- Maintenance and update frequency of the dataset
- What location or area to which the data relates.

**Table 4: Typical data sheet for recording metadata that describes the data set**

Key element	Metadata
Short description of the contents of the dataset	
Name of the land manager or business responsible for the dataset	
Brief assessment of reliability of the information in the dataset	
Brief history of the source and processing steps used to produce the dataset	
Maintenance and update frequency of the dataset	
Location or area does the data relates to	

## What does your data mean?

The main data and information that results from monitoring native plant richness is the names and total number of native plant species (and for level 2 monitoring the richness of each plant form and the abundance class and relative abundance of plant species)(see 'Glossary') and how these have changed over time.

How useful your monitoring data is will depend on factors such as:

- Why you have decided to monitor
- How it can inform your management decisions
- Your objectives for the management of natural resources on your property
- The value you place on your natural resources as part of your overall farm system
- The interest others may have in particular natural resources on your property.

The information you collect in the field can be quickly and easily entered into a computer spreadsheet to create a long-term record. Spreadsheets like table 5 can store data about one monitoring site (or plot) over time. Looking at the totals of each species that are observed can assist in detecting any trends. These totals will tell you whether the individual species numbers are increasing or decreasing with each observation and you may be able to detect a change before a decrease eventually shows up as an absence. However, unless there is a consistent change in one direction, it may be difficult to see any clear trends or relationships by looking at the spreadsheets on their own. The data that you enter into a spreadsheet can be used to create charts, such as figure 4. Charts help to illustrate how things may have changed overtime and in comparison to other events. Using the data from table 5, figure 4 shows how individual species have changed on the sample site over four years of monitoring. From this way of presenting the data it can clearly be seen how some species have hardly changed while others are either increasing or declining. Shrub species *Acacia fimbriata* (Brisbane wattle) seems to be steadily declining while another shrub *Leptospermum petersonii* (Lemon scented tea tree) has doubled in numbers.

The data can also be grouped by plant forms and presented in a chart like figure 5. The grouping of the data shows an increase in tree species, change in the number of forbs but no overall change for the other plant forms. However, the grouping of data disguises the significant changes that appear to be happening to selected species as demonstrated in figure 4.

**Table 5: Example data collected from monitoring native plant richness at one plot over time**

Monitoring area number or name		P1		Date	20/07/2005	5/07/2006	18/07/2007	15/07/2008
Item	Local or common name	Scientific name	Plant form	Notes	Plant totals	Plant totals	Plant totals	Plant totals
1	Blue gum	<i>Eucalyptus tereticornis</i>	T		29	28	28	28
2	Brisbane wattle	<i>Acacia fimbriata</i>	S		18	15	14	10
3	Black wattle	<i>Acacia falcata</i>	S		4	4	4	4
4	Lemon scented tea tree	<i>Leptospermum petersonnii</i>	S		21	25	33	47
5	Kangaroo grass	<i>Themedia triandra</i>	G		9	9	9	9
6	Queensland blue-grass	<i>Dichanthium sericeum</i>	G		8	7	6	5
7	Paddock lovegrass	<i>Eragrostis leptostachya</i>	G		23	23	23	23
8	Barbed wire	<i>Cymbopogon refractus</i>	G		24	24	20	18
9	Gum top box	<i>Eucalyptus mollucana</i>	T		19	19	19	19
10	Narrow leaf ironbark	<i>Eucalyptus crebra</i>	T		4	4	4	4
11	Brisbane laurel	<i>Pittosporum revolutum</i>	S		19	19	19	19
12	Davesia	<i>Davesia squarosa</i>	S		14	13	14	10
13	May	<i>Baekea virgata</i>	S		14	10	15	9
14	Swamp tea-tree	<i>Melaleuca irbyana</i>	S		14	14	14	14
15	Mattrush	<i>Lomandra longifolia</i>	O		4	4	4	4
16	Sago flower	<i>Ozothamnus diosmifolius</i>	F		9	11	15	14
17	Forb 1	Forb 1	F		13	12	12	13
18	Forb 2	Forb 2	F		19	19	17	19

19	Yellow box	Eucalyptus melliodora	T			5	5	6
20	Forb 3	Forb 3	F	55m		4	4	0

Add more species here

<b>Species total</b>	18	20	20	19
<b>Trees</b>	3	4	4	4
<b>Shrubs</b>	7	7	7	7
<b>Grasses</b>	4	4	4	4
<b>Forbs</b>	3	4	4	3
<b>Other</b>	1	1	1	1

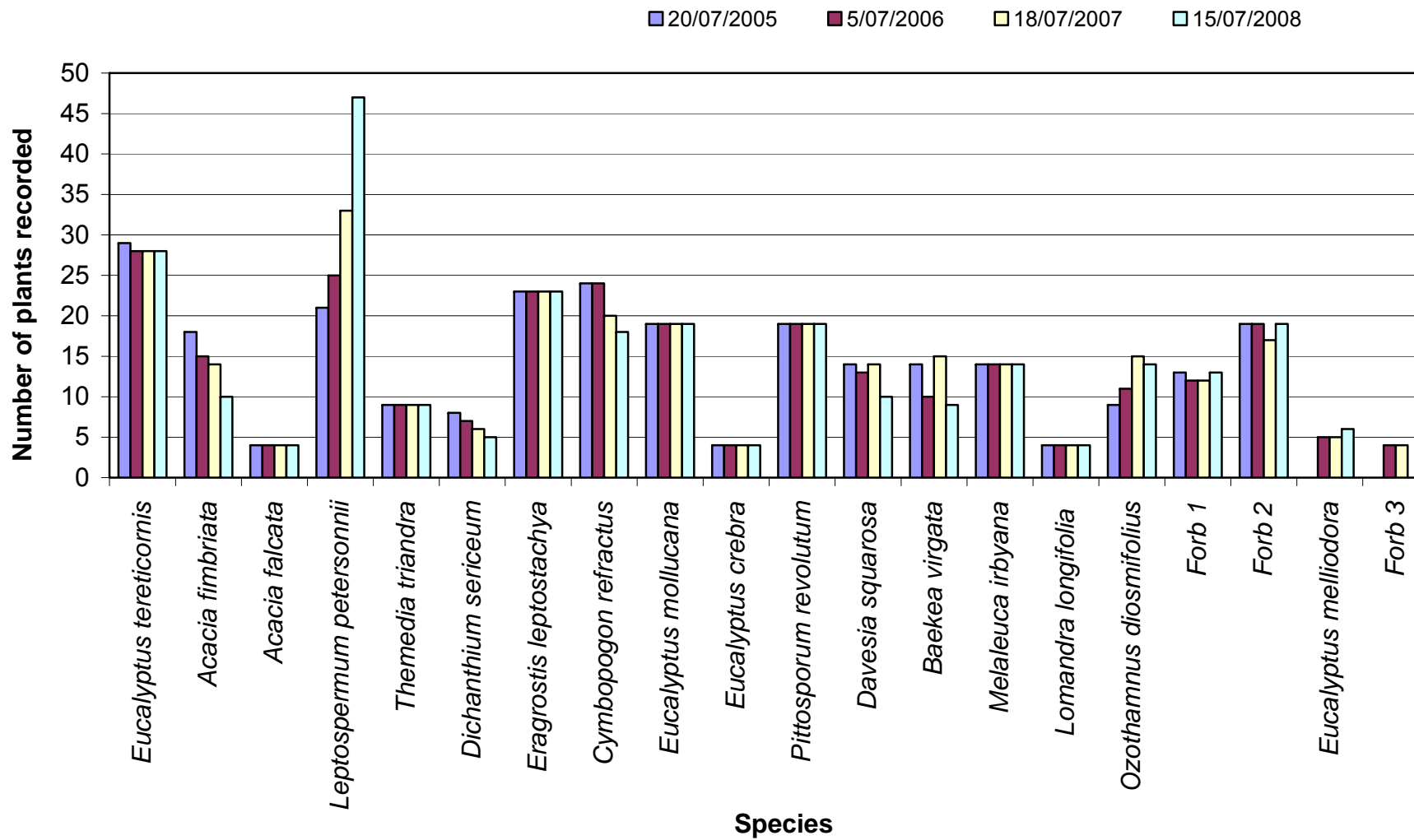


Figure 4: Example of data showing a change in native plant richness over time (individual species)

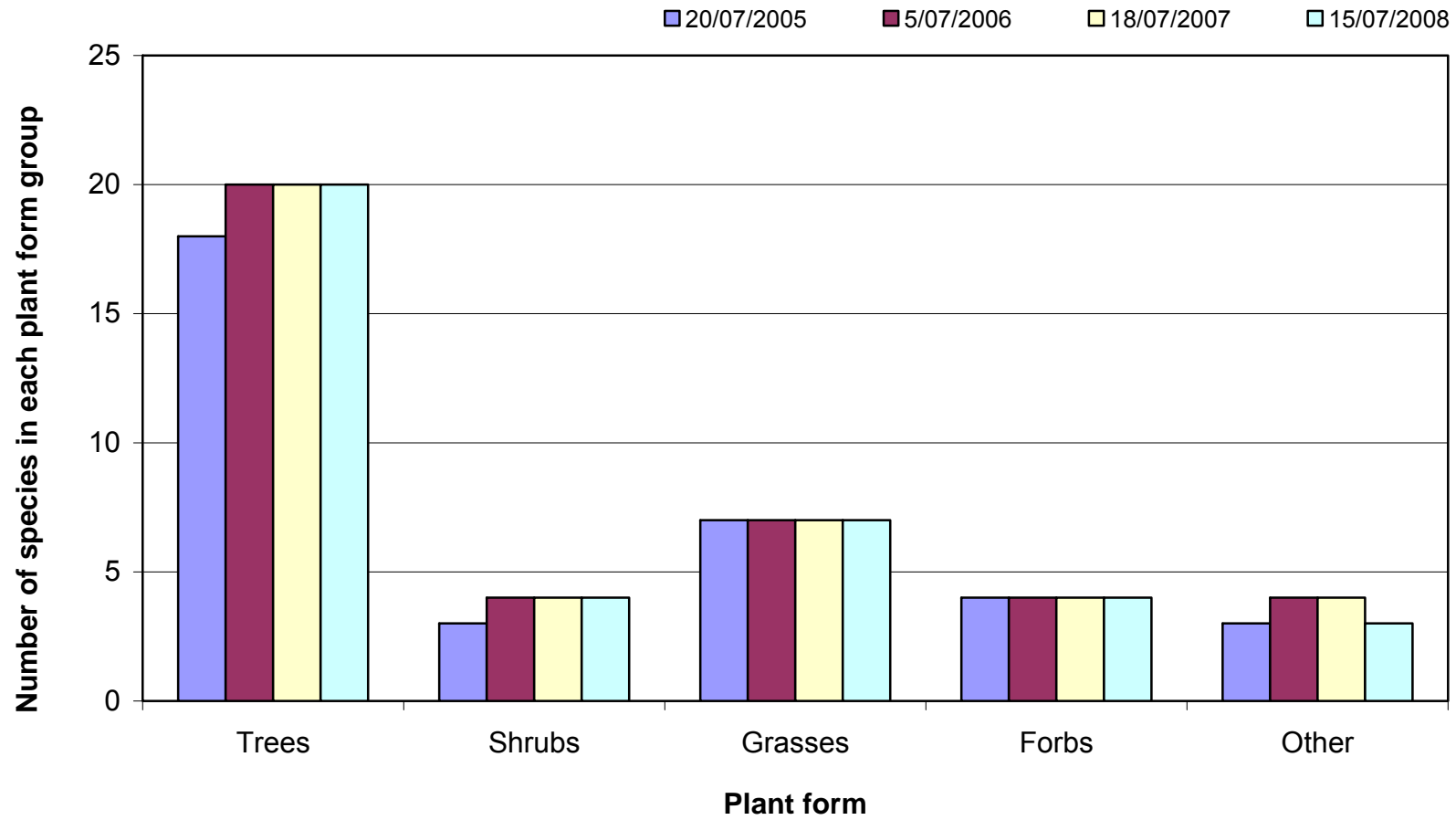


Figure 5: Example of data showing a change in native plant richness over time (plant forms)

Several observations may be needed to obtain an accurate list of what plant species are 'normally' present. Developing a reliable list is important; it will help you avoid interpreting normal variation as a decline or increase in richness. Variability between monitoring events can depend upon:

- The skill of the plant identifier
- The number of short-lived plant species and those that are only noticeable during specific conditions
- The conditions and/or season during which the observations are made
- The influence if any of management actions or events on the presence or absence of plant species.

You may wish to compare your native plant richness data to any available benchmark data or an optimum range of species that can be expected to occur for the vegetation type or regional ecosystem (see 'Glossary') can be. Comparisons like this will give you an indication of the condition of your monitoring area and can be used as part of a Queensland BioCondition Assessment <<http://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/biocondition.html>>. If you find many species that aren't on the species list for the vegetation type or regional ecosystem you should double check your species identification and then seek advice on whether it should be regarded as a different vegetation type.

The data from monitoring native species can also be combined with other vegetation data to provide a more accurate understanding of what is happening with biodiversity on the land you manage.

Native vegetation communities are changing all the time. There are often many factors that influence change in native plant richness of an area of vegetation. In analysing your data it may help to consider the following possible changes to determine how your data can assist with your management decisions:

- Has a species disappeared from the area that you are monitoring?
- Is its temporary absence because of an environmental factor such as drought or a recent management action?
- Is there more of a particular species present than a few years ago?
- Is there is a major shift in the abundance of species, e.g. from rare to common?
- Is the relative abundance of species changing?
- Does a particular management practice have a beneficial or detrimental effect on the area of vegetation?
- What are the long-term implications of continuing with this practice?
- Has a once-common species returned?
- Has a new species arrived?

Vegetation responds to climate variability. Many short-lived (ephemeral) plants will only be visible during certain phases of the drought/wet (El Niño/La Niña) cycle and many perennial plants may die during an extreme drought while others will thrive during wet phases. When interpreting any native vegetation data, you should always consider the influence of climate variability. Monitoring local rainfall and accessing long-term rainfall data will help you assess this (see 'Longpaddock' website <[www.longpaddock.qld.gov.au](http://www.longpaddock.qld.gov.au)>). Books and information on plant identification and local vegetation may help develop your understanding of what factors influence the growth, decline and reproduction of a particular species.

## What are some management options?

The management decisions you make in response to any change in native plant richness identified by your monitoring will depend upon:

- Which plant species are changing in terms of their presence or absence
- The abundance of the plant species
- Relative abundance of the plant species
- Whether the plant species are wanted and valued on your property
- What pressures may be coming from a particular land use or management action
- Landscape processes such as salinity or erosion, which may influence management actions.

You may need to obtain further information or take advice on the plants in the native vegetation for which you are responsible, before making any significant changes in the way you manage the area. The situation on your property is unique to the particular location and history of management. What is happening on your property can only be determined from the data you collect and your knowledge of the management history. Outlined below are only a few situations and responses in which change in native plant richness may require responsive management. These management actions are only generalisations and should be interpreted with caution.

## Biocontrol agents and integrated pest management

Many birds and insects are natural 'biocontrol' agents. They help to keep down the population of damaging insect numbers below economic thresholds in both cropping and grazing land uses. Many of these natural predators require areas of native vegetation with a high level of plant diversity that includes smaller understorey plants and undisturbed soils. Your local pest management advisor may be able to advise on the local native plants that assist in the management of pests in production areas.

## Chemical spray drift

Drift of chemical spray, particularly herbicides, can kill or reduce the vigour of more susceptible native plant species in non-target areas of neighbouring native vegetation. Chemical safety management procedures should include a consideration of potential drift and the risk of damage of such areas.

## Maintaining biodiversity

Monitoring native plant richness directly measures some of the biodiversity values on your property and how they are changing. Achieving a level of plant richness that is within the benchmark range for the vegetation type of the area is important for maximising the biodiversity of the area. Other factors important to maintaining overall biodiversity include the size, connectivity and condition of the vegetation and factors that support native fauna, such as soil life. Evidence of biodiversity variation can include the increase or decline of different plants, increase of fuel loads, disappearance of understorey and birds and other fauna that used to be common may decline in numbers. Each property will be affected by different specific factors.

## Fire management

Fire regime can also have a major impact on species numbers. For example, if there was a noticeable increase in the numbers (thickening) of sandalwood in a vegetation community, it could be the result of a small fire – just large enough to germinate seeds but not so large as to kill mature trees. Disturbed sandalwood vegetation communities need fire on a regular basis to keep numbers in control. The declining shrub species *Acacia fimbriata* (Brisbane wattle) and the increased presence of *Leptospermum petersonii* (lemon scented tea tree) shown in sample data in table 2 and figure 4 may be the result of a particular fire regime. The Brisbane wattle grows very fast, will produce seed within one to two years, lives for about five years and tends to favour more disturbed sites where seed will readily germinate. The lemon scented tea tree grows a little slower, lives much longer, generally take 3–4 years before it seeds prolifically and will normally be burnt back to a lignotuber after a fire. So subtle changes in the fire regime, in areas where these plants grow, can be enough to stimulate a change in relative abundance between these two species.

## Grazing management

Grazing can have a dramatic influence on native plant richness. The most direct effect of grazing within remnant vegetation is change in native plant richness (Friedel & James 1995; Scanlan & Burrows 1990). If you have monitoring sites in grazed and non-grazed areas of the same vegetation types, you may be able to more accurately detect how grazing may be influencing native plant richness. If there is a large decline in palatable ground-layer plant species, including regenerating seedlings of canopy cover species, excessive grazing may be the cause. Numbers of native perennial grasses such as kangaroo grass (*Themeda triandra*), black speargrass (*Heteropogon contortus*), wiregrasses (*Aristida* spp.) and bluegrasses (*Bothriochloa* spp. and *Dichanthium* spp.) can decline significantly with increased grazing pressure, whereas clumps of exotic grasses such as buffel (*Cenchrus ciliaris*) can actually increase. Species richness can change significantly. It needs to be noted, however, that because palatability of species may vary according to season, age of plant, location or the type of grazing (e.g. sheep or cattle), the response of the plant community to domestic grazing is complex and specific to a property or paddock.

You may need to limit grazing in areas where there are small shrubs and ground cover or seedling trees you want to protect. Similar to pasture grasses, either seasonally or during drought, some woody vegetation species may be more palatable than others and so will be preferentially consumed. Consider shifting fences or installing electric fences to protect an area where you want to reduce grazing or trampling pressure.

Depending upon stock condition, pasture condition and palatability of the native plant you want to protect, you may wish to supplement with stock feed when natural forage becomes scarce, to reduce grazing pressure on regenerating trees, ground covers, and shrubs. Pasture improvement practices such as fertilising, seeding of non-local grass and legume species, cultivation, ripping and aeration can all influence the presence or absence of desired native pasture and native plant species.

Review the location of watering points to ensure that stock do not pass through or camp where susceptible plants are growing. Watering points generally develop a zone of extreme degradation around them – up to 0.5km (Boulter et. al. 2000) in drier areas – where unpalatable plants dominate and the numbers of palatable plants, including native vegetation, decline. In areas where water supplies are limited, installing artificial watering points may increase the range of grazing animals including stock, native animals (kangaroos) and feral animals (rabbits, pigs, goats). This can lead to a decline in plant species composition.

## Vegetation thickening

The issue of vegetation thickening is of interest in many parts of the state. It is the native plant richness, cover or abundance of native species and usually relates to the thickening of the shrub layer and associated decrease in the amount and diversity of the ground layer. Possible factors are natural cycles and inappropriate fire regimes, over-grazing, insufficient fuel loads, the timing and frequency of fires, etc. Recording information on what grazing intensity (see 'Yearly pasture use' indicator) or fire regime (see 'Impact of fire' indicator) has been applied will assist you in understanding what is happening with your situation.

## Forestry practice

Native forest harvesting and management practices can have significant impact upon native plant richness. Codes of practice now apply to forest practices in native vegetation on freehold and state land in Queensland to ensure native plant richness is maintained (as a component of biodiversity). See the Queensland Department of Environment and Resource Management's vegetation management pages for more information on native forest practice <[www.derm.qld.gov.au/vegetation/clearing/forestpractice.html](http://www.derm.qld.gov.au/vegetation/clearing/forestpractice.html)>.

## Other information sources

### Books

Greening Australia's publication, *Tracking your community vegetation project*, is a very useful book that has lots of worksheets and examples about monitoring vegetation. See the reference list for more information.

### Websites

- Greening Australia <[www.greeningaustralia.org.au](http://www.greeningaustralia.org.au)>
- Australian Government environment web portal <[www.environment.gov.au](http://www.environment.gov.au)>
- Department of Environment and Resource Management <[www.derm.qld.gov.au](http://www.derm.qld.gov.au)>

# Glossary

## BioCondition Assessment Manual

The BioCondition Assessment Manual developed by the Queensland Department of Environment and Resource Management provides a means of assessing biodiversity values at a patch, property or paddock scale. The framework uses data collected from site-based and landscape context attributes, related to biodiversity and compares these values to benchmarks established for different ecosystem types. The framework is a site-based, rapid, field-assessment procedure that provides a condition rating of 1, 2, 3 or 4 (with 1 being excellent and 4 being poor) (Eyre, Kelly, Neldner, Wilson & Ferguson 2010).

## Bioregions

Queensland is divided into 13 bioregions <<http://www.derm.qld.gov.au/vegetation/bioregions.html#bioregions>> based on broad landscape patterns that reflect the major underlying geology, climate patterns and broad groupings of plants and animals (DERM 2010)

## Plant form (also known as growth or life form)

Plant form is the type of vegetation growth into which plants may be grouped. They help to describe the type of plant and are also used to define vegetation communities. The twenty most common growth forms identified are: trees, tree mallee, shrub, mallee shrub, heath shrub, chenopod shrub, tussock grass, hummock grass, sod grass, sedge, rush, forb, fern, moss, vine, cycad, palm, Xanthorrhoea, lichen and liverwort (McDonald et al., 1998, pp.65–66). To simplify identification these are grouped together into five broad forms: trees, shrubs, grasses, forbs and others.

## Projection (map)

The way the geography of the Earth is taken from the globe and reassembled on a flat surface is called the map's projection. Another way of thinking of projection is that every point on the globe can be projected by a straight line onto a transparent form wrapped around the globe. The shape of the form and how the points are spread onto it determine the type of projection. Some common forms are cylinders, cones, ellipses and flat planes, giving rise to cylindrical, conic, elliptical, and orthographic projections. There are many types of projection. Each distorts the spherical surface of the Earth in a different way, and each has its practical advantages and disadvantages.

## Relative abundance

Relative abundance is a comparison of how many individuals of a particular species are actually measured at a site and how many individuals of other species occur at the site or can be expected for the vegetation type. It can be expressed as a ratio of the actual numbers recorded at a location, as a percentage of the total number of individuals recorded for a transect or be grouped under the following classifications of dominance: dominant, co-dominant, associated or suppressed.

## Regional ecosystems classification

The Queensland Government uses a regional ecosystem classification for mapping native vegetation. Regional ecosystems are organised on bioregions, which are subdivided into land zones, and these in turn are based on the dominant vegetation. Variation in vegetation type arises from different geologies and soil types, local climate, elevation, drainage and landscape processes. A combination of these factors and the vegetation type defines the regional ecosystems that are present in an area. Information on regional ecosystems can be obtained from the regional ecosystem description database <[www.derm.qld.gov.au/nature\\_conservation/biodiversity/regional\\_ecosystems](http://www.derm.qld.gov.au/nature_conservation/biodiversity/regional_ecosystems)>.

## Species abundance class

Species abundance refers to how many individuals of a plant species occur at a particular location or can be expected for a vegetation type. It can be expressed as the actual number recorded at a location or be grouped under the following classifications:

- Abundant – many always present
- Common – always a few present
- Uncommon – only a few individuals or only 2–3 patches
- Rare – only one specimen found.

## Vegetation type

The group of the most dominant plants in an area of vegetation is described as a vegetation type. It is used in different ways depending upon the scale, level of detail recorded for the vegetation or context. There is now a national framework for vegetation classification <[www.derm.gov.au/monitoring/indicators/vegetation-extent/priority.html](http://www.derm.gov.au/monitoring/indicators/vegetation-extent/priority.html)>. In Queensland, the most

relevant classification of vegetation type for a property is the regional ecosystem classification.

**Vegetation structure**

Vegetation usually consists of a mixture of growth forms of varying height and spacing. Growth form, height and spacing are used to describe vegetation structure.

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# Authors

Andrew Grodecki and Kylie Hey, Queensland Department of Environment and Resource Management