

PASTORAL LEASE ASSESSMENT TECHNICAL TRAINING MANUAL (2011)



Revised Technical Manual for the second round of assessments of
pastoral leases in South Australia, 2005 - 2015, Pastoral Program,
DENR

PASTORAL LEASE ASSESSMENT TECHNICAL MANUAL

Technical detail for the methods to be used for the second
round of pastoral assessments in SA.
2005 - 2015

Version 3

- This version prepared for use as part of the training of new Assessment staff.

PASTORAL LAND MANAGEMENT GROUP
DENR

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ACKNOWLEDGMENTS

This document is based on manuals written for the first (baseline) assessment program, by Rodger Tynan when the Pastoral Land Management and Conservation Act came into operation in 1989. It was up-dated by Jack White to reflect the procedures undertaken during the latter part of first round of Pastoral lease assessment between 1995 and 2000.

Refinements and changes to the detailed elements of the assessment methods resulted from input from all members of the Pastoral Group, particularly during “field calibration” exercises in the early years of the program. Regular contact with interstate counterparts, particularly in NT and WA, has helped the group formulate robust methods which have at least some common attributes with monitoring systems used in these other jurisdictions.

Those that contributed to and participated in the assessment process between 1990 and 2000 included – Geoff Axford, Dennis Barber, Rick Barratt, Andrew Bateman, Craig Baulderstone, Jenny Bourne, Amanda Brook, Tonia Brown, John Chappel, Ben Della Torre, Guy Edwards, Mike Fleming, Paul Gould, Louisa Halliday, Justin Jay, Frank Kutsche, Brendan Lay, Vicki Linton, John McDonald, John Maconochie, Chris Turner, Merri Tohill, Rodger Tynan and Jack White.

The 2007 assessment team, Adrian Friedel, Simone Lawson, Emma Kinnane, David Oag and Jeff Stringer have made comments and contributed to the 2007 version of this training manual.

The current assessment and inspection team of Craig Baulderstone, Gavin Baird, Augie Facelli, John Maconochie, David Oag, Andrew Sheath, Jeff Stringer, Chris Turner and Carolyn Woods have continued to review the methodology and clarify the information in this document. Methods are still essentially consistent with those originally used but with clarification in text.

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INTRODUCTION

South Australia's Pastoral Leasehold lands cover some 44 million hectares (44 384 km²) and includes 321 Pastoral Leases which are amalgamated into 220 properties or 'runs'. The 2225 km long dingo fence stretches across the rangelands and separates the dingo free sheep leases to the south from the cattle leases in the north.

The rangelands comprise spectacular ranges (Flinders and Gawlers), sand dunes, gibber and alluvial plains and tablelands. Vegetation types range from mulga tall shrubland to chenopod shrubland (saltbush and bluebush) and grasslands. Rainfall is generally less than 250 mm per year that is highly variable and unpredictable with evaporation generally exceeding 2250 mm per year.

The Pastoral Land Management Group is a unit within, Department of Environment and Natural Resources. It is responsible for the administration of the Pastoral Leases (by direction from the Pastoral Board) under statutory provisions of the Pastoral Land Management and Conservation Act, 1989. This group undertakes surveillance (Pastoral Inspection), assessment and monitoring of the pastoral and other arid lands in this State.

The assessment method developed in South Australia for determining land condition employs standardised criteria and sampling routines consistent with State legislation and provides a scientific assessment of the land condition of properties within a district. The information provides the Pastoral Board with an objective basis upon which to consider stocking levels and other factors that affect land condition on pastoral leases. Photo standards provide an accurate standardised record of the criteria used to determine the various condition classes, and the survey can therefore be repeated in the next 14-year assessment period using consistent standards. The process is objective, relatively simple, easily demonstrated to pastoralists, and has wide potential application to other rangeland areas.

The methods were developed during the late 1980's in anticipation of the new Pastoral legislation. Some components are based on WARMS (Western Australian Rangeland Monitoring System) methods.

At the time of initial assessment, the photopoint manuals contained most of the photopoint sites, including old pastoral inspectors "opportunistic" photos which had been relocated. However an objective indication of trends in land condition, which can be related to current management strategies on each lease is only possible after subsequent re-monitoring from the original 1990's baseline. It was assumed at the time that at least one or more re-takes of photopoints and data would be carried out in the 14 year period between assessments of any one property. This has not occurred and trends will have to be determined from many sequences based on two observations 14 years apart. Any trends revealed can then be used to supplement the Land Condition Index (LCI) survey findings, as the LCI will also be repeated during this second round exercise.

Any repeat photos of these sites by Pastoralists or pastoral inspectors will indicate effects of seasonal changes and will assist in directing their focus towards the land resources, rather than on stock condition.

The whole assessment process must be repeated every 14 years under the Act. Consequently, at the time the first version of this manual was written, it was noted that the original methodology should be followed, so that subsequent surveys can repeat these measurements to provide the objective basis on which to determine trends in rangeland condition.

Land Condition Index surveys were commenced in the Kingoonya Soil Board District in 1990. Separate LCI manuals detail the methods and photo-standards to be used in each former Soil Board district, now known as NRM Group districts.

Pastoralist involvement in the assessment process and ongoing monitoring is seen as an important component in achieving long-term 'land care' ideals and the methodology that has been developed seeks to encourage land manager input.

NATURAL RESOURCE MANAGEMENT (NRM) BOARDS

The District Soil Conservation Boards in the late 1980's were a relatively recent development in the pastoral lands, at the time of the first round of lease assessment.

These Boards have been "transformed" into district NRM Groups of the SA Arid Lands or Murray Darling NRM Board. All areas are now covered by NRM Boards recently established under the Natural Resources Management Act of 2004. Appendix 13 shows the Board boundaries across SA. The Pastoral Land Management Group provides information about the district's resources so that the NRM Group can provide input to the NRM planning processes that seeks to encourage sustainable land management objectives.

LEGISLATIVE REQUIREMENTS

The Pastoral Land Management and Conservation Act, 1989, provides the mandate for the assessment process and the methodology has been developed to comply with the specific requirements of the Act.

Objectives of the Act

The Objects (Section 4) and other sections of the PLM&C Act provide the legal charter and instructions about what is required of an assessment of the land.

The PLM&C Act (the Act), has the following land care objectives:

- *to ensure that all pastoral land in the State is well managed and utilised prudently so that its renewable resources are maintained and its yield sustained*
- *to provide for the effective monitoring of the condition of pastoral land; the prevention of degradation of the land and its indigenous plant and animal life; and the rehabilitation of the land in cases of damage.*

The Act defines degradation of the land as "a decline in the quality of the natural resources of the land resulting from human activities on the land". Rehabilitation of degraded land means "to bring the land back to at least the condition it was in before its degradation, having particular regard to its capacity to carry stock and its level of soil stability".

Pastoral leaseholders also have a duty (Section 7) to use good land management practices, prevent degradation of the land and to endeavour, within the limits of financial resources, to improve the condition of the land. They also have related and more explicit duties in connection with the Soil Conservation and Land Care Act, 1989. These duties have, in general terms been included in the Natural Resources Management (NRM) Act 2004, which will now replaces the Soil Conservation legislation

Tenure provisions

Tenure provisions under the Act include a 'rolling' 42 year lease, whereby the lease is assessed to determine its land condition every 14 years. Provided the lessee has not wilfully breached a condition of the lease resulting in, or likely to result in, degradation of the land, then the lease term is topped up from the remaining 28 years to a full 42 years. Land management conditions of the lease may also be varied every 14 years.

Section 43 of the Act provides for further protection of the land whereby the Board may direct the lessee to take action to prevent degradation of the land, e.g. to destock certain paddocks. There is no right of appeal under this section.

Assessment of land condition

To be defensible in a legal sense (e.g. if contested under the jurisdiction of the Pastoral Land Tribunal) the methodology used to assess land condition must strictly follow the directions of the Act.

The Act specifies (Section 6) that the assessment of the condition of the land must:

- *be thorough*
- *include an assessment of the capacity of the land to carry stock*
- *be conducted in accordance with recognised scientific principles*
- *be carried out by persons who are qualified and experienced in land assessment techniques.*

The Objects refer to the indigenous plant and animal life, consequently there is a requirement to assess at the plant species level to determine to what degree the indigenous plant communities have been degraded or removed. It is important to note that replacement of indigenous species by introduced species is an example of degradation under this Act. Additionally, the composition of indigenous communities may be degraded under stock grazing by the replacement of palatable perennial plants with less palatable native species.

A draft assessment report on the condition of the land comprising each “run” (management unit) must be completed. Under the second round process, the initial report preparation is carried out by the field assessor teams. The Pastoral Board will consider the report together with any comments from the lessee, before setting the lease conditions.

Updating of the photopoint manual is required. The capture of spatial data for any new lease infrastructure (using vehicle-mounted downloadable GPS units) will occur at the same time as the fieldwork for the lease assessment, as the paddock plans produced during the first round process have proven most useful to the lessees and managers of these properties.

FACTORS INFLUENCING THE METHODS USED FOR THE BASELINE ASSESSMENT IN THE FIRST ROUND

Soil Conservation Districts

Soil Conservation Districts set up in the pastoral lands under the Soil Conservation and Land Care Act, 1989, required Soil Boards to prepare a District Plan that seeks to provide land management guidelines for the district. The Pastoral Board agreed to provide support to these Boards by providing land system maps and descriptions, and general vegetation management guidelines for the district. The baseline assessment process therefore included a land inventory component that provided land system descriptions for each district.

Baseline assessment timetable and resource restrictions

The baseline assessment of all leases was completed in September 2000. This involved assessing approximately 405,000 km² of country that comprises the 330 pastoral leases (see Figure 1). The process also involved:

- Gathering geographic information which would enable the creation or update of pastoral plans showing lease infrastructure e.g. fence lines, waters
- provide hardcopy maps (paddock plans) of each lease
- Setting up a paddock- based, and long-term photopoint monitoring system.
- compile field data using site sheets for input to a database and GIS
- Assess land condition using the Land Condition Index methodology on all sheep leases south of the Dog Fence.

Even at the time of the first baseline assessments, the resource requirements imposed by the huge task of visiting every paddock of every lease in the 10 year timeframe continually governed and influenced what could actually be undertaken. As a consequence, in the latter years of the baseline assessments, various changes to the methods occurred to enable a revised legislative deadline of December 2000 to be met. (the original time specified in the Act for completion of assessments was March 1998 – this was extended in that year by legislative amendment)

Lessee involvement in monitoring

The monitoring process is aimed at increasing the awareness of lessees in managing the land resource and focuses on plant and soil resources to determine trends in condition under grazing practices. A significant though small number of pastoral managers have become involved in the monitoring process since the baseline assessments, and have retaken photos at photopoints to monitor seasonal or short-term changes, or effects of stock management practices.

The first training lease Coondambo, for the second round process in 2005, is one such property where the manager has regularly revisited and photographed the photopoint sites.

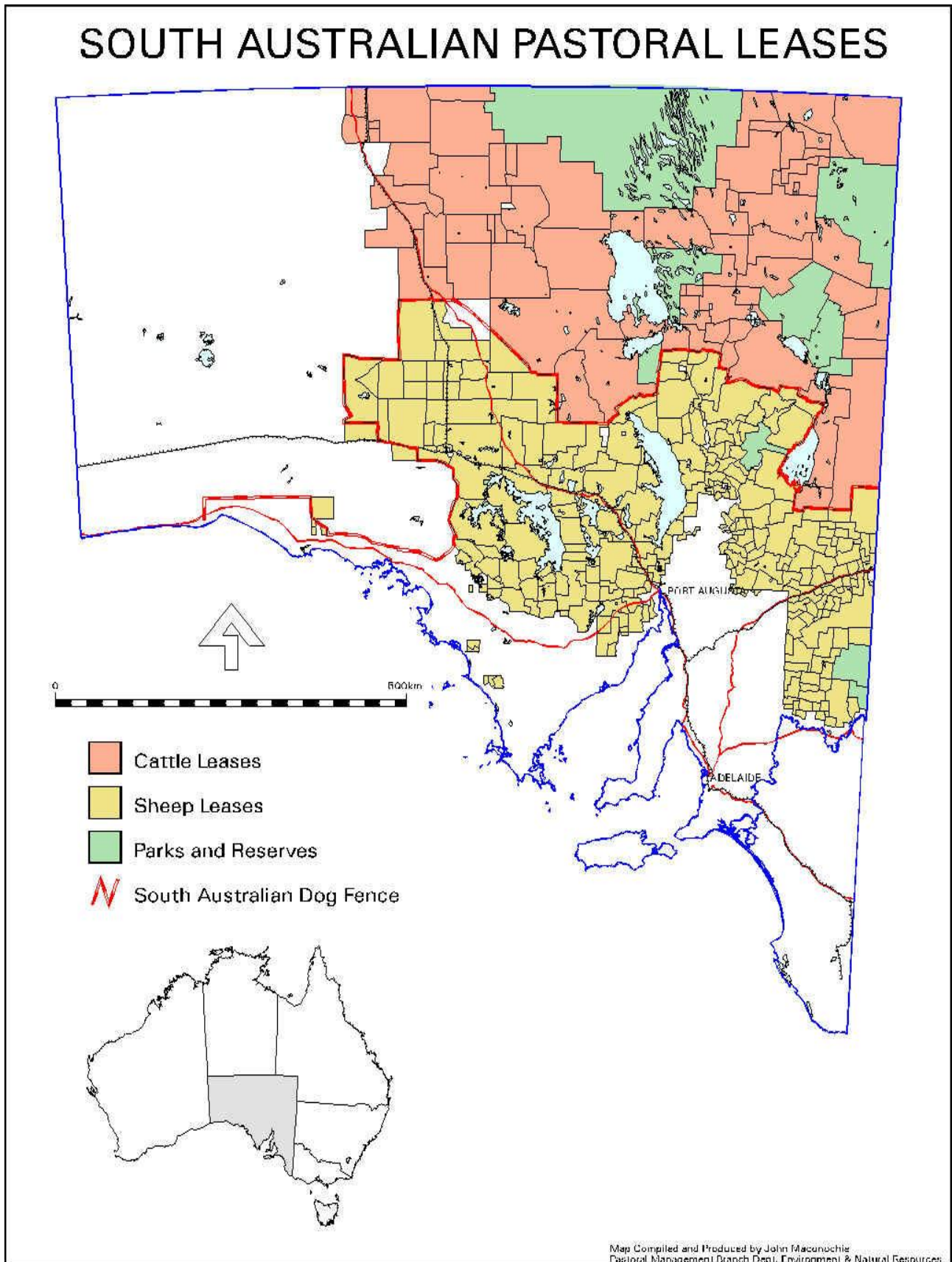


Figure 1: Map of pastoral leases within South Australia

PREPARATION FOR AN ASSESSMENT TRIP

The following check list should be completed prior to each trip:

Contact lessee/manager

- To arrange a time and location to meet at the beginning of the field trip (Act states 28 days notice)
- Discuss potential accommodation, availability of fuel (if required).

Collect property information

- Copy of first assessment report from Pastoral Land Management Group (PLMG), Adelaide
- Paddock write-ups, site revisit and pastoral inspection sheets from ALIS
- Blank sheets for new photopoints and upload Getacs (ALIS)
- Blank Jessup sheets
- LCI transect, measure of distance and list of stops generated
- Map updates
- Photopoint manual
- Recent stock return and past inspection reports
- Property docket (optional for extra information)
- Land system and paddock plan maps

Photopoint Equipment

- 100 m surveyor tape, with clearly visible and fixed 10 m markers and ties both ends.
- sledge hammer
- 2 m measuring rod
- jarrah pegs, poly posts, rebar or other markers

Photopoint/camera box with:

- numbered photopoint discs
- nails for securing disc to marker peg
- site description and species list sheets.
- Jessup transect recording sheet
- digital camera, all batteries charged
- sighting compass
- hand counters (at least 2)
- inclinometer

Other equipment

- Clipboards and elastic bands, Pencils and sharpener
- Reference books e.g. plant books
- Charged computer/Getac for GPS data
- Hand held GPS, cleared of data from previous trips
- Inverter checked
- Water tanks filled
- Ropes
- Plastic bags
- Cooking kit
- Food
- Fridge

MEETING WITH LESSEES/MANAGERS

First Meeting

Explain the assessment process, answer any questions and invite them to participate.

Discuss:

- Infrastructure changes
- Seasonal conditions e.g. rainfall, fire
- Problem areas/issues
- Future plans
- General management including paddock use, changes to management, feral animal numbers and kangaroo numbers

- Availability of station facilities e.g. shearers quarters, places to camp, places to avoid
- Radio frequency to contact them
- Photopoints updated e.g. have they been taking photos, do they have a Photopoint manual?

Final Meeting

Cross reference map items and do final check that everything has been up dated.

Discuss:

- Problem areas, get their perspective and plans they have to address problems
- Make sure they are aware of negative comments likely to be in the report, giving them the opportunity to discuss
- Next stage of the process and give them contact details of who they can speak to
- Get their preferred contact details e.g. email, phone etc.

DESCRIPTION OF METHODOLOGY USED IN THE BASELINE ASSESSMENTS

Land system mapping

This involved identifying landscape patterns on remotely sensed images and describing the units that make up this pattern in the field. Land System boundaries were digitised and transferred to ARC/INFO to form a graphical base for a GIS. Land systems descriptions and boundaries are checked during the assessment process. A coloured land system map for each station accompanies the lease assessment report.

Lease infrastructure

During the assessment process the layout of the lease is discussed with the Pastoralist and any changes, such as new water point, fence line or track developments, that are not included on existing maps, are noted. These details are then checked in the field and accurately located using a Global Positioning Unit (GPS) and use of Getac. Amendments are then made to the digitised files to update the paddock plans (see figure 2) and the GIS.

Waypoints of features and tracking of line features for updating of mapping products will be made by the field assessors in the second round, this includes both new and existing infrastructure, not previously captured.

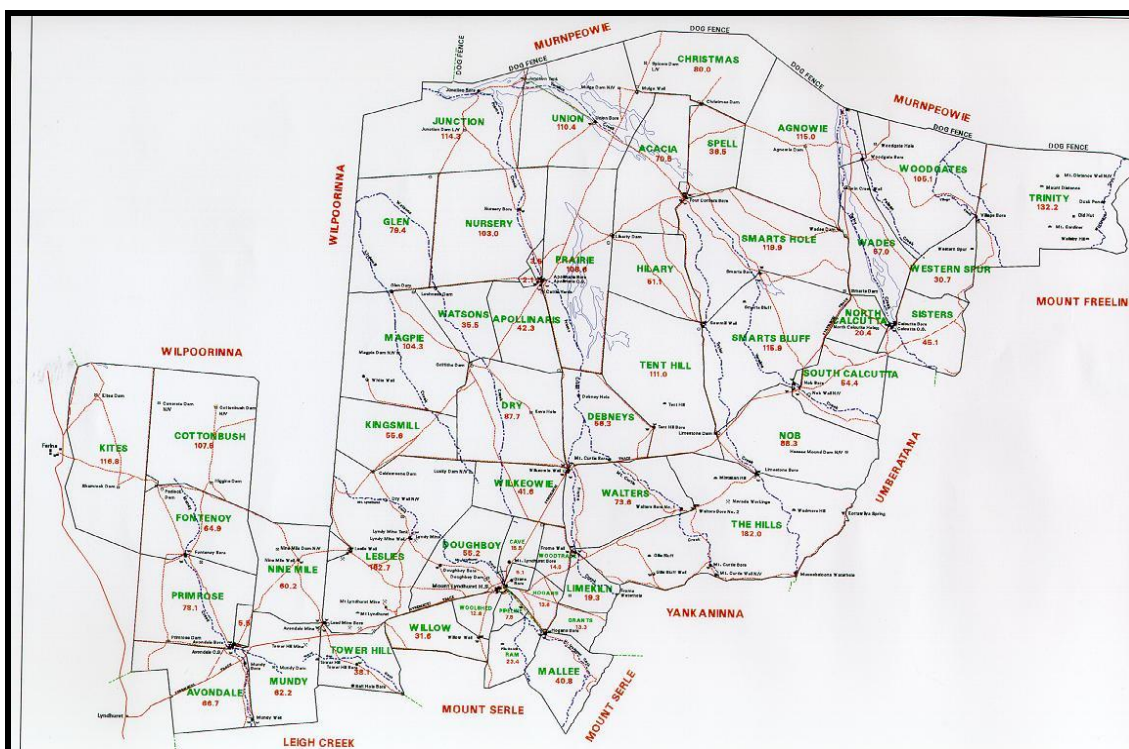


Figure 2: Station paddock plan**Monitoring**

A monitoring baseline has been established in each paddock. This consists of a photopoint and a plant species list with associated data. Fixed belt transects have been used to collect ecological data. This is compiled into a “photopoint manual” and the lessee is given a copy and encouraged to photographically monitor the sites. These sites are usually located on water runs to enable the Pastoralist to inspect the sites on a regular basis. It was planned these sites would be re-measured by the Pastoral Management Branch every 5-7 years (depending on resources), but in reality only sites in “priority paddocks” have been revisited at this order of frequency.

All previously-established photopoints which can be re-located will be revisited and re-measured. Every attempt should be made to relocate photopoints but if not possible new sites will be installed.

**Plate 1: Pastoralist involvement in the assessment process****Paddock condition**

The assessment process also describes the condition of each paddock within a lease and identifies any land management issues that require attention. This information is entered into the database so that a history for each paddock within a district is developed.

Paddocks that require immediate attention or action are detailed in the assessment report for the Board. These “priority paddocks” are inspected on a more regular basis, and the lessee must make progress towards rectifying the identified land management problems. “Monitor paddocks” are identified where less immediate attention is required or where issues should be monitored by lessees and the PLMG.

Lease Assessment Reports

A lease Assessment Report is the formal document that provides details of the assessment of the land condition over the “run”. These reports are forwarded to the lessees, who have 60 days to consider and comment. The Board then considers all comments and accepts the report.

On completion of a district and all LCI scores analysed, the Board will set the land management conditions of the lease, which includes a maximum stocking level. The lessee may apply to the Pastoral Board at any time for a temporary increase above this maximum. Land management conditions may be adjusted and the term of the lease extended if the lessee has complied with the lease conditions and fulfilled a duty to improve the condition of the land.

The report provides pastoralists or other land managers with information to ensure sound land management practices are followed. These reports provide details of a monitoring system that will supply the land user with reliable, interpretable and repeatable information to detect changes that result from land use practices (rangeland condition and trend).

Capacity of the land to carry stock

The Pastoral Board is required to specify a maximum stocking level for the lease and the lessee is not permitted to exceed this figure without the prior permission of the Board. Stock maxima determined under the previous Act (Pastoral Act 1936) did not include an assessment of the condition of the land and were often set at inappropriate levels. The previous maximum figure has long been represented by the pastoral industry as the actual carrying capacity of the lease.

The Objects of the Act specify that the Pastoral Board must ensure that degradation does not, or is not likely to occur. Maximum stocking levels for a lease are far from ideal as an effective method for ensuring that pastoral land is not degraded as they do not provide for stocking levels in individual paddocks under a range of condition classes and pasture components.



Plate 2: Fenceline contrast resulting from different management practices

The evidence for appropriate long term stocking levels must come primarily from:-

- what the land has carried in the past without severe degradation;
- what successful management practices have been implemented for various pasture types,
- how management practices generally are related to the present land condition.

For the first round of assessments, the Board determined that the most recent 10 year stocking average (which includes a range of seasonal conditions) plus 20% allowance for good seasons would provide the basis of the maximum lease offer. This had the effect of bringing a number of leases with unrealistic previous maximums to a more realistic figure.

The Board has reviewed its approach (and policy) on the setting of stocking limits for round two, however it acknowledges that lease stocking maxima are at best a “blunt instrument” for use in managing land resources. Short-term adjustment of paddock stock numbers appropriate for conditions is the most effective tool but a maximum provides a statutory limit and guide to numbers likely to be able to be carried in the best seasons.

The current method uses a combination of LCI results, paddock condition ratings, area and watered area.

The Board considers that a better way of setting stock maximum would be to do so based on the capability of each land type within its watered area. However the current inventory of these resources is not accurate to the level required and steps are being taken to work towards the future use of such a method.

LAND CONDITION INDEX

The land condition assessment of the various pasture types involves defining what constitutes an intact or un-degraded landscape and deciding on the criteria that indicates to what degree disturbance has occurred. The PLMC Act's emphasis on indigenous plant species largely determines an on-ground approach, as it is necessary to ascertain the mix of plant species. It is also important to determine if seedlings are present, as this helps to indicate whether the land has a capacity to rehabilitate in cases of past damage. It is for this reason that remote sensing techniques may not be appropriate to determine land condition in most parts of the sheep pastoral areas according to the Act.

The following processes were used in training and calibration for these assessments during the first round of assessments:

The process of land condition assessment involves a preliminary reconnaissance survey by senior scientific officers to determine pasture types and condition criteria. This is followed by a training period for field staff to become fully competent in using these criteria in assessing the various land condition states.

The purpose of this reconnaissance survey by senior officers is to:

- identify the various pasture types and the sub-units called pasture components that make up these pasture types within the district
- determine the criteria that will be used to identify three condition classes within each pasture component.

Only three land condition classes (1 = poor, 2 = fair and 3 = good) are described as this limits the number of choices and therefore reduces possible observer errors. To avoid the influence of seasonal changes and drought, the criteria are based primarily on perennial vegetation components, with erosion levels included where applicable. The issue of so-called "opportunity country" involving only ephemeral growth, is dealt with separately.

Each condition class for each pasture component is described according to key indicator plants. Photographs and written criteria are compiled that depict each of the three condition classes for each of the pasture components. The criteria and photo-standards are compiled into manuals, which are subsequently used by the assessment officers in carrying out the lease assessments.

Field staff are trained in the field to recognise the various condition classes for each of the pasture components to achieve a uniform standard, and tested, thereby ensuring that all staff will assess the condition of land uniformly and without bias.

Analysis of changes from round 1 to 2 on any particular station occurs and also changes on a station comparative to the average change of each pasture type in a district.

PHOTOPOINTS

Monitoring the condition and trend of land under various grazing practices is an important on-going management tool. Photopoints are established in most paddocks to provide an indication of these trends. Revisiting these sites enables the development of a photographic sequence, supplemented by vegetation and soil information, to provide an objective record of change at a site. The photopoint is a sample of land condition in a particular paddock where located in a typical area. This objective data is used to support subjective judgements on condition in a paddock and a station overall. A photopoint can also be set up in atypical areas to monitor a specific issue.

The Pastoral Land Management group will carry out regular long term monitoring of these sites. However, it is important that short-term seasonal changes are also recorded if possible. Pastoralists are encouraged to regularly monitor the photopoints and have been involved in the initial establishment of the sites. During this

process the assessment techniques can be demonstrated and the photopoint method explained, to ensure the pastoralist is able to carry on with subsequent monitoring if he or she desires.

Through combining short term and long-term records our understanding of ecosystems may be improved and future grazing practices can be adapted to suit these trends. Stock records for each paddock, together with climatic information, observations of grazing on desirable plants, germination events and other factors, will provide a valuable record that will assist in future decision making regarding the objectives of sustainable use.

Changes in the soil and vegetation components may follow:

- a fire
- extreme seasons, wet or dry
- a marked change in vegetation cover
- defoliation of chenopod shrubs (saltbush or bluebush)
- establishment of new shrub seedlings
- death of shrubs or trees
- invasion by unpalatable plants.

Access and relocation of existing photopoints (finding the site)

Sites are generally placed alongside station tracks for ease of relocation. If a site is located on a now-unused track then be sure to note how to find the turn-off and any other important features. The photopoint peg or post should in open country be visible from the track although it is desirable to place it far enough off the track to reduce the chance of it being driven over or destroyed by road maintenance or minor realignment.. Experience has shown that sites placed 10-50 metres from the track provide the best chance of not being damaged or rendered useless from road effects, while still being easily accessible for revisits. **Careful recording of the GPS and distances is essential and will assist future assessors.** Use of hills and other features in a photo may assist in relocation.

New Photopoints

Choosing the location for a new photopoint.

The photopoint location will depend on the major objective for setting it up.

To encourage pastoralists to monitor the sites they need to be easily locatable. Record the distance from a permanent feature e.g. gate or trough, and if possible record the distance from the opposite direction. Use the GPS to capture co-ordinates for the site.

The following factors should be considered when choosing a site, particularly when monitoring grazing impact.

Distance from water

Grazing intensity of domestic stock decreases with distance from the permanent water source. Choosing sites at a consistent distance from water allows for more effective comparison between sites.

Assessment sites for sheep stations are generally placed about 1.5 km from permanent water, but more importantly should monitor areas where indicator species are still present or be expected to occur. In cattle areas the site may be between 2-4 km from water.

Where an acceptable site does not occur at the desired distance, personal judgement must be used in choosing the best location taking the above factors into consideration. This may involve locating the site further or a little closer to the watering point, or simply abandoning the attempt to locate a site out from that particular water (especially if another track or water in the paddock is also monitored)

Representation of a land unit

If establishing a new site in a paddock which does not have any existing sites, this site should be located within a recognisable land unit that is typical of the paddock. For example, do not choose an isolated

bluebush patch if it is not typical of the paddock. Avoid vegetation patches that are obviously atypical or are small areas of transition between communities.

The unit chosen must also be one that gives a good indication of grazing impact. For example do not place a site in a very stable resilient vegetation type if the majority of the paddock, or areas preferred by stock, are much less resilient.

Size and uniformity

The site should be uniform with respect to vegetation, soil, slope and aspect. The more extensive the area of the site the better. While a site might take observations of a radius of 200m, an area of 100m radius should be considered a minimum but all observations must be made within uniform land type/unit. Disturbed areas such as roadsides must not be considered.

Other influencing factors

Other factors likely to bias or influence the site vegetation should be recognised and avoided where possible. Avoid placing sites in the following situations:

- on a southern fence since sheep tend to graze into the wind and in most sheep - pastoral areas of SA the prevailing wind is from the south
- sheep camp areas or where animals walk parallel to the track resulting in heavily tracking
- mechanically disturbed areas
- water run-on areas from tracks, or where old track marks or erosion is evident.

Photopoint setup

Directions to each photopoint should comprise a distance and direction from a known point such as a water point. A metal numbered disc on a polydropper, fibreglass or steel rebar post (or wooden peg) marks each photopoint established during or before the first round (refer figure 3). This is referred to as the **marker peg**.. However where the marker has disappeared or deteriorated, new markers will consist of some more permanent/visible materials.

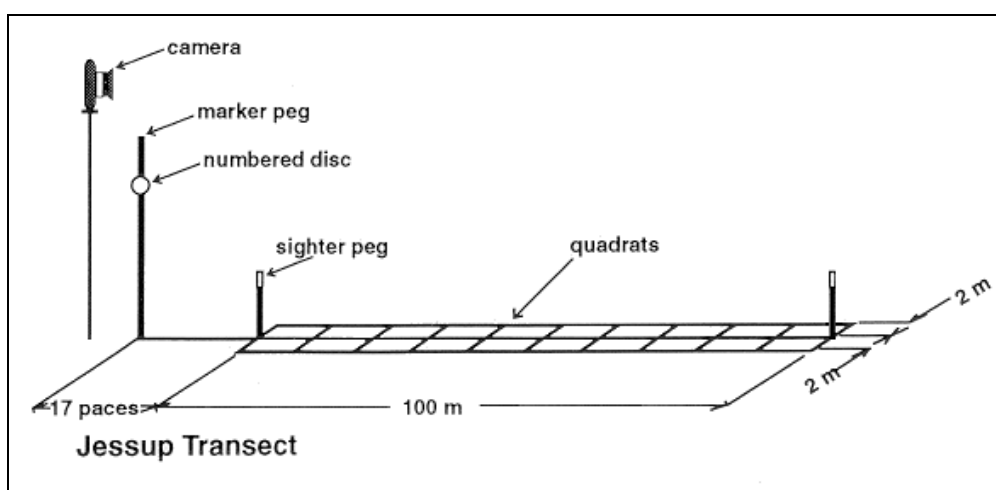


Figure 3: Diagram of a typical "QS" Photopoint Monitoring site

Position the marker peg 10-50 m off the track in a clearly visible location that is not likely to be disturbed. However, ensure the area to be monitored is free of vehicle track effects such as water flow, stock movement etc. If the marker peg is positioned further than, 50 m from the track, position another directional peg near the track and give clear directions on the site sheet to the location of the marker peg or post (i.e.

bearing and distance from 1st peg). Remember it may be some time before the site is re-visited and the site is wasted if it can't be re-located!

A second peg, usually a jarrah peg, is located approximately 17 paces from the marker peg. This is referred to as the **sighter peg**. This peg is positioned such that the photograph area does not include more than 1/3 skyline and the bearing will follow the line of the Jessup transect. A third peg is placed 100 m from the sighter and used to mark the end of the Jessup transect. Not all sites will have a Jessup transect.

Locations of all photopoint sites will be recorded with a GPS from the vehicle and marked on the updated station paddock plan.

The photograph should be taken from the marker peg. Record a compass bearing between the marker peg and sighter peg. If other photos are taken from the marker peg, the bearing should be marked with an additional sighter peg.

Taking the photograph

Photos are taken with a digital SLR camera and with the zoom set to replicate the original 50mm lens cameras. Photos are taken in RAW format and downloaded daily. To take the photograph, stand behind the marker peg and centre on the base of the sighter peg as shown in plate 5 and figure 4. Adjust focus to infinity to ensure all of the transect is in focus.

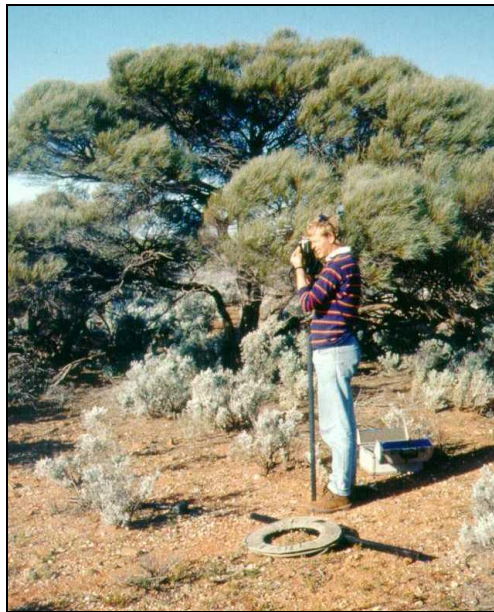


Plate 3: Taking a photograph

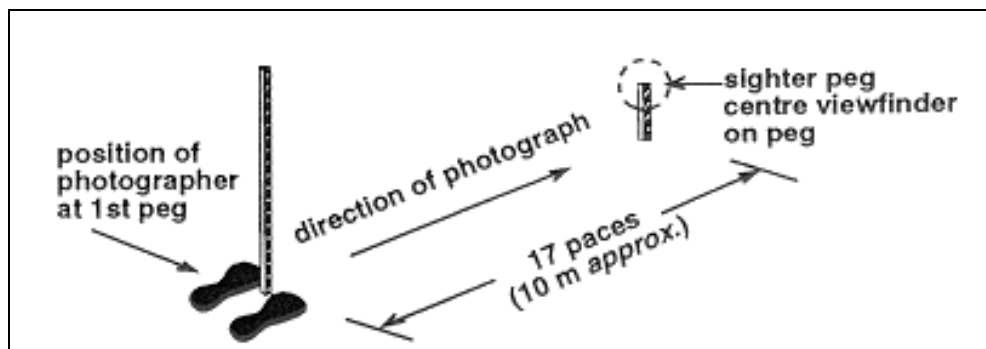


Figure 4: Directions for taking the photograph

RECORDING FIELD INFORMATION

Site description and location

Site sheets and the information collected have changed and evolved over the period of assessment. An example of the current site sheet is shown in appendix 1.

Detailed below are the fields of information together with the type of detail that should be recorded.

Note: Completed entry example shown in brackets (*italics*).

QS, OB, RS, TS

Prefix to describe type of photopoint, followed by photopoint number as per the disc. (e.g. QS 2345)

QS - Quantitative site. A pegged site used for monitoring vegetation changes, with Jessup and/or step-point data (formerly photopoint - PP).

OB - Observation site. A pegged site used as an observation site to monitor changes that can be detected by a photographic sequence. e.g. rehabilitation, spread of erosion gullies. Site description includes a list of plant species but with no measured plant data collected.

RS - Reference site. Sites are in areas remote from grazing influence, greater than 5 km from water in sheep country and 8 km in cattle country. Also includes enclosure sites. Complete all site description and plant and soil sheets.

TS - Type Site. Designated for site characteristic of mapped land system in early part of baseline assessment process. As per OB, but sites were not usually pegged.

PC – Photo Comparison. Should be used strictly where a photo is to be compared and data collected would not be required, eg. A panorama on a hill top where species in the foreground are not relevant to the background being monitored in a photo.

All photopoints should be prefixed with QS, OB, RS, PC or TS.

DATE

Day, Month and Year (e.g. 01/06/2007)

OBSERVERS

Initials of persons involved in data collection. Initials of the person filling out the sheet first, followed by second observer. (e.g. MT/CB)

STATION

Pastoral station name. Use the full name of the station. (e.g. Bulgunnia)

PADDOCK

Full paddock name, may include subscript e.g. formerly part Cyclone. (Monsoon)

ZONE

Grid reference zone, generally on the bottom of the map. (e.g. 54)

MAP SHEET

Map sheet number 1:50,000 five digits e.g. 66341. 1:100,000 four digits e.g. 5434. (66341)

EASTING & NORTHING

Co-ordinates on GPS Unit.

DATUM	GDA 94
SERIES	Refers to the filing system for photopoint photograph series for the station, indicates the station with the month & year the photo was taken. First four spaces are for the station (or trip name) abbreviated to the first four letters e.g. Bulg for Bulgunnia. Next two are digits for the month, followed by two digits for the year e.g. (<i>Bulg 06/91</i>)
DIGITAL	Image number
WATERPOINT	Name of nearest permanent water source, by direct route, as a sheep would walk. Note type also e.g. dam, trough, tank. (<i>Moonbi Tank</i>)
DISTANCE (km)	Distance (to one decimal point) to water source named above, i.e. by direct route as a sheep would walk. Record the straight-line distance from the GPS. (<i>e.g. 1.6 km</i>)
CONDITION	Condition rating for the site as per condition rating guidelines. Refer to appendix 2 for condition class attributes. Notes on attributes in the site comments will help to support this judgement. (<i>e.g. Good</i>)
MUD MAP	Diagram of how to relocate the site, clearly labelled, with distances. Include paddock name and adjacent paddocks, track location and gate, zero origin, water location, site number. Orient the map with north to the top of the page.
MUD MAP COMMENTS	<p>Clear directions on how to relocate the site, completed according to the following format. Keep in mind that this will be printed out for the lessee.</p> <p>Distance from gate or trough, direction, on track to next bore or paddock along fence. Place where zero taken from, e.g. tank, trough, gate - be specific. What type of peg or marker was used and how far it is off the track and in what direction. Distance to sighter peg and bearing. Jessup transect length (normally 100m) and bearing from sighter peg. (Use tripmeter if no <i>Halda</i> rally meter or similar)</p> <p>Example mud map comments: <i>(1.5 km south of Twin Well on track to Gladstone Bore, or 3.5km north of gate from Dusty paddock. Zero at trough. Jarrah peg and disc at 15 paces east of track. Sighter peg (jarrah) at 17 paces bearing 90°.</i> <i>Jessup transect 100 m x 2 m x 2 at 90° end marked by jarrah peg).</i></p>
EROSION	Record the severity and type of erosion according to the table in appendix 4
COMMENTS	Record notes that help to further explain observations, or that will assist interpretation of the data for present and future observations. This should include notes to indicate why the site was established and what it is monitoring. It should also include notes that help explain the condition rating and current impacts or changes, including erosion.
Data entry	Initials of person who entered data on the database and the date of entry. (<i>e.g. CB 5/3/91</i>)

Establishing new sites

The site details below are only relevant for new sites set up as part of the second assessment– not used for revisits as part of the second round.

LAND SYSTEM	Land system name taken from land system map (<i>e.g. Weedna</i>)
ROCK TYPE	Name of rock type from geological map, or rock type identified at site if geology map incorrect. (<i>e.g. red sandstone</i>)
FORMATION	Name of rock formation from geological map. (<i>e.g. Pound Quartzite</i>)
LANDFORM; SLOPE	Slope of the site measured in degrees by use of clinometer Do not confuse degrees with %. (<i>e.g. 2°</i>)
ELEMENT	Landform element of site. <ol style="list-style-type: none"> 1. crest; curved in down slope profile and margins at limit of observed curvature. 2. slope; considered as planar. Note in comments if upper, mid, or lower slope. 3. flat; planar 4. depression. may be open or closed
PATTERN	Term to describe the landform type, e.g. alluvial plain = ALP. See appendix 3 for abbreviations and descriptions. (<i>e.g. ALP</i>)

Vegetation

SIGNIFICANT RAIN	<p>Yes - data collection following rains that resulted in green ephemeral response, record dates if known of significant falls.</p> <p>No - dry ephemeral growth only.</p>
TYPE	<p>S (summer) - rain fell between November and March. W (winter) - rain fell between April and October. I (indistinguishable) - cannot tell if resultant green ephemeral growth is from summer or winter rain events, or is a combination of both.</p>
VEGETATION SPECIES	<p>Effort should be made to record all plant species throughout the site. Recording plant species should be carried out until most species are recorded (ie until a period of minutes elapses before further species are not found). Record full species name on the site sheet.</p> <p>If plant species is not known, collect a specimen, fill out details in the herbarium collection booklet and include photopoint number and line number of record on sheet. e.g. 2345/12, so that this number can be entered on subsequent site sheets. Put the herbarium label with the specimen in the plant press. Keep a list of plants collected and PP/line number so that you can give this number to collected species at other sites. Update the site sheet with the correct species name when it comes back from the herbarium or identity confirmed.</p>
DOM	<p>Dominant species. This will be used to classify vegetation associations/groups.</p> <ol style="list-style-type: none"> 1. visually pre-dominant species forming the tallest stratum. CSR class should exceed 1 (CSR 2-6) 2. if another tallest stratum species is present (co-dominant) it is selected OR if absent the most abundant understorey species is selected. e.g. <i>Mai sed</i> 3. selected from any stratum, usually a lower stratum as an indicator species (that is a species of known environmental preferences or of such abundance that it can't be ignored), or to distinguish between associations. e.g. <i>Atr ves</i> 4. other conspicuous species to separate associations. e.g. <i>Scl obl</i>
GRAZED	<p>If a plant is obviously grazed, tick the box. If grazing is mainly by rabbits or goats this should be noted in the comments.</p>
RESPROUT	<p>If the plant has previously been grazed back and is now showing fresh new growth, tick the box. Note extent in comments. e.g. <i>Atr ves</i> adults showing abundant new growth following recent rains.</p>
RECRUITMENT	<p>If seedlings are evident, or new suckers (e.g. Bullock bush) tick the box. Note height of seedlings in comments. e.g. <i>Mai sed</i> seedlings to 5 cm abundant in open areas.</p>
FRUIT	<p>If the plant is in fruit, tick the box. This will enable data collection on best times for seed collection. Record relevant notes in comments.</p>

Crown Separation Ratio (CSR)

The average distance between crowns divided by the average size of the crown, grouped into various size classes (see appendix 5).

1. present < 12 plants in 200 m radii.
2. isolated clumps >20 CSR, clumps of two to five woody plants 200 m further apart.
3. isolated plants >20 CSR, trees >100 m apart.
4. very sparse 6-20 CSR, crowns well separated.
5. sparse 1-5 CSR, crowns clearly separated.
6. mid dense 0-0.9 CSR crowns touching to slightly separated.
7. closed or dense crowns touching to over lapping.

JESSUP Refers to the results of the Jessup transect (see section 8.1 for more details)

See appendix 6 for Jessup transect recording sheet. Record total counts from the Jessup transect field sheet, for each species, adult and juvenile.

FIRE SCARS

Yes - fire scars evident on stumps, trees or fence posts. Fire scars should be recorded if fire occurred since the first assessment.

No - no fire scars visible

Last burn - date of last known fire. Check with the lessee and record further details in the comments e.g. fierce summer fire burnt out NW corner, killing all mulga.

Vertebrates

VERTEBRATES

Present/absent for dung, tracks, browsed vegetation, burrows throughout the site.

It is only necessary to record current or fresh activity and record as presence (P). Old or past activity should be noted in the comments.

Table 1: Vertebrate pests

Animal	Sighted	Dung	Tracks	Browse	Burrows/Camp
Rabbit	visual sighting	fresh buck heaps	scratchings present	graze line with chisel marks on stems	warren heaps marks warren active
Sheep	visual sighting	fresh dung	active padding	recent grazing	camps
Cattle	visual sighting	fresh dung	active padding	recent grazing	camps
Goats	visual sighting	fresh dung	active padding	browse shrubs Note in comments height of browse line	camps
Roos	visual sighting	fresh dung	active padding	recent grazing (check for tail drag)	camp/hollows
other					

Others include fox, cat, dingo, camel, horse, wombat etc.

Note any other useful information in the general comments for example mob of 200 goats sighted. More detailed comments can be included if needed in the paddock description.

DENSITY MEASUREMENT OF PERENNIAL PLANT SPECIES

Perennial plants provide stability to grazing management systems due to their ability to persist during dry periods, consequently the measurement of plant attributes such as density and frequency of perennials, particularly those which are palatable, are important in understanding plant dynamics and rangeland condition. Plant counts within fixed belt transects have been used to determine the density of shrubs, and repeated measurements allows density changes to be detected. To ensure that observer error is minimised, it is vital that the same technique and standards are used in repeat measurements. Modifications made in 1990 enabled changes to be isolated to discreet quadrats, and recruitment and deaths of cohorts can be followed.

Jessup transect

This method incorporates a belt transect (a standard ecological technique) that is based on an original survey technique used for chenopod shrublands by Jessup (1951) and further developed by Lay (1979). Their technique involved driving a vehicle over a site for a set distance and shrubs occurring within the wheel marks (representing the belt transect) were recorded. This rather destructive technique is now simulated by a fixed 4 m x 100 m transect and enables a density and frequency estimate of perennials for each site. The frequency estimates are not based on the optimum quadrat size for all species, and the 10 m x 2 m quadrats used should not be taken to represent 'true' frequency readings. It should also be noted that species composition by frequency is not equivalent to composition by cover or density. The length of some early transects has varied from the current standard, so ensure that any future comparisons use the same transect configuration (see 8.2.1below).

The Jessup transect method measures the density (shrubs/area) and frequency of perennial plants at sites where perennial cover occurs i.e. chenopods, other shrubs and tussock (perennial) grasses. Counting age classes of shrubs (adult/juvenile) gives further information on population changes. Monitoring over time provides an indication of recruitment trends.

Recording is based on all perennial shrubs within the transect being recorded by species and age class (adult/juvenile). If the base of the plant is in the transect it is counted. If the foliage only is in the transect it is not counted.

Transect layout

Jessup transects are permanently marked and comprise:

- transects 100 m x 2 m x 2 (see figure 5)
 - recordings separated into 10 m x 2 m blocks
 - identification of perennial plant species
 - less than 10 cm high and/or non woody base = juvenile
 - more than 20 individual juvenile bushes or perennial grasses per 10 m x 2 m block = 20+ recording.
1. Transects should include only one land unit and preferably be restricted to one element for data analysis. Transects are 100m long and generally at right angles to the track. Walk the length of the transect to ensure it is suitable before setting up the site and identify and discuss species present with the other observers.
 2. Record a compass bearing for the transect.
 3. Secure a surveyors tape (marked into 10 m segments) to the sighter peg and lay out the tape to 100 m keeping the marker and sighter pegs in line.
 4. Check that the tape is in line with the sighter and marker peg. Tension the tape and drive in the peg at the 100 m mark and secure tape to the peg. It is **important to have the tape extended to full 100m and tight and straight**, so that data is replicated at the quadrat level.

5. If the transect layout is 'normal' note this on the sheet; if different, note the transect layout on the site description sheet, and orient diagram with north to the top of the page. Give clear legible directions and bearings.

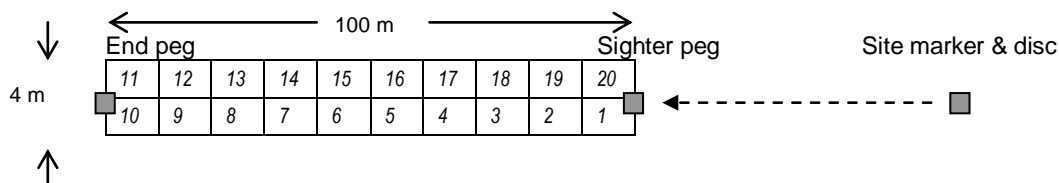


Figure 5: Jessup transect layout

Recording a Jessup transect

1. Use a surveyors tape that is clearly marked into 10 m intervals. If it is marked with tape, check that this has not slipped from the 10 m graduations. Counts should be recorded on a Jessup transect data sheet (see appendix 6)
2. Commence transect on left side of tape (UP) using 2 m rod (refer plate below). Check that the rod is 2 m! A two metre curtain pole is ideal for this.



Plate 4: Recording a Jessup transect

3. Identify each perennial species. If in doubt collect a specimen.
4. Easiest operation is with one person observing (counting) and another recording and acting as a checking observer. The recorder (scribe) stands at the 10 m marker intervals and the observer calls out the adult/juvenile strikes along each 10 m transect interval. The recorder can assist by spotting hidden plants and small juvenile plants.
5. For plants on quadrat margins include only in the quadrat where the rooted stem is located. Count plants only if they are more than 50% rooted within the quadrat.
6. Chenopods occur in clumps and it is difficult to distinguish individuals, for this reason clumps are recorded, and are recognised as individual clumps if there is more than a 30 cm gap between the rooted stems. Criteria for counting plants growing close together are as follows:

- distinguish between individual clumps if there is more than a 30 cm gap between rooted stems.
- if crowns are distinct and bases are less than 30 cm apart count each as an individual.
- if crowns are touching or overlapping and gap between rooted stems is less than 30 cm, count as one clump.

Note: In cases of perennial plants such as low bluebush being grazed, the reduction of the crown may lead to higher count of bush numbers. Care is required when comparing existing Jessup counts and noted should be recorded if this type of splitting has occurred.

7. Record juveniles as plants less than 10 cm high or wide, and not woody. However, if obviously old woody plants are grazed back to less than this size, record as adults but make comment accordingly.

If greater than 20 juvenile individuals of any species encountered in 10m interval (quadrat), record as 20+. This avoids attempting to count up to 200 seedlings, but still provides sufficient data to interpret that recruitment is occurring. Large numbers of seedlings can occur following favourable conditions and it becomes difficult to count all of these. However, where feasible, a total count of juveniles should be undertaken.

8. For perennial grasses, record clumps if greater than 10 cm high or 10 cm wide i.e. no juvenile categories. Record count as 20 + if greater than 20 individuals within one 10 m x 2 m block. This is to aid interpretation of step-point cover data, e.g. low density but high cover implies large spreading individuals, high density but low cover may imply a grazing effect - site comments should indicate this. The quadrat sizes are not well suited to grasses, but do provide an indication of the level of grasses within a shrubland.
9. Do not record dead or completely defoliated bushes, but note occurrence in comments.
10. Proceed to end of transect and commence quadrats 11-20 (i.e. 100-0m) on other side of tape (down).
11. Record minor site variations in comments relating to quadrat intervals e.g. 20-30m large scaled area.

DATABASE AND GIS – needs update for ALIS and FDE

Site information is currently entered into the Arid Lands Information System (ALIS) and print-outs and photographs are supplied to the lessee for every photopoint on the station in the form of a Photopoint Manual.

In 1991 the Geographic Analysis and Research Unit (GAR) of the Department of Housing and Urban Development has been assisting the Pastoral Management Branch in the establishment and maintenance of a Pastoral Geographic Information System (Malcolm and Nicolson, 1995). The GAR unit operates a centralised ARC/INFO (Environmental Systems Research Institute USA) GIS facility and is the Environmental Node of South Australia's Land Information System.

Extensive development was carried out on ALIS and while operational is still undergoing some further development. Management of this system is through Client Services in DENR in collaboration with the Pastoral Program. Development of a system for field data entry onto GETEC tablets has been completed and is undergoing transition into the operational phase. This will improve data collection with validation in the field and also allow considerable time saving and possible transposition errors removing one stage in the data entry process.

Lease infrastructure information is derived from a number of sources that vary in age, scale and accuracy. During the assessment process topographic maps are used as a base map and information is checked, corrected or altered using various techniques. Prior to the introduction of Global Positioning Systems (GPS) in 1992 the information was collected using bearing and distance measurement that were plotted onto base maps. The improved accuracy of GPS units over time has allowed increased accuracy and therefore an improved mapping product.

Lease maps and land system maps are available as hard copy products. Watered areas for each paddock can also be produced, that indicate the extent that the lease is utilised by stock. Undisturbed areas represent quality wildlife habitats, and further investigations are required to study the relationships between stocking intensity, land condition and wildlife habitat. More detailed information can be found in Malcolm and Nicolson, (1995).

POST TRIP PROCEEDURE

The following checklist should be completed after each trip.

- Download photos and GPS co-ordinates
- Data entry
- Update photopoint manual and make 2 copies
- Conduct LCI peer review
- All spatial updates sent to GIS, DWLBC
- Write draft Assessment report
- Submit for review

ATTRIBUTE	CONDITION CLASS				
	EXCELLENT	GOOD	FAIR	POOR	VERY POOR
PLANT SPECIES COMPOSITION	<p>maximum diversity of annual and perennial species possible for the land type</p> <p>perennial species of various ages</p>	<p>some reduction in density of palatable and susceptible perennials</p> <p>increased proportion of shorter lived species</p> <p>perennial species of various ages</p>	<p>significantly reduced cover, density and/or regeneration of palatable species</p> <p>establishment of less preferred or unpalatable species</p>	<p>dominance of annual and ephemeral species and perennials with relatively low palatability</p> <p>no regeneration of desirable perennial species, existing stands degenerate</p>	<p>seasonal cover of only "pioneer" ephemerals or unpalatable weeds.</p> <p>large areas totally unproductive</p>
PLANT PRODUCTIVITY	<p>at full potential</p> <p>sustained productivity</p> <p>annual communities maintain litter cover but not production in dry seasons</p>	<p>some fluctuation; lower in drought and may be higher than site potential for some species eg. Mitchell grass</p>	<p>reduced overall; high productivity in good season</p> <p>low in drought (fluctuates markedly with season)</p>	<p>impaired productivity, very seasonally dependant, low or non existent in dry seasons</p>	<p>areas incapable of any plant growth</p>
SOIL EROSION STATUS	<p>no erosion (other than natural features or processes).</p> <p>plant and litter cover protect soil from wind and water in all seasons</p>	<p>minor or slight erosion evident</p> <p>increased susceptibility of soils to erosion in dry seasons</p>	<p>moderate erosion evident</p> <p>reduced density and cover of perennial and litter increases susceptibility of soils to erosion in most seasons</p>	<p>severe erosion overall</p> <p>high susceptibility of soils to erosion in all seasons</p> <p>extent of past erosion renders site susceptible to further soil movement if grazed at any level</p>	<p>unstable, severely or very eroded</p>

Appendix 1: Erosion severity/type intensity criteria –for reference to first round data sheets

EROSION: Severity/Type intensity criteria + RATING (max 200 m radius)

NO ACCELERATED EROSION	00
SLIGHT EROSION (10% of site affected)	
◆ slight accumulation of wind blown soil and plant bases and other obstacles	11
◆ removal of finer soil particles evident but soil crust is largely intact	12
◆ occasional rills (<300 mm deep) evident	13
◆ no gullies present	14
◆ a few scalds present, usually less than 2 m in diameter	15
MINOR EROSION (10-25% of site affected)	
◆ accumulation of soil around plant bases with plant mounds noticeably enlarged	21
◆ evidence of pedestalling but soil loss minor and plant bases not greatly elevated	22
◆ breaking of surface crust with small erosion faces and some redistribution of soil and/ or some rilling evident	23
◆ occasional shallow gullies only	24
◆ scalding evident but scalds relatively small and discontinuous	25
MODERATE EROSION (25-50% of site affected)	
◆ wind piling around plant bases and other obstacles is common but no plants completely covered	31
◆ pedestalling apparent with plant bases distinctly raised and with obvious soil loss and deflation in parts	32
◆ surface sheeting and/or rilling common, with erosion faces, (and/or micro- terracing) and active redistribution of soil	33
◆ gullying present on parts of the site	34
◆ numerous small scalds common, and/or with a tendency to coalesce to form larger scalds in parts	35
SEVERE EROSION (50-75% of site affected)	
◆ extreme hummocking around plants and other obstacles; some plants completely covered	41
◆ severe pedestalling with plant bases greatly elevated and major soil loss from deflation, and/or much of surface generally unstable with ripple marks	42
◆ major rilling or surface sheeting, with extensive exposure of subsoil or parent material; erosion faces (and/or microterracing) and active redistribution of soil	43
◆ widespread gullying	44
◆ scalding extensive, smaller scalds have coalesced to form large, more or less continuous scalded areas	45
EXTREME EROSION (75-100% of site affected)	
◆ general surface movement; area more or less bare with formation of shifting dunes	51
◆ most of original land surface altered, any last remnants of original soil or vegetation standing as sentinels in a barren landscape	52
◆ water sheeting and/or rilling coalesced to expose subsoil or parent material	53
◆ extensive gullying	54
◆ scalding more or less continuous over large areas	55

Note: Record severity first and then type e.g. 5/3 = Extreme erosion/Scalding

Appendix 2: Crown Separation Ratio

This is a **visual estimate** of plant cover.

It is the average distance between crowns (the area the plant takes up if viewed from above) divided by the average size of the crown. In the field, this means visualising how many crowns of a given plant species can be fitted in between the distance to the nearest neighbour of that species on **average over the site**. The classes are as follows:

CLASS	TERM	CSR	FIELD CRITERIA
1	Present	< 12 plants	<12 plants within 200 m radius
2	Isolated clumps	>20 spaces	Isolated clumps of two to five woody plants 200 m further apart.
3	Isolated Plants	>20 spaces	Isolated plants
4	Very Sparse	6-20 spaces	well spaced, crowns well separated
5	Sparse	1-5 spaces	clearly spaced, crowns clearly separated
6	Mid dense	0-0.9 spaces	crowns touching to slight separation
7	Closed or dense	0	crowns touching to overlapping

Modified from Table 14 McDonald (1990)