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## Establishing pastoralist monitoring sites in the grasslands: a guide for pastoralists

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Department of  
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Western Australia.*

# Establishing pastoralist monitoring sites in the grasslands

A guide for pastoralists



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Cover: Soft spinifex plains pasture south of Halls Creek



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## Introduction

This guide is for lessees and station managers who wish to establish rangeland condition monitoring programs for their pastoral leases. The guide outlines the main principles to consider for establishing monitoring sites, and the collecting and recording data to monitor changes over time of rangeland condition within a grassland environment.

Identifying and ongoing monitoring of representative sites can be used to objectively assess the effect of livestock numbers, fire and seasonal conditions on the health of the perennial vegetation and soil. Importantly, monitoring can assist lessees demonstrate whether their current land management practices are appropriate for achieving acceptable rangeland condition.

This guide is one of a series of guides the Department of Primary Industries and Regional Development (DPIRD) is developing to assist lessees and land managers as part of the broader pastoral lands management reform process. While the adoption of a structured, formal monitoring program for leases is not compulsory, we strongly recommend adopting such an approach as part of a best practice approach to pastoral land management.

Many pastoral leases across the WA rangelands already have a network of monitoring sites installed by, or on behalf of, the lessee for management purposes at the paddock scale. Many of the original photos taken at site installation in the 1990s are filed at local DPIRD offices. The layout of these sites is used as the basis for this guide. In many instances, these sites will still be suitable for use as pastoralist monitoring sites (PMS) and lessees should consider using some or all of these sites when planning their PMS network.

## Monitoring rangelands

### Rangeland types

Pastoral rangelands in WA occur as two distinct types:

- grasslands, where pasture is characterised by perennial tussock and hummock grasses, which occur primarily in the Kimberley and Pilbara regions
- shrublands, where pasture is characterised by shrubs, with a variable acacia or eucalypt overstorey, which occur primarily in the Gascoyne, Murchison, Goldfields and Nullarbor regions.

Both grasslands and shrublands occur in the Gascoyne and Ashburton regions.

Grasslands and shrublands require different monitoring methods. This guide describes the method for assessing grasslands.<sup>1</sup>

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<sup>1</sup> Establishing pastoralist monitoring sites in the shrublands is also being developed.

## **Rangeland plant species**

Rangeland plants are categorised as annual, biennial or perennial. Annual plants complete their life cycle within a single year, e.g. button grass and Flinders grass. Biennial plants can survive more than one season, but rarely survive beyond two years, such as limestone grass and wind grass. Perennial plants live for more than two years and include:

- trees, e.g. bauhinia and beefwood
- shrubs, e.g. silver saltbush and mimosa bush
- grasses, e.g. ribbon grass and woollybutt grass
- forbs, e.g. mulla mulla and sensitive plant.

## **Monitoring changes in rangeland condition**

Rangeland (range) condition is monitored by measuring the main characteristics of the base resource: the vegetation (measured as the number and type of plant species present), and the soil (estimated by the soil surface condition and degree of erosion).

Determining whether the range condition of the lease has improved, declined or remained stable over a period of monitoring is the primary way of determining how well your current management strategies are affecting these landscapes. For example, improved range condition will show measureable increases in the presence of productive and palatable perennial plant species, plus increases in litter cover and reduced erosion risk.

### **Pasture condition**

Interpreting vegetation (pasture) condition can be done by comparing the pasture at the monitoring site to standards that have been determined for each pasture type. These standards are provided in regional [pasture condition guides](#) that are available from the DPIRD website.

Species composition and frequency is the primary measure of grassland pasture condition. Healthy rangelands contain diverse and reasonably stable populations of plant species of varying palatability. Plants respond differently to changes in grazing pressure and seasons. Therefore, monitoring the presence and frequency of particular plant species can reliably indicate the prevailing condition of a pasture and changes over time.

For monitoring purposes, the more important pasture species are referred to as indicator species and can include desirable and undesirable species. These indicator species vary among different regions.

Desirable species are perennial plants that are productive and palatable to domestic livestock. In grassland environments, these are usually perennial grasses. These plants drive pastoral production. Excessive grazing of rangeland pastures reduces or removes desirable species. This loss indicates a decline in range condition.

Undesirable species are unpalatable and of limited value for livestock production. Excessive grazing may cause undesirable grasses and woody species to increase in frequency, at the expense of desirable species. This increase indicates a decline in range condition.

Conversely, an improvement in range condition may be indicated by an increase in the frequency of desirable species or a decrease in the frequency of undesirable species.

Intermediate species include a large group of plants that may or may not be palatable, but their frequency does not change to any great extent when palatable species are removed. Therefore, the presence or absence of intermediate species cannot be used as a reliable indicator of range condition.

In grassland environments, an increase in the density of woody perennial species has the potential to suppress the growth of desirable species and may also increase mustering difficulty. Such an increase usually indicates a decline in range condition.

Conversely, a decrease in the density (number of) of woody species in grasslands indicates an improvement in range condition.

Pasture condition can be described as:

- **good** — most plants present are desirable; some intermediate perennials and annuals may be present; undesirable species are rare; groundcover is optimal for the site
- **fair** — intermediate species usually predominate; desirable and undesirable species occupy similar proportions of the available ground space; small patches of bare ground may be present
- **poor** — undesirable and intermediate species predominate; desirable species are very infrequent and may occur only in small patches; groundcover may be sparse or patchy, or large bare areas may be present.

We recommend you use DPIRD's pasture condition guides ([Kimberley](#) or [Pilbara](#)) as a visual key to determine the condition of various pasture types at the time of each visit.

### **Soil surface condition**

Soil surface condition is a visual categorisation of the soil's capacity to retain water and minimise soil loss (erosion). Maintaining the soil's ability to retain water and minimising erosion risk usually requires retaining critical levels of groundcover and limiting the degree of pasture utilisation.

Soil surface condition is described as:

- **very good** — stable soil surface (no topsoil loss occurring); many physical barriers, including decomposing litter, live plants and fallen timber, to retard water flows and promote infiltration
- **good** — soil surface is mostly stable (no or little topsoil loss occurring); some accumulated litter and live plants; minor evidence of loss of water or litter from site
- **fair** — some signs of topsoil loss; some litter, but with little evidence of decomposition; reduced obstructions to intercept water flows, including few live plants
- **poor** — significant topsoil loss; minimal litter present; few obstructions to intercept water flows
- **very poor** — almost total loss of topsoil; exposed soil surfaces are impermeable; very few objects to intercept water flows; no accumulated litter; no live plants.



## Pastoralist monitoring site (PMS)

The purpose of establishing a PMS is to assist lessees assess the impact of their management on the vegetation. There may be many objectives to establishing a PMS, including monitoring the impact of wet season spelling, monitoring range condition after rehabilitating land in poor condition and as a reference site in areas of a paddock that are not grazed.

Establishing a PMS has four steps, which are explained in the following sections:

1. site location: selecting the site location within a paddock or management unit
2. site installation: setting up the physical hardware (e.g. posts, corner pegs), and documenting the site characteristics (e.g. location, indicator species)
3. initial site assessment: obtaining the baseline data for each site — the frequency of indicator species and the initial site photograph
4. site reassessment: after a period, reassessing the sites and comparing the data with initial or previous data to determine the change in range condition under the prevailing grazing and seasonal regime.

### Site location

Selecting the site location is critical and the purpose of establishing a PMS will influence its location. For example:

- if you are seeing a decline in condition of spinifex pastures due to overgrazing or fire, locate a site on this pasture type
- if a station had a very high density of water points and areas within 1.5km of water points have become a significant land management unit, locate sites within this zone
- if you are interested in what is happening further from water, locate sites further away
- for monitoring erosion, locate a site on the area eroding.

Many leases have an existing network of monitoring sites installed by, or on behalf of, the lessee for management purposes at the paddock scale. In many instances, these sites will still be suitable for use as PMSs and lessees should consider using some or all of these sites when planning their PMS network.

For monitoring the impact of grazing on range condition you need sites that are representative of the lease and sensitive to changes in management. For example, a site in poor condition cannot decline in condition because it is already in poor condition, but it may tell you something if its condition improves. Similarly, a site in good condition may not be able to improve, but it tells you something if it declines.

When selecting a site for monitoring the effect of grazing on range condition, consider all of the following factors:

- distance from water — locate sites within the grazing radius of domestic stock, but outside the sacrifice zone adjacent to a stock water point; a distance of 1.5–3km from a water point is applicable in most circumstances
- pasture type and land system — locate sites in country that is:
  - preferred by livestock

- responsive to grazing management (that is, in such a state that it can improve or decline)
- representative of a significant portion of the paddock or management unit
- regulatory requirements — lessees may be required under the *Soil and Land Conservation Act 1945* and *Land Administration Act 1997* to provide data demonstrating improved land management, so locate sites that can provide this information.

Avoid placing sites on:

- pasture types of low or very low productivity, e.g. hard spinifex
- pasture types of insignificant area, e.g. a small patch of Mitchell grass amongst black spear grass
- transition zones between pasture types
- WARMS (Western Australian Rangeland Monitoring System) sites, i.e. those sites on which data is collected by DPIRD staff, are not to be included in a PMS network. These sites have been located to provide long-term monitoring at a regional scale and are therefore generally inappropriate for reporting at a paddock scale
- areas likely to be affected by future development of fences, tracks or water points.

Sites should also be:

- away from the influence of roads, fences or other structures that may lead to modified grazing pressure
- easy to locate for reassessment.

## Site installation

Install the site soon after the wet season, while plants are more easily identifiable.

Determine the grasslands pasture type from one of the following DPIRD publications:

- [Pasture condition guide for the Kimberley](#)
- [Pasture condition guide for the Pilbara.](#)

These guides will help you select indicator species to monitor. Record these species on the Site installation sheet (Appendix A). The layout for a PMS is shown in Figure 1.

## Equipment

You need the following equipment to establish each monitoring site in the paddock:

- two star pickets
- picket driver (dolly)
- six steel pegs, preferably galvanised (Figure 2)
- hammer
- 100m measuring tape
- pre-stamped permanent site identification tag with fastener
- Site installation sheet (Appendix A)
- land system map and station map (if available)
- pasture condition guide
- station map
- global positioning system (GPS) unit (if available).

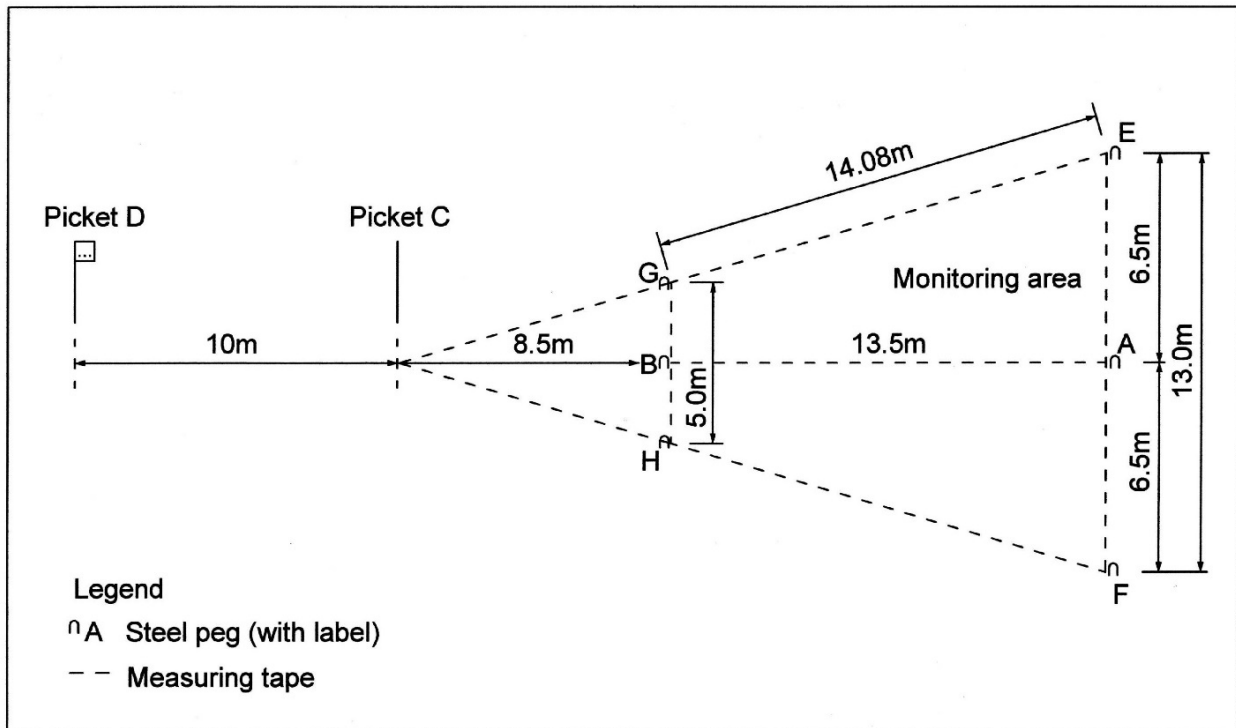


Figure 1 Pastoralist monitoring site layout

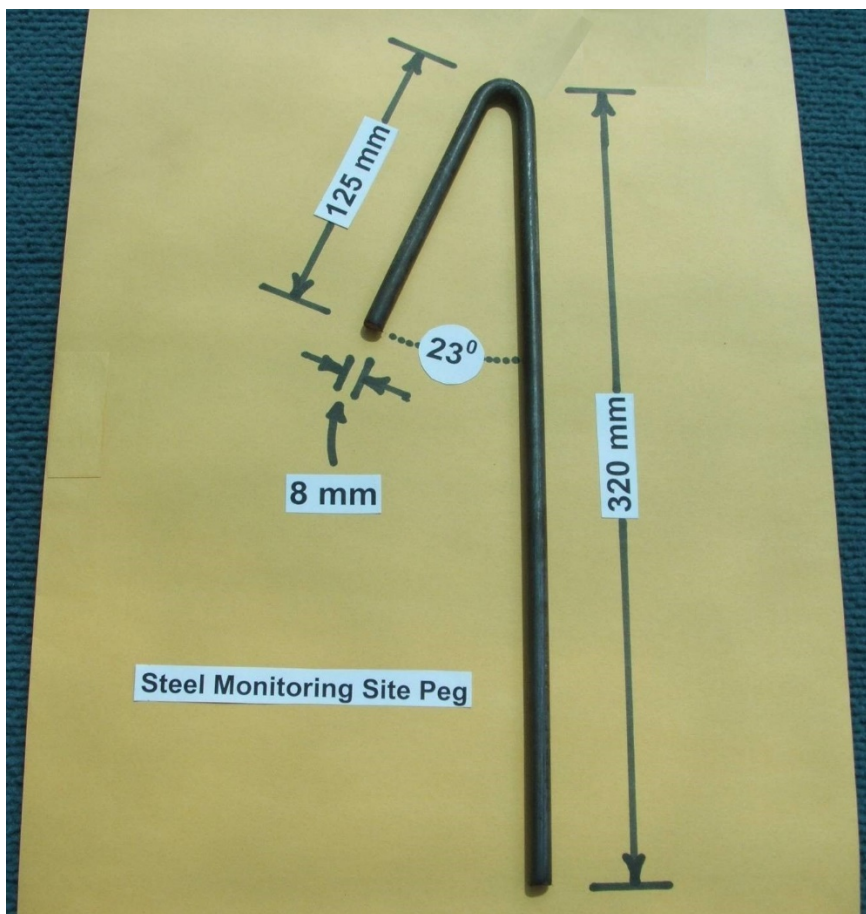


Figure 2 Suggested steel peg dimensions

## Method

- Step out the approximate boundary of the monitoring area to ensure that the site is appropriate; for example, make sure you can see the two steel pickets from the rear of the area, and that all the indicator species are contained within the area.
- Position steel peg A in the centre rear of the proposed area, as indicated in Figure 1.
- Position steel peg B in the centre front of the area, 13.5m from peg A, along the axis of the site. Since a photograph needs to be taken, orientate the site more or less in a north–south direction to avoid taking photographs into the sun.
- Position two star pickets (C and D) in line with pegs A and B. Locate picket C 22m from peg A (8.5m from peg B), and locate picket D 32m from peg A (10m from picket C). These two pickets fix the exact location and orientation of the monitoring site, and will help to locate the site in the future.
- Position two steel pegs (E and F) 6.5m either side of the rear peg A. Then position another two steel pegs (G and H) 2.5m either side of the front peg B. These four pegs mark the corners of the monitoring area.
- Attach the pre-stamped permanent site identification tag to picket D.
- While standing at picket D, record the GPS coordinates for the site and the access directions from the nearest permanently named point (e.g. windmill, yards) on the Site installation sheet (Appendix A). Mark the site on the station map.
- Record the name of the nearest permanent water point and its distance (as the crow flies) from the site on the Site installation sheet.
- Finally, ensure all the fields on the Site installation sheet are complete.

## Initial site assessment for grasslands

Grassland assessment determines the frequency (presence or absence) of indicator grasses.

## Equipment

You need the following equipment to photograph and assess each site:

- 70 x 70cm (0.5 square metres) quadrat (Figure 3)
- 100m measuring tape
- small signboard to display site identification and date (for the photograph of the site)
- tripod or other suitable support for signboard
- digital camera
- Grassland recording sheets A and B (Appendix A).

## Method

- With the start of the 100m tape attached at peg B, mark out the perimeter of the monitoring area, moving in a clockwise direction via pegs G, then E, A, F, H, and back to B (viewed from above in Figure 1). Then, stretch the tape directly from peg B to peg A, and attach it at peg A. Keep the tape taut, but not overtight, at all times.
- A frequency assessment is made at 2m intervals along the tape starting at the 1m mark. Place the centre of the quadrat exactly on the 1m mark of the tape (Figure 3). On Grassland recording sheet A, individually record grass species that are rooted



within the quadrat by placing a tick in the appropriate box (Figure 4). This is not a count of individual grass species, but a recording of their presence or absence.

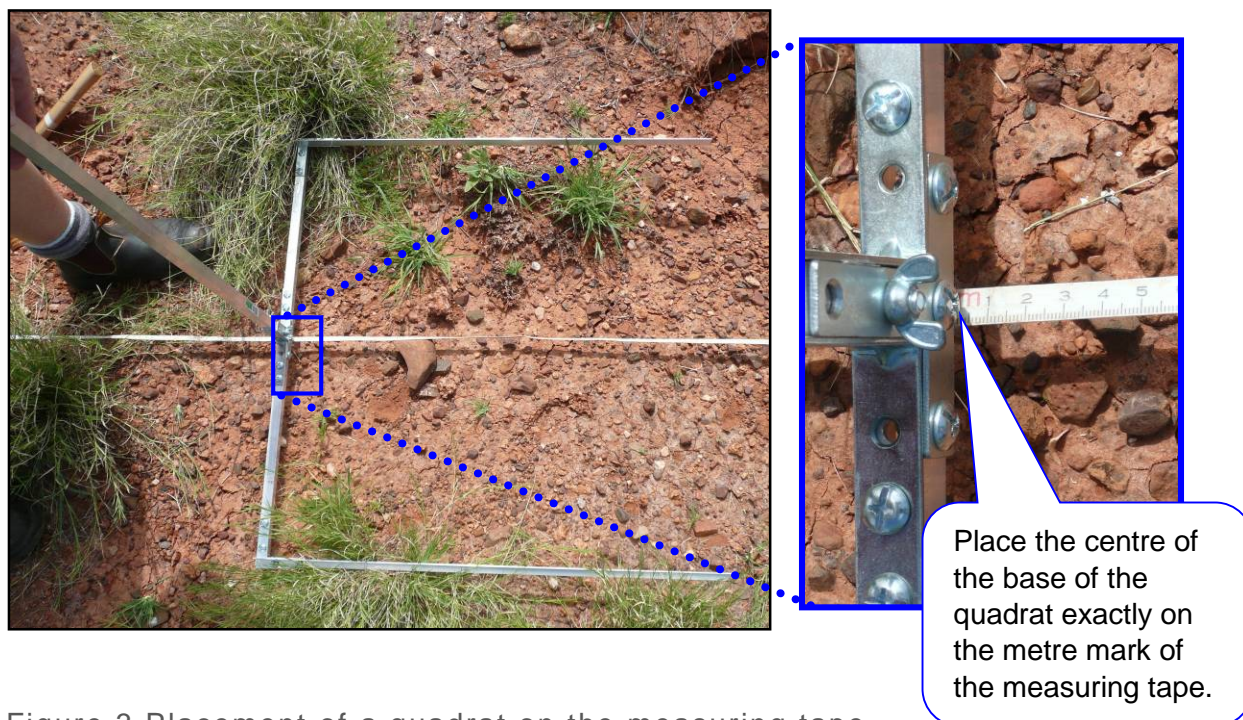


Figure 3 Placement of a quadrat on the measuring tape

Pastoralist monitoring site: Grassland recording sheet A							
Station:		<i>Spinifex Downs</i>					
Site number:		<i>04</i>		Date assessed:		<i>19 April 2019</i>	
Assessed by:		<i>John Smith</i>					
<b>Perennial plant species</b>							
Place a tick ✓ in the appropriate cell if the species is present in the quadrat.							
Quadrat number	Position on tape (m)	Species 1 <i>Ribbon grass</i>	Species 2 <i>Black spear grass</i>	Species 3 <i>Three awn</i>	Species 4 <i>Hard spinifex</i>	Species 5	Species 6
1	1		✓	✓			
2	3		✓				
3	5		✓		✓		
4	7	✓					

Figure 4 Example of recording the frequency of perennial grasses



Pastoralist monitoring site: Grassland recording sheet B					
Station:	<i>Spinifex Downs</i>				
Site number:	<i>04</i>	Date assessed:	<i>19 April 2019</i>		
Assessed by:	<i>John Smith</i>				
<b>Shrubs:</b> depending on the number of shrubs within the monitoring area, place a tick ✓ in the single appropriate cell.					
	0	1–5	6–10	11–20	>20
Number of shrubs and trees taller than 1m		✓			
Previous assessment		✓			
<b>Soil surface condition:</b> make an assessment of soil surface condition, using descriptions below. Place a tick ✓ in the single appropriate cell.					
	Very good	Good	Fair	Poor	Very poor
Soil surface condition		✓			
Previous assessment		✓			

Figure 6 Example of recording the woody weeds and soil surface condition

## Site reassessment

There is no prescribed time interval for reassessment, but we recommend assessing sites every three years. This timing is likely to pick up pasture condition changes and allow management to respond to those changes. The best time to assess pasture is soon after the wet season, when plants are more easily identifiable.

After the site has been reassessed, assess the change in range condition at the site by comparing the current data with the data from the previous assessment.

## Determining the change in range condition

Assess the change in range condition at a grassland PMS using the change in:

- frequency of the indicator perennial grass species — increased, decreased or the same
- density of woody species — increased, decreased or the same
- change in soil condition (if any), for example, poor to fair.

Figure 7 outlines some common indicators of change.

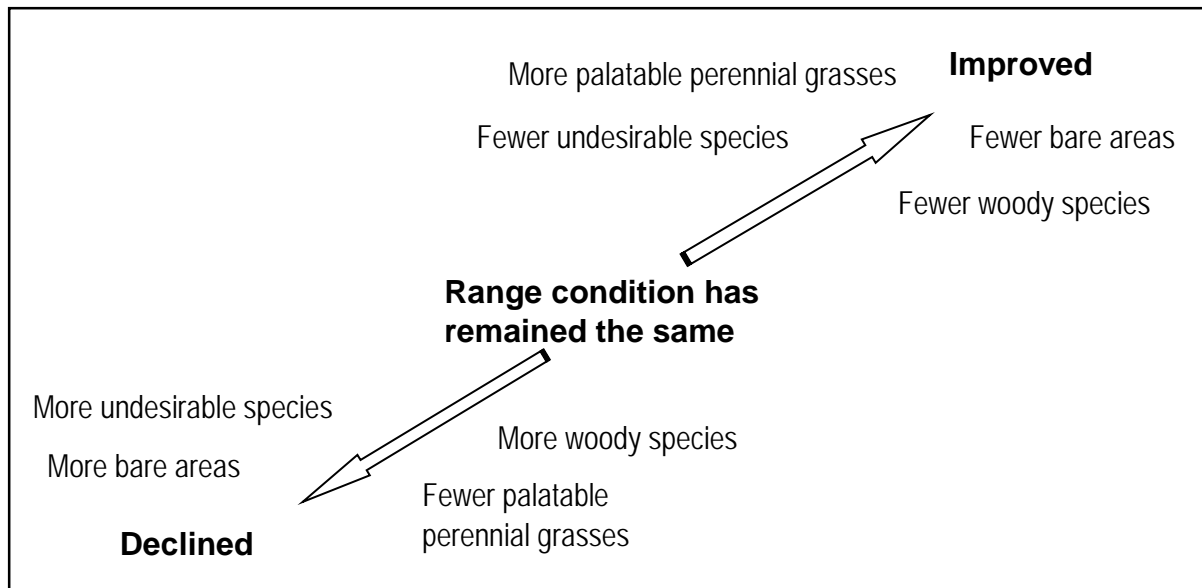


Figure 7 Indicators of change in range condition in grasslands

What are the implications of this change, and what is causing it?

- What has the season been like, how intense was the rain and when did it fall?
- Are unmanaged grazers (e.g. kangaroos, feral stock) affecting range condition?
- Are there any other factors which may have influenced this change (e.g. wildfire, flood event)?
- Given the change, should I adjust grazing pressure in this paddock?

Make your assessment: how has range condition at the site changed? Record your assessment on Grassland recording sheet B, as shown in Figure 8.

<b>Your assessment</b> of change since the previous assessment		
<input type="checkbox"/> Improved	<input checked="" type="checkbox"/> Stable	<input type="checkbox"/> Declined
Reason for decision: <u>Grass frequency and soil surface stable</u>		
Other comments: <u>Paddock burnt late November 2018</u>		

Figure 8 Example of recording your change in range condition assessment



## Glossary

**Annual plant:** plant that completes its life cycle within one year.

**Baseline:** the initial site assessment.

**Biennial plant:** plant that requires more than one year to complete a life cycle, but rarely survives beyond two years.

**Density:** the number of individuals of a certain species per unit area; it is not a measure of cover.

**Desirable species:** perennial plants that are productive and palatable to domestic livestock; these plants drive pastoral production.

**Frequency:** the number of times a plant is present.

**Grassland:** vegetation characterised by perennial tussock and hummock grasses; occur primarily in the Kimberley and Pilbara regions.

**Grazing radius:** 1.5–3km from a livestock water point.

**Hummock grasses:** spinifexes that grow together as large rounded mounds or 'hummocks' that can be up to several metres across, often forming rings around a central dead or decaying patch.

**Indicator species:** plants that increase or decrease in frequency and distribution in response to grazing pressure.

**Intermediate species:** a large group of plants that may or may not be palatable to livestock, but do not increase in frequency to any great extent when other palatable species are removed.

**Pasture condition:** the current condition of the vegetation compared with the optimal condition which could be expected given the potential of the site; usually assessed as good, fair or poor.

**Perennial plant:** plant that lives for more than two years.

**Range condition:** the state of a rangeland ecological community in relation to its ability to conserve water, soil and nutrients compared to an optimal state unaltered by grazing or physical disturbance; expressed as good, fair or poor; calculated using a matrix of soil surface condition and pasture condition.

**Sacrifice zone:** the area adjacent to a stock water point.

**Shrubland:** vegetation characterised by shrubs with a variable mulga (*Acacia aneura*) or eucalypt overstorey; occur primarily in the Gascoyne, Murchison, Goldfields and Nullarbor regions.

**Soil surface condition:** a visual categorisation of the soil's capacity to retain water and minimise soil loss (erosion).

**Tussock grasses:** grasses that grow in clumps, such as buffel grass and Mitchell grass.

**Undesirable species:** plants that are unpalatable and of limited value to livestock production.

**Woody species:** trees and shrubs taller than 1m.

## Station:

Site identification number: \_\_\_\_\_ If pre-existing site, record number \_\_\_\_\_

Date PMS installed: \_\_\_\_/\_\_\_\_/\_\_\_\_

Installed by: \_\_\_\_\_

Paddock:

Site GPS coordinates:            E                                 N

Datum and zone: \_\_\_\_\_

Nearest permanent water point accessible to stock (name and distance):

Site directions from named point (e.g. windmill, yards):

Land system: \_\_\_\_\_

Pasture type: \_\_\_\_\_

[illegible]

\* **D** = desirable species; **U** = undesirable species; or **I** = intermediate species

## Pastoralist monitoring site: Grassland recording sheet A

Station: \_\_\_\_\_

Site number: \_\_\_\_\_ Date assessed: \_\_\_\_\_

Assessed by: \_\_\_\_\_

### Perennial plant species

Place a tick ✓ in the appropriate cell if the species is present in the quadrat.

Quadrat number	Position on tape (m)	Species 1	Species 2	Species 3	Species 4	Species 5	Species 6
1	1						
2	3						
3	5						
4	7						
5	9						
6	11						
7	13						
8	15						
9	17						
10	19						
11	21						
12	23						
13	25						
14	27						
15	29						
16	31						
17	33						
18	35						
19	37						
20	39						
21	41						
22	43						
23	45						
24	47						
25	49						
Total							
Previous assessment							

## Grassland recording sheet A continued

### Pasture condition

Make an assessment of pasture condition, using the descriptions below. Place a tick ✓ in the single appropriate cell.

	Good	Fair	Poor
Pasture condition			
Previous assessment			

- **Good** — most plants present are desirable; some intermediate perennials and annuals may be present; undesirable species are rare; groundcover is optimal for the site.
- **Fair** — intermediate species usually predominate; desirable and undesirable species occupy similar proportions of the available ground space; small patches of bare ground may be present.
- **Poor** — undesirable and intermediate species predominate; desirable species are very infrequent and may occur only in small patches; groundcover may be sparse or patchy, or large bare areas may be present.

## Pastoralist monitoring site: Grassland recording sheet B

Station: \_\_\_\_\_

Site number: \_\_\_\_\_ Date assessed: \_\_\_\_\_

Assessed by: \_\_\_\_\_

### Shrubs

Depending on the number of shrubs within the monitoring area, place a tick ✓ in the single appropriate cell.

	0	1–5	6–10	11–20	>20
Number of shrubs & trees taller than 1m					
Previous assessment					

### Soil surface condition

Make an assessment of soil surface condition, using the descriptions below. Place a tick ✓ in the single appropriate cell.

	Very good	Good	Fair	Poor	Very poor
Soil surface condition					
Previous assessment					

- **Very good** — stable soil surface (no topsoil loss occurring); many physical barriers, including decomposing litter, live plants and fallen timber, to retard water flows and promote infiltration
- **Good** — soil surface is mostly stable (no or little topsoil loss occurring); some accumulated litter and live plants; minor evidence of loss of water or litter from site
- **Fair** — some signs of topsoil loss; some litter, but with little evidence of decomposition; reduced obstructions to intercept water flows, including few live plants
- **Poor** — significant topsoil loss; minimal litter present; few obstructions to intercept water flows
- **Very poor** — almost total loss of topsoil; exposed soil surfaces are impermeable; very few objects to intercept water flows; no accumulated litter; no live plants.

**Photographs:** Record photo number/s and describe the monitoring area.

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**Your assessment** of change since the previous assessment

☐ Improved      ☐ Stable      ☐ Declined

Reason for decision: \_\_\_\_\_

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Other comments: \_\_\_\_\_

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