Department of Environment
and Resource Management

Land Manager's Monitoring Guide

Photopoint Monitoring

Tomorrow's Queensland:
strong, green, smart, healthy and fair

Toward Tomorrow's Queensland

Queensland Government

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Department of Environment and Resource Management

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Contents

What is it?

Photopoints are permanent or semi-permanent sites set up from where you can take a series of photographs over time which can be compared to show short- or long-term physical change at each location. The pictures for comparison are taken at the same location, with the same direction (south), angle, focus points and preferably camera settings. Photographic records provide a permanent visual record of change on your property without reliance on memory or taking physical measurements, and are used to support other monitoring efforts where you are collecting data.

Key types of photographs

- The *spot photograph* is an image taken looking nearly vertically down on a marked spot or a quadrat from head height (about 1.6m). This is used for recording ground cover and species, and organic litter.
- The *'trayback' photograph* is taken standing on a vehicle tray back providing an elevation of approximately 3 metres. A step ladder can be used as an alternative. The image taken is of the immediate foreground and is used for ground cover and condition, the amount of feed available and small gullies.
- *Landscape photographs* are taken of features in the intermediate distance or further. They are used for showing shrub or tree layers, or the extent of events on the landscape such as floods or fire.

Choosing which of the three key types of photographs – spot, trayback, and landscape – to use will depend very much on what and why you are monitoring. If you are following standard assessment methodology such as BioCondition Assessment you will use a set combination of types of photographs.

Why use photographs for monitoring?

Taking photographs at photopoints on your property can be the simplest way to monitor short- and/or longer-term change that is the result of management decisions, climatic conditions/impacts and natural events. It is a relatively quick, simple and inexpensive monitoring method. A sequence of photos taken at suitable intervals over a period of time can provide a rich source of information. A pictorial record of changing conditions can also support your other monitoring efforts.

When photopoints are set up in the right location, photographs can be one of the most reliable and consistent methods of 'summary' monitoring over time. Little technical skill is required for photo monitoring, and there is less of a problem with measurement error and variation found with other types of monitoring. Other advantages include low capital requirement to install and maintain this system of monitoring, and there is little impact on surrounding areas or ongoing management.

Photographic records accompanied by information on management actions, climate and natural events enable you to show and explain to others (workers, family, neighbours, contractors, funding bodies etc) how and possibly why particular locations have changed.

Images from photopoints can provide a valuable supporting record if you are monitoring:

- Pasture condition, pasture species and yearly pasture use
- Ground cover, organic litter, shrub cover, recruitment of woody plants, tree canopy cover and health, and vegetation density
- Native vegetation area and wetland area
- Native plant richness, large trees, fallen woody material and in-stream habitat
- Impacts on native vegetation, impacts on wetlands
- Farm water flow, gully erosion, hill slope erosion and wind erosion
- Saline land and deep-rooted perennials
- Weed cover & weed species
- Effects of fire, drought, flood, dieback and feral animals
- Wind erosion

How will your photographs be used?

Photographs may be used to visually represent physical measurements taken at a location, and can capture a number of different indicators or features of interest in one frame. Photographs must be accompanied by information on factors affecting each site, which will make it easier to interpret the reason for the changes that are visible.

Photographs from each photopoint taken on at least two to three different occasions over time will be needed to make

meaningful comparisons, and for significant changes to be really noticeable.

Annotate initial photographs taken at each location, marking plants or features of interest to be monitored for change over time. Include these photographs in your field notebook or location record sheets to help you on later visits.

Key types of photographs

The Spot photo

This is a photo taken from head height looking nearly vertically down on a spot marked with a one square metre frame or quadrat as shown in figure 1. Spot photos provide a detailed picture of the groundcover, organic litter and plant species for a standard sized area. If there is great variety at the site, take more spot photographs. Some monitoring methods specify the number and location of quadrats along established transects where spot photographs can be taken.

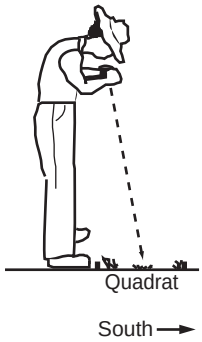


Figure 1: Taking the spot photo – try and keep the top of your feet out of the frame, and angle the camera down as straight as possible

You may find it useful to build up a small collection of spot photographs like those shown in figure 2 to give you a benchmark of ground conditions in different areas of your property. Checking or calibrating the rest your quadrat assessments against these will speed up assessments and improve accuracy of measurements.

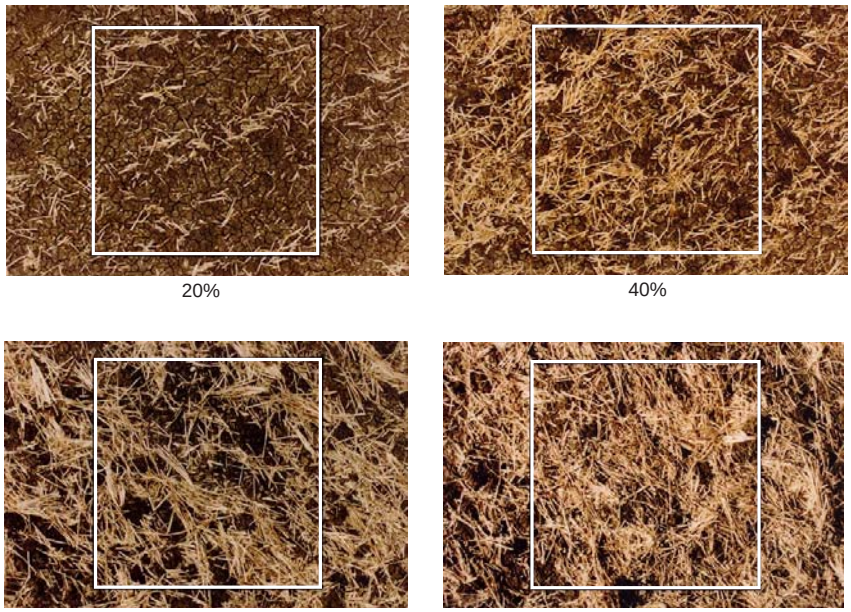


Figure 2: Spot photographs of wheat stubble for 20%, 40%, 60% and 80% cover levels.

The 'trayback' photo

The trayback photograph is taken standing on the back of a ute tray although a stepladder can be used as an alternative to a vehicle. This approximately equals an elevation of about 3 metres and a downwards angle of 15 degrees. This photo angle will best illustrate ground condition and the amount of feed available in a pasture. It can also show the amount, type and condition of nearby vegetation or the condition of a small gully.

The vehicle trayback or stepladder is positioned at the photopoint post (Figure 3). Focus the middle of the viewfinder on the base of the sighter post located 10 metres (approximately 17 paces) to the south of the photopoint post.

The top quarter of each post is painted bright white or yellow for safety purposes, and each photopoint is marked with a unique number which is useful for identifying the site and keeping records.

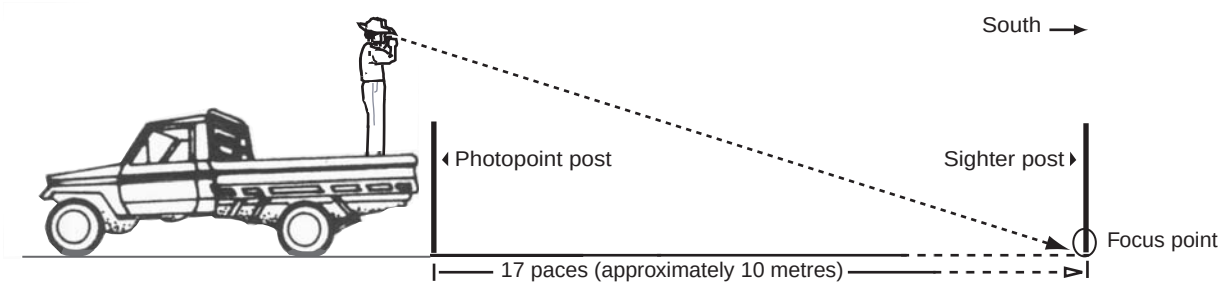


Figure 3: Taking the 'trayback' photo with viewfinder centred on the base of the sighter post.

The landscape photo

Setting up a landscape photo can be simple using two posts a distance apart – see figure 4 below. Occasionally it may be appropriate to use landmark features which future pictures can be matched up with. More precise setups have a distance of 10 metres between the photopoint and sighter post. Vegetation transects require even more detailed set up arrangements and at least three sighter posts. This is covered more fully under the BioCondition Assessment heading below.

Figure 4: Monitoring the progress of rehabilitating a sandy track using native vegetation plantings. Sighter posts as well as landforms (grassy knoll) and mature trees (on near-middle horizon) are used to line up images and make direct comparisons (Photographs courtesy of Queensland Parks and Wildlife Service)

Landscape photos will best illustrate the general condition of the site showing major changes in shrub and tree populations. Stand next to the photopoint post as in figure 5. Position the top of the sighter post in the middle of the viewfinder and focus on infinity.

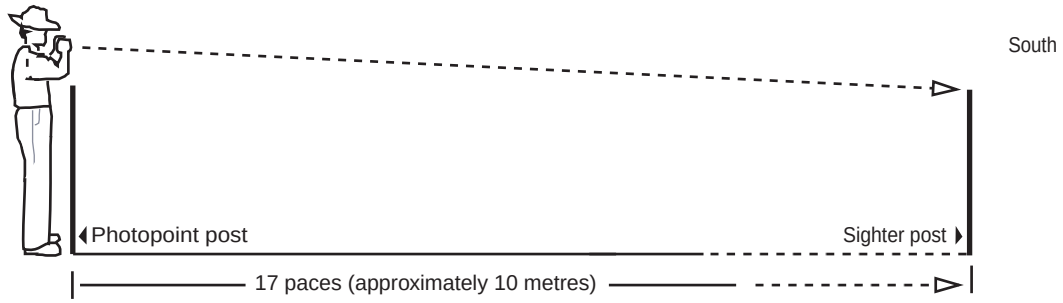


Figure 5: Taking a landscape photograph from a photopoint marker, with the top of the sighter post in the centre of the viewfinder and focus on infinity

Site specific landscape photos can be used to record a particular event – for example, flood levels, impacts of a bushfire – or as part of a time series taken over a period of time such as hillside revegetation or gully erosion. Record how the photograph was lined up so that later pictures can be taken of the same aspect. Alternatively, take a hard copy of the picture with you on future visits will make lining up the shots easier.

Photographs for BioCondition Assessment

For monitoring native vegetation using the Queensland BioCondition Assessment Framework <methodologyhttp://www.derm.qld.gov.au/wildlife-ecosystems/biodiversity/biocondition.html>, at least 9 photographs are taken at each location. A landscape and trayback photograph is taken at the start of a 100m transect and four additional landscape photographs are taken from the centre point of the transect (see Figure 6). Take the photograph from a standing or crouched position, one each facing the four points of the compass (00 north, 900 east, 1800 south, and 2700 west) with the centre of the view finder aimed at the horizon, with focus on infinity.

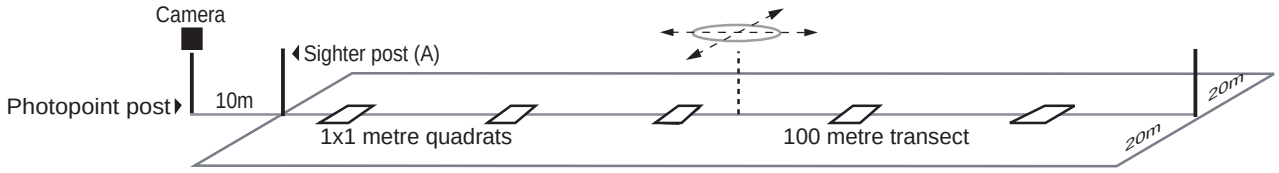


Figure 6: Photopoints for vegetation transects, using a standard layout for a bio-condition assessment of vegetation (EPA 2005). Note - Quadrats show layout for other assessment techniques used with transects.

In addition to this, establish at least two more permanent sighter posts, about 20 metres either side of the end of the transect (Figure 7). Take photographs from the photopoint post 1, one each with the view finder centred on the tops of the sighter posts (B). Take a spot photo 10 metres along the transect from the photopoint post to reveal the density and variety of ground cover species. If your ground cover varies greatly then take more photos to show the different ground cover types.

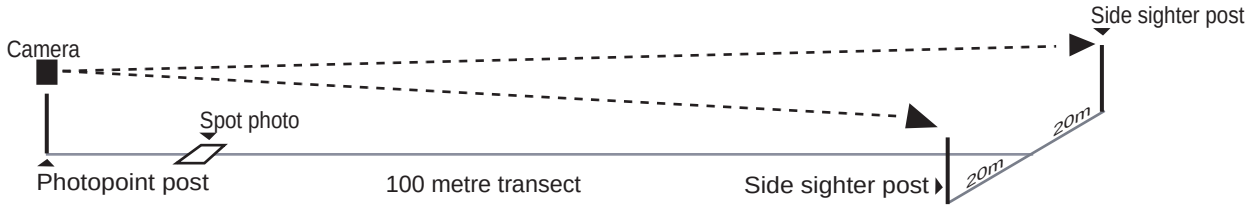


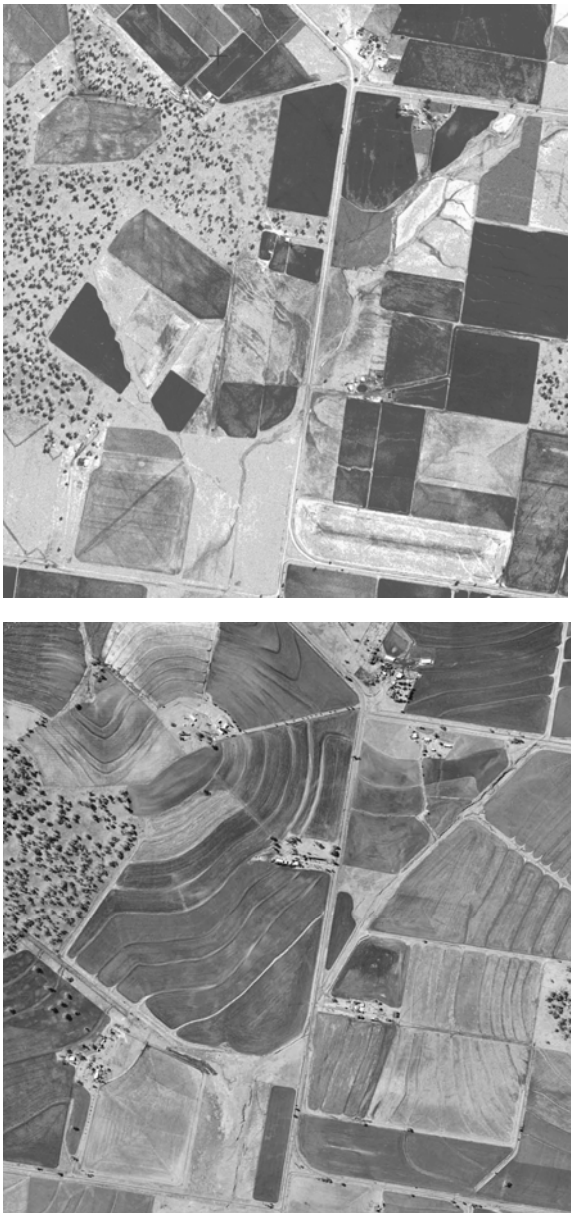
Figure 7: Landscape photographs taken 20 metres on either side of the transect line, with the view finder centred on the top of the sighter posts (B).

Aerial photographs

You may wish to identify or track changes on large sections or the whole of your property. Aerial photographs taken at intervals of about ten years are readily available for comparing land use, vegetation cover (density and area), gully formation and stream lines (see Figure 8). Features such as roadways, buildings and waterbodies which are evident in each photograph can be used as reference points when lining up a series of images for comparison. Much of Queensland was photographed from the air back to the mid-1950s, and by the late 1980s the whole state was photographed digitally.

Printed aerial photography is available from the Queensland Department of Environment and Resource Management <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 approximatly $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> 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.



Example of comparing aerial photographs

Severe soil erosion and gully formation is clearly evident—running from the top right diagonally across to the bottom middle of the photo—in the earlier photo. A comparison with the subsequent photograph shows significant improvements brought about by adoption of different management techniques and remediation works.

Paddock design was changed to reflect the natural contours of the land. Grassed waterways were established along drainage lines.

Other points of interest for comparison include: pattern of cultivation; area of cultivation and grazing and tree cover.

Figure 8: Aerial photographs showing an area of interest in 1955 (top photograph) and 2003 (bottom photograph).

Satellite images

Digital or printed satellite images of recent and/or historical images are useful for looking at changes to the environment over a broad area. Although there may be no historical images available, start collecting images now for future reference. These images are currently available from:

- The Queensland Department of Environment and Resource Management <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>.
- Geoimage Pty Ltd <www.geoimage.com.au>
- Geo Mapping Technologies <www.geomap.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.

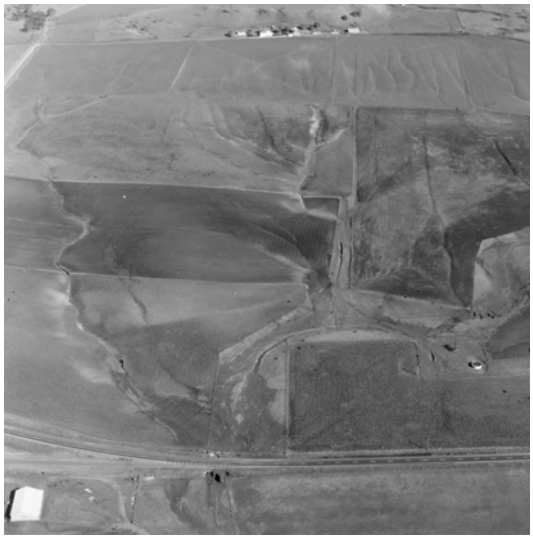
Oblique aerial photographs

Taken from a light plane oblique aerial photographs are angled toward the ground view as shown in Figure 9. Maintaining the same set up for taking the photograph – approach direction, altitude, time of day – and including landmarks such as roads, buildings and waterbodies, will help when comparing images from different dates.

Photographs taken at an altitude of around 600 m are likely to be suitable for monitoring purposes. Work out the scale of the image by comparing the actual size of a building or length of road with the size/length measured in the printed photograph. This can be useful when determining the extent of a problem such as how far a weed infestation reaches, or the length of a gully.

There are a number of advantages in using this technique. You can:

- target areas of particular interest on your property
- take the aerial photographs yourself or commission someone else
- control the frequency and timing of photographs being taken
- gain a large scale perspective of an issue that on the ground photopoints can’t provide.



Location: *Barries Run*

Date: *March 1983*

Time: *12.30pm*

Photographer: *Lionel Coxson*

Flight approach: *South*

Altitude: 2300m

Scale: *1:10,000*

Target issue: *Erosion*

Comment: *Severe soil erosion and gully formation is evident.*

Location: *Barries Run*

Date: *March 1991*

Time: *2.30pm*

Photographer: *Lionel Coxson*

Flight approach: *South*

Altitude: 2300m

Scale: *1:10,000*

Target issue: *Erosion.*

Comment: *Changed practice - Contour banks introduced and reduced erosion and gully formation*

Figure 9: Examples of oblique aerial photographs taken of an area targeted to control land degradation and reduce environmental impacts.

Key aspects of photopoint monitoring

Baseline data

To track changes at a site over time you need to take initial photographs of the indicator(s) you will be monitoring. This is particularly useful if taking photographs before major developments, changes in management practices or remediation works. These first photos which will become your baseline data with subsequent photos compared to these to gauge how much change has occurred. It is important that photographs are taken in the same way so they can be reliably compared with others taken at the same location but different times.

The Land Manager's Monitoring Guide suggests two levels of monitoring change—the first is recommended if you want to quickly and regularly check up on an indicator. Collecting more detailed and accurate information requires following level 2 monitoring instructions. Photopoint monitoring is useful for a number of different indicators, and is appropriate for both levels of monitoring.

When and how often will you take photographs?

Take photographs when carrying out other monitoring activities—the frequency of which depends on what is being monitored, the visible rate of change, and the timing of influences such as climate and other natural events such as fire.

For example, take photographs of native vegetation condition and abundance at least once a year at the end of the growing season as a minimum and if possible twice a year to show seasonal differences. Time the monitoring so that monitoring is not

being carried out during the peak of summer or in the middle of severe drought, unless you are monitoring the effects of these conditions. Vegetation is generally best during May to October though north of the Tropic of Capricorn taking photographs is best after the wet season—February to May— and May – June to the south.

The time of day photos are taken is also important. Photos should be taken on a clear day between 9am and 3pm with the sun behind the camera. Always face south if possible to reduce the potential for too much sunlight and over-exposure of the picture.

Selecting your photopoint location/s

How you select your site, will depend upon what and why you are monitoring. Photographic monitoring is most suitable when monitoring physical changes that are readily visible. Where you take photographs will largely be determined by which indicators you have chosen to monitor. Each indicator in this guide will contain information on how to select photo monitoring locations—please see the indicator list for those already available.

Monitoring is usually undertaken at sites typical for the indicator(s) of interest. Your photopoints will therefore be located at the same sites. For example, when measuring an indicator that covers a wide area such as ground cover choose an area with average grazing pressure, located some distance from watering points. You may also want to set up separate photopoints where the condition indicator is less typical and more extreme than the main monitoring site. You can create a photo record of a range of conditions across your property which allows comparisons to be made of different locations from the same time period as well as over time. Take care not to set up too many sites—better to have a few good sites with the monitoring activities continuing long term.

When events such as floods and fires occur, it is unlikely that you will be able to set up marker posts. In such cases choose photopoints where you can get good images of the event as will as local landmarks such as hills, rocky outcrops, particular trees etc. These landmarks will help you find the location again as well as replicate the view so that the series of photos can be compared easily.

Return visits

Sites must be readily accessed and found again. Choose locations which are off established tracks and near landmarks such as a rocky outcrop, known water hole or fence line. Record a description of the directions to each photopoint, or the coordinates of the site using a GPS (geographic positioning system). If you have a property map, the location of the photopoints can be plotted.

Place a sign on the sighter post or at its base so the site details are captured in the photograph. A small slate, whiteboard or a clipboard with paper is useful, making sure the writing is large enough to be read in the photograph.

Scale

Rough estimates of the amount of change may be possible if marker pegs or some other visual indicator of scale are used. A ruler or a coin is suitable for spot photos which are used for close up pictures of 1m x 1m quadrats. Sighter or end posts can have their top height clearly marked, and a person, vehicle or other object of known size would be suitable placed midway in a landscape photograph.

Camera settings

Use whatever settings that work well for the type of photograph (landscape, trayback, spot or site specific) and your type of camera. The main principle is to use the settings that consistently give a good picture. Different camera settings can make it harder to compare photos, so keep them simple. Auto settings are generally reliable and an easy option in most situations. Turn on date stamping feature if available and unlikely to obscure important elements of the picture.

Light levels

Photos should be taken on a clear day and between 9am and 3pm. Before 9am and after 3pm will generally result in more shadowing and different colour cast which may conceal some features. A photo taken around midday shouldn't look washed out if a few precautions are taken. If using film, try to use one that is fast (400 – 800ASA) so that the shutter speed is fast and the amount of time the film is exposed to light is reduced.

Auto-settings used appropriately for different light levels can help reduce the problems of too much light blanking out colour and landscape features. If you have control over the settings of your camera set the light exposure level for the monitoring site only by excluding the sky. To do this lower the camera and obtain exposure whilst the top of the frame is no higher than the horizon (no sky) and lock the exposure for that site.

Picture directions

You will always get a better photo by having the sun behind you with the sunlight shining on the landscape facing you. To do

this you need to be facing south and so avoid ever having the sun shining into your lens. This is an important consideration even at midday in the tropics when the angle of the sun is such that you will cast a shadow.

Hold your camera so that the image is taken with a 'landscape' perspective – that is where the picture is wider than it is high.

Managing your information

There are two aspects to the information you are creating each time you undertake photopoint monitoring: the **'data'** you collect each time you take a photograph – that is the photograph itself – and the **'metadata'** associated with your photographic monitoring.

Photographs as data

The information you collect while monitoring is referred to as data. Data is distinct pieces of information (e.g. numbers, text or images) that can be stored electronically, on paper or as samples. An organised collection of data with a common theme is called a dataset. For example, a collection of photographs taken for a monitoring project on revegetation would form a 'dataset' for that project.

There is a shift toward using digital cameras. Software to manage images and photo albums is generally supplied with the software to download images onto computers. Whether you use the system provided by the camera maker or make up your own, the aim is to be able to easily find images for each location and monitoring occasion.

As with all computer records you should regularly make back ups of your electronic files such as burning a CD of your photographs in case of computer crashes and viruses.

Store printed photographs in a way that makes it easy to identify the location, indicators being monitored and the date they were taken. When the photographs have been printed it is a good idea to clearly label and date all photographs and place them into a photo-album. Using your photo record sheet, it should be easy to keep them in order and include this in the album where the photos are kept.

Metadata

Metadata is pieces of information that describe data or is 'data about data' providing additional information about the: who, what, when, where, why and how a particular dataset was collected. Metadata is critical to preserving the usefulness of data over time.

Descriptive data will include details of each location that photographs are taken, as well as information about each photograph. This metadata is recorded in a field note book or a standard record sheet you design to ensure all relevant pieces of information are collected on site as well as details of the site location. Information about possible influences on the sites, such as recent or ongoing climatic extremes and changes in stocking rates are also important to record. Table 1 shows an example of what a record sheet could look like, and suggested details to record.

Some of this information will also be included within each photograph if you make use of a sign board, such as date, location code, photograph number and indicator or feature of interest. Including this information will make it easier to match photographs and create a series which shows the condition of a location over time.

Details related to each image should be recorded and filed in a way that can also be easily located and matched with the relevant photograph. Current database software provide options for including images with information records. The advantage of using a database is the immediate link made between photographs and information about the site when the images were taken. Datasets are also easily set up, accessed and available for review and sorting, and printing reports. Alternatively use an electronic spread sheet such as MS Excel or a manual system for filing field notebooks or record sheets.

Store all data and metadata, whether electronic or printed, safe from possible damage by magnetic fields, weather, insects or other influences.

Table 1: Example of information recorded about a photopoint location and the photos taken

Location	Carp Gully
Site number	CG2
Directions to location	Connors Creek, Use 4th gate along Fitzy's Road from T-junction
Coordinates	
Site issues	Waterlogging, salinity, loss of vegetation cover
Management history	1999 – planted salt tolerant species to help pump groundwater – grey box (*Eucalyptus moluccana*), river red gum (*E.camaldulensis*), golden wattle (*Acacia saligna*), broad leaf tea tree (*melaleuca quinquenveria*), river tea tree (*M. bracteata*)

Photo No.	Date	Time	Indicator/feature	Weather	Comments
1	3.3.2002	2pm	Ground cover	Dry	Only salt tolerant species evident around scald.
2	3.3.2002	2.10pm	Ground cover	"	
3	3.3.2002	2.15	Growth rate	"	High mortality golden wattle – bora attack. Red gum growing faster than grey gum
247	7.3.2003	1.40	Ground cover	Dry	20mm rain 14 days earlier, some groundwater discharge. A few salt sensitive plants evident away from scald.
248	7.3.2003	1.45	Growth rate	"	

Interpreting your photographs

Photographs by themselves provide insufficient information for conclusions to be drawn regarding the reason for changes. In the time between photographs being taken there will be various influences, both human and natural, on the photopoint site(s). These need to be recorded on an ongoing basis to provide information to help interpret the changes seen in the photographs.

Photographs also provide a visual representation of data collected for other monitoring methods, sometimes making it easier to understand the meaning or significance of the measurements taken. Conversely the data from those methods can be useful in explaining the amount and type of change visible at each site. Other key variables that should be considered include those factors recorded in your notes such as climate, rainfall, grazing history and mechanical interference.

Presenting your findings

A photo album or project book with printed copies of the pictures is useful when talking to others and equipment for presenting your results – such as computers and data projectors – is not available. Combine this with the results of analysing data from other monitoring methods used on the same site. These can be presented as graphs, tables and field notes and put together into one document.

Equipment

Many of the items listed below will already be included on equipment lists for other indicators:

- Digital or film camera and film
- Property map or area map (1:25 000). Details on mapping property information can be found in property planning and mapping sections of the Department of Environment and Resource Management website <www.derm.qld.gov.au/propertyplanning/preparingplans.html> and the Land Management series of fact sheets <http://www.derm.qld.gov.au/services_resources/category.php?class_id=9>.
- Markers – posts or star pickets with one end painted white – a standard set contains one for the photopoint, one each

for the sighter post and end post. If undertaking BioCondition assessment an additional three posts will be needed – one for each side photograph and once for the centre point. The total number will depend on the number of sites being monitored.

- Quadrat frame (1x1 metre)
- Computer for storing information and running mapping, image management and database software.

GPS (global positioning systems) receiver

A wide range of GPS receivers are now available from camping, boating, scientific and electronics stores. 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. Approximate cost of a GPS receiver is $250+.

GIS (geographic information systems) software

GIS software basic functions include display of digital images (maps) and overlaying of data layers. Vendors of a range of computer programs for use in property mapping can be found by carrying out an Internet search. Suggested terms to search for include ‘farm mapping’, ‘farm recording’ or ‘property mapping’. Costs vary depending on the software purchased.

Minor items

- Tape measure – 50 or 100 metre
- Sign board or clip board
- Chalk or whiteboard marker pens
- Photo album
- Notebook for recording events and factors affecting each area with monitoring sites.

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Acknowledgments

Photographic sources

Oblique aerial shots – Lionel Coxson

Vegetation monitoring – Roland Dowling, Queensland Parks and Wildlife Service

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